


# Hydraulics Product Catalog With Preferred & Spotlight Delivery Programs Section





Authorized  
Distribution  
Network

The  
Drive & Control  
Company

### Full-line Bosch Rexroth Hydraulic Distributors

Bosch Rexroth is proud to work with the highest qualified Distributors in the hydraulics industry. These distributors add value by extending the level of technical and industry expertise available to users of fluid power across the country. They work closely with our applications engineering personnel to deliver innovative, effective, and reliable solutions to your most challenging needs. Following is the list of our authorized full-line Hydraulic Distributors:

**A & L Hydraulics, Inc.**  
4412 South 87th Street  
Omaha, NE 68127  
(402) 339-3873

**Airline Hydraulics, Inc.**  
Expressway 95 Business Ctr.  
3557 Progress Drive  
Bensalem, PA 19020  
(215) 638-4700

**Catey Controls, Inc.**  
3102 West Broadway  
Missoula, MT 59808  
(406) 728-7860

**Flodyne/Hydradyne, Inc.**  
1000 Muirfield Drive  
Hanover Park, IL 60103  
(630) 563-3600

**FPS Technologies, Inc.**  
1417 Forestdale Boulevard  
Birmingham, AL 35214  
(205) 798-9440

**Fluid System  
Components, Inc.**  
1700 Suburban Drive  
DePere, WI 54115  
(920) 337-0234

**Gulf Controls Company, LLC**  
5201 Tampa West Boulevard  
Tampa, FL 33634  
(813) 884-0471

**Hydraulic Controls, Inc.**  
4700 San Pablo Avenue  
Emeryville, CA 94608  
(510) 658-8300

**Hydrotech, Inc.**  
10052 Commerce Park Drive  
Cincinnati, OH 45246  
(513) 881-7000

**Innotek Engineered Products**  
9140 Zachary Lane North  
Maple Grove, MN 55369  
(763) 488-9910

**Interstate Hydraulics, Inc.**  
426 West 9160 South  
Sandy, UT 84070  
(801) 566-4333

**Iowa Fluid Power, Inc.**  
1610 Blairs Ferry Road NE  
Cedar Rapids, IA 52402  
(319) 395-7000

**John Henry Foster, Co.**  
4700 Lebourget Drive  
St. Louis, MO 63134  
(314) 427-0600

**Livingston & Haven, Inc.**  
11616 Wilmar Boulevard  
Charlotte, NC 28273  
(704) 588-3670

**Morrell, Inc.**  
3333 Bald Mountain Road  
Auburn Hills, MI 48326  
(248) 373-1600

**Pacific Power Tech, LLC**  
18977 NE Portal Way  
Portland, OR 97230  
(503) 667-9222

**Womack Machine Supply Co.**  
2010 Shea Road  
Dallas, TX 75235  
(214) 357-3871

For more information on distributor coverage in your local area,  
go to our Web site [www.boschrexroth-us.com](http://www.boschrexroth-us.com) and enter Web code US0017.

Electric Drives  
and Controls

Hydraulics

Linear Motion and  
Assembly Technologies

Pneumatics

Service

**Rexroth**  
Bosch Group



To our valued Bosch Rexroth Customer;

The Bosch Rexroth Corporation's Hydraulic Technology Group, is pleased to provide a Hydraulics Product Program Catalog including a specific listing of Preferred and Spotlight products.

Purpose: This catalog represents an overview of the North American Bosch Rexroth Hydraulic product portfolio, and an identified, focused range of Rexroth Preferred & Spotlight Products to guide selections for a wide range of typical applications.

The focus on a range of Preferred & Spotlight products allows us to offer a higher service level including:

- Delivery of Preferred items not to exceed four weeks<sup>†</sup>
- Delivery of Spotlight items not to exceed two weeks<sup>\*\*†</sup>
- Simplified pricing
- Enhanced customer service

\* See *Hydraulics Preferred Products Component List* for specific Preferred and Spotlight product identification, in Section XX.

† Nine (9) pieces per material number, per order, is the maximum quantity permitted. We reserve the right to limit quantities; however, will acknowledge all orders and the quantity which will be delivered to Preferred and Spotlight lead times. If quantities greater than (9) pieces per material number are required, please consult us for price and delivery.

Material numbers listed in the Preferred and Spotlight section of this catalog for quantities (9) or less will be considered preferred product orders, unless specified under another agreement.

Delivery, Preferred products will be delivered in (4) weeks or less, Spotlight products will be delivered in (2) weeks or less.

Distributed by:

**Please visit our website at  
[www.boschrexroth-us.com](http://www.boschrexroth-us.com)  
and select the Sales Locator  
for the name of your nearest  
Bosch Rexroth Distributor  
or call 1-800-REXROTH.**

All items subject to prior sale. It is advisable to confirm critical delivery requirements at time of order.

### **WARNING!**

#### **FAILURE, IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR OF RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.**

This document and other information from Bosch Rexroth Corporation and its divisions provide products and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the products or systems in Rexroth's Technical Data Sheets & Catalogs. Due to the variety of operating conditions and applications for these products or systems, the user, through his own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements are met.

The products described herein, including without limitation, product features, specifications, designs, and prices are subject to change at any time without notice.





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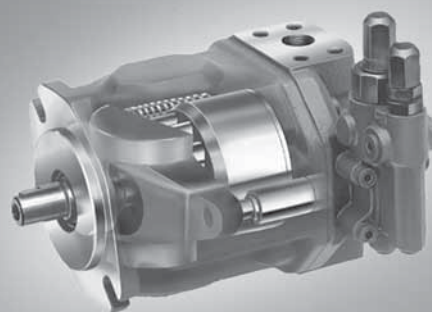


# Section 1

## Pumps and Motors

### The Drive & Control Company

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 ▶ Products and Catalogs  
 ▶ Preferred Product Catalog



**Extracted from RA 10 097/02.06**

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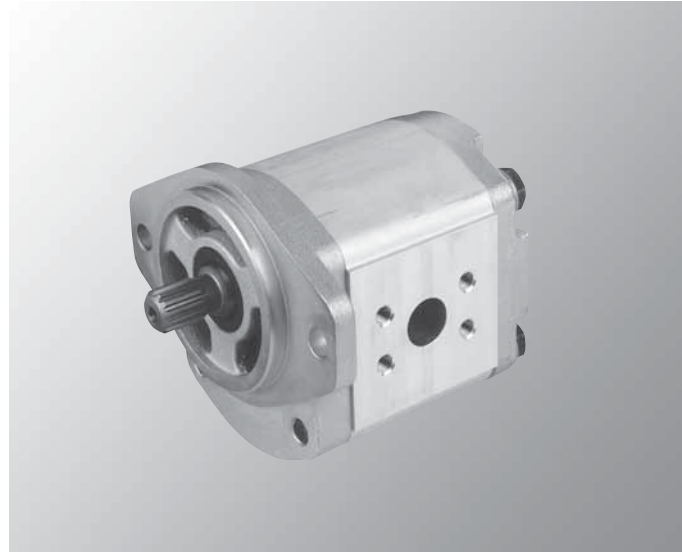
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**External gear pumps  
Series F, N, & G**

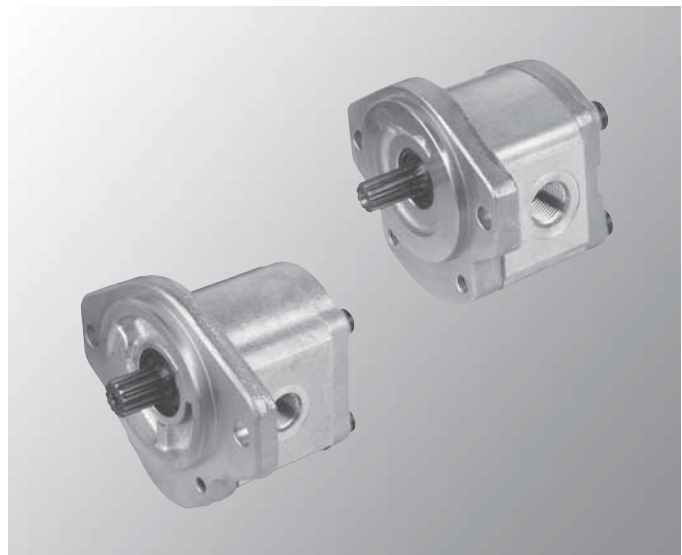
Fixed displacement pumps

Sizes 4.1...63.0 cm<sup>3</sup> (0.26...3.84 in<sup>3</sup>)

- Displacements of 4cc to 63cc
- Plain bearings for heavy duty applications
- Drive shafts SAE or ISO
- Multiple Pump Assemblies
- Port connections: flange or threaded
- Optimized pressure pulsation, which reduces noise levels and vibration excitation in the system
- Consistent high quality
- Considerably longer life due to reinforced shaft and housing



Series G



Series N

Series F

## Extracted from RA 10 097/02.06

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Ordering code F series pump

AZ		P		F - 1□ or 2□ - 016		R R R		12 M		B - □□□ □□ - S□□□□		
<b>Function</b>										PRV(bar) FCV(l/min)		<b>Special Design*</b>
P = Pump										EXAMPLE: 180 bar, 9 l/min = 180 09 Use XXX if valve not applicable		
<b>Size (F)</b>										<b>End cover</b>		B - Standard A - Rear ports E - FCV, excess flow ext. V - PRV + FCV P - Priority flow control D - Pressure relief valve
.26in <sup>3</sup> ( 4.1 cm <sup>3</sup> ) = 004 .35in <sup>3</sup> ( 5.6 cm <sup>3</sup> ) = 005 .51in <sup>3</sup> ( 8.2 cm <sup>3</sup> ) = 008 .71in <sup>3</sup> (11.3 cm <sup>3</sup> ) = 011 .89in <sup>3</sup> (14.3 cm <sup>3</sup> ) = 014 1.03in <sup>3</sup> (16.5 cm <sup>3</sup> ) = 016 1.22in <sup>3</sup> (19.5 cm <sup>3</sup> ) = 019 1.43in <sup>3</sup> (22.9 cm <sup>3</sup> ) = 022 1.59in <sup>3</sup> (25.4 cm <sup>3</sup> ) = 025 1.78in <sup>3</sup> (28.5 cm <sup>3</sup> ) = 028												
<b>Direction of rotation</b>										<b>Seals</b>		NBR = M FPM = P NBR, shaft seal in FPM = K
Right = R Left = L												
Drive shafts				Front flange				Line connections				
<b>C</b>	Conical 1:5 (Tapered key)		<b>B</b> <b>P</b>	<b>B</b>	Square flange Pilot Ø 80 mm		<b>20</b>	Rectangular flange				
<b>S</b>	Conical 1:5 for flange A (Tapered key)		<b>A</b>	<b>R</b>	SAE A 2-bolt		<b>12</b>	Thread (UN-2B) SAE O-ring BOSS				
<b>H</b>	Conical 1:8 (Tapered key)		<b>O</b>	<b>P</b>	Transmission flange Pilot Ø 50 mm		<b>01</b>	BSP Pipe thread ISO 228				
<b>N</b>	Dog (Tang)		<b>M</b>	<b>O</b>	Square flange Pilot Ø 36.47 mm		<b>30</b>	Rectangular flange				
<b>A</b>	Cylindrical (Straight key) ISO Ø 18mm		<b>B</b>	<b>C</b>	SAE B 2-bolt		<b>07</b>	Split flange SAE Code 61 Metric bolts				
<b>Q</b>	Cylindrical (Straight key) SAE A 5/8"		<b>R</b>	<b>M</b>	Transmission flange Pilot Ø 52 mm with O-ring		<b>40</b>	Split flange SAE Code 61 UNC bolts				
<b>Q</b>	SAE 3/4" Keyed, Long *Use S0022 suffix		<b>R</b>	<b>A</b>	Outtrigger bearing Pilot Ø 80 mm (outboard bearing)							
<b>R</b>	Spline shaft SAE A 9T		<b>R</b> <b>C</b>									
<b>P</b>	Spline shaft SAE 11T		<b>R</b> <b>C</b>									
<b>F</b>	Spline shaft DIN 5482 B17x14		<b>B</b> <b>P</b>									















\* Common S0 Codes: S0022 – Long Keyed Shaft  
Contact factory for additional codes.

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code N series pump**

A Z		P		N - 1 □ - 0 3 2		R		D		C		1 2		M		B - S □ □ □ □ *	
<b>Function</b>																	
P = Pump																	
<b>Size (N)</b>																	
1.28 in <sup>3</sup> (20.4 cm <sup>3</sup> ) = 020																	
1.44 in <sup>3</sup> (23.1 cm <sup>3</sup> ) = 022																	
1.61 in <sup>3</sup> (25.8 cm <sup>3</sup> ) = 025																	
1.78 in <sup>3</sup> (28.4 cm <sup>3</sup> ) = 028																	
2.02 in <sup>3</sup> (32.4 cm <sup>3</sup> ) = 032																	
2.28 in <sup>3</sup> (36.4 cm <sup>3</sup> ) = 036																	
<b>Direction of rotation</b>																	
Right = R																	
Left = L																	
<b>End cover</b>																	
Standard = B																	
Rear Ports = A																	
<b>Seals</b>																	
NBR = M																	
FPM = P																	
NBR, shaft seal in FPM = K																	
<b>Drive shafts</b>						<b>Front flange</b>						<b>Line connections</b>					
<p><b>C</b> Conical 1:5 (Tapered key)  <b>B</b> Matching front flange</p> <p><b>N</b> Dog (Tang)  <b>M</b></p> <p><b>D</b> Spline shaft SAE B 13T  <b>C</b></p> <p><b>P</b> Spline shaft SAE 11T  <b>R</b> <b>C</b></p> <p><b>Q</b> SAE 3/4" Keyed Short  <b>R</b> <b>C</b></p> <p><b>Q</b> SAE 3/4" Keyed Long - use S0022 Suffix  <b>R</b> <b>C</b></p> <p><b>X</b> Special (SO Code Defines Special Shaft) <b>R</b> <b>C</b></p>						<p><b>B</b> Square flange Pilot Ø 100 mm </p> <p><b>C</b> SAE B 2-bolt </p> <p><b>M</b> Transmission flange Pilot Ø 52 mm with O-ring </p> <p><b>R</b> SAE A 2-bolt </p>						<p><b>20</b> Rectangular flange </p> <p><b>12</b> Thread (UN-2B) SAE O-ring BOSS </p> <p><b>07</b> Split flange SAE Code 61 Metric bolts </p> <p><b>40</b> Split flange SAE Code 61 UNC bolts </p>					

\* Common S0 Codes: S0075 – Tapered Shaft  
Contact factory for additional codes.



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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code G series pump**

A Z P G - 22 - 045 - R D C 12 M B									
<b>Function</b>									
P = Pump									
<b>Size (G)</b>									
1.99 in <sup>3</sup> (32.6 cm <sup>3</sup> ) = 032									
2.20 in <sup>3</sup> (36.0 cm <sup>3</sup> ) = 036									
2.75 in <sup>3</sup> (45.0 cm <sup>3</sup> ) = 045									
3.42 in <sup>3</sup> (56.0 cm <sup>3</sup> ) = 056									
3.84 in <sup>3</sup> (63.0 cm <sup>3</sup> ) = 063									
<b>Direction of rotation</b>									
Right = R									
Left = L									
		<b>End cover</b>							
		Standard = B							
		<b>Seals</b>							
		NBR = M							
		FPM = P							
		NBR, shaft seal in FPM = K							
Drive shafts		Front flange		Line connections					
		Matching front flange							
<b>C</b>	Conical 1:5 (Tapered key)		<b>B</b>	<b>B</b>	Square flange Pilot Ø 105 mm		<b>20</b>	Rectangular flange	
<b>S</b>	Conical 1:5 for flange A (Tapered key)		<b>A</b>	<b>O</b>	Square flange Pilot Ø 50.78 mm		<b>30</b>	Rectangular flange	
<b>H</b>	Conical 1:8 (Tapered key)		<b>O</b>	<b>C</b>	SAE B 2-bolt		<b>07</b>	Split flange SAE Code 61 Metric bolts	
<b>N</b>	Dog (Tang)		<b>M</b>	<b>M</b>	Transmission flange Pilot Ø 52 mm with O-ring		<b>40</b>	Split flange SAE Code 61 UNC bolts	
<b>Q</b>	Cylindrical (Straight Key) SAE B 7/8"		<b>C</b>	<b>A</b>	Outrigger bearing Pilot Ø 105 mm (outboard bearing)		<b>12</b>	Thread (UN-23) SAE O-Ring BOSS	
<b>D</b>	Spline shaft SAE B 13T		<b>C</b>						
<b>F</b>	Spline shaft DIN 5482 B17x14		<b>B</b>						


















Note: Consult factory for availability

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code for multiple pumps**

<b>AZ</b>	<b>P</b>	<b>GGFF</b>	-	□□	-	<b>032 / 022 / 016 / 005</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>M</b>	<b>B</b>																										
<table border="1"> <tr> <td><b>Function</b></td> <td rowspan="10"> <p>P = Pump</p> <p><b>Model **</b></p> <p>F = 4.0 ... 28.0 cm<sup>3</sup>/rev N = 20.0 ... 36.0 cm<sup>3</sup>/rev G = 32.0 ... 63.0 cm<sup>3</sup>/rev</p> <p><b>Series</b></p> <p>1x = Standard bearing 2x = Reinforced bearing</p> <p><b>Size</b></p> <p>Based on available sizes per series</p> <p><b>Direction of rotation</b></p> <p>Right = R Left = L</p> </td> <td colspan="14"> <p><b>Rear cover</b> refers on the last pumps part</p> <p>Model F Standard = <b>B</b> Model N Standard = <b>B</b> Model G Standard = <b>B</b></p> <p><b>Seals</b></p> <p>NBR = <b>M</b> NBR, Shaft Seal in FPM = <b>K</b></p> </td> </tr> <tr><td><b>Model **</b></td></tr> <tr><td><b>Series</b></td></tr> <tr><td><b>Size</b></td></tr> <tr><td><b>Direction of rotation</b></td></tr> <tr><td><b>Function</b></td></tr> <tr><td><b>Model **</b></td></tr> <tr><td><b>Series</b></td></tr> <tr><td><b>Size</b></td></tr> <tr><td><b>Direction of rotation</b></td></tr> <tr><td><b>Function</b></td></tr> </table>																<b>Function</b>	<p>P = Pump</p> <p><b>Model **</b></p> <p>F = 4.0 ... 28.0 cm<sup>3</sup>/rev N = 20.0 ... 36.0 cm<sup>3</sup>/rev G = 32.0 ... 63.0 cm<sup>3</sup>/rev</p> <p><b>Series</b></p> <p>1x = Standard bearing 2x = Reinforced bearing</p> <p><b>Size</b></p> <p>Based on available sizes per series</p> <p><b>Direction of rotation</b></p> <p>Right = R Left = L</p>	<p><b>Rear cover</b> refers on the last pumps part</p> <p>Model F Standard = <b>B</b> Model N Standard = <b>B</b> Model G Standard = <b>B</b></p> <p><b>Seals</b></p> <p>NBR = <b>M</b> NBR, Shaft Seal in FPM = <b>K</b></p>														<b>Model **</b>	<b>Series</b>	<b>Size</b>	<b>Direction of rotation</b>	<b>Function</b>	<b>Model **</b>	<b>Series</b>	<b>Size</b>	<b>Direction of rotation</b>	<b>Function</b>
<b>Function</b>	<p>P = Pump</p> <p><b>Model **</b></p> <p>F = 4.0 ... 28.0 cm<sup>3</sup>/rev N = 20.0 ... 36.0 cm<sup>3</sup>/rev G = 32.0 ... 63.0 cm<sup>3</sup>/rev</p> <p><b>Series</b></p> <p>1x = Standard bearing 2x = Reinforced bearing</p> <p><b>Size</b></p> <p>Based on available sizes per series</p> <p><b>Direction of rotation</b></p> <p>Right = R Left = L</p>	<p><b>Rear cover</b> refers on the last pumps part</p> <p>Model F Standard = <b>B</b> Model N Standard = <b>B</b> Model G Standard = <b>B</b></p> <p><b>Seals</b></p> <p>NBR = <b>M</b> NBR, Shaft Seal in FPM = <b>K</b></p>																																							
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<b>Drive shafts</b>				<b>Front cover</b>				<b>Port connections</b>																																	
<p><b>Model F:</b></p> <p><b>Q</b> Cylindrical (Straight Way) SAE A 5/8"  <b>R</b></p> <p><b>P</b> Spline Shaft SAE 11T  <b>R</b> <b>C</b></p> <p><b>R</b> Multiple spline shaft SAE A 5/8" 9T  <b>R</b> <b>C</b></p>				<p><b>C</b> SAE B 2-bolt flange Pilot Ø 101.6 mm </p> <p><b>R</b> SAE A 2-bolt flange Ø 82.55 mm </p>				<p><b>12</b> Thread (UN-2B) SAE O-Ring BOSS </p>																																	
<p><b>Model N:</b></p> <p><b>P</b> Spline Shaft SAE 11T  <b>R</b> <b>C</b></p> <p><b>D</b> Multiple spline shaft SAE B 13T  <b>C</b></p> <p><b>Q</b> SAE 3/4" Keyed, Short  <b>R</b> <b>C</b></p>				<p><b>R</b> SAE A 2-bolt flange Ø 82.55 mm </p> <p><b>C</b> SAE B 2-bolt flange Pilot Ø 101.6 mm </p>				<p><b>12</b> Thread (UN-2B) SAE O-Ring BOSS </p>																																	
<p><b>Model G:</b></p> <p><b>D</b> Multiple spline shaft SAE B 13T  <b>C</b></p> <p><b>Q</b> Cylindrical (Straight Key) SAE B 7/8"  <b>C</b></p>				<p><b>C</b> SAE B 2-bolt flange Pilot Ø 101.6 mm </p>				<p><b>12</b> Thread (UN-2B) SAE O-Ring BOSS </p> <p><b>40</b> Split Flange SAE Code 61 UNC bolts </p>																																	

\* Contact factory for availability of units with no ordering number listed.

\*\* Refer to page 18 for SAE O-Ring Boss specifications and dimensions.

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Performance ratings**
**F Series Performance Ratings**

Size		004	005	008	011	014	016	019	022	025	028
Displacement	cm <sup>3</sup> /rev	4.1	5.6	8.2	11.3	14.3	16.5	19.5	22.9	25.4	28.5
Inlet pressure	bar	min. 0.7 max. 3 (absolute)									
max. continuous pressure p <sub>1</sub>	bar	250						210	180	200	170
	psi	3625						3045	2610	2900	2465
max. intermittent pressure p <sub>2</sub>	bar	280						230	210	220	190
	psi	4060						3335	3045	3190	2755
max. peak pressure p <sub>3</sub>	bar	300						250	230	240	210
	psi	4350						3625	3335	3528	3045
min. rotational speed (RPM) % 100	RPM	600	500	500	500	500	500	500	500	500	500
max. rotational speed at (RPM)	p <sub>1</sub>	3500			3000	2500	2000	2000	2000	2000	2000
	p <sub>2</sub>	4000			3500	3500	3500	3000	2750	2500	2500

**N Series Performance Ratings**

Size		020	022	025	028	032	036
Displacement	cm <sup>3</sup> /rev	20.4	23.1	25.8	28.4	32.4	36.4
Inlet pressure	bar	min. 0.7 max. 3 (absolute)					
max. continuous pressure p <sub>1</sub>	bar	230	230	230	210	180	160
	psi	3335	3335	3335	3045	2610	2610
max. intermittent pressure p <sub>2</sub>	bar	250	250	250	230	200	180
	psi	3625	3625	3625	3335	2900	2610
max. peak pressure p <sub>3</sub>	bar	270	270	270	250	220	200
	psi	3915	3915	3915	3625	3190	2900
min. rotational speed (RPM) % 100	RPM	500	500	500	500	500	500
max. rotational speed at (RPM)	p <sub>1</sub>	2500	2500	2500	2300	2300	2100
	p <sub>2</sub>	3000	3000	3000	2800	2800	2600

**G Series Performance Ratings**

Size		32	36	45	56	63
Displacement:	cm <sup>3</sup> /rev	32	36	45	56	63
	cu in/rev	1.95	2.20	2.75	3.42	3.84
Range Speed:	Min RPM	400	400	400	400	400
	Max RPM	2800	2800	2600	2300	2300
Pressure - Rated: p <sub>1</sub>	(Bar)	250	250	250	195	170
	(PSI)	3625	3625	3625	2828	2465
Intermittent: p <sub>2</sub>	(Bar)	280	280	280	225	200
	(PSI)	4060	4060	4060	3263	2900
Max Peak: p <sub>3</sub>	(Bar)	300	300	300	250	230
	(PSI)	4350	4350	4350	3625	3335
Inlet Pressure:	Continuous	0.7 - 3.0 bar absolute (9in Hg vacuum to 29 PSIG)				
	Intermittent	0.1 - 10 bar absolute (26in Hg vacuum to 130 PSIG)				



**Extracted from RA 14 025/08.06**

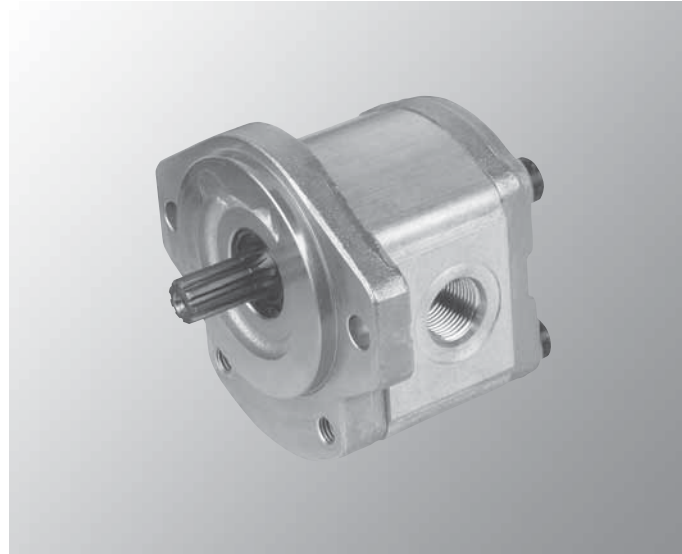
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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**External gear motors  
Series F & N**

Fixed displacement motors  
Sizes 8.2...36.4 cm<sup>3</sup> (0.51...2.28 in<sup>3</sup>)

- Plain bearings for heavy duty applications
- Drive shafts SAE or ISO
- Port connections: flange or threaded
- Consistent high quality
- Considerably longer life due to reinforced shaft and housing



**Ratings and specifications**

**F Series Performance Ratings**

Size		008	011	014	016	019	022
Displacement	cm <sup>3</sup> /rev	8.2	11.3	14.3	16.5	19.5	22.9
max. continuous pressure $p_1$	bar	250	250	250	250	180	180
	psi	3625	3625	3625	3625	2610	2610
max. starting pressure $p_2$	bar	280	280	280	280	210	210
	psi	4060	4060	4060	4060	3045	3045
min. rotational speed	min <sup>-1</sup>	500	500	500	500	500	500
max. rotational speed $p_1$		4000	4000	3500	3000	3000	3000
Motor outlet pressure $p_A$	bar						
Leakage-oil line pressure $p_L$							

**N Series Performance Ratings**

Size		020	022	025	028	032	036
Displacement	cm <sup>3</sup> /rev	20.4	23.1	25.8	28.4	32.4	36.4
max. continuous pressure $p_1$	bar	210	210	210	180	180	160
	psi	3045	3045	3045	3045	2610	2320
max. starting pressure $p_2$	bar	240	240	240	240	210	190
	psi	3480	3480	3480	3480	3045	2755
min. rotational speed	min <sup>-1</sup>	500	500	500	500	500	500
max. rotational speed $p_1$		2500	2500	2500	2300	2300	2100
Motor outlet pressure $p_A$	bar						
Leakage-oil line pressure $p_L$							

\*) Short-term when starting 10 bar

\*\*) Pressure ratings based on standard SAE ORB ports.

**Extracted from RA 14 025/08.06**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code F series motor**

AZ		M	F - 1□ or 2□ - 016	U	R	R	12	M	L	- □□□	- S□□□□
										PRV Setting (bar)	<b>Special Design</b>
<b>Function</b>										EXAMPLE: 180 bar = 180	
M = Motor											
<b>Size (F)</b>										<b>End cover</b>	
.51 in <sup>3</sup> ( 8.2 cm <sup>3</sup> ) = 008										B - Standard	
.69 in <sup>3</sup> (11.3 cm <sup>3</sup> ) = 011										A - Rear ports	
.87 in <sup>3</sup> (14.3 cm <sup>3</sup> ) = 014										L - Case drain port	
1.01 in <sup>3</sup> (16.5 cm <sup>3</sup> ) = 016										L S0018 - Internal case drain	
1.19 in <sup>3</sup> (19.5 cm <sup>3</sup> ) = 019										D - PRV (bar)	
1.40 in <sup>3</sup> (22.9 cm <sup>3</sup> ) = 022											
<b>Direction of rotation</b>										<b>Seals</b>	
Right = R										NBR = M	
Left = L										FPM = P	
Universal = U (Bi-rotational)										NBR, shaft seal in FPM = K	
<b>Drive shafts</b>				<b>Front flange</b>				<b>Line connections</b>			
Matching front flange											
<b>C</b>	Conical 1:5 (Tapered key)		<b>B</b> <b>P</b>	<b>B</b>	Square flange Centring Ø 80 mm		<b>20</b>	Rectangular flange			
<b>S</b>	Conical 1:5 metric for flange A (Tapered key)		<b>A</b>	<b>R</b>	SAE A 2-bolt		<b>12</b>	Thread (UN-2B) SAE O-ring BOSS			
<b>H</b>	Conical 1:8 metric (Tapered key)		<b>O</b>	<b>P</b>	Transmission flange Centring Ø 50 mm		<b>01</b>	BSP Pipe thread ISO 228			
<b>N</b>	Dog (Tang)		<b>M</b>	<b>O</b>	Square flange Centring Ø 36.47 mm		<b>30</b>	Rectangular flange			
<b>A</b>	Cylindrical (Straight key) ISO Ø 18mm		<b>B</b>	<b>C</b>	SAE B 2-bolt		<b>07</b>	Split flange SAE Code 61 Metric bolts			
<b>Q</b>	Cylindrical (Straight key) SAE A 5/8"		<b>R</b>	<b>M</b>	Transmission flange Centring Ø 52 mm with O-ring		<b>40</b>	Split flange SAE Code 61 UNC bolts			
<b>Q</b>	SAE 5/8" Keyed, Long *Use <b>S0022</b> suffix		<b>R</b>	<b>A</b>	Outrigger bearing Centring Ø 80 mm (outboard bearing)						
<b>R</b>	Spline shaft SAE A 9T		<b>R</b> <b>C</b>								
<b>P</b>	Spline shaft SAE 11T		<b>R</b> <b>C</b>								
<b>F</b>	Spline shaft DIN 5482 B17x14		<b>B</b> <b>P</b>								















\* Common S0 Codes: S0018 = Cross check valve in rear cover (internal case drain), S0022 = Long keyed shaft, S0030 = S0018 + S0022, S0028 = Pressure relief valve and anti-cavitation valve.

**Extracted from RA 14 025/08.06**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code N series motor**

AZ		M	N - 1□ or 2□ - 028		U	D	C	12	M	L	-□□□	- S□□□□
<b>Function</b>											<b>Special Design</b>	
M = Motor											PRV (bar)	
<b>Size (N)</b>											EXAMPLE: 180 bar = 180	
1.28 in <sup>3</sup> (20.4 cm <sup>3</sup> ) = 020 1.44 in <sup>3</sup> (23.1 cm <sup>3</sup> ) = 022 1.61 in <sup>3</sup> (25.8 cm <sup>3</sup> ) = 025 1.78 in <sup>3</sup> (28.4 cm <sup>3</sup> ) = 028 2.02 in <sup>3</sup> (32.4 cm <sup>3</sup> ) = 032 2.28 in <sup>3</sup> (36.4 cm <sup>3</sup> ) = 036											<b>End cover</b> B - Standard A - Rear ports L - Case drain port L S0018 - Internal case drain D - PRV (bar)	
<b>Direction of rotation</b>											<b>Seals</b>	
Right = R Left = L Universal = U (Bi-rotational)											NBR = M FPM = P NBR, shaft seal in FPM = K	
Drive shafts					Front flange					Line connections		
Matching front flange												
<b>C</b>	Conical 1:5 (Tapered key)		<b>B</b>	<b>B</b> Square flange Pilot Ø 100 mm						<b>20</b>	Rectangular flange	
<b>N</b>	Dog (Tang)		<b>M</b>	<b>C</b> SAE B 2-bolt						<b>12</b>	Thread (UN-2B) SAE O-ring BOSS	
<b>D</b>	Spline shaft SAE B 13T		<b>C</b>	<b>M</b> Transmission flange Pilot Ø 52 mm with O-ring						<b>07</b>	Split flange SAE Code 61 Metric bolts	
<b>P</b>	Spline shaft SAE 11T		<b>R</b>	<b>R</b> SAE A 2-bolt						<b>40</b>	Split flange SAE Code 61 UNC bolts	
<b>Q</b>	SAE 3/4" Keyed - Short		<b>R</b>									
<b>Q</b>	SAE 3/4" Keyed - Long *S0022 Suffix		<b>R</b>									
<b>X</b>	Special (S0 Code Defines Special Shaft)		<b>R</b>									

\* Common S0 Codes: S0018 = Cross check valve in rear cover (internal case drain), S0022 = Long keyed shaft, S0030 = S0018 + S0022, S0028 = Pressure relief valve and anti-cavitation valve.



**Extracted from RE 10213/04.05**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Internal gear pump, fixed displacement Model PGF

Frame sizes 1, 2 and 3

Component series: 2X (FS1 and 2)  
3X (FS3)

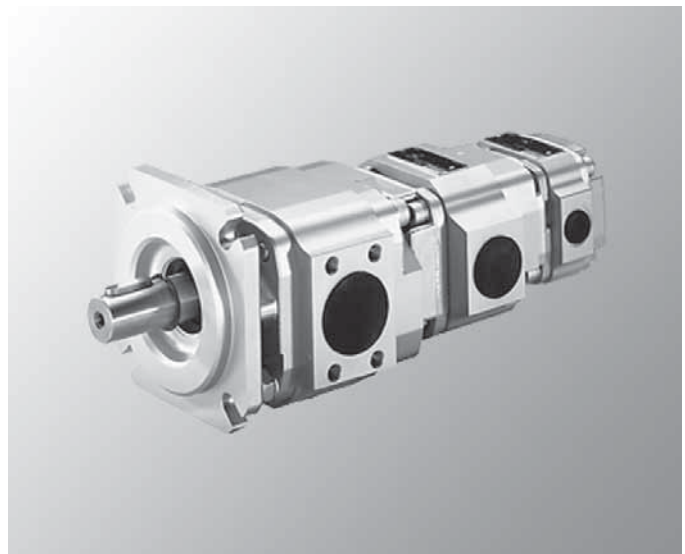
Max. operating pressure up to 250 bar (3626 PSI)

Max. displacement 1.7 to 40 cm<sup>3</sup> (0.10 to 2.44 in<sup>3</sup>)

- Fixed displacement
- Low operating noise
- Low flow pulsation
- High efficiency even at low viscosity due to sealing gap compensation
- Long service life due to plain bearings and sealing gap compensation
- Suitable for a wide viscosity and speed range
- Excellent suction characteristics
- All frame sizes can be combined with each other
- Can be combined with PGH internal gear pumps, PV7 vane pumps and axial piston pumps
- Valve technology can be integrated in the cover plate on inquiry



Model PGF1... for direct mounting



Model PGF3... for direct mounting

**Extracted from RE 10213/04.05**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code**

	PG	F	-	/				V		*
<b>Series</b> Medium-pressure pump		= F								Further details in clear text
<b>Frame size – component series</b>										<b>Options</b>
<b>FS1</b> – component series 2X (component series 20 to 29: unchanged installation and connection dimensions)										<b>N =</b> Anti-cavitation valve <b>D =</b> Pressure relief valve <b>K =</b> Cover plate for mounting the next smaller size
<b>FS2</b> – component series 2X (component series 20 to 29: unchanged installation and connection dimensions)										<b>Mounting flange centering</b>
<b>FS3</b> – component series 3X (component series 30 to 39: unchanged installation and connection dimensions)										<b>K4 =</b> Special flange to ISO 7653-1985 (for truck PTO) <b>E4 =</b> 4-hole mounting flange to ISO 3019/2 and VDMA 24560 part 1 <b>U2 =</b> SAE 2-hole mounting flange <b>M =</b> 2-hole mounting, centering Ø32 mm (1.26 in.) – <b>FS1</b> , centering Ø52 mm (2.05 in.) – <b>FS2</b> and <b>3</b> <b>P =</b> 2 hole mounting, centering Ø 50 mm (1.97 in.) <b>P1 =</b> 2-hole mounting, centering Ø 45.24 mm (1.78 in.) <b>P2 =</b> 2-hole mounting, centering Ø 63 mm (2.48 in.)
<b>Size</b>										<b>Seal material</b> FKM seals <b>Please observe our regulations to data sheet RE 07075!</b>
<b>FS1</b>	Size	Displacement/ revolution								<b>Suction and pressure port</b>
	1.7	1.7 cm <sup>3</sup> (0.10 in <sup>3</sup> )								<b>01 =</b> BSP to ISO 228/1 <b>07<sup>1)</sup> =</b> SAE flange connection <b>20 =</b> Square flange connection to DIN 3901 or DIN 3902, metric mounting thread
	2.2	2.2 cm <sup>3</sup> (0.13 in <sup>3</sup> )								<b>Shaft versions</b>
	2.8	2.8 cm <sup>3</sup> (0.17 in <sup>3</sup> )								<b>A =</b> Cylindrical <b>E =</b> Cylindrical with output <b>T =</b> Involute splines <b>J =</b> Involute splines with output <b>N =</b> Two flats for claw coupling <b>L =</b> Two flats for claw coupling with output <b>S =</b> Conical 1 : 5 <b>O =</b> Conical with output 1 : 5
	3.2	3.2 cm <sup>3</sup> (0.20 in <sup>3</sup> )								<b>Direction of rotation (viewed to shaft end)</b>
	4.1	4.1 cm <sup>3</sup> (0.25 in <sup>3</sup> )								<b>R =</b> Clockwise <b>L =</b> Counter-clockwise
	5.0	5.0 cm <sup>3</sup> (0.31 in <sup>3</sup> )								
<b>FS2</b>	6.3	6.5 cm <sup>3</sup> (0.40 in <sup>3</sup> )								
	8.0	8.2 cm <sup>3</sup> (0.50 in <sup>3</sup> )								
	11.0	11.0 cm <sup>3</sup> (0.67 in <sup>3</sup> )								
	13.0	13.3 cm <sup>3</sup> (0.81 in <sup>3</sup> )								
	16.0	16.0 cm <sup>3</sup> (0.98 in <sup>3</sup> )								
	19.0	18.9 cm <sup>3</sup> (1.15 in <sup>3</sup> )								
	22.0	22.0 cm <sup>3</sup> (1.34 in <sup>3</sup> )								
<b>FS3</b>	20.0	20.6 cm <sup>3</sup> (1.26 in <sup>3</sup> )								
	22.0	22.2 cm <sup>3</sup> (1.35 in <sup>3</sup> )								
	25.0	25.4 cm <sup>3</sup> (1.55 in <sup>3</sup> )								
	32.0	32.5 cm <sup>3</sup> (1.98 in <sup>3</sup> )								
	40.0	40.5 cm <sup>3</sup> (2.47 in <sup>3</sup> )								

<sup>1)</sup> Part code 07 is only available on FS3 option

**Extracted from RE 10213/04.05**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

		Frame Size 1						
Nominal Displacement	cc/rev.	1.7	2.2	2.8	3.2	4.1	5.0	
Actual Displacement	in <sup>3</sup> /rev.	0.10	0.13	0.17	0.20	0.25	0.31	
Max. Outlet Pressure	psig	2610	3045				2610	
Inlet Pressure Range	psia	11.8 to 29.0						
Viscosity	SUS	55 to 1450						
Bulk Fluid Temperature	°F	-4 to +212						
Minimum Speed	rpm	600						
Maximum Speed	rpm	4500	3600	4000	3600			
Rotation		RH or LH possible (not capable of bi-directional rotation)						
		Frame Size 2						
Nominal Displacement	cc/rev.	6.3	8	11	13	16	19	22
Actual Displacement	in <sup>3</sup> /rev.	0.40	0.50	0.67	0.81	0.98	1.15	1.34
Max. Outlet Pressure	psig	3045					2610	
Inlet Pressure Range	psia	8.9 to 29.0						
Viscosity	SUS	55 to 1450						
Bulk Fluid Temperature	°F	-4 to +212						
Minimum Speed	rpm	600						
Maximum Speed	rpm	3600					3000	
Rotation		RH or LH possible (not capable of bi-directional rotation)						
		Frame Size 3						
Nominal Displacement	cc/rev.	20	22	25	32	40		
Actual Displacement	in <sup>3</sup> /rev.	1.26	1.35	1.55	1.98	2.47		
Max. Outlet Pressure	psig	3045				2610		
Inlet Pressure Range	psia	8.9 to 29.0						
Viscosity	SUS	55 to 1450						
Bulk Fluid Temperature	°F	-4 to +212						
Minimum Speed	rpm	500						
Maximum Speed	rpm	3600	3400	3200	3000	2500		
Rotation		RH or LH possible (not capable of bi-directional rotation)						

**Extracted from RE 10223/03.05**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Internal gear pump, fixed displacement  
Model PGH**

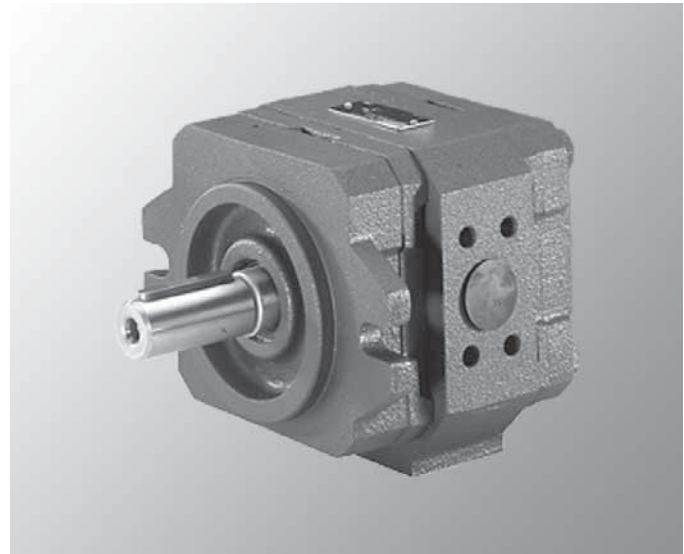
Frame sizes 2, 3, 4 and 5

Component series: 2X

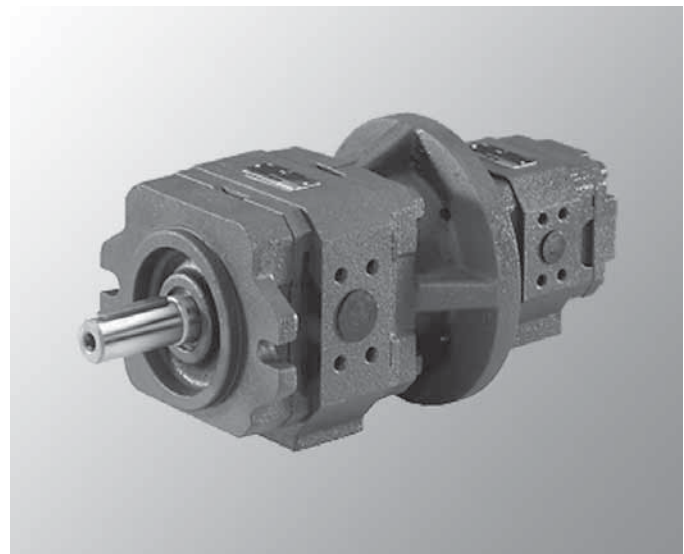
Max. operating pressure up to 350 bar (5076 PSI)

Max. displacement 250 cm<sup>3</sup> (15.26 in<sup>3</sup>)

- Fixed displacement
- Low operating noise
- Low flow pulsation
- High efficiency even at low speed and viscosity due to sealing gap compensation
- Suitable for wide viscosity and speed ranges
- All frame sizes and nominal sizes can freely combined with each other
- Can be combined with PGF internal gear pumps, vane pumps and axial piston pumps
- Suitable for operation with HFC fluids (seal version "W")



Model PGH... with SAE 2-hole mounting flange



Double pump model PGH4 + PGH3



### Extracted from RE 10223/03.05

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Ordering code

		PG	H	-	2X	/						*	
<b>Series</b>		= H											Further details in clear text
High pressure pump													
<b>Frame size</b>													<b>Mounting flange</b>
FS2		= 2											U2 = SAE 2-hole mounting flange
FS3		= 3											E4 = <sup>1)</sup> ISO 4-hole mounting flange to
FS4		= 4											ISO 3019/2 and
FS5		= 5											VDMA 24560 part 1
<b>Component series:</b>													<b>Seal material</b>
Component series 20 to 29		= 2X											V = FKM seals
(20 to 29: unchanged installation and connection dimensions)													W = <sup>2)</sup> Shaft seal ring made of NBR (other seals made of FKM)
<b>Size</b>													<b>Suction and pressure port to SAE <sup>3)</sup></b>
	Size	Displacement/revolution											<b>07 =</b> Pressure port for standard pressure series
<b>FS2</b>	5.0	5.2 cm <sup>3</sup> (0.32 in <sup>3</sup> )											<b>11 =</b> Pressure port for high pressure series
	6.3	6.5 cm <sup>3</sup> (0.40 in <sup>3</sup> )											<b>Shaft version</b>
	8.0	8.2 cm <sup>3</sup> (0.50 in <sup>3</sup> )											E = Cylindrical
													R = SAE involute splined shaft
<b>FS3</b>	11	11.0 cm <sup>3</sup> (0.67 in <sup>3</sup> )											<b>Direction of rotation (viewed to shaft end)</b>
	13	13.3 cm <sup>3</sup> (0.81 in <sup>3</sup> )											R = Clockwise
	16	16.0 cm <sup>3</sup> (0.98 in <sup>3</sup> )											L = Counter-clockwise
<b>FS4</b>	20	20.1 cm <sup>3</sup> (1.23 in <sup>3</sup> )											
	25	25.3 cm <sup>3</sup> (1.54 in <sup>3</sup> )											
	32	32.7 cm <sup>3</sup> (2.00 in <sup>3</sup> )											
	40	40.1 cm <sup>3</sup> (2.45 in <sup>3</sup> )											
	50	50.7 cm <sup>3</sup> (3.09 in <sup>3</sup> )											
	63	65.5 cm <sup>3</sup> (4.00 in <sup>3</sup> )											
	80	80.3 cm <sup>3</sup> (4.90 in <sup>3</sup> )											
	100	101.4 cm <sup>3</sup> (6.19 in <sup>3</sup> )											
<b>FS5</b>	63	64.7 cm <sup>3</sup> (3.95 in <sup>3</sup> )											
	80	81.4 cm <sup>3</sup> (4.97 in <sup>3</sup> )											
	100	100.2 cm <sup>3</sup> (6.11 in <sup>3</sup> )											
	125	125.3 cm <sup>3</sup> (7.65 in <sup>3</sup> )											
	160	162.8 cm <sup>3</sup> (9.93 in <sup>3</sup> )											
	200	200.4 cm <sup>3</sup> (12.23 in <sup>3</sup> )											
	250	250.5 cm <sup>3</sup> (15.29 in <sup>3</sup> )											

<sup>1)</sup> Only in conjunction with cylindrical shaft (to VDMA), frame sizes 4 and 5 only, clockwise rotation only

<sup>2)</sup> FS4 and FS5 only for operation with HFC fluid

<sup>3)</sup> A type of connection **07** or **11** is determined for each size:

**07:** PGH2-2X/005/006/008...

PGH3-2X/011/013/016...

PGH4-2X/063/080/100...

PGH5-2X/160/200/250...

**11:** PGH4-2X/020/025/032/040/050...

PGH5-2X/063/080/100/125...

The suction ports are standard pressure series ports (for the dimensions, see page 17).

**Extracted from RE 10223/03.05**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

		Frame Size 2			Frame Size 3				
Nominal Displacement	cc/rev.	5	6	8	11	13	16		
Actual Displacement	in <sup>3</sup> /rev.	0.32	0.40	0.50	0.67	0.81	0.98		
Max. Outlet Pressure	psig	4570							
Inlet Pressure Range	psia	11.5 to 29.0							
Viscosity	SUS	55 to 1450							
Bulk Fluid Temperature	°F	14 to 176							
Minimum Speed	rpm	600							
Maximum Speed	rpm	3000							
Rotation		RH or LH possible (not capable of bi-directional rotation)							
		Frame Size 4							
Nominal Displacement	cc/rev.	20	25	32	40	50	63	80	100
Actual Displacement	in <sup>3</sup> /rev.	1.23	1.54	2.00	2.45	3.09	4.00	4.90	6.19
Max. Outlet Pressure	psig	3625				3045		2320	
Inlet Pressure Range	psia	11.5 to 29.0							
Viscosity	SUS	55 to 1450							
Bulk Fluid Temperature	°F	14 to 176							
Minimum Speed	rpm	500				400			
Maximum Speed	rpm	3000			2600			2200	
Rotation		RH or LH possible (not capable of bi-directional rotation)							
		Frame Size 5							
Nominal Displacement	cc/rev.	63	80	100	125	160	200	250	
Actual Displacement	in <sup>3</sup> /rev.	3.95	4.97	6.11	7.65	9.93	12.23	15.29	
Max. Outlet Pressure	psig	3625				3045	2320	1810	
Inlet Pressure Range	psia	11.5 to 29.0							
Viscosity	SUS	55 to 1450							
Bulk Fluid Temperature	°F	14 to 176							
Minimum Speed	rpm	400				300			
Maximum Speed	rpm	2600	2200			1800			
Rotation		RH or LH possible (not capable of bi-directional rotation)							

**Extracted from RE 10335/11.02**

 Page 1 of 2  
 Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Fixed displacement vane pump  
 Model PVV**

Series 1X

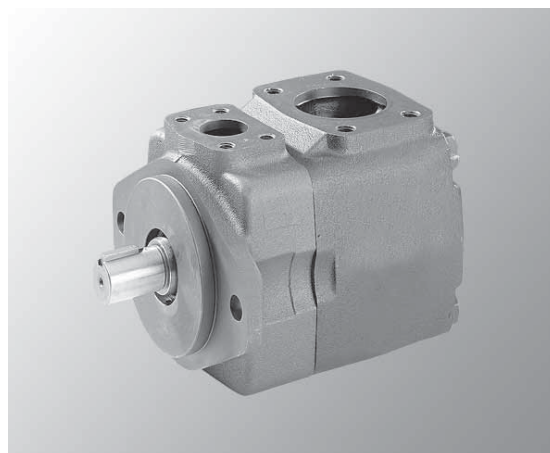
Max. pressure up to 210 bar (3050 PSI)

 Max. displacement 18–193 cm<sup>3</sup> (1.09–11.78 in<sup>3</sup>)

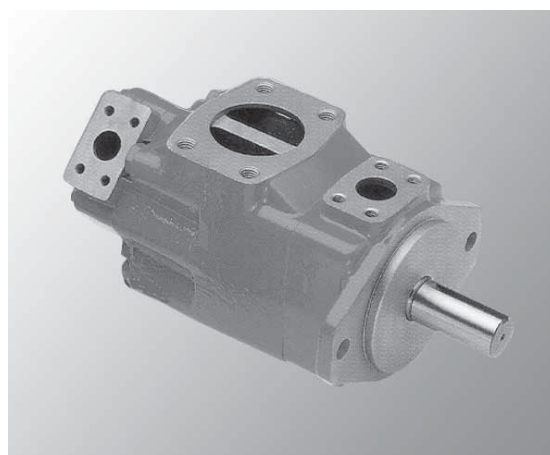
- 4 frame sizes
  - single pumps
  - double pumps
- Standard, right hand rotation
- SAE dimensions
- Direct replacement capability to other manufacturers' product
- Fixed displacement
- Long bearing life due to minimal shaft loading
- Low wear due to minimal vane tip loading
- Low operating noise
- Easy to service due to exchangeable pump cartridges
- Good efficiency
- Optional positioning of the pressure connection
- Keyed or splined drive shafts available

Double pump:

- Very compact design
- The position of the pressure connections is separately selectable
- Industrial version PVV



Single pump model PVV2-1X/...A15D..



Double pump model PVV21-1X/...A15DD..

**Technical data**

Design	vane pump, fixed																				
Type	PVV																				
Mounting style	flange mounting to SAE J744																				
Pipe connections	SAE flange version (UNC mounting bolts)																				
Direction of rotation	clockwise or counter-clockwise																				
Direction of flow	inlet and outlet are independent of the direction of rotation																				
Drive	direct, radial and axial forces are not permitted																				
Frame size (pump cartridge)	1				2				4				5								
Nom. displacement	≈ V cm <sup>3</sup>																				
	18	27	36	40	46	40	45	55	60	68	69	82	98	113	122	139	154	162	183	193	
	1.09	1.64	2.19	2.44	2.80	2.44	2.74	3.35	3.66	4.14	4.21	5.00	5.97	6.89	7.44	8.48	9.39	9.88	11.1	11.7	
Max. flow (q <sub>v</sub> )	L/min																				
at n = 1500 RPM,	26	39	53	59	70	59	66	80	89	100	101	120	141	167	177	203	223	234	267	285	
p = 0.7 bar (10.2 PSI) and n = 25 mm <sup>2</sup> /s (119 SUS)	GPM	6.8	10.3	14.0	15.5	18.5	15.5	17.4	21.1	23.5	26.4	26.6	31.7	37.2	44.1	46.7	53.6	58.9	61.8	70.5	75.2
Outlet continuous for PVV p <sub>max</sub>	bar	210	210	210	160	140	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175
	PSI	3000	3000	3000	2400	2000	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
peak p <sub>max</sub>	a max. of 10 % above the max. continuous output pressure; not longer than 0.5 seconds																				
RPM:	n <sub>min</sub>																				
	RPM	600				600				600				600							
at 1 bar (14.5 PSI)	n <sub>max</sub> for PVV																				
	RPM	2700		2000		1800				1800				1800							

**Extracted from RE 10335/11.02**

Page 2 of 2  
Issue: 04.03

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code**

<b>PV</b>		<b>1X</b>	<b>/</b>	<b>R</b>		<b>15</b>	<b>D</b>		<b>M</b>		<b>*</b>
Pump type Industrial version	= V										
Frame size											Further details to be written in clear text
Single pumps		1									<b>Flange version</b>
		2									<b>B =</b>
		4									SAE-B-2 hole flange
		5									(Frame sizes 1; 2; 21)
Double pumps		21									<b>C =</b>
		41									SAE-C-2 hole flange
		42									(Frame sizes 4; 5 and
		51									Frame sizes 41 to 54)
		52									Seals
		54									<b>M =</b>
											NBR seals
<b>Series</b> Series 10 to 19 (10 to 19, unchanged installation and connection dimensions)			= 1X								<b>Only for double pump pressure connection</b> (as viewed from cover)
<b>Nominal Displacement</b> (For codes please see table on next page)											<b>Frame sizes 21 to 52</b>
<b>Direction of rotation (viewed on the shaft end)</b> Clockwise				= R							<b>D =</b>
											Top (45° to the right of the inlet)
<b>Shaft end</b> Drive shaft (keyed)											<b>Frame size 54</b>
Splined drive shaft (SAE)											<b>D =</b>
											Top (0° from the inlet)
<b>Connections</b> SAE suction and pressure connections, UNC mounting bolt						= 15					
<b>Position of the pressure connection (as viewed from rear)</b> (Front pump or single pump, flange end) Top (0° from the inlet)							= D				

**Technical data** (continued from page 1)

Alternative pressure fluids:	Water in oil emulsion	Water glycol fluids									
Max. perm. operating pressure bar (PSI)	70 (1015)	140 (2030)									
	Only in conjunction with a return filter, retention efficiency $b_{10} \geq 100$ or higher. The permissible pressure fluid temperature range is 15 °C to 50 °C (59 °F to 122 °F). Maximum permissible RPM: 1200.										
Please consult us before applying fixed displacement vane pumps with alternative fluids!											
Weight	Frame size	1	2	4	5	21	41	42	51	52	54
	kg (lbs.)	12 (26.45)	14.8 (32.62)	23 (50.69)	34 (74.94)	20 (44.08)	34 (74.94)	34.5 (76.04)	43 (94.77)	46 (101.38)	54 (119.02)

**Extracted from 9535233084, 9535233089,  
9535233090, &  
9535233091**

Page 1 of 2  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Vane pumps Model PSV

Series 5X and 6X

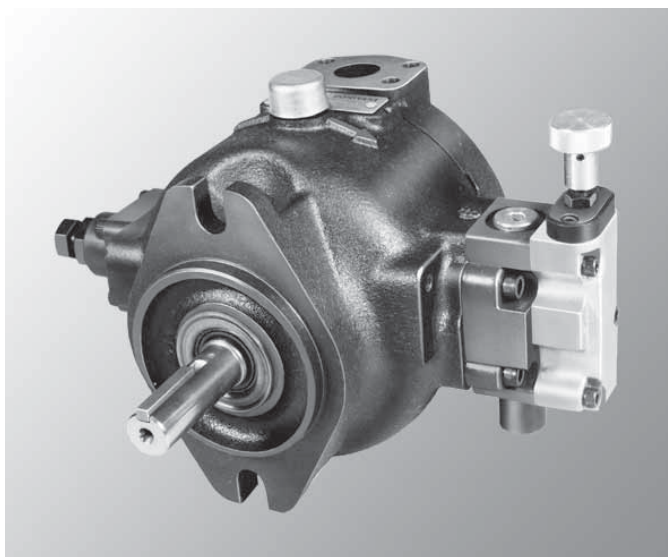
Max. pressure up to 140 bar (2000 PSI)

Max. displacement 164 cm<sup>3</sup> (10 in<sup>3</sup>)

The PSV product is a variable displacement vane pump from the Racine Fluid Power legacy. The success of the PSV pump over the years' has created a large installed base of satisfied customers. Bosch Rexroth is pleased to continue the support of this product in the market for both new and replacement business.

In most cases, current production is backwards compatible with previous designs and can be upgraded with little or no rework by the end user. A complete array of spare parts and kits also remain available for service requests.

Complete details on the PSV product line can be retrieved from the product datasheets online in the Bosch branded product section.



PSV10/15	Datasheet number 9535233084
PSV20/25	Datasheet number 9535233089
PSV40	Datasheet number 9535233090
PSV80/100	Datasheet number 9535233091

### Ordering code

PSV				F			R	-	
<b>Model designation</b>									<b>Design series</b>
<b>Compensator type</b>									<b>5X =</b>
Pressure comp.	= P								<b>6X =</b>
with remote capability									
Solenoid two pressure	= S								
<b>Volume control</b>									<b>Shaft type</b>
Volume control	= S								Keyed/combination
No volume control	= N								Thru
<b>Mounting type</b>									<b>Rotation</b>
Subplate	= S								RH only
Pilot (flange) with threaded ports	= A								
Pilot (flange) with flanged ports	= C								
<b>Seal type</b>									<b>Pressure rating</b>
Viton	= F								H = 2000 PSI
<b>Displacement</b>									G = 1500 PSI
1.0 cid	= 10								E = 1000 PSI
1.5 cid	= 15								D = 750 PSI
2.0 cid	= 20								
2.6 cid	= 25								
4.0 cid	= 40								
8.0 cid	= 80								
10.0 cid	= 100								



**Extracted from 9535233084, 9535233089,****9535233090, &  
9535233091**See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

Page 2 of 2

Issue: 06.06

**Technical data**

		PSV10	PSV15	PSV20	PSV25	PSV40	PSV80	PSV100
Displacement	in <sup>3</sup> /rev	1.0	1.5	2.0	2.6	4.0	8.0	10.0
Max. Outlet Pressure	PSI	2000	1000	2000	1000	2000	1500	1000
Max. Inlet Vacuum Pressure		6 in. of Hg						
Max. Case Pressure	PSIG	10						
Viscosity	SUS	100 - 1000			150 - 1000			
Bulk Fluid Temperature	°F	130 Max.						
Speed Range	rpm	750 to 1800						
Rotation		RH Only (CW as viewed from shaft end)						
Fluid Compatibility		Mineral Oil and Esters OK, Water Glycol Prohibited						
Mounting Types S = Subplate P = Pilot / Flanged"		S & P	S & P	S & P	S & P	P Only	P Only	P Only



**Extracted from RE 11263/03.05**

 Page 2 of 2  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Speed range	rpm	1000 to 2000		
Operating pressure	– inlet	bar (PSIA)	0.8 to 2.5 absolute (12 to 35)	
		Cylinder I.D.	Ø 10 mm (0.394 in)	Ø 15 mm (0.591 in)
	– outlet	bar (PSI)	700 (10,150)	500 (7250)
Max. torque (drive shaft)	Nm (lb-ft)	160 (118)		
Mounting position		optional		
Shaft loading		radial- and axial forces may not be transmitted		
Mounting		face mounting		
Connection ports		threaded ports		
Direction of rotation		clockwise		
<b>Fluid</b>		HLP mineral oils to DIN 51 524 part 2 <b>Also, please observe the fluid specifications in RA 07 075!</b>		
Fluid temperature range	°C (°F)	–10 ... +70 (14 ... 158)		
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 200 (45 ... 930)		
Maximum permissible degree of contamination of fluid to NAS 1638 Class 9.				
		3 pistons	5 pistons	10 pistons
Weight	kg (lbs.)	6.8 (15)	8.6 (19)	12.7 (28)

**Extracted from RE 11260/08.05**Page 1 of 2  
Issue: 06.04See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Radial piston pump  
Model R4 mini**

Series 1X

Operating pressure up to 700 bar (10,000 PSI)

Sizes 0.40 to 2.00 mm<sup>3</sup> (0.024 to 0.122 in<sup>3</sup>)

- Self-priming, valve controlled
- Very low noise
- High bearing life due to hydro-dynamically lubricated plain bearings
- Very compact design, therefore installation-friendly dimensions
- Can be combined with fixed and variable displacement vane pumps
- Five nominal sizes

**Ordering code**

PR4	-	1X	/			W			01		01	*
-----	---	----	---	--	--	---	--	--	----	--	----	---

**Series**Series 10 to 19  
(10 to 19: installation and connection  
dimensions remain unchanged)

= 1X

**Size****Displacement**0.40 mm<sup>3</sup> (0.024 in<sup>3</sup>)0.63 mm<sup>3</sup> (0.038 in<sup>3</sup>)1.00 mm<sup>3</sup> (0.061 in<sup>3</sup>)1.60 mm<sup>3</sup> (0.098 in<sup>3</sup>)2.00 mm<sup>3</sup> (0.122 in<sup>3</sup>)**Size-pmax**

= 0.40 - 700

= 0.63 - 700

= 1.00 - 450

= 1.60 - 250

= 2.00 - 175

**Direction of rotation** Counter- and clockwise

= W

**Note:** All five sizes of pump have 3 pistonsFurther details to be  
written in clear text**Number of pressure ports**

01 = 1 pressure port

M = NBR seals, suitable for mineral oil  
HLP to DIN 51 524, part 2

V = FKM seals

**Suction and pressure ports**

01 = Pipe threads to ISO 228/1

G = Splined shaft end  
(for use as combination pump with vane pumps)

A = Cylindrical shaft end

**Extracted from RE 11260/07.02**

 Page 2 of 2  
 Issue: 06.04

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Size	mm <sup>3</sup> (in <sup>3</sup> )	0.40 (0.024)	0.63 (0.038)	1.00 (0.061)	1.60 (0.098)	2.00 (0.122)
Speed range	rpm	1000–3400	1000–3000	1000–2000	1000–2000	1000–2000
Operating pressure range						
Inlet (absolute)	bar (PSI)	0.80–1.5 (11.6–21.8)	0.80–1.5 (11.6–21.8)	0.80–1.5 (11.6–21.8)	0.80–1.5 (11.6–21.8)	0.80–1.5 (11.6–21.8)
Outlet (max. permissible)	bar (PSI)	700 (10,000)	700 (10,000)	450 (6527)	250 (3626)	175 (2538)
Installation		Size: 0.024 in <sup>3</sup> – 10,000 PSI <b>Horizontal:</b> The suction port should lie vertically above the pressure port. This improves the bleeding of the pump <b>Vertical:</b> No limitation All other sizes have no installation limitations.				
Max. permissible torque (drive shaft)	Nm (lb-ft)	10 (7.38)				
Shaft loading		Radial and axial forces are not permitted.				
Mounting style		Face mounting				
Pipe connections		Threaded connections				
Direction of rotation		Clockwise and counter-clockwise, does not affect the direction of flow				
Pressure fluid		HLP mineral oil to DIN 51 524 part 2, other pressure fluid upon request. <b>Also, please observe the fluid specifications in RA 07 075!</b>				
Pressure fluid temperature range	°C (°F)	–10 ... +70 (14 ... 158)				
Viscosity range	mm <sup>2</sup> /s (SUS)	10 ... 200 (45 ... 930)				
Required filtration		Maximum permissible degree of contamination of fluid to NAS 1638 Class 9.				
Weight	kg (lbs.)	2.6 (5.7)				



**Extracted from 9 535 233 724/10.03**

Page 1 of 3

Issue: 06.04

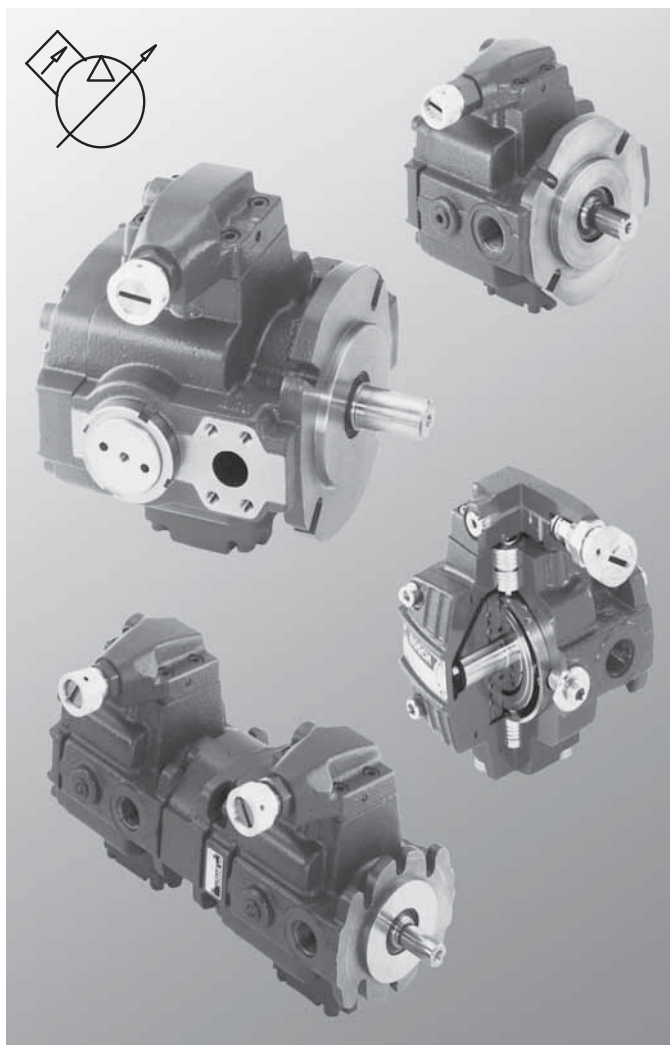
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Vane pumps  
Model VPV**

Sizes 16 to 164, Pressure to 210 bar (3050 PSI)

Rexroth is leading the way in advanced variable vane pump technology.

Market conditions favor hydraulic components that operate at low noise levels without sacrificing efficiency or durability while keeping pricing competitive. VPV pumps feature an outstanding response to the needs of the market today and for the future.

- Flows from 30 to 287 L/min (7.6 to 75.8 GPM) in single pumps
- Available in combination with other VPV pumps and Rexroth gear pumps
- Through-drive horsepower transfer is 100% to the second pump
- VPV pumps are available with through shaft versions for quick combinations
- Pressures to 210 bar (3050 PSI)
- Continuous speeds from 1000 to 1800 rpm
- Overall efficiencies to 89%
- A variety of fluids can be used: mineral oil, phosphate ester, and environmentally friendly fluids
- Controls include standard pressure compensation, remote pressure compensation, load sense, solenoid 2-pressure, and solenoid vented

**w SAE**

Size – in <sup>3</sup> /rev (cc/rev)		1.0 (16)	1.5 (25)	2.0 (32)	2.75 (45)	3.84 (63)	4.88 (80)	6.0 (100)	7.93 (130)	10.0 (164)
Flow <sup>1)</sup>	L/min	30	43	57	79	110	140	172	227	287
	GPM	(7.6)	(11.4)	(15.1)	(20.8)	(29.1)	(37.0)	(45.4)	(60.0)	(75.8)
Max. Pressure	bar	210	210	210	210	210	210	210	210	210
	(PSI)	(3000)	(3000)	(3000)	(3000)	(3000)	(3000)	(3000)	(3000)	(3000)
Speed range		1000 to 1800 rpm								
Mounting		Flange to ISO 3019/1								
Mount Position		Any								
Rotation		RH								
Sound Pressure Level <sup>2)</sup>		67	69	69	68	69	71	74	76	77

1) 1750 rpm in GPM.

2) dB(A) at 3000 PSI, 1750 rpm, full flow in a hemi-anechoic chamber with microphone placed 1 meter away at 7 discrete locations. Sound pressure levels are spatially and time weighted averaged.

### Extracted from 9 535 233 724/10.03

Page 2 of 3  
Issue: 06.04

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

#### VPV "Whisper Pumps"™

Size in3/rev (cc/rev)	Mount	Maximum Pressure bar (PSI)	L/min (GPM) @ 1750	Rotation	Description	Matl. No.	Weight kg (lbs)
1.00 (16)	SAE A	210 (3050)	30 (7.6)	R	0513R18C3VPV16SM21HYB03	0 513 300 212	17.7 (39.0)
1.00 (16)	SAE A	210 (3050)	30 (7.6)	R	0513R18C3VPV16SM21HYB03P1	0 513 300 246	20.9 (46.0)
1.50 (25)	SAE B	210 (3050)	43 (11.4)	R	0513R18C3VPV25SM21HYB03	0 513 400 212	30.4 (67.0)
1.50 (25)	SAE B	210 (3050)	43 (11.4)	R	0513R18C3VPV25SM21HYB03P1	0 513 400 248	33.6 (74.0)
2.00 (32)	SAE B	210 (3050)	57 (15.1)	R	0513R18C3VPV32SM21HYB03	0 513 500 220	30.4 (67.0)
2.00 (32)	SAE B	210 (3050)	57 (15.1)	R	0513R18C3VPV32SM21HYB03P1	0 513 500 254	33.7 (74.0)
2.75 (45)	SAE C	210 (3050)	79 (20.8)	R	0513R18C3VPV45SM21HYB05	0 513 600 214	57.6 (127.0)
2.75 (45)	SAE C	210 (3050)	79 (20.8)	R	0513R18C3VPV45SM21HYB05P1	0 513 600 234	61.2 (135.0)
3.84 (63)	SAE C	210 (3050)	110 (29.1)	R	0513R18C3VPV63SM21HYB05	0 513 700 218	57.6 (127.0)
3.84 (63)	SAE C	210 (3050)	110 (29.1)	R	0513R18C3VPV63SM21HYB05P1	0 513 700 242	61.2 (135.0)
4.88 (80)	SAE C	210 (3050)	140 (37.0)	R	0513R18C3VPV80SM21HYB05	0 513 800 248	57.6 (127.0)
4.88 (80)	SAE C	210 (3050)	140 (37.0)	R	0513R18C3VPV80SM21HYB05P1	0 513 800 238	61.2 (135.0)
6.00 (100)	SAE D	210 (3050)	172 (45.4)	R	0513R18C3VPV100SM21HYB04	0 513 850 216	111.1 (245.0)
6.00 (100)	SAE D	210 (3050)	172 (45.4)	R	0513R18C3VPV100SM21HYB04P1	0 513 850 214	115.7 (255.0)
7.93 (130)	SAE D	210 (3050)	227 (60.0)	R	0513R18C3VPV130SM21HYB04	0 513 860 250	111.1 (245.0)
7.93 (130)	SAE D	210 (3050)	227 (60.0)	R	0513R18C3VPV130SM21HYB04P1	0 513 860 258	115.7 (255.0)
10.0 (164)	SAE D	210 (3050)	287 (75.8)	R	0513R18C3VPV164SM21HYB04	0 513 870 226	111.1 (245.0)
10.0 (164)	SAE D	210 (3050)	287 (75.8)	R	0513R18C3VPV164SM21HYB04P1	0 513 870 216	115.7 (255.0)

See catalog #9 535 233 724 for complete description and performance specifications.

Adaptor Kits for Combinations	Old Number	Matl. No.
VPV 16 to VPV 16 SAE	9 511 230 518	9 511 230 518
VPV 16 to "F" Gear Pump SAE Key	9 511 230 521	R978711779
VPV 25/32 to VPV 25/32 SAE	9 511 230 523	9 511 230 523
VPV 25/32 to VPV 16 SAE	9 511 230 525	9 511 230 525
VPV 45/63/80 to VPV 45/63/80 SAE	9 511 230 528	9 511 230 528
VPV 45/63/80 to VPV 16 SAE	9 511 230 532	9 511 230 532
VPV 45/63/80 to VPV 25/32	9 511 230 530	9 511 230 530
VPV 45/63/80 to "F" Gear Pump SAE Key	9 511 230 533	R978711781
VPV 45/63/80 to "G" Gear Pump SAE Key	9 511 230 534	R978711782
VPV 100/130/164 to VPV 100/130/164	9 511 230 536	9 511 230 536
VPV 100/130/164 to VPV 45/63/80	9 511 230 538	9 511 230 538
VPV 100/130/164 to VPV 25/32	9 511 230 540	9 511 230 540
VPV 100/130/164 to VPV 16	9 511 230 542	9 511 230 542
VPV 100/130/164 to "F" Gear Pump SAE Key	9 511 230 543	R978711783
VPV 100/130/164 to "G" Gear Pump SAE Key	9 511 230 594	R978711808

See catalog #9 535 233 724 for complete description and performance specifications.

**Extracted from 9 535 233 724/10.03**

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Issue: 06.04

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

<b>VPV "Whisper Pumps" TM (continued)</b>		
<b>Pump Repair Kits SAE 210 bar (3050 PSI)</b>	<b>Old Number</b>	<b>Matl. No.</b>
VPV 16 Standard Pump	9 511 230 606	R978711812
VPV 16 "P1" Pump	9 511 230 608	R978711814
VPV 25/32 Standard Pump	9 511 230 598	R978711809
VPV 25/32 "P1" Pump	9 511 230 623	R978711825
VPV 45/63 Standard Pump	9 511 230 639	R978711838
VPV 45/63 "P1" Pump	9 511 230 642	R978711841
VPV 80 Standard Pump	9 511 230 641	R978711840
VPV 80 "P1" Pump	9 511 230 643	R978711842
VPV 100/130 Standard Pump	9 511 230 650	R978711849
VPV 100/130 "P1" Pump	9 511 230 652	R978711851
VPV 164 Standard Pump	9 511 230 651	R978711850
VPV 164 "P1" Pump	9 511 230 653	R978711852

<b>Seal Kits for VPV SAE</b>	<b>Old Number</b>	<b>Material No.</b>
VPV 16	9 511 230 605	9 511 230 605
VPV 25/32	9 511 230 597	9 511 230 597
VPV 45/63/80	9 511 230 658	9 511 230 658
VPV 100/130/164	9 511 230 659	9 511 230 659

See catalog #9 535 233 724 for complete description and performance specifications.

**Extracted from RE 15 205/02.98**

Page 1 of 5  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Hydraulic motor

### Radial piston, low speed, high torque

### Model MCR 03

Sizes 160 to 400

Series 3X

Maximum operating pressure 6500 psi (450 bar)

Maximum displacement volume 24.4 in<sup>3</sup> (400 cm<sup>3</sup>)

Maximum output torque 1702 lb-ft (2307 Nm)

- Compact, sturdy construction
- Smooth running even at very low speeds
- Low noise
- Reversible
- Sealed taper roller bearings
- High radial forces permitted on the output shaft
- Shaft seal up to 10 bar
- Freewheeling
- Available with optional built-on holding (multi-disc) brake or dynamic (drum) brake



## Function

---

### Closed circuit

Minimum inlet pressure must be adapted to suit operating conditions; the following must be taken into consideration:

Idling pressure. flow resistances. pump operation.

Minimum flow of the feed pump must be adapted to suit operating conditions.

### Open circuit

Minimum inlet pressure must be adapted to suit operating conditions; the following must be taken into consideration:

Idling pressure. flow resistances. pump operation.

The outlet pressure must be at least 2 bar greater than the pressure in the housing.

**Note: If the motor circuits are in series please consult the manufacturer.**

### Extracted from RE 15 205/02.98

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Ordering code

MCR	03				Z - 3X /	M	/		*	
<b>Frame size</b>										further information in clear text
Size 3 = 03										<b>Wheel stud</b>
<b>Flange housing</b>										<b>No code =</b> without wheel stud
Compact version = A										<b>/S =</b> with wheel stud
Flange motor = D										<b>Ports</b>
Wheel motor = F										<b>01 =</b> pipe thread to ISO 228/1
Hydrobase = H										<b>12 =</b> UNF-SAE-thread
<b>Nominal size, displacement V</b>										<b>Two speed operation</b>
Size 160 = 160 cm <sup>3</sup> = 160										<b>No code =</b> not switchable
Size 225 = 225 cm <sup>3</sup> = 225										<b>2W =</b> switchable operation
Size 255 = 255 cm <sup>3</sup> = 255										<b>Seals</b>
Size 280 = 280 cm <sup>3</sup> = 280										<b>M =</b> NBR seals suitable for mineral oil to DIN 51 524 (HL,HLP) (except dynamic brake see p.10)
Size 325 = 325 cm <sup>3</sup> = 325										<b>Brake mounting</b>
Size 365 = 365 cm <sup>3</sup> = 365										<b>A0 =</b> without brake
Size 400 = 400 cm <sup>3</sup> = 400										<b>B2 =</b> hydraulic release holding brake (spring pressure disc brake)
<b>Single shaft end</b>										<b><sup>3)</sup> C2R =</b> dynamic brake (drum brake) for right hand side of vehicle (see Fig., p.10)
Splined to DIN 5480 = W40 <sup>1)</sup>										<b><sup>3)</sup> C2L =</b> dynamic brake (drum brake) for left hand side of vehicle (see Fig., p.10)
Parallel with key Ø 40 mm = L40 <sup>2)</sup>										<b>Series</b>
With flange Ø 172 mm = F180 <sup>3)</sup>										<b>30 to 39: externally interchangeable</b>
<b>Without 2nd shaft end</b> = Z										
<sup>1)</sup> only with flange housing A maximum torque 1500 Nm										
<sup>2)</sup> only with flange housing D maximum torque 1500 Nm										
<sup>3)</sup> only with flange housing F										
										<b>3X =</b>

### Extracted from RE 15 205/02.98

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data (For applications outside these parameters please consult us)

Description	Radial piston multi-disc motor with fixed displacement								
Frame size	MCR 03...								
Type of mounting	Flange mounting; face mounting								
Cable connections	Threaded or flanged								
Mounting position	Optional								
Shaft load	See page 7								
Direction of rotation	Right/left – reversible								
Frame size	3								
Nominal size			160	225	255	280	325	365	400
Displacement volume	V	cm <sup>3</sup>	160	225	255	280	325	365	400
Flow at n = 100 rpm/100bar	q <sub>v</sub>	L/min	16	22.5	25.5	28	32.5	36.5	40
Output torque <sup>1;7)</sup>									
– specific torque (at Δp = 100 bar)	T	Nm	225	358	405	445	517	580	636
– peak torque	T	Nm	1022	1386	1570	1760	1875	2105	2307
Output speed <sup>1;7)</sup>									
– min. speed	n	rpm	5 to 10 when running smooth, dependent on application						
– max. continuous speed	n	rpm	320	320	280	260	240	240	240
– max. peak speed	n	rpm	400	400	360	330	310	280	260
– freewheeling speed	n	rpm	900						
Output power <sup>1;7)</sup>									
– continuous power	P	kW	18	18	18	18	22	22	22
– cont. power half displacement	P	kW	12	12	12	12	14	14	14
Weight	see unit dimensions pages 8 to 10								
Polar moment of inertia	J <sub>m</sub>	kgmm <sup>2</sup>	see unit dimensions pages 8 to 10 (rotating mass only)						
<b>Hydraulic</b>									
Nominal pressure	p	bar	250						
Pressure differential, fixed <sup>2;6)</sup>	Δp								
– with mineral oil (HL, HLP)		bar	250						
Pressure differential, peak <sup>3;6)</sup>	Δp								
– with mineral oil (HL, HLP)		bar	450			400			
Inlet pressure <sup>6)</sup> Port “A” or “B”	p	bar	450			420		400	
Summated pressure <sup>4;6)</sup> Port “A” + “B”	p	bar	450			420		400	
Case drain pressure max.	p	bar	10						
Hydraulic fluid <sup>5)</sup>	Mineral oil (HL, HLP) to DIN 51 524								
Hydraulic fluid temperature range	ϑ	°C	– 20 to +80						
Viscosity range	v	mm <sup>2</sup> /s	10 to 2000						
Fluid cleanliness	Max. degree of contamination of the fluid to NAS 1638 class 9. We recommend a filter with a min retention rate of β <sub>10</sub> ≥ 75.								
<b>Brake</b>									
Holding brake (disc brake)									
Holding torque	T	Nm	2200						
Release pressure	p	bar	min. 15; max. 30						
volume to operate brake	V	cm <sup>3</sup>	23						

<sup>1)</sup> The data given apply after 100 hours running-in time

<sup>2)</sup> Continuous operation

<sup>3)</sup> Peak values may occur for a maximum duration of one second within an operating minute.

<sup>4)</sup> In the return line we recommend p<sub>min</sub> = 15 ba <sup>5)</sup> Environmentally

friendly fluids HETG. HEPG. HEE to RE 90 221

<sup>6)</sup> For connection in series. consult the technical sales department.

<sup>7)</sup> **Warning!** During the running-in time of the motor (min. 20 hours) motors should not be run unloaded at greater than 50% of maximum speed.



### Extracted from RE 15 205/02.98

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data (Mean values, measured at $v = 46 \text{ mm}^2/\text{s}$ and $\vartheta = 45 \text{ }^\circ\text{C}$ )

Pressure diff. $\Delta p$ in bar		Speed n in rpm							Speed n in rpm						
		0	25	50	100	200	300	320	0	25	50	100	150	200	240
		MCR 03 . 160							MCR 03 . 325						
100	T Nm	147	214	219	224	222	213	208	284	447	467	452	429	412	
	q L/min	0.3	4.3	8.3	16.3	32.6	48.7	52.0	0.8	8.9	17.1	33.3	49.6	66.0	79.0
	$q_{VL}$ L/min	0.15	0.15	0.15	0.15	0.30	0.35	0.40	0.40	0.40	0.40	0.40	0.40	0.50	0.50
200	T Nm	321	438	453	463	463			672	917	952	952	937		
	q L/min	0.3	4.3	8.3	16.6	32.8			2.0	10.1	18.3	34.5	51.2		
	$q_{VL}$ L/min	0.15	0.15	0.15	0.30	0.40			1.00	1.00	1.00	1.00	1.20		
300	T Nm	519	659	680	695				1086	1397	1432	1440			
	q L/min	0.4	4.4	8.4	16.8				3.6	11.3	19.5	35.9			
	$q_{VL}$ L/min	0.20	0.20	0.20	0.40				1.80	1.60	1.60	1.70			
400	T Nm	693	876	908	926				1489	1875					
	q L/min	0.6	4.6	8.8	17.0				4.4	12.1					
	$q_{VL}$ L/min	0.30	0.30	0.40	0.5				2.20	2.00					
450	T Nm	779	985	1022											
	q L/min	1.0	5.4	9.8											
	$q_{VL}$ L/min	0.5	0.7	0											
Charge pressure	$p$ bar	1	2	2	3	6	9	10	1	2	3	4	6	8	10
Pressure diff. $\Delta p$ in bar		Speed n in rpm							Speed n in rpm						
		0	25	50	100	150	220		0	25	50	100	150	200	240
		MCR 03 . 225							MCR 03 . 365						
100	T Nm	215	308	315	322	318	305		320	503	524	507	495	483	462
	q L/min	0.3	5.9	11.6	22.8	45.6	68.2		0.8	9.9	19.1	37.3	55.6	74.0	88.6
	$q_{VL}$ L/min	0.15	0.15	0.15	0.15	0.3	0.35		0.4	0.4	0.4	0.4	0.4	0.5	0.5
200	T Nm	466	630	651	666	651			755	1030	1069	1068	1053		
	q L/min	0.3	5.9	11.6	23.1	45.8			2.0	11.1	20.3	38.5	57.2		
	$q_{VL}$ L/min	0.15	0.15	0.15	0.3	0.4			1.0	1.0	1.0	1.0	1.2		
300	T Nm	752	946	978	999				1219	1570	1609	1617			
	q L/min	0.4	6.0	11.7	23.3				3.6	12.3	21.5	39.9			
	$q_{VL}$ L/min	0.20	0.20	0.20	0.40				1.80	1.60	1.60	1.70			
400	T Nm	1003	1261	1304					1673	2105					
	q L/min	0.6	6.2	12.1					4.4	13.1					
	$q_{VL}$ L/min	0.3	0.3	0.4					2.2	2.0					
450	T Nm	1128	1386												
	q L/min	1.0	7.0												
	$q_{VL}$ L/min	0.5	0.7												

- All torques given apply to run-in motors (see page 4, footnote 7 of complete data sheet.)
- For “half displacement” operating mode multiply the torques and  $Q_L$ -values by 0.5.
- For maximum case leakage multiply  $Q_L$  by 2

T = torque in Nm  
 Q = input flow in L/min  
 $Q_L$  = mean case leakage in L/min  
 $p$  = min. charge pressure in pump mode

### Extracted from RE 15 205/02.98

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data (Mean values, measured at $v = 46 \text{ mm}^2/\text{s}$ and $\vartheta = 45 \text{ }^\circ\text{C}$ )

Charge pressure	p	bar	1	2	2	3	6	9		1	3	3	5	6	9	11	
Pressure diff. $\Delta p$ in bar			Speed n in rpm								Speed n in rpm						
			0	25	50	100	150	220		0	25	50	100	150			
			MCR 03 . 255								MCR 03 . 400						
100	T	Nm	239	342	350	358	354	338		350	551	575	556	543	529	506	
	q	L/min	0.4	6.8	13.2	25.9	51.8	72.4		0.8	10.8	20.8	40.8	60.8	81.0	97.0	
	$q_{VL}$	L/min	0.2	0.2	0.2	0.2	0.4	0.5		0.4	0.4	0.4	0.4	0.4	0.5	0.5	
200	T	Nm	517	700	724	740	724			828	1129	1171	1171	1153			
	q	L/min	0.4	6.8	13.2	26.3	52.2			2.0	12.0	22.0	42.0	62.4			
	$q_{VL}$	L/min	0.2	0.2	0.2	0.4	0.6			1.0	1.0	1.0	1.0	1.20			
300	T	Nm	836	1051	1087	1110				1337	1721	1762	1772				
	q	L/min	0.6	7.0	13.4	26.7				3.6	13.2	23.2	43.4				
	$q_{VL}$	L/min	0.3	0.3	0.3	0.6				1.8	1.6	1.6	1.7				
400	T	Nm	1114	1401	1449					1834	2307						
	q	L/min	0.8	7.2	14.0					4.4	14.0						
	$q_{VL}$	L/min	0.4	0.4	0.6					2.20	2.00						
450	T	Nm	1253	1575													
	q	L/min	1.6	8.4													
	$q_{VL}$	L/min	0.8	1.0													
Charge pressure	p	bar	1	2	2	4	6	9		1	3	3	5	6	9	11	
Pressure diff. $\Delta p$ in bar			Speed n in rpm														
			0	25	50	100	200	300									
			MCR 03. 280														
100	T	Nm	287	383	392	401	397	365									
	q	L/min	0.6	7.6	14.6	28.6	56.8	85.0									
	$q_{VL}$	L/min	0.30	0.30	0.30	0.30	0.40	0.50									
200	T	L/min	579	784	811	829	811										
	q	L/min	0.6	7.6	14.6	28.8	57.2										
	$q_{VL}$	L/min	0.30	0.30	0.30	0.40	0.60										
300	T	Nm	936	1177	1217	1243											
	q	L/min	0.6	7.6	14.6	29.2											
	$q_{VL}$	L/min	0.30	0.30	0.30	0.60											
400	T	Nm	1248	1569	1623												
	q	L/min	0.8	7.8	15.2												
	$q_{VL}$	L/min	0.40	0.40	0.60												
450	T	Nm	1404	1764													
	q	L/min	1.6	9.0													
	$q_{VL}$	L/min	0.8	1.0													
Charge pressure	p	bar	1	2	2	4	7	10									

- All torques given apply to run-in motors (see page 4, footnote 7 of complete data sheet.)
- For “half displacement” operating mode multiply the torques and  $Q_L$ -values by 0.5.
- For maximum case leakage multiply  $Q_L$  by 2

T = torque in Nm

Q = input flow in L/min

$Q_L$  = mean case leakage in L/min

p = min. charge pressure in pump mode

**Extracted from RE 15 206/02.98**Page 1 of 4  
Issue: 06.06See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Hydraulic motor**  
**Radial piston, low speed, high torque**  
**Model MCR 05**

Sizes 380 to 820

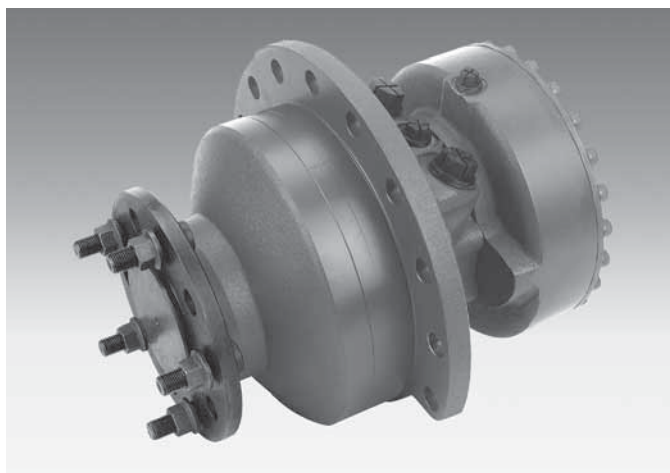
Series 3X

Maximum operating pressure 6500 psi (450 bar)

Maximum displacement volume 50 in<sup>3</sup> (820 cm<sup>3</sup>)

Maximum output torque 3573 lb-ft (4844 Nm)

- Compact, sturdy construction
- Smooth running even at very low speeds
- Low noise
- Reversible
- Sealed taper roller bearings
- High radial forces permitted on the output shaft
- Shaft seal up to 10 bar
- Freewheeling
- Available with optional built-on holding (multi-disc) brake or dynamic (drum) brake



Model MCR 05 C...F180Z-3X/B4M/..

**Function****Closed circuit**

Minimum inlet pressure must be adapted to suit operating conditions; the following must be taken into consideration:

Idling pressure. flow resistances. pump operation.

Minimum flow of the feed pump must be adapted to suit operating conditions.

**Open circuit**

Minimum inlet pressure must be adapted to suit operating conditions; the following must be taken into consideration:

Idling pressure. flow resistances. pump operation.

The outlet pressure must be at least 2 bar greater than the pressure in the housing.

**Note: If the motor circuits are in series please consult the manufacturer.**

## Extracted from RE 15 206/02.98

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Ordering code

MCR	05				Z - 3X /	M	/		*
<b>Frame size</b>									Further information in clear text
Size 05	= 05								<b>Wheel stud</b>
<b>Flange housing</b>									<b>No code =</b> without wheel stud
Short motor	= A								<b>/S =</b> with wheel stud
Compact version	= C								<b>Ports</b>
Flange motor	= D								<b>01 =</b> Pipe thread to ISO 228/1
Wheel motor	= F								<b>12 =</b> UNF- SAE-thread
Hydrobase	= H								<b>Two speed operating</b>
<b>Nominal size, displacement V</b>									<b>No code =</b> not switchable
Size 380 = 380 cm <sup>3</sup>	= 380								<b>2W =</b> switchable operation
Size 470 = 470 cm <sup>3</sup>	= 470								<b>Seals</b>
Size 520 = 520 cm <sup>3</sup>	= 520								<b>M =</b> NBR seals suitable for mineral oil to DIN 51 524 (HL,HLP) (except drum brake see p.12)
Size 565 = 565 cm <sup>3</sup>	= 565								<b>Brake mounting</b>
Size 680 = 680 cm <sup>3</sup>	= 680								<b>A0 =</b> without brake
Size 750 = 750 cm <sup>3</sup>	= 750								<b>B4 =</b> hydraulic release holding brake (spring pressure disc brake)
Size 820 = 820 cm <sup>3</sup>	= 820								<b>4) C4R =</b> dynamic brake (drum brake)
Single shaft end									for right hand side of vehicle (see Fig., p.12)
Splined to DIN 5480	= W50 <sup>1)</sup>								<b>4) C4L =</b> travel brake (drum brake)
Parallel with key Ø 50 mm	= L50 <sup>2)</sup>								for left hand side of vehicle (see Fig., p.12)
With flange Ø 180 mm	= F180 <sup>3)</sup>								<b>Series</b>
Without shaft	= Z <sup>5)</sup>								<b>3X =</b> Series 32 to 39 (30 to 39: externally interchangeable)
Without 2nd shaft end	= Z								

- 1) only with flange housing A maximum torque 3000 Nm  
 2) only with flange housing D maximum torque 3000 Nm  
 3) only with flange housing C or F  
 4) only with flange housing F  
 5) only with Hydrobase

**Extracted from RE 15 206/02.98**

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Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data** (For applications outside these parameters please consult us!)

Radial piston multi-disc motor with fixed displacement									
Frame size	MCR 05...								
Type of mounting	Flange mounting; face mounting								
Pipe connections	Threaded or flanged								
Mounting position	optional								
Shaft loading	see page 7								
Direction of rotation	Right/left - reversible								
Frame size	05								
Nominal size			380	470	520	565	680	750	820
Displacement	V	cm <sup>3</sup>	380	470	520	565	680	750	820
Flow at n = 100 rpm/100 bar	q <sub>v</sub>	L/min	38	47	52	56.5	70	77	84
Output torque <sup>1:7)</sup>									
– specific torque (at Δp = 100 bar)	T	Nm	604	748	827	899	1082	1194	1305
– peak torque	T	Nm	2528	3127	3459	3759	4017	4430	4844
Output speed <sup>1:7)</sup>									
– min. speed	n	rpm	5 to 10 when running smoothly, dependent on application						
– max. speed	n	rpm	220	220	220	220	200	170	150
– freewheeling speed	n	rpm	600						
Output power <sup>1:7)</sup>									
– cont. power at full displacement	P	kW	29	29	29	29	35	35	35
– cont. power at half displacement	P	kW	19	19	19	19	23	23	23
Weight	m	kg	see unit dimensions pages 8 to 12						
Polar moment of inertia	J <sub>m</sub>	kgmm <sup>2</sup>	see unit dimensions pages 8 to 12						
<b>Hydraulic</b>									
Nominal pressure	p	bar	250						
Pressure differential, cont. <sup>2:3)</sup>	Δp								
– with mineral oil (HL, HLP)		bar	250						
Pressure differential, peak <sup>4:3)</sup>	Δp								
– with mineral oil (HL, HLP)		bar		450				400	
Inlet pressure Port "A" or "B"	p	bar		470				420	
Summated pressure <sup>5:3)</sup> ports "A" + "B"	p	bar		470				420	
Case drain pressure,max	p	bar	10						
Hydraulic fluid <sup>6)</sup>	Mineral oils (HL, HLP) to DIN 51 524								
Hydraulic fluid temperature range	θ	°C	– 20 to +80						
Viscosity range	v	mm <sup>2</sup> /s	10 to 2000						
Fluid cleanliness	Maximum degree of contamination of the fluid to NAS 1638 class 9. We therefore recommend a filter with a minimum retention rate of β <sub>10</sub> ≥ 75.								
<b>Brake</b>									
Holding brake (disc brake)				B2			B4		
Holding torque	T	Nm	2200			5000			
Release pressure, min – max	p	bar	15 – 30			15 – 30			
Volume to operate brake	V	cm <sup>3</sup>	23			46			

1) The data given apply after 100 hours running-in time

2) Continuous operation

3) Peak values may occur for a maximum duration of one second within an operating minute.

4) In the return line we recommend p<sub>min</sub> = 15 bar

5) Environmentally friendly fluids HETG. HEPG. HEE to RE 90 221

6) For connection in series, consult the technical sales department.

7) **Warning!** During the running-in time of the motor (min. 20 hours) motors should not be run unloaded at greater than 50% of maximum speed.

## Technical data (Mean values, measured at $v = 46 \text{ mm}^2/\text{s}$ and $\vartheta = 45 \text{ }^\circ\text{C}$ )

Pressure diff. $\Delta p$ in bar		Speed n in rpm						Speed n in rpm					
		0	25	50	100	150	220	0	25	50	100	150	220
		MCR 05 . 380						MCR 05 . 680					
100	T Nm	393	513	538	544	525	507	5.95	989	995	908	821	698
	$q_V$ L/min	0.3	9.8	19.3	38.6	57.7	84.4	0.88	17.64	34.93	70.01	102.76	139.54
	$q_{VL}$ L/min	0.15	0.15	0.15	0.30	0.35	0.40	0.44	0.47	0.50	0.57	0.64	0.64
200	T Nm	846	1075	1123	1111	1087		1407	1938	2017	1973	1862	
	$q_V$ L/min	0.7	10.2	19.7	38.9	58.0		2.4	18.55	36.09	72.17	103.61	
	$q_{VL}$ L/min	0.35	0.35	0.35	0.45	0.50		1.20	1.22	1.24	1.30	1.41	
300	T Nm	1268	1613	1685	1667			2338	2964	3026	3013		
	$q_V$ L/min	0.9	10.4	19.9	39.2			3.7	19.24	36.82	71.98		
	$q_{VL}$ L/min	0.45	0.45	0.45	0.60			1.85	1.91	1.97	2.14		
400	T Nm	1691	2150	2247				3116	3939	4017			
	$q_V$ L/min	1.5	11.0	20.5				4.34	19.91	38.18			
	$q_{VL}$ L/min	0.75	0.75	0.75				2.17	2.35	2.33			
450	T Nm	1903	2419	2528									
	$q_V$ L/min	2.2	11.7	21.2									
	$q_{VL}$ L/min	1.1	1.1	1.1									
Charge pressure	p bar	1	4	4	6	9	14	1	2	3	7	12	23
Speed	n rpm	0	25	50	100	150	220	0	25	50	100	150	
		MCR 05 . 470						MCR 05 . 750					
100	T Nm	484	632	662	670	647	625	657	1091	1098	1002	906	
	$q_V$ L/min	0.40	12.2	23.9	47.8	71.5	105.0	0.88	19.39	38.43	77.01	113.26	
	$q_{VL}$ L/min	0.20	0.20	0.20	0.40	0.50	0.80	0.44	0.47	0.50	0.57	0.64	
200	T Nm	1042	1324	1384	1369	1339		1551	2137	2224	2176		
	$q_V$ L/min	0.80	12.6	24.3	48.2	71.9		2.40	20.30	39.59	79.17		
	$q_{VL}$ L/min	0.40	0.40	0.40	0.60	0.70		1.20	1.22	1.24	1.30		
300	T Nm	1562	1986	2076	2053			2578	3270	3338			
	$q_V$ L/min	1.2	13.0	24.7	48.6			3.7	20.99	40.32			
	$q_{VL}$ L/min	0.60	0.60	0.60	0.80			1.85	1.91	1.97			
400	T Nm	2083	2649	2768				3438	4345	4430			
	$q_V$ L/min	2.0	13.8	25.5				4.34	21.66	41.73			
	$q_{VL}$ L/min	1.0	1.0	1.0				2.17	2.35	2.37			
450	T Nm	2344	2980	3114									
	$q_V$ L/min	3.0	14.8	26.5									
	$q_{VL}$ L/min	1.5	1.5	1.5									
Charge pressure	p bar	1	5	5	7	10	16	1	3	4	9	15	
Speed	n min <sup>-1</sup>	0	25	50	100	150	220	0	25	50	100	150	
		MCR 05 . 520						MCR 05 . 820					
100	T Nm	538	702	737	744	683	620	718	1192	1200	1095	990	
	$q_V$ L/min	0.4	13.4	26.4	52.8	79.0	116.0	0.88	21.14	41.93	84.01	123.76	
	$q_{VL}$ L/min	0.20	0.20	0.20	0.40	0.50	0.80	0.44	0.47	0.50	0.57	0.64	
200	T Nm	1158	1472	1537	1520	1487		1697	2337	2432	2380		
	$q_V$ L/min	0.80	13.8	26.8	53.2	79.4		2.40	22.05	43.09	86.17		
	$q_{VL}$ L/min	0.40	0.40	0.40	0.60	0.70		1.20	1.22	1.24	1.30		
300	T Nm	1735	2207	2305	2281			2819	3573	3649			
	$q_V$ L/min	1.2	14.2	27.2	53.6			3.70	22.74	43.82			
	$q_{VL}$ L/min	0.60	0.60	0.60	0.80			1.85	1.91	1.97			
400	T Nm	2314	2942	3074				3758	4750	4844			
	$q_V$ L/min	2.0	15.0	28.0				4.34	23.35	45.18			
	$q_{VL}$ L/min	1.00	1.00	1.00				2.17	2.35	2.37			
450	T Nm	2604	3310	3459									
	$q_V$ L/min	3.0	16.0	29.0									
	$q_{VL}$ L/min	1.5	1.5	1.5									
Charge pressure	p bar	1	6	6	7	11	17	1	4	6	11	19	

– All torques given apply to run-in motors (see page 4, footnote 7 of complete data sheet.)

– For “half displacement” operating mode multiply the torques and  $Q$ -values by 0.5.

– For maximum case leakage multiply  $Q_L$  by 2

T = torque in Nm

$Q$  = input flow in L/min

$Q_L$  = mean case leakage in L/min



**Extracted from RE 15 207/02.98**

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See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

## Hydraulic motor

### Radial piston, low speed, high torque

#### Model MCR 10

Sizes 780 to 1340

Series 3X

Maximum operating pressure 6500 psi (450 bar)

Maximum displacement volume 81.8 in<sup>3</sup> (1340 cm<sup>3</sup>)

Maximum output torque 5920 lb-ft (8027 Nm)

- Compact, robust construction
- Smooth running even at very low speeds
- Low noise
- Reversible
- Sealed taper roller bearings
- High radial forces permitted on the output shaft
- Shaft seal up to 10 bar
- Available with optional built-on holding (multi-disc) brake or dynamic (drum) brake
- switchable
  - free-running
  - half displacement volume
- for open and closed circuit operation

## Function

### Closed circuit

Minimum inlet pressure must be adapted to suit operating conditions; the following must be taken into consideration:

Idling pressure. flow resistances. pump operation.

Minimum flow of the feed pump must be adapted to suit operating conditions.

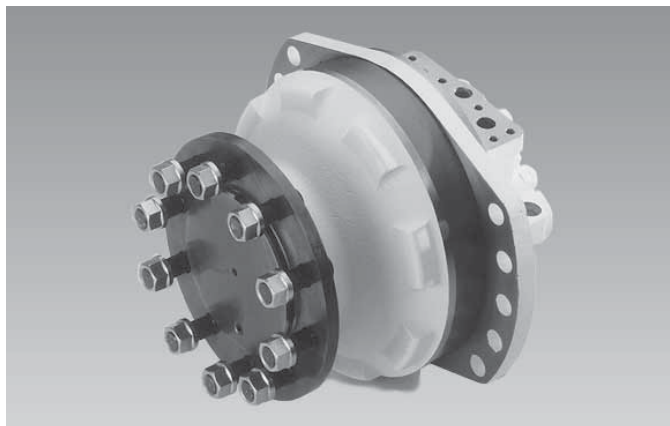
### Open circuit

Minimum inlet pressure must be adapted to suit operating conditions; the following must be taken into consideration:

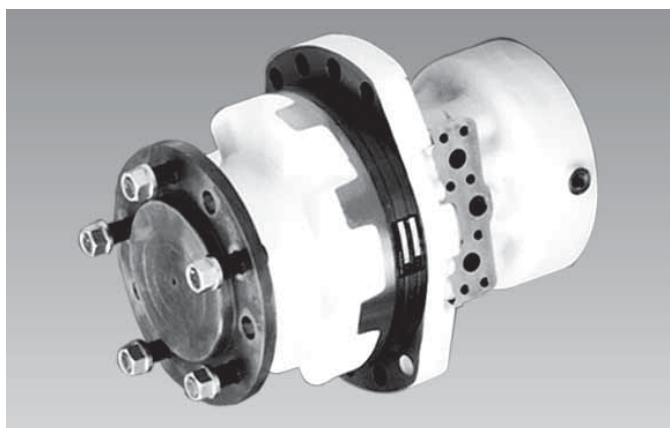
Idling pressure. flow resistances. pump operation.

The outlet pressure must be at least 2 bar greater than the pressure in the housing.

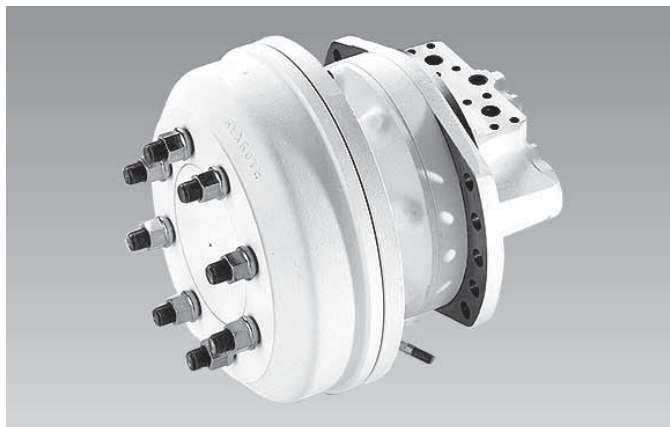
**Note: If the motor circuits are in series please consult the manufacturer.**



Model MCR 10 F...F250Z-3X/A0M...



Model MCR 10 F...F250Z-3X/B7M...



Model MCR 10 F...F250Z-3X/C7M...

**Extracted from RE 15 207/02.98**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code**

<b>MCR</b>	<b>10</b>				<b>Z -3X/</b>	<b>M</b>				<b>*</b>	Further details in clear text
<b>Frame size</b>											
Frame size 10	= 10										
<b>Flange housing</b>											<b>Studs</b>
Short motor	= C										No code = without studs
Wheel motor	= F										/S = with studs for wheel mounting
Flange motor	= D										
<b>Size/displacement volume V</b>											<b>Connections</b>
Size 780 =	780 cm <sup>3</sup>	=	<b>780</b>								/11 = Pipe thread to ISO 228/1
Size 940 =	940 cm <sup>3</sup>	=	<b>940</b>								/42 = UNF-SAE-thread
Size 1120 =	1120 cm <sup>3</sup>	=	<b>1120</b>								<b>Switchable displacement</b>
Size 1250 =	1250 cm <sup>3</sup>	=	<b>1250</b>								No code = not switchable
Size 1340 =	1340 cm <sup>3</sup>	=	<b>1340</b>								2W = switchable operation
<b>Single shaft end</b>											<b>Seals</b>
With flange Ø 250		=	<b>F250</b>	<sup>1)</sup>							M = NBR seals suitable for mineral oil to DIN 51 524 (HL, HLP)
Parallel with key Ø 60		=	<b>L60</b>	<sup>2;3)</sup>							
<b>Without 2nd shaft end</b>					=	<b>Z</b>					<b>Brake mounting</b>
<b>Series nos.</b>											A0 = no brake
Series 30 to 39					=	<b>3X</b>					B7 = hydraulically released holding brake (spring pressure disc brake)
(30 to 39, externally interchangeable)											<sup>4)</sup> C7R = travel brake (drum brake)
<sup>1)</sup> Only with flange housing C or F											<sup>4)</sup> C7L = travel brake (drum brake)
<sup>2)</sup> Only with flange housing D											for right hand side of vehicle, see fig., p. 9
<sup>3)</sup> Max. permitted pressure differential Δp = 250 bar											for left hand side of vehicle, see fig., p. 9
<sup>4)</sup> Only with flange housing F											

### Extracted from RE 15 207/02.98

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data (For applications outside these parameters please consult us)

Description	Radial piston multi-disc motor, switchable displacement						
Model description	MCR 10...						
Type of mounting	Flange mounting; face mounting						
Connections	Threaded or flanged						
Mounting position	Optional						
Shaft loading	See page 6						
Rotation	clockwise/anti-clockwise - reversible						
Frame size	10						
Size			780	940	1120	1250	1340
Displacement	V	cm <sup>3</sup>	780	940	1120	1250	1340
Flow n = 100 rpm/100 bar	q <sub>v</sub>	L/min	79	95	113.5	126.5	136.5
Output torque <sup>1;7)</sup>							
– specific torque (at Δp = 100 bar)	T	Nm	1240	1494	1783	1990	2130
– peak torque	T	Nm	5134	6187	6659	7432	8027
Output speed <sup>1;7)</sup>							
– min. speed	n	rpm	5 to 10 for smooth running, depending on application				
– max. speed	n	rpm	170	150	150	140	120
– freewheeling speed	n	rpm	400				
Output power <sup>1;7)</sup>							
– continuous power	P	kW	44	44	50	50	50
Weight							
– motor	m	kg	69				
– motor with holding brake	m	kg	81				
– motor with travel brake	m	kg	92				
<b>Hydraulic</b>							
Nominal pressure	p	bar	250				
Pressure differential, cont. <sup>2;6;7;8)</sup>	Δp						
– for mineral oil (HL, HLP)		bar	250				
Pressure differential, peak <sup>3;6;7;8)</sup>	Δp						
–for mineral oil (HL, HLP)		bar		450			400
Inlet pressure <sup>6)</sup> Port "A" or "B"	p	bar		470			420
Summated pressure <sup>4;6)</sup> Port "A" + "B"	p	bar		470			420
Case drain pressure, max.	p <sub>max</sub>	bar	10				
Switching pressure (displacement switching)		bar	10 to 30				
Hydraulic fluid <sup>5)</sup>			Mineral oil (HL, HLP) to DIN 51 524				
Hydraulic fluid temperature range	ϑ	°C	– 20 to +80				
Viscosity range	ν	mm <sup>2</sup> /s	10 to 2000				
Fluid cleanliness:			Maximum permissible degree of contamination of fluid to NAS 1638 Class 9. We therefore recommend a filter with a minimum retention rate of β <sub>10</sub> ≥ 75.				
<b>Brake Holding brake (disc brake)</b>							
Holding torque	T	Nm	7000				
Release pressure	p	bar	min. 15; max. 30				

1) The data given apply after 100 hours running-in time

2) Continuous operation

3) Peak values may occur for a maximum duration of one second within an operating minute.

4) In the return line we recommend p<sub>min</sub> = 15 bar

5) Environmentally friendly fluids HETG. HEPG. HEE to RE 90 221

6) For connection in series. consult the technical sales department.

7) **Warning!** During the running-in time of the motor (min. 20 hours) motors should not be run unloaded at greater than 50% of maximum speed.

8) For single shaft end "L60" max. permissible pressure differential Δp = 250 bar

### Extracted from RE 15 207/02.98

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data (Mean values, measured at $v = 46 \text{ mm}^2/\text{s}$ and $\vartheta = 45 \text{ }^\circ\text{C}$ )

Nominal Size		780					1250				
Speed n in rev/min		0	25	50	100	150	0	25	50	100	150
100	T Nm	806	994	1049	1029	911	1094	1818	1726	1517	1309
	q <sub>V</sub> L/min	0.3	19.8	39.47	79.00	118.20	1.00	32.09	63.73	126.69	189.30
	q <sub>VL</sub> L/min	0.15	0.15	0.24	0.50	0.60	0.50	0.56	0.63	0.76	0.90
200	T Nm	1736	2232	2282	2232	2158	2586	3669	3684	3497	
	q <sub>V</sub> L/min	0.60	20.10	39.80	79.50	118.8	2.86	33.03	64.63	127.82	
	q <sub>VL</sub> L/min	0.30	0.30	0.40	0.75	0.9	1.43	1.44	1.45	1.46	
300	T Nm	2604	3348	3422	3348		4178	5550	5574		
	q <sub>V</sub> L/min	0.80	20.30	40.00	80.00		4.08	34.08	66.16		
	q <sub>VL</sub> L/min	0.40	0.40	0.50	1.00		2.04	2.10	2.16		
400	T Nm	3472	4464	4563			5730	7432	7416		
	q <sub>V</sub> L/min	1.40	20.90	40.80			5.68	35.11	67.35		
	q <sub>VL</sub> L/min	0.70	0.70	0.90			2.84	2.92	3.00		
450	T Nm	3906	5022	5134							
	q <sub>V</sub> L/min	1.6	21.10	41.00							
	q <sub>VL</sub> L/min	0.8	0.8	1.00							
Nominal Size		940					1340				
Speed n in rev/min		0	25	50	100	150	0	25	50	100	
100	T Nm	971	1198	1264	1240	1098	1182	1964	1865	1639	
	q <sub>V</sub> L/min	1.00	23.80	47.47	95.00	142.20	1.00	34.61	68.78	136.76	
	q <sub>VL</sub> L/min	0.15	0.15	0.24	0.50	0.60	0.50	0.56	0.63	0.76	
200	T Nm	2091	2690	2750	2689		2793	3962	3979	3777	
	q <sub>V</sub> L/min	0.60	24.10	47.80	95.50		2.86	35.56	69.68	137.93	
	q <sub>VL</sub> L/min	0.30	0.30	0.40	0.75		1.43	1.44	1.45	1.46	
300	T Nm	3137	4035	4124			4512	5994	6020		
	q <sub>V</sub> L/min	0.80	24.30	48.00			4.08	36.64	71.24		
	q <sub>VL</sub> L/min	0.40	0.40	0.50			2.04	2.10	2.16		
400	T Nm	4183	5380	5500			6188	8027	8010		
	q <sub>V</sub> L/min	1.40	24.90	48.80			5.68	37.67	72.50		
	q <sub>VL</sub> L/min	0.70	0.70	0.90			2.84	2.92	3.00		
450	T Nm	4706	6052	6187							
	q <sub>V</sub> L/min	1.60	25.10	49.00							
	q <sub>VL</sub> L/min	0.80	0.80	1.00							
Nominal Size		1120									
Speed n in rev/min		0	25	50	100	150					
100	T Nm	980	1629	1547	1360	1173					
	q <sub>V</sub> L/min	1.00	28.82	57.19	113.62	169.80					
	q <sub>VL</sub> L/min	0.50	0.56	0.63	0.76	0.90					
200	T Nm	2317	3287	3301	3134						
	q <sub>V</sub> L/min	2.86	29.76	58.07	114.71						
	q <sub>VL</sub> L/min	1.43	1.44	1.45	1.46						
300	T Nm	3743	4973	4994							
	q <sub>V</sub> L/min	4.08	30.76	59.49							
	q <sub>VL</sub> L/min	2.04	2.10	2.16							
400	T Nm	5134	6660	6645							
	q <sub>V</sub> L/min	5.68	31.76	60.87							
	q <sub>VL</sub> L/min	2.84	2.92	3.00							

#### Notes on the technical data

T = torque in Nm

Q = input flow in L/min

Q<sub>L</sub> = mean case leakage in L/min

- All torques given apply to run-in motors (see page 4, footnote 7 of complete data sheet.)
- For “half displacement” operating mode multiply the torques and Q-values by 0.5.
- For maximum case leakage multiply Q<sub>L</sub> by 2

### Extracted from RE 15 208/10.94

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Hydraulic motor Radial piston, low speed, high torque Model MCR 15

Sizes 1130 to 2150

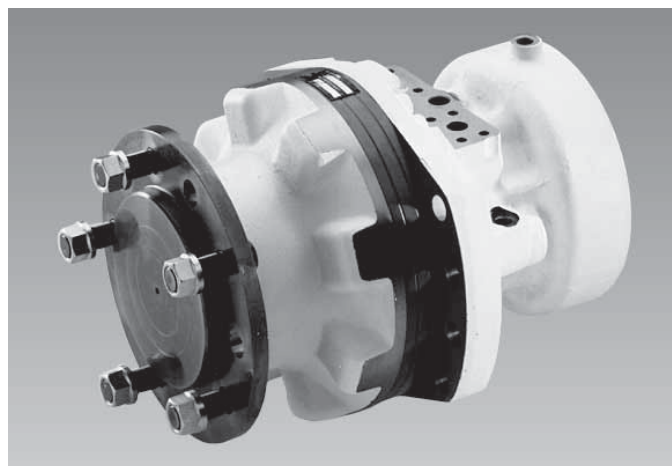
Series 3X

Maximum operating pressure 6500 psi (450 bar)

Maximum displacement volume 131 in<sup>3</sup> (2150 cm<sup>3</sup>)

Maximum output torque 10096 lb-ft (13688 Nm)

- compact, sturdy construction
- smooth running even at very low speeds
- low noise
- reversible
- sealed tapered roller bearing
- high radial forces permitted on output shaft
- shaft seal up to 10 bar
- optional integral holding brake (multi-disc brake) or wheel brake (drum brake)
- switchable
  - freewheeling
  - half displacement
- for open and closed circuits



### Function

#### Closed circuit

Minimum inlet pressure must be adapted to suit operating conditions; the following must be taken into consideration:

Idling pressure, flow resistances, pump operation.

Min. flow of the pump must be adapted to suit operating conditions.

#### Open circuit

Minimum inlet pressure must be adapted to suit operating conditions; the following must be taken into consideration:

Idling pressure, flow resistances, pump operation.

The outlet pressure must be at least 2 bar greater than the pressure in the housing.

**Note: If the motor circuits are in series please consult the manufacturer.**

### Ordering code

MCR	15				Z	-3X/	M	/		*	Further details in clear text	
											<b>Studs</b>	
											no code =	without studs
											/S =	with studs for wheel mounting
											<b>Ports</b>	
											11 =	BSP thread to ISO 228/1
											42 =	UNF-SAE threads
											no code =	not switchable.
												anti-clockwise rotation preferred
											2R =	switchable, clockw. rotation preferred
											2L =	switchable, anti-clw. rotation preferred
											<b>Seals</b>	
											M =	NBR seals, suitable for mineral oil to DIN 51 524 (HL, HLP)
											<b>Brake mounting</b>	
											AO =	without brake
											B11 =	hydraulic holding brake (spring pressure disc brake)
<b>Flange housing</b> Wheel version = F Sizes/Displacement V Size 1130 = 1130 cm <sup>3</sup> = 1130 Size 1250 = 1250 cm <sup>3</sup> = 1250 Size 1500 = 1500 cm <sup>3</sup> = 1500 Size 1780 = 1780 cm <sup>3</sup> = 1780 Size 2150 = 2150 cm <sup>3</sup> = 2150 <b>1st shaft end</b> with flange 280 = F 280 without 2nd shaft end = Z <b>Series</b> = 3X Series 30 to 39 (30 to 39, externally interchangeable)												

### Extracted from RE 15 208/10.94

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data (For applications outside these parameters please consult us)

Type	Piston machine						
Model	Radial piston multi-stroke motor, switchable displacement						
Type code	MCR 15...						
Type of mounting	Flange mounting; face mounting						
Type of connection	Threaded, flange						
Mounting position	Optional						
Shaft load	See pages 6, 7						
Direction of rotation	Right / left - reversible						
Frame size	15						
Nominal size			1130	1250	1500	1780	2150
Displacement	V	cm <sup>3</sup>	1130	1250	1500	1780	2150
Displacement flow at n = 100 rev/min/100 bar	Q	L/min	114	126	151	179	216
Output torque <sup>1), 7)</sup>							
– spec. torque (at $\Delta p = 100$ bar)	T	Nm	1799	1990	2388	2833	3422
– max. torque	T	Nm	8095	8955	9552	11332	13688
Output torque <sup>1), 7)</sup>							
– min. speed	n	rev/min	5 to 10 when running smooth, depending on application				
– max. speed	n	rev/min	150	150	150	125	125
– freewheeling	n	rev/min	300				
Output power <sup>1)</sup>							
– continuous power	P	kW	55	55	55	60	60
Weight							
– motor	m	kg	93				
– motor with holding brake	m	kg	120				
– motor with wheel brake	m	kg	135				
<b>Hydraulic</b>							
Nominal pressure	p	bar	250				
Pressure difference, cont. <sup>2), 6), 7)</sup>	$\Delta p$						
– with mineral oil (HL, HLP)		bar	250				
Pressure difference, peak <sup>3), 6), 7)</sup>	$\Delta p$						
– with mineral oil (HL, HLP)		bar		450		400	
Inlet pressure port "A" or "B"	p	bar		470		420	
Summated pressure <sup>4), 6)</sup> port "A" + "B"	p	bar		470		420	
Case drain pressure	p	bar	10				
Fluid <sup>5)</sup>			Mineral oil (HL, HLP) to DIN 51 524				
Fluid temperature range	$\vartheta$	°C	– 20 to +80				
Viscosity range	v	mm <sup>2</sup> /s	10 to 2000				
Fluid cleanliness			Max. permissible degree of contamination of the fluid to NAS 1638 class 9. We therefore recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .				
<b>Brake</b>							
Holding brake (multi-disc brake)							
Holding torque	T	Nm	11 000				
Brake release pressure, min – max	p	bar	Min. 15 max. 30				
Wheel brake (drum brake)			See table page 8				

<sup>1)</sup> The data given apply after 100 hours running-in time

<sup>2)</sup> Continuous operation

<sup>3)</sup> Peak values may occur for a maximum duration of one second within an operating minute.

<sup>4)</sup> In the return line we recommend  $p_{\min} = 15$  bar

<sup>5)</sup> Environmentally friendly fluids HETG, HEPG, HEE to RE 90 221

<sup>6)</sup> For connection in series, consult the technical sales department.

<sup>7)</sup> **Warning!** During the running-in time of the motor (min. 20 hours) motors should not be run unloaded at greater than 50% of maximum speed.

### Extracted from RE 15 208/10.94

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data (Mean values, measured at $v = 46 \text{ mm}^2/\text{s}$ and $\vartheta = 45 \text{ }^\circ\text{C}$ )

Nominal Size			1130					1780				
Speed n in rev/min			0	25	50	100	150	0	25	50	100	150
100	T	Nm	1133	1529	1583	1493	1397	1558	2456	2420	2043	
	Q	L/min	0.72	28.95	57.40	114.19	171.31	0.74	45.41	90.05	179.22	
	Q <sub>L</sub>	L/min	0.20	0.20	0.30	0.50	0.90	0.37	0.41	0.45	0.53	
200	T	Nm	2447	3166	3238	3166	3133	3683	5049	5116	4833	
	Q	L/min	2.18	29.59	58.09	114.98	172.16	2.18	46.55	91.22	180.55	
	Q <sub>L</sub>	L/min	0.40	0.40	0.50	0.60	1.00	1.09	1.11	1.13	1.17	
300	T	Nm	3670	4749	4858	4694		5949	7692	7794		
	Q	L/min	4.04	30.10	59.02	115.52		4.04	48.00	93.10		
	Q <sub>L</sub>	L/min	0.50	0.50	0.70	0.70		2.02	2.15	2.28		
400	T	Nm	4892	6331	6474			8160	10335	10425		
	Q	L/min	5.84	31.00	59.81			5.82	49.46	94.81		
	Q <sub>L</sub>	L/min	1.00	1.00	1.00			2.92	3.21	3.50		
450	T	Nm	5503	7122	7284							
	Q	L/min	6.90	31.46	60.59							
	Q <sub>L</sub>	L/min	1.10	1.10	1.30							
Nominal Size			1250					2150				
Speed n in rev/min			0	25	50	100	150	0	25	50	100	
100	T	Nm	1253	1692	1751	1691	1512	1882	2967	2922	2467	
	Q	L/min	0.74	31.95	63.40	126.19	189.31	0.72	54.66	108.55	216.22	
	Q <sub>L</sub>	L/min	0.20	0.20	0.30	0.50	0.90	0.37	0.41	0.45	0.53	
200	T	Nm	2707	3503	3582	3503		4448	6098	6180		
	Q	L/min	2.18	32.59	64.09	126.98		2.18	55.80	109.72		
	Q <sub>L</sub>	L/min	0.40	0.40	0.50	0.60		1.09	1.11	1.13		
300	T	Nm	4060	5254	5373			7186	9290	9414		
	Q	L/min	4.04	33.10	65.02			4.04	57.25	111.60		
	Q <sub>L</sub>	L/min	0.50	0.50	0.70			2.02	2.15	2.28		
400	T	Nm	5411	7003	7162			9855	12483			
	Q	L/min	5.82	34.00	65.81			5.84	58.71			
	Q <sub>L</sub>	L/min	1.00	1.00	1.00			2.92	3.21			
450	T	Nm	6088	7878	8057							
	Q	L/min	6.90	34.46	66.59							
	Q <sub>L</sub>	L/min	1.10	1.10	1.30							
Nominal Size			1500									
Speed n in rev/min			0	25	50	100	150					
100	T	Nm	1504	2030	2101	1983	1719					
	Q	L/min	0.40	37.90	75.60	151.00	226.80					
	Q <sub>L</sub>	L/min	0.20	0.20	0.30	0.50	0.90					
200	T	Nm	3248	4203	4298	4203						
	Q	L/min	0.80	38.30	76.00	151.20						
	Q <sub>L</sub>	L/min	0.40	0.40	0.50	0.60						
300	T	Nm	4872	6304	6448							
	Q	L/min	1.00	38.50	76.40							
	Q <sub>L</sub>	L/min	0.50	0.50	0.70							
400	T	Nm	6494	8403	8594							
	Q	L/min	2.00	39.50	77.40							
	Q <sub>L</sub>	L/min	1.00	1.00	1.00							
450	T	Nm	7305	9454	9669							
	Q	L/min	2.20	39.70	77.60							
	Q <sub>L</sub>	L/min	1.10	1.10	1.30							

#### Notes on the technical data

T = torque in Nm

Q = input flow in L/min

Q<sub>L</sub> = mean case leakage in L/min

- All torques given apply to run-in motors (see page 4, footnote 7 of complete data sheet.)
- For "half displacement" operating mode multiply the torques and Q-values by 0.5.
- For maximum case leakage multiply Q<sub>L</sub> by 2



**Extracted from RE 15 209/03.95**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Hydraulic motor**  
**Radial piston, low speed, high torque**  
**Model MCR 20**

Sizes 1750 to 3000

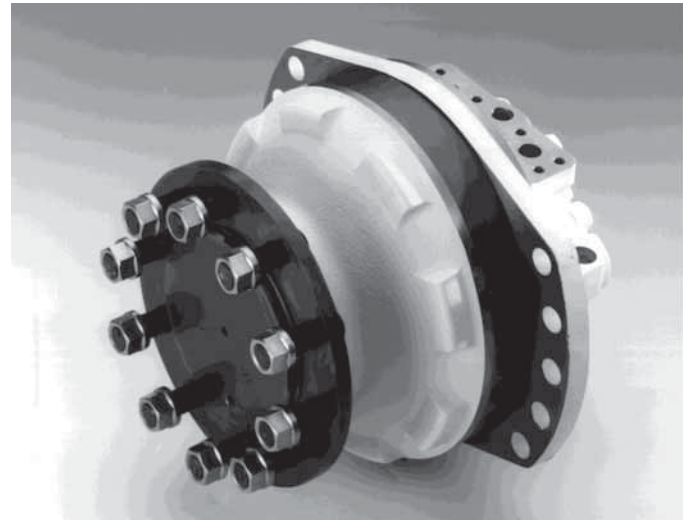
Series 3X

Maximum operating pressure 6500 psi (450 bar)

Maximum displacement volume 183 in<sup>3</sup> (3000 cm<sup>3</sup>)

Maximum output torque 12570 lb-ft (17043 Nm)

- compact, sturdy construction
- smooth running even at very low speeds
- low noise
- reversible
- sealed tapered roller bearing
- high radial forces permitted on output shaft
- shaft seal up to 10 bar
- optional integral holding brake (multi-disc brake)
- switchable
  - freewheeling
  - half displacement
- for open and closed circuits



**Function**

**Closed circuit**

Minimum inlet pressure must be adapted to suit operating conditions; the following must be taken into consideration:

Idling pressure. flow resistances. pump operation.

Min. flow of the pump must be adapted to suit operating conditions.

**Open circuit**

Minimum inlet pressure must be adapted to suit operating conditions; the following must be taken into consideration:

Idling pressure. flow resistances. pump operation.

The outlet pressure must be at least 2 bar greater than the pressure in the housing. **Note: If the motor circuits are in series please consult the manufacturer.**

**Ordering code**

MCR	20	C		Z	-3X/	M	/			*
-----	----	---	--	---	------	---	---	--	--	---

**Sizes/Displacement V**

Size 1750	= 1750 cm <sup>3</sup>	= <b>1750</b>
Size 2100	= 2100 cm <sup>3</sup>	= <b>2100</b>
Size 2500	= 2500 cm <sup>3</sup>	= <b>2500</b>
Size 3000	= 3000 cm <sup>3</sup>	= <b>3000</b>

**1st shaft end**

with flange 280 = **F 280**

without 2nd shaft end = **Z**

**Series**

Series 30 to 39 = **3X**  
(30 to 39, externally interchangeable)

Further details  
in clear text

**Studs**

**no code** = without studs  
**/S** = with studs for wheel mounting

**Ports**

**11** = BSP thread to ISO 228/1  
**42** = UNF-SAE threads

**no code** = not switchable,  
**2W** = switchable displacement

**Seals**

**M** = NBR seals, suitable for mineral oil to DIN 51 524 (HL, HLP)

**Brake mounting**

**AO** = without brake  
**B19** = hydraulic holding brake (spring pressure disc brake)

**Extracted from RE 15 209/03.95**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data** (For applications outside these parameters please consult us)

Type	Piston machine					
Model	Radial piston multi-stroke motor, switchable displacement					
Type code	MCR 20...					
Type of mounting	Flange mounting; face mounting					
Type of connection	Threaded, flange					
Mounting position	Optional					
Shaft load	See page 6					
Direction of rotation	Right / left - reversible					
Frame size	20					
Nominal size		1750	2100	2500	3000	
Displacement	V	cm <sup>3</sup>	1750	2100	2500	3000
Displacement flow at n = 100 rev/min/100 bar	Q	L/min	176	211	252	302
Output torque <sup>1), 7)</sup>						
– spec. torque (at $\Delta p = 100$ bar)	T	Nm	2785	3342	3979	4775
– max. torque	T	Nm	11 531	13 762	14 244	17 093
Output speed						
– min. speed	n	rev/min	5 to 10 when running smoothly, depending on application			
– max. continuous speed	n	rev/min	125	125	115	115
– max. intermittent speed	n	rev/min	160	160	115	115
– freewheeling	n	rev/min	500			
Output power <sup>1)</sup>						
Weight – continuous power	P	kW	70	70	85	85
– motor	m	kg	110			
– motor with holding brake	m	kg	140			
<b>Hydraulic</b>						
Nominal pressure	p	bar	250			
Pressure difference, cont. <sup>2), 6), 7)</sup>	$\Delta p$					
– with mineral oil (HL, HLP)		bar	250			
Pressure difference, peak <sup>3), 6), 7)</sup>	$\Delta p$					
– with mineral oil (HL, HLP)		bar	450		400	
Inlet pressure port “A” or “B”	p	bar	470		420	
Summated pressure <sup>4), 6)</sup> port “A” + “B”	p	bar	470		420	
Case drain pressure	p	bar	10			
Fluid <sup>5)</sup>			Mineral oil (HL, HLP) to DIN 51 524			
Fluid temperature range	$\vartheta$	°C	– 20 to +80			
Viscosity range	v	mm <sup>2</sup> /s	10 to 2000			
Fluid cleanliness			Max. permissible degree of contamination of the fluid to NAS 1638 class 9. We therefore recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .			
<b>Brake</b>						
Holding brake (multi-disc brake)						
Holding torque	T	Nm	19 000			
Brake release pressure, min – max	p	bar	Min. 15 Max. 30			

<sup>1)</sup> The data given apply after 100 hours running-in time

<sup>2)</sup> Continuous operation

<sup>3)</sup> Peak values may occur for a maximum duration of one second within an operating minute.

<sup>4)</sup> In the return line we recommend  $p_{\min} = 15$  bar

<sup>5)</sup> Environmentally friendly fluids HETG, HEPG, HEE to RE 90 221

<sup>6)</sup> For connection in series, consult the technical sales department.

<sup>7)</sup> **Warning!** During the running-in time of the motor (min. 20 hours) motors should not be run unloaded at greater than 50% of maximum speed.

## Extracted from RE 15 209/03.95

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data (Mean values, measured at $v = 46 \text{ mm}^2/\text{s}$ and $\vartheta = 45 \text{ }^\circ\text{C}$ )

Pressure Differential $\Delta p$ bar		Speed in RPM					Speed in RPM				
		0	25	50	100	125	0	25	50	100	115
		MCR20. 1750					MCR20. 3000				
100	T Nm	1950	2423	2507	2206	2111	2626	3915	4011	3247	2435
	Q L/min	1.6	45.4	89.3	176.8	221.0	1.6	76.6	151.8	301.8	347.0
	$Q_L$ L/min	0.8	0.8	0.9	0.9	1.1	0.8	0.8	0.9	0.9	1.0
200	T Nm	3899	5013	5124	5013		6207	8212	8403		
	Q L/min	2.4	46.2	90.3	178.0		2.4	77.4	152.8		
	$Q_L$ L/min	1.2	1.2	1.4	1.5		1.2	1.2	1.4		
300	T Nm	5850	7520	7688			10027	126052	12891		
	Q L/min	3.4	47.2	91.3			3.4	78.4	153.8		
	$Q_L$ L/min	1.7	1.7	1.9			1.7	1.7	1.9		
400	T Nm	7799	10028	10251			13751	16998			
	Q L/min	4.4	48.2	92.1			4.4	79.4			
	$Q_L$ L/min	2.2	2.2	2.3			2.2	2.2			
450	T Nm	8774	11281	11531							
	Q L/min	4.8	48.6	92.6							
	$Q_L$ L/min	2.4	2.4	2.6							
Speed	n rpm	0	25	50	100	125					
		MCR20. 2100									
100	T Nm	2335	2902	3002	2570	2390					
	Q L/min	1.6	54.1	106.8	211.8	269.7					
	$Q_L$ L/min	0.8	0.8	0.9	0.9	1.1					
200	T Nm	4670	6005	6138	6005						
	Q L/min	2.4	54.9	107.8	213						
	$Q_L$ L/min	1.2	1.2	1.4	1.5						
300	T Nm	7006	9007	9207							
	Q L/min	3.4	55.9	108.8							
	$Q_L$ L/min	1.7	1.7	1.9							
400	T Nm	9341	12010	12276							
	Q L/min	4.4	56.9	109.6							
	$Q_L$ L/min	2.2	2.2	2.3							
450	T Nm	10508	13510								
	Q L/min	4.8	57.3								
	$Q_L$ L/min	2.4	2.4								
Speed	n rpm	0	25	50	100	115					
		MCR20. 2500									
100	T Nm	2188	3263	3342	2706	2594					
	Q L/min	1.6	64.1	126.8	251.8	289.5					
	$Q_L$ L/min	0.8	0.8	0.9	0.9	1.0					
200	T Nm	5173	6844	7003	6605						
	Q L/min	2.4	64.9	127.8	253						
	$Q_L$ L/min	1.2	1.2	1.4	1.5						
300	T Nm	8356	10504	10743							
	Q L/min	3.4	65.9	128.8							
	$Q_L$ L/min	1.7	1.7	1.9							
400	T Nm	11459	14165	14244							
	Q L/min	4.4	66.9	129.6							
	$Q_L$ L/min	2.2	2.2	2.3							

### Notes on the technical data

T = torque in Nm

Q = input flow in L/min

$Q_L$  = mean case leakage in L/min

- All torques given apply to run-in motors (see page 4, footnote 7 of complete data sheet.)
- For "half displacement" operating mode multiply the torques and Q-values by 0.5.
- For maximum case leakage multiply  $Q_L$  by 2

**Extracted from RA 91 001/11.04**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Fixed displacement motor  
for open and closed circuits,  
Axial piston, bent axis design  
Model AA2FM (A2FM)**

Sizes 5, Series 6

Nominal pressure 315 bar (4600 PSI)

Maximum pressure 350 bar (5100 PSI)

Size 10 to 200, Series 6

Nominal pressure 400 bar (5800 PSI)

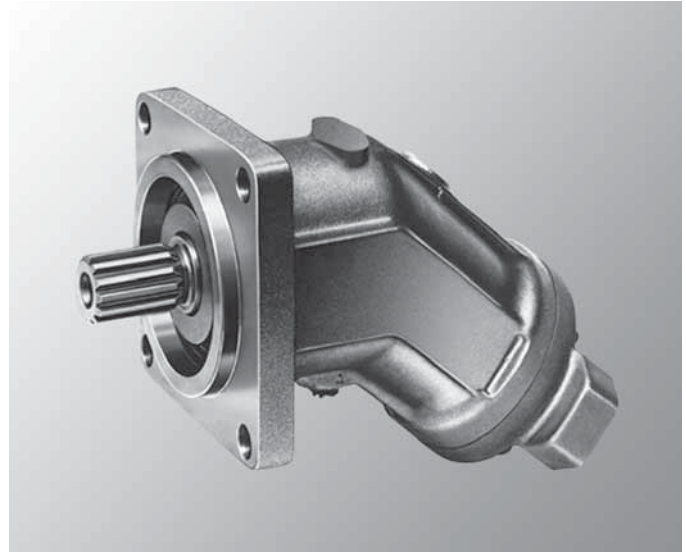
Maximum pressure 450 bar (6500 PSI)

Size 250 to 1000, Series 6

Nominal pressure 350 bar (5100 PSI)

Maximum pressure 400 bar (5800 PSI)

- Fixed displacement motor AA2FM of axial piston, bent axis design, suitable for hydrostatic drives in open and closed circuits
- Use in mobile and industrial applications
- The output speed depends on the flow capacity of the pump and the displacement of the motor
- The torque increases with the pressure differential between the high and low pressure side and with increasing displacement
- Careful selection of the displacements offered, permit sizes to be matched to practically every application
- High power density
- Compact design
- High overall efficiency
- Excellent starting torque efficiency
- Economical conception
- One piece pistons with piston rings



**Extracted from RA 91 001/11.04**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code**

**Pressure fluid**

Mineral oil, HFD for sizes 250-1000 only in combination with long-life bearing "L" (no code)	
HFB-, HFC pressure fluid	Sizes 10...200 (no code)
	Sizes 250...1000 (only in combination with long-life bearing "L")
	<b>E-</b>

**Axial piston unita**

		<b>10...180</b>	<b>200</b>	<b>250</b>	<b>355...1000</b>	
Bent axis design, fixed displacement	Version SAE	●	—	●	—	<b>AA2F</b>
	Version ISO	—	●	—	●	<b>A2F</b>

**Drive shaft bearing**

		<b>10...200</b>	<b>250...500</b>	<b>710...1000</b>	
Mechanical bearing (no code)		●	●	—	
Long-life bearing		—	●	●	<b>L</b>

**Mode of operation**

Motor (plug-in motor A2FE see RE 91008)	<b>M</b>
---	----------

**Size**

Size ≈ displacement V <sub>g</sub> cm <sup>3</sup> /rev.	<b>Size</b>	<b>10</b>	<b>12</b>	<b>16</b>	<b>23</b>	<b>28</b>	<b>32</b>	<b>45</b>	<b>56</b>	<b>63</b>	<b>80</b>
	in <sup>3</sup> /rev.	0.63	0.73	0.98	1.40	1.71	1.95	2.78	3.42	3.84	4.91
	<b>Size</b>	<b>90</b>	<b>107</b>	<b>125</b>	<b>160</b>	<b>180</b>	<b>200</b>	<b>250</b>	<b>355</b>	<b>500</b>	<b>710</b>
	in <sup>3</sup> /rev.	5.49	6.51	7.63	9.79	10.98	12.20	15.25	21.66	30.51	43.33

**Series**

	<b>6</b>
--	----------

**Index**

	sizes 10...180	<b>1</b>
	size 200	<b>3</b>
	sizes 250...1000	<b>0</b>

**Direction of rotation**

Viewed on shaft end	alternating	<b>W</b>
---------------------	-------------	----------

**Seals**

FKM (flour-caoutchouc)	<b>V</b>
------------------------	----------

**Shaft end**

		<b>10</b>	<b>12</b>	<b>16</b>	<b>23</b>	<b>28</b>	<b>32</b>	<b>45</b>	<b>56</b>	<b>63</b>	<b>80</b>	<b>90</b>	<b>107</b>	<b>125</b>	<b>160</b>	<b>180</b>	<b>250</b>	
SAE Version (AA2F)	SAE Splined shaft	●	●	●	●	●	●	●	●	●	—	—	●	●	●	●	●	<b>S</b>
		—	—	—	—	—	—	—	●	●	—	—	—	—	—	—	—	<b>T</b>
		—	—	—	—	—	—	—	—	—	●	●	●	●	—	—	—	<b>U</b>
		—	—	—	—	—	—	—	—	—	●	●	—	—	—	—	—	<b>Q</b>
Cylindrical shaft with key DIN 6885	●	●	●	●	●	●	—	●	●	—	—	●	●	●	●	—	<b>B</b>	
	—	—	—	—	—	—	●	—	—	—	—	—	—	—	—	—	<b>P</b>	
SAE cyl. shaft with key	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	●	<b>K</b>	

ISO Version	Splined shaft DIN 5480	—	●	●	●	●	—	—	—	—	—	—	—	—	—	—	<b>Z</b>	
		●	—	—	—	—	—	—	—	—	—	—	—	—	—	<b>A</b>		
	Cylindrical shaft with key DIN 6885	—	●	●	●	●	—	—	—	—	—	—	—	—	—	—	<b>P</b>	
		●	—	—	—	—	—	—	—	—	—	—	—	—	—	<b>B</b>		

		<b>10</b>	<b>12</b>	<b>16</b>	<b>23</b>	<b>28</b>	<b>32</b>	<b>45</b>	<b>56</b>	<b>63</b>	<b>80</b>	<b>90</b>	<b>107</b>	<b>125</b>	<b>160</b>	<b>180</b>	<b>250</b>	
SAE Version (AA2F)	SAE 2-bolt	●	●	●	—	—	—	—	—	—	—	—	—	—	—	—	—	<b>C</b>
	SAE 4-bolt	—	—	—	●	●	●	●	●	●	—	—	●	●	●	●	●	<b>D</b>
		—	—	—	—	—	—	—	—	—	●	●	—	—	—	—	—	<b>DN</b>

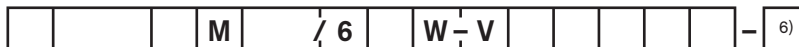
ISO Version (A2F)	ISO 4-bolt	●	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<b>B</b>	
	ISO 8-bolt	—	●	●	●	●	—	—	—	—	—	—	—	—	—	—	<b>H</b>	

**Extracted from RA 91 001/11.04**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.



- Pressure fluid
- Axial piston unit
- Drive shaft bearing
- Mode of operation
- Size
- Series
- Index
- Direction of rotation
- Seals
- Shaft end
- Mounting flange

**Service line connections**

AA2F <sup>1)</sup>		10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	250		
SAE ports A and B, rear	51	0	-	-	•	•	•	•	•	•	•	•	•	•	•	•	•	•	510
SAE ports A and B at side, opposite side	52	0	-	-	•	•	•	•	•	•	•	•	•	•	•	•	•	•	520
Threaded ports A and B at side, opposite side	53	0	•	•	•	•	•	-	-	-	-	-	-	-	-	-	-	530	
Threaded ports A and B at side and rear <sup>2)</sup>	54	0	-	-	•	•	•	-	-	-	-	-	-	-	-	-	-	540	
SAE ports A and B bottom	60	0	-	-	-	-	-	-	-	-	-	-	•	•	-	-	-	600	
Port plate for fitting a counterbalance valve <sup>3)</sup>	18	1	-	-	-	•	•	•	•	•	•	•	•	•	•	•	-	181	
Port plate with integrated pressure relief valves <sup>3)</sup>	19	1	-	-	-	•	•	•	•	•	•	•	•	•	•	•	•	-	191
		2	-	-	-	•	•	•	•	•	•	•	•	•	•	•	•	-	192
<b>A2F<sup>3)</sup></b>								200	355	500	710	1000							
SAE ports A and B rear	01	0							•	•	•	•	•						010
		7							-	•	•	○	○						017
SAE ports A and B, bottom	10	0							-	•	-	-	-						100

**Valves**

without valves	0
with pressure relief valves (without pressure sequence range)	1
with pressure relief valves (with pressure sequence range)	2
with flushing and boost pressure valve	7

**Speed measurement**

	10...16	23...180	200	250	355...1000	
without speed measurement (no code)	•	•	•	•	•	
prepared for speed measurement with ID sensor <sup>4)</sup>	-	•	-	-	-	D
prepared for speed measurement with HDD sensor <sup>4)</sup>	-	•	•	- <sup>5)</sup>	○	F

**Special design**

Standard design (no code)	
Special design for slew drive applications (standard for port plate 19)	sizes 23...180 J

•	= available
○	= in preparation
-	= not available

<sup>1)</sup> Threads of fixing screws and service lines are SAE (UN/UNF)

<sup>2)</sup> Threaded ports at side are plugged with locking screw

<sup>3)</sup> Threads of fixing screws are metric

<sup>4)</sup> Complete order recommended (AA2FM inc. speed sensor)

<sup>5)</sup> See RE 91001 (ISO-Version)

<sup>6)</sup> No code = standard version, S = special version (sizes 5...200), SO = special version (sizes 250...1000), K = combination with mounting part or mounting pump (sizes 5...200)

### Extracted from RA 91 001/11.04

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Technical Data

### Operational pressure range – Maximum pressure on port A or B (pressure data according to DIN 24312)

AA2F	Sizes	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	250	Nominal pressure	Peak pressure
Shaft end:	S	●	●	●	●	●	●	●					●	●	●	●		400 bar (5800 psi)	450 bar (6500 psi)
	S								●	●							●	350 bar (5100 psi)	400 bar (5800 psi)
	Q										●							300 bar (4350 psi)	350 bar (5100 psi)
	Q											●						280 bar (4000 psi)	315 bar (4600 psi)
	T								●	●								400 bar (5800 psi)	450 bar (6500 psi)
	U											●	●	●	●			400 bar (5800 psi)	450 bar (6500 psi)
	B	●	●	●	●	●	●		●	●				●	●	●	●	350 bar (5100 psi)	400 bar (5800 psi)
	P								●									350 bar (5100 psi)	400 bar (5800 psi)
K																	●	350 bar (5100 psi)	400 bar (5800 psi)
A2F	Sizes	5	200	355	500	710	1000	Nominal pressure	Peak pressure										
Shaft end:	Z				●	●	●	●	350 bar (5100 psi)	400 bar (5800 psi)									
	A		●						400 bar (5800 psi)	450 bar (6500 psi)									
	P			●	●	●	●		350 bar (5100 psi)	400 bar (5800 psi)									
	B			●					350 bar (5100 psi)	400 bar (5800 psi)									
	B	●							210 bar (3000 psi)	250 bar (3600 psi)									
	C	●							315 bar (4600 psi)	350 bar (5100 psi)									

With pulsating loads over  $p_N = 315$  bar (4600 psi) ( $p_{max} = 350$  [5100 psi]);  
we recommend the use of a splined shaft (AA2FM 10...250: S, T or U / A2FM 200: A / A2FM 355...1000: Z)  
The sum of the pressure at ports A and B may not exceed 700 bar (10000 psi) (A2F5: 630 bar (9000 psi))

**Attention:** shaft end with drives of radial force loads at the drive shaft (pinion, V-belt drives) necessitate reduction of the nominal pressure to  $p_N = 315$  bar (4600 psi)! Sizes 250...1000 please contact us.x

### Permissible radial and axial loading on the drive shaft – These are maximum values and do not apply to continuous operation.

Size	5	10	12	16	23	28	32	45	56	63	80		
Radial force, max. <sup>1)</sup> at distance a (from shaft collar)	$F_{q \max}$	N (lbf)	710 (160)	2100 (472)	2500 (562)	3250 (730)	3850 (865)	4800 (1079)	5400 (1214)	7250 (1630)	8150 (1832)	9150 (2057)	10250 (2304) <sup>2)</sup>
	a	mm (in)	12 (0.47)	16 (0.63)	16 (0.63)	16 (0.63)	16 (0.63)	16 (0.63)	16 (0.63)	18 (0.71)	18 (0.71)	18 (0.71)	20 (0.79)
Axial force, max. <sup>3)</sup>	$+F_{ax \max}$	N (lbf)	180 (40)	320 (72)	320 (72)	320 (72)	500 (112)	500 (112)	500 (112)	630 (142)	800 (180)	800 (180)	1000 (225)
	$-F_{ax \max}$	N (lbf)	180 (40)	320 (72)	320 (72)	320 (72)	500 (112)	500 (112)	500 (112)	630 (142)	800 (180)	800 (180)	1000 (225)
Permissible axial force/bar (psi) operating pressure	$\pm F_{ax \text{ per.}} / \text{bar (psi)}$	N/bar (lbf/psi)	1.5 (0.023)	3.0 (0.05)	3.0 (0.05)	3.0 (0.05)	5.2 (0.08)	5.2 (0.08)	5.2 (0.08)	7.0 (0.11)	8.7 (0.13)	8.7 (0.13)	10.6 (0.16)

Size	90	107	125	160	180	200	250	355	500	710	1000		
Radial force, max. <sup>1)</sup> at distance a (from shaft collar)	$F_{q \max}$	N (lbf)	11450 (2574) <sup>2)</sup>	12100 (2720)	14100 (3170)	16300 (3664)	18300 (4114)	22900 (5148)	1200 <sup>4)</sup> (270)	1500 <sup>4)</sup> (337)	1900 <sup>4)</sup> (427)	3000 <sup>4)</sup> (674)	2600 <sup>4)</sup> (584)
	a	mm (in)	20 (0.79)	20 (0.79)	20 (0.79)	25 (0.98)	25 (0.98)	25 (0.98)	41 (1.61)	52.5 (2.07)	52.5 (2.07)	67.5 (2.66)	67.5 (2.66)
Axial force, max. <sup>3)</sup>	$+F_{ax \max}$	N (lbf)	1000 (225)	1250 (281)	1250 (281)	1600 (360)	1600 (360)	1600 (360)	2000 (450)	2500 (562)	3000 (674)	4400 (989)	4400 (989)
	$-F_{ax \max}$	N (lbf)	1000 (225)	1250 (281)	1250 (281)	1600 (360)	1600 (360)	1600 (360)	2000 (450)	2500 (562)	3000 (674)	4400 (989)	4400 (989)
Permissible axial force/bar (psi) operating pressure	$\pm F_{ax \text{ per.}} / \text{bar (psi)}$	N/bar (lbf/psi)	10.6 (0.16)	12.9 (0.20)	12.9 (0.20)	16.7 (0.26)	16.7 (0.26)	16.7 (0.26)	5) (0.11)	5) (0.11)	5) (0.11)	5) (0.11)	5) (0.11)

<sup>1)</sup> during intermittent operation (sizes 5...200)

<sup>2)</sup> value for Q-shaft:  $F_{q \max} = 9000$  N (2023 lb-ft)

<sup>3)</sup> max. permissible axial force when stopped or when axial piston unit working in pressureless conditions.

<sup>4)</sup> when stopped or when axial piston unit working in pressureless conditions. Higher forces are permitted when under pressure, please contact us.

<sup>5)</sup> please contact us

When considering the permissible axial force, the force-transfer direction must be taken into account.

$-F_{ax \max}$  = increase in service life of bearings

$+F_{ax \max}$  = reduction in service life of bearings (avoid if at all possible)



**Extracted from RA 91 001/11.04**

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Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical Data**
**Table of values** (theoretical values, ignoring  $\eta_{mh}$  and  $\eta_{vi}$ ; values rounded)

Size			5	10	12	16	23	28	32	45	56	63	80
Displacement	$V_g$	in <sup>3</sup>	0.30	0.63	0.73	0.98	1.40	1.71	1.95	2.78	3.42	3.84	4.91
		cm <sup>3</sup>	4.93	10.3	12.0	16.0	22.9	28.1	32.0	45.6	56.1	63.0	80.4
Speed max.	$n_{max}$	rpm	10000	8000	8000	8000	6300	6300	6300	5600	5000	5000	4500
		$n_{max\ intermit.}^{1)}$	rpm	11000	8800	8800	8800	6900	6900	6900	6200	5500	5500
Flow max.	$qV_{max}$	gpm	13	21.8	25.3	33.9	38.2	46.6	52.2	67.4	74.0	83.1	95.6
		L/min	49	82	96	128	144	176	201	255	280	315	360
Torque constants	$T_K$	lb-ft/psi	0.004	0.0084	0.0097	0.013	0.019	0.023	0.026	0.037	0.045	0.051	0.065
		Nm/bar	0.076	0.164	0.19	0.25	0.36	0.445	0.509	0.725	0.89	1.0	1.27
Torque at	$T$	$\Delta p = 5100\ psi$	18 <sup>2)</sup>	42	49	66	94	115	132	188	231	259	332
		$\Delta p = 350\ bar$	24.7 <sup>2)</sup>	57	67	88	126	156	178	254	312	350	445
		$\Delta p = 5800\ psi$	–	48	56	75	107	131	150	213	263	295	377
		$\Delta p = 400\ bar$	–	65	76	100	144	178	204	290	356	400	508
Rotary stiffness		lb-ft/°	40	89	89	89	170	170	170	243	325	325	494
		Nm/°	54	120	120	120	230	230	230	330	440	440	670
Mass moment of inertia around output shaft	$J$	lbs-ft <sup>2</sup>	0.0019	0.0095	0.0095	0.0095	0.0285	0.0285	0.0285	0.0569	0.0997	0.0997	0.1708
		kgm <sup>2</sup>	0.00008	0.0004	0.0004	0.0004	0.0012	0.0012	0.0012	0.0024	0.0042	0.0042	0.0072
Filling capacity		gal		0.045	0.045	0.045	0.053	0.053	0.053	0.087	0.119	0.119	0.145
		L		0.17	0.17	0.17	0.20	0.20	0.20	0.33	0.45	0.45	0.55
Mass (approx.)	$m$	lbs	5.5	12	12	12	21	21	21	30	40	40	51
		kg	2.5	5.4	5.4	5.4	9.5	9.5	9.5	13.5	18	18	23

Size			90	107	125	160	180	200	250	355	500	710	1000
Displacement	$V_g$	in <sup>3</sup>	5.49	6.51	7.63	9.79	10.98	12.20	15.25	21.66	30.51	43.33	61.02
		cm <sup>3</sup>	90	106.7	125	160.4	180	200	250	355	500	710	1000
Speed max.	$n_{max}$	rpm	4500	4000	4000	3600	3600	2750	2700	2240	2000	1600	1600
		$n_{max\ intermit.}^{1)}$	rpm	5000	4400	4400	4000	4000	3000	–	–	–	–
Flow max.	$qV_{max}$	gpm	106.9	112.7	132.1	152.5	171.1	145.2	178	210	264	300	422
		L/min	405	427	500	577	648	550	675	795	1000	1136	1600
Torque constants	$T_K$	lb-ft/psi	0.073	0.086	0.101	0.130	0.146	0.162	0.202	0.287	0.405	0.575	0.809
		Nm/bar	1,43	1,70	1,99	2,54	2,86	3,18	3,98	5,65	7,96	11,3	15,9
Torque at	$T$	$\Delta p = 5100\ psi$	371	440	516	662	742	825	1030	1465	2063	2930	4127
		$\Delta p = 350\ bar$	501	595	697	889	1001	1114	1393	1978	2785	3955	5570
		$\Delta p = 5800\ psi$	422	500	587	753	844	938	–	–	–	–	–
		$\Delta p = 400\ bar$	572	680	796	1016	1144	1272	–	–	–	–	–
Rotary stiffness		lb-ft/°	494	649	649	996	996	2146	2753	3756	6069	13832	13832
		Nm/°	670	880	880	1350	1350	2910	3733	5092	8228	18753	18753
Mass moment of inertia around output shaft	$J$	lbs-ft <sup>2</sup>	0.1708	0.2753	0.2753	0.5221	0.5221	0.8970	1.4475	2.4205	4.2240	13.052	13.052
		kgm <sup>2</sup>	0.0072	0.0116	0.0116	0.0220	0.0220	0.0378	0.061	0.102	0.178	0.55	0.55
Filling capacity		gal	0.145	0.211	0.211	0.291	0.291	0.713	0.660	0.925	1.110	2.113	2.113
		L	0.55	0.8	0.8	1.1	1.1	2.7	2.5	3.5	4.2	8	8
Mass (approx.)	$m$	lbs	51	71	71	99	99	145	161	242	342	715	741
		kg	23	32	32	45	45	66	73	110	155	325	336

<sup>1)</sup> intermittent maximum speed: overspeed at discharge and over-running travel operations,  $t < 5\ sec.$  and  $\Delta p < 150\ bar$  (2200 psi)

<sup>2)</sup>  $\Delta p = 315\ bar$  (4600 psi)

**Extracted from RA 91 172/10.03**Page 1 of 4  
Issue: 06.06See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Fixed displacement motor  
for open and closed circuits,  
Axial piston, swashplate design  
Model A10FM, Standard version  
Model A10FE, Plug-in version**

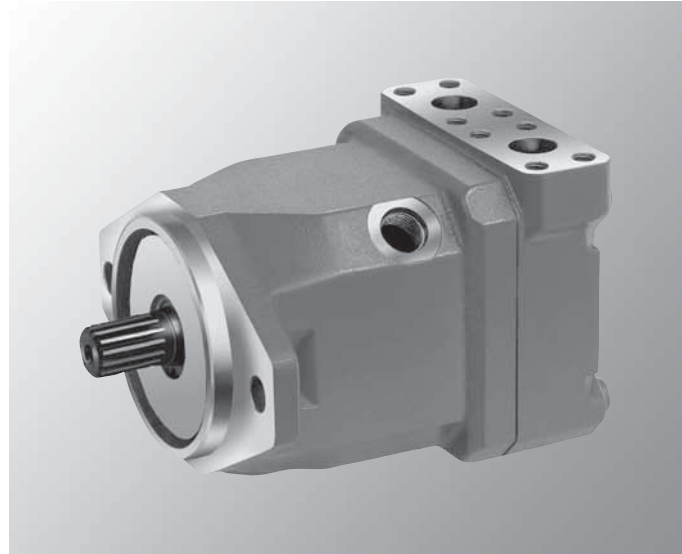
Size 10...63

Series 5

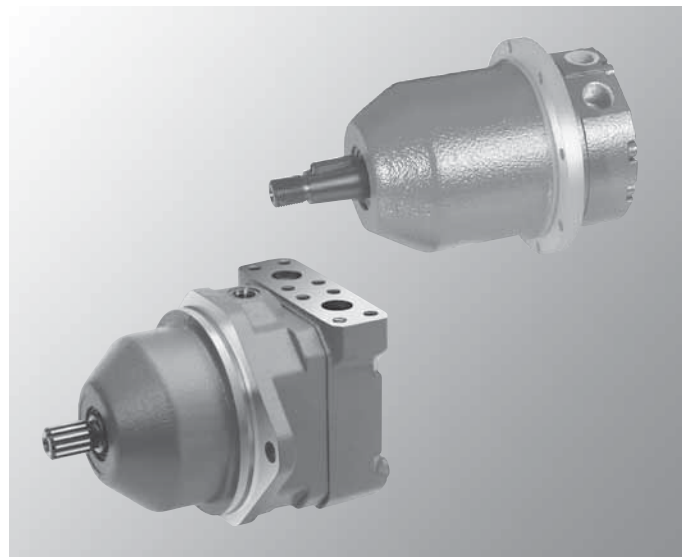
Nominal pressure 4060 psi (280 bar)

Peak pressure 5100 psi (350 bar)

- Output speed proportional to inlet flow
- Output torque increases with the pressure gradient between high and low-pressure sides
- For mobile and industrial use
- Long service life
- High permissible output speeds
- Well proven A10-rotary group
- High power to weight ratio- compact size
- Low noise levels
- Mechanical and hydraulic connections acc. to SAE standards
- Optional speed pickup
- Integrated anti cavitation valve optional, i.e. fan drives
- Plug-in version for space saving installation



Model A10FM, size 23 to 63

A10FE, size 10 to 45  
(2-hole flange)A10FE, size 11 to 18  
(8-hole flange)

## Extracted from RA 91 172/10.03

Page 2 of 4

Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Ordering code

A10F M / 5 2 - V C

### Hydraulic fluid

Mineral oil (without prefix)

### Axial piston motor

Swashplate design fixed displacement, nomi-  
nal pressure 4060psi (280 bar) peak pres-  
sure 5000 psi (350 bar)

A10F

### Operating mode

Motor

M

### Size

Displacement V <sub>g</sub> in cm <sup>3</sup>	18	23	28	37	45	58	63
in <sup>3</sup> /rev	1.10	1.43	1.73	2.23	2.71	3.53	3.84
cm <sup>3</sup> /rev	18	23.5	28.5	36.7	44.5	58	63.1
	○	●	●	●	●	●	●

### Series

5

### Index

2

### Direction of rotation (Looking at shaft end)

	changing	W
with valve option "2" only	right <sup>1)</sup>	R
with valve option "2" only	left <sup>1)</sup>	L

### Seals

FPM fluororubber

V

### Shaft end

	18	23	28	37	45	58	63	
SAE splined shaft with runout	○	●	●	●	●	●	●	R
SAE splined shaft with runout	-	○	○	●	●	●	●	W
Tapered with woodruff key	○	●	●	●	●	○	○	C

### Mounting flange

SAE 2-hole

C

### Ports for service lines

	18	23	28	37	45	58	63	
Ports A/B on side - same side; SAE flange, UNC threaded bolt holes	-	●	●	●	●	●	●	60N00
Threaded ports A/B on side - same side; UNF thread	○	●	●	●	●	●	●	66N00
Ports A/B at rear - SAE flange, UNC threaded bolt holes	○	○	○	●	●	○	○	61N00
SAE threaded ports at rear - UNF thread	○	●	●	●	●	○	○	64N00

### Valves

	18	23	28	37	45	58	63	
Without valves	○	●	●	●	●	●	●	0
Integrated flushing valve	-	●	●	●	●	●	●	7 <sup>2)</sup>
Integrated anti-cavitation valve	○	●	●	●	●	●	●	2 <sup>1,2)</sup>

### Speed pickup

Without speed pickup (no code)	○	●	●	●	●	●	●	
Prepared for speed pickup (for inductive sensor ID)	○	●	●	●	●	●	●	D

<sup>1)</sup> Integrated anti-cav valve requires selection of R- or L hand rotation

<sup>2)</sup> with port for service lines option "60N00" and "66N00"

● = available    ○ = in preparation    - = not available

**Extracted from RA 91 172/10.03**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code**

A10F	M	E	/	5	2		-	V											
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**Hydraulic fluid**

Mineral oil (without prefix)

**Axial piston motor**

Swashplate design fixed displacement, nominal pressure 4060psi (280 bar) peak pressure 5000 psi (350 bar) **A10F**

**Operating mode**

Motor **E**

**Size**

Displacement V <sub>g</sub> in cm <sup>3</sup>	10	11	14	16	18	23	28	37	45	58	63
in <sup>3</sup> /rev	0.65	0.70	0.86	0.98	1.10	1.43	1.73	2.24	2.71	3.53	3.84
cm <sup>3</sup> /rev	10.6	11.5	14.1	16.1	18.0	23.5	28.5	36.7	44.5	58.0	63.1
	●	●	●	●	●	●	●	●	●	○	○

**Series**

**5**

**Index**

**2**

**Direction of rotation (Looking at shaft end)**

	changing	<b>W</b>
with valve option "2" only	right <sup>1)</sup>	<b>R</b>
with valve option "2" only	left <sup>1)</sup>	<b>L</b>

**Seals**

FPM fluororubber **V**

**Shaft end**

	10	11	14	16	18	23	28	37	45	58	63	
SAE splined shaft with runout	○	○	○	○	○	●	●	●	●	○	○	<b>R</b>
SAE splined shaft with runout	-	-	-	-	-	○	○	○	○	○	○	<b>W</b>
Tapered with woodruff key	●	●	●	●	●	●	●	●	●	○	○	<b>C</b>

**Mounting flange**

SAE 2-hole	●	●	●	●	●	-	-	-	-	-	-	<b>C</b>
Special 2-hole flange	-	-	-	-	-	●	●	●	●	○	○	<b>F</b>
Special 8-hole flange	-	●	●	●	●	-	-	-	-	-	-	<b>H</b>

**Ports for service lines**

	10	11	14	16	18	23	28	37	45	58	63	
Ports A/B on side - same side; SAE flange, UNC threaded bolt holes	-	-	-	-	-	●	●	●	●	○	○	<b>60N00</b>
Threaded ports A/B on side - same side; UNF thread	●	○	●	●	●	○	○	●	●	○	○	<b>66N00</b>
Ports A/B at rear - SAE flange, UNC threaded bolt holes	-	-	-	-	-	○	○	○	○	○	○	<b>61N00</b>
SAE threaded ports at rear - UNF thread	-	-	-	-	-	○	○	○	○	○	○	<b>64N00</b>

**Valves**

	10	11	14	16	18	23	28	37	45	58	63	
Without valves	○	●	○	●	●	●	●	●	○	○	○	<b>0</b>
Integrated flushing valve	-	-	-	-	-	○	○	●	●	○	○	<b>7<sup>2)</sup></b>
Integrated anti-cavitation valve	●	○	●	●	●	●	●	○	●	○	○	<b>2<sup>1,2)</sup></b>

**Speed pickup**

Without speed pickup (no code)	○	●	●	●	●	●	●	●	○	○	
Prepared for speed pickup (for inductive sensor ID)	-	-	-	-	-	○	○	○	○	○	<b>D</b>

<sup>1)</sup> Integrated anti-cav valve requires selection of R- or L hand rotation

<sup>2)</sup> with port for service lines option "60N00" and "66N00"

● = available    ○ = in preparation    - = not available

### Extracted from RA 91 172/10.03

Page 4 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data

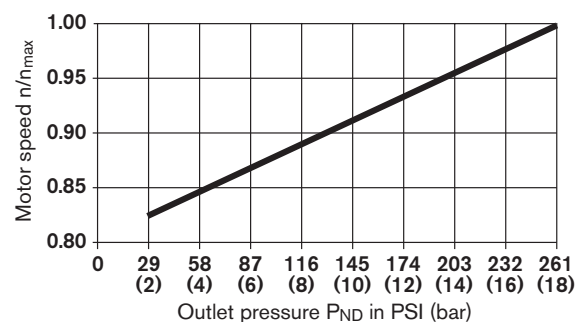
**Table of values** (theoretical values, without considering  $\eta_{mh}$  and  $\eta_v$ : values rounded)

Size			10	11	14	16	18
Motor displacement	$V_{g \max}$	in <sup>3</sup> (cm <sup>3</sup> )	0.65 (10.6)	0.70 (11.5)	0.86 (14.1)	0.98 (16.1)	1.10 (18)
Max. speed <sup>1)</sup>	$n_{\max}$	rpm	5000	4200	4200	4200	4200
Max. inlet flow at $n_{\max}$	$q_{v \max}$	gpm (L/min)	14 (53)	12.7 (48)	15.6 (59)	17.9 (68)	20.1 (76)
Max. power at $n_{\max}$ $\Delta p = 4060$ psi (280 bar)	$P_{\max}$	HP (kW)	33 (24.7)	30 (22.5)	37 (27.6)	42 (31.6)	47 (35.3)
Max. torque at $V_{g \max}$ $\Delta p = 4060$ psi (280 bar)	$T_{\max}$	lb-ft (Nm)	34.6 (47)	37.6 (51)	46.5 (63)	53.1 (72)	59 (80)
Mass moment of inertia (about the output shaft)	J	lb-ft <sup>2</sup>	0.014	0.022	0.022	0.022	0.022
		(kgm <sup>2</sup> )	(0.0006)	(0.00093)	(0.00093)	(0.00093)	(0.00093)
Filling volume. approx.		gal. (L)	0.026(0.1)	0.039(0.15)	0.039(0.15)	0.039(0.15)	0.039(0.15)
Weight. approx.	m	lbs (kg)	11 (5)	14.3 (6.5)	14.3 (6.5)	14.3 (6.5)	14.3 (6.5)
Permissible load on output shaft. max. perm. axial force	$F_{ax \max}$	lbf (N)	900 (400)	1570 (700)	1570 (700)	1570 (700)	1570 (700)
Max. perm. radial force	$F_{q \max}$	lbf (N)	560 (250)	790 (350)	790 (350)	790 (350)	790 (350)
Actual starting torque at $n = 0 \text{ min}^{-1}$ $\Delta p = 4060$ psi (280 bar)	T	lb-ft (Nm)	27.6 (37.5)	22.1 (30)	33.2 (45)	39.1 (53)	49.8 (67.5)

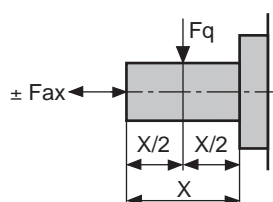
**Table of values** (theoretical values, without considering  $\eta_{mh}$  and  $\eta_v$ : values rounded)

Size			23	28	37	45	58	63
Motor displacement	$V_{g \max}$	in <sup>3</sup> (cm <sup>3</sup> )	1.43(23.5)	1.73(28.5)	2.24(36.7)	2.71(44.5)	3.53(58)	3.84(63.1)
Max. speed <sup>1)</sup>	$n_{\max}$	rpm	4900	4700	4200	4000	3600	3400
Max. inlet flow at $n_{\max}$	$q_{v \max}$	gpm (L/min)	30.4(115)	35.4(134)	40.7(154)	47(178)	55.2(209)	56.8(215)
Max. power at $n_{\max}$ $\Delta p = 4060$ psi (280 bar)	$P_{\max}$	HP (kW)	71(53.6)	83(62.5)	95(71.8)	111(83.1)	130(97.4)	133(100.1)
Max. torque at $V_{g \max}$ $\Delta p = 4060$ psi (280 bar)	$T_{\max}$	lb-ft (Nm)	77.4(105)	93.7(127)	120(163)	146(198)	190(258)	207(281)
Mass moment of inertia (about the output shaft)	J	lb-ft <sup>2</sup>	0.04	0.04	0.078	0.078	0.133	0.133
		(kgm <sup>2</sup> )	(0.0017)	(0.0017)	(0.0033)	(0.0033)	(0.0056)	(0.0056)
Filling volume. approx.		gal. (L)	0.16(0.6)	0.16(0.6)	0.185(0.7)	0.185(0.7)	0.21(0.8)	0.21(0.8)
Weight. approx.	m	lbs (kg)	26.5(12)	26.5(12)	37.5(17)	37.5(17)	48.5(22)	48.5(22)
Permissible load on output shaft. max. perm. axial force	$F_{ax \max}$	lbf (N)	2250(1000)	2250(1000)	3370(1500)	3370(1500)	4500(2000)	4500(2000)
Max. perm. radial force	$F_{q \max}$	lbf (N)	2700(1200)	2700(1200)	3370(1500)	3370(1500)	3820(1700)	3820(1700)
Actual starting torque at $n = 0 \text{ min}^{-1}$ $\Delta p = 4060$ psi (280 bar)	T	lb-ft (Nm)	55.3(75)	77.4(105)	92.2(125)	125(170)	151(205)	169(230)

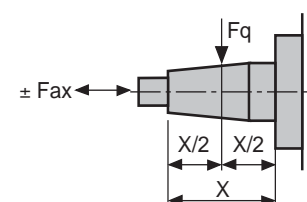
<sup>1)</sup> Maximum speed depending on outlet pressure



Applied force with shaft R and W



Applied force with shaft C



**Extracted from RA 91 401/07.05**

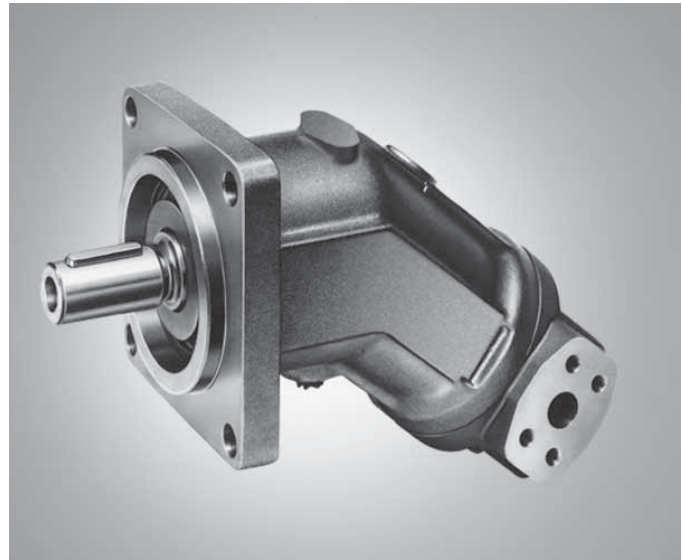
 Page 1 of 4  
 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Fixed displacement pump  
 for open circuits,  
 Axial piston, bent axis design  
 Model AA2FO (A2FO)**

Sizes	Nominal pressure/Peak pressure
5	4600/5100 psi (315/350 bar)
10...200	5800/6500 psi (400/450 bar)
250...1000	5100/5800 psi (350/400 bar)
Series 6	

- Fixed displacement pump AA2FO of axial piston, bent axis design, suitable for hydrostatic drives in open circuits
- Use in mobile and industrial applications
- Output flow is proportional to drive speed and displacement
- The drive shaft bearings are designed to give the service life expected in these areas of operation
- High power density
- Compact design
- High overall efficiency
- Cost effective concept
- One piece pistons with piston rings


**Ordering code for size 5**

<b>A2F</b>	<b>5</b>	<b>/</b>	<b>60</b>		<b>-</b>		<b>7</b>
01	02		03	04		05	06

Additional instructions in text form

**Seals**

The fixed pump A2F5 is equipped with Buna-N (NBR) seals in standard design. In case of need FKM- (fluor-caoutchouc) seals please indicate when ordering in clear text:

"with FKM-seals"

**Axial piston unit**

01	Bent axis design, fixed displacement	<b>A2F</b>
----	--------------------------------------	------------

**Size**

02	Size	<b>5</b>	
	≈ Displacement $V_g$	$\text{in}^3/\text{rev.}$	0.30
		$\text{cm}^3/\text{rev.}$	4.93

**Series**

03		<b>60</b>
----	--	-----------

**Direction of rotation**

04	Viewed on shaft end	$\text{clockwise}$	<b>R</b>
		$\text{counter-clockwise}$	<b>L</b>

**Shaft end**

05	Parallel keyed shaft DIN 6885	<b>B</b>
	Tapered shaft with threaded end and woodruff key per DIN 6888	<b>C</b>

**Service line ports**

06	Threaded ports A und B at side, metric	<b>7</b>
----	--	----------

**Extracted from RA 91 401/07.05**

Page 2 of 4

Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Ordering code**

			<b>O</b>		<b>/</b>	<b>6</b>			<b>-</b>	<b>V</b>			
01	02	03	04	05		06	07	08		09	10	11	12

**Hydraulic fluid**

01	Mineral oil, HFD for sizes 250...1000 only in combination with long-life bearing "L" (no code)	
	HFB-, HFC hydraulic fluid	Sizes 10...200 (no code)
		Sizes 250...1000 (only in combination with long-life bearing "L")
		<b>E-</b>

**Axial piston unit**

			<b>10...180</b>	<b>200</b>	<b>250</b>	<b>355...1000</b>	
02	Bent axis design, fixed displacement	Version SAE	●	-	●	-	<b>AA2F</b>
		Version ISO	-	●	-	●	<b>A2F</b>

**Drive shaft bearing**

			<b>10...200</b>	<b>250...500</b>	<b>710...1000</b>	
03	Mechanical bearing (no code)		●	●	-	
	Long-life bearing		-	●	●	<b>L</b>

**Mode of operation**

04	Pump, open circuits	<b>O</b>
----	---------------------	----------

**Size**

05	Size ≈ displacement $V_g$ (cm <sup>3</sup> )											
	Size	<b>10</b>	<b>12</b>	<b>16</b>	<b>23</b>	<b>28</b>	<b>32</b>	<b>45</b>	<b>56</b>	<b>63</b>	<b>80</b>	
	in <sup>3</sup> /rev.	0.63	0.73	0.98	1.40	1.71	1.95	2.78	3.42	3.84	4.91	
	Size	<b>90</b>	<b>107</b>	<b>125</b>	<b>160</b>	<b>180</b>	<b>200</b>	<b>250</b>	<b>355</b>	<b>500</b>	<b>710</b>	<b>1000</b>
	in <sup>3</sup> /rev.	5.49	6.51	7.63	9.79	10.98	12.20	15.25	21.66	30.51	43.33	61.02

**Series**

06		<b>6</b>
----	--	----------

**Index**

07		sizes 10...180	<b>1</b>
		size 200	<b>3</b>
		sizes 250...1000	<b>0</b>

**Direction of rotation**

08	Viewed on shaft end	clockwise	<b>R</b>
		counter-clockwise	<b>L</b>

**Seals**

09	FKM (flour-caoutchouc)	<b>V</b>
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**Extracted from RA 91 401/07.05**

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 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data** (theoretical values, without considering  $\eta_{mh}$  and  $\eta_v$ ; values rounded)

Size			5	10	12	16	23	28	32	45	56	63	80		
Displacement	$V_g$	in <sup>3</sup>	0.30	0.63	0.73	0.98	1.40	1.71	1.95	2.78	3.42	3.84	4.91		
		cm <sup>3</sup>	4.93	10.3	12	16	22.9	28.1	32	45.6	56.1	63	80.4		
Speed max.	$n_{max}^{1)}$	rpm	5600	3150	3150	3150	2500	2500	2500	2240	2000	2000	1800		
		$n_{max\ limit}^{2)}$	rpm	8000	6000	6000	6000	4750	4750	4750	4250	3750	3750	3350	
Flow max.	$q_{V\ max}$	gpm	7.3	8.6	10.0	13.2	15.1	18.5	21.1	27.0	29.6	33.3	38.0		
		L/min	27.6	32.4	37.8	50	57	70	80	102	112	126	144		
Power at	$\Delta p = 5100\ psi$	$P_{max}$	HP	19.5 <sup>3)</sup>	25	30	39	44	55	63	80	88	99	113	
		$\Delta p = 350\ bar$	$P_{max}$	kW	14.5 <sup>3)</sup>	18.9	22	29.2	33	41	47	59.5	65	73.5	84
		$\Delta p = 5800\ psi$	$P_{max}$	HP	–	30	34	45	51	63	71	100	113	129	
		$\Delta p = 400\ bar$	$P_{max}$	kW	–	22	25	34	38	47	53	68	75	84	96
Torque at	$\Delta p = 5100\ psi$	T	lb-ft	18 <sup>3)</sup>	42	50	65	94	116	132	189	232	260	331	
		T	Nm	24.7 <sup>3)</sup>	57	67	88	126	156	178	254	312	350	445	
		T	lb-ft	–	48	56	75	107	131	150	214	263	295	377	
		T	Nm	–	65	76	101	145	178	203	290	356	400	511	
Mass moment of inertia around output shaft	J	lbs-ft <sup>2</sup>	0.0019	0.0095	0.0095	0.0095	0.0285	0.0285	0.0285	0.0569	0.0997	0.0997	0.1708		
		kgm <sup>2</sup>	0.00008	0.0004	0.0004	0.0004	0.0012	0.0012	0.0012	0.0024	0.0042	0.0042	0.0072		
Case fill capacity		gal		0.045	0.045	0.045	0.053	0.053	0.053	0.087	0.119	0.119	0.145		
		L		0.17	0.17	0.17	0.20	0.20	0.20	0.33	0.45	0.45	0.55		
Weight (approx.)	m	lbs	5.5	12	12	12	21	21	21	30	40	40	51		
		kg	2.5	5.4	5.4	5.4	9.5	9.5	9.5	13.5	18	18	23		

Size			90	107	125	160	180	200	250	355	500	710	1000		
Displacement	$V_g$	in <sup>3</sup>	5.49	6.51	7.63	9.79	10.98	12.20	15.25	21.66	30.51	43.33	61.02		
		cm <sup>3</sup>	90	106.7	125	160.4	180	200	250	355	500	710	1000		
Speed max.	$n_{max}^{1)}$	rpm	1800	1600	1600	1450	1450	1550	1500	1320	1200	1200	950		
		$n_{max\ limit}^{2)}$	rpm	3350	3000	3000	2650	2650	2750	1800	1600	1500	1500	1200	
Flow max.	$q_{V\ max}$	gpm	42.8	44.9	52.8	61.2	69.0	81.9	99.1	123.9	158.5	218.2	251.0		
		L/min	162	170	200	232	261	310	375	469	600	826	950		
Power at	$\Delta p = 5100\ psi$	$P_{max}$	HP	127	134	157	183	205	244	295	368	472	670	747	
		$\Delta p = 350\ bar$	$P_{max}$	kW	95	100	117	135	152	181	219	273	350	497	554
		$\Delta p = 5800\ psi$	$P_{max}$	HP	145	153	179	208	233	277	–	–	–	–	
		$\Delta p = 400\ bar$	$P_{max}$	kW	108	114	133	155	174	207	–	–	–	–	
Torque at	$\Delta p = 5100\ psi$	T	lb-ft	372	442	517	664	746	828	1036	1470	2070	2940	4141	
		T	Nm	501	594	696	893	1003	1114	1393	1978	2785	3955	5570	
		T	lb-ft	422	500	586	752	845	938	–	–	–	–	–	
		T	Nm	572	678	795	1020	1145	1272	–	–	–	–	–	
Mass moment of inertia around output shaft	J	lbs-ft <sup>2</sup>	0.1708	0.2753	0.2753	0.5221	0.5221	0.8970	1.4475	2.4205	4.2240	13.052	13.052		
		kgm <sup>2</sup>	0.0072	0.0116	0.0116	0.0220	0.0220	0.0378	0.061	0.102	0.178	0.55	0.55		
Case fill capacity		gal	0.145	0.211	0.211	0.291	0.291	0.713	0.660	0.925	1.110	2.113	2.113		
		L	0.55	0.8	0.8	1.1	1.1	2.7	2.5	3.5	4.2	8	8		
Weight (approx.)	m	lbs	51	71	71	99	99	145	161	242	342	715	741		
		kg	23	32	32	45	45	66	73	110	155	325	336		

<sup>1)</sup> The values shown are valid for an absolute pressure ( $p_{abs}$ ) of 14.5 psi (1 bar) at the suction inlet S and when operated on mineral oil (with a specific mass of 7.36 lbs/gal (0.88 kg/L)).

<sup>2)</sup> By increase of the input pressure ( $p_{abs} > 14.5\ psi / 1\ bar$ ) the rotational speeds can be increased to the max. admissible speeds  $n_{max\ limit}$  (speed limits).

<sup>3)</sup>  $\Delta p = 4600\ psi$  (315 bar)

**Extracted from RA 91 604/02.04**

Page 1 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Variable displacement motor  
for open and closed circuits,  
Axial piston, bent axis design  
Model AA6VM (A6VM)**

Sizes 28...1000

Series 6

Nominal pressure 5800 psi (400 bar)

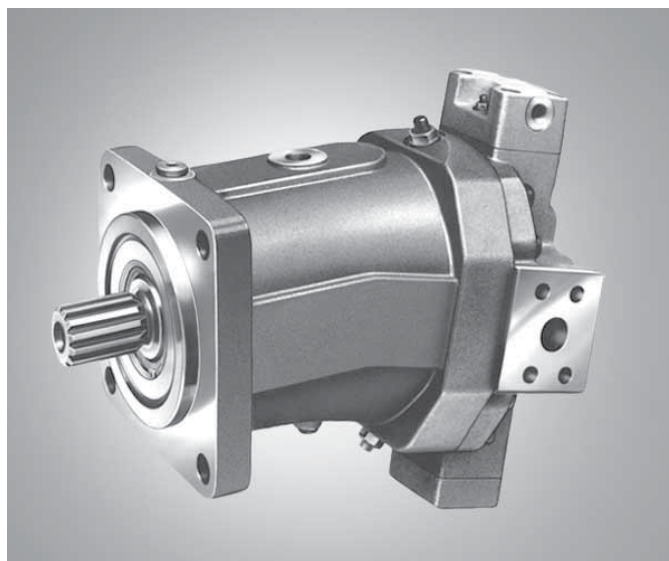
Peak pressure 6500 psi (450 bar)

Sizes 250...1000

Nominal pressure 5100 psi (350 bar)

Peak pressure 5800 psi (400 bar)

- Variable displacement axial piston motor of bent axis design for hydrostatic transmissions in open and closed circuits
- For use in mobile and stationary applications
- The wide control range enables the variable displacement motor to satisfy the requirement for high rotational speed and high torque.
- The displacement is continuously variable from  $V_{g\max}$  to  $V_{g\min} = 0$ .
- The output speed depends on the flow capacity of the pumps and the displacement of the motor.
- The torque increases with the pressure differential between the high and low pressure side and with increasing displacement.
- Wide control range with hydrostatic transmissions
- Wide selection of regulating and control devices
- Cost savings as no need for shiftable gearboxes and possibility to use smaller pumps
- Rugged, compact bearing system with long service life
- High power density
- Favorable start-up efficiency
- Low moment of inertia
- Large swivel range



### Extracted from RA 91 604/02.04

Page 4 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Technical Data

**Table of values (theoretical values, ignoring  $\eta_{mh}$  and  $\eta_v$ ; values rounded)**

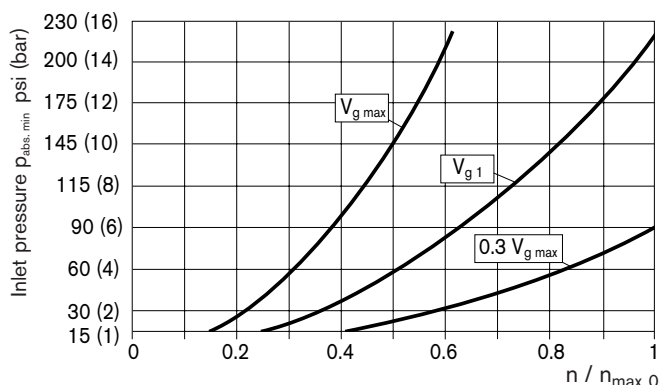
Size		28	55	80	107	140	160	200	250	355	500	1000	
Displacement <sup>1)</sup>	$V_{g \max}$	in <sup>3</sup>	1.71	3.34	4.88	6.53	8.54	9.76	12.20	15.25	21.66	30.51	61.02
		cm <sup>3</sup>	28.1	54.8	80	107	140	160	200	250	355	500	1000
	$V_{g 0}$	in <sup>3</sup>	0	0	0	0	0	0	0	0	0	0	0
		cm <sup>3</sup>	0	0	0	0	0	0	0	0	0	0	0
Rotational speed max. (while adhering to max. permitted flow)	$n_{\max}$ at $V_{g \max}$	rpm	5550	4450	3900	3550	3250	3100	2900	2700	2240	2000	1600
	$n_{\max 1}$ at $V_g < V_{g,1}$	rpm	8750	7000	6150	5600	5150	4900	4600	3600	2950	2650	2100
	$V_{g,1}$	in <sup>3</sup>	1.10	2.14	3.11	4.15	5.37	6.16	7.69	11.47	16.48	23.00	46.5
		cm <sup>3</sup>	18	35	51	68	88	101	126	188	270	377	762
	$n_{\max 0}$ at $V_{g 0}$	rpm	10450	8350	7350	6300	5750	5500	5100	3600	2950	2650	2100
Flow max.	$q_{V \max}$	gpm	41	64	82	100	120	131	153	178	210	264	423
		L/min	156	244	312	380	455	496	580	675	795	1000	1600
Torque max.	$T_{\max}$ at $V_{g \max}^2)$	lb-ft	132	257	???	502	657	752	939	1026	1459	2054	4109
		Nm	179	349	509	681	891	1019	1273	1391	1978	2785	5571
Torsional rigidity		lb-ft/rad	266	516	848	1151	1545	1711	2146	2753	3756	6069	13832
		Nm/rad	360	700	1150	1560	2095	2320	2910	3733	5092	8228	18753
Mass moment of inertia J around output shaft		lbs-ft <sup>2</sup>	0.033	0.100	0.190	0.301	0.491	0.600	0.838	1.448	2.420	4.224	13.05
		kgm <sup>2</sup>	0.0014	0.0042	0.0080	0.0127	0.0207	0.0253	0.0353	0.061	0.102	0.178	0.550
Filling capacity		L	0.5	0.75	1.2	1.5	1.8	2.4	2.7	3.0	5.0	7.0	16.0
Mass (approx.)	m	lbs	35	57	75	104	132	141	176	198	375	463	948
		kg	16	26	34	47	60	64	80	90	170	210	430

<sup>1)</sup> The minimum and maximum displacement are continuously variable, see model codes on page 2.

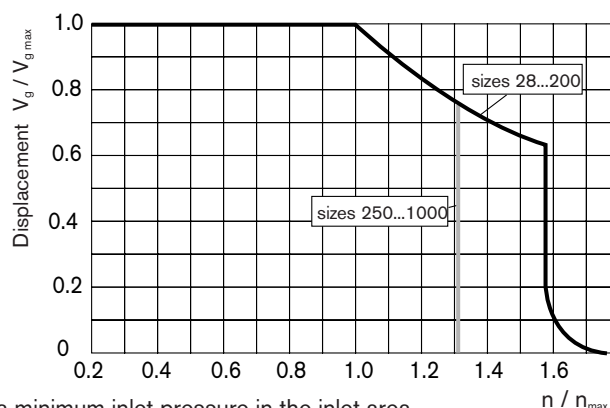
(default setting sizes 250 to 1000 unless specified in order:  $V_{g \min} = 0.2 \cdot V_{g \max}$ ,  $V_{g \max} = V_{g \max}$ ).

<sup>2)</sup> sizes 28 to 200:  $\Delta p = 5800$  psi (400 bar); sizes 250 to 1000:  $\Delta p = 5100$  psi (350 bar)

### Minimum inlet pressure on service line port A(B)



### Permitted displacement in relation to rotational speed



To prevent damage to the variable displacement motor, there has to be a minimum inlet pressure in the inlet area.  
The minimum inlet pressure depends on the speed and swivel angle (displacement) of the variable displacement motor.

Please contact us if these conditions cannot be satisfied.

## Ordering Code

### Pressure fluid

Petroleum oil (no character), HFD for sizes 250-1000 only in combination with long-life bearing "L"	
HFB, HFC pressure fluid	Sizes 28 to 200 (no character)
	Sizes 250 to 1000 (only in combination with long-life bearing "L")
	E

### Axial piston unit

		28	55	80	107	140	160	200	250	355	500	1000	
Bent-axis type, variable	Version SAE	-	●	●	●	-	●	●	●	-	-	-	AA6V
	Version ISO	●	<sup>1)</sup>	<sup>1)</sup>	<sup>1)</sup>	●	<sup>1)</sup>	<sup>1)</sup>	<sup>1)</sup>	●	●	●	A6V

### Drive shaft bearing

		28...200	250	355	500	1000	
Standard bearing (no character)		●	●	●	●	-	
Long-life bearing		-	●	●	●	●	L

### Operation mode

Motor (A6VE plug-in motor, see RE 91606)	M
--	---

### Size

Displacement $V_{g \max}$	$\text{in}^3/\text{rev}$	1.71	3.34	4.88	6.53	8.54	9.76	12.20	15.25	21.66	30.51	61.02
	$\text{cm}^3/\text{rev}$	28	55	80	107	140	160	200	250	355	500	1000

### Control device

		28	55	80	107	140	160	200	250	355	500	1000		
Hydraulic control, pilot pressure dependent	$\Delta p = 145 \text{ psi (10 bar)}$	HD1	●	●	●	●	●	●	●	●	●	●	HD1	
	$\Delta p = 365 \text{ psi (25 bar)}$	HD2	●	●	●	●	●	●	●	●	●	●	HD2	
	$\Delta p = 508 \text{ psi (35 bar)}$	HD3	-	-	-	-	-	-	-	●	●	●	HD3	
Hydraulic two-point control		HZ	-	-	-	-	-	-	-	●	●	●	HZ	
		HZ1	●	-	-	-	●	●	●	-	-	-	HZ1	
		HZ3	-	●	●	●	-	-	-	-	-	-	HZ3	
Electrical control, with proportional solenoid (sizes 28 to 200) <sup>2)</sup>	12 V	EP1	●	●	●	●	●	●	●	●	●	●	EP1	
	24 V	EP2	●	●	●	●	●	●	●	●	●	●	EP2	
Electrical two-point control, with solenoid	12 V	EZ1	●	-	-	-	●	●	●	●	●	●	EZ1	
	24 V	EZ2	●	-	-	-	●	●	●	●	●	●	EZ2	
	12 V	EZ3	-	●	●	●	-	-	-	-	-	-	EZ3	
	24 V	EZ4	-	●	●	●	-	-	-	-	-	-	EZ4	
Automatic control, high-pressure dependent	without pressure rise	HA1	●	●	●	●	●	●	●	●	●	●	HA1	
	with pressure rise $\Delta p = 1450 \text{ psi (100 bar)}$	HA2	●	●	●	●	●	●	●	●	●	●	HA2	
Hydraulic control, speed dependent	$p_{Si}/p_{HD} = 3/100$ , hydraulic travel direction valve	DA	-	-	-	-	-	-	-	●	●	●	○	DA
	$p_{Si}/p_{HD} = 5/100$ , hydraulic travel direction valve	DA1	●	●	●	●	●	●	●	-	-	-	-	DA1
	electrical travel direction valve	12 V DA2	●	●	●	●	●	●	●	-	-	-	-	DA2
	+ electrical $V_{g \max}$ switch	24 V DA3	●	●	●	●	●	●	●	-	-	-	-	DA3
	$p_{Si}/p_{HD} = 8/100$ , hydraulic travel direction valve	DA4	●	●	●	●	●	●	●	-	-	-	-	DA4
	electrical travel direction valve	12 V DA5	●	●	●	●	●	●	●	-	-	-	-	DA5
+ electrical $V_{g \max}$ switch	24 V DA6	●	●	●	●	●	●	●	-	-	-	-	DA6	

### Pressure control (for HD, EP only)

		28	55	80	107	140	160	200	250	355	500	1000		
without pressure control (no character)		●	●	●	●	●	●	●	●	●	●	●		
Pressure control direct		●	●	●	●	●	●	●	●	●	●	●	D	
	direct, with 2nd pressure setting	●	●	●	●	●	●	●	●	<sup>3)</sup>	<sup>3)</sup>	<sup>3)</sup>	<sup>3)</sup>	E
	remotely controlled	-	-	-	-	-	-	-	-	●	●	●	●	G

### Overriding HA control (for HA1, HA2 only)

without override (no character)		●	●	●	●	●	●	●	●	●	●	●	
Hydraulic override		●	●	●	●	●	●	●	●	●	●	●	T
Electrical override	12 V	●	●	●	●	●	●	●	●	-	-	-	U1
	24 V	●	●	●	●	●	●	●	●	-	-	-	U2
Electrical override + electrical travel direction valve	12 V	●	●	●	●	●	●	●	●	-	-	-	R1
	24 V	●	●	●	●	●	●	●	●	-	-	-	R2

### Series

Series 6, Index 3	63
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### Direction of rotation

when viewing shaft end, alternating	W
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### Setting range for displacement <sup>4)</sup>

		28	55	80	107	140	160	200	250	355	500	1000	
$V_{g \min} = 0 \text{ to } 0.8 V_{g \max}$ (no character)		●	●	●	●	●	●	●	-	-	-	-	
$V_{g \min} = 0 \text{ to } 0.4 V_{g \max}$	$V_{g \max} = V_{g \max} \text{ to } 0.8 V_{g \max}$	-	-	-	-	-	-	-	●	●	●	●	1
$V_{g \min} > 0.4 V_{g \max} \text{ to } 0.8 V_{g \max}$	$V_{g \max} = V_{g \max} \text{ to } 0.8 V_{g \max}$	-	-	-	-	-	-	-	●	●	●	●	2

<sup>1)</sup> ISO-Version see RE 91604 <sup>2)</sup> with proportional valve (sizes 250 to 1000) <sup>3)</sup> supplied as standard with D version (sizes 250 to 1000)

<sup>4)</sup> please specify precise values for  $V_{g \min}$  and  $V_{g \max}$  in plain text when placing your order:  $V_{g \min} = \dots \text{ cm}^3$ ,  $V_{g \max} = \dots \text{ cm}^3$

M / 6 3 W - V

Pressure fluid  
 Axial piston unit  
 Transmission shaft bearing  
 Operation mode  
 Size  
 Control device  
 Series/Index  
 Direction of rotation  
 Setting range for displacement

**Seals**

FKM (fluor-caoutchouc) V

**Shaft end**

	28	55	80	107	140	160	200	250	355	500	1000	
SAE-Version (AA6VM) SAE-splined shaft	-	●	●	●	-	●	●	●	-	-	-	S
ISO-Version (A6VM)	●	-	-	-	-	-	-	-	-	-	-	A
Splined shaft DIN 5480	●	-	-	-	●	-	-	-	●	●	●	Z
Cylindrical shaft with key DIN 6885	-	-	-	-	-	-	-	-	●	●	●	P

**Mounting flange**

	28	55	80	107	140	160	200	250	355	500	1000	
SAE-Version SAE J744 – 2-bolt (AA6VM)	-	-	●	-	-	-	-	-	-	-	-	C
SAE J744 – 4-bolt	-	●	-	●	-	●	●	●	-	-	-	D
ISO-Version ISO 3019-2 – 4-bolt (A6VM)	●	-	-	-	●	-	-	-	-	-	-	B
ISO 3019-2 – 8-bolt	-	-	-	-	-	-	-	-	●	●	●	H

**Service line connections**

	28	55	80	107	140	160	200	250	355	500	1000		
SAE-Version (AA6VM) Ports A, B: SAE rear (UN threads)	51	0	-	●	●	●	-	●	●	●	-	510	
	7	-	●	●	●	-	●	●	●	-	-	517	
	52	0	-	●	●	●	-	●	●	●	-	-	520
		7	-	●	●	●	-	●	●	●	-	-	527
Port plate with pressure relief valve, for fitting a counterbalance valve <sup>1)</sup>	37	0	-	-	●	-	-	-	-	-	-	370	
	38	0	-	●	●	●	●	●	-	-	-	380	
ISO-Version (A6VM) Ports A, B: SAE rear (metric threads)	01	0	●	-	-	-	●	-	-	-	●	010	
	7	●	-	-	-	-	●	-	-	-	●	017	
	02	0	●	-	-	-	-	●	-	-	-	●	020
		7	●	-	-	-	-	●	-	-	-	●	027
Ports A, B: SAE side, opposite + rear	15	0	-	-	-	-	-	-	-	●	●	150	

**Valves**

no valves	0
with flushing and boost pressure valve	7

**Speed measurement**

	28	55	80	107	140	160	200	250	355	500	1000	
no speed measurement (no character)	●	●	●	●	●	●	●	●	●	●	●	
prepared for speed measurement (ID)	●	●	●	●	●	●	●	-	-	-	-	D
prepared for speed measurement (HDD)	-	○	●	●	○	●	●	○	○	○	○	F

**Swivel angle indicator**

no swivel angle indicator (no character)	●	●	●	●	●	●	●	●	●	●	-	
with optical swivel angle indicator	-	-	-	-	-	-	-	●	●	●	●	V
with electrical swivel angle indicator	-	-	-	-	-	-	-	●	●	●	●	E

**Connectors for solenoids (sizes 28 to 200 only)<sup>2)</sup>**

	EP1/2	EZ1/2	EZ3/4	HA.U.	HA.R.	DA.	
DEUTSCH DT04-2P-EP04 2-pin injection molded, without bidirectional quenching diode	●	●	-	-	-	●	P
injection molded, with bidirectional quenching diode	-	○	-	-	-	○	Q
with lead, without bidirectional quenching diode <sup>3)</sup>	●	●	●	●	●	●	T
Hirschmann according to DIN EN 175 301-803-A, without bidirectional quenching diode <sup>4)</sup>	●	●	●	●	●	●	H

**Start of control**

	28	55	80	107	140	160	200	250	355	500	1000	
at V <sub>g min</sub> (standard for HA)	●	●	●	●	●	●	●	●	●	●	●	A
at V <sub>g max</sub> (standard for HD, HZ, EP, EZ, DA)	●	●	●	●	●	●	●	●	●	●	●	B

<sup>1)</sup> only possible in combination with HD, EP, HA control

<sup>2)</sup> for sizes 250 to 1000, the DIN connector is a Hirschmann one as standard (no character)

<sup>3)</sup> under development for size 28

<sup>4)</sup> not for new projects (sizes 28 to 200)

● = available    ○ = under development    - = not available

**Extracted from RA 91 703/11.04**

Page 1 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Dual displacement motor  
for open and closed circuits,  
Axial piston, swashplate design  
Model A10VM  
Model A10VE, Plug-in version**

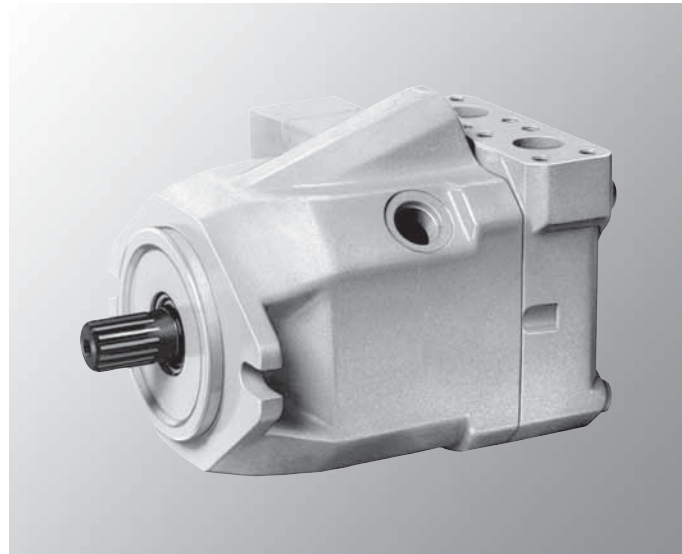
Size 28...63

Series 5

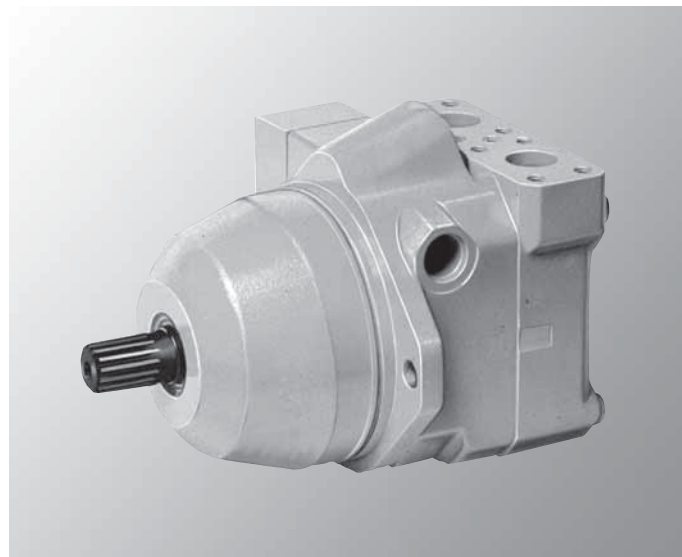
Nominal pressure 4000 psi (280 bar)

Peak pressure 5100 psi (350 bar)

- Dual displacement motor, axial piston swashplate design, for hydrostatic transmissions in open and closed circuits
- Output speed directly proportional to inlet flow and inversely proportional to motor displacement
- Output torque increases proportional to the pressure difference between high and low pressure sides and increasing displacement
- Heavy duty bearings for long service life
- High permissible output speed
- Well proven A10 rotary unit technology
- High power/weight ratio – compact size
- Cost effective
- Low noise
- Control range 1 : 3.75
- External direct control supply possible
- Minimum displacement can be set externally
- SAE 2-bolt mounting flange on A10VM
- Special 2-bolt mounting flange on A10VE



Model A10VM



Model A10VE



**Extracted from RA 91 703/11.04**

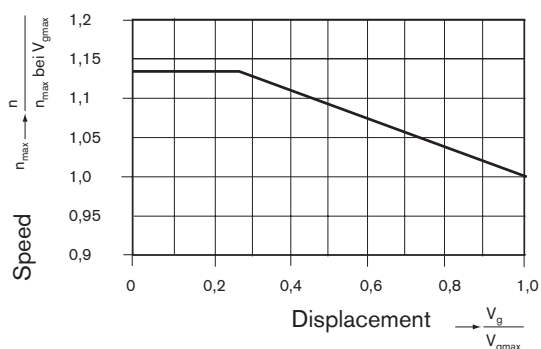
 Page 4 of 4  
 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

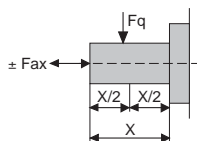
**Technical data**
**Table of values** (Theoretical values, without considering  $\eta_{mh}$  and  $\eta_v$ ; values rounded)

Size		28	45	63	
Motor displacement	$V_{g \max}$ in <sup>3</sup>	1.71	2.75	3.78	
	$V_{g \min}$ in <sup>3</sup>	0.49 <sup>(VM)</sup> 0.61 <sup>(VE)</sup>	0.73	0.98	
Speed maximum <sup>1)</sup> at	$V_{g \max}$ $V_{g \min}$	$n_{\max}$ rpm	4700	4000	3300
		cont. rpm	5300	4600	3800
Speed minimum		$n_{\max}$ rpm	250	250	250
		$n_{\min}$			
Inlet flow	at $n_{\max}$ cont. and $V_{g \max}$	$q_{v \max}$ gpm	34.8	47.5	54
Power	at $n_{\max}$ cont. and $V_{g \max}$	$\Delta p = 4000$ psi $P_{\max}$ HP	81	111	126
Torque constant at	$V_{g \max}$	$T_c$ lb-ft/psi	0,022	0,036	0,049
Torque	at $V_{g \max}$	$\Delta p = 4000$ psi $T_{\max}$ lb-ft	91	146	200
Actual starting torque	at $n = 0$ rpm	$\Delta p = 4000$ psi	67	108	149
Mass moment of inertia	(about output shaft)	$J$ lb-ft <sup>2</sup>	0.0403	0.0783	0.1329
Angular acceleration	maximum	rad/s <sup>2</sup>	5500	4000	3300
Rotational stiffness of	Output shaft	R lb-ft/rad	18900	29800	50500
		W lb-ft/rad	14400	25000	39300
Filling volume		gal	0.16	0.185	0.21
Weight	approx.	$m$ lbs	30.9	39.7	57.3

<sup>1)</sup> At max. speed the low pressure side must see at least 260 psi (18 bar).

**Permissible displacement dependent on speed**

**Permissible radial and axial force on output shaft**

Size		28	45	63
Max. perm. axial force on output shaft	$F_{ax \max}$ lbf (N)	225 (1000)	337 (1500)	450 (2000)
Max. perm. radial force on output shaft	$F_{q \max}$ lbf (N)	270 (1200)	337 (1500)	382 (1700)



## Ordering code

A10V	M		/	5	2	W		-	V										
------	---	--	---	---	---	---	--	---	---	--	--	--	--	--	--	--	--	--	--

### Axial piston unit

Swash plate design, variable, nom. press. 4000 psi (280 bar) peak press. 5100 psi (350 bar)	A10V
---	------

### Operating mode

Motor	M
-------	---

### Size

		28	45	63
Motor displacement $V_{g \max}$	in <sup>3</sup> / rev.	1.71	2.75	3.78
	cm <sup>3</sup> / rev.	28	45	62

### Control devices

Two-point direct control, external control supply, without pilot valve	DG			●	●	○	DG
Two-point control, hydraulically operated	HZ			●	●	●	HZ
	HZ		6	●	●	●	HZ6
Two-point control, electrically operated, with solenoid valve	EZ	1		●	●	●	EZ1
	EZ		6	●	●	●	EZ6
Control voltage 12V	EZ	2		●	●	●	EZ2
	EZ		7	●	●	●	EZ7
Control voltage 24V							
with stroking time orifice							

### Series

	5
--	---

### Design index

	2
--	---

### Direction of rotation

bi-directional	W
----------------	---

### Min. displacement

		28	45	63	
$V_{g \min}$ in <sup>3</sup> (cm <sup>3</sup> ) infinitely variable	from	0.49 (8)	0.73 (12)	0.98 (16)	1
	to	1.71 (28)	1.52 (25)	2.32 (38)	
Adjustment, please state in clear text	from	-	1.59 (26)	2.44 (40)	2
	to	-	2.75 (45)	3.78 (62)	

### Seal

FKM fluororubber (DIN ISO 1629)	V
---------------------------------	---

### Shaft end

SAE splined (for details see unit dimensions)	●	●	●		R
SAE splined (for details see unit dimensions)	-	●	●		W

### Mounting flange

SAE 2-hole	●	●	●		C
------------	---	---	---	--	---

### Ports for service lines

A/B at side-same side; SAE flange, UNC fixing screws	●	●	●		60N00
A/B at side-same side; UNF threaded ports	●	●	●		66N00
A/B at rear, SAE flange; UNC fixing screws	-	●	-		61N00
A/B at rear, UNF threaded ports	-	●	-		64N00

### Valves

without valves	●	●	●		0
integrated flushing valve, only with side ports (60N00, 66N00)	●	●	●		7

### Speed pickup

without speed pickup (no code)	●	●	●		-
prepared for speed pickup (IDR 18/20-L250)	●	●	●		D

- = not available   ○ = in preparation   ● = available

# Ordering code

A10V E / 5 2 W - V

### Axial piston unit

Swash plate design, variable, nom. press. 4000 psi (280 bar) peak press. 5100 psi (350 bar)	A10V
---	------

### Operating mode

Plug-in motor	E
---------------	---

### Size

		28	45	63
Motor displacement $V_{g \max}$	in <sup>3</sup> / rev.	1.71	2.75	3.78
	cm <sup>3</sup> / rev.	28	45	62

### Control devices

Two-point direct control, external control supply, without pilot valve	DG		●	●	○	DG
Two-point control, hydraulically operated	HZ		●	●	●	HZ
	HZ	6	●	●	●	HZ6
Two-point control, electrically operated, with solenoid valve with stroking time orifice	Control voltage 12V	EZ 1	●	●	●	EZ1
		EZ	6	●	●	●
	Control voltage 24V	EZ 2	●	●	●	EZ2
		EZ	7	●	●	●

### Series

	5
--	---

### Design index

	2
--	---

### Direction of rotation

bi-directional	W
----------------	---

### Min. displacement

		28	45	63	
$V_{g \min}$ in <sup>3</sup> (cm <sup>3</sup> ) infinitely variable	from	0.61 (10)	0.73 (12)	0.98 (16)	1
	to	1.71 (28)	1.52 (25)	2.32 (38)	
Adjustment, please state in clear text	from	-	1.59 (26)	2.44 (40)	2
	to	-	2.75 (45)	3.78 (62)	

### Seal

FKM fluororubber (DIN ISO 1629)	V
---------------------------------	---

### Shaft end

SAE splined (for details see unit dimensions)	●	●	●	R
SAE splined (for details see unit dimensions)	-	●	●	W

### Mounting flange

Special 2-hole	●	●	●	F
----------------	---	---	---	---

### Ports for service lines

A/B at side-same side; SAE flange, UNC fixing screws	●	●	●	60N00
A/B at side-same side; UNF threaded ports	●	●	○	66N00
A/B at rear, SAE flange; UNC fixing screws	-	●	-	61N00
A/B at rear, UNF threaded ports	-	●	-	64N00

### Valves

without valves	●	●	●	0
integrated flushing valve, only with side ports (60N00, 66N00)	●	●	●	7

### Speed pickup

without speed pickup (no code)	●	●	●	-
prepared for speed pickup (IDR 18/20-L250)	○	●	○	D

- = not available   ○ = in preparation   ● = available

**Extracted from RA 92 003/05.06**

Page 1 of 5  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Variable displacement pump  
for closed circuits,  
Axial piston, swashplate design  
Model AA4VG**

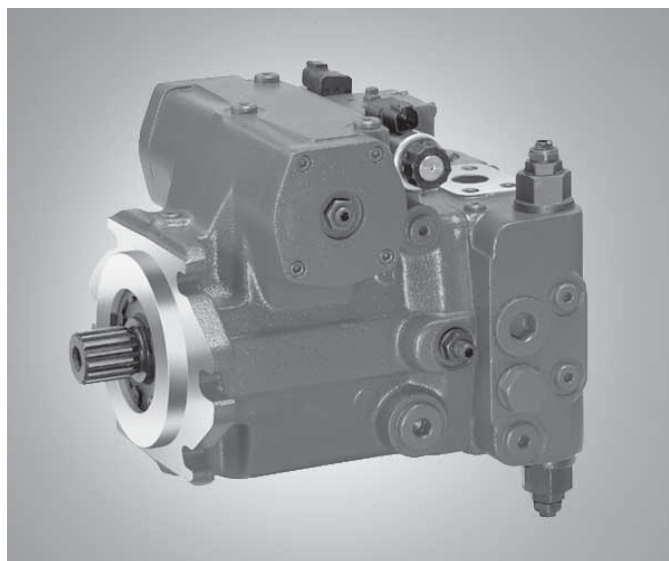
Sizes 28...250

Series 3

Nominal pressure 5800 psi (400 bar)

Peak pressure 6500 psi (450 bar)

- Variable displacement axial piston pump of swashplate design for hydrostatic closed circuit transmissions
- Flow is proportional to drive speed and displacement and is infinitely variable
- Output flow increases with swivel angle from 0 to its maximum value
- Swivelling the pump over center smoothly changes the direction of flow
- Availability of a highly adaptable range of control and regulating devices
- The pump is equipped with two pressure relief valves on the high pressure ports to protect the hydrostatic transmission (pump and motor) from overloads
- These valves also function as boost inlet valves
- An integral auxiliary pump serves as boost and pilot oil pump
- The maximum boost pressure is limited by a built-in boost pressure relief valve
- The integral pressure cut-off is standard



**Changes in ordering code from 02.04 issue**

---

- Control device
  - new standard: supply filtration at HD3, EP3 and EP4 control
  - not for new projects: HD1, EP1, EP2
- Service line ports
  - new: sophisticated designation of the position of suction port S
- Filtration
  - new: contamination indicator with electr. signal and DEUTSCH male connector
  - not for new projects: M and L
- Range of male connectors for solenoids
  - not for new projects: H

### Extracted from RA 92 003/05.06

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Ordering code

<b>AA4V</b>	<b>G</b>			<b>D</b>						<b>/ 32</b>		<b>-</b>	<b>N</b>									
01	02	03	04	05	06	07	08	09		10	11		12	13	14	15	16	17	18	19	20	21

#### Axial piston unit

01	Variable swashplate design, nominal pressure 5800 psi (400 bar), peak pressure 6500 psi (450 bar)	<b>AA4V</b>
----	---	-------------

#### Operation

02	Pump in closed circuit	<b>G</b>
----	------------------------	----------

#### Size

03	≈ Displacement $V_{g \max}$	$\text{cm}^3$	28	40	56	71	90	125	180	250
			1.71	2.44	3.42	4.33	5.49	7.63	10.98	15.25
		$\text{in}^3$								

#### Control device

			28	40	56	71	90	125	180	250		
04	Without control unit		●	●	●	●	●	●	●	●	NV	
	Hydraulic control	pilot pressure without supply filtration	▲	▲	▲	▲	●	●	●	●	●	HD1 <sup>1)</sup>
		related with supply filtration	●	●	●	●	○	○	○	○	○	HD3
	mechanical servo		●	●	●	●	●	●	●	●	●	HW
	direct operated		●	●	●	●	●	●	●	●	●	DG
	speed related	U = 12 V DC	●	●	●	●	●	●	●	●	●	DA1
		U = 24 V DC	●	●	●	●	●	●	●	●	●	DA2
	Electrical control	with proportional solenoid without supply filtration	U = 12 V DC	▲	▲	▲	▲	●	●	●	●	EP1 <sup>1)</sup>
			U = 24 V DC	▲	▲	▲	▲	●	●	●	●	EP2 <sup>1)</sup>
		with proportional solenoid with supply filtration	U = 12 V DC	●	●	●	●	○	○	○	○	EP3
U = 24 V DC			●	●	●	●	○	○	○	○	EP4	
with switching solenoid		U = 12 V DC	●	●	●	●	●	●	●	●	EZ1	
U = 24 V DC		●	●	●	●	●	●	●	●	●	EZ2	

#### Pressure cut-off

05	With pressure cut-off (standard)	●	●	●	●	●	●	●	●	●	D
----	----------------------------------	---	---	---	---	---	---	---	---	---	---

#### Neutral position switch (only for HW)

			28	40	56	71	90	125	180	250	
06	Without neutral position switch (no code)		●	●	●	●	●	●	●	●	
	With neutral position switch		●	●	●	●	●	●	●	●	●

#### Mechanical stroke limiter

			28	40	56	71	90	125	180	250	
07	Without mechanical stroke limiter (no code)		●	●	●	●	●	●	●	●	
	With mechanical stroke limiter, external adjustable		●	●	●	●	●	●	●	●	●

#### Ports $X_3$ , $X_4$ for positioning pressure

			28	40	56	71	90	125	180	250	
08	Without ports $X_3$ , $X_4$ (no code)		●	●	●	●	●	●	●	●	
	With ports $X_3$ , $X_4$		●	●	●	●	●	●	●	●	●

#### DA control valve

			NV	HD	HW	DG	DA	EP	EZ	28...250	
09	Without DA control valve		●	●	●	●	-	●	●	●	1
	With DA control valve, fixed setting		-	●	●	●	●	●	-	●	2
	With DA control valve, mech. adjust. with control lever	operating direction counter-clockwise	-	●	●	●	●	●	-	●	3L
		operating direction clockwise	-	●	●	●	●	●	-	●	3R
	With DA control valve, fixed setting and hydraulic inch valve built-on, control with brake fluid		-	-	-	-	●	-	-	●	4
	With DA control valve, fixed setting, connections for master controller		-	●	●	●	●	●	-	●	7
	With DA control valve, fixed setting and hydraulic inch valve built-on, control with mineral oil		-	-	-	-	●	-	-	●	8

## Extracted from RA 92 003/05.06

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Ordering code

<b>AA4V</b>	<b>G</b>			<b>D</b>						<b>/ 32</b>		<b>- N</b>										
01	02	03	04	05	06	07	08	09		10	11		12	13	14	15	16	17	18	19	20	21

### Series

10	Series 3, Index 2	<b>32</b>
----	-------------------	-----------

### Direction of rotation

28...250

11	Viewed from shaft end	clockwise	●	<b>R</b>
		counter-clockwise	●	<b>L</b>

### Seals

12	NBR (nitril-caoutchouc), shaft seal in FKM (fluor-caoutchouc)	<b>N</b>
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### Shaft end (permissible input torque see page X)

28 40 56 71 90 125 180 250

	Splined shaft	for single pump	●	●	●	●	●	●	●	<b>S</b>
	ANSI B92.1a-1976	for combination pump – 1st pump	- <sup>2)</sup>	- <sup>2)</sup>	●	●	- <sup>2)</sup>	●	●	<b>T</b>
		only for combination pump – 2nd pump	-	●	-	-	●	-	-	<b>U</b>

### Mounting flange

28 40 56 71 90 125 180 250

14	SAE J744 – 2-hole	●	●	●	-	-	-	-	-	<b>C</b>
	SAE J744 – 4-hole	-	-	-	-	-	-	●	●	<b>D</b>
	SAE J744 – 2+4-hole	-	-	-	●	●	●	-	-	<b>F</b>

### Service line ports

28 40...180 250

15	SAE flange ports	suction port S bottom	-	●	-	<b>52</b>
	A and B top/bottom	suction port S top	-	○	-	<b>53</b>
	SAE flange ports	right suction port S bottom	●	-	●	<b>60</b>
	A and B same side	left suction port S top	○	-	○	<b>63</b>

### Boost pump

28 40 56 71 90 125 180 250

16	Without integral boost pump	without through drive	●	●	●	●	●	●	●	<b>N00</b>
		with through drive	●	●	●	●	●	●	●	<b>K..</b>
	With integral boost pump	without through drive	●	●	●	●	●	●	●	<b>F00</b>
		with through drive	●	●	●	●	●	●	●	<b>F..</b>

### Through drive

17	Flange SAE J744 <sup>3)</sup>	Splined shaft hub	28	40	56	71	90	125	180	250	
	82-2 (A)	5/8 in 9T 16/32DP <sup>4)</sup>	●	●	●	●	●	●	●	●	<b>.01</b>
	101-2 (B)	7/8 in 13T 16/32DP <sup>4)</sup>	●	●	●	●	●	●	●	●	<b>.02</b>
		1 in 15T 16/32DP <sup>4)</sup>	●	●	●	●	●	●	●	●	<b>.04</b>
	127-2 (C)	1 in 15T 16/32DP <sup>4)</sup>	-	●	-	-	-	-	-	-	<b>.09</b>
		1 1/4 in 14T 12/24DP <sup>4)</sup>	-	-	●	●	●	●	●	●	<b>.07</b>
	152-2/4 (D)	1 1/4 in 14T 12/24DP <sup>4)</sup>	-	-	-	-	●	-	-	-	<b>.90</b>
		1 3/4 in 13T 8/16DP <sup>4)</sup>	-	-	-	-	-	●	●	●	<b>.69</b>
	165-4 (E)	1 3/4 in 13T 8/16DP <sup>4)</sup>	-	-	-	-	-	-	●	●	<b>.72</b>

**Extracted from RA 92 003/05.06**

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Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Ordering code**

<b>AA4V</b>	<b>G</b>			<b>D</b>						<b>/ 32</b>		<b>-</b>	<b>N</b>									
01	02	03	04	05	06	07	08	09		10	11		12	13	14	15	16	17	18	19	20	21

<b>Valves</b>		<b>Setting range</b>		<b>28</b>	<b>40</b>	<b>56</b>	<b>71</b>	<b>90</b>	<b>125</b>	<b>180</b>	<b>250</b>	
18	With high pressure relief valve, pilot controlled	1450...6100 psi (100...420 bar)	with bypass	-	-	-	●	●	●	●	●	1
	With high pressure relief valve, direct controlled, (fixed setting)	3900...6100 psi (270...420 bar)	without bypass	●	●	●	-	-	-	-	-	3
			with bypass	●	●	●	-	-	-	-	-	5
		1450...3600 psi (100...250 bar)	without bypass	●	●	●	-	-	-	-	-	-
with bypass			●	●	●	-	-	-	-	-	-	6

<b>Filtration</b>				<b>28</b>	<b>40</b>	<b>56</b>	<b>71</b>	<b>90</b>	<b>125</b>	<b>180</b>	<b>250</b>			
19	Filtration in the suction line of the boost pump			●	●	●	●	●	●	●	●	S		
	Filtration in the pressure line of the boost pump port for external boost circuit filter, (F <sub>e</sub> and F <sub>a</sub> )			●	●	●	●	●	●	●	●	D		
		and cold start valve		-	●	●	●	●	●	●	●	-	K	
	Filter built-on with contamination indicator and cold start valve			-	●	●	●	●	●	●	●	-	F	
	Filter built-on with window			-	●	●	●	●	●	●	●	-	P	
	contamination indicator and cold start valve	lamp/electr. signal - HIRSCHMANN male connector			-	▲	▲	▲	▲	▲	▲	▲	-	M
		electr. signal - HIRSCHMANN male connector			-	▲	▲	▲	▲	▲	▲	▲	-	L
	electr. signal - DEUTSCH male connector			-	●	●	●	●	●	●	●	-	B	
External supply (model without integral boost pump - N00, K...)				●	●	●	●	●	●	●	●	●	E	

<b>Swivel angle display</b>				<b>28</b>	<b>40</b>	<b>56</b>	<b>71</b>	<b>90</b>	<b>125</b>	<b>180</b>	<b>250</b>	
20	Without swivel angle display (no code)			●	●	●	●	●	●	●	●	
	Electrical swivel angle sensor			●	●	●	●	●	●	●	●	R

<b>Range of male connectors for solenoids (only for EP, EZ and DA)</b>				<b>28</b>	<b>40</b>	<b>56</b>	<b>71</b>	<b>90</b>	<b>125</b>	<b>180</b>	<b>250</b>	
21	DEUTSCH	without quenching diode		●	●	●	●	●	●	●	●	P
	male connector 2-pin	with quenching diode (only for EZ and DA)		○	○	○	○	○	○	○	○	Q
	DIN male connector to HIRSCHMANN	without quenching diode		▲	▲	▲	▲	▲	▲	▲	▲	H

<sup>1)</sup> The conversion for existing projects to HD3, EP3/4 is carried out automatically \_\_\_\_\_ sizes 28-71 starting May 1, 2006  
 \_\_\_\_\_ sizes 90-250: date in 2006 still open

<sup>2)</sup> standard for combination pumps – 1st pump: shaft **S**

<sup>3)</sup> 2 = 2-hole; 4 = 4-hole

<sup>4)</sup> splined shaft hub to ANSI B92.1a-1976 (for mounting options and splined shaft allocation to SAE J744, see pages XX)

● = available      ○ = available on request      ▲ = not for new projects      - = not available



**Extracted from RA 92 003/05.06**

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 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Table of values** (theoretical values, without considering  $\eta_{mh}$  and  $\eta_v$ : values rounded)

Size			28	40	56	71	90	125	180	250	
Displacement	variable pump	$V_{g \max}$	in <sup>3</sup>	1.71	2.44	3.42	4.33	5.49	7.63	10.98	15.25
			cm <sup>3</sup>	28	40	56	71	90	125	180	250
	auxiliary pump (at p = 290 psi / 20 bar)	$V_{g H}$	in <sup>3</sup>	0.37	0.52	0.71	1.20	1.20	1.73	2.43	3.20
			cm <sup>3</sup>	6.1	8.6	11.6	19.6	19.6	28.3	39.8	52.5
Speed											
	maximum $V_{g \max}$	$n_{\max \text{ contin.}}$	rpm	4250	4000	3600	3300	3050	2850	2500	2400
	limited maximum <sup>1)</sup>	$n_{\max \text{ limited}}$	rpm	4500	4200	3900	3600	3300	3250	2900	2600
	intermittent maximum <sup>2)</sup>	$n_{\max \text{ interm.}}$	rpm	5000	5000	4500	4100	3800	3450	3000	2700
	minimum	$n_{\min}$	rpm	500	500	500	500	500	500	500	500
Flow at $n_{\max \text{ contin.}}$ and $V_{g \max}$		$q_v \max$	gpm	31.5	42.3	53.4	61.8	72.5	94.1	118.8	158.4
			L/min	119	160	202	234	275	356	450	600
Power <sup>3)</sup> at $n_{\max \text{ contin.}}$	$\Delta p = 5800 \text{ psi}$	$P_{\max}$	hp	106	144	180	209	245	318	402	536
	$\Delta p = 400 \text{ bar}$		kW	79	107	134	156	183	237	300	400
Torque <sup>3)</sup> at $V_{g \max}$	$\Delta p = 5800 \text{ psi}$	$T_{\max}$	lb-ft	131	187	263	333	422	587	844	1173
	$\Delta p = 400 \text{ bar}$	$T_{\max}$	Nm	178	255	356	451	572	795	1144	1590
	$\Delta p = 1000 \text{ psi}$	T	lb-ft	22.7	32.4	45.4	57.4	72.8	101.2	145.6	202.2
	$\Delta p = 100 \text{ bar}$	T	Nm	44.5	63.5	89.0	112.8	143.0	198.8	286.0	398.0
Moment of inertia (about drive axis)	J		lbs-ft <sup>2</sup>	0.0522	0.0902	0.1566	0.2302	0.3536	0.5505	1.0536	2.3327
			kgm <sup>2</sup>	0.0022	0.0038	0.0066	0.0097	0.0149	0.0232	0.0444	0.0983
Angular acceleration, max.			rad/s <sup>2</sup>	38000	30000	24000	21000	18000	14000	11000	6700
Speed variation, max.			rpm	103	81	72	69	64	55	50	34
Rotary stiffness	shaft end S		lb-ft/rad	23159	50892	59595	72871	116609	161010	180334	261466
			Nm/rad	31400	69000	80800	98800	158100	218300	244500	354500
	shaft end T		lb-ft/rad	–	–	70068	89171	–	185939	234840	394079
			Nm/rad	–	–	95000	120900	–	252100	318400	534300
	shaft end U		lb-ft/rad	–	37468	–	–	79362	–	–	–
			Nm/rad	–	50800	–	–	107600	–	–	–
Filling capacity of housing		L	0.9	1.1	1.5	1.3	1.5	2.1	3.1	6.3	
Weight approx. (without through drive)	m		lbs	64	68	64	110	145	176	223	344
			kg	29	31	38	50	60	80	101	156

<sup>1)</sup> Limited maximum speed: – at half corner power (e.g. at  $V_{g \max}$  and  $p_N / 2$ )

<sup>2)</sup> Intermittent maximum speed: – at high idling speed  
 – at engine overspeed:  $\Delta p = 1000 \dots 2200 \text{ psi (70 \dots 150 bar)}$  and  $V_{g \max}$   
 – with reversing pressure peaks:  $\Delta p < 4350 \text{ psi (300 bar)}$  and  $t < 5 \text{ sec.}$ 
<sup>3)</sup> without auxiliary pump

**Extracted from RA 92 050/10.97**

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Issue: 01.02

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

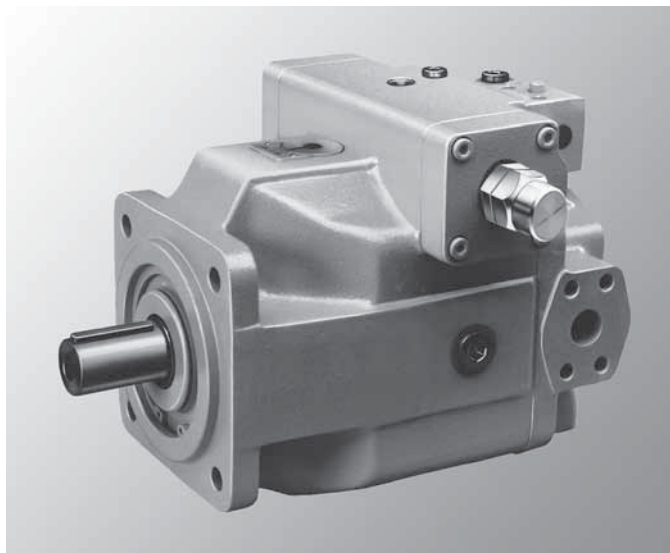
**Variable displacement pump  
for open circuits,  
Axial piston, swashplate design  
Model A4VSO**

Sizes 40 to 250, Series 1 and 3

Nominal pressure up to 350 bar (5100 PSI)

Maximum pressure up to 400 bar (5800 PSI)

- Swashplate design
- Infinitely variable displacement
- Good self priming suction characteristics
- Continuous operating pressure of 350 bar (5100 PSI)
- Low noise level
- Excellent service life
- Drive shaft able to accept axial and radial loading
- Good power to weight ratio
- Compact modular design
- Short control times
- Over-center design (swallow circuits)
- Swivel angle indicator standard
- Installation positional optional



For the description and operation of the various controls, see relevant RA-sheets (see page 2).

## Extracted from RA 92 050/10.97

Page 3 of 6  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Ordering code

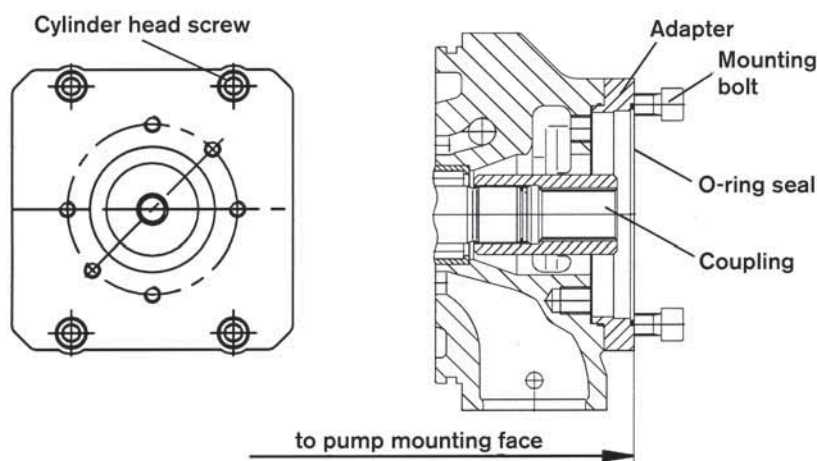
Hydraulic fluid / version	40	71	125	180	250	355	500	750	1000			
Mineral oil (no code)	●	●	●	●	●	●	●	●	●			
HF hydraulic fluid (with the exception of Skydrol)	●	●	●	●	●	●	●	-	-	E		
High-speed version	-	-	-	-	●	●	●	-	-	H		
High-speed version for HF fluids	-	-	-	-	●	●	●	-	-	K		
<b>Version</b>												
SAE										A		
<b>Axial piston unit</b>												
Swashplate design, variable, industrial design										A4VS		
<b>Charging pump</b>												
Without charging pump (no code)	●	●	●	●	●	●	●	●	●			
<b>Mode of operation</b>												
Pump, open circuit										O		
<b>Nominal size</b>												
Displacement, V <sub>g</sub> max	in <sup>3</sup> (cm <sup>3</sup> )	2.44 (40)	4.33 (71)	7.63 (125)	10.98 (180)	15.26 (250)	21.66 (355)	30.51 (500)	45.77 (750)	61.02 (1000)		
<b>Control and adjustment devices</b>												
Constant pressure control	DR	●	●	●	●	●	●	●	●	●	DR..	see RA 92060
Parallel pressure control	DP	●	●	●	●	●	●	●	●	○	DP..	
Constant flow control (load sensing)	FR							-	-	-	FR..	see RA 92064
Const. power control with hyperbolic oper. curve	LR	●	●	●	●	●	●	●	●	○	LR..	
Manual control	MA	●	●	●	●	●	●	●	-	-	MA..	see RA 92072
Electric motor control	EM	●	●	●	●	●	●	●	-	-	EM..	
Hydraulic control, with rotary servo	HW	●	●	●	●	●	●	●	●	○	HW..	see RA 92068
Hydraulic control, volume dependent	HM	●	●	●	●	●	●	●	○	○	HM..	see RA 92076
Hydraulic control with servo/ proportional valve	HS	●	●	●	●	●	●	●	●	○	HS..	
Electronic control	EO	●	●	●	●	●	●	●	○	○	EO..	see RA 92080
Hydraulic control, pilot pressure dependent	HD	●	●	●	●	●	●	●	●	○	HD..	
Hydraulic control, speed dependent	DS1	●	●	●	●	●	●	●	●	○	DS..	see RE 92055
<b>Series</b>												
Series 10		●	●	-	-	-	-	-	-	-	10*	
Series 30		-	-	○	○	●	○	●	○	●	30	
<b>Direction of rotation</b>												
As viewed from drive shaft										clockwise	R	
										counter-clockwise	L	
<b>Seals</b>												
NBR (Nitrile rubber to DIN ISO 1629) with shaft seal FPM											P	
FPM (Fluorocarbon rubber to DIN ISO 1629)											V	
<b>Shaft end</b>												
SAE parallel keyed shaft		●	●	●	●	●	●	-	-	-	K	
SAE splined shaft		●	●	●	●	●	●	-	-	-	S	
Metric keyed parallel shaft DIN 6885		●	●	●	●	●	●	●	●	●	P	
Metric splined shaft DIN 5480		●	●	●	●	●	●	●	●	●	Z	



**Extracted from RA 92 050/10.97**

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 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Through-drive adapter kits to fit U99 port plate for A4VSO**


Through-drive Code	Mount-shaft Type	Through-Drive Kit Part Numbers	
		125 - 180	250
U01	SAE A, 2-bolt Mount SAE A, Spline 5/8"	R902447030	R902447032
U52	SAE A, 2-Bolt Mount SAE A-B Spline, 3/4"	R902447035	R902447037
U68 ("K02")	SAE B 2-Bolt Mount SAE B Spline, 7/8"	R902447040	R902447042
U04	SAE B 2-Bolt Mount SAE B-B Spline, 1"	R902447045	R902447047
U07	SAE C 2-Bolt Mount SAE C Spline, 1 1/4"	R902447050	R902447051
U24	SAE C 2-Bolt Mount SAE C-C Spline, 1 1/2"	R902447052	R902447053
U15	SAE C, 4-Bolt Mount SAE C Spline, 1 1/4"	R902447054	R902447055
U16	SAE C, 4-Bolt Mount SAE C-C Spline, 1 1/2"	R902447056	R902447057
U17	SAE D 4-Bolt Mount SAE D Spline, 1 3/4"	R902447062	R902447063
U78	SAE D 4-Bolt Mount SAE F Spline, 2"	R902447065	R902447066
U18	SAE E 4-bolt Mount SAE F Spline, 2"	N/A	R902447067

"U"-type through drives are identical in mount and flange to "K" type.

Kits consist of Adapter flange, Coupling, Mtg Bolts, O-Ring Seal.

**Extracted from RA 92 050/10.97**

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Issue: 01.02

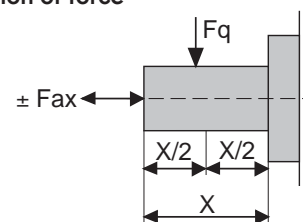
 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**Table of values** (theoretical values, without considering  $\eta_{mh}$  and  $\eta_v$ ; values rounded)

Size			40	71	125	180	250/H*	355/H*	500/H*	750	1000	
Displacement	$V_{g \max}$	in <sup>3</sup> /rev (cm <sup>3</sup> )	2.44 (40)	4.33 (71)	7.63 (125)	11.0 (180)	15.26 (250/250)	21.7 (355/355)	30.51 (500/500)	45.8 (750)	61.02 (1000)	
Max. speed at pabs 14.5 psi (1 bar) at port S	$n_{o \max}$	rpm	2600	2200	1800	1800	1500/1900	1500/1700	1320/1500	1200	1000	
Max. perm. speed (speed limit) dependent on inlet pressure pabs or reduced displacement $V_g < V_{g \max}$	$n_{o \max \text{ perm.}}$	rpm	3200	2700	2200	2100	1800/2100	1700/1900	1600/1800	1500	1000	
Max. flow	at $n_{o \max}$	$Q_{o \max}$	gpm (L/min)	27.5 (104)	41.2 (156)	59.4 (225)	85.6 (324)	99/125 (375/475)	140/159 (533/604)	174/198 (660/750)	237.9 (900)	264.1 (1000)
	at $n_E =$ 1500 rpm	Q	gpm (L/min)	15.8 (60)	28.2 (107)	49.1 (186)	71.3 (270)	99.0 (375)	140 (533)	153.4 <sup>1)</sup> (581) <sup>1)</sup>	203.4 <sup>1)</sup> (770) <sup>1)</sup>	–
Max. power	at $n_{o \max}$	$P_{o \max}$	HP (kW)	81 (61)	122 (91)	176 (131)	254 (189)	294 (219/277)	419 (311/352)	518 (385/437)	708 (525)	781 (583)
	at $n_E =$ 1500 rpm	P	HP (kW)	9.24 (35)	16.3 (62)	28.7 (109)	41.7 (158)	57.8 (219)	82.1 (311)	89.5 <sup>1)</sup> (339) <sup>1)</sup>	118.6 <sup>1)</sup> (449) <sup>1)</sup>	–
Max. torque	at $V_{g \max}$ $\Delta p = 5100$ psi (350 bar)	$T_{\max}$	lb-ft (Nm)	165 (223)	292 (395)	516 (696)	744 (1002)	1032 (1391)	1467 (1976)	2063 (2783)	3097 (4174)	4104 (5565)
Torque	at $V_{g \max}$ $\Delta p = 1450$ psi (100 bar)	T	lb-ft (Nm)	47 (64)	83 (113)	147 (199)	211 (286)	294 (398)	417 (564)	586 (795)	880 (1193)	1172 (1590)
Moment of inertia about drive axis	J	lb-ft <sup>2</sup> (kgm <sup>2</sup> )	0.116 (0.005)	0.287 (0.012)	0.712 (0.03)	1.305 (0.055)	2.276 (0.096)	4.509 (0.19)	7.890 (0.333)	15.66 (0.66)	28.47 (1.20)	
Filling volume (case)		gal (L)	0.5 (2)	0.6 (2.5)	1.3 (5)	1.0 (4)	2.6 (10)	2.1 (8)	3.7 (14)	5.0 (19)	7.13 (27)	
Approx. weight (pump with press. control)	m	lbs (kg)	86 (39)	117 (53)	194 (88)	225 (102)	406 (184)	456 (207)	705 (320)	1014 (460)	1333 (605)	
Permissible loading of drive shaft	max. axial force	$\pm F_{ax \max}$	lbf (N)	135 (600)	180 (800)	225 (1000)	315 (1400)	405 (1800)	450 (2000)	450 (2000)	495 (2200)	495 (2200)
	max. radial force	$F_{q \max}$	lbf (N)	225 (1000)	270 (1200)	360 (1600)	450 (2000)	450 (2000)	495 (2200)	560 (2500)	675 (3000)	786 (3500)

<sup>1)</sup>  $V_g < V_{g \max}$ 

H\* = High-Speed-Version

**Application of force**


**Extracted from RA 92 053/02.05**

Page 1 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Axial piston variable pump  
for HFC Fluids (Water-Glycol)  
Model AA4VSO**

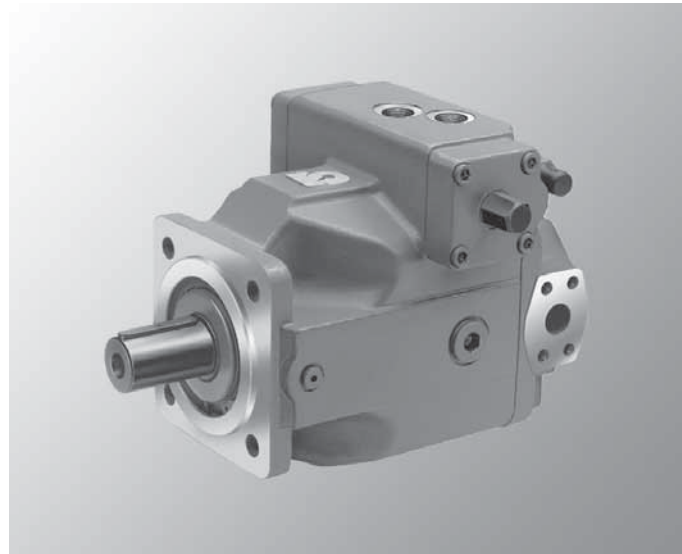
Sizes 125 to 355

Series 30

Nominal pressure up to 5100 PSI (350 bar)

Peak pressure up to 5800 PSI (400 bar)

- Variable displacement axial piston pump in swashplate design for open circuit hydrostatic drives
- Especially suitable for operation with HFC fluids
- With the approved HFC fluids the units can be operated with the same speeds and pressures as on mineral oil
- Infinitely variable displacement
- Good suction characteristics
- Low noise level
- Long service life
- High power/weight ratio
- Drive shaft capable of absorbing axial and radial loads
- Modular design
- Short control times
- Through drive and pump combinations possible
- Swivel angle indicator
- Optional mounting position



Model AA4VSO



**Extracted from RA 92 053/02.05**

 Page 2 of 4  
 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**Operating pressure range**
**Inlet**

Absolute pressure at port S

 $P_{abs \min}$  ..... 14.5 PSI (1 bar)

 $P_{abs \max}$  ..... 435 PSI (30 bar)

For further information see page 7 under item "Filters."

**Outlet**

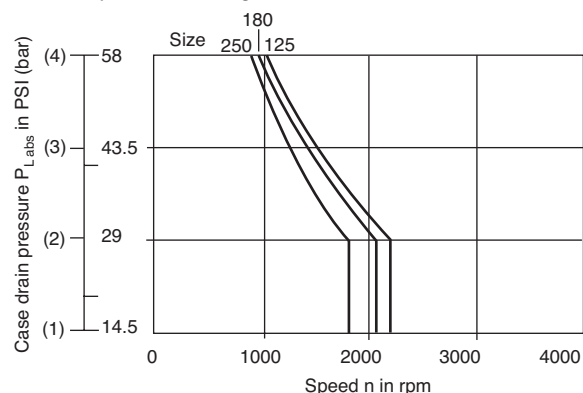
Pressure at port B

 Nominal pressure  $p_N$  ..... 5,100 PSI (350 bar)

 Peak pressure  $p_{max}$  ..... 5,800 PSI (400 bar)

(Pressure data to DIN 24312)

**Case drain pressure**

 The permissible case drain pressure (housing pressure) depends  
 on the drive speed (see diagram).


Max. permissible case pressure (housing pressure)

 $P_{L \text{ abs max}}$  ..... 58 PSI (4 bar)

 These are approximate values; under certain operating conditions  
 a reduction in these values may be necessary.

**Table of values <sup>1)</sup>**

Size			125	180	250
Displacement	$V_{g \max}$	in <sup>3</sup> /rev (cm <sup>3</sup> )	7.63 (125)	10.98 (180)	15.26 (250)
Speed <sup>2)</sup>					
	max. at $V_{g \max}$	$n_{0 \max}$	rpm	1800	1800
	max. at $V_g \leq V_{g \max}$	$n_{0 \max \text{ zul}}$	rpm	2200	2100
Flow					
	at $n_{0 \max}$	$q_{V0 \max}$	GPM (L/min)	59.4 (225)	85.6 (324)
	at $n_E = 1500 \text{ min}^{-1}$	$q_{VE \max}$	GPM (L/min)	49.1 (186)	71.3 (270)
Power	$\Delta p = 5100 \text{ PSI } (\Delta p = 350 \text{ bar})$				
	at $n_{0 \max}$	$P_{o \max}$	HP (kW)	176 (131)	254 (189)
	at $n_E = 1500 \text{ rpm}$	$P_{E \max}$	HP (kW)	146 (109)	212 (158)
Torque					
	at $V_{g \max}$	$\Delta p = 5100 \text{ PSI } (\Delta p = 350 \text{ bar})$	$T_{\max}$	lb-ft (Nm)	516 (696)
		$\Delta p = 1450 \text{ PSI } (\Delta p = 100 \text{ bar})$	$T$	lb-ft (Nm)	147 (199)
					744 (1002)
					211 (286)
					1032 (1391)
					294 (398)
Moment of inertia (about drive axis)	$J$	lb-ft <sup>2</sup> (kgm <sup>2</sup> )	0.712 (0,03)	1.305 (0,055)	2.276 (0,0959)
Angular acceleration, max.		rad/s <sup>2</sup>	1225	1000	775
Torsional stiffness	shaft K	Nm/rad	277,000	339,000	542,000
	shaft S	Nm/rad	286,000	354,000	558,000
Case volume		gal (L)	1 (4)	1.3 (5)	2.6 (10)
Weight (with pressure control)	$m$	lbs (kg)	194 (88)	225 (102)	406 (184)

<sup>1)</sup> theoretical values, without considering  $\eta_{mh}$  and  $\eta_v$ , values rounded

<sup>2)</sup> Values are valid with inlet pressure of 14.5 PSI (1 bar) absolute at port S.

**Extracted from RA 92 053/02.05**

 Page 3 of 4  
 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Ordering code**
**Axial piston unit**

 Swashplate design, variable, SAE version AA4VS
**Type of operation**

 Pump, open circuit O

Size	125	180	250	355
Displacement $V_{g \max}$ in in <sup>3</sup>	7.63	10.98	15.26	21.66

**Control device**

Pressure control (see RA 92 060)	●	●	●	○	DR
Flow control (see RA 92 060)	●	●	●	○	FR
Power control with hyperbolic curve (see RA 92 064)	●	●	●	○	LR
Manual control (see RA 92 072)	●	●	●	○	MA
Electric motor control (see RA 92 072)	●	●	●	○	EM
Hydraulic control, volume dependent (see RA 92 076)	●	●	●	○	HM
Hydraulic control, with servo-proportional valve (see RA 92 076)	●	●	●	○	HS
Electronic control (see RA 92 076)	●	●	●	○	EO
Hydraulic control, pilot pressure dependent (see RA 92 080)	●	●	●	○	HD
Hydraulic control, operation in parallel with multiple pumps (see RA 92 060)	●	●	●	○	DP
Electro-hydraulic control system (see RE 92 088)	●	●	●	○	DFE1

**Series**
30
**Direction of rotation**

Viewed on shaft end	clockwise	R
	counter-clockwise	L

**Seals and fluid**

 NBR nitrile rubber, shaft seal PTFE Teflon, special version for HFC-Fluids F
**Shaft end**

Keyed parallel shaft SAE	K
Splined shaft SAE	S

**Mounting flange**

 SAE 4-hole D
**Ports**

Pressure port B, inlet port S: SAE flange on side 90° offset, UNC threads	63
Pressure port B, inlet port S: SAE flange on side 90° offset, UNC threads, 2nd pressure port B <sub>1</sub> opposite B (closed with blanking flange on delivery)	75

## Extracted from RA 92 053/02.05

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

	AA4VS	O		/ 30	- F		D		
Axial piston unit									
Type of operation									
Size									
Control device									
Series									
Direction of rotation									
Seals and fluid									
Shaft end									
Mounting flange									
Ports									
<b>Through drive</b>			<b>125</b>	<b>180</b>	<b>250</b>	<b>355</b>			
Without through drive		●	●	●	●				N00
With universal through drive									
Flange SAE J744	Hub for splined shaft	Sealing							
82-2 (A)	5/8 in (A)	axial	●	●	●	●			U01
82-2 (A)	3/4 in (A-B)	axial	●	●	●	●			U52
101-2 (B)	7/8 in (B)	axial	●	●	●	●			U68
101-2 (B)	1 in (B-B)	axial	●	●	●	●			U04
127-2 (C)	1 1/4 in (C)	axial	●	●	●	●			U07
127-2 (C)	1 1/2 in (C-C)	axial	●	●	●	●			U24
127-4 (C)	1 1/4 in (C)	axial	●	●	●	●			U15
127-4 (C)	1 1/2 in (C-C)	axial	●	●	●	●			U16
152-4 (D)	1 3/4 in (D)	axial	—	●	●	●			U17
152-4 (D)	2 in (F)	axial	—	●	●	●			U78
165-4 (E)	2 in (F)	axial	—	—	●	●			U18
with through drive, without coupling, without adapter flange, with cover plate for operation									U99

●	= available
○	= in preparation
—	= not available

**Extracted from RA 92 100/10.97**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Variable displacement pump for closed  
circuit axial piston, swashplate design  
Model A4VSG**

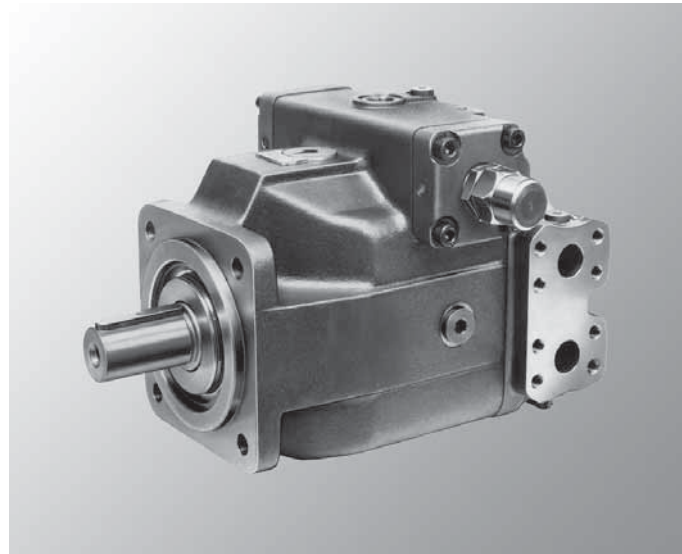
Sizes 40 to 1000

Series 1 and 2

Nominal pressure up to 5100 PSI (350 bar)

Peak pressure up to 5800 PSI (400 bar)

- Swashplate design
- Infinitely variable displacement
- Reversible flow
- Numerous control options
- Nominal pressure 5100 psi (350 bar)
- Low noise level
- Long service life
- Drive shaft capable of absorbing axial and radial loads
- Low power / weight ratio
- Modular design
- Short control times
- Tandem pumps possible, full thru drive
- Swivel angle indicator standard
- Installation position optional
- Operation on HF fluids permitted at derated parameters



Model A4VSG

**Extracted from RA 92 100/10.97**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**Table of values** (theoretical values, without considering  $h_{mh}$  and  $h_v$ ; values rounded)

Size			40	71	125	180	250	355	500	750	1000	
Displacement	$V_{g \max}$	in <sup>3</sup> /rev (cm <sup>3</sup> /rev)	2.44 (40)	4.33 (71)	7.63 (125)	11.0 (180)	15.26 (250)	21.7 (355)	30.51 (500)	45.8 (750)	61.02 (1000)	
Max. speed	$n_{\max}$	rpm	3700	3200	2600	2400	2200	2000	1800	1600	1600	
Max. flow	at $n_{\max}$	$Q_{\max}$	gpm (L/min)	39.1 (148)	60.0 (227)	85.9 (325)	114.1 (432)	145.3 (550)	187.5 (710)	237.7 (900)	317.0 (1200)	422.6 (1600)
	at $n_E = 1200$ rpm	$Q$	gpm (L/min)	12.7 (48)	22.5 (85)	39.6 (150)	57.0 (216)	79.3 (300)	112.5 (426)	158.5 (600)	237.8 (900)	317.0 (1200)
	at $n_E = 1800$ rpm	$Q$	gpm (L/min)	19.0 (72)	33.7 (128)	59.4 (2259)	85.6 (324)	118.9 (450)	168.8 (639)	237.7 (900)	— —	— —
Max. power $\Delta p = 5100$ PSI (350 bar)	at $n_{\max}$	$P_{\max}$	HP (kW)	116 (86)	178 (132)	255 (190)	339 (252)	432 (321)	558 (414)	707 (525)	943 (700)	1257 (933)
	at $n_E = 1200$ rpm	$P$	HP (kW)	37.8 (28)	66.9 (50)	117.8 (88)	169.6 (126)	236.0 (175)	334.7 (248)	471.6 (350)	707.6 (525)	943.2 (700)
	at $n_E = 1800$ rpm	$P$	HP (kW)	56.5 (42)	100.3 (75)	176.7 (131)	254.7 (189)	353.8 (263)	502.3 (373)	707 (525)	— —	— —
Max. torque $\Delta p = 5100$ PSI (350 bar)	at $V_{g \max}$	$T_{\max}$	lb-ft (Nm)	165 (223)	293 (395)	516 (696)	743 (1002)	1032 (1391)	1465 (1976)	2064 (2783)	3096 (4174)	4127 (5565)
Torque $\Delta p = 1450$ PSI (100 bar)	at $V_{g \max}$	$T$	lb-ft (Nm)	32 (64)	57 (113)	101 (199)	146 (286)	202 (398)	287 (564)	405 (795)	607 (1193)	809 (1590)
Moment of inertia about drive axis	$J$	lb-ft <sup>2</sup> (kgm <sup>2</sup> )	0.116 (0.005)	0.287 (0.012)	0.712 (0.03)	1.305 (0.055)	2.276 (0.096)	4.509 (0.19)	7.890 (0.333)	15.66 (0.66)	28.47 (1.20)	
Filling volume (case)		gal (L)	0.5 (2)	0.6 (2.5)	1.3 (5)	1.0 (4)	2.6 (10)	2.1 (8)	3.7 (14)	5.0 (19)	7.13 (27)	
Approx. weight (pump with press. control)	$m$	lbs (kg)	104 (47)	132 (60)	220 (100)	251 (114)	472 (214)	523 (237)	772 (350)	1102 (500)	1389 (630)	
Permissible loading of drive shaft	max. axial force $\pm F_{ax \max}$	lbf (N)	135 (600)	180 (800)	225 (1000)	315 (1400)	405 (1800)	450 (2000)	450 (2000)	495 (2200)	495 (2200)	
	max. radial force $F_{q \max}$	lbf (N)	225 (1000)	270 (1200)	360 (1600)	450 (2000)	450 (2000)	495 (2200)	562 (2500)	674 (3000)	787 (3500)	

**Installation notes**

Optional installation position. The pump housing must be filled with fluid during commissioning and stay full when operating. In order to obtain the lowest noise level, all connections (suction, pressure, case drain ports) must be linked by flexible couplings to tank.

Avoid placing a check valve in the case drain line. This may be permissible in individual cases, but only after consultation with us.

**Calculation of size**

Flow	$Q = \frac{V_g \cdot n \cdot \eta_v}{231} \text{ gpm}$	$\left( Q = \frac{V_g \cdot n}{1000} \text{ L/min} \right)$	$V_g = \text{Geometric displacement per rev.} - \text{in}^3 \text{ (cm}^3\text{)}$
			$n = \text{Speed rpm (rpm)}$
			$\Delta p = \text{Pressure differential} - \text{PSI (bar)}$
Drive torque	$T = \frac{V_g \cdot \Delta p}{24 \cdot \pi \cdot \eta_{mh}} \text{ lb-ft}$	$\left( T = \frac{V_g \cdot \Delta p}{24 \cdot \pi \cdot \eta_{mh}} \text{ Nm} \right)$	$Q = \text{Flow} - \text{gpm (L/min)}$
			$T = \text{Torque} - \text{lb-ft (Nm)}$
			$P = \text{Power} - \text{HP (kW)}$
Power	$P = \frac{Q \cdot \Delta p}{1714 \cdot \eta_t} \text{ HP}$	$\left( P = \frac{Q \cdot \Delta p}{600 \cdot \eta_t} \text{ kW} \right)$	$\eta_v = \text{Volumetric efficiency}$
			$\eta_{mh} = \text{Mechanical-hydraulic efficiency}$
			$\eta_t = \text{Total efficiency } (\eta_t = \eta_v \cdot \eta_{mh})$

## Extracted from RA 92 100/10.97

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Ordering code

### Fluid

Petroleum oils (no code)

HF-Fluids (except Skydrol)

E

### Version

SAE version

A

Metric version (no code)

### Axial piston unit

Variable pump, swashplate design, industrial applications

A4VS

### Mode of operation

Pump, closed circuit

G

### Sizes

	40	71	125	180	250	355	500	750	1000
Displacement	in <sup>3</sup> /rev. 2.44	4.33	7.63	10.98	15.26	21.66	30.51	45.77	61.02
	cm <sup>3</sup> /rev. 40	71	125	180	250	355	500	750	1000

### Control and adjustment devices

	40	71	125	180	250	355	500	750	1000		
Manual control	MA	●	●	●	●	●	●	—	—	MA	see RE 92072
Hydraulic control, volume dependent	HM	●	●	●	●	●	●	○	○	HM..	see RE 92076
Hydraulic control, with servo valve	HS	●	●	●	●	●	●	●	●	HS..	see RE 92076
Hydraulic control, with proportional valve	EO	●	●	●	●	●	●	○	○	EO..	see RE 92076
Hydraulic control, pilot pressure dependent	HD <sup>1)</sup>	●	●	●	●	●	●	●	○	HD..	see RE 92080
Constant pressure control	DR <sup>1)</sup>	●	●	●	●	●	●	●	○	DR..	see RE 92060
Parallel pressure control	DP <sup>1)</sup>	●	●	●	●	●	●	●	○	DP..	see RE 92060
Const. power control w/ hyperb. operating curve	LR <sup>1)</sup>	●	●	●	●	●	●	●	○	LR..N	see RE 92064
Hydraulic control, with rotary servo	HW	●	●	●	●	●	●	●	○	HW	see RA 92068
Hydraulic control, speed dependent	DS	●	●	●	●	●	●	●	○	DS..	see RA 92055

### Series

	●	●	—	—	—	—	—	—	—	10 <sup>1)</sup>
	—	—	●	●	●	●	●	●	●	30

### Direction of rotation

As viewed from shaft drive

clockwise	R
counter-clockwise	L
bi-directional <sup>1)</sup>	W

### Seals

Buna N/ Shaft seal: FPM (Fluorocarbon)

P

FPM (Fluorocarbon)

V

### Shaft end

	40	71	125	180	250	355	500	750	1000	
Parallel keyed shaft SAE	●	●	●	●	●	○	—	—	—	K
Splined shaft SAE	●	●	●	●	●	○	—	—	—	S
Metric keyed shaft per DIN 6885	●	●	●	●	●	●	●	●	●	P
Metric splined shaft per DIN 5480	●	●	●	●	●	●	●	●	●	Z

### Mounting flange

	40	71	125	180	250	355	500	750	1000	
SAE 4-bolt	●	●	●	●	●	○	—	—	—	D
ISO 4-bolt	●	●	●	●	●	●				B
ISO 8-bolt	—	—	—	—	—	—	●	●	●	H

### Port connections

Port A,B: SAE on the side, same side, UNC mounting threads

60

Port A,B: SAE on the side, same side, metric mounting threads

10

## Extracted from RA 92 100/10.97

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

		A4VS	G		/	-								
<b>Fluids</b>														
<b>Version</b>														
<b>Axial piston unit</b>														
<b>Mode of operation</b>														
<b>Sizes</b>														
<b>Control and adjustment devices</b>														
<b>Series</b>														
<b>Direction of rotation</b>														
<b>Seals</b>														
<b>Shaft end</b>														
<b>Mounting flange</b>														
<b>Port connections</b>														
<b>Through drive</b>		40	71	125	180	250	355	500	750	1000				
Without auxiliary pump, without through drive		●	●	●	●	●	●	●	●	●				N00
With through drive (For information, please refer to table on next page)														K...
<b>Auxiliary pump mounted and with boost circuit filter piped</b>														
1 Auxiliary pump for boost oil circuit	n < 2800 rpm	-	●	●	●	●	●	●	○	○				H02
	n > 2800 rpm	●	●	-	-	-	-	-	-	-				H03
1 Auxiliary pump for a combined boost oil and pilot oil circuit (EO1 only)	n < 2800 rpm	-	●	●	-	●	-	-	-	-				H04
	n > 2800 rpm	●	●	-	-	-	-	-	-	-				H05
Auxiliary pumps mounted – see RA 90139 (in preparation)														
<b>Valves</b>														
Without valve block														0
With SDVB valve block built on														9
<b>Filtration</b>		40	71	125	180	250	355	500	750	1000				
Without filter		●	●	●	●	●	●	●	●	●				N
Filter installed in the boost circuit		●	●	●	●	●	●	●	○	○				F
Sandwich filter with HS and DS controls (see RE/RA 92076 and RA 92055)		●	●	●	●	●	●	● <sup>2)</sup>	-	-				Z
Filter mounted in the boost circuit and sandwich filter with HS and DS controls		●	●	●	●	●	●	● <sup>2)</sup>	-	-				U

<sup>1)</sup> HD control is series 11.

<sup>1)</sup> Depending on control type, alternating direction of rotation may not be possible, please note separate RA sheets on controls.

<sup>2)</sup> For sizes 500 (only available for DS control), HS/HS1 see RA 92076

●	= available
○	= in preparation
-	= not available



## Extracted from RA 92 100/10.97

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Ordering code

Through drive ordering codes			40	71	125	180	250	355	500	750	1000	
Without auxiliary pump, without through drive			●	●	●	●	●	●	●	●	●	N00
With through drive for mounting of axial piston unit, gear or radial piston pump												
Flange	Hub/shaft	to accept										
ISO 125, 4-bolt	Splined shaft 32x2x30x14x9g	A4VSO/H/G 40	●	●	●	●	●	●	●	○	○	K31
ISO 125, 4-bolt	splined 32x2x14x9g	A4VSO/H/G 40	●	●	●	●	●	○	●	○	○	K31
ISO 140, 4-bolt	splined 40x2x18x9g	A4VSO/H/G 71	–	●	●	●	●	●	●	○	○	K33
ISO 160, 4-bolt	splined 50x2x24x9g	A4VSO/H/G 125	–	–	●	●	●	○	●	○	○	K34
ISO 160, 4-bolt	splined 50x2x24x9g	A4VSO/G 180	–	–	–	●	●	○	●	○	○	K34
ISO 224, 4-bolt	splined 60x2x28x9g	A4VSO/H/G 250	–	–	–	–	●	○	●	○	○	K35
ISO 224, 4-bolt	splined 70x3x22x9g	A4VSO/G 355	–	–	–	–	–	●	○	○	○	K77
ISO 315, 8-bolt	splined 80x2x38x9g	A4VSO/G 500	–	–	–	–	–	–	●	●	○	K43
ISO 400, 8-bolt	splined 90x3x28x9g	A4VSO/G 750	–	–	–	–	–	–	–	○	○	K76
127-4 (SAE C, 4-bolt)	splined 32-4 (SAE C)	AA4VSO/G 40	○	○	○	○	○	○	–	–	–	K15
127-4 (SAE C, 4-bolt)	splined 38-4 (SAE C-C)	AA4VSO/G 71	○	○	●	○	○	○	–	–	–	K16
152-4 (SAE D, 4-bolt)	splined 44-4 (SAE D)	AA4VSO/G 125	–	–	●	○	○	○	–	–	–	K17
152-4 (SAE D, 4-bolt)	splined 50-4 (SAE F)	AA4VSO/G 180	–	–	–	○	○	○	–	–	–	K78
165-4 (SAE E, 4-bolt)	splined 50-4 (SAE F)	AA4VSO/G 250	–	–	–	–	●	○	–	–	–	K18
82-2 (SAE A, 2-bolt)	keyed 19-1 (SAE A-B)	AA10VSO 18	○	○	○	○	○	○	–	–	–	K40
101-2 (SAE B, 2-bolt)	keyed 22-1 (SAE B) *	AA10VSO 28	●	●	●	○	○	○	–	–	–	K03
101-2 (SAE B, 2-bolt)	keyed 25-1 (SAE B-B) *	AA10VSO 45	○	○	○	○	○	○	–	–	–	K05
127-2 (SAE C, 2-bolt)	keyed 32-1 (SAE C) *	AA10VSO 71	–	○	○	○	●	○	–	–	–	K08
127-2 (SAE C, 2-bolt)	keyed 38-1 (SAE C-C) *	AA10VSO 100	–	–	○	○	○	○	–	–	–	K38
152-4 (SAE D, 4-bolt)	keyed 44-1 (SAE D) *	AA10VSO 140	–	–	○	○	○	○	–	–	–	K21
82-2 (SAE A, 2-bolt)	splined 5/8" 16-4 (SAE A)	G2 / GC2/GC3-1X	●	●	●	●	●	●	●	○	○	K01
82-2 (SAE A, 2-bolt)	splined 3/4" 19-4 (SAE A-B)	A10VSO 18	●	●	●	●	●	●	●	○	○	K52
101-2 (SAE B)	22-4 (SAE B)	G3, G4, A10VSO 28	●	●	●	●	●	●	●	●	○	K68
101-2 (SAE B)	splined 25-4 (SAE B-B)	GC4-1X, A10VO 45	○	○	●	○	○	●	○	○	○	K04
101-2 (SAE B)	splined 32-4 (SAE C)	GC5-1X	●	●	●	○	●	○	○	○	○	K06
127-2 (SAE C)	splined 32-4 (SAE C)	A10VO 71	○	○	○	○	○	○	○	○	○	K07
127-2 (SAE C)	splined 38-4 (SAE C-C)	GC6-1X, A10VO 100	–	○	●	●	●	○	○	○	○	K24
152-4 (SAE D)	splined 44-4 (SAE D)	A10VO 140	○	○	○	○	○	○	○	○	○	K17
Ø 63 (mm) metric, 4-bolt, keyed Ø 25 (mm)		R4	●	●	●	○	●	○	○	○	○	K57
101-2 (SAE B, 2-bolt)	splined 7/8" R-shaft (SAE B med.)	A10VO 28...R, PVV 1 & 2	○	○	○	○	○	○	○	○	○	KA3
101-2 (SAE B, 2-bolt)	splined 1" R-shaft (SAE BB)	A10VO 45...R	○	○	○	○	○	○	○	○	○	KA4
127-2 (SAE C, 2-bolt)	splined 1-1/4", R-shaft (SAE C)	A10VO 71...R, PVV 4 & 5	○	○	○	○	○	○	○	○	○	KA5
with through drive shaft, without coupler, without intermediate flange, with cover			●	●	●	○	●	●	●	●	○	K99

### Through drive / Combination pumps

1. If a second Brueninghaus Hydromatik pump is to be mounted at the factory, the two ordering codes have to be connected with a "+".

Ordering code of the first pump + ordering code of the second pump

**SAE Example:** AA4VSG 125 EO1/22R – PSD60K16ON + AA4VSG 71 HM1/10R – PSD60N000N

**Metric Example:** A4VSG 125 EO1/22R – PPB10K339F + A4VSG 71 HM1/10R – PZB10N000N

2. Please check with the factory if a gear pump or radial piston pump is to be mounted at the factory.

\* Not for new projects. Permitted with reduced through drive torque only.

**Extracted from RA 92 105/05.04**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Axial piston-compact unit Model AA4CSG (A4CSG)

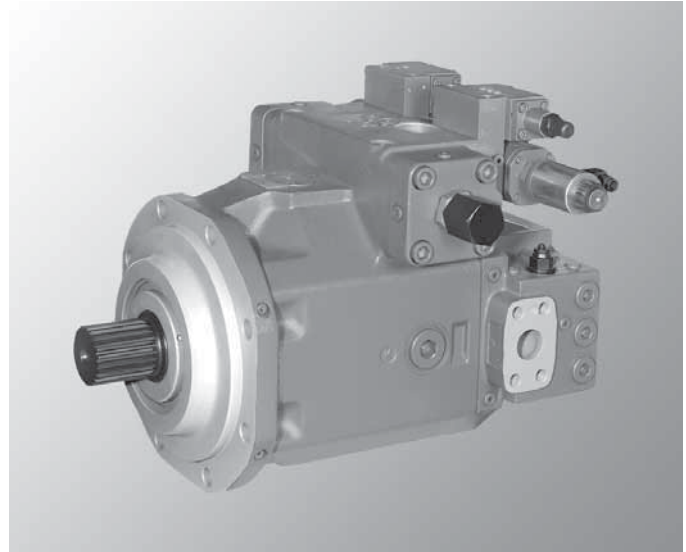
Sizes 250 to 750

Series 3

Nominal pressure up to 5100 PSI (350 bar)

Peak pressure up to 5800 PSI (400 bar)

- Axialpiston pump-variable displacement, swashplate design for hydrostatic drives in closed circuits.
- The flow is proportional to input speed and displacement. It can be infinitely varied by adjustment of the swashplate.
- The necessary boostpump and all required controlvalves are integrated.
- One common auxiliary pump for boost and EP-control pressure
- Compact design (extremely short in length)
- Favorable power to weight ratio
- Low noise level
- Long service life
- High efficiency
- New electro-hydr. control EP with proportional solenoid and zero displacement position at power loss (fail safe function)
- Throughdrive for multiple pumpcombinations also possible with integrated boost pump
- Full through drive capability, tandems of same size possible
- For further information on control- and regulating devices see separate data sheets RA 92 076 and RA 92 080



Model AA4CSG

### Extracted from RA 92 105/05.04

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Ordering code

Version		250	355	500	750	A
SAE version		●	●	—	—	
Metric version (no code)		—	—	●	●	
<b>Axial piston unit</b>						
Compact unit, swashplate design, variable displacement						A4CS
Nominal pressure 5100 psi (350 bar), peak pressure 5800 psi (400 bar)						
<b>Type of operation</b>						
Pump, closed circuit operation						G
<b>Size</b>						
		250	355	500	750	
Displacement $V_{g \max}$	in <sup>3</sup>	15.26	21.66	30.51	45.77	
	(cm <sup>3</sup> )	(250)	(355)	(500)	(750)	
<b>Control and adjustment devices</b>						
Hydr. adjustment, control volume dependent	HM	○	○	○	○	HM..
Hydr. adjustment with servo-/ proportional valve	HS	○	○	○	○	HS..
Electronic control	EO	○	○	○	○	EO..
Hydr. control, pilot pressure dependent	HD	○	●	●	○	HD..
Electro-hydraulic control with proportional solenoid	EP	●	●	●	●	EP..
						see RA 92076
						see RA 92080
						see RA 92084
<b>Series</b>						
						30
<b>Direction of rotation</b>						
viewing at shaft end					clockwise	R
					counter-clockwise	L
<b>Seals</b>						
FKM (Fluorocarbon rubber)						V
<b>Shaft end</b>						
		250	355	500	750	
SAE parallel keyed shaft		●	●	—	—	K
SAE splined shaft		●	—	—	—	S
SAE splined shaft with run out spline		—	●	—	—	R
Metric keyed parallel shaft DIN 6885		—	—	●	●	P
Metric splined shaft DIN 5480		—	—	●	●	Z
<b>Mounting flange</b>						
4-hole to SAE J744 (ISO 3019-1)		●	●	—	—	D
8-hole to ISO 3019-2		—	—	●	●	H
<b>Port connections</b>						
Ports A,B: SAE flanged opposite sides } UNC threaded	bolt holes	●	●	—	—	85
Port S: SAE flanged on side 90° offset						
Ports A,B: SAE flanged opposite sides } metric threaded	bolt holes	—	—	●	●	35
Port S: SAE flanged on side 90° offset						
<b>Boost pump</b>						
		250	355	500	750	
with integrated boost pump		●	●	●	●	F
without integrated boost pump		○	○	●	○	K

● = available    ○ = in preparation    — = not available

### Extracted from 92 105/05.04

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

	A4CS	G	/ 30	- V										
<b>Version</b>														
<b>Axial piston unit</b>														
<b>Type of operation</b>														
<b>Size</b>														
<b>Control and adjustment device</b>														
<b>Series</b>														
<b>Direction of rotation</b>														
<b>Seals</b>														
<b>Shaft end</b>														
<b>Mounting flange</b>														
<b>Port connections</b>														
<b>Boost pump</b>														
<b>Through drive</b>								250	355	500	750			
prepared for through drive, no coupling, no adapter flange, closed with cover								●	●	●	●			99
with through drive for mounting of second pump (for further options see page 18)														
Flange SAE J744 shaft coupling splined SAE J744 to mount														
127-4 <sup>1)</sup> (C) 32-4 11/4 in 14T (C) AA4VSO/G 40								○	○	○	○			15
127-4 <sup>1)</sup> (C) 38-4 11/2 in 17T (C-C.) AA4VSO/G 71								○	○	○	○			16
152-4 <sup>1)</sup> (D) 44-4 13/4 in 13T (D) AA4VSO/G 125								●	●	●	○			17
152-4 <sup>1)</sup> (D) 50-4 2 in 15T (F) AA4VSO/G 180								○	○	○	○			78
165-4 <sup>1)</sup> (E) 50-4 2 in 15T (F) AA4CSG, AA4VSO/G 250								○	○	○	○			18
165-4 <sup>1)</sup> (E) 50-4 2 in 15T (F) AA4CSG, AA4VSO/G 355								-	○	○	○			18
Flange ISO 3019-2 (metr.) shaft coupling splined DIN 5480 to mount														
315, 8-hole W 0x3x30x25x9g A4CSG, A4VSO/G 500								-	-	●	○			43
400, 8-hole W 0x3x30x28x9g A4CSG, A4VSO/G 750								-	-	-	○			76
Flange SAE J 744 shaft coupling splined SAE J744 to mount														
82-2 <sup>1)</sup> (A) 16-4 5/8 in 9T (A) AZPF, PGF2								●	●	●	○			01
82-2 <sup>1)</sup> (A) 19-4 3/4 in 11T (A-B) A10VSO 10, 18								○	○	○	○			52
101-2 <sup>1)</sup> (B) 22-4 7/8 in 13T (B) (A)A10V(S)O 28, PGF3, AZPN/G								●	●	●	○			68
101-2 <sup>1)</sup> (B) 25-4 1 in 15T (B-B) (A)A10V(S)O 45, PGH4								○	○	●	○			04
127-2 <sup>1)</sup> (C) 32-4 11/4 in 14T (C) (A)A10V(S)O 71								●	●	●	○			07
127-2 <sup>1)</sup> (C) 38-4 11/2 in 17T (C-C) (A)A10V(S)O 100, PGH5								○	○	○	○			24
152-4 <sup>1)</sup> (D) 44-4 13/4 in 13T (D) (A)A10V(S)O 140								●	●	●	○			17
<sup>1)</sup> 2 = 2-bolt; 4 = 4-bolt to SAE J744														
<b>Valves</b>														
Integrated: boost-, control pressure relief- and flushing valve; direct operated mainline relief valves <sup>2)</sup>								○	○	○	○			3
Integrated: boost-, control pressure relief- and flushing valve; pilot operated mainline relief valves <sup>2)</sup>								●	●	●	●			4
<sup>2)</sup> crossover relief valves														
<b>Filtration</b>														
without filter								●	●	●	●			N
with threaded connection for filter in boost circuit								●	●	●	●			D
with built on filter (optical-electr. dirt indicator) in boost circuit								●	●	●	○			M
with threaded connection f. filter in boost circuit (D) a. sandwichplate filter for HS-control (see RA 92076)								○	○	-	-			Z
with built on filter in boost circuit (M) and sandwichplate filter for HS-control (see RA 92076)								○	○	-	-			U

### Extracted from RA 92 105/05.04

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Ordering code

**Table of values (theoretical values, without considering h<sub>mh</sub> und h<sub>v</sub>; values rounded)**

Size				250	355	500	750
Displacement	Variable pump	$V_{g \max}$	in <sup>3</sup> (cm <sup>3</sup> )	15.26 (250)	21.7 (355)	30.51 (500)	45.8 (750)
	integr. boost pump	$V_{gH}$	in <sup>3</sup> (cm <sup>3</sup> )	3.84 (63)	4.88 (80)	5.98 (98)	8.72 (143)
Drive speed	max. speed	$n_{\max}$	rpm	2200	2000	1800	1600
	min. speed	$n_{\min}$	rpm	800	800	800	800
Max. flow (variable pump)	at $n_{\max}$	$q_{v \max}$	gpm (L/min)	145.3 (550)	187.6 (710)	237.8 (900)	317.0 (1200)
	at $n_E = 1200$ rpm	$q_{v 1200}$	gpm (L/min)	79.3 (300)	112.5 (426)	158.5 (600)	237.8 (900)
	at $n_E = 1800$ rpm	$q_{v 1800}$	gpm (L/min)	118.9 (450)	168.8 (639)	237.7 (900)	— —
Max. power (variable pump, $\Delta p = 5100$ psi [350 bar] without boost pump)	at $n_{\max}$	$P_{\max}$	HP (kW)	432 (321)	558 (414)	707 (525)	943 (700)
	at $n_E = 1200$ rpm	$P_{1200}$	HP (kW)	236 (175)	334.7 (248)	471.6 (350)	707.6 (525)
	at $n_E = 1800$ rpm	$P_{1800}$	HP (kW)	353.8 (263)	502.3 (373)	707 (525)	— —
Max. torque at $V_{g \max}$ (variable pump without boost pump)	$\Delta p = 5100$ psi (350 bar)	$T_{\max}$	lb-ft (Nm)	1032 (1391)	1465 (1976)	2064 (2783)	3096 (4174)
	$\Delta p = 1450$ psi (100 bar)	$T$	lb-ft (Nm)	295 (398)	416 (564)	586 (795)	879 (1193)
Moment of inertia about drive axis		$J$	lb-ft <sup>2</sup> (kgm <sup>2</sup> )	2.276 (0.96)	4.509 (0.19)	7.890 (0.333)	15.66 (0.66)
Torsional stiffness	Shaft end K / P		lb-ft/rad (kNm/rad)	326491 (443)	599918 (814)	843865 (1145)	1370820 (1860)
	Shaft end S / R / Z		lb-ft/rad (kNm/rad)	271216 (368)	350075 (475)	891033 (1209)	1335444 (1812)
Case volume			gal (L)	2.64 (10)	2.11 (8)	3.70 (14)	5.02 (19)
Weight approx.. (Pump with EP-control and integrated boost pump)		$m$	lbs (kg)	472 (214)	523 (237)	772 (350)	1102 (500)

### Determination of size

$$\text{Flow } q_v = \frac{V_g \cdot n \cdot \eta_v}{231} \text{ gpm} \left( q_v = \frac{V_g \cdot n \cdot \eta_v}{1000} \text{ L/min} \right)$$

$$\text{Drive torque } T = \frac{V_g \cdot \Delta p}{24 \cdot \pi \cdot \eta_{mh}} \text{ lb-ft} \left( T = \frac{1.59 \cdot V_g \cdot \Delta p}{100 \cdot \eta_{mh}} \text{ Nm} \right)$$

$$\text{Power } P = \frac{q_v \cdot \Delta p}{1714 \cdot \eta_t} \text{ HP} \left( P = \frac{2\pi \cdot T \cdot n}{60,000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t} \text{ kW} \right)$$

$V_g$  = geometr. displacement per revolution in in<sup>3</sup> (cm<sup>3</sup>)

$\Delta p$  = Pressure differential in PSI (bar)

$n$  = Drive speed in rpm (min<sup>-1</sup>)

$\eta_v$  = Volumetric efficiency

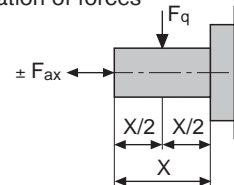
$\eta_{mh}$  = Mechanical-hydraulic efficiency

$\eta_t$  = Overall efficiency ( $\eta_t = \eta_v \cdot \eta_{mh}$ )

### Permissible forces on drive shaft

Size			250	355	500	750
Permissible radial force	$F_{q \max}$	lbf (N)	450 (2000)	495 (2200)	562 (2500)	674 (3000)
Permissible axial force	$\pm F_{ax \max}$	lbf (N)	405 (1800)	450 (2000)	450 (2000)	495 (2200)

Application of forces



**Extracted from RA 92 500/06.04**

Page 1 of 4  
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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Variable displacement pump  
for open circuits,  
Axial piston, swashplate design  
Model AA11VO**

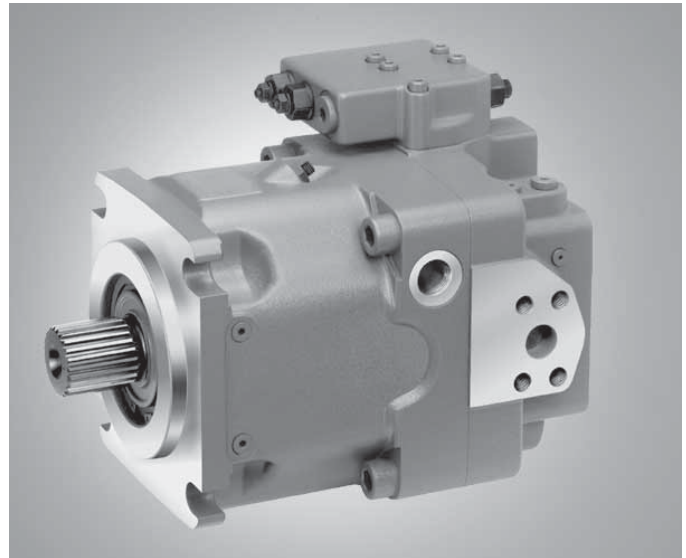
Sizes 40...260

Series 1

Nominal pressure 5100 psi (350 bar)

Peak pressure 5800 psi (400 bar)

- Variable displacement axial piston pump of swashplate design for hydrostatic drives in open circuit hydraulic system
- Designed primarily for use in mobile applications
- The pump operates under self-priming conditions, with tank pressurization, or with an optional built-in charge pump (impeller)
- A comprehensive range of control options is available matching any application requirement
- Power control option is externally adjustable, even when the pump is running
- The through drive is suitable for adding gear pumps and axial piston pumps up to the same, i.e. 100% through drive
- The output flow is proportional to the drive speed and infinitely variable between maximum and zero



**Ordering code**

**Axial piston unit**

Swashplate design, variable displacement, SAE version	AA11V
---	-------

**Charge pump (impeller)**

	40	60	75	95	130	145	190	260
without charge pump (no code)	●	●	●	●	●	●	●	●
with charge pump	-	-	-	-	●	●	●	●

**Operation**

Pump, open circuit	O
--------------------	---

**Size**

	40	60	75	95	130	145	190	260
Displacement $V_{g \max}$ $\text{cm}^3/\text{rev.}$	42	58.5	74	93.5	130	145	193	260
$\text{in}^3/\text{rev.}$	2.56	3.57	4.52	5.71	7.93	8.84	11.78	15.87

**Control device**

		40	60	75	95	130	145	190	260
Power control	LR	●	●	●	●	●	●	●	●
with override	cross-sensing negative	●	●	●	●	●	●	●	●
	high pressure related negative	●	●	●	●	●	●	●	●
	pilot pressure related negative	●	●	●	●	●	●	●	●
	positive	○	○	○	○	○	○	○	○
	electrical 12V negative	○	○	○	○	○	○	○	○
	24V negative	○	○	○	○	○	○	○	○
with pressure cut-off		●	●	●	●	●	●	●	●
	hydraulic 2-stage	●	●	●	●	●	●	●	●
	hydraulic remote controlled	●	●	●	●	●	●	●	●
with load sensing		●	●	●	●	●	●	●	●
	electr. prop. override, 24V neg.	○	○	○	○	○	○	○	○
	hydr. prop. override, negative	○	○	○	○	○	○	○	○
with stroke limiter	negative $\Delta p = 365 \text{ psi (25 bar)}$	●	●	●	●	●	●	●	●
	characteristic $\Delta p = 145 \text{ psi (10 bar)}$	●	●	●	●	●	●	●	●
	positive $\Delta p = 365 \text{ psi (25 bar)}$	●	●	●	●	●	●	●	●
	characteristic $\Delta p = 145 \text{ psi (10 bar)}$	●	●	●	●	●	●	●	●
	positive characteristic $U = 12 \text{ V}$	●	●	●	●	●	●	●	●
	$U = 24 \text{ V}$	●	●	●	●	●	●	●	●
Pressure control	DR	●	●	●	●	●	●	●	●
with load sensing	DRS	●	●	●	●	●	●	●	●
remote controlled	DRG	●	●	●	●	●	●	●	●
for parallel operation	DRL	●	●	●	●	●	●	●	●
Hydraulic control	$\Delta p = 145 \text{ psi (10 bar)}$ HD1	●	●	●	●	●	●	●	●
pilot pressure related (pos. charac.) $\Delta p = 365 \text{ psi (25 bar)}$ HD2		●	●	●	●	●	●	●	●
with pressure cut-off	D	●	●	●	●	●	●	●	●
with pressure cut-off, remote controlled	G	○	○	○	○	○	○	○	○
Electrical control	$U = 12 \text{ V}$ EP1	●	●	●	●	●	●	●	●
with proportional solenoid (pos. characteristic) $U = 24 \text{ V}$ EP2		●	●	●	●	●	●	●	●
with pressure cut-off	D	●	●	●	●	●	●	●	●
with pressure cut-off, remote controlled	G	●	●	●	●	●	●	●	●

In case of controls with several additional functions, observe the order of the columns, only one option per column is possible (e.g. LRDCH2).

The following combinations are not available for the power control:

LRDS2, LRDS5, L...GS, L...GS2, L...GS5, L...EC and the combination L...DG in connection with the stroke limiters H1, H2, H5, H6, U1 and U2.

- = available
- = available on request
- = not available



AA11V O / 1 - N 62 - <sup>6)</sup>

Axial piston unit

Charge pump

Operation

Size

Control device

Series

1

Index

size 40...130

0

size 145...260

1

Direction of rotation

viewed on shaft end

clockwise

R

counter-clockwise

L

Seals

NBR (Buna-N), shaft seal in FKM (fluorocarbon)

N

Shaft end (perm. input torques see page 7)

40 60 75 95 130 145 190 260

Splined shaft ANSI B92.1a-1976 for single pump

● ● ● ● ● ● ● ●

S

for combination pump

● ● ● <sup>-1)</sup> <sup>-1)</sup> <sup>-1)</sup> ● ● ● ●

T

Cylindrical shaft with key DIN 6885

● ● ● ● ● ● ● ●

P

Mounting flange

40 60 75 95 130 145 190 260

SAE J744 - 2-hole

● ● - - - - - -

C

SAE J744 - 4-hole

- - ● ● ● ● ● ● ● ●

D

SAE J617 <sup>2)</sup> (SAE 3)

- - - ● ● ● ● ● - -

G

Service line ports

40 60 75 95 130 145 190 260

Pressure and suction port on opposite sides (SAE),  
with UNC fastening threads

● ● ● ● ● ● ● ●

62

Through drive (see page 56 for attachments)

Flange SAE J744 <sup>3)</sup>	Splined shaft coupler	40	60	75	95	130	145	190	260	
-	-	●	●	●	●	●	●	●	●	N00
82-2 (A)	5/8in 9T 16/32DP (A)	●	●	●	●	●	●	●	●	K01
	3/4in 11T 16/32DP (A-B)	○	●	○	●	●	●	○	○	K52
101-2 (B)	7/8in 13T 16/32DP (B)	●	●	●	●	●	●	●	●	K02
	1in 15T 16/32DP (B-B)	●	●	●	●	●	●	●	●	K04
127-2 (C) <sup>4)</sup>	1 1/4in 14T 12/24DP (C)	-	●	●	●	●	●	●	●	K07
	1 1/2in 17T 12/24DP (C-C)	-	-	-	●	●	●	●	●	K24
152-4 (D)	1 1/4in 14T 12/24DP (C)	-	-	●	●	●	●	●	●	K86
	1 3/4in 13T 8/16DP (D)	-	-	-	-	●	●	●	●	K17
165-4 (E)	1 3/4in 13T 8/16DP (D)	-	-	-	-	-	-	●	●	K72

Swivel angle indicator (page 57)

40 60 75 95 130 145 190 260

without (no code)	●	●	●	●	●	●	●	●	●	
with optical swivel angle indicator	●	-	●	●	●	●	●	●	●	V
with electrical swivel angle sensor	●	-	●	●	●	●	●	●	●	R

Male connectors for solenoids <sup>5)</sup> (page 58)

40 60 75 95 130 145 190 260

DEUTSCH DT04-2P-EP04 (2-pole), molded to the solenoid coil	●	●	●	●	●	●	●	●	●	P
Hirschmann according to DIN EN 175 301-803-A (not for new projects)	●	●	●	●	●	●	●	●	●	H

<sup>1)</sup> S-shaft suitable for combination pump!<sup>4)</sup> Size 190 and 260 with 2 + 4-hole flange<sup>2)</sup> To fit the flywheel housing of the combustion engine<sup>5)</sup> Male connector without bidirectional suppressor diode<sup>3)</sup> 2 2-hole; 4 4-hole<sup>6)</sup> no code = standard version, S = special version, K = combination with mounting part or mounting pump

**Extracted from RA 92 500/06.04**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical Data**
**Value table**

(theoretical values, without efficiencies and tolerances; values rounded)

Size	AA11VO		40	60	75	95	130	145	190	260						
	AA11VLO (with charge pump)										130	145	190	260		
Displacement	$V_{g \max}$	$\text{In}^3/\text{rev.}$	2.56	3.57	4.52	5.71	7.93	8.84	11.78	15.87	7.93	8.84	11.78	15.87		
		$\text{cm}^3/\text{rev.}$	42	58.5	74	93.5	130	145	193	260	130	145	193	260		
		$V_{g \min}$	$\text{In}^3/\text{rev.}$	0	0	0	0	0	0	0	0	0	0	0	0	
Speed	$n_{\max}$	rpm	3000	2700	2550	2350	2100	2200	2100	1800	2500 <sup>2)</sup>	2500 <sup>2)</sup>	2500 <sup>2)</sup>	2300 <sup>2)</sup>		
		maximum at $V_{g \max}$ <sup>1)</sup>														
	$n_{\max 1}$	rpm	3500	3250	3000	2780	2500	2500	2500	2300	2500	2500	2500	2300		
Flow <sup>4)</sup> at $n_{\max}$ and $V_{g \max}$	$q_{V \max}$	gpm	33.3	41.7	49.9	58.1	72.1	84.3	107	123.6	85.9	95.9	127.6	158		
		L/min	126	158	189	220	273	319	405	468	325	363	483	598		
Power at $q_{V \max}$ and $\Delta p = 5100 \text{ psi (350 bar)}$	$P_{\max}$	hp	99.2	123.4	147.5	171.7	213.2	249.4	316.5	366.1	254.8	283	376.8	468		
		kW	74	92	110	128	159	186	236	273	190	211	281	349		
Torque at $V_{g \max}$ and $\Delta p = 5100 \text{ psi (350 bar)}$	$T_{\max}$	lb-ft	172.6	240.4	303.9	384.3	534	596	792.9	1068	534	596	792.9	1068		
		Nm	234	326	412	521	724	808	1075	1448	724	808	1075	1448		
Mass moment of inertia around drive axis	J	lbs-ft <sup>2</sup>	0.1139	0.1946	0.2729	0.4105	0.7546	0.8092	1.3052	2.0835	0.7997	0.8543	1.3692	2.1238		
		kgm <sup>2</sup>	0.0048	0.0082	0.0115	0.0173	0.0318	0.0341	0.055	0.0878	0.0337	0.036	0.0577	0.0895		
Rotational vibration <sup>4)</sup> Angular acceleration, max.	$\alpha$	rad/s <sup>2</sup>	22000	17500	15000	13000	10500	9000	6800	4800	10500	9000	6800	4800		
		Speed variation, max.	$\Delta n$	rpm	85	73	68	63	57	49	37	28	57	49	37	28
		Frequency limit	$f_{\text{limit}}$	Hz	788	731	675	626	563	563	563	518	563	563	563	518
Rotary stiffness	Shaft end S	lb-ft/rad	43035	63658	75173	128117	174700	174700	191599	259628	174700	174700	191599	259628		
		Nm/rad	58347	86308	101921	173704	236861	236861	259773	352009	236861	236861	259773	352009		
	Shaft end T	lb-ft/rad	54931	75556	92640	-	-	-	222691	418282	-	-	222691	418282		
		Nm/rad	74476	102440	125603	-	-	-	301928	567115	-	-	301928	567115		
	Shaft end P	lb-ft/rad	64512	79574	105548	14883	230417	230417	282702	482244	230417	230417	282702	482244		
		Nm/rad	87467	107888	143104	196435	312403	312403	383292	653835	312403	312403	383292	653835		
Filling volume		gal	0.29	0.36	0.49	0.55	0.77	0.77	1.0	1.22	0.77	0.77	1.0	1.22		
		L	1.1	1.35	1.85	2.1	2.9	2.9	3.8	4.6	2.9	2.9	3.8	4.6		
Weight (approx.)	m	lbs	71	88	99	117	145	168	209	276	159	161	229	304		
		kg	32	40	45	53	66	76	95	125	72	73	104	138		

<sup>1)</sup> The values apply at absolute pressure ( $p_{\text{abs}}$ ) 14.5 psi (1 bar) at the suction port S and mineral hydraulic fluid.

<sup>2)</sup> The values apply at absolute pressure ( $p_{\text{abs}}$ ) of at least 12 psi (0.8 bar) at the suction port S and mineral hydraulic fluid.

<sup>3)</sup> The values apply at  $V_{g \leq V_{g \max}}$  or in case of an increase in the inlet pressure  $p_{\text{abs}}$  at the suction port S (see diagram page 5)

<sup>4)</sup> The permissible angular acceleration or speed variation only applies for single pumps, not for combi pumps.

The load on connection parts (e.g. through drive) must be taken into account additionally.

 At  $f < f_{\text{limit}}$  the  $\Delta n$  specified in the table is permissible.

 At  $f > f_{\text{limit}}$  the permissible angular acceleration  $\alpha$  specified in the table limits the value of the speed variation:  $\Delta n_{\text{perm}} = 3.04 \cdot \alpha / f$ .

**Extracted from RA 92 701/05.04**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Variable displacement pump  
for open circuits,  
Axial piston, swashplate design  
Model A10V(S)O**

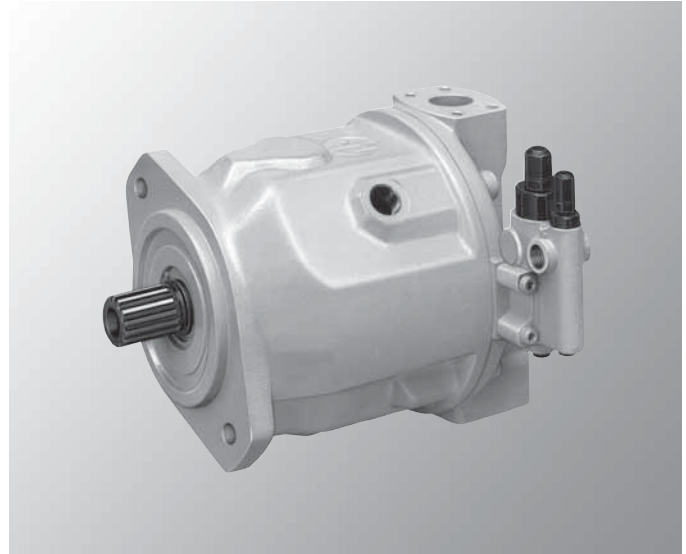
Size 18...140

Series 31

Nominal pressure 4000 psi (280 bar)

Peak pressure 5100 psi (350 bar)

- Axial piston pump A10VO, variable, in swashplate design for hydrostatic transmissions in open loop circuit
- Flow is proportional to drive speed and displacement. By adjusting the swashplate angle it is possible to infinitely vary the flow
- Mounting flange acc. to SAE J744
- Flanged ports acc. to SAE J518
- 2 case drain ports
- Good suction characteristics
- Permissible working pressure 4000 psi (280 bar)
- Low noise level
- Long service life
- Axial and radial loading of drive shaft possible
- High power-weight ratio
- Wide range of controls
- Short response times
- Through drive option for multi-circuit system



Extracted from RA 92 701/05.04

Ordering code

<b>Version</b>		18, 28		45...140		<b>Version</b>	
High-Speed-Version		-	●	H		Axial piston unit	
<b>Axial piston unit</b>		18		28...140		Mode of operation	
Swashplate design variable		-	●	A10V		Size	
		●	-	A10VS		Control devices	
<b>Mode of operation</b>				O		Series	
Pump open circuit						Dir of rotation	
<b>Size</b>		18		28		45	
Displacement $V_{g \max}$		in <sup>3</sup> /rev		1.10		1.71	
		cm <sup>3</sup> /rev		18		28	
				45		71	
				100		140	
				6.10		8.54	
<b>Control devices</b>		18		28		45	
Two point, direct control		DG		○		●	
Pressure control		DR		●		●	
remote control _____		DR		G		●	
Pressure and flow control		DFR		●		●	
orifice in X-channel closed _____		DFR		1		●	
Pressure, flow and torque control		-		●		●	
Electro-hydr. pressure control, see RA 92707		●		●		●	
Pressure and flow control with electrically adjustable differential pressure see RE 92709 (in preparation)		○		●		●	
<b>Series</b>				31			
<b>Direction of rotation</b>		Viewed on drive shaft		clockwise		R	
				counter clockwise		L	
<b>Seals</b>		NBR nitril-caoutchouc, shaft seal FKM		P			
		FKM fluoro-caoutchouc		V			
<b>Shaft end acc. to SAE J744</b>		18		28		45	
Splined, reduced dia. (not for through drive) [in]		5/8		-		7/8	
Splined, regular dia. (with undercut) [in]		3/4		7/8		1	
Splined (with runout, higher input torque) [in]		-		7/8		1	
Splined (with runout, reduced dia.) [in]		-		-		7/8	
Parallel with key		●		●		●	
Traped with woodruff key		-		●		-	

● = available      ○ = in preparation      - = not available       = preferred program

Extracted from RA 92 701/05.04

	A10V(S)	O			/ 31	-				
Version										
Axial piston unit										
Mode of operation										
Size										
Control devices										
Series										
Direction of rotation										
Seals										
Shaft										
<b>Mounting flange</b> acc. to SAE J744	<b>18</b>	<b>28</b>	<b>45</b>	<b>71</b>	<b>100</b>	<b>140</b>				
2-hole	●	●	●	●	●	-			<b>C</b>	
4-hole	-	-	-	-	-	●			<b>D</b>	
<b>Port for service lines</b>	<b>18</b>	<b>28</b>	<b>45</b>	<b>71</b>	<b>100</b>	<b>140</b>				
Pressure port B Suction port S	SAE flange rear, fixing thread UNC	-	-	-	●	-	-		<b>91</b>	Port plate 91 and 61 without through drive only
Pressure port B Suction port S	SAE flange on opposite side fixing thread UNC	-	-	-	●	-	-		<b>92</b>	
Pressure port B Suction port S	SAE flange rear, fixing thread UNC	-	●	●	-	●	●		<b>61</b>	
Pressure port B Suction port S	SAE flange on opposite side fixing thread UNC	●	●	●	-	●	●		<b>62</b>	
<b>Through drive</b>	<b>18</b>	<b>28</b>	<b>45</b>	<b>71</b>	<b>100</b>	<b>140</b>				
Without through drive	●	●	●	●	●	●			<b>N00</b>	
With through drive (port plate 62 org <sup>2)</sup> )										
Mounting flange <sup>1)</sup>	Shaft/coupling <sup>2)</sup>	Sealing								
82-2 (A)	16-4 (A)	axial	●	●	●	●	●	●		<b>K01</b>
82-2 (A)	19-4 (A-B)	axial	●	●	●	●	●	●		<b>K52</b>
101-2 (B)	22-4 (B)	axial	-	●	●	●	●	●		<b>K68</b>
101-2 (B)	25-4 (B-B)	axial	-	-	●	●	●	●		<b>K04</b>
127-2 (C)	32-4 (C)	axial	-	-	-	●	●	●		<b>K07</b>
127-2 (C)	38-4 (C-C)	axial	-	-	-	-	●	●		<b>K24</b>
152-4 (D)	44-4 (D)	axial	-	-	-	-	-	●		<b>K17</b>

1) Flange acc. to SAE J744

2) Coupling for splined shaft acc. to SAE J744 OCT83

For mounting options on through drive see page 29.

## Extracted from RA 92 701/05.04

Page 4 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Technical Data

**Table of values** (theoretical values, without considering  $\eta_{mh}$  and  $\eta_v$ ; values rounded)

Size			18	28	45	71	100	140	45	71	100	140
High-Speed-Version												
Displacement	$V_{g \max}$	in <sup>3</sup> (cm <sup>3</sup> )	1.10 (18)	1.71 (28)	2.75 (45)	4.33 (71)	6.10 (100)	8.54 (140)	2.75 (45)	4.33 (71)	6.10 (100)	8.54 (140)
Speed <sup>1)</sup> , max.												
at $V_{g \max}$	$n_{o \max}$	rpm	3300	3000	2600	2200	2000	1800	3000	2550	2300	2050
at $V_g < V_{g \max}$	$n_{o \max \text{ perm.}}$	rpm	3900	3600	3100	2600	2400	2100	3300	2800	2500	2200
Flow, max.												
at $n_{o \max}$	$q_{vo \max}$	gpm (L/min)	15.6 (59.4)	22.2 (84)	30.9 (117)	41.2 (156)	52.8 (200)	66.6 (252)	35.7 (135)	47.8 (181)	60.7 (230)	75.8 (287)
at $n_E = 1800$ rpm	$q_{vE}$	gpm (L/min)	8.5 (32.4)	13.2 (50)	21.4 (81)	33.8 (128)	47.5 (180)	66.6 (252)	21.4 (81)	33.8 (128)	47.5 (180)	66.6 (252)
Power ( $\Delta p = 4000$ psi (280 bar) & $V_{g \max}$ )												
at $n_{o \max}$	$P_{o \max}$	HP (kW)	37 (27.7)	52 (39)	74 (55)	98 (73)	125 (93)	157 (117)	84 (63)	113 (84)	143 (107)	180 (134)
at $n_E = 1800$ rpm	$P_{E \max}$	HP (kW)	20 (15)	31 (23)	51 (38)	80 (60)	113 (84)	158 (118)	51 (38)	80 (60)	113 (84)	158 (118)
Torque at $V_{g \max}$												
$\Delta p = 4000$ psi (280 bar)	$T_{\max}$	lb-ft (Nm)	58.9 (80.1)	91 (125)	146 (200)	230 (316)	324 (445)	453 (623)	146 (200)	230 (316)	324 (445)	453 (623)
$\Delta p = 1450$ psi (100 bar)	$T$	lb-ft (Nm)	21 (28.6)	33 (45)	53 (72)	83 (113)	117 (159)	164 (223)	53 (72)	83 (113)	117 (159)	164 (223)
Moment of inertia about drive axis	$J$	lb-ft <sup>2</sup> (kgm <sup>2</sup> )	0.022 (0.00093)	0.040 (0.0017)	0.078 (0.0033)	0.197 (0.0083)	0.396 (0.0167)	0.574 (0.0242)	0.078 (0.0033)	0.197 (0.0083)	0.396 (0.0167)	0.574 (0.0242)
Max. angular acceleration		rad/s	6800	5500	4000	2900	2400	2000	4000	2900	2400	2000
Torsional stiffness - shaft "S"		lb-ft/rad (Nm/rad)	8149 (11087)	16403 (22317)	27562 (37499)	52835 (71884)	89039 (121142)	124610 (169537)	27562 (37499)	52835 (71884)	89039 (121142)	124610 (169537)
shaft "U"		lb-ft/rad (Nm/rad)	5946 (8090)		22107 (30077)		66953 (91093)		22107 (30077)		66953 (91093)	
shaft "R"		lb-ft/rad (Nm/rad)		19375 (26360)	30153 (41025)	56261 (76545)			30153 (41025)	56261 (76545)		
shaft "W"		lb-ft/rad (Nm/rad)			25330 (34463)		74858 (101847)		25330 (34463)		74858 (101847)	
shaft "K"		lb-ft/rad (Nm/rad)	9805 (13340)	19712 (26819)	32270 (43905)	60352 (82112)	99448 (135303)	144680 (196844)	32270 (43905)	60352 (82112)	99448 (135303)	144680 (196844)
Filling capacity		gal. (L)	0.1 (0.4)	0.18 (0.7)	0.26 (1.0)	0.42 (1.6)	0.58 (2.2)	0.79 (3.0)	0.26 (1.0)	0.42 (1.6)	0.58 (2.2)	0.79 (3.0)
Weight (without fluid) m		lbs (kg)	26 (12)	33 (15)	46 (21)	73 (33)	99 (45)	132 (60)	46 (21)	73 (33)	99 (45)	132 (60)

<sup>1)</sup> Values shown are valid for an absolute pressure of 14.5 psi (1 bar) at inlet port S. At reduced displacement or increased inlet pressure the speed may be increased according to the diagram.

<sup>2)</sup> For higher radial loads, please consult us.

**Extracted from RA 92 703/03.06**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Variable displacement pump  
for open circuits,  
Axial piston, swashplate design  
Model A10VO**

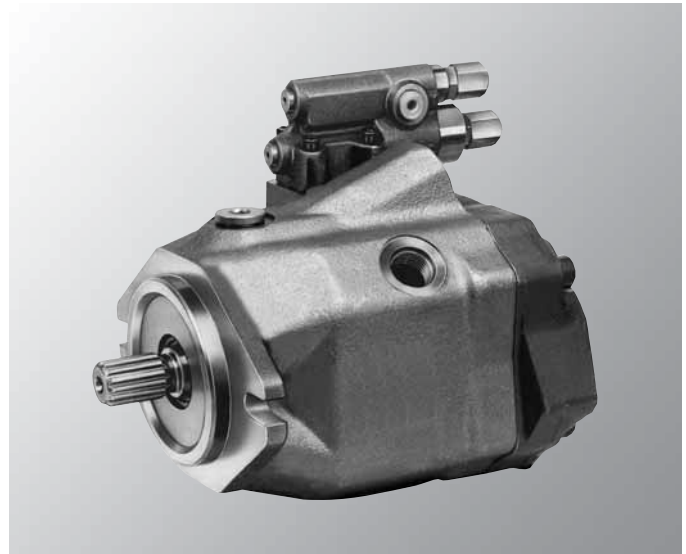
Size 10...85

Series 52/53

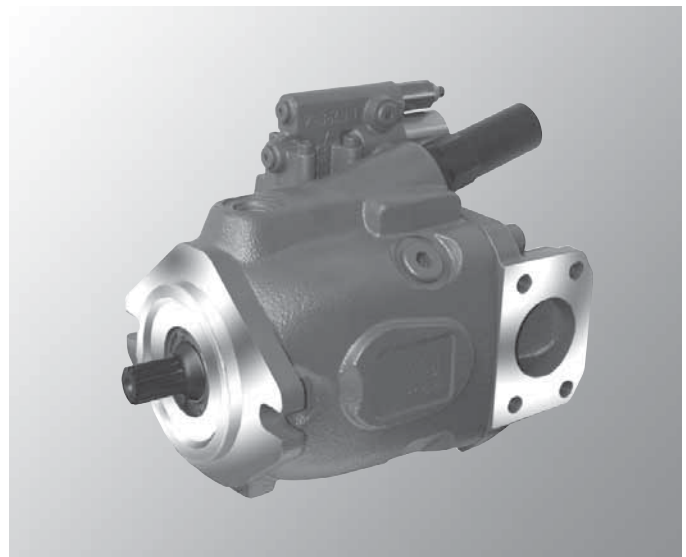
Nominal pressure 3600 psi (250 bar)

Peak pressure 4600 psi (315 bar)

- Variable axial piston pump in swashplate design for hydrostatic drives in open circuits
- Flow is proportional to drive speed and displacement. The flow is infinitely variable by adjustment of the swashplate
- Strong bearings for long service life
- High permissible drive speeds
- High power-weight ratio - small dimensions
- Low noise level
- Good suction characteristics
- Axial and radial loading of drive shaft possible
- Pressure and flow control
- Electro-hydraulic pressure control
- Power control
- Electro-hydraulic displacement control
- Short response times



Series 52



Series 53



## Extracted from RA 92 703/03.06

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Ordering code

<b>A10V(S)</b>	<b>O</b>			<b>/</b>	<b>5</b>			<b>-</b>	<b>V</b>				
01	02	03	04		05	06	07		08	09	10	11	12

#### Axial piston unit

10 28 45 60/63<sup>1)</sup> 85

01	Swash plate design, variable	●	-	-	-	-	<b>A10VS</b>
		-	●	●	●	●	<b>A10V</b>

#### Operating mode

02	Pump, open circuit	<b>O</b>
----	--------------------	----------

#### Size

03	Displacement $V_{g \max}$		<b>10</b>	<b>28</b>	<b>45</b>	<b>60/63<sup>1)</sup></b>	<b>85</b>
		[cm <sup>3</sup> ]	10	28	45	63	85
		[in <sup>3</sup> ]	0.61	1.71	2.75	3.84	5.18

#### Control devices<sup>2)</sup>

04	Pressure control	DR							●	●	●	●	●	<b>DR</b>	
	with hydraulic flow control														
	X-T open				DFR				-	●	●	●	●	<b>DFR<sup>2)</sup></b>	
	X-T open	DR			F				-	○	○	○	○	<b>DRF<sup>2)</sup></b>	
	X-T closed				DFR1				●	●	●	●	●	<b>DFR1<sup>2)</sup></b>	
	X-T closed	DR			S				-	○	○	○	○	<b>DRS<sup>2)</sup></b>	
	with flow control, electro-hydraulic adjustment of differential press. (inverse proportional characteristic) (RE 92 709)	EF	.	D	.					-	●	○	●	●	<b>EF.D.</b>
	with remote pressure control														
	hydraulic	DR			G					●	●	●	●	●	<b>DRG</b>
	electric, inverse charact. (RE 92 707)	ED	.							-	●	●	●	●	<b>ED.</b>
	Power control														
	with pressure control														
	min. start of control														
	145 to 510 psi (10 to 35 bar)	LA	5	D						-	●	○	●	●	<b>LA5D</b>
	520 to 1015 psi (36 to 70 bar)	LA	6	D						-	●	○	●	●	<b>LA6D</b>
	1030 to 1520 psi (71 to 105 bar)	LA	7	D						-	●	○	●	●	<b>LA7D</b>
	1535 to 2030 psi (106 to 140 bar)	LA	8	D						-	●	○	●	●	<b>LA8D</b>
	2045 to 3335 psi (141 to 230 bar)	LA	9	D						-	●	○	●	●	<b>LA9D</b>
with remote pressure control															
min. start of control see above	LA	X	D	G					-	●	○	●	●	<b>LAXDG</b>	
with pressure and flow control, X-T closed															
min. start of control see above	LA	X	D	S					-	●	○	●	●	<b>LAXDS</b>	
with press. and flow control, electro-hydr. adjustment of diff. press. (inverse prop. characteristic), X-T closed (RE 92 709)															
min. start of control see above	LA	X		S	.				-	●	○	●	●	<b>LAXS.</b>	
Electro-proportional displacement control (RE 92 708)															
with pressure and flow control positive characteristic	EP	.	D	.					-	●	○	●	●	<b>EP.D.</b>	
with pressure and flow control positive characteristic; deactivation of control at I = 0	EK	.	D	.					-	●	○	●	●	<b>EK.D.</b>	

<sup>1)</sup> Size 60 only in series 52; size 63 only in series 53 (see also index 06 in ordering code)

<sup>2)</sup> For availability of control options in series 52 and 53 (see also index 06 in ordering code)



### Extracted from RA 92 703/03.06

Page 4 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data

Size	A10V(S)O		10	28	45	60	63	85
Displacement	$V_{g \max}$	in <sup>3</sup> (cm <sup>3</sup> )	0.61 (10.5)	1.71 (28)	2.75 (45)	3.66 (60)	3.84 (63)	5.18 (85)
Speed <sup>2)</sup>								
max. at $V_{g \max}$	$n_{0 \max}$	min <sup>-1</sup>	3600	3000	2600 <sup>3)</sup>	2700	2600	2500
max. at $V_{g \leq V_{g \max}}$	$n_{0 \max \text{ zul}}$	min <sup>-1</sup>	4320	3600	3120	3240	3140	3000
Flow								
at $n_{0 \max}$	$q_{V0 \max}$	gpm (L/min)	9.7 (37)	22 (84)	31 (117)	43 (162)	43.1 (163)	55 (212)
at $n_{0 \max \text{ zul}}$	$q_{V0 \max \text{ zul}}$	gpm (L/min)	11.4 (43,2)	26.6 (100)	37 (140)	51 (194)	52.2 (198)	67.3 (255)
Power	$\Delta p = 3600 \text{ psi (250 bar)}$							
at $n_{0 \max}$	$P_{o \max}$	HP (kW)	22 (16)	47 (35)	65 (49)	90 (68)	90 (68)	119 (89)
at $n_{0 \max \text{ zul}}$	$P_{o \max \text{ zul}}$	HP (kW)	25.5 (18)	56 (42)	77.8 (58)	108 (81)	110 (82,5)	141 (106)
Torque								
at $V_{g \max}$	$\Delta p = 3600 \text{ psi (250 bar)}$	$T_{\max}$	31 (42)	82 (111)	131 (179)	175 (238)	184 (250)	247 (338)
	$\Delta p = 1440 \text{ psi (100 bar)}$	$T$	13 (16.7)	33 (44.5)	53 (71.5)	70 (95)	74 (100)	102 (135)
Moment of inertia (about drive axis)	$J$	lbs-ft <sup>2</sup> (kgm <sup>2</sup> )	0.0142 (0.0006)	0.0403 (0.0017)	0.0783 (0.0033)	0.1329 (0.0056)	0.1329 (0.0056)	0.2848 (0.012)
Angular acceleration, max.		rad/s <sup>2</sup>	8000	5500	4000	3300	3300	2700
Torsional stiffness	Shaft S	lb-ft/rad (Nm/rad)	6760 (9200)	16400 (22300)	27560 (37500)	48100 (65500)	48100 (65500)	105100 (143000)
	Shaft R	lb-ft/rad (Nm/rad)	–	19400 (26300)	30240 (41000)	51200 (69400)	51200 (69400)	–
	Shaft U	lb-ft/rad (Nm/rad)	5020 (6800)	–	22130 (30000)	36290 (49200)	36290 (49200)	75900 (102900)
	Shaft W	lb-ft/rad (Nm/rad)	–	–	25370 (34400)	39830 (54000)	39830 (54000)	86960 (117900)
	Shaft P	lb-ft/rad (Nm/rad)	7890 (10700)	–	–	–	–	–
Case volume		gal (L)	0.05 (0.2)	0.08 (0.3)	0.13 (0.5)	0.21 (0.8)	0.21 (0.8)	0.26 (1)
Weight (without fluid)		lbs (kg)	17 (8)	31 (14)	40 (18)	48.5 (22)	48.5 (22)	75 (34)

<sup>1)</sup> theoretical values, without considering  $\eta_{mh}$  and  $\eta_v$ , values rounded

<sup>2)</sup> Values are valid with inlet pressure of 1 bar at suction inlet S. With reduced displacement or increased inlet pressure the drive speed can be increased according to the diagram on page 5

<sup>3)</sup> For higher drive speeds, please consult us.

**Extracted from RA 92 711/05.95**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

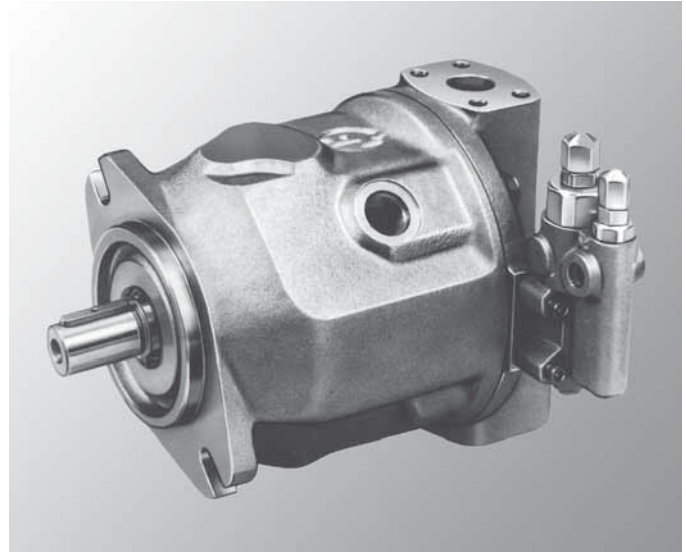
**Variable displacement pump  
for open circuits,  
Axial piston, swashplate design  
Model AA10VSO (A10VSO; Size 18)**

Sizes 18 to 140, Series 31

Nominal pressure up to 280 bar (4000 PSI)

Maximum pressure up to 350 bar (5100 PSI)

- Variable displacement axial piston pump of swashplate design for hydrostatic open circuit systems
- Flow is proportional to drive speed and displacement. It can be infinitely varied by adjustment of the swashplate.
- SAE mounting flange
- Flange connections to SAE
- Two case drain ports
- Good suction characteristics
- Permissible continuous pressure 280 bar (4000 PSI)
- Low noise level
- Long service life
- Axial and radial load of drive shaft possible
- High power-weight ratio
- Wide range of controls
- Short response times
- Through drive option for multi-circuit system



## Extracted from RA 92 711/05.95

Page 2 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Ordering code

Hydraulic Fluid, Type of rotary group		18...45	71...140					
Mineral oil and HFD (no code)		●	●					
HFA, HFB and HFC - Fluids		●	●	E				
High-Speed-Version		—	●	H				
<b>Axial Piston Unit</b>								
Swashplate design, variable		size 18		A10VS				
		size 28 to 140		AA10VS				
<b>Type of operation</b>								
Pump in open circuit		O						
<b>Size</b>								
		18	28	45	71	100	140	
		in <sup>3</sup> /rev.	1.10	1.71	2.75	4.33	6.10 8.54	
		cm <sup>3</sup> /rev.	18	28	45	71	100 140	
<b>Control device</b>								
Two-position control, direct controls		DG	●	●	●	●	●	DG
Pressure control		DR	●	●	●	●	●	DR
		DR G	●	●	●	●	●	DRG
remote control								
Pressure flow control		DFR	●	●	●	●	●	DFR
		DFR 1	●	●	●	●	●	DFR1
without orifice between X and tank								
Pressure, flow and power control		—	●	●	●	●	●	DFLR
Pressure and flow control, electronic, see RA30022		●	●	●	●	●	●	DFE1
Electro-hydraulic pressure control, see RE92707		●	●	●	●	●	●	ED
<b>Series</b>								
		31						
<b>Direction of rotation</b>								
Viewed on shaft end		clockwise						R
		counter clockwise						L
<b>Seals</b>								
NBR nitril-caoutchouc, shaft seal in FKM								P
FKM flour-caoutchouc								V
<b>Shaft end</b>								
		18	28	45	71	100	140	
SAE Parallel with key		●	●	●	●	●	●	K
SAE Splined shaft		●	●	●	●	●	●	S
SAE Splined shaft (higher through drive torque)		●	●	●	●	—	—	R
SAE Splined shaft (not suitable for through drive)		●	—	●	—	●	—	U
<b>Mounting flange</b>								
		18	28	45	71	100	140	
SAE 2-bolt		●	●	●	●	●	—	C
SAE 4-bolt		—	—	—	—	—	●	D

### Extracted from RA 92 711/05.95

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

	AA10VS	O		/ 31	-				
Hydraulic Fluid, Type of rotary group									
Axial Piston Unit									
Type of operation									
Size									
Control device									
Series									
Direction of rotation									
Seals									
Shaft end									
Mounting flange									
<b>Service line connections</b>			<b>18</b>	<b>28</b>	<b>45</b>	<b>71</b>	<b>100</b>	<b>140</b>	
Pressure port B and suction port S:	SAE ports at opposite sides		●	●	●	—	●	●	<b>62</b>
	UNC fixing threads		—	—	—	●	—	—	<b>92</b>
<b>Through drives</b>			<b>18</b>	<b>28</b>	<b>45</b>	<b>71</b>	<b>100</b>	<b>140</b>	
without through drive			●	●	●	●	●	●	<b>N00</b>
with through drive to accept an axial piston pump or a gear pump									
<b>Mounting flange SAEJ744</b>	<b>hub</b>	<b>sealing</b>							
82-2(A)	keyed (A-B)	axial	○	●	●	●	●	●	<b>K40<sup>1)</sup></b>
101-2 (B)	keyed (B)	axial	—	●	●	●	●	●	<b>K03<sup>1)</sup></b>
101-2 (B-B)	keyed (B-B)	axial	—	—	●	●	●	●	<b>K05<sup>1)</sup></b>
127-2 (C)	keyed (C)	axial	—	—	—	●	●	●	<b>K08<sup>1)</sup></b>
127-2 (C)	keyed (C)	radial	—	—	—	—	●	●	<b>K38<sup>1)</sup></b>
152-4 (D)	keyed (D)	axial	—	—	—	—	—	●	<b>K21<sup>1)</sup></b>
82-2 (A)	5/8 in (A)	axial	●	●	●	●	●	●	<b>K01</b>
82-2 (A)	3/4 in (A-B)	axial	●	●	●	●	●	●	<b>K52</b>
101-2 (B)	7/8 in (B)	axial	—	●	●	●	●	●	<b>K68</b>
101-2 (B)	1 in (B-B)	axial	—	—	●	●	●	●	<b>K04</b>
127-2 (C)	1 1/4 in (C)	axial	—	—	—	●	●	●	<b>K07</b>
127-2 (C)	1 1/2 in (C-C)	axial	—	—	—	—	●	●	<b>K24</b>
152-4 (D)	1 3/4 in (D)	axial	—	—	—	—	—	●	<b>K17</b>

<sup>1)</sup> Not for new projects. Permitted with reduced through drive torque only.

●	= available
○	= in preparation
—	= not available

### Extracted from RA 92 711/05.95

Page 4 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Technical data

**Table of values** (theoretical values, without considering  $\eta_{mh}$  and  $\eta_v$ ; values rounded)

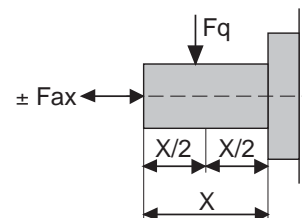
Size	(A)A10VSO Standard AA10VSO High Speed		18	28	45	71	100	140	71	100	140
Displacement	$V_{g \max}$	cm <sup>3</sup> (in <sup>3</sup> )	18 (1.10)	28 (1.71)	45 (2.75)	71 (4.33)	100 (6.10)	140 (8.54)	71 (4.33)	100 (6.10)	140 (8.54)
Speed <sup>1)</sup> , max.											
at $V_{g \max}$	$n_{o \max}$	rpm	3300	3000	2600	2200	2000	1800	2550	2300	2050
at increased inlet pressure $p_{abs}$ resp. $V_g < V_{g \max}$	$n_{o \max \text{ perm.}}$	rpm	3900	3600	3100	2600	2400	2100	2600	2400	2100
Flow, max											
at $n_{o \max}$	$q_{vo \max}$	L/min (GPM)	59.4 (15.7)	84 (22)	117 (31)	156 (41)	200 (53)	252 (67)	181 (48)	230 (61)	287 (76)
at $n_E = 1800$ rpm	$q_{vo}$	L/min (GPM)	32 (7.2)	59 (13.3)	81 (21.4)	128 (33.8)	180 (47.6)	252 (67)	128 (33.8)	180 (47.6)	252 (67)
Power, max. ( $\Delta p = 280$ bar (4000 PSI))											
at $n_{o \max}$	$P_{o \max}$	kW (HP)	28 (36.6)	39 (51)	55 (72)	73 (96)	93 (124)	118 (156)	84 (112)	107 (142)	134 (177)
at $n_E = 1800$ rpm	$P$	kW (HP)	15 (19)	24 (31)	38 (50)	69 (79)	84 (111)	118 (156)	69 (79)	84 (111)	118 (156)
Torque, max.											
at $V_{g \max}$ $\Delta p = 280$ bar (4000 PSI)	$T_{max}$	Nm (ft-lb)	80 (58)	125 (91)	200 (146)	316 (230)	445 (324)	623 (453)	316 (230)	445 (324)	623 (453)
at $V_{g \max}$ $\Delta p = 100$ bar (1450 PSI)	$T$	Nm (ft-lb)	28.6 (14.6)	45 (33)	72 (53)	113 (83)	159 (117)	223 (164)	113 (83)	159 (117)	223 (164)
Moment of inertia (about drive axis)	$J$	kgm <sup>2</sup> (lbs-ft <sup>2</sup> )	0.0009 (0.022)	0.0017 (0.0403)	0.0033 (0.0783)	0.0083 (0.1970)	0.0167 (0.3963)	0.0242 (0.5743)	0.0083 (0.1970)	0.0167 (0.3963)	0.0242 (0.5743)
Fill volume		L (gal.)	0.4 (0.1)	0.7 (0.2)	1.0 (0.3)	1.6 (0.4)	2.2 (0.6)	3.0 (0.8)	1.6 (0.4)	2.2 (0.6)	3.0 (0.8)
Weight (without fluid) ca.	$m$	kg (lbs.)	12 (27)	15 (33)	21 (46)	33 (73)	45 (99)	60 (132)	33 (73)	45 (99)	60 (132)
Permissible loading of drive shaft											
max. perm. load	$F_{ax \max}$	N (lbs.)	700 (157)	1000 (225)	1500 (337)	2400 (540)	4000 (900)	4800 (1080)	2400 (540)	4000 (900)	4800 (1080)
max. perm. load <sup>2)</sup>	$F_{q \max}$	N (lbs.)	350 (79)	1200 (270)	1500 (337)	1900 (427)	2300 (517)	2800 (630)	1900 (427)	2300 (517)	2800 (630)

<sup>1)</sup> These values are valid for an absolute pressure of 14.5 psi (1 bar) at the suction port S.

By reducing the displacement or increasing the input pressure the speed can be increased as shown in the diagram.

<sup>2)</sup> Please consult us for higher radial forces.

### Application of force





**Extracted from RA 92 714/11.05**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Variable displacement pump  
for open circuits,  
Axial piston, swashplate design  
Model A10VSO**

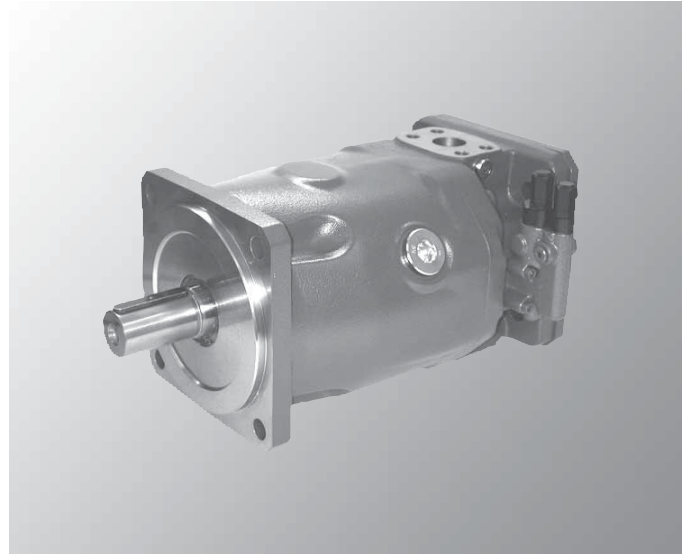
Size 71...180

Series 32

Nominal pressure 4000 psi (280 bar)

Peak pressure 5100 psi (350 bar)

- Low noise level
- Variable pump in axial piston-swashplate design
- The flow is proportional to the drive speed and the displacement
- Optimized housing and port plate structure to minimize noise radiation
- Optional with pulsation damping
- High efficiency
- Hydrostatic unloading of cradle bearings
- Double retainer mechanism for high speed version (Size 140 and 180)
- Arrangement to counteract cylinder lift off
- Optimized sealing
- High functional reliability, also with torsional vibrations or under unfavorable operating conditions
- Port for pressure transducer in pump outlet
- Universal through drive
- Excellent power to weight ratio



**Extracted from RA 92 714/11.05**

 Page 2 of 4  
 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Ordering code for standard program**

<b>A10VS</b>	<b>O</b>			<b>/</b>	<b>32</b>		<b>-</b>	<b>V</b>		<b>D</b>			<b>S</b>
01	02	03	04		05	06		07	08	09	10	11	12

**Axial piston unit**

01	Swashplate design, variable, industrial applications, nom. pres. 4000 psi (280 bar), peak press. 5100 psi (350 bar)	<b>A10VS</b>
----	---	--------------

**Type of operation**

02	Pump, open circuit	<b>O</b>
----	--------------------	----------

**Size**

			<b>45</b>	<b>71</b>	<b>100</b>	<b>140</b>	<b>180</b>
03	Displacement $V_{g \max}$	[cm <sup>3</sup> ]	45	71,1	100	140	180
		[in <sup>3</sup> ]	2.75	4.34	6.10	8.54	10.98

**Control and adjustment devices**

04	Two-point control, directly operated	DG											<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>DG</b>		
	Pressure control	DR												<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>DR</b>	
	with flow control, hydraulic, X-T open	DR			F									<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>DRF</b>	
	X-T closed	DR			S									<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>DRS</b>	
	with displacement control, electronic	DF	E1											<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>DFE1<sup>1)</sup></b>	
	(with pressure control), remotely adjustable																			
	hydraulic	DR			G									<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>DRG</b>	
	electric, inversely prop. characteristic	ED	.											<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>ED.<sup>2)</sup></b>	
	Power control																			
	with pressure control																			
	Beginning of control 725 psi below (50 bar)	LA	5	D											<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>LA5D</b>
	from 739.5 to 1305 psi (51 to 90 bar)	LA	6	D											<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>LA6D</b>
	1319.5 to 2320 psi (91 to 160 bar)	LA	7	D											<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>LA7D</b>
	2334.5 to 3480 psi (160 to 240 bar)	LA	8	D											<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>LA8D</b>
over 3480 psi (240 bar)	LA	9	D											<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>LA9D</b>	
with pressure control, remotely adjustable																				
Beginning of control see above	LA	X	D	G										<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>LAXDG</b>	
with pressure and flow control, X-T closed																				
Beginning of control see above	LA	X	D	S										<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>LAXDS</b>	
with separate flow control, X-T closed																				
Beginning of control see above	LA	X		S										<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<b>LAXS</b>	



**Extracted from RA 92 714/11.05**

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 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data<sup>1)</sup>**

Size	Standard High-speed		71	100	140	140
Displacement	$V_{g \max}$	in <sup>3</sup> (cm <sup>3</sup> )	4.34 (71)	6.10 (100)	8.54 (140)	8.54 (140)
Speed <sup>2)</sup>						
max. at $V_{g \max}$	$n_{0 \max}$	min <sup>-1</sup>	2200	2000	1800	1800 <sup>3)</sup>
max. at $V_{g \leq V_{g \max}}$	$n_{0 \max \text{ zul}}$	min <sup>-1</sup>	2600	2400	2100	2300
Flow						
at $n_{0 \max}$	$q_{V0 \max}$	gpm (L/min)	41.1 (156.4)	53 (200)	67 (252)	67 (252)
at $n_E = 1800 \text{ min}^{-1}$	$q_{VE \max}$	gpm (L/min)	34 (128)	47.6 (180)	67 (252)	67 (252)
at $n_{0 \max \text{ zul}}$	$q_{V0 \max \text{ zul}}$	gpm (L/min)	49 (184.3)	63.8 (240)	78.2 (294)	78.2 (294)
Power $\Delta p = 4000 \text{ psi}$ ( $\Delta p = 280 \text{ bar}$ )						
at $n_{0 \max}$	$P_{o \max}$	HP (kW)	96 (73)	124 (93)	156 (118)	156 (118)
at $n_E = 1800 \text{ rpm}$	$P_{E \max}$	HP (kW)	146 (109)	212 (158)	156 (118)	156 (118)
Torque						
at $V_{g \max}$ $\Delta p = 4000 \text{ psi}$ ( $\Delta p = 280 \text{ bar}$ )	$T_{\max}$	lb-ft (Nm)	231 (317)	325 (446)	454 (624)	454 (624)
$\Delta p = 1450 \text{ psi}$ ( $\Delta p = 100 \text{ bar}$ )	$T$	lb-ft (Nm)	83 (113)	117 (159)	164 (223)	164 (223)
Moment of inertia (about drive axis)	$J$	lb-ft <sup>2</sup> (kgm <sup>2</sup> )	0.2065 (0.0087)	0.4390 (0.0185)	0.6549 (0.0276)	0.6549 (0.0276)
Angular acceleration, max.		rad/s <sup>2</sup>	2900	2400	2000	2000
Torsional stiffness	shaft K	lb-ft/rad (Nm/rad)	59.466 (80627)	97.603 (132335)	138.958 (188406)	138.958 (188406)
	shaft S	lb-ft/rad (Nm/rad)	53.018 (71884)	89.348 (121142)	125.042 (169537)	125.042 (169537)
	shaft R	lb-ft/rad (Nm/rad)	56.456 (76545)	– (–)	– (–)	– (–)
Case volume		gal (L)	0.4 (1.6)	0.6 (2.2)	0.8 (3.0)	0.8 (3.0)
Weight (with pressure control)	$m$	lbs (kg)	103 (47)	152 (69)	161 (73)	161 (73)

<sup>1)</sup> Theoretical values, without considering  $\eta_{mh}$  and  $\eta_v$ , values rounded

<sup>2)</sup> Values are valid with inlet pressure of 1 bar absolute at port S.

<sup>3)</sup> With inlet pressure of 12 psi (0.8 bar) abs. at port S.

**Extracted from RA 92 735/10.03**

Page 1 of 3  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Variable displacement pump  
for open circuits,  
Axial piston, swashplate design  
Model A10VNO**

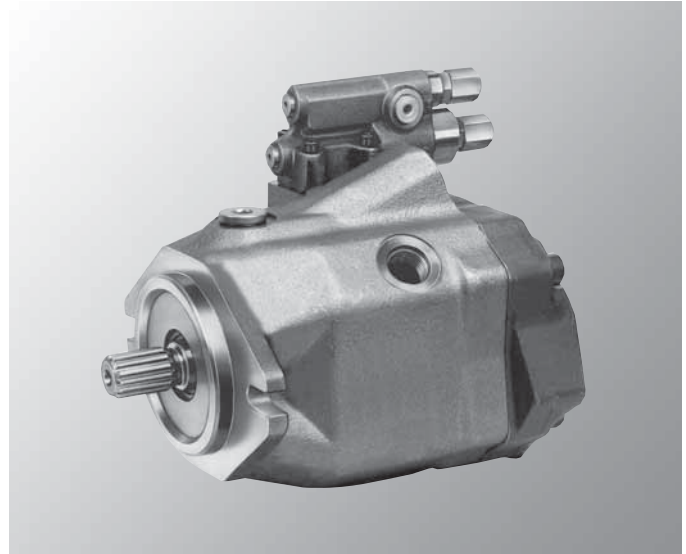
Size 28...85

Series 52

Nominal pressure 3000 psi (210 bar)

Peak pressure 3600 psi (250 bar)

- Variable displacement axial piston pump in swashplate design for hydrostatic drives in open circuits
- Flow is proportional to drive speed and displacement. It can be infinitely varied by adjustment of the swashplate
- High power to weight ratio - small dimensions
- Low noise level
- Permissible continuous pressure 3000 psi (210 bar)
- Axial and radial loading of drive shaft possible
- Pressure and flow control (load sensing)
- Short response times
- Well proven A10-Technology
- Extreme small mounting dimensions
- Cost effective alternative to fixed displacement pumps
- Costs-optimized design



**Extracted from RA 92 735/10.03**

Page 2 of 3

Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Ordering code**

<b>A10VN</b>	<b>O</b>		<b>DFR1</b>	<b>/</b>	<b>52</b>	<b>-</b>			<b>C</b>			
01	02	03	04		05	06		07	08	09	10	11

**Axial piston unit**

01	Swashplate design, variable, nominal press. 3000 psi (210 bar), peak press. 3600 psi (250 bar)									<b>A10VN</b>
----	--	--	--	--	--	--	--	--	--	--------------

**Type of operation**

02	Pump, open circuit									<b>O</b>
----	--------------------	--	--	--	--	--	--	--	--	----------

**Size**

03	Displacement $V_{gmax}$ [cm <sup>3</sup> ]	<b>28</b>	<b>45</b>	<b>63</b>	<b>85</b>	
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**Control device**

04	Pressure and flow control (without orifice between X and Tank)	●	●	●	●	<b>DFR1</b>
----	--	---	---	---	---	-------------

**Series**

05										<b>52</b>
----	--	--	--	--	--	--	--	--	--	-----------

**Direction of rotation**

06	viewed on shaft end	clockwise	●	●	●	●	<b>R</b>
		counterclockwise	●	●	●	●	<b>L</b>

**Seals**

07	HNBR (high density nitrile-rubber resp. Buna -N)	●	●	-	-	<b>H</b>
	FKM (fluoride -rubber)	-	-	●	●	<b>V</b>

**Shaft end**

08	Splined shaft ANSI B92.1a-1976 (with runout)	●	●	●	-	<b>R</b>
	Splined shaft ANSI B92.1a-1976 (with undercut)	-	-	-	●	<b>W</b>

**Mounting flange**

09	SAE J744 2-hole	●	●	●	●	<b>C</b>
----	-----------------	---	---	---	---	----------

**Connection for service lines**

10	B, S and L: at rear, metric threaded ports (ISO 6149-1)	●	●	-	-	<b>40</b>
	B and S: SAE flange at rear, metric bolt holes	-	-	●	●	<b>11</b>

**Through drive**

11	without through drive	●	●	●	●	<b>N00</b>
----	-----------------------	---	---	---	---	------------

● available      - not available

**Available versions** when ordering, state ordering code and ident nr.

Ordering code	Ident-Nr.	Ordering code	Ident-Nr.
A10VNO28DFR1/52R-HRC40N00	2436422	A10VNO63DFR1/52R-VRC11N00	2436458
A10VNO28DFR1/52L-HRC40N00	2436423	A10VNO63DFR1/52L-VRC11N00	2436459
A10VNO45DFR1/52R-HRC40N00	2436456	A10VNO85DFR1/52R-VWC11N00	2436460
A10VNO45DFR1/52L-HRC40N00	2436457	A10VNO85DFR1/52L-VWC11N00	2436461

**Extracted from RA 92 735/10.03**

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Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**Inlet operating pressure range**

Absolute pressure at port S

 $p_{abs \min}$  \_\_\_\_\_ 12 psi (0.8 bar)

 $p_{abs \max}$  \_\_\_\_\_ 435 psi (30 bar)

**Output operating pressure range**

Pressure at port B

 Nominal pressure  $p_N$  \_\_\_\_\_ 3000 psi (210 bar)

 Peak pressure  $p_{max}$  \_\_\_\_\_ 3600 psi (250 bar)

(Pressure data to DIN 24312)

**Direction of flow**

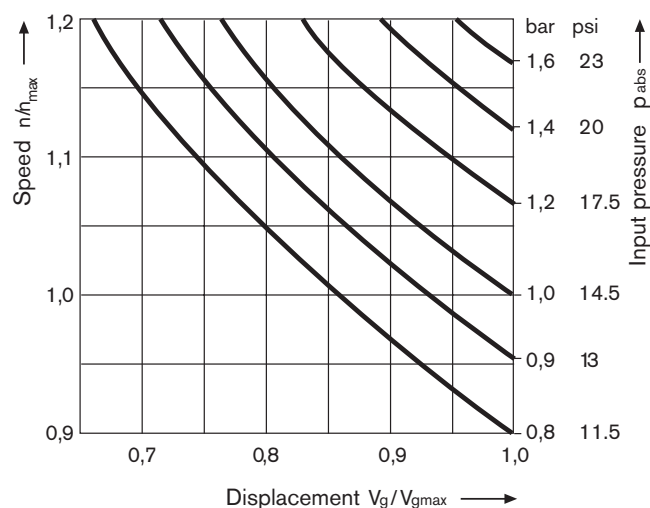
S to B.

**Case drain pressure**

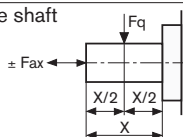
 The max. permissible pressure of the leakage fluid (at port L,  $L_1$ )  
 max. 7 psi (0,5 bar) higher than inlet pressure at port S, but not  
 higher than 29 psi (2 bar) absolute.

 $p_{L \text{ abs max}}$  \_\_\_\_\_ 29 psi (2 bar)

**Maximum permissible speed (Speed limit)**

 Graph, showing permissible speed with increased inlet pressure  
 at port S ( $p_{abs}$ ) resp. reduced displacement ( $V_g < V_{g \max}$ ).

**Table of values**

Size	28	45	63	85
Displacement $V_{g \max}$ in <sup>3</sup> (cm <sup>3</sup> )	1.71 (28)	2.74 (45)	3.84 (63)	5.18 (85)
Speed				
max. at $V_{g \max}$ self priming (14.5 psi (1 bar)) $n_{0 \max}$ rpm	3000	1800	1800	1800
with boost (72 psi (5 bar)) $n_{0 \max}$ rpm	3500	2600	2600	2600
Flow				
at $n_{0 \max}$ self priming ((14.5 psi (1 bar)) $q_{vo \max}$ gpm (L/min)	22.2 (84)	21.4 (81)	29.8 (113)	40.4 (153)
with boost (72 psi (5 bar)) $q_{vo \max}$ gpm (L/min)	25.98 (98)	30.9 (117)	43 (163)	58.3 (221)
Power ( $\Delta p = 3000$ psi (210 bar))				
at $n_{0 \max}$ self priming (14.5 psi (1 bar)) $P_{o \max}$ HP (kW)	39 (29)	38 (28)	52 (39)	71 (53)
with boost (72 psi (5 bar)) $P_{o \max}$ HP (kW)	45 (34)	55 (41)	76 (57)	104 (77)
Torque ( $\Delta p = 3000$ psi (210 bar))				
at $V_{g \max}$ $T_{max}$ ft-lb (Nm)	69 (94)	110 (150)	154 (210)	208 (284)
Moment of inertia (about drive axis) J lbs-ft <sup>2</sup> (kgm <sup>2</sup> )	0.0403 (0.0017)	0.0474 (0.002)	0.0948 (0.004)	0.1422 (0.006)
angular acceleration, max. rad/s <sup>2</sup>	5500	4900	3500	2500
speed fluctuation, max. rpm	70	65	57	47
Torsional stiffness Shaft end R lb-ft/rad (Nm/rad)	19480 (26500)	19480 (26500)	29770 (40500)	49900 (68000)
Shaft end W lb-ft/rad (Nm/rad)	14330 (19500)	14330 (19500)	25140 (34200)	39100 (53200)
Fill volume gal. (L)	0.08 (0.3)	0.08 (0.3)	0.13 (0.5)	0.21 (0.8)
Weight (without fluid) m lbs (kg)	30.8 (14)	30.8 (14)	39.6 (18)	48.4 (22)
Permissible loading of drive shaft				
max. prem. load $\pm F_{ax}$ $F_{ax \max}$ lbf (N)	146 (650)	146 (650)	225 (1000)	300 (1350)
max. prem. load $F_{q \max}$ lbf (N)	146 (650)	146 (650)	225 (1000)	300 (1350)





**Extracted from RA 92 750/06.06**

Page 1 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Variable displacement pump  
for closed circuits,  
Axial piston, swashplate design  
Model AA10VG**

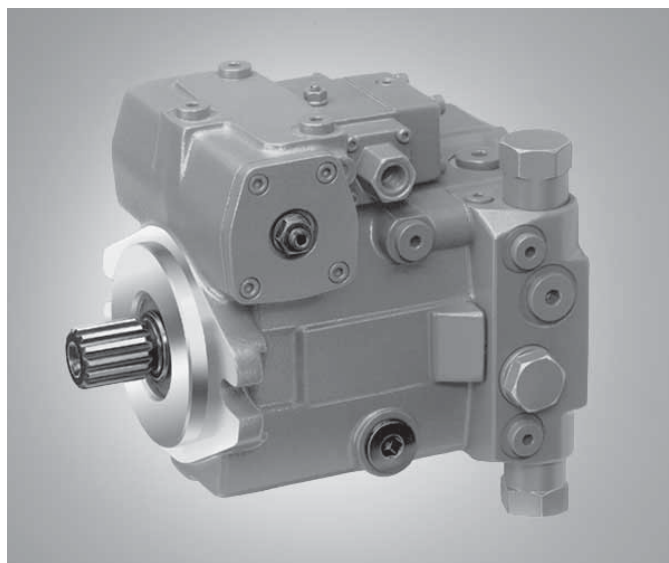
Sizes 18...63

Series 1

Nominal pressure 4350 psi (300 bar)

Peak pressure 5100 psi (350 bar)

- Variable displacement axial piston pump with swashplate design for hydrostatic closed circuit transmissions
- Flow is proportional to drive speed and displacement and is infinitely variable
- Output flow increases with the swivel angle of the swashplate from 0 to its maximum value
- Flow direction changes smoothly when the swashplate is moved through the neutral position
- A wide range of highly adaptable control instruments is available for different control and regulating functions
- The pump is equipped with two pressure relief valves on the high pressure ports to protect the hydrostatic transmission (pump and motor) from overload
- The pressure relief valves also function as boost inlet valves
- An integral auxiliary pump serves as boost and pilot oil pump
- The maximum boost pressure is limited by a built-in boost pressure relief valve

**Changes in ordering code from 06.04 issue**

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- Control device
  - new standard: supply filtration at HD3, EP3 and EP4 control
  - not for new projects: HD1, EP1, EP2
- Range of male connectors for solenoids
  - not for new projects: H

### Extracted from RA 92 750/06.06

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Ordering Code

<b>AA10V</b>	<b>G</b>									<b>/ 10</b>		<b>- N</b>		<b>C</b>							
01	02	03	04	05	06	07	08	09		10	11		12	13	14	15	16	17	18	19	20

#### Axial piston unit

01	Variable swashplate design, nominal pressure 4350 psi (300 bar), peak pressure 5100 psi (350 bar)	<b>AA10V</b>
----	---	--------------

#### Operation

02	Pump in closed circuit	<b>G</b>
----	------------------------	----------

#### Size

03	≈ Displacement $V_{g \max}$	cm <sup>3</sup>	<b>18</b>	<b>28</b>	<b>45</b>	<b>63</b>
		in <sup>3</sup>	1.10	1.71	2.81	3.84

#### Control device

				18	28	45	63		
04	Hydraulic control	pilot pressure related	without supply filtration	▲	▲	▲	▲	<b>HD1</b>	
			with supply filtration	●	●	●	●	<b>HD3</b>	
		mechanical servo		●	●	●	●	<b>HW</b>	
			direct operated	●	●	●	●	<b>DG</b>	
		speed related		U = 12 V DC	-	●	●	●	<b>DA1</b>
				U = 24 V DC	-	●	●	●	<b>DA2</b>
04	Electrical control	with proportional solenoid	without supply filtration	U = 12 V DC	▲	▲	▲	▲	<b>EP1</b>
				U = 24 V DC	▲	▲	▲	▲	<b>EP2</b>
			with supply filtration	U = 12 V DC	●	●	●	●	<b>EP3</b>
			U = 24 V DC	●	●	●	●	<b>EP4</b>	
		with switching solenoid		U = 12 V DC	●	●	●	●	<b>EZ1</b>
				U = 24 V DC	●	●	●	●	<b>EZ2</b>
	Mechanical pivot control		●	-	-	-	<b>MD</b>		

#### Pressure cut-off

				18	28	45	63	
05	Without pressure cut-off (no code)			●	●	●	●	
	With pressure cut-off (standard for version with DA control valve)			-	●	●	●	<b>D</b>

#### Neutral position switch (only for HW)

				18	28	45	63	
06	Without neutral position switch (no code)			●	●	●	●	
	With neutral position switch			●	●	●	●	<b>L</b>

#### Mechanical stroke limiter

				18	28	45	63	
07	Without mechanical stroke limiter (no code)			●	●	●	●	
	With mechanical stroke limiter, external adjustable			●	●	●	●	<b>M</b>

#### Spring neutral position centering (only MD)

				18	28	45	63	
08	Without spring neutral position centering (no code)			●	-	-	-	
	With spring neutral position centering			●	-	-	-	<b>N</b>

#### DA control valve

				HD	HW	DG	DA	EP	EZ	28	45	63		
09	Without DA control valve			●	●	●	-	●	●	●	●	●	<b>1</b>	
	With DA control valve, fixed setting			●	●	●	●	●	-	●	●	●	<b>2</b>	
	With DA control valve, mech. adjust. with control lever	operating direction	counter-clockwise	●	●	●	●	●	-	●	●	●	●	<b>3L</b>
			clockwise	●	●	●	●	●	-	●	●	●	●	<b>3R</b>
	With DA control valve, fixed setting and hydraulic inch valve built-on, control with brake fluid			-	-	-	●	-	-	●	●	●	<b>4</b>	
	With DA control valve, fixed setting, connections for master controller			●	●	●	●	●	-	●	●	●	<b>7</b>	
With DA control valve, fixed setting and hydraulic inch valve built-on, control with mineral oil			-	-	-	●	-	-	●	●	●	<b>8</b>		

## Extracted from RA 92 750/06.06

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Ordering Code

<b>AA10V</b>	<b>G</b>									<b>/ 10</b>		<b>-</b>	<b>N</b>		<b>C</b>						
01	02	03	04	05	06	07	08	09		10	11		12	13	14	15	16	17	18	19	20

### Series

10	Series 1, Index 0																					<b>10</b>
----	-------------------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-----------

### Direction of rotation

18...63

11	Viewed from shaft end	clockwise	●	<b>R</b>
		counter-clockwise	●	<b>L</b>

### Seals

12	NBR (nitril-caoutchouc), shaft seal in FKM (fluor-caoutchouc)																					<b>N</b>
----	---	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----------

### Shaft end (permissible input torque see page X)

18 28 45 63

13	Splined shaft	standard for single pump	●	●	●	●	<b>S</b>
	ANSI B92.1a-1976	standard for combination pump	-	-	●	●	<b>T</b>

### Mounting flange

14	SAE J744 – 2-hole																					<b>C</b>
----	-------------------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----------

### Service line ports (metric thread)

18 28 45 63

15	SAE flange ports A and B, same side left, suction port S bottom	-	●	●	●	<b>60</b>
	Threaded ports A and B, same side right, suction port S bottom	●	-	-	-	<b>66</b>

### Boost pump

18 28 45 63

16	Without integral boost pump	without through drive	●	●	●	●	<b>N00</b>
		with through drive	●	●	●	●	<b>K..</b>
	With integral boost pump	without through drive	●	●	●	●	<b>F00</b>
		with through drive	●	●	●	●	<b>F..</b>

### Through drive

17	Flange SAE J744 <sup>1)</sup>	Splined shaft hub																					
	82-2 (A)	5/8 in	9T 16/32DP <sup>2)</sup>	●	●	●	●	●	.01														
	101-2 (B)	7/8 in	13T 16/32DP <sup>2)</sup>	●	●	●	●	●	.02														
		1 in	15T 16/32DP <sup>2)</sup>	-	●	●	●	●	.04														
	127-2 (C)	1 1/4 in	14T 12/24DP <sup>2)</sup>	-	-	-	●	●	.07														

### Valves

Setting range

18 28 45 63

18	With high pressure relief valve, direct controlled, (fixed setting)	3600...4600 psi without bypass	●	●	●	●	<b>3</b>
		(250...320 bar) with bypass	●	●	●	●	<b>5</b>
		1450...3600 psi without bypass	●	●	●	●	<b>4</b>
		(100...250 bar) with bypass	●	●	●	●	<b>6</b>

### Filtration

18 28 45 63

19	Filtration in the suction line of the boost pump	●	●	●	●	<b>S</b>
	Filtration in the pressure line of the boost pump ports for external boost circuit filter, (F <sub>e</sub> and G (F <sub>a</sub> ))	-	● <sup>3)</sup>	● <sup>3)</sup>	●	<b>D</b>
	External supply (model without integral boost pump - N00, K...)	●	●	●	●	<b>E</b>

### Range of male connectors for solenoids (only for EP, EZ and DA)

18 28 45 63

20	DEUTSCH male connector	without quenching diode	●	●	●	●	<b>P</b>
	2-pin	with quenching diode (only for EZ and DA)	○	○	○	○	<b>Q</b>
	DIN male connector to HIRSCHMANN	without quenching diode	▲	▲	▲	▲	<b>H</b>

<sup>1)</sup> 2 = 2-hole

<sup>2)</sup> splined shaft hub to ANSI B92.1a-1976 (splined shaft allocation to SAE J744, see pages XX)

<sup>3)</sup> pressure filtration in connection with the DA control valve is not possible.

● = available ○ = available on request ▲ = not for new projects - = not available

**Extracted from RA 92 750/06.06**

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 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Table of values** (theoretical values, without efficiencies and tolerances; values rounded)

Size				18	28	45	63
Displacement	variable pump	$V_{g \max}$	in <sup>3</sup>	1.10	1.71	2.81	3.84
			cm <sup>3</sup>	18	28	46	63
	auxiliary pump (at p = 290 psi/20 bar)	$V_{g H}$	in <sup>3</sup>	0.34	0.37	0.53	0.91
			cm <sup>3</sup>	5.5	6.1	8.6	14.9
Speed							
	maximum at $V_{g \max}$	$n_{\max \text{ continuous}}$	rpm	4000	3900	3300	3000
	limited maximum <sup>1)</sup>	$n_{\max \text{ limited}}$	rpm	4850	4200	3550	3250
	intermittent maximum <sup>2)</sup>	$n_{\max \text{ interm.}}$	rpm	5200	4500	3800	3500
	minimum	$n_{\min}$	rpm	500	500	500	500
Flow							
		$q_{v \max}$	gpm	19	28.8	40.2	49.9
	at $n_{\max \text{ continuous}}$ and $V_{g \max}$		l/min	72	109	152	189
Power <sup>3)</sup>							
		$P_{\max}$	hp	48.3	73.2	101.8	126.7
	at $n_{\max \text{ continuous}}$	$\Delta p = 300 \text{ bar}$	kW	36	54.6	75.9	94.5
Torque <sup>3)</sup>							
	$\Delta p = 4350 \text{ psi}$	$T_{\max}$	lb-ft	63.5	98.6	162.3	221.5
	at $V_{g \max}$	$(\Delta p = 300 \text{ bar})$	Nm	86	134	220	301
	$\Delta p = 1450 \text{ psi}$	T	lb-ft	14.6	32.9	54	74
	at $V_{g \max}$	$(\Delta p = 100 \text{ bar})$	Nm	28.6	44.6	73.2	100.3
Moment of inertia							
		J	lbs-ft <sup>2</sup>	0.0221	0.0403	0.0738	0.1252
	(about drive axis)		kgm <sup>2</sup>	0.00093	0.0017	0.0033	0.0056
Rotational vibration <sup>4)</sup>							
	Angular acceleration, max	$\alpha$	rad/s <sup>2</sup>	6800	5500	4000	3300
	Speed variation, max	$\Delta n$	rpm	18	17	14	13
	Frequency limit	$f_{\text{limit}}$	Hz	1170	1013	855	788
Rotary stiffness							
	shaft end S		lb-ft/rad	14960	23707	39388	57802
			Nm/rad	20284	32143	53404	78370
	shaft end T		lb-ft/rad	–	–	54435	68127
			Nm/rad	–	–	73804	92368
Filling capacity							
			gal	0.12	0.17	0.20	0.29
			L	0.45	0.64	0.75	1.1
Weight approx.							
		m	lbs	31(40) <sup>5)</sup>	55	60	86
	(without through drive)		kg	14(18) <sup>5)</sup>	25	27	39

 1) Limited maximum speed: – at half power (e.g. at  $V_{g \max}$  and  $p_N / 2$ )

 2) Intermittent maximum speed: – at high idling speed  
 – at overspeed:  $\Delta p = 1000 \dots 2200 \text{ psi (70 \dots 150 bar)}$  and  $V_{g \max}$   
 – at reversing peaks:  $\Delta p < 4350 \text{ psi (300 bar)}$  and  $t < 5 \text{ sec.}$ 

3) Without auxiliary pump

 4) The permissible angular acceleration or speed variation only applies to single pumps, not to combination pumps.  
 The load on connection parts (e.g. through drive) must be taken into account additionally.

 at  $f < f_{\text{limit}}$ , the  $\Delta n$  indicated in the table is permitted.

 at  $f > f_{\text{limit}}$ , the permitted angular acceleration  $\alpha$  indicated in the table limits the size of the speed variation:  $\Delta n_{\text{perm.}} = 3.04 \cdot \alpha / f$ .

5) 31 lbs (14 kg): MD control, 40 lbs (18 kg): HD control

**Extracted from RA 30 024/10.02**

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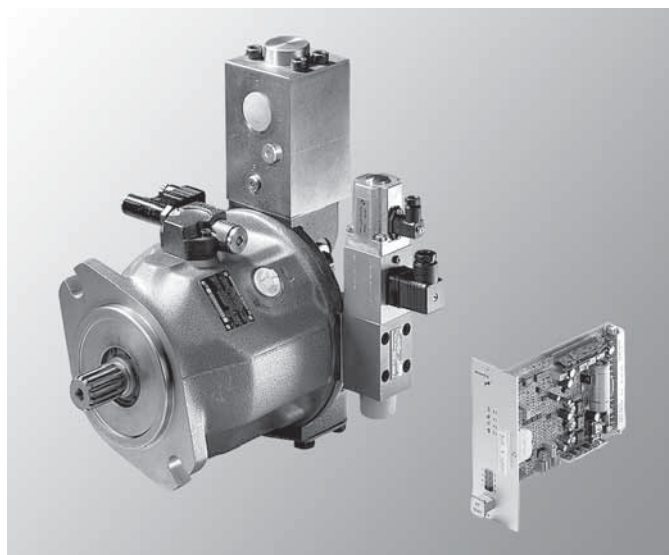
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Closed loop pressure and  
flow control system  
Model SYDFE1****Series 2X**

- The DFE1 control is used for the electro-hydraulic closed loop control of the pressure and swivel angle of a variable displacement axial piston pump

The SYDFE1 closed loop control system is comprised of the following components:

- AA10VSO axial piston pump with built-on VT-DFP-2X proportional valve, which serves as the pilot valve, and inductive position transducers for sensing the swivel angle and valve position
- VT 5041-2X analog amplifier for the realization of all of the electrical functions required for the DFE1 control
- Pump pre-load valve (optional)
- Combination pumps are possible



Model SYDFE1-2X/071R-PSA12N00-0000-A030PX2

### Extracted from RA 30 024/10.02

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Ordering code

SYDFE1							- 2X /		- P		12		- - A		0		0		*		
Single pump <sup>1)</sup>																			Further details in clear text		
Pump combination <sup>2)</sup>																			<b>Preload valve</b>		
Series 20 to 29 = 2X (20 to 29: unchanged installation and connection dimensions)																			1 = Pressure limitation 200 bar (2900 PSI)		
A10VSO pump																			2 = Pressure limitation 250 bar (3626 PSI)		
Size 18 = 018																			3 = Pressure limitation 300 bar (4350 PSI)		
Size 28 = 028																			X = Without preload valve		
Size 45 = 045																			<b>Pressure transducer</b>		
Size 71 = 071																			HM 12 (4 to 20 mA)		
Size 100 = 100																			C = Measuring range 315 bar (4568 PSI)		
Size 140 = 140																			HM 13 (0 to 10 V)		
<b>Direction of rotation</b>																			G = Measuring range 315 bar (4568 PSI)		
Clockwise (preferred types for through-drive pumps) = R																			X = Without pressure transducer		
Anti-clockwise = L																			<b>Electronic assembly,</b>		
<b>Hydraulic fluid</b>																			VT 5041-2X with switch-able actual pressure value signal (from series 25)		
Mineral oil to DIN 51 524 (HL / HLP) = P																			P = 4-20 mA / 0-10 V / 0-5 V / 1-10 V		
<b>Shaft end</b>																			X = Without amplifier		
(▲ = Preferred types for through-drive pumps)																			Additional function, VT 5041-2X with power limiter and swivel angle indicator		
Size	18	28	45	71	100	140													X = Without amplifier		
<sup>3)</sup>	-	Ø22	Ø25	Ø32	Ø40	Ø45	= P													1 = Amplifier without additional function	
<sup>4)</sup>	3/4"	-	-	-	1 1/2"	1 3/4"	= S													3 = Amplifier with additional function	
<sup>5)</sup>	-	7/8"	1"	1 1/4"	-	-	= R													<b>Valve, installation orientation</b>	
<b>Connection flange</b> (● = available)																			0 = Plug-in connector installed radially to pump axis		
Size	18	28	45	71	100	140													A = <b>Valve, spool variant</b>		
ISO 2-hole	-	●	●	●	●	-	= A													<b>Basic pump version</b>	
ISO 4-hole	-	-	-	-	-	●	= B													0000 = Standard (internal pilot oil supply)	
SAE 2-hole	●	-	-	-	-	-	= C													0479 = External supply (sizes 18 ... 100)	
<b>Connection for service lines</b>																			0487 = External supply (size 140)		
Pressure port B ] SAE on opposite sides = 12																					
Pressure port S ] Mounting thread, metric																					
<b>Through-drive</b> (see table on page 3)																					
Without through-drive = N00																					
Through-drive without hub for mounting: (any built-on pumps with SAE splined shaft profile)																					
<b>Center diameter</b>																					
Ø82.55 mm (3.25 in.)																			A10VSO18 = KC1 <sup>6)</sup>		
Ø100 mm (3.94 in.)																			= KD3 <sup>6)</sup>		
Ø125 mm (4.92 in.)																			= KD5 <sup>6)</sup>		
Ø180 mm (7.09 in.)																			= KD7 <sup>6)</sup>		
Ø101.6 mm (4.00 in.)																			Gear pump = KC3 <sup>6)</sup>		
Ø127 mm (5.00 in.)																			Gear pump = KC5 <sup>6)</sup>		
For single pumps, the hub must be ordered separately, if required																					
For double pumps, the hub is included in the scope of supply.																					

<sup>1)</sup> See order example at the top of page 3

<sup>2)</sup> See order example at the top of page 3

<sup>3)</sup> Cylindrical with keyed shaft DIN 6885

<sup>4)</sup> Splined shaft profile SAE

<sup>5)</sup> Splined shaft profile SAE (higher through-drive torque)

<sup>6)</sup> Through-drive is fitted with an operationally safe  
blind cover

### Extracted from RA 30 024/10.02

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Ordering code

#### Order example

<sup>1)</sup> **Order example of single pump**

SYDFE1-2X/100R-PSA12N00-0479-A0X0XCX

<sup>2)</sup> **Order example of pump combination**

Both model designations must be connected with "+" (material number of 1st pump + material number of 2nd pump)

SY2DFE1-2X/100-100/ R900709794 + R900709794

SY2DFE1-2X/100-100/ SYDFE1-2X/100R-PSA12KD5-0000-A010PCX + SYDFE1-2X/100R-PSA12KD5-0000-A010PCX

Double pump				
Size of front pump				
Size of rear pump				
Material number of front pump (or details in clear text, if material number is not known)				
Material number of rear pump (or details in clear text, if material number is not known)				

### Standard models

#### Single pumps

Model	Material no.
SYDFE1-2X/018R-PSC12N00-0000-A010PCX	<b>R900783410</b>
SYDFE1-2X/028R-PPA12N00-0000-A010PCX	<b>R900708517</b>
SYDFE1-2X/045R-PPA12N00-0000-A010PCX	<b>R900708518</b>
SYDFE1-2X/071R-PPA12N00-0000-A010PCX	<b>R900708519</b>
SYDFE1-2X/100R-PPA12N00-0000-A010PCX	<b>R900708520</b>
SYDFE1-2X/140R-PPB12N00-0000-A010PCX	<b>R900708521</b>

#### Through-drive pumps for pump combinations

Model	Material no.
SYDFE1-2X/028R-PRA12KD3-0000-A010PCX	<b>R900709782</b>
SYDFE1-2X/045R-PRA12KD3-0000-A010PCX	<b>R900709786</b>
SYDFE1-2X/071R-PRA12KD5-0000-A010PCX	<b>R900709792</b>
SYDFE1-2X/100R-PSA12KD5-0000-A010PCX	<b>R900709794</b>
SYDFE1-2X/140R-PSB12KD7-0000-A010PCX	<b>R900709795</b>

#### Through-drive (● = available)

			Size						
			18	28	45	71	100	140	
Without through-drive			●	●	●	●	●	●	N00
With through-drive for building on an axial piston unit, a gear pump or a radial piston pump									
Mounting flange	Shaft/coupling (separate order)	for mounting:							
ISO 100, 2-hole	Splined shaft 7/8" 22-4 (SAE B)	A10VSO 28 (shaft S or R)	-	●	●	●	●	●	KD3
ISO 100, 2-hole	Splined shaft 1" 25-4 (SAE B-B)	A10VSO 45 (shaft S or R)	-	-	●	●	●	●	KD3
ISO 125, 2-hole	Splined shaft 1 1/4" 32-4 (SAE C)	A10VSO 71 (shaft S or R)	-	-	-	●	●	●	KD5
ISO 125, 2-hole	Splined shaft 1 1/2" 38-4 (SAE C-C)	A10VSO 100 (shaft S)	-	-	-	-	●	●	KD5
ISO 180, 4-hole	Splined shaft 1 3/4" 44-4 (SAE D)	A10VSO 140 (shaft S)	-	-	-	-	-	●	KD7
82-2 (SAE A, 2-hole)	Splined shaft 5/8" 16-4 (SAE A)	1PF2G2, PGF2	●	●	●	●	●	●	KC1
82-2 (SAE A, 2-hole)	Splined shaft 3/4" 19-4 (SAE A-B)	A10VSO 10, 18 (shaft S)	●	●	●	●	●	●	KC1
101-2 (SAE B)	Splined shaft 7/8" 22-4 (SAE B)	A10VO 28 (shaft S), PGF3	-	●	●	●	●	●	KC3
101-2 (SAE B)	Splined shaft 1" 25-4 (SAE B-B)	A10VO 45 (shaft S), PGH4	-	●	●	●	●	●	KC3
127-2 (SAE C)	Splined shaft 1 1/4" 32-4 (SAE C)	A10VO 71 (shaft S)	-	-	-	●	●	●	KC5
127-2 (SAE C)	Splined shaft 1 1/2" 38-4 (SAE C-C)	A10VO 100 (shaft S), PGH5	-	-	-	-	●	●	KC5
152-4 (SAE D)	Splined shaft 1 3/4" 44-4 (SAE D)	A10VO 140 (shaft S)	-	-	-	-	-	●	KC6



**Extracted from RA 30 030/10.02**

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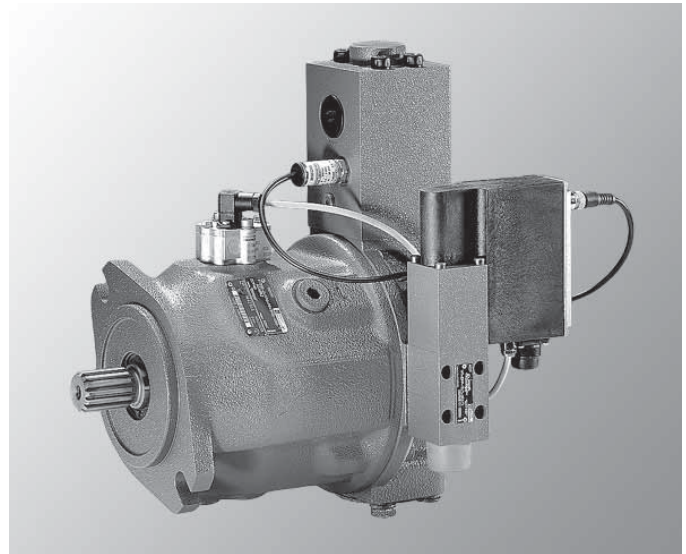
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Pressure and flow closed loop system  
Model SYDFEE****Series 2X**

The DFEE control is used for the electro-hydraulic closed loop control of the pressure and swivel angle of an axial piston pump

The SYDFEE.. closed loop control system consists of the following components:

- AA10VSO axial piston pump with built-on proportional valve as the pilot valve VT-DFPE...-2X/..
- The VT-DFPE..-2X/.. valve with integrated analog control and closed loop control electronics realizes the complete closed loop control function for the DFEE system
- The acquisition of the swivel angle is via a rotary angle sensor type VT-SWA-1-1X which is a hall effect based sensor
- Pump pre-load valve (optional)
- Combination pumps are possible



**Model SYDFEE-2X/071R-PSA12N00-0000-A2AOF2**



### Extracted from RA 30 030/10.05

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Ordering code

#### Ordering example

1) Ordering example for a single pump  
SYDFEE-2X/100R-PSA12N00-0479-A0A0VGX

2) Ordering example for a combination pump

Both of the model codes are to be connected by a "+" (Material No. of the 1st pump + Material No. of the 2nd pump)

SY2DFEE-2X/100-100/ R900709780 + R900709780  
SY2DFEE-2X/100-100/ SYDFEE-2X/100R-PSA12KD5-0000-A0A0CCX + SYDFEE-2X/100R-PSA12KD5-0000-A0A0CCX

Double pump			
Nom. size of the front pump			
Nom. size of the rear pump			
Material No. of the front pump (or in clear text if the Material No. is not known)			
Material No. of the rear pump (or in clear text if the Material No. is not known)			

### Standard models

#### Single pump

Model	Material No.
SYDFEE-2X/018R-PSC12N00-0000-A0A0CCX	R900708503
SYDFEE-2X/018R-PSC12N00-0000-A0A0CC2	R900708504
SYDFEE-2X/028R-PPA12N00-0000-A0A0CCX	R900708505
SYDFEE-2X/028R-PPA12N00-0000-A0A0CC2	R900708506
SYDFEE-2X/045R-PPA12N00-0000-A0A0CCX	R900708507
SYDFEE-2X/045R-PPA12N00-0000-A0A0CC2	R900708508
SYDFEE-2X/071R-PPA12N00-0000-A0A0CCX	R900708510
SYDFEE-2X/071R-PPA12N00-0000-A0A0CC2	R900708511
SYDFEE-2X/100R-PPA12N00-0000-A0A0CCX	R900708512
SYDFEE-2X/100R-PPA12N00-0000-A0A0CC2	R900708513
SYDFEE-2X/140R-PPB12N00-0000-A0A0CCX	R900708514
SYDFEE-2X/140R-PPB12N00-0000-A0A0CC2	R900708515

#### Through drive pumps for combination pumps

Model	Material No.
SYDFEE-2X/028R-PRA12KD3-0000-A0A0CCX	R900709773
SYDFEE-2X/045R-PRA12KD3-0000-A0A0CCX	R900709774
SYDFEE-2X/071R-PRA12KD5-0000-A0A0CCX	R900709775
SYDFEE-2X/100R-PSA12KD5-0000-A0A0CCX	R900709780
SYDFEE-2X/140R-PSB12KD7-0000-A0A0CCX	R900709781

#### Through drive (● = available)

			Nominal size						
			18	28	45	71	100	140	
Without through drive			●	●	●	●	●	●	N00
With through drive for mounting an axial piston pump, a gear pump or radial piston pump									
Mounting flange	Shaft/coupling (separate order)	For fitting a:							
ISO 100, 2-hole	Splined shaft 7/8" 22-4 (SAE B)	A10VSO 28 (shaft S or R)	-	●	●	●	●	●	KD3
ISO 100, 2-hole	Splined shaft 1" 25-4 (SAE B-B)	A10VSO 45 (shaft S or R)	-	-	●	●	●	●	KD3
ISO 125, 2-hole	Splined shaft 1 1/4" 32-4 (SAE C)	A10VSO 71 (shaft S or R)	-	-	-	●	●	●	KD5
ISO 125, 2-hole	Splined shaft 1 1/2" 38-4 (SAE C-C)	A10VSO 100 (shaft S)	-	-	-	-	●	●	KD5
ISO 180, 4-hole	Splined shaft 1 3/4" 44-4 (SAE D)	A10VSO 140 (shaft S)	-	-	-	-	-	●	KD7
82-2 (SAE A, 2-hole)	Splined shaft 5/8" 16-4 (SAE A)	1PF2G2, PGF2	●	●	●	●	●	●	KC1
82-2 (SAE A, 2-hole)	Splined shaft 3/4" 19-4 (SAE A-B)	A10VSO 10, 18 (shaft S)	●	●	●	●	●	●	KC1
101-2 (SAE B)	Splined shaft 3/8" 22-4 (SAE B)	A10VO 28 (shaft S), PGF3	-	●	●	●	●	●	KC3
101-2 (SAE B)	Splined shaft 1" 25-4 (SAE B-B)	A10VO 45 (shaft S), PGH4	-	●	●	●	●	●	KC3
127-2 (SAE C)	Splined shaft 1 1/4" 32-4 (SAE C)	A10VO 71 (shaft S)	-	-	-	●	●	●	KC5
127-2 (SAE C)	Splined shaft 1 1/2" 38-4 (SAE C-C)	A10VO 100 (shaft S), PGH5	-	-	-	-	●	●	KC5
152-4 (SAE D)	Splined shaft 1 3/4" 44-4 (SAE D)	A10VO 140 (shaft S)	-	-	-	-	-	●	KC6

**Extracted from RE 30035/12.03**Page 1 of 3  
Issue: 06.06See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Pressure-flow closed loop control system  
Model SYHDFEE**

Nominal size 125 to 355

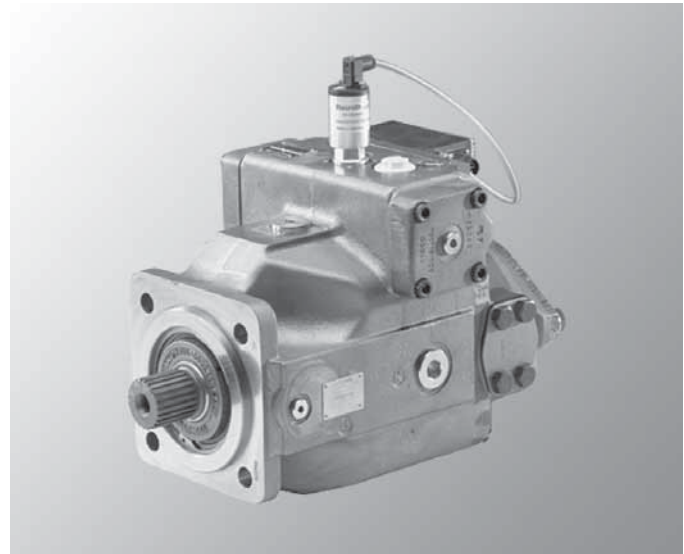
Series 1X

Max. operating pressure up to 350 bar (5100 PSI)

The DFE control is used for the electro-hydraulic closed loop control of the pressure and swivel angle of an axial piston pump

The SYHDFEE.. closed loop control system consists of the following components:

- A4VSO axial piston pump with a built-on proportional valve as the pilot valve VT-DFPE...-2X/..
- The VT-DFPE..-2X/.. valve with integrated open and closed loop control electronics contains the complete closed loop control function of the DFE system
- The acquisition of the swivel angle is via a linear sensor type VT-SWA-LIN-1X which is a hall effect based sensor
- Combination pumps are possible

**For further information regarding this system see:**

Model SYHDFEE

- Component description, pump A4VSO RE 92 050
- Component description, valve VT-DFPE RE 29 016
- Sales information (engineering guidelines) RE 30 030-01-V



## Extracted from RE 30035/12.03

Page 3 of 3  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Ordering code

### Ordering example:

<sup>1)</sup> Ordering example for a single pump  
SYHDFEE-1X/125R-PZB25N00-0000-A0A0F

<sup>2)</sup> Ordering example for a combination pump

Both of the type codes are to be connected by a "+" (Material No. 1st pump + Material No. 2nd pump)

Possibility 1: SY2HDFEE-1X/ 125 - 045/ R901038404 + R901019184  
Possibility 2: SY2HDFEE-1X/ 125 - 045/ SYHDFEE-1X/125R-PZB25KD3-0000-A0A0V + SYDFEE-2X/045R-PRA12KD3-0000-A0A0VXX

Combination pump				
Nom. size of the front pump				
Nom. size of the rear pump				
Material No. of the front pump (or in clear text if the Material No. is not known)				
Combination part				
Material No. of the rear pump (or in clear text if the Material No. is not known)				

## Standard models

SYHDFEE-1X/125R-PZB25N00-0000-A0A0F  
SYHDFEE-1X/180R-PZB25N00-0000-A0A0F  
SYHDFEE-1X/250R-PZB25N00-0000-A0A0F  
SYHDFEE-1X/355R-PZB25N00-0000-A0A0F

### Through drive

– = Not available

● = The flange is integrated into the connection plate

zw = Through drive K99 + intermediate flange (sep. order)

			Nominal size				
			125	180	250	355	
Without auxiliary pump; without through drive			●	●	●	●	N00
With through drive for mounting an axial piston pump, a gear pump or radial piston pump							
Flange	Hub/splined shaft	For mounting an					
ISO 125, 4-hole	32x2x30x14x9g	A4VSO/H/G 40	●	●	●	●	Kxx <sup>3)</sup>
ISO 140, 4-hole	40x2x30x18x9g	A4VSO/H/G 71	●	●	●	●	Kxx
ISO 160, 4-hole	50x2x30x24x9g	A4VSO/H/G 125/180	zw	zw	zw	zw	(K34)
ISO 224, 4-hole	60x2x30x28x9g	A4VSO/G 250	–	–	zw	zw	(K35)
ISO 224, 4-hole	70x3x30x22x9g	A4VSO/G 355	–	–	–	zw	(K77)
ISO 100, 2-hole	7/8" 22-4 (SAE B)	A10VSO28BR31	●	●	●	●	KD3
ISO 100, 2-hole	1" 25-4 (SAE B-B)	A10VSO45BR31	●	●	●	●	KD3
ISO 125, 2-hole	1 1/4" 32-4 (SAE C)	A10VSO71BR31	zw	zw	zw	zw	(KD5)
ISO 125, 2-hole	1 1/2" 38-4 (SAE C-C)	A10VSO100BR31	zw	zw	zw	zw	(KD5)
ISO 180, 4-hole	1 3/4" 44-4 (SAE D)	A10VSO140BR31	–	zw	zw	zw	(KD7)
82-2 (SAE A)	5/8" 16-4 (SAE A)	PGH2, 3 ; PGF2	●	●	●	●	KC1
82-2 (SAE A)	3/4" 19-4 (SAE A-B)	A10VSO10BR31, 18	●	●	●	●	KC1
101-2 (SAE B)	7/8" 22-4 (SAE B)	A10VO28BR31; PGF3	●	●	●	●	KC3
101-2 (SAE B)	1" 25-4 (SAE B-B)	A10VO45BR31; PGH4	●	●	●	●	KC3
127-2 (SAE C)	1 1/4" 32-4 (SAE C)	A10VO71BR31	zw	zw	zw	zw	(KC5)
127-2 (SAE C)	1 1/2" 38-4 (SAE C-C)	A10VO100BR31; PGH5	zw	zw	zw	zw	(KC5)
152-4 (SAE D)	1 3/4" 44-4 (SAE D)	A10VO140BR31	–	zw	zw	zw	(KC6)
With through drive shaft, without hub, without intermediate flange, with blanked off functional cover			●	●	●	●	K99

## Section 2

# Check Valves

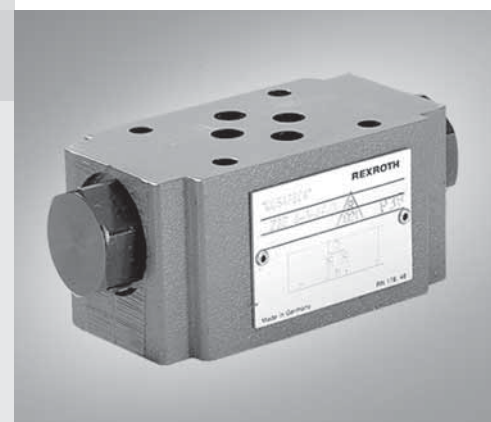
### The Drive & Control Company

- Check valve, inline model – S..... 128
- Cartridge check valve, cavity mount – M-SR ..... 129
- Pilot operated check valve – SV/SL..... 130
- Sandwich Prefill valves – ZSF ..... 132
- Pilot operated prefill valve
  - SF ..... 134
  - SFA ..... 136
- Direct operated sandwich plate check valve
  - Z1 S 6 ..... 138
  - Z1 S 10..... 140
- Pilot operated sandwich plate check valve
  - Z2 S 6 ..... 141
  - Z2 S 10..... 142
- Pilot operated sandwich plate check valve
  - Z2 SRK 6..... 143
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- Pilot operated sandwich plate check valve
  - Z2 S 16..... 145
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For a complete copy of the data sheets in this catalog, visit our website at:

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

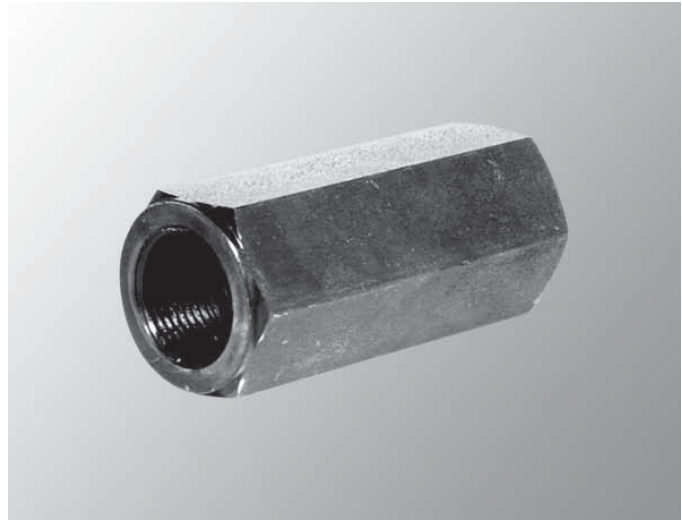
**Check valve  
Model S**

Sizes 6 to 30

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 450 L/min (120 GPM)

- For in-line or subplate mounting
- Leak-free closure in one direction
- Various cracking pressures (see ordering code)



Model S 15 A1.0/12

**Ordering code**

	<b>S</b>			• 0 /	*	
Threaded version "A"	Subplate version "P"	Size				Threaded version
1/4"	-	= 6				BSP threads
3/8"	-	= 8				SAE threads
1/2"	ANSI C 06	= 10				Modification no.
3/4"	-	= 15				
1"	ANSI C 08	= 20				without spring (standard)
1-1/4"	-	= 25				
1-1/2"	ANSI C 09	= 30				
Threaded for in-line mounting		= A				
				no code =		
				12 =		
				0 =		
			0 =			
			1 =			
			2 =			
			3 =			
			5 =			

**Technical data**

Hydraulic fluid		Petroleum oils (HM, HL, HLP) Phosphate-ester fluids (HFD-R)
Fluid temperature range	°C (°F)	NBR seals: -30 to +70 (-22 to +158) FPM seals: -20 to +70 (-4 to +158)
Viscosity range	mm <sup>2</sup> /s (SUS)	2.8 to 500 (35 to 2320)
Maximum degree of fluid contamination		Class 18/15 according to ISO 4406. Therefore we recommend a filter with a retention rate of β <sub>10</sub> ≥ 75.
Operating pressure	bar (PSI)	up to 315 (4600)

### Extracted from RA 20 380/06.98

Page 1 of 1

Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Check valve cartridge

### Model M-SR

Sizes 8 to 30

Series 1X

Maximum operating pressure 315 bar (4600 PSI)

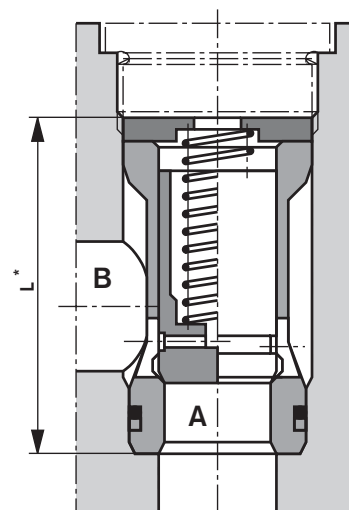
Maximum flow 400 L/min (106 GPM)

- For installation in manifold blocks: available as right angled valve cartridge
- Leak-free closure in checked direction
- Various cracking pressure options (see ordering code)

#### Symbol



Size	L - mm (in)
8	36.3 (1.43)
10	39.3 (1.55)
15	45.8 (1.80)
20	55.3 (2.18)
25	74.3 (2.93)
30	83.3 (3.28)



KE Right angle cartridge

### Ordering code

M-SR		- 1X / / *	
Cartridge check valve	= M-SR		no code = NBR seals, suitable for petroleum oils
Size 8	= 8	1X =	Series 10 to 19 (10 to 19: installation and connection dimensions remain unchanged)
Size 10	= 10		
Size 15	= 15		
Size 20	= 20		
Size 25	= 25		
Size 30	= 30		
Right angle valve cartridge (typical stock)	= KE	05 = (standard)	
		15 =	
		30 =	
		50 =	

### Technical data

Hydraulic fluid		Petroleum oils (HM, HL, HLP) Phosphate-ester fluids (HFD-R) High water content (HFA) not permitted
Fluid temperature range	°C (°F)	NBR seals: -30 to +80 (-22 to 176) FPM seals: -20 to +80 (-4 to 176)
Viscosity range	mm <sup>2</sup> /s (SUS)	2.8 to 500 (35 to 2320)
Maximum degree of contamination		Class 18/15 according to ISO 4406. Therefore, we recommend a filter with a retention rate of $\beta_{10} \geq 75$ .
Operating pressure	bar (PSI)	up to 315 (4600)

**Extracted from RA 21 468/06.98**

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Check valve  
Model SV/SL**

Sizes 6 to 30

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 450 L/min (120 GPM)

- Pilot operated check valve, with leakfree closure in checked direction
- Subplate mounting with connection dimensions to ISO 5781-06, NFPA T3.5.1M R1 and ANSI B 93.7 POC 06 (for subplates, see datasheet RA 45 062)
- Threaded connections, for in-line mounting
- With or without external drain connection, as required
- Optional pilot poppet, for cushioned decompression and reduced hydraulic shock
- Various cracking pressures (see ordering code)



Model SV 10 PA.-4X/...

**Ordering code**

S				- 4X /		/ *	
Internally drained (without drain port)	= V					no desig. =	Threaded connections
Externally drained (with drain port)	= L					12 =	BSP threaded ports SAE threaded ports
<i>Subplate mounting</i>							
Ordering code	NFPA interface standard	Subplates available SAE, NPT, BSP					
10	POC 06	3/8" and 1/2"					
20	POC 08	3/4" and 1"					
30	POC 10	1-1/4" and 1-1/2"					
<i>Threaded in-line connections</i>							
Ordering code		SAE					
10		-8; 3/4-16					
15		-12; 1-1/16-12					
20		-16; 1-5/16-12					
25		-20; 1-5/8-12					
30		-24; 1-7/8-12					
Subplate mounting		= P					
Threaded connections		= G					
				4X =		no desig. = NBR seals suitable for petroleum oils (HM, HL, HLP) V = FPM seals suitable for phosphate ester fluids (HFD-R)	
				1 = ] 2 = ]		Series 40 to 49 (40 to 49; externally interchangeable)	
				A = B =		Cracking pressure With decompression poppet Without decompression poppet	

**Extracted from RA 21 468/06.98**

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Issue: 01,01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Size			10	15	20	25	30
Weight (approx.)	– Subplate mounting	kg (lbs)	1.8 (4.0)		4.7 (10.4)		7.8 (17.2)
	– Threaded connections	kg (lbs)	2.1 (4.6)	5.4 (11.9)	5.4 (11.9)	10 (22.0)	10 (22.0)
Mounting position	Optional						
Direction of flow	Free flow A to B; B to A when piloted open						

**Hydraulic**

Operating pressure	bar (PSI)	... 315 (4600)					
Pilot control pressure range	bar (PSI)	5 ... 315 (72 ... 4570)					
Pilot volume	– Port X	cm <sup>3</sup> (in <sup>3</sup> )	2.5 (0.153)	10.8 (0.659)	10.8 (0.659)	19.3 (1.176)	19.3 (1.176)
	– Port Y (only type SL)	cm <sup>3</sup> (in <sup>3</sup> )	2.0 (0.122)	9.6 (0.586)	9.6 (0.586)	17.5 (1.068)	17.5 (1.068)
Control areas (see sectional drawing page 1)	– Area A <sub>1</sub>	cm <sup>3</sup> (in <sup>3</sup> )	1.3 (0.206)	3.5 (0.536)	3.5 (0.536)	5.7 (0.887)	5.7 (0.887)
	– Area A <sub>2</sub>	cm <sup>3</sup> (in <sup>3</sup> )	0.33 (0.051)	0.7 (0.109)	0.7 (0.109)	1.3 (0.206)	1.3 (0.206)
	– Area A <sub>3</sub>	cm <sup>3</sup> (in <sup>3</sup> )	3.8 (0.589)	10.2 (1.576)	10.2 (1.576)	16.6 (2.575)	16.6 (2.575)
	– Area A <sub>4</sub>	cm <sup>3</sup> (in <sup>3</sup> )	0.8 (0.122)	1.1 (0.175)	1.1 (0.175)	1.5 (0.239)	1.5 (0.239)
Hydraulic fluid	Petroleum oils (HM, HL, HLP) Phosphate ester fluids (HFD-R)						
Fluid	– NBR seals	°C (°F)	– 30 ... 80 (– 22 ... 176)				
Temperature range	– FPM seals	°C (°F)	– 20 ... 80 (– 4 ... 176)				
Viscosity range		mm <sup>2</sup> /s (SUS)	35 ... 2320				
Maximum degree of fluid contamination	Class 18/15 according to ISO 4406. Therefore, we recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .						

**Extracted from RA 20 478/06.98**

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Prefill valve – Sandwich plate  
Model ZSF**

Nominal sizes 32 to 125

Series 1X

Maximum operating pressure 350 bar (5100 PSI)

- Hydraulic pilot operated prefill valve, sandwich plate construction
  - for flange mounting
  - for pipe installation
- With decompression
- Integral high pressure supply port



Model ZSF 40 F.-1-1X/...

**Ordering code**

ZSF			F	-	1	-	1X	/	M	/	*
-----	--	--	---	---	---	---	----	---	---	---	---

Nominal size	
Nominal size 32	= 32
Nominal size 40	= 40
Nominal size 50	= 50
Nominal size 63	= 63
Nominal size 80	= 80
Nominal size 100	= 100
Nominal size 125	= 125
Mounting For flange connection	= F
With decompression	= 1

<sup>1)</sup> Applicable to Sizes 32, 40, and 50 only  
<sup>2)</sup> Applicable to Sizes 63, 80, 100, and 125

Further details in clear text

**Threaded connections**

**12<sup>1)</sup>** = SAE threads  
**01<sup>2)</sup>** = metric threads

**M** = NBR seals (other seals on request)  
**⚠ Attention!** The compatibility of the seals and pressure fluid has to be taken into account!

**1X** = Series 10 to 19  
(series 10 to 19: externally interchangeable)

**2X** = \* Series 20 to 29  
(series 20 to 29: externally interchangeable)

**Spring return of main poppet**  
**1** = opening pressure ≈ 1.74 PSI

\* Through YR2006, series 2X versions will displace series 1X. As substitutions occur for preferred versions, series 2X will be made preferred.

**Extracted from RA 20 478/06.98**

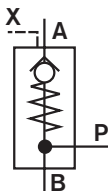
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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Symbols**

Prefill valve without directional valve model ZSF


**Technical data**

Nominal size	Size	32	40	50	63	80	100	125
Weight	kg (lbs)	3.5 (7.7)	4.2 (9.2)	5.5 (12)	7 (15.4)	10 (22)	15 (33)	26 (57)
Installation position		optional						
Maximum operating pressure	Ports B, P	bar (PSI)	350 (5100)					
	Port X	bar (PSI)	150 (2175)					
	Port A	bar (PSI)	16 (230)					
Cracking pressure	bar (PSI)	≈ 0.12 (1.75)						
Pressure fluid temperature range	°C (°F)	-30 ... +80 (-22 to +176)						
Viscosity range	mm <sup>2</sup> /s (SUS)	10 ... 800 (45 to 3720)						
Degree of contamination		Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We, therefore, recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .						

**Extracted from RE 20482/07.02**

Page 1 of 2

Issue: 06.06

**Pre-fill valve  
Model SF**

Nominal size 125 to 400

Series 4X

Max. operating pressure up to 350 bar (5076 PSI)

- Hydraulic pilot operated check valve
  - For flange connections
  - For reservoir mounting
- With or without de-compression
- As a check valve
- Reduced shock noise due to damping measures



Model SF...A.-1-4X/

**Ordering details**

SF			- 1 - 4X /		*
Nominal size 125	= 125				Further details in clear text
Nominal size 150	= 150				
Nominal size 200	= 200				
Nominal size 250	= 250				
Nominal size 300	= 300				
Nominal size 350	= 350				
Nominal size 400	= 400				
<b>Connection type</b>					
For flange connections		= A			
For reservoir mounting		= B			
As a cartridge valve without control spool (check valve)		= K			
<b>With de-compression <sup>1)</sup></b>		= 1			
<b>Without de-compression</b>		= 0			
					No Code = BSP thread connection
					12 = SAE thread connection ("X" pilot port)
					No code = BSP thread connection (other seals on request)
					12 = SAE thread connection ("x" pilot port)
					<b>⚠ Attention!</b>
					The compatibility of the seals and pressure fluid has to be taken into account!
					4X = Series 40 to 49 (40 to 49: unchanged installation and connection dimensions)
					<b>Spring return of the main poppet</b>
					1 = Opening pressure ≈ 0.2 bar (3.0 PSI)

<sup>1)</sup> Not with version "K"



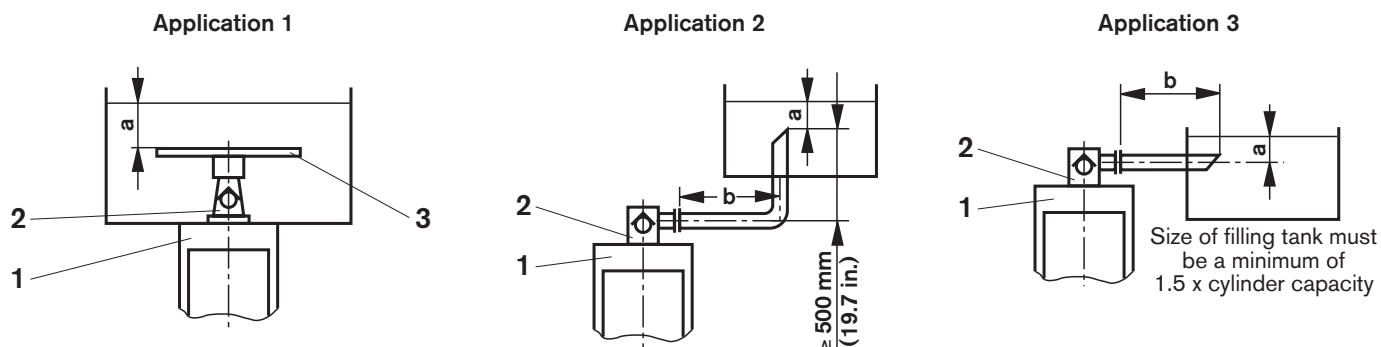
**Extracted from RE 20482/07.02**

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Issue: 06.06

**Technical data** (for applications outside these applications, please consult us!)

Installation		Optional						
Nominal size	Size	125	150	200	250	300	350	400
- Connection type "A" (connection A: welding flange ND 16 to DIN 2633)	mm (in.)	125 (5)	150 (6)	200 (8)	250 (10)	300 (12)	350 (14)	400 (16)
- Connection types "B" and "K"		Reservoir mounting						
- Port X (only with types "A" and "B")	BSP	G 3/4	G 3/4	G 1	G 1 1/4	G 1 1/4	G 1 1/2	G 1 1/2
	SAE	-12; 11/16-12	-12; 11/16-12	-16; 15/16-20	-20; 1 5/8-12	-20; 1 5/8-12	-24 1 7/8-12	-24 1 7/8-12
Max. operating pressure	- Port A bar (PSI)	16 (232)						
	- Ports B and X bar (PSI)	350 (5076)						
Opening pressure (pressure differential at the main poppet to overcome the spring pressure)	bar (PSI)	≈ 0.2 (3.0)						
Pressure fluid		Mineral oil (HL, HLP) to DIN 51 524; Fast bio-degradable pressure fluids to VDMA 24 568 (also see RE 90 221); HETG (rape seed oil); Other pressure fluids on request						
Pressure fluid temperature range	°C	-30 to +80 (-22 to +176)						
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3720)						
Degree of contamination		Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We therefore recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .						

**Applications**


- 1 Cylinder
- 2 Pre-fill valve
- 3 This metal sheet is not included within the scope of supply. Its use avoids the formation of a depressed suction vortex if the reservoir is too small and at low oil levels (a).
- a Min. 300 mm (11.8 in.) when cylinder is extended
- b Up to 1000 mm (39.4 in.) at the maximum given flow



**Extracted from RE 20485/02.03**

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Issue: 06.06

**Technical data** (for applications outside these parameters, please consult us!)

Nominal size	Size	32	40	50	63	80
Weight	kg (lbs.)	6 (13.2)	7 (15.4)	10.5 (23.1)	16 (35.3)	23 (50.7)
Installation		Optional				
Ambient temperature range	°C (°F)	-30 to +80 (-22 to +176) – NBR seals				
Maximum operating pressure	Ports B, P	bar (PSI) 350 (5076)				
	Port X	bar (PSI) 150 (2175)				
	Port A	bar (PSI) 16 (232)				
Opening pressure <sup>1)</sup>	bar (PSI)	≈ 0.12 (1.74)				
Maximum flow	L/min (GPM)	See application cases on page 7				
Pressure fluid		Mineral oil (HL, HLP) to DIN 51 524 <sup>2)</sup> ; Fast bio de-gradable pressure fluids to VDMA 24 568 (also see RE 90 221); HETG (rape seed oil) <sup>2)</sup> ; Other pressure fluids on request				
Pressure fluid temperature range	°C (°F)	-30 to +80 (-22 to +176)				
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3720)				
Cleanliness class to ISO code		Maximum permissible degree of contamination of the pressure fluid is to ISO 4406 (C) class 20/18/15 3)				

<sup>1)</sup> Pressure differential required at the main poppet to overcome the spring force

<sup>2)</sup> Suitable for NBR **and** FKM seals

<sup>3)</sup> The cleanliness class stated for the components must be adhered to in hydraulic systems. Effective filtration prevents faults from occurring and at the same time increases the component service life.

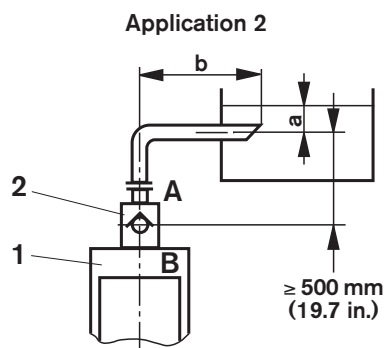
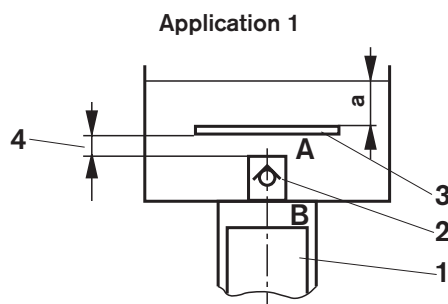
For the selection of filters see data sheets RE 50 070, RE 50 076 and RE 50 081.

**Maximum flow  $q_v$  in L/min (GPM) [A to B] for the various applications**

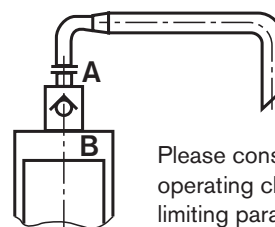
Size	32	40	50	63	80
<b>Application 1</b>	200 (52.8)	300 (79.3)	500 (132.1)	800 (211.3)	1200 (317.0)
<b>Application 2</b>	170 (44.9)	250 (66.0)	400 (105.7)	650 (171.7)	1000 (264.2)

⚠ If the pre-fill valve or pipe line is too small, gases may be released from the oil resulting in consequential damage which in turn often leads, in the long term, to damage to the cylinder seals.

- 1 Cylinder
- 2 Pre-fill valve
- 3 This metal sheet is **not** included within the scope of supply. Its use avoids the formation of a depressed suction vortex in small tanks and at low oil levels (a).
- 4 Take the supply cross-section into account!



**Note regarding application 2**



Please consult us when operating close to the limiting parameters. However, it is often sufficient to choose a pipe one size larger.

**Dimensions a and b**

**a** = Min. 300 mm (11.8 in.) when the cylinder is extended

**b** = Up to 1000 mm (39.4 in.) at the maximum given flow

**Extracted from RE 21534/10.05**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

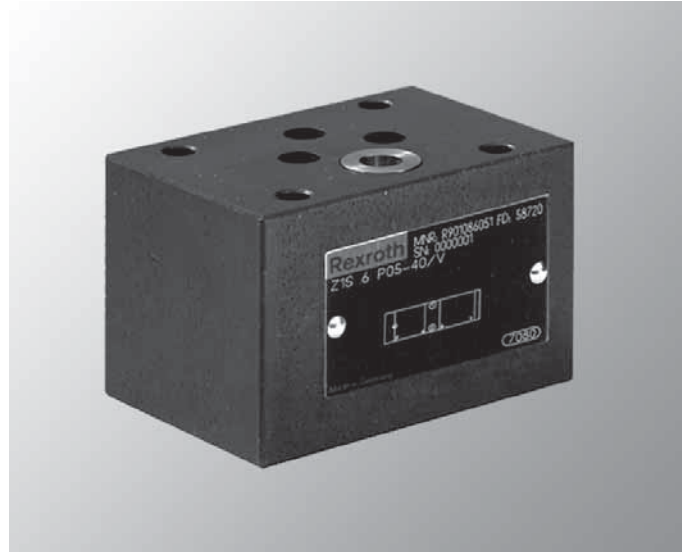
**Check Valve  
Model Z1S**

Nominal size 6  
Series 4X

Max. operating pressure up to 350 bar (5076 PSI)

Max. flow 40 l/min (10.57 GPM)

- Sandwich plate valve for use in vertical stacking assemblies
- Position of ports to DIN 24340 form A (**without** locating bore) (standard)
- Position of ports to ISO 4401-03-02-0-94 (**with** locating bore)
- Eight different checking functions, optional
- Improved freedom from leakage due to poppet/bushing made of heavy-duty plastic material
- Optional seawater-resistant version
- Supplementary documentation:  
Sandwich plates size 6 RE 48050 and RE 59015



Model Z1S

**Ordering code**

<b>Z1S</b>	<b>6</b>	<b>-</b>	<b>4X</b>	<b>/</b>	<b>V</b>	<b>*</b>																																																																																																																																
<table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">Check valve, sandwich plate</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Further details in clear text</td> </tr> <tr> <td>Size 6</td> <td style="text-align: center;">= 6</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td><b>No code =</b> Without locating bore</td> </tr> <tr> <td>Leak-free closure in channel A (A1 → A2)</td> <td style="text-align: center;">= A</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td><b>/60 1) =</b> With locating bore</td> </tr> <tr> <td>Leak-free closure in channel B (B1 → B2)</td> <td style="text-align: center;">= B</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td><b>/62 =</b> With locating bore and locating pin</td> </tr> <tr> <td>Leak-free closure in channel A (A2 → A1)</td> <td style="text-align: center;">= C</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td style="text-align: right;">ISO 8752-3x8-St</td> </tr> <tr> <td>Leak-free closure in channel B (B2 → B1)</td> <td style="text-align: center;">= D</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td style="text-align: center;"><b>Seal material</b></td> </tr> <tr> <td>Leak-free closure in channels A and B (A2 → A1) and (B2 → B1)</td> <td style="text-align: center;">= E</td> <td></td> <td></td> <td></td> <td></td> <td><b>V =</b></td> <td>FKM seals (other seals on enquiry)</td> </tr> <tr> <td>Leak-free closure in channels P and T (P1 → P2) and (T2 → T1)</td> <td style="text-align: center;">= F</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td style="text-align: center;"><b>Caution!</b></td> </tr> <tr> <td>Leak-free closure in channel P (P1 → P2)</td> <td style="text-align: center;">= P</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Observe compatibility of seals with hydraulic fluid used!</td> </tr> <tr> <td>Leak-free closure in channel T (T2 → T1)</td> <td style="text-align: center;">= T</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td><b>No code =</b> Standard</td> </tr> <tr> <td>(For symbol, see page 3)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td><b>J =</b></td> <td>Seawater-resistant <sup>2)</sup></td> </tr> <tr> <td>Cracking pressure</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td><b>4X =</b></td> <td>Component series 40 to 49</td> </tr> <tr> <td>0.5 bar (7.25 PSI)</td> <td style="text-align: center;">= 05</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>(40 to 49: unchanged installation and connection dimensions)</td> </tr> <tr> <td>1.5 bar (21.75 PSI)</td> <td style="text-align: center;">= 15</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td><sup>1)</sup> Locating pin ISO 8752-3x8-St,</td> </tr> <tr> <td>3.0 bar (43.50 PSI)</td> <td style="text-align: center;">= 30</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td><b>Material no. R900005694</b> (separate order)</td> </tr> <tr> <td>5.0 bar (72.50 PSI)</td> <td style="text-align: center;">= 50</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td><sup>2)</sup> With ordering code "J", outside parts are galvanised in contrast to the standard version</td> </tr> </table>							Check valve, sandwich plate							Further details in clear text	Size 6	= 6						<b>No code =</b> Without locating bore	Leak-free closure in channel A (A1 → A2)	= A						<b>/60 1) =</b> With locating bore	Leak-free closure in channel B (B1 → B2)	= B						<b>/62 =</b> With locating bore and locating pin	Leak-free closure in channel A (A2 → A1)	= C						ISO 8752-3x8-St	Leak-free closure in channel B (B2 → B1)	= D						<b>Seal material</b>	Leak-free closure in channels A and B (A2 → A1) and (B2 → B1)	= E					<b>V =</b>	FKM seals (other seals on enquiry)	Leak-free closure in channels P and T (P1 → P2) and (T2 → T1)	= F						<b>Caution!</b>	Leak-free closure in channel P (P1 → P2)	= P						Observe compatibility of seals with hydraulic fluid used!	Leak-free closure in channel T (T2 → T1)	= T						<b>No code =</b> Standard	(For symbol, see page 3)						<b>J =</b>	Seawater-resistant <sup>2)</sup>	Cracking pressure						<b>4X =</b>	Component series 40 to 49	0.5 bar (7.25 PSI)	= 05						(40 to 49: unchanged installation and connection dimensions)	1.5 bar (21.75 PSI)	= 15						<sup>1)</sup> Locating pin ISO 8752-3x8-St,	3.0 bar (43.50 PSI)	= 30						<b>Material no. R900005694</b> (separate order)	5.0 bar (72.50 PSI)	= 50						<sup>2)</sup> With ordering code "J", outside parts are galvanised in contrast to the standard version
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**Extracted from RE 21534/10.05**

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 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Notes**

- Valve housing (steel) and spool with sealing bushing (plastic) can be disassembled to allow proper disposal.
- The integrated plastic bushing (blue) assumes a sealing function! Do not remove or damage!

**Technical data** (for applications outside these parameters, please consult us!)

**General**

Weight	kg (lbs.)	0.8 (1.76)
Installation orientation		Optional
Ambient temperature range	°C (°F)	–20 to +80 (–4 to +176)

**Hydraulic**

Maximum operating pressure	bar (PSI)	350 (5076)
Cracking pressure	– Metal seal	bar (PSI) 0.5 (7.25); 1.5 (21.75); 3 (43.50); 5 (72.50)
	– Soft seal	bar (PSI) 0.5 (7.25)
Maximum flow	l/min (GPM)	40 (10.6)
Hydraulic fluid		Mineral oil (HL, HLP) to DIN 51524; fast bio-degradable hydraulic fluids to VDMA 24568 (see also RE 90221); HETG (rape seed oil); HEPG (polyglycols); HEES (synthetic esters); other hydraulic fluids on enquiry
Hydraulic fluid temperature range	°C (°F)	–20 to +80 (–4 to +176)
Viscosity range	mm <sup>2</sup> /s (SUS)	2.8 to 500 (13 to 2320)
Max. permissible degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)		Class 20/18/15 <sup>1)</sup>

<sup>1)</sup> The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

**Extracted from RA 21 536/06.98**

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Check valve – Sandwich plate  
Model Z1 S 10**

Size 10

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 100 L/min (26.4 GPM)

- Sandwich plate design for use in vertical stacking assemblies
- Leak-free closure of one or two service ports, as required
- Porting pattern to ISO 4401-5, NFPA T3.5.1 M R1 and ANSI B93.7 D 05
- Optional cracking pressures (see ordering code)



Model Z1 S 10.../V

**Ordering code**

Z1 S 10			- 3X / V	*
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Leak free closure in port(s):

A (A2 + A1)	= C
B (B2 + B1)	= D
P (P1 + P2)	= P
T (TA2 + TA1)	= T
(For symbols, see below)	

Cracking pressure 0.5 bar (7 PSI)	= 1
Cracking pressure 3.0 bar (45 PSI)	= 2
Cracking pressure 5.0 bar (75 PSI)	= 3

Further details to be written in clear text

no code = metal seal

V = FPM seals suitable for  
Petroleum oils (HM, HL, HLP)  
Phosphate-ester fluids (HFD-R)  
Other seal types on request

3X = Series 3X (model with metal seal)  
(30 to 39, externally interchangeable)

**Technical data**

**Hydraulic fluid:** Petroleum oils (HM, HL, HLP)  
Phosphate ester fluids (HFD-R)

**Fluid Temperature range:** -20 ... +80 °C (-4 ... 176 °F)

**Viscosity range:** 2.8 ... 500 mm<sup>2</sup>/s (35 ... 2320 SUS)

**Maximum degree of contamination** Class 18/15 according to ISO 4406. Therefore, we recommend a filter with a retention rate of  $\beta_{10} \geq 75$ .

**Operating pressure:** ... 315 bar (4600 PSI)

**Cracking pressure:** Model Z1 S10...3X/V  
0.5 bar (7 PSI)  
3 bar (45 PSI)  
5 bar (75 PSI)

**Fluid velocity:** Model Z1 S10...3X/V > 4 m/s (13 ft/s)

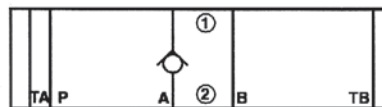
**Flow:** 100 L/min (26.4 GPM)

**Weight (approx.):** 0.8 kg (1.7 lbs)

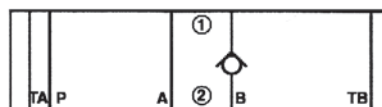
(For applications outside these parameters, please consult us!)

**Symbols**

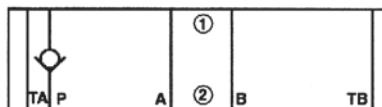
Z1 S 10C.../..



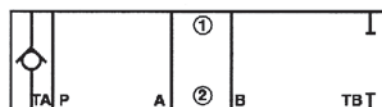
Z1 S 10D.../..



Z1 S 10P.../..



Z1 S 10T.../..



## Extracted from RA 21 548/06.98

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

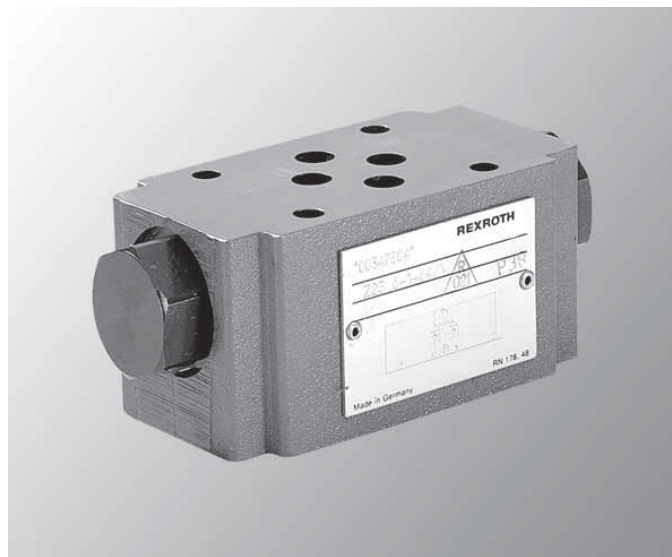
## Pilot operated check valve – Sandwich plate Model Z2 S 6

Size 6, Series 6X

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 60 L/min (16 GPM)

- Sandwich plate design for use in vertical stacking assemblies
- Leak-free closure of one or two actuator ports, as required
- Porting pattern to ISO 4401-3, NFPA T3.5.1 M R1 and ANSI B93.7 D 03
- Optional cracking pressures (see ordering code)



Model Z2 S 6–.–6X/...

## Ordering code

Z1 S 6		– 6X /		*
P.O. Check valve, size 6				Further details to be written in clear text
Sandwich plate design				
Check assembly in lines A and B	= -			no code = NBR seals, suitable for petroleum oils
Check assembly in line A	= A			V = FPM seals, suitable for phosphate ester fluids
Check assembly in line B	= B			
1.5 bar (22 PSI) cracking pressure		= 1		6X = Series 6X (60 to 69, externally interchangeable)
3.0 bar (45 PSI) cracking pressure		= 2		

## Technical data

**Viscosity range:** 2.8 ...500 mm<sup>2</sup>/s (35...2320 SUS)

**Flow (max):** 60 L/min (16 GPM)

**Area ratio:** A2/A1 = 3:1

**Weight (approx.):** 0.8 kg (1.8 lbs)

(For applications outside these parameters, please consult us!)

**Extracted from RA 21 553/06.98**

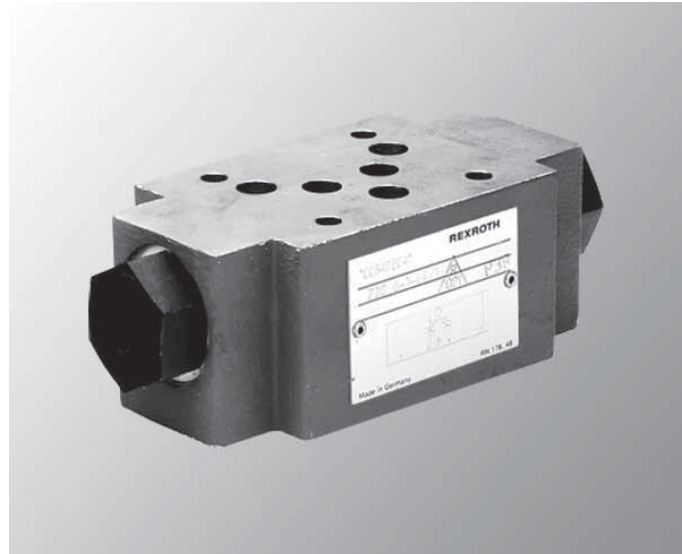
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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Pilot operated check valve –  
Sandwich plate  
Model Z2 S 10**

Size 10, Series 3X  
Maximum operating pressure 315 bar (4600 PSI)  
Maximum flow 120 L/min (32 GPM)

- Sandwich plate design for use in vertical stacking assemblies
- Leak-free closure of one or two actuator ports, as required
- Porting pattern to ISO 4401-5, NFPA T3.5.1 M R1 and ANSI B93.7 D 05
- Optional cracking pressures (see ordering code)



Model Z 2 S 10..-3X/...

**Ordering code**

<b>Z1 S 10</b>	<b>- 3X /</b>	<b>*</b>	Further details to be written in clear text
P.O. Check valve, size 10 Sandwich plate design			
Leakage free closure of ports A and B	= -		<b>no code</b> = NBR seals, suitable for petroleum oils (HM, HL, HLP)
Leakage free closure of port A	= A		<b>V</b> = FPM seals, suitable for phosphate ester fluids (HFD-R)
Leakage free closure of port B	= B		
Cracking pressure 1.5 bar (22 PSI)	= 1		<b>3X</b> = Series 30 to 39 (30 to 39, externally interchangeable)
Cracking pressure 3 bar (45 PSI)	= 2		
Cracking pressure 6 bar (90 PSI)	= 3		

**Technical data**

**Maximum flow:** 120 L/min (32 GPM)

**Orientation:** see symbols

**Area ratio:** A1/A2 = 1:2.86  
A3/A2 = 1:11.45

**Weight (approx.):** 2 kg (4.4 lbs)

(For applications outside these parameters, please consult us!)



**Extracted from RA 21 543/06.98**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

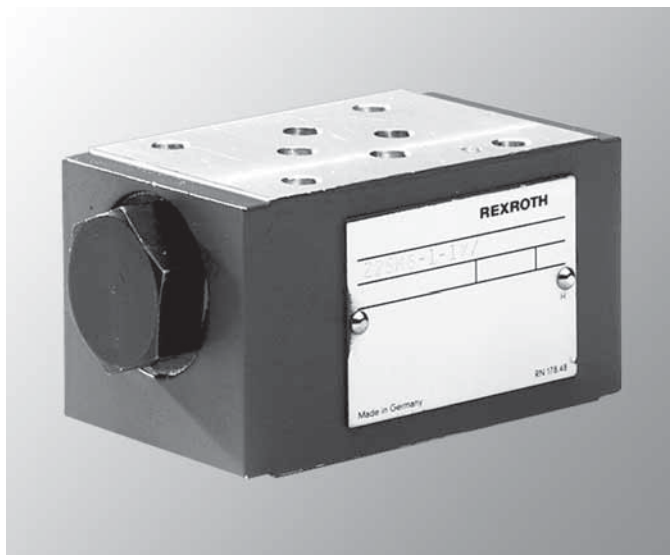
**Check valve**  
**Sandwich plate**  
**Model Z2 SRK 6**

Size 6, Series 1X

Maximum operating pressure 210 bar (3050 PSI)

Maximum flow 40 L/min (10.5 GPM)

- Mounting pattern to ISO 4401-3 NFPA T3.5.MR1, and ANSI B 93.7 D 03
- Sandwich plate design
- Leak-free closure of two actuator ports



Model Z2 SRK6-1-1X/V

**Ordering code, symbols ( ① = valve side, ② = manifold sides)**

Symbol	Cracking pressure	Part no.	Model designation
	1.5 bar (22 PSI)	R900564519	Z2SRK6-1-1X/V

**Technical data** (For applications outside these parameters, please consult us!)

Hydraulic fluid		Petroleum oil (HL; HLP); phosphate ester (HFD-R)
Temperature range of fluid	°C (°F)	-20 to +80 (- 4 to 176)
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 800 (60 to 3720)
Fluid cleanliness		Maximum permissible degree of contamination to ISO 4406, class 18/15. For this, we recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .
Permissible flow max.	L/min (GPM)	40 (10.5)
Direction of flow		see symbol
Cracking pressure in open direction		see operating curves
Area ratio		A1/A2 = 1/3
Weight	kg (lbs)	approx. 1.1 (2.4)

**Extracted from RA 21 549/06.98**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

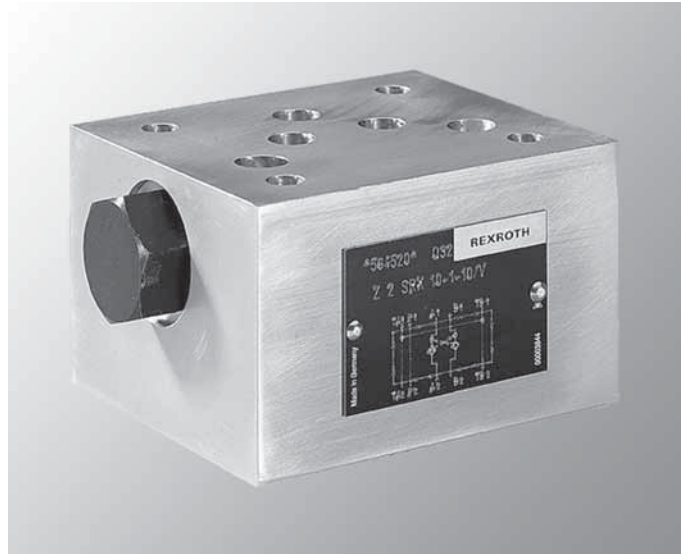
**Pilot operated check valve  
 Sandwich plate  
 Model Z2 SRK 10**

Size 10, Series 1X

Maximum operating pressure 210 bar (3050 PSI)

Maximum flow 80 L/min (21 GPM)

- Mounting pattern to ISO 4401-5 NFPA T3.5.MR1, and ANSI B 93.7 D 05
- Sandwich plate design
- Leak-free closure of two actuator ports



Model Z2 SRK10-1-1X/V

**Ordering code, symbols ( ① = valve side, ② = manifold sides)**

Symbol	Cracking pressure	Part no.	Model designation
	1.5 bar (22 PSI)	R900564520	Z2SRK10-1-1X/V

**Technical data (For applications outside these parameters, please consult us!)**

Hydraulic fluid		Petroleum oil (HL; HLP); phosphate ester (HFD-R)
Temperature range of fluid	°C (°F)	-20 to +80 (-4 to +176)
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 800 (60 to 3720)
Fluid cleanliness		Maximum permissible degree of contamination to ISO 4406, class 18/15. For this, we recommend a filter with a minimum retention rate of $B_{10} \geq 75$ .
Permissible flow max.	L/min (GPM)	80 (21)
Direction of flow		see symbol
Cracking pressure in open direction		see operating curves
Area ratio		A1/A2 = 1/3
Weight	kg (lbs)	approx. 3.2 (7.1)

**Extracted from RA 21 558/06.98**

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

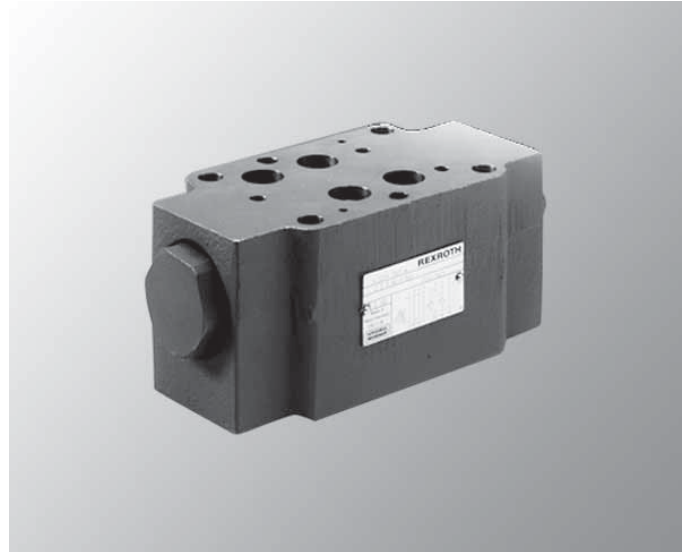
**Pilot operated check valve –  
Sandwich plate  
Model Z2 S 16**

Size 16, Series 5X

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 300 L/min (80 GPM)

- Sandwich plate design for use in vertical stacking assemblies
- Leak-free closure of one or two service ports, as required
- Z2S16 – Porting pattern to ISO 4401-7, NFPA T3.5.1 M R1 and ANSI B93.7 D 07; Z2S22
- Optional cracking pressures (see ordering code)



Model Z2 S16-1-5X/...

**Ordering code**

	<b>Z1 S 16</b>	<b>- 5X /</b>	<b>*</b>	
Pilot operated check valve				Further details to be written in clear text
Sandwich plate design				
Size 16 (D 07)	<b>= 16</b>			<b>no code =</b> NBR seals, suitable for petroleum oils (HM, HL, HLP)
Leakfree closure in lines A and B		<b>= -</b>		<b>V =</b> FPM seals, suitable for phosphate ester fluids (HFD-R)
Leakfree closure in line A		<b>= A</b>		
Leakfree closure in line B		<b>= B</b>		
Cracking pressure 3.0 bar (45 PSI)			<b>= 1</b>	
Cracking pressure 5.0 bar (75 PSI)			<b>= 2</b>	<b>5X =</b> Series 50 to 59 (50 to 59, externally interchangeable)

**Technical data**

**Maximum flow:** 300 L/min (80 GPM) – Size 16

**Weight (approx.):** 6.5 kg (14.3 lbs) – Size 16

(For applications outside these parameters, please consult us!)

**Extracted from RA 21 564/06.98 (Size 22)**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

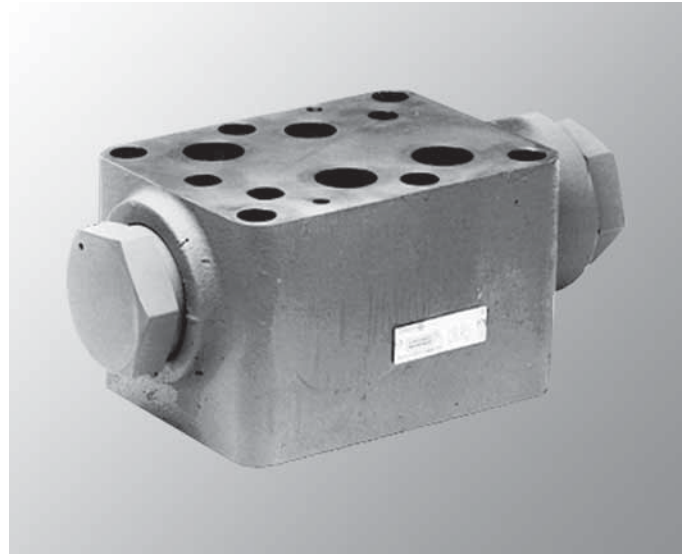
**Pilot operated check valve –  
 Sandwich plate  
 Model Z2 S22**

Size 22, Series 5X

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 450 L/min (120 GPM)

- Sandwich plate design for use in vertical stacking assemblies
- Leak-free closure of one or two service ports, as required
- Porting pattern to ISO 4401-8, NFPA T3.5.1 M R1 and ANSI B93.7 D 08
- Various cracking pressures (see ordering code)



Model Z2 S22-1-5X/...

**Ordering code**

Z1 S22		- 5X /	*
Pilot operated check valve			
Sandwich plate design			
Size 22 (D 08)	= 22		
Leakfree closure in lines A and B	= -		
Leakfree closure in line A	= A		
Leakfree closure in line B	= B		
Cracking pressure 3.0 bar (45 PSI)		= 1	
Cracking pressure 5.0 bar (75 PSI)		= 2	
			Further details to be written in clear text
			no code = NBR seals, suitable for petroleum oils (HM, HL, HLP)
			V = FPM seals, suitable for
		5X =	Series 50 to 59 (50 to 59, externally interchangeable)

**Technical data** (For applications outside these parameters, please consult us!)

Hydraulic fluid		Petroleum oil (HL; HLP); phosphate ester (HFD-R)
Temperature range of fluid	°C (°F)	NBR seals: -30 to +80 (-22 to +176) FPM seals: -20 to +80 (-4 to +176)
Viscosity range	mm <sup>2</sup> /s (SUS)	2.8 to 500 (35 to 2320)
Fluid cleanliness		Maximum permissible degree of contamination to ISO 4406, class 18/15. For this, we recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .
Permissible flow max.	L/min (GPM)	450 (120)
Direction of flow		see complete data sheet
Cracking pressure in open direction		see complete data sheet
Area ratio		$A_1/A_2 = 1/13.6$ ; $A_3/A_2 = 1/2.8$
Weight (approx.)	kg (lbs)	12 (26.5)

## Section 3

# Directional Valves

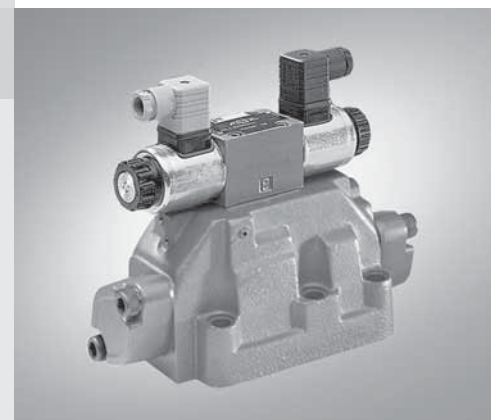
### The Drive & Control Company

- Directional poppet valve with solenoid operation –
  - M-SED 6 ..... 148
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For a complete copy of the data sheets in this catalog, visit our website at:

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      - ▶ Preferred Product Catalog





**Extracted from RA 22 049/03.00**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Installation			optional
Ambient temperature range	°C (°F)		-30 to +50 (-22... +122)
Weight	3/2-way directional poppet valve	kg (lbs)	1.5 (3.306)
	4/2-way directional poppet valve	kg (lbs)	2.3 (5.069)

**Hydraulic data**

Max. operating pressure	bar (PSI)	see table on page 7 of datasheet	
Max. flow	L/min (GPM)	25 (6.60)	
Pressure fluid		Mineral oil (HL, HLP) to DIN 51 524 <sup>1)</sup> ; fast bio-degradable pressure fluids to VDMA 24 568 (also see RE 90 221); HETG (rape seed oil) <sup>1)</sup> ; HEPG (polyglycols) <sup>2)</sup> ; HEES (synthetic esters) <sup>2)</sup> ; other pressure fluids on request	
Pressure fluid temperature range	°C (°F)	-30 to +80 (-22... +176) (with NBR seals)	
		-20 to +80 (-4... +176) (with FPM seals)	
Viscosity range	mm <sup>2</sup> /s (SUS)	2.8 to 500 (35 to 2320)	
Degree of contamination		Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We, therefore, recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .	

**Electrical data**

Voltage type		DC	
Available voltages	V	24, 96	
Voltage tolerance (nominal voltage)	%	±10	
Power consumption	W	30	
Duty		continuous	
Switching time to ISO 6403		see table below	
Switching frequency	cycles/h	up to 15000 operations per hour, see table below	
Protection to DIN 40 050		IP 65	
Max. coil temperature <sup>3)</sup>	°C (°F)	...150 (302)	

<sup>3)</sup> Due to the occurring surface temperature of the solenoid coils, the European standards EN563 and EN982 must be taken into account!

**When connecting the electrics, the protective conductor (PE  $\perp$ ) must be connected according to the relevant regulations.**



**Extracted from RA 22 058/09.99**

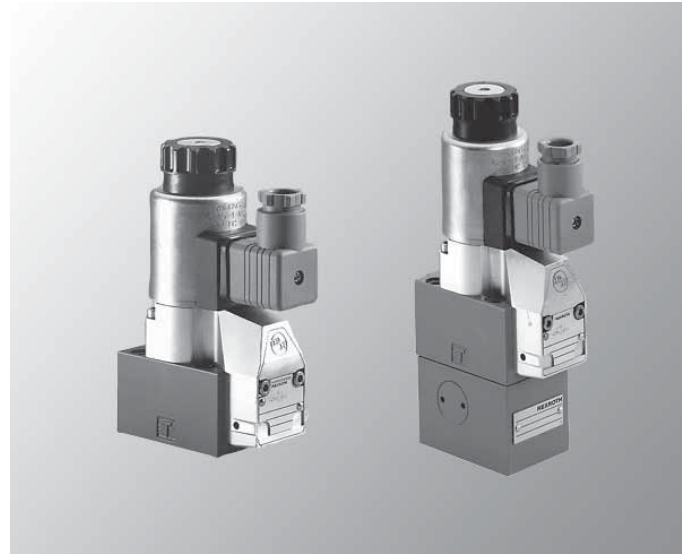
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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**2/2-, 3/2- and 4/2-way Directional poppet  
valves with solenoid operation  
Model M-SEW 6**

Size 6, Series 3X  
Maximum operating pressure  
420/630 bar (6100/9150 PSI)  
Maximum flow 25 L/min (6.6 GPM)

- Mounts on standard ISO 4401-3, NFPA T3.5.1 M R1 and ANSI B93.7 D 03 interface (except 630 bar version)
- 10-24 UNC (M5) mounting bolts for 420 bar (6100 PSI) Model 1/4-20 UNC (M6) mounting bolts for 630 bar (9150 PSI) Model
- Leak-free closure in checked position
- Resists silting, even during extended pressure periods
- Solenoids with removable coils



Model M-3SEW 6 U3X/420MG24N9K4 with plug-in connector and Model M-4SEW 6 D3X/420MG24N9K4 with plug-in connector

**Ordering code**

M -		SEW 6		3X /		M		K4 /		*	
3 actuator ports	= 3										
4 actuator ports	= 4										
Poppet valve											
Nominal size 6	= 6										
Actuator ports	2	3	4								
Symbols											
	-	●	-	= U							
	-	●	-	= C							
	-	-	●	= D							
	-	-	●	= Y							
				● = available							
Series 30 to 39	= 3X										
(30 to 39: externally interchangeable)											
Operating pressure 420 bar (6100 PSI)	= 420										
(10-24/M5 mounting bolts)											
Operating pressure up to 630 bar (9150 PSI)	= 630										
(1/4-20/M6 mounting bolts)											
Solenoid (air gap) with removable coil	= M										
Further details to be written in clear text											
No code = NBR seals											
V = FPM seals (other seals on request)											
⚠ Attention! The compatibility of the seals and pressure fluid has to be taken into account!											
No code = Without cartridge check valve, without throttle insert											
P = With cartridge check valve											
B10, 12 = Orifice Ø mm (in.) Throttle used when flow exceeds the power limit of the valve; inserted in the P port											
K4 <sup>1;2)</sup> = Electrical connection Individual connection, with component plug DIN 43 650-AM2, without plug-in connector											
N9 = With protected manual override											
G24 = Example: 12, 24, 96 V DC											

<sup>1)</sup> Plug-in connectors must be ordered separately. For additional connector information, see datasheet RA 08 006.

<sup>2)</sup> For the connection to an AC supply a DC solenoid must be used which is controlled via a rectifier.



**Extracted from RA 22 058/09.99**

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Issue: 04.03

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Installation			optional
Max. ambient temperature		°C (°F)	+50 (+122)
Weight	2/2-way poppet valve	kg (lbs)	1.5 (3.31)
	3/2-way poppet valve	kg (lbs)	1.5 (3.31)
	4/2-way poppet valve	kg (lbs)	2.3 (5.1)

**Hydraulic data**

Max. operating pressure		bar (PSI)	see table on page 7
Max. flow		L/min (GPM)	25 (6.6)
Pressure fluid			Mineral oil (HL, HLP) to DIN 51 524 1); Fast bio-degradable pressure fluids to VDMA 24 568 (also see RA 90 221); HETG (rape seed oil) <sup>1)</sup> ; HEPG (Polyglycols) <sup>2)</sup> ; HEES (synthetic esters) <sup>2)</sup> ; other pressure fluids on request
<sup>1)</sup> suitable for NBR <b>and</b> FPM seals			
<sup>2)</sup> <b>only</b> suitable for FPM seals			
Pressure fluid temperature range		°C (°F)	-30 to +80 (-22 to +176) (with NBR seals)
			-20 to +80 (-4 to +176) (with FPM seals)
Viscosity range		mm <sup>2</sup> /s (SUS)	2.8 to 500 (35 to 2318)
Degree of contamination			Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We, therefore, recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .

**Electrical data**

Model of voltage			DC
Available voltages		V	<b>12, 24, 96</b>
Voltage tolerance (nominal voltage)		%	±10
Power consumption		W	30
Duty			continuous
Switching time to ISO 6403			see table below
Switching frequency		cycles/h	15000
Protection to DIN 40 050			IP 65
Max. coil temperature <sup>3)</sup>		°C (°F)	150 (302)

<sup>3)</sup> Due to the surface temperatures which occur on the solenoid coils, the European standards EN563 and EN982 must be taken into account!

**When connecting electric power, the protective conductor (PE  $\perp$ ) must be connected according to the relevant regulations.**

**Extracted from RA 22 045/03.00**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

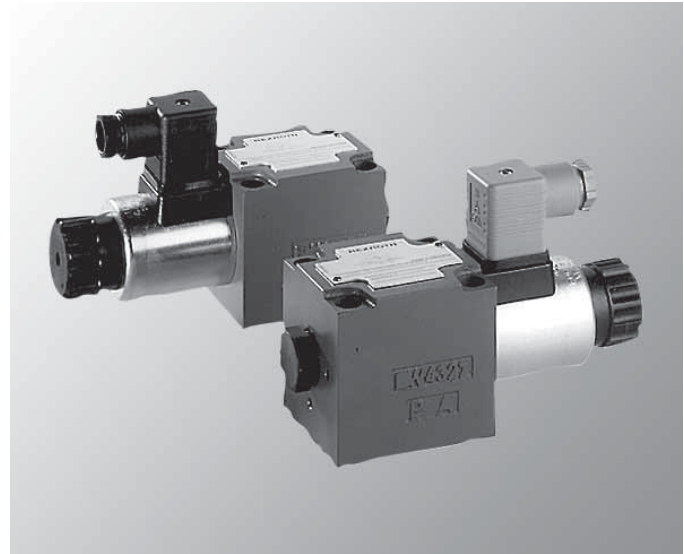
**3/2- and 4/2-way Directional poppet valves  
with solenoid operation  
Model M-.SED 10**

Size 10, Series 1X

Maximum operating pressure 350 bar (5000 PSI)

Maximum flow 40 L/min (10.6 GPM)

- Direct operated directional poppet valve with solenoid actuation
- Mounts on standard ISO 4401-5, NFPA T3.5.1 M R1 and ANSI B 93.7 D 05 interface subplates to datasheet RA 45 054 (separate order)
- Leak-free closure in checked position
- Switching is ensured even when under pressure for long periods of time
- Solenoid coil can be rotated by 90°
- Coils can be changed without engaging fluid
- Individual electrical connection
- With protected manual override, standard "N9"



Model M-3SED 10 <sup>UK</sup><sub>CK</sub> 1X/350CG24N9K4 with plug-in connector

**Ordering code**

<b>M</b>	<b>SED</b>	<b>10</b>	<b>1X / 350</b>	<b>C</b>	<b>K4 /</b>	<b>*</b>
3 actuator ports = 3 4 actuator ports = 4						
Poppet valve						Further details to be written in clear text
Nominal size 6 = 10						No code = NBR seals
Actuator ports	3	4				No code = without cartridge check valve, without throttle insert
Symbols						P = with cartridge check valve
	●	-				<b>Electrical connection</b>
	●	-				K4 <sup>1)</sup> = individual connection; with component plug DIN 43 650-AM2, without plug-in connector
	-	●				N9 = with protected manual override
	-	●				G24 = Example: 24, 96 V DC
						C = Wet pin solenoid with removable coil
						350 = Operating pressure 350 bar (5000 PSI)
						1X = Series 10 to 19 (10 to 19: externally interchangeable)
						● = available

<sup>1)</sup> Plug-in connectors must be ordered separately.

**Extracted from RA 22 045/03.00**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Installation		optional
Ambient temperature range	°C (°F)	-30 to +50 (-22 to +122)
Weight	3/2-way directional poppet valve	kg (lbs)
	4/2-way directional poppet valve	kg (lbs)
		2.6 (5.7)
		3.9 (8.6)

**Hydraulic data**

Max. operating pressure	bar (PSI)	see table on page 7
Max. flow	L/min (GPM)	40 (10.60)
Pressure fluid		Mineral oil (HL, HLP) to DIN 51 524 <sup>1)</sup> ; fast bio-degradable pressure fluids to VDMA 24 568 (also see RE 90 221); HETG (rape seed oil) <sup>1)</sup> ; HEPG (polyglycols) <sup>2)</sup> ; HEES (synthetic esters) <sup>2)</sup> ; other pressure fluids on request
<sup>1)</sup> suitable for NBR <b>and</b> FPM seals		
<sup>2)</sup> <b>only</b> suitable for FPM seals		
Pressure fluid temperature range	°C (°F)	-30 to +80 (-22 to +176) (with NBR seals)
		-20 to +80 (-4... +176) (with FPM seals)
Viscosity range	SUS (mm <sup>2</sup> /s)	2.8 to 500 (35 to 2320)
Degree of contamination		Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We, therefore, recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .

**Electrical data**

Voltage type		DC
Available voltages	V	24, 96
Voltage tolerance (nominal voltage)	%	±10
Power consumption	W	30
Duty		continuous
Switching time to ISO 6403		see table below
Switching frequency	cycles/h	up to 15000 operations per hour, see table below
Protection to DIN 40 050		IP 65
Max. coil temperature <sup>3)</sup>	°C (°F)	...150 (302)

<sup>3)</sup> Due to the occurring surface temperature of the solenoid coils, the European standards EN563 and EN982 must be taken into account!

**When connecting the electrics, the protective conductor (PE  $\perp$ ) must be connected according to the relevant regulations.**

**Extracted from RA 22 075/08.99**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

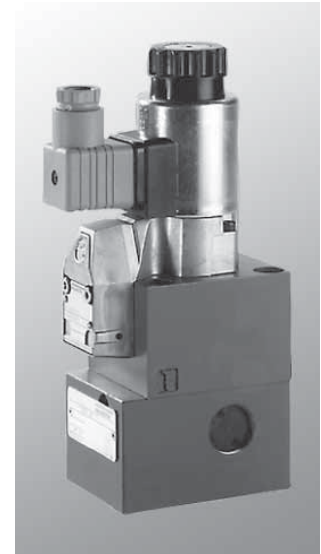
**3/2- and 4/2-way Directional poppet valves  
with solenoid operation  
Model M-SEW 10**

Size 10, Series 1X  
Maximum operating pressure  
420/630 bar (6100/9135 PSI)  
Maximum flow 40 L/min (10.5 GPM)

- Directly operated directional poppet valve with solenoid operation
- Porting pattern to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H, subplates to data sheet RA 45 054 (separate order)
- Leak-free closure in checked position
- Resists silting, even during extended pressure periods
- Solenoid coil can be rotated by 90°
- Single electrical connection
- With manual override, standard



Model M-3SEW  
10 U1X/  
420MG24N9Z45



Model M-4SEW  
10 D1X/  
420MG24N9Z45

**Ordering code**

<b>M</b>	<b>SEW</b>	<b>10</b>	<b>1X</b>	<b>M</b>	<b>K4</b>	<b>*</b>
3 actuator ports = 3 4 actuator ports = 4						
Poppet valve						
Nominal size 6 = 10						
Actuator ports	2	3	4			
Symbols						
	-	●	-	= U		
	-	●	-	= C		
	-	-	●	= D		
	-	-	●	= Y		
		● = available				
Series 10 to 19 (10 to 19: externally interchangeable)				= 1X		
Operating pressure up to 420 bar (6100 PSI)				= 420		
Operating pressure up to 630 bar (9150 PSI)				= 630		
						Further details to be written in clear text
						<b>No code =</b> NBR seals <b>V =</b> FPM seals ⚠ Attention! The compatibility of the seals and pressure fluid must be taken into account!
						<b>No code =</b> Without cartridge check valve or orifice insert <b>P =</b> With cartridge check valve insert <b>B10, 12 =</b> Orifice Ø mm (in.) Throttle used when flow exceeds the power limit of the valve; inserted in the P port
						<b>Electrical connectors</b> <b>K4</b> <sup>1)</sup> = without angled plug connector
						<b>no code =</b> without manual override (24 V only) <b>N9 =</b> with protected manual override
						<b>G24 =</b> 24, 96 V DC
				<b>M =</b>		removable air gap solenoid

<sup>1)</sup> Plug-in connectors must be ordered separately.  
For additional information, see datasheet RA 08 006.

**Extracted from RA 22 075/08.99**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Mounting position			optional
Ambient temperature, max.		°C (°F)	50 (122)
Weight (approx.)	3/2-way poppet valve	kg (lbs)	2.0 (4.40)
	4/2-way poppet valve	kg (lbs)	3.5 (7.71)

**Hydraulic**

Operating pressure, max.		bar (PSI)	420/630 (6100/9135)
Flow, max.		L/min (GPM)	40 (10.60)
Hydraulic fluid	Mineral oil (HL, HLP) to DIN 51 524 <sup>1)</sup> ; Fast bio-degradable pressure fluids to VDMA 24 568 (also see RA 90 221); HETG (rape seed oil) <sup>1)</sup> ; HEPG (Polyglycol) <sup>2)</sup> ; HEES (synthetic ester) <sup>2)</sup> ; other fluids on request		
<sup>1)</sup> Suitable for NBR <b>and</b> FPM seals			
<sup>2)</sup> <b>Only</b> suitable for FPM seals			
Fluid temperature range		°C (°F)	NBR seals: -30 to +80 (-22 to +172)
			FPM seals: -20 to +80 (-4 to +176)
Viscosity range		mm <sup>2</sup> /s (SUS)	2.8 to 500 (35 to 2320)
Maximum degree of contamination	Class 18/15 according to ISO 4406. We therefore recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .		

**Electrical**

Type of supply			DC
Available voltages		V	24, 96
Voltage tolerance (nominal voltage)		%	±10
Power requirement		W	30
Duty cycle			100 %
Operating time to ISO 6403			see table
Shifting frequency		Cycles/h	15000
Type of protection to DIN 40 050			IP 65
Coil temperature range		°C (°F)	up to 150 (302)

**Extracted from RA 22 280/06.98**

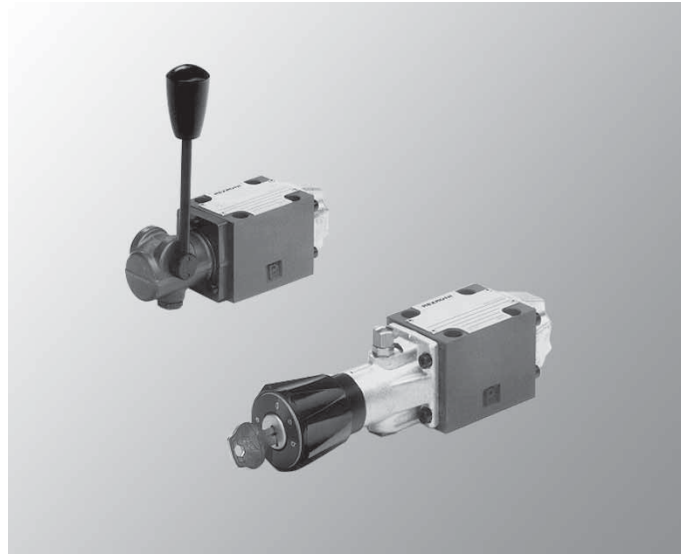
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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**4/3-, 4/2- and 3/2-way Directional valves  
Mechanical/Manual operation  
Model WM.6**

Size 6, Series 5X  
Maximum operating pressure 315 bar (4600 PSI)  
Maximum flow 60 L/minn (16.0 GPM)

- Direct operated spool type directional control valves
- Mounts on standard ISO 4401-3, NFPA T3.5.1M R1 and ANSI B 93.7 D 03 interface
- For subplates, see data sheet RA 45 052



Mechanical/manual operation

**Ordering code**

		<b>6</b>	<b>5X /</b>			<b>*</b>
4 service ports	= 4					No code = NBR seals, suitable for petroleum oils (HM, HL, HLP)
Hand lever	= WMM					No code = without orifice insert
Rotary knob	= WMD					No code = with spring return (available for WMM)
Size 6	= 6					F = with detent (available for WMM, WMD)
Spool type e.g. C, D, E, H, J, W, Y						
Series 50 to 59 (50 to 59, externally interchangeable)						

**Extracted from RA 22 280/06.98**

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Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Installation position		optional
Weight	kg (lbs.)	approx. 1.4 (3.1)

**Hydraulic**

Operating pressure max			
– Ports A, B, P	bar (PSI)	315 (4600)	
– Port T:			
for WMM, WMD, WMDA	bar (PSI)	160 (2320)	With spool types A or B, port T must be used as a drain port if the operating pressure is higher than the permissible tank pressure.
for WMR, WMU	bar (PSI)	60 (900)	
Max. volume flow	L/min (GPM)	60 (16.0)	
Flow section (Control position 0)		with spool type W 3% of nominal section	
Hydraulic fluid		Petroleum oils (HM, HL, HLP); Phosphate ester fluids (HFD-R)	
Fluid temperature range	°C (°F)	NBR seals: –30 to +80 (–22 to +176) FPM seals: –20 to +80 (–4 to +176)	
Viscosity range	mm <sup>2</sup> /s (SUS)	2.8 to 500 (35 to 2320)	
Maximum degree of fluid contamination		Class 18/15 according to ISO 4406. Therefore, we recommend a filter with a retention rate of $\beta_{10} \geq 75$ .	

**Operating force/-torque**

Valve type		WMM	WMD/WMDA
Operating torque max.	Ncm (lb-in)	–	150 (13.3)
Operating force			
– without tank pressure with and without detent	kg (lbs)	20 (4.5)	–
– 150 bar tank pressure	kg (lbs)	30 (6.7)	–

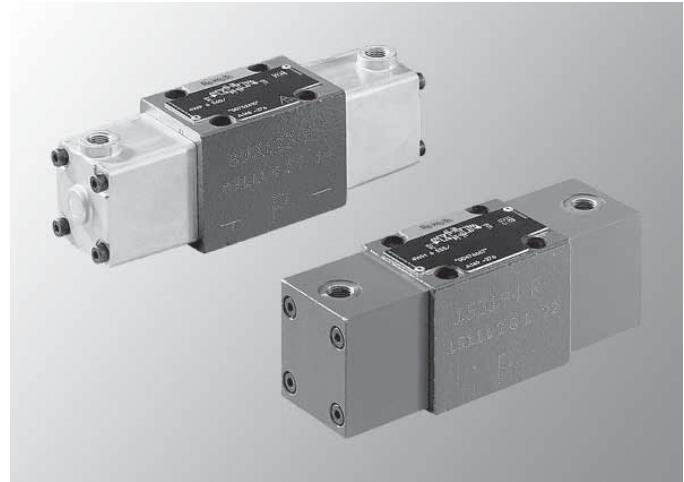
**Extracted from RE 22282/07.02**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**4/3-, 4/2- and 3/2-way Directional valves  
with fluidic actuators  
Model WP, WH**

Nominal size 6  
Series 6X (WP), 5X (WH)  
Maximum operating pressure 315 bar (4600 PSI)  
Maximum flow 60 L/min (16 GPM)

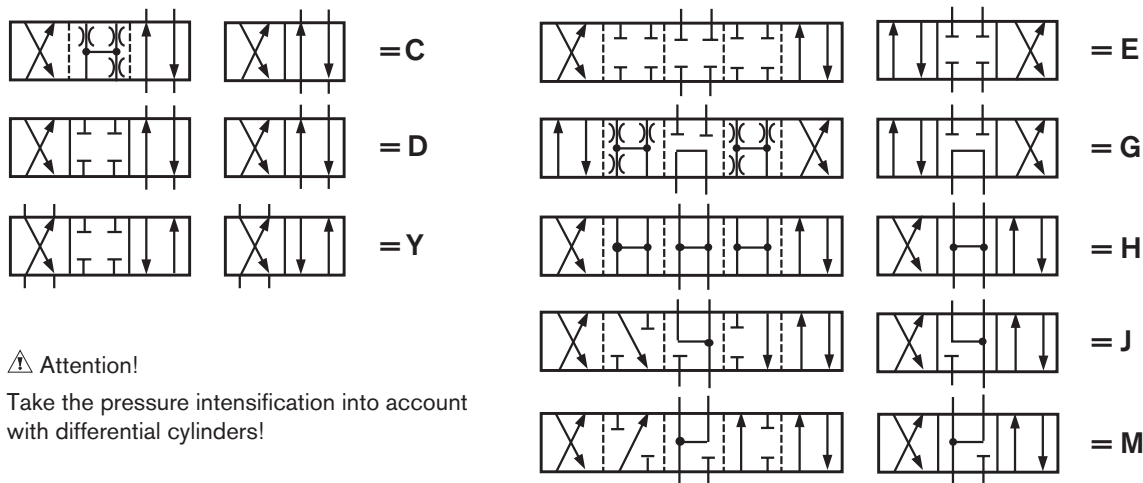


Fluidic actuators

**Ordering code**

	<b>4</b>	<b>6</b>	<b>/</b>	<b>/</b>	<b>/</b>	<b>5</b>	
4 actuator ports						<b>5 =</b>	NPT threaded connection
Fluidic actuation						<b>No code =</b>	NBR seals
Pneumatic	<b>= WP</b>					<b>No code =</b>	Without orifice insert
Hydraulic	<b>= WH</b>					<b>No code =</b>	Without manual override
Nominal size 6	<b>= 6</b>					<b>No code =</b>	With spring return
Symbols, e.g.	<b>= C, D, E, G, H, J, M, Y</b>						
(For symbols and examples see below)							
WP							
Series 60 to 69						<b>= 6X</b>	
(60 to 69: unchanged installation and connection dimensions)							
WH						<b>= 5X</b>	
Series 50 to 59							
(50 to 59: unchanged installation and connection dimensions)							

**Symbols**



**⚠ Attention!**  
Take the pressure intensification into account  
with differential cylinders!



**Extracted from RE 22282/07.02**

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Issue: 04.03

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Valve type			WP	WH
Installation			Optional <sup>1)</sup>	
Ambient temperature range	°C (°F)		NBR seals: -30 to +80 (-22 to +176)	
			FKM seals: -20 to +80 (-4 to +176)	
Weight	1 operating cylinder	kg (lbs.)	Approx. 1.8 (4.0)	Approx. 2.0 (4.4)
Valve with:	2 operating cylinders	kg (lbs.)	Approx. 2.0 (4.4)	Approx. 2.2 (4.9)

**Hydraulic**

Max. operating pressure	Ports A, B, P	bar (PSI)	Up to 315 (4600)	
	Port T	bar (PSI)	Up to 160 (2300) (with symbols A and B, the port T must be used as leakage port when the operating pressure is above 160 bar (2300 PSI)).	
Max. flow	L/min (GPM)		60 (16)	
Flow cross-section	With symbol Q		6 % of the nominal cross-section	
(switched position 0):	With symbol W		3 % of the nominal cross-section	
Min. control pressure	bar (PSI)		4 (60) (see char. curves on page 5)	6 to 10 (87 to 145) > tank pressure <sup>2)</sup>
Max. control pressure	bar (PSI)		10 (145)	200 (2900)
Control volume	cm <sup>3</sup> (in <sup>3</sup> )		1.23 (0.075)	
Pressure fluid	Mineral oil (HL, HLP) to DIN 51 524 <sup>3)</sup> ; Fast bio-degradable pressure fluids to VDMA24 568 (also see RE 90 221); HETG (rape seed oil) <sup>3)</sup> ; HEPG (polyglycols) <sup>4)</sup> ; HEES (synthetic ester) <sup>4)</sup> ; Other pressure fluids on request			
Pressure fluid temperature range	°C (°F)		NBR seals: -30 to +80 (-22 to +176)	
			FKM seals: -20 to +80 (-4 to +176)	
Viscosity range	mm <sup>2</sup> /s (SUS)		2.8 to 500 (35 to 2318)	
Degree of contamination	Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We therefore recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .			

<sup>1)</sup> With version ../O.. (A, C, and D): horizontal

<sup>2)</sup> Performance limits dependent on the minimum control pressure, see datasheet

<sup>3)</sup> Suitable for NBR **and** FPM seals

<sup>4)</sup> **Only** suitable for FKM seals

**Extracted from RA 22 331/06.98**

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

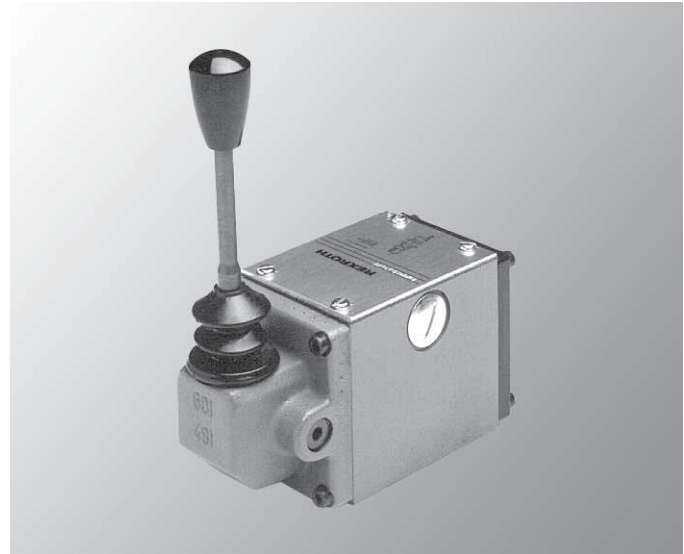
**4/3-, 4/2- and 3/2-way Directional valves  
Manual or hydraulic operated  
Models WMM, WMD, WP, WN, or WHD**

Size 10, Series 3X

Maximum operating pressure 315 bar (4600 PSI)

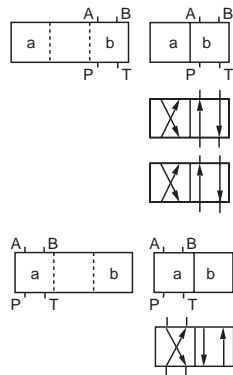
Maximum flow 120 L/min (32 GPM)

- Direct operated spool type directional control valves
- Mounts on standard ISO 4401-5, NFPA T3.5.1M R1 and ANSI B 93.7 D 05 interface
- For subplates, see data sheet RA 45 054
- Available operator options: Hand lever or hydraulic pilot

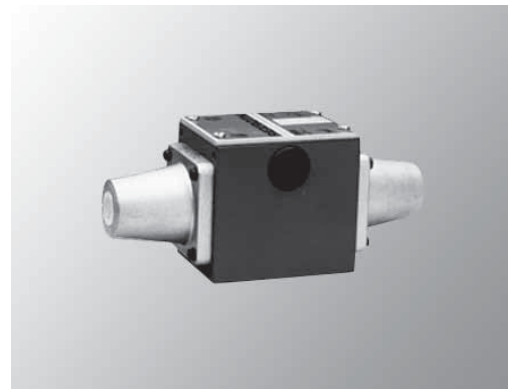


Manual operation

**Symbols**



<sup>3)</sup> **Note:** When ordering a spool with only two positions "o" & "a" or "o & b", specify the desired position a or b after the spool code.  
Example: Spool E with spool position "a"  
Ordering Code **4 WMM10EA-3X**



Pilot fluid operation

**Ordering code**

		<b>10</b>	<b>3X</b>	/	/	/	*
4 service ports	= 4						
Hand lever	= <b>WMM</b>						
Rotary hand knob	= <b>WMD</b>						
Pneumatic piloted							
1.5 to 6 bar (22 to 87 PSI)	= <b>WN</b>						
4.5 to 12 bar (65 to 175 PSI)	= <b>WP</b>						
Hydraulic operated	= <b>WHD</b>						
ISO size 5, NFPA/ANSI D 05 interface	= <b>10</b>						
Spool type ex. <b>C, D, E, G, H, J, Y</b> for possible spool configurations, see above							
Valves with both operators (3-position spool)	= <b>no desig.</b>						
MM, WHD model with 3-position spools and							
Operator "a" side only	= <b>A</b>						
Operator "b" side only	= <b>B</b>						
						<b>12</b> =	Further details to be written in clear text
						<b>no code</b> =	SAE threaded connections (WHD only)
						<b>no code</b> =	NBR seals for petroleum oils (HM, HL, HLP)
						<b>no code</b> =	without orifice insert
						<b>no code</b> =	with spring return
						<b>F</b> =	with detent
						<b>OF</b> =	without spring return, with detent
			<b>3X</b> =				Series 30 to 39 (30 to 39; externally interchangeable)

**Extracted from RA 22 331/06.98**Page 2 of 2  
Issue: 01.01See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Technical data****Hydraulic**

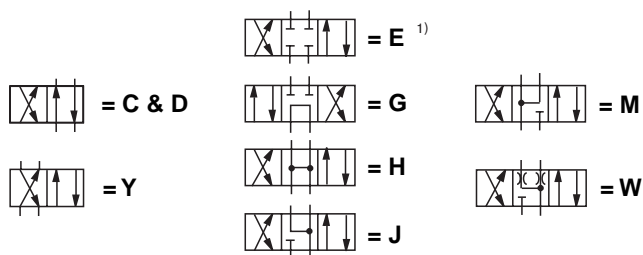
Maximum operating pressure	Ports A, B, P	bar (PSI)	315 (4600)
	Port T	bar (PSI)	160 (2320) (For spool types A and B, port T must be use a drain port, if the operating pressure exceeds 160 bar (2320 PSI))
Maximum flow		L/min (GPM)	120 (32)
Hydraulic fluids			Petroleum oils (HM, HL, HLP) Phosphate ester fluids (HFD-R)
Fluid temperature range		°C (°F)	NBR seals: -30 to +80 (-22 to +176) FPM seals: -20 to +80 (-4 to +176)
Viscosity range		mm <sup>2</sup> /s (SUS)	2.8 to 500 (35 to 2320)
Maximum degree of fluid contamination			Class 18/15 according to ISO 4406. Therefore, we recommend a filter with a retention rate of $\beta_{10} \geq 75$ .



**Extracted from RA 23 178/08.99**

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 Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Symbols**

<sup>1)</sup> Example: Spool E with switching position "a"  
 Order code 4 WE6 EA•6X/EW 110 NK4

Caution: Be aware of pressure intensification in differential cylinders

**Technical data**
**General**

Installation position				Optional
Weight	Single solenoid valve	<i>m</i>	kg (lbs.)	1.45 (3.2)
	Valve with 2 solenoids	<i>m</i>	kg (lbs.)	1.95 (4.3)

**Hydraulic**

Operating pressure	Port A, B, P	$p$	bar (PSI)	350 (5100)
	Port T	$p$	bar (PSI)	up to 210 (3050) DC, up to 160 (2320) AC Where symbols A and B occur, port T must be employed as a drain port if the operating pressure is above the permitted tank pressure .
Flow, max.		$q_v$	L/min (GPM)	up to 80 (21) DC, up to 60 (15.8) AC

**Electrical**

Type of voltage				DC voltage	AC voltage
Available voltages	<i>V</i>	V		<b>12, 24, 96</b>	<b>110, 230</b> 50/60 Hz
Power consumption	<i>P</i>	W		30	–
Holding current	<i>P</i>	VA		–	50
In-rush current	<i>P</i>	VA		–	220
Duty cycle				continuous	continuous
Shifting time to ISO 6403	ON	<i>T</i>	ms	25 to 45	10 to 20
	OFF	<i>T</i>	ms	10 to 25	15 to 40
Shifting frequency			Sw/h	up to 15000	up to 7200
Insulation				Exceeds NEMA class B	Exceeds NEMA class B
Coil temperature	<i>t</i>	°C (°F)		up to 150 (302)	up to 180 (356)

**Extracted from RA 23 327/07.98**

 Page 1 of 2  
 Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

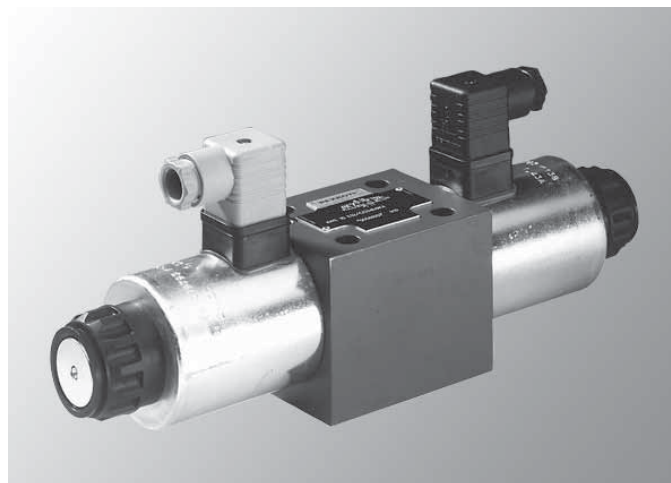
**4/3-, 4/2- and 3/2-way Directional control  
 valves with wet pin AC or DC solenoids  
 Model WE 10.. /C**

 Nominal Size 10, Series 3X (DIN spade to 43650)  
 Series 4X (conduit box)

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 120 L/min (32 GPM)

- Direct solenoid actuated directional spool valve in the standard version
- Mounting pattern to ISO 4401-5, NFFA T3.5.1 M R1 and ANSI B93.7 D 05 interface
- Subplates, see datasheet RA 45 054 (separate order)
- Wet pin AC or DC solenoids with removable coil
- Solenoid coil can be rotated through 90°
- Coils may be replaced without engaging fluid ports



Model 4WE 10 E3X/CG24N9K4 with plug-in connector

- Electrical connections available as either individual spade connections or as a conduit box connection
- Manual override, standard
- For soft switching version, see RA 23 183
- High flow body and spool design

**Technical data**
**General**

Installation	optional			
Weight			Central connection	Individual connection
	Valve with 1 solenoid	kg (lbs.)	DC 4.4 (9.7), AC 3.6 (7.93)	DC 4.3 (9.48), AC 3.5 (7.71)
	Valve with 2 solenoids	kg (lbs.)	DC 6.0 (13.2), AC 4.4 (9.7)	DC 5.9 (13), AC 4.3 (9.48)

**Hydraulic data**

Max. operating pressure	Ports A, B, P	bar (PSI)	315 (4600)
	Port T	bar (PSI)	DC 210 (3050), AC 160 (2320). For symbols A and B, Port T must be used as a drain line if the operating pressure is higher than the permissible tank pressure.
Max. flow		L/min (GPM)	120 (32)

**Electrical data**

Voltage model		DC	AC
Available voltages	V	<b>12, 24, 96</b>	<b>110, 230</b> 50/60 Hz
Voltage tolerance (nominal voltage)	%	±10	
Power consumption	W	35	–
Holding power	VA	–	90
Inrush current	VA	–	550
Duty	continuous		
Switching time to ISO 6403	ON	ms	45 to 60
	OFF	ms	20 to 30
Switching frequency		cycles/h	15,000
Protection to DIN 40 050	IP 65		
Insulation class VDE 0580			F H

### Extracted from RA 23 327/07.98

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Ordering code

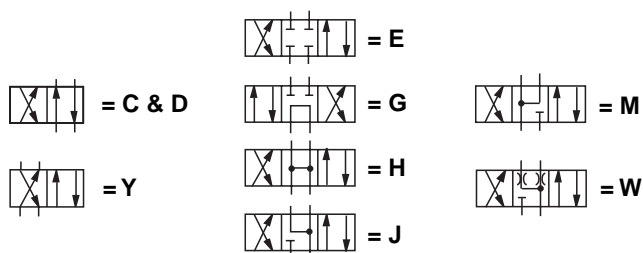
	2	3	4	6	7	9	10	11	12	15	16	19	22	23
		WE	10			/	C		N9			/		*
3 service ports	= 3													
4 service ports	= 4													
Directional control valve, electrically operated														
ISO Size 5, NFPA/ANSI D 05 interface			= 10											
Spool symbol e.g. <b>E, G, H, J, M, W</b> etc.														
Series 30 to 39 – spade connection (30 to 39: externally interchangeable)					= 3X									
Series 40 to 49 – conduit box connection (40 to 49: externally interchangeable)					= 4X									
<b>With</b> spring return					= No code									
<b>Without</b> spring return, with detent					= OF									
Wet pin solenoid (oil immersed) with removable coil							= C							
<b>Voltages</b>														
DC – 12, 24, 96					Example		= G 24							
AC <sup>1)</sup> – 110, 220					Example		= W110							
<b>With manual override (standard)</b>									= N9					
<b>Central solenoid connections</b>														
1/2" NPT conduit connector in conduit box										= DA				
1/2" NPT conduit connector in conduit box with light(s)										= DAL				
<b>ANSI B 93.55 M plug-in type connections</b> (without female end)														
Terminal box with 3-pin connector (single solenoid)										= DK23				
Terminal box with 5-pin connector (double solenoid)										= DK25				
Terminal box with 3-pin connector and lights (single solenoid)										= DK23L				
Terminal box with 5-pin connector and lights (double solenoid)										= DK25L				
Terminal box with 4-pin connector, lights, and surge suppression										= DK24L2				
<b>Individual solenoid plug connections</b>														
Without plug in connector(s)										= K4				
NBR seals											= No code			
FPM seals											= V			
<b>⚠ Attention!</b> The compatibility of the seals and fluid must be taken into account!														
Further details in clear text														

<sup>1)</sup> AC Voltage and Frequency

110 = 110V–50Hz, 110V–60Hz, 120V–60Hz

230 = 220V–50Hz, 220V–60Hz, 240V–60Hz

### Symbols



## Extracted from RA 23 351/09.99

Page 1 of 2  
Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## 4/3-, 4/2- and 3/2-way Directional valves with switching time adjustment Model 5-.WE 10

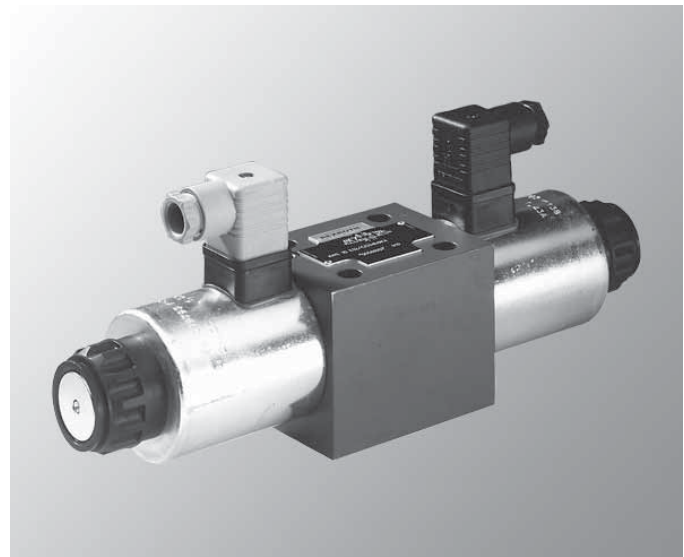
Nominal Size 10

Series 3X

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 120 L/min (32 GPM)

- Direct solenoid operated spool type directional control valve
  - With “5th chamber” for dampened adjustable spool shifting time
  - Mounts on standard ISO 4401-5, NFPA/ANSI T3.5.1 M R1 **D 05**, and ANSI B93.7 **D 05** interface
- Subplates, see datasheet RA 45 054 (separate order)
- Wet pin DC solenoids
  - Removable coils for quick replacement



Model 5-.WE 10 E3X/CG24N9K4 with plug-in connector

## Ordering code

	1	2	3	4	6	7	9	10	11	12	15	18	19	22	23	
	5	-	WE	10		3X	/	C		N9	K4	/			*	
4 actuator ports	= 4															
Nominal size 10			= 10													
Symbol e.g. C, D, E, G, H, J																
Series 30 to 39 (30 to 39: unchanged installation and connection dimensions)					= 3X											
With spring return					= No code											
Wet pin solenoid (oil immersed) with removable coil							= C									
24 V DC								= G24								
96 V DC								= G96								
With protected manual override (standard)									= N9							
Model of electrical connection Individual connection; with component plug DIN 43 650-AM2, without plug-in connector										= K4						
Without switching time adjustment										= No code						
With adjustable screw (throttle)										= C						
Orifice Ø 0.8 mm (0.031"), 1.0 mm (0.039"), 1.2 mm (0.047")										= A08, A10, A12						
Without cartridge throttle										= No code						
NBR seals														= No code		
⚠ Attention! The compatibility of the seals and pressure fluid has to be taken into account!																
Further details to be written in clear text																



**Extracted from RA 23 351/09.99**

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Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Installation	optional		
Max. ambient temperature	°C (°F)	50 (122)	
Weight	Valve with 1 solenoid	kg (lbs.)	4.7 (10.4)
	Valve with 2 solenoids	kg (lbs.)	6.3 (13.9)

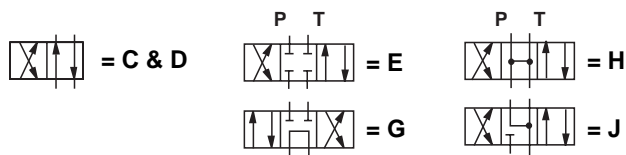
**Hydraulic data**

Max. operating pressure	Ports A, B, P	bar (PSI)	315 (4600)
	Port T	bar (PSI)	210 (3050)
Max. flow	L/min (GPM)		120 (32)
Pressure fluid	Mineral oil (HL, HLP) to DIN 51 524 <sup>1)</sup> ; Fast bio-degradable pressure fluids to VDMA 24 568 (also see RA 90 221); HETG (rape seed oil) <sup>1)</sup>		
Pressure fluid temperature range	°C (°F)		NBR seals: -30 to +80 (-22 to +176)
			FPM seals: -20 to +80 (-4 to +176)
Viscosity range	mm <sup>2</sup> /s (SUS)		35 to 2318
Degree of contamination	Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We, therefore, recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .		

**Electrical data**

Model of voltage	DC		
Available voltages	V	<b>24, 96</b>	
Voltage tolerance (nominal voltage)	%	±10	
Power consumption	W	35	
Duty	continuous		
Switching time to ISO 6403 (without switching time adjustment)	ON	ms	45 to 70
	OFF	ms	35 to 45
Switching frequency	cycles/h		15000
Protection to DIN 40 050	IP 65		
Insulation class VDE 0580	F		
Max. coil temperature	°C (°F)		150 (302)

<sup>1)</sup> suitable for NBR and FPM seals

**Symbols**


**Extracted from RA 23 183/08.99**

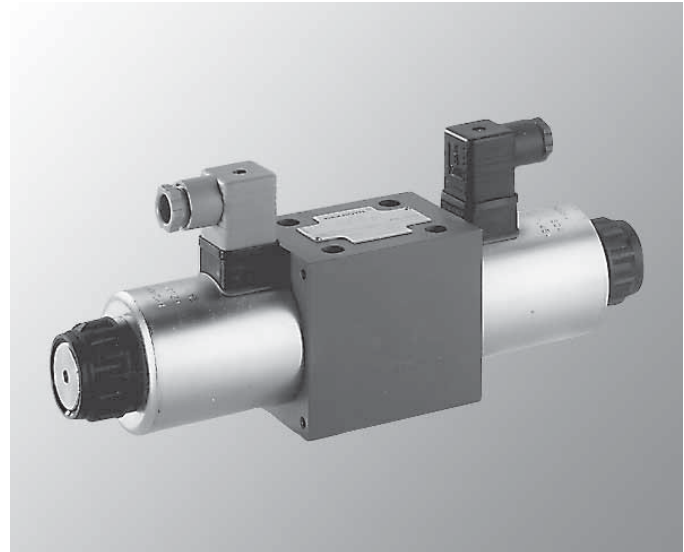
Page 1 of 2  
Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Soft switching 4/2- and 4/3-way  
Directional valves with DC solenoids,  
Model WE...73-../A12..**

Nominal Sizes 6 and 10  
Series 6X (Size 6) and 3X (Size 10)  
Maximum operating pressure  
350/315 bar (5100/4600 PSI)  
Maximum flow 60/100 L/min (15.85/26.42 GPM)

- Direct operated directional spool valve with solenoid operation
- Soft switching characteristics
- Porting pattern to DIN 24 340 form A, ISO 4401 and CETOP-**RP 121 H**  
Mounts on standard ISO 4401, NFPA T3.5.1 M R1 and ANSI B 93.7 D interfaces  
For subplates see catalog sheets RA 45 052 (size 6), and RA 45 054 (size 10), separate order
- Wet pin solenoids with removable coils
- Coils can be replaced without engaging fluid
- Individual electrical connections
- With manual override



Model 4WE 10 E73-3X/CG24N9K4/A12 with plug-in connector

**Ordering code**

	2	3	4	6	7	9	10	11	12	15	18	19	22	23
		WE			- /					N9	K4 / A12			*
4 service ports	= 4													
Nominal size 6		= 6												
Nominal size 10		= 10												
Spool symbols e.g. D73, E73, G73, J73														
Size 6 Series 60 to 69 (60 to 69: unchanged installation and connection dimensions)														= 6X
Size 10 Series 30 to 39 (30 to 39: unchanged installation and connection dimensions)														= 3X
Spring return														= No code
Nominal size 6														= E
Nominal size 10														= C
<b>Voltages</b> DC - 12, 24, 96														<b>Example</b> = 24

Further details in clear text

No code = NBR seals  
V = FPM seals

**⚠ Attention!**  
The compatibility of the seals and pressure fluid has to be taken into account!

A12 = Switching time delay

K4 = Electrical connection types  
Single connection; with cover, without plug-in connector

N9 = With concealed manual override

**Extracted from RA 23 183/08.99**Page 2 of 2  
Issue: 01.01See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Technical data****General**

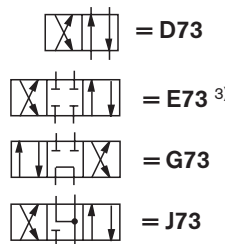
Nominal size	Size		6	10
Installation position			optional	
Weight	– Single solenoid valve	kg (lbs.)	1.45 (3.2)	4.5 (9.918)
	– Valve with 2 solenoids	kg (lbs.)	1.95 (4.3)	6.1 (13.44)

**Hydraulic**

Max. operating pressure	Ports A, B, P	bar (PSI)	350 (5076)	315 (4600)
	Ports T	bar (PSI)	210 (3050)	210 (3050)

**Electrical**

Available voltages	V	12, 24, 96	12, 24, 96
Voltage tolerance (nominal voltage)	%	±10	±10
Power consumption	W	30	35
Duty cycle		continuous	
Switching time t <sub>S</sub> to ISO 6403	ON/OFF	approx. 3 to 4 times longer than a standard valve	
Switching frequency	1/h	7200	7200
Protection to DIN 40 050		IP 65	IP 65
Insulation class VDE 0580		F	F

**Symbols**

<sup>3)</sup> **Example:** Spool E73 with switching position "a"  
ordering details **..E73A..**

## Extracted from RA 24 751/06.98

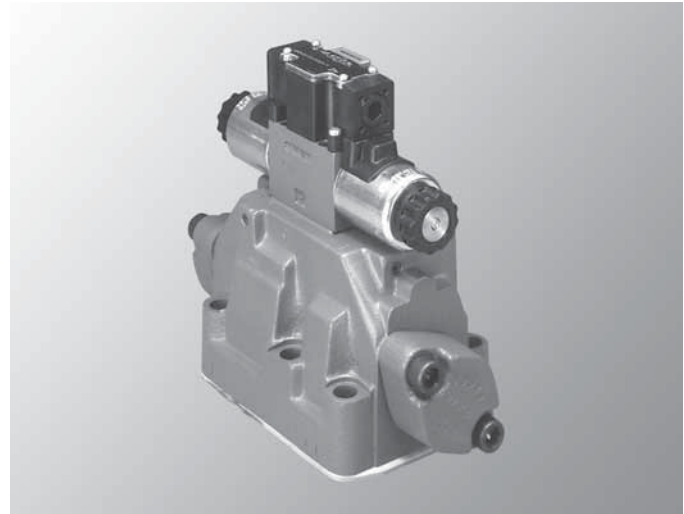
Page 1 of 2  
Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## 4/2- and 4/3-way Directional valves, Pilot operated, Model 4 WEH... Externally pilot operated, Model 4 WH ...

Sizes 10 to 32, Series 4X, 6X, 7X  
Maximum pressure up to 350 bar (5100 PSI)  
Maximum volume up to 1100 L/min (290 GPM)

- Solenoid pilot operated directional valves (WEH)
- Hydraulic pilot operated directional valves (WH)
- Mounts on standard ISO 4401-5, 7, 8, or 10, NFPA T 3.5.1 M R1 and ANSI B 93.7 D 05, D 07, D 08, or D10 interfaces
- For subplates, see data sheets RA 45 045 ... RA 45 060, may be ordered separately
- 3-position spring centered (sizes 10 to 32)
- 3-position spring or hydraulic centering (sizes 16, 25 and 32)
- 2-position hydraulic or spring offset (sizes 10 to 32)
- Wet pin AC or DC solenoids as required
- Manual overrides standard (WEH)



Model 4WEH 22 E 7X/..6EG..N9..DA.. with plug-in connector

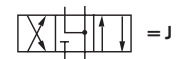
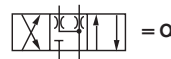
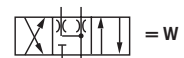
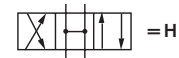
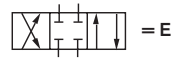
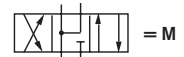
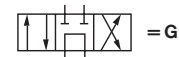
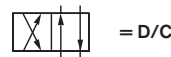
- Individual solenoid plug-in connectors or central wiring box, see datasheet RA 08 006
- Optional meter-in or meter-out pilot choke option
- "P" port pilot pressure insert (sizes 16 to 32), for open center spools

### Technical data

Sizes (ordering code)		10	16	22	25	32		
<b>Operating pressure, max.</b>								
– Port P, A, B	Model 4WEH	bar (PSI)	280 (4060)	280 (4060)	280 (4060)	–	280 (4060)	
	Model H-4WEH	bar (PSI)	350 (5100)	350 (5100)	350 (5100)	350 (5100)	350 (5100)	
– Port T	Pilot oil drain Y external	bar (PSI)	315 (4600)	250 (3625)	250 (3625)	250 (3625)	250 (3625)	
	Pilot oil drain Y internal	bar (PSI)	3046 DC					
		bar (PSI)	2321 AC					
– Port Y	Pilot oil drain external:	bar (PSI)	3046 DC, 2321 AC					
	with version 4WH	bar (PSI)	250 (3625)	250 (3625)	210 (3050)	250 (3625)	250 (3625)	
<b>Pilot pressure, max.</b>		bar (PSI)	250 (3625)	250 (3625)	210 (3050)	250 (3625)	250 (3625)	
(With higher pilot pressures, a pressure reducing valve is required.)								
<b>Pilot pressure, min.</b>								
– Pilot oil supply X external, pilot oil supply X internal			H-4W..	4W..				
	(not with spools: C, G, H)			12.5 (180)	10.5 (150)			
	3-position valve, spring-centered	bar (PSI)	10 (145)	14 (205)	–	13 (190)	8.5 (125)	
	3-position valve, pressure-centered	bar (PSI)	–	14 (205)	–	18 (260)	8.5 (125)	
	2-position valve, with spring offset	bar (PSI)	10 (145)	14 (205)	14 (205)	11 (160)	13 (190)	10 (145)
	2-position valve, with hydraulic offset	bar (PSI)	7 (100)	14 (205)	8 (115)	8 (115)	5 (72)	
– Internally piloted (with spools C, F, G, H, P, T, V, Z, S)		bar (PSI)	4.5 (65)	4.5 (65)	4.5 (65)	4.5 (65)	4.5 (65)	

### Symbols (to ISO 1219)

- 4WEH.. EA.xx/... = 2-position main valve with single solenoid pilot  
 4WEH.. HD.xx/OF... = 2-position main valve with detented pilot,  
 main stage hydraulically offset  
 4WEH.. D.xx/OF... = 2-position main valve with detented pilot,  
 main stage spring offset  
 4WEH.. D.xx/... = 2-position main valve with single solenoid pilot,  
 main stage spring offset





**Extracted from RA 23 193/09.99**

Page 1 of 2  
Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**4/2- and 4/3-way Isolating valves  
Model Z4WE 6**

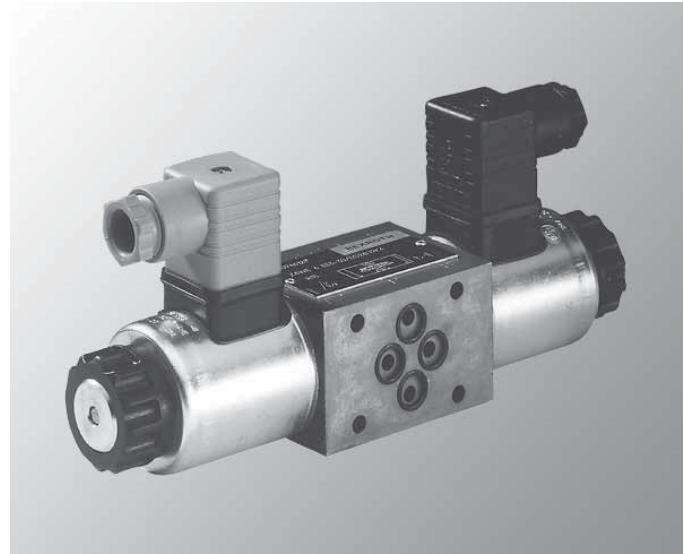
Nominal Size 6

Series 3X

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 40 L/min (10.6 GPM)

- Direct solenoid actuated directional spool valve
- Sandwich plate valve
- For use as an isolator/free-flow valve or as a  
isolator/free-flow/short circuit valve
- Free-flow through ports P and T in all spool positions
- Porting pattern to DIN 24 340 form A,  
ISO 4401 and CETOP-RP 121 H,
- Wet pin AC or DC solenoids
- Manual override



Model Z4WE 6 E53-3X/EG24N9K4 with plug-in connector

**Ordering code**

<b>Z4WE</b>	<b>6</b>	<b>- 3X / E</b>	<b>K4</b>	<b>*</b>
Nominal size 6 E68, E63, ...	= 6			Further details in clear text
Series 30 to 39 (30 to 39: externally interchangeable)	= 3X			No code = NBR seals
High performance solenoid (wet pin)	= E			<b>K4 = Electrical connection</b> Individual connection; with component plug DIN 43 650-AM2, without plug-in connector
<b>Voltages</b> DC - 12, 24, 96 AC <sup>1)</sup> - 110, 230	Example = G 24 Example = W110			
With protected manual override (standard)		= N9		

<sup>1)</sup> AC Voltage and Frequency

110 = 110V-50Hz, 110V-60Hz, 120V-60Hz  
230 = 220V-50Hz, 220V-60Hz, 240V-60Hz

**Extracted from RA 23 193/09.99**

Page 2 of 2

Issue: 01.01

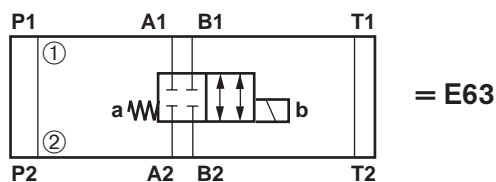
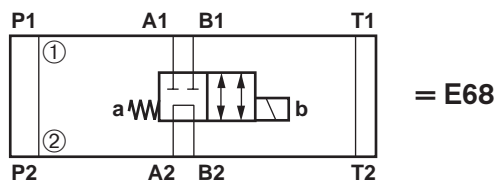
 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Weight	Valve with 1 solenoid	kg (lbs.)	1.2 (2.65)
	Valve with 2 solenoids	kg (lbs.)	1.6 (3.53)
Installation	optional		
<b>Hydraulic data</b>			
Max. operating pressure	Ports P, A, B	bar (PSI)	315 (4600)
	Port T	bar (PSI)	210 (3050) for DC voltages; 160 (2320) for AC voltages

**Electrical data**

Power consumption (DC)		W	30
Holding power (AC)		VA	50
Inrush current (AC)		VA	220
Voltage tolerance (nominal voltage)		%	±10
Duty	continuous		
Switching time	ON	ms	20 to 45 for DC voltages, 10 to 20 for AC voltages
	OFF	ms	10 to 25 for DC voltages, 15 to 40 for AC voltages
Switching frequency		1/h	up to 15000 for DC voltages; up to 7200 for AC voltages
Protection to DIN 40 050	IP 65		

**Symbols** (Codes: ① = valve side: ② = manifold side)






**Extracted from RA 24 753/06.98**

Page 2 of 2

Issue: 04.03

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Technical data**

**General**

Weight (approx.)			
– Electrical operation	Valve with one solenoid	kg (lbs.)	4.2 (9.2)
	Valve with two solenoids	kg (lbs.)	4.6 (10.1)
Mounting position			Optional

**Hydraulic**

Maximum operating pressure			
– Ports A and B		bar (PSI)	315 (4600)
– Port P	with internal pilot	bar (PSI)	210 (3100)
– Port T	(only internal pilot fluid possible)		
	with DC solenoid	bar (PSI)	160 (2320)
	with AC solenoid	bar (PSI)	100 (1450)

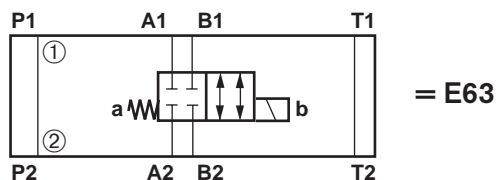
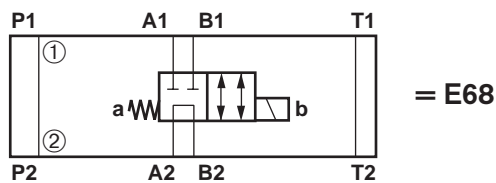
Operating time "ON" (From energizing the pilot valve to the start of the opening of the spool in the main valve)

– at a pilot pressure of	bar (PSI)	~ 70 (1000) =	~ 140 (2000) =	~ 210 (3100) =
– 2- and 3-position valves	ms	30	65	25    60    20    55

Operating time "OFF" (spring operation)

– 2- and 3-position valves	ms	30
----------------------------	----	----

**Symbols (Codes: ① = valve side: ② = manifold side)**



**Extracted from RA 21 010/05.99**

Page 1 of 2  
Issue: 04.03

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**2-way Cartridge valves –  
Directional function  
Cartridge valves, Model LC...  
Control covers, Model LFA...**

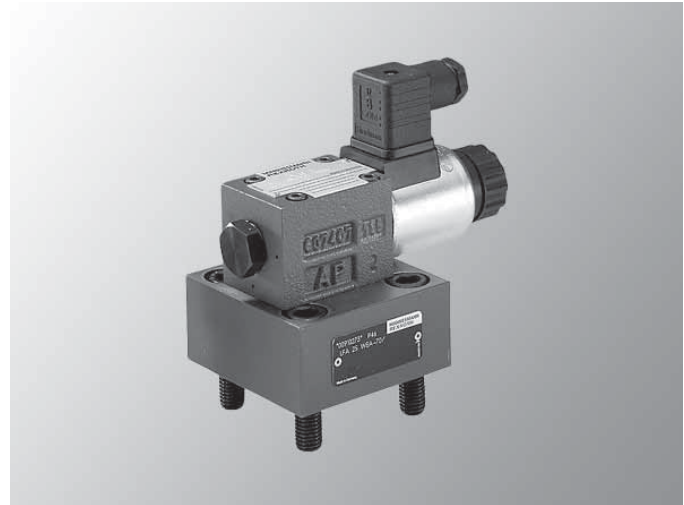
Nominal Size 16 to 50

Series 7X

Maximum operating pressure 420 bar (6100 PSI)

Maximum flow 2500 L/min (660 GPM)

- Valve poppet with or without damping nose
- 2 area ratios
- 4 spring rates
- Stroke limiter option
- Control cover for mounting directional spool valves with or without built-in shuttle valve
- Control cover for mounting directional poppet valves with or without built-in shuttle valve



Control cover model LFA 25 WEA7X/... with directional valve 4WE 6 D6X/EG24N9K4 and plug-in connector



Cartridge valve model LC 25 A40E7X/...

**Ordering code**

		<b>LC</b>						<b>7X /</b>	
Nom. size 16	] (series 7X)	= 16						No code =	NBR seals
Nom. size 25		= 25						7X =	Series 70 to 79
Nom. size 32		= 32							(70 to 79: unchanged installation and connection dimensions)
Nom. size 40		= 40						E =	Valve poppet without damping nose
Nom. size 50		= 50						D =	Valve poppet with damping nose
Area ratio 2:1 (annulus area = 50%)		= A							
Area ratio 14.3:1 (annulus area = 7%)		= B							
Cracking pressure approx. 0.5 bar (7.25 PSI)									= 05
Cracking pressure approx. 1.0 bar (14.5 PSI)									= 10
Cracking pressure approx. 2.0 bar (29.0 PSI)									= 20
Cracking pressure approx. 4.0 bar (58.0 PSI)									= 40

**Extracted from RA 21 010/05.99**

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Issue: 04.03

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Technical data**

Max. operating pressure	- Without directional valve	bar (PSI)	6100
	- Ports A, B, X, Z1, Z2	bar (PSI)	315 (4600); 350 (5100); 420 (6100) (dependent on the pilot valve)
	- Port Y	bar (PSI)	Corresponds to the tank pressure of the pilot valve

**General notes on the ordering code  
for control covers**

1					2					3					4					9				
LFA																								
Nominal size					Model					Series					Remote control port					Seal Material				
16	25	32	40	50																				
x	x	x	x	x											7X									
x	x	x	x	x	D															F				
x	x	x	x		H2															F				
x	x	x	x	x	WEA																			
	x	x	x	x	WEB																			
	x				WEMA																			
x	x	x	x		GWA																			
x	x	x	x	x	KWA																			

Ordering details can be found on the pages covering the individual control cover variations

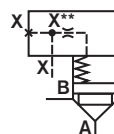
x = available

**Symbols, cartridge valves**

**LFA . D-./F...**

Control cover with remote control port

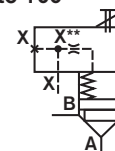
Size 16 to 160



**LFA . H2-./F...**

Control cover with stroke limiter, with remote control port

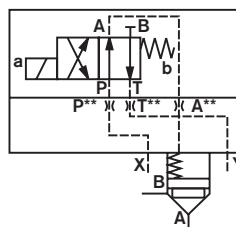
Size 16 to 160



**LFA . WEA-./...**

Control cover for mounting a directional spool or poppet valve

Size 16 to 160

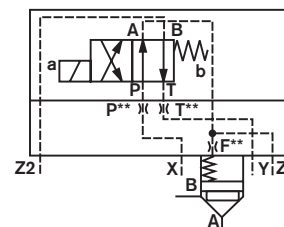


**LFA . WEMA-7X/...;**

**LFA . WEA8-6X/...**

Control cover for mounting a directional spool or poppet valve with control port for switching a 2nd valve

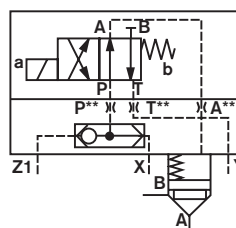
Size 16 to 100



**LFA . GWA-./...**

Control cover for mounting a directional spool or poppet valve, with built-in shuttle valve

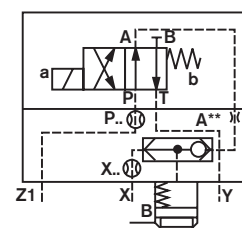
Size 16 to 100



**LFA . KWA-./...**

Control cover for mounting a directional spool or poppet valve, with built-in shuttle valve as a check valve circuit

Size 16 to 100



**Extracted from RA 21 050/06.98**

Page 1 of 2  
Issue: 04.03

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**2-way Cartridge valves – Pressure function  
Cartridge valves, Model LC...  
Control covers, Model LFA...**

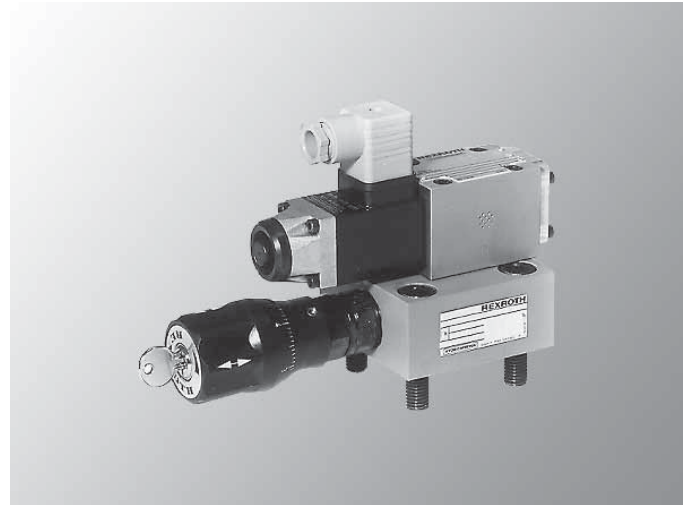
Sizes 16 to 50

Series 7X

Maximum operating pressure 420 bar (6100 PSI)

Maximum flow 2000 L/min (528 GPM)

- Valve poppet with or without dampening function
- 2 spring rates
- Stroke limiter option
- Control cover with integral relief (DB)
- Control cover with integral relief and poppet or spool valve unloading (DBW)



Control cover with manual pressure adjustment model LFA .. DBW ...



Cartridge valve model LC ..DB...-7X/...

**Ordering code**

	LC		DB			7X /	
<b>Sizes 16 ... 100</b>							
Size 16	= 16						No code = NBR seals
Size 25	= 25						7X = Sizes 16 to 50 Series 70 to 79 (70 to 79: unchanged installation and connection dimensions)
Size 32 (series 7X)	= 32						
Size 40	= 40						E = Poppet valve D = Poppet spool valve Standard model
Size 50	= 50						
Cracking pressure 2.0 bar (29 PSI)			= 20				
Cracking pressure 4.0 bar (58 PSI)			= 40				

**Extracted from RA 21 050/06.98**

Page 2 of 2  
Issue: 04.03

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Technical data**

**2-way cartridge valve**

Max. operating pressure at ports A and B		bar (PSI)	Up to 420 (6100)				
Nominal size			16	25	32	40	50
Max. flow (recommendation)		L/min (GPM)	300 (79.3)	450 (118.9)	600 (158.5)	1000 (264.2)	1600 (422.7)
Poppet valve insert	LC..DB..E../..						
Spool valve insert	LC..DB..D../..	L/min (GPM)	175 (46.2)	300 (79.3)	450 (118.9)	700 (184.5)	1400 (369.8)

**General notes on the ordering code  
for control covers**

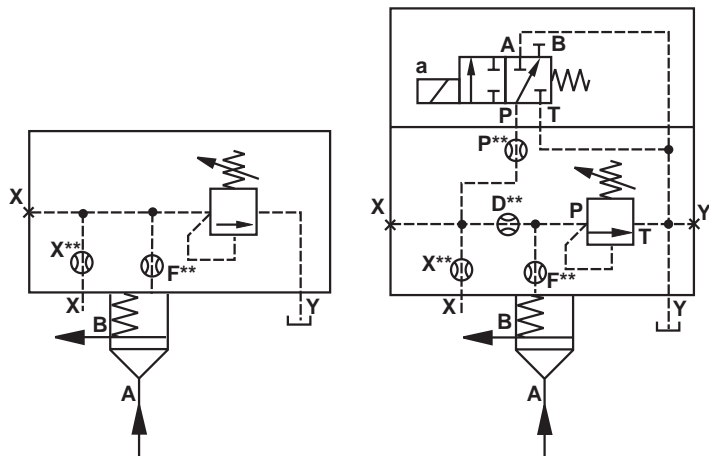
1					2					3					4					5				
LFA																								
Nominal size					Model					Control Model					Series					Seal Material				
16	25	32	40	50	Model	Control Model					Series					Seal Material								
x	x	x	x	x							7X													
x	x	x	x		DB																			
x	x	x	x	x	DBW																			

x = available

**Symbols**

**LFA..DB.-../..**  
Size 16 to 50

**LFA..DBW.-../..**  
Size 16 to 50



## Notes

## Section 4

# Mobile Controls

### The Drive & Control Company

- Electronic remote control for the actuation of hydraulic axis – 4THES5, THEC5, THE5..... 182
- Pilot control devise in pedal design for the remote control of directional valves, pumps and motors – 2TH6R ..... 184
- Hydraulic pilot control unit of sandwich plate design for the remote control of directional valves, pumps and motors – 2TH6..... 186
- Hydraulic pilot control units for armrest installation – 4TH6, 4TH6N, 4TH5..... 188
- Load sensing control block, Sandwich plate design – M4-12..... 190
- High pressure load sensing control block, Sandwich plate design – M4-15..... 194
- High pressure load sensing control block, Sandwich plate design – M4-22..... 198
- Load sensing control block, Sandwich plate design – SP-08 ..... 202

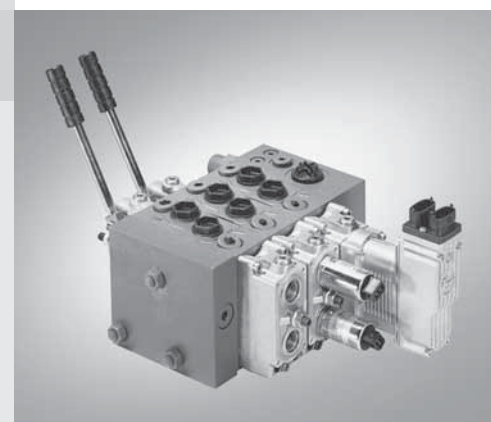
### Bosch Rexroth Oil Control

- Heavy duty priority flow controls, 3-way flow regulator with pressure compensated and solenoid controlled priority flow for standard and two pump systems – A-VRFC3C-VEI-VS ..... 206
- Flow diverters
  - 6 ways flow diverter – VS 311/312/315..... 212
  - 6 ways bankable flow diverters – VS 281/5/6F..... 214

For a complete copy of the data sheets in this catalog, visit our website at:

[www.boschrexroth-us.com](http://www.boschrexroth-us.com)

- ▶ Products and Solutions
  - ▶ Industrial Hydraulics
    - ▶ Products and Catalogs
      - ▶ Preferred Product Catalog



**Extracted from RA 29 881/06.03**

 Page 1 of 2  
 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Electronic remote control for the  
 actuation of hydraulic axis  
 Model 4THES5, THEC5, THE5**
**Series 1X**

- Specially designed for mobile machines
- Types available : Signal, CAN, Power PWM
- High mechanical robustness of hydraulic remote control components
- Large selection of ergonomic grips with various E-contacts
- Actuator ergonomics comparable with hydraulic remote controls
- Metallic electronic box


**Functional description**
**Design**

Remote controls type THE5 are mainly composed of a control lever (1), a fixation body (2) and a box (3) containing the sensors and electronic cards.

**General**

All types of THE5 remote controls have similar mechanics and ergonomics. Their main differences are the integrated electronic functions and the type of output signals.

- The remote control 4THES5 Signal needs external regulated power supplies for its sensors. It generates an analog voltage command value (V).
- The CAN bus type THEC5 works in a similar manner. It periodically generates a frame on CAN bus.

Both types of remote controls generate only low power signals. The actuation of an electrohydraulic axis requires a further external electronic power interface.

- The remote control THE5 Power PWM gives stabilized currents for the direct operation of electrohydraulic proportional pressure reducing valves. The analog Power outputs are pulse-width-modulated (PWM).

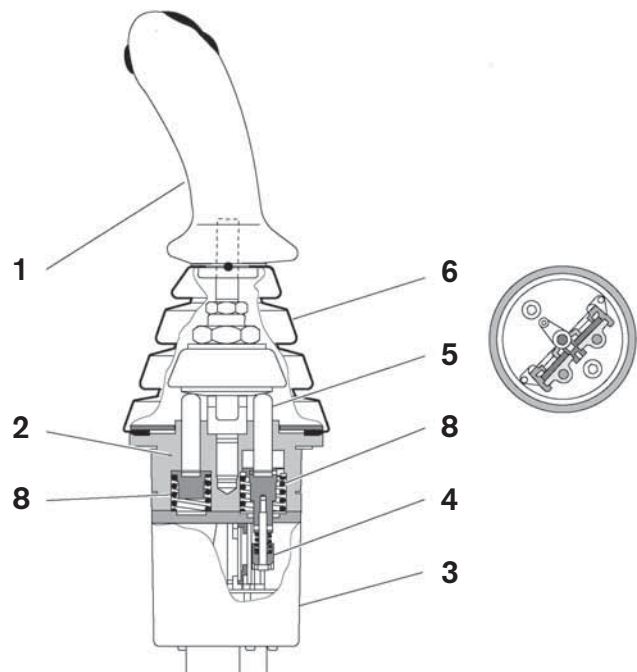
Remote controls THE5 fitted with microcontrollers (CAN bus and Power PWM) communicate with the PC through a serial interfaces RS232. CAN bus interfaces enable command values to be sent to further systems, such as Brueninghaus Hydromatik MC microcontrollers.

**Function principle**

When not actuated the control lever is held in the neutral position by the 4 return springs (8).

With deflection of control lever (1) plunger (5) pushes against return spring (8). A position sensor is allocated to each actuation axis. Slider (4) of the sensor fixed on plunger (5) moves upward or downward while following the lever actuation direction. The command value generated by the sensor is proportional to lever deflection.

A rubber grommet (6) protects the mechanical components of the housing from contamination.





**Extracted from RA 29 881/06.03**

Page 2 of 2

Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Ordering code**

THE		5	-1X/							*
-----	--	---	------	--	--	--	--	--	--	---

**Remote control :**
2 axis controlled by the remote control electronic **4<sup>2)</sup>**3 axis controlled by the remote control electronic **6<sup>1)</sup>**4 axis controlled by the remote control electronic **8<sup>1)</sup>**
**Type :**

Signal

**S<sup>2)</sup>**

Can bus

**C**

Power PWM

**no code**
**Grip range:**

Ergonomic EC2000

**E**

Ergonomic EC4000

**H**

Customer's

**no code**

No grip

**Z**
**Ergonomic grip types :**

Grip type E

**TT, ST, VT, YT, YU**

Grip type H

see EC4000 datasheet : RE 64562

**Ergonomic grip orientation :**

lever straight and grip in the direction of control port 1 –

**03**

lever curved by 15° in the direction of control port 2 –

and grip in the direction of control port 1 –

(pilot control unit for the left hand)

**43**

lever curved by 15° in the direction of control port 2 +

and grip in the direction of control port 1 –

(pilot control unit for the right hand)

**23**
**Plugs for ergonomic wiring :**

DEUTSCH sealed plug IP 67

**5**

Plug AMP MAT-N-LOK

**6**

Without plug

**no code**
<sup>1)</sup> Remote controls CAN and Power PWM

<sup>2)</sup> Designate the Signal remote control with 2 axis maximum because the additional axis provided by grips EC4000 are not controlled by the remote control electronic.

**Extracted from RE 64 551/05.03**

Page 1 of 2  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Pilot control device in pedal design for  
the remote control of directional  
valves, pumps and motors  
Model 2TH6R****Series 1X**

- Progressive, sensitive operation
- Precise control
- Working ports underneath
- Control elements protected by rubber sleeve
- Plungers made of stainless steel, plunger guides made of brass; this prevents corrosion and seizing

**Further remote controls and pilot control units:****• Hydraulic remote control**

- Pilot control device type 2TH6 (see RE 64 552) in sandwich plate design
- Pilot control device types 4 TH 6, 4 TH 5 and 4 TH 6N for arm rest installation (see RE 64 555)
- Pilot control device type TH 7, for instrument panel installation or in pedal design (see RE 64 558)
- Pilot control device type 4/5 THF 6 with end position locking (see RE 64 553)

**• Electronic remote control**

- Electronic remote control type THE6 for direct controlling of electrical or electro-hydraulic pilot operated actuators (see RE 29 771)



### Extracted from RE 64 551/05.03

Page 2 of 2  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical Data

Hydraulic fluid		Mineral oil (HL, HLP) to DIN 51 524; phosphate ester (HFD-R)
Hydraulic fluid temperature range	°C	- 20 to + 80
Viscosity range	mm <sup>2</sup> /s	10 to 380
Fluid cleanliness		Max. permissible degree of hydraulic fluid contamination according to NAS 1638 class 9. For this, we recommend a filter with a minimum retention rate of $\beta_{10} \oplus 75$ .
Max. inlet pressure	bar	max. 50
Counterpressure in port T	bar	max. 3
Pilot flow	l/min	max. 16
Hysteresis	bar	max. 1
Weight	kg	approx. 3.8
Max. permissible operating torque at foot lever	daNm	20

### Ordering Code

	<b>2</b>	<b>TH6</b>	<b>R</b>		<b>1X</b>	<b>*</b>	
2 control ports	= 2						Further details in plain text
Pedal operation		= R					<b>Connecting thread</b>
Pedal version							<b>01 =</b> G 1/4 pipe thread to standard ISO 228/1
Bent pedal			= C				<b>02 =</b> M 14 x 1,5 metric to standard ISO 9974
Flat pedal			= P				<b>05 =</b> 9/16 UNF-2B to standard ISO 11926
Standard control curve				= 06			<b>Seals</b>
Series 10 to 19 (10 to 19: Installation and connection dimensions unchanged)					= 1X		<b>M =</b> NBR seals, suitable for mineral oil (HL, HLP) to DIN 51 524
							<b>V =</b> FKM seals for phosphate ester (HFD-R)

**Extracted from RE 64 552/05.03**

Page 1 of 2  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Hydraulic pilot control unit of sandwich plate design for the remote control of directional valves, pumps and motors Model 2TH6

**Series 1X**

- Progressive, sensitive control
- Precise and play-free control characteristics
- Low actuation force at the lever
- Rust-free plunger

**Further remote controls and pilot control units:****• Hydraulic remote control**

- Pilot control unit type 2 TH 6 R, pedal version (see RE 64 551)
- Pilot control unit types 4 TH 6, 4 TH 5, 4TH 6 N, for arm rest installation (see RE 64 555)
- Pilot control unit type 4/5 THF 6, with end position locks (see RE 64 553)

**• Electronic remote control**

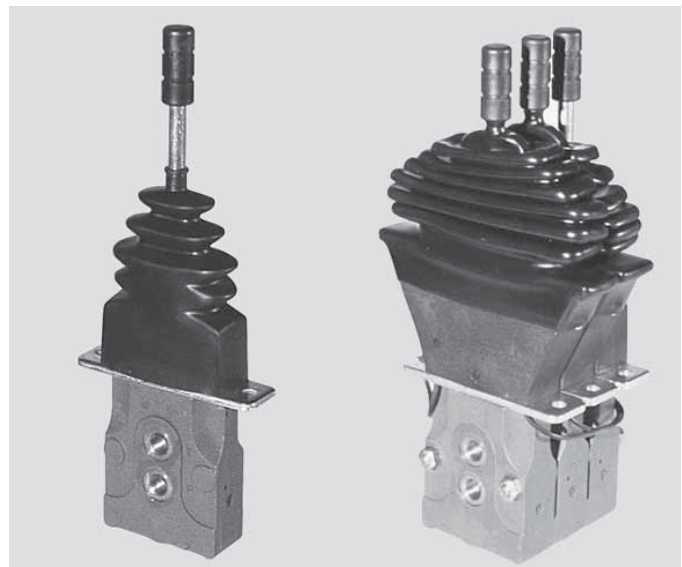
- Electronic remote control type THE 6 for the direct control of electrical or electro-hydraulic pilot operated actuators (see RE 29 771)

**• B2 TH 6**

- Recommended for use with a single 2 TH 6 control axis
- This pilot control unit cannot be flanged on



Model 1-2 TH 6 L06-1X/M01



3-2 TH 6 H06-1X/H06 L06 M01

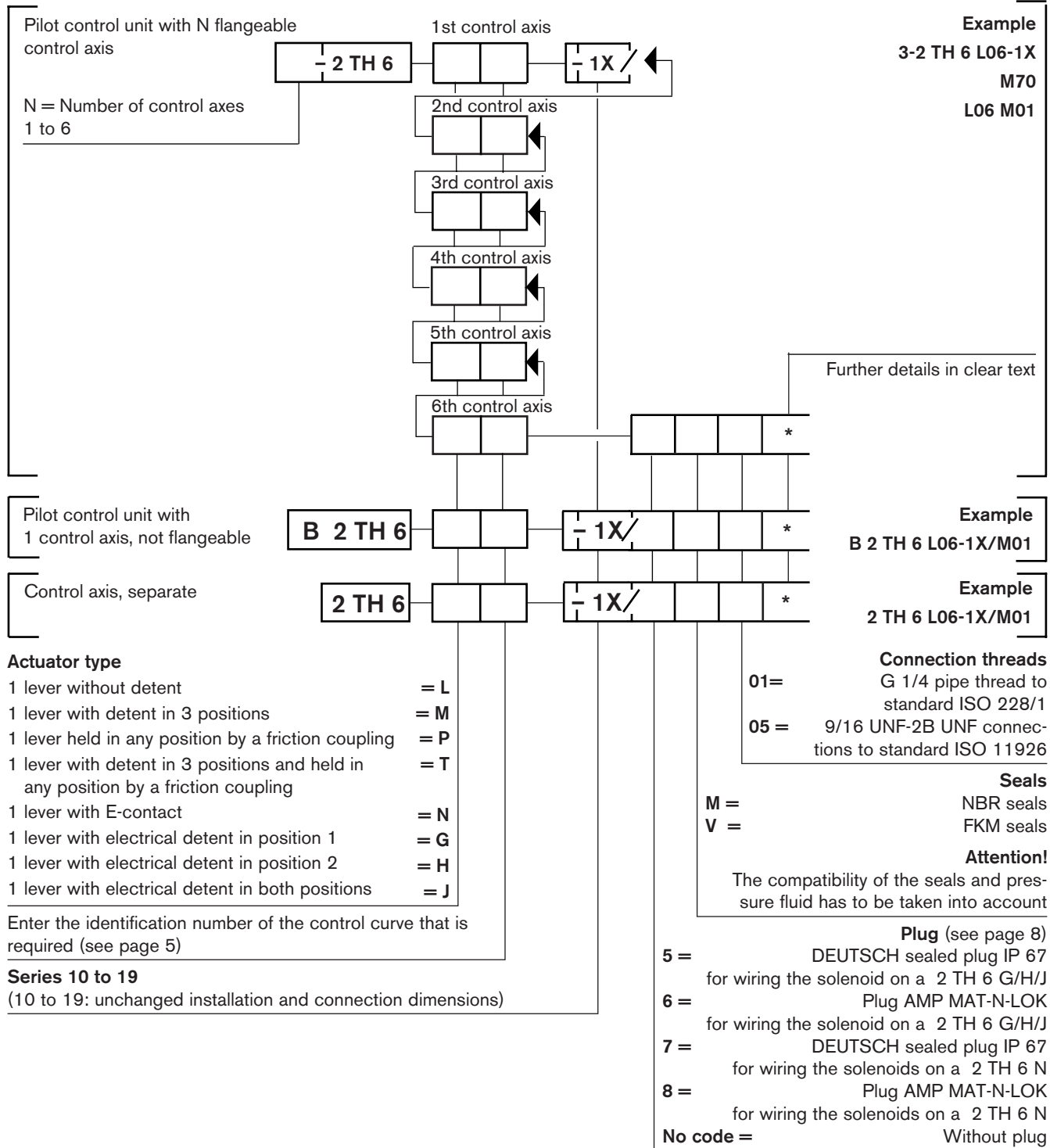
B2 TH 6 L06-1X/M01

**Extracted from RE 64 552/05.03**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering Code**



**Extracted from RE 64 555/05.03**

Page 1 of 2  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Hydraulic pilot control units for  
armrest installation  
Model 4TH6, 4TH6N, 4TH5****Series 1X**

- Progressive, sensitive operation
- Low actuation forces
- Low force deviations when lever is actuated (4TH5, 4TH6N)
- Several ergonomic grips with various E contacts
- All connections point downwards



Model 4TH6, 4TH6N



Model 4TH5 for mini excavators



**Extracted from RA 64 278/02.04**

Page 1 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Load sensing control block Sandwich plate design Model M4-12

### Series 1X

Nominal pressure 5000 psi (350 bar) pump side

Nominal pressure 6100 psi (420 bar) actuator side

Max flow pump side:

40 GPM (150 l/min) inlet element

Max flow actuator side:

35 GPM (130 l/min) with load-holding function

26 GPM (100 l/min) with pressure compensator  
and load-holding function

### System

- Load pressure-independent flow control
  - Open center for fixed displacement pump
  - Closed center for variable displacement pump

### Design

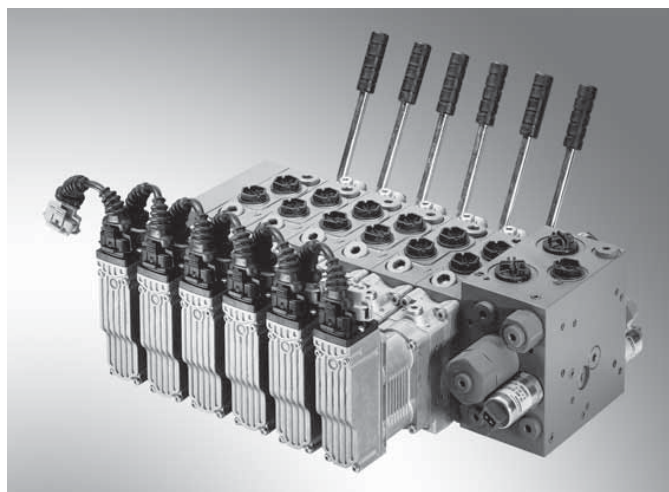
- Sandwich plate design
  - Inlet element
  - Up to 10 directional valve elements
  - End element
- Types of actuation
  - Mechanical (hand lever)
  - Hydraulic
  - Electrohydraulic
    - On/off
    - Proportional
  - Electrohydraulic with on-board electronics (OBE)

### Flow

- Load pressure-compensated
- High repeatability
- Low hysteresis
- Adjustable via stroke limiter

### Pressure relief function

- Inlet element
  - Pilot operated pressure valves of large nominal width
- Directional valve element / actuator ports
  - Compact shock valves with anti-cavitation function
- LS pressure limitation
  - Adjustable for each actuator port
- External pressure adjustment possible for each actuator port



### Fields of application

- Truck applications
- Large & telescopic fork lifts
- Lifting platforms
- Forestry machines
- Construction machines
- Drilling equipment
- Cranes
- Municipal vehicles
- Stationary applications

### Flow

- Load pressure-compensated
- High repeatability
- Low hysteresis
- Adjustable via stroke limiter

### Pressure relief function

- Inlet element
  - Pilot operated pressure valves of large nominal width
- Directional valve element / actuator ports
  - Compact shock valves with anti-cavitation function
- LS pressure limitation
  - Adjustable for each actuator port
- External pressure adjustment possible for each actuator port

### Fields of application

- Truck applications
- Large & telescopic fork lifts
- Lifting platforms
- Forestry machines
- Construction machines
- Drilling equipment
- Cranes
- Municipal vehicles
- Stationary applications



**Extracted from RA 64 278/02.04**

Page 2 of 4

Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

<b>General</b>				
Design		Sandwich plate		
Designation		LS control block		
Type		M4		
Size		12		
Installation position		Optional		
Type of connection		SAE J1626 or ISO 11926-1		
Weight	Inlet element:	Open center	lbs (kg)	13.8 (6.3)
		Closed center	lbs (kg)	9.5 (4.3)
	Directional valve element, mechanical		lbs (kg)	10.8 (4.9)
	Directional valve element, hydraulic		lbs (kg)	9.3 (4.2)
	Directional valve element, electrohydraulic		lbs (kg)	9.9 (4.5)
	Additional weight for manual operation, hand lever included		lbs (kg)	1.3 (0.6)
End element		lbs (kg)	5.7 (2.6)	
Hydraulic fluid and ambient temperature range $\vartheta$			°F (°C)	-4 to +176 (-20 to +80)
<b>Hydraulic</b>				
Flow	Port P	$q_v$ , max	GPM (l/min)	40 (150)
	Port A, B	$q_v$ , max	GPM (l/min)	26 (100) with pressure comp. & load-holding function
		$q_v$ , max	GPM (l/min)	35 (130) without pressure compensator
Nominal pressure		$p_{nom}$	psi (bar)	5000 (350)
Max. operating	P / LS	p	psi (bar)	5000 (350)
pressure in port:	A / B	p	psi (bar)	6100 (420)
	T	p	psi (bar)	435 (30)
	Y	p	psi (bar)	at zero pressure to tank
Max. pilot	X	p	psi (bar)	508 (35)
pressure in port:	a, b	p	psi (bar)	508 (35)
Pilot pressure range	Hydraulic	p	psi (bar)	123 to 326 (8.5 to 22.5)
	Electrohydraulic	p	psi (bar)	94 to 250 (6.5 to 17.2)
Necessary hydraulic pilot control devices				TH 6... characteristic curve 97, see RA 64 552
LS pressure limitation (adjustment ranges) (is selected in the factory)			psi (bar)	725 to 2160 (50 to 149) <sup>1)</sup> 2175 to 5000 (150 to 350)
Hydraulic fluid				Mineral oil (HL,HLP) to DIN 51 524 Other fluids, e.g. HEES (synthetic esters) to VDMA as well as hydraulic fluids as specified in RA 90 221 on inquiry
Viscosity range		$\nu$	SSU (mm <sup>2</sup> /s)	35 to 1760 (10 to 380)
Degree of contamination (max. permissible)				DIN4406 (C) class 20/18/15
<b>Electrical</b>				
Electrical pilot control valves				FTWE 2 K...; see RA 58 007 FTDRE 2 K...; see RA 58 032 } Without mating connector Type Junior Timer (AMP) <sup>2)</sup>
Recommended amplifiers (other controlling options on enquiry)				Analog amplifier: MHVA2...; 1 to 6 axes, see RA 29 875; RA 29 883 Digital amplifier: RC2-2, RC4-4, RC6-9; see RA 95 200.
On-board electronics				Data from page 19 onwards

1) Pressures below 725 psi (50 bar) please consult factory

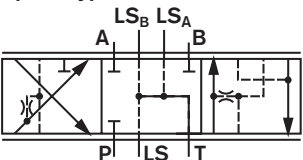
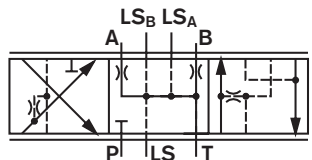
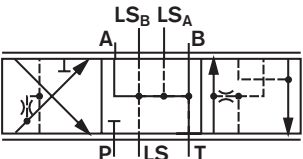
2) Mating connectors are not included in the scope of supply and must be ordered separately.

### Extracted from RA 64 278/02.04

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Ordering code

Short code	Inlet elements	Directional valve elements	
<b>M4 -12- 1X /</b>		1st spool axis 2nd spool axis 3rd spool axis, etc.	Continued on next page
No. of directional valves 1 to 10 Size 12 = <b>12</b> Series 10 to 19 = <b>1X</b> (10 to 19: unchanged installation and connection dimensions)	<b>Inlet element</b> Open center = <b>P</b> Closed center = <b>J</b> Without primary pressure relief valve (not with version P) = <b>Q</b> With primary pressure relief valve (pressure details in bar, 3-digit) = ...	Actuator port "A" Actuator port "B"	<b>Secondary valves</b> H...H... = Shock valves with anti-cavitation function (see table) Q = Plug screw (secondary valves can be retrofitted)
<b>Pilot oil supply</b> With internal pilot oil supply = <b>Y</b> For external pilot oil supply = <b>X</b>	Without pressure comp., with load-holding function (standard) = <b>S</b> Without pressure comp., with load-holding function = <b>C</b>	<b>Operation, cover B</b> - = Standard cover <sup>3)</sup> Hand lever (engaged) B, K = Hand lever upwards F, L = Hand lever straight D, M = Hand lever dwnwrld	
With LS pressure relief valve, pressure details in bar, 3-digit = ... With LS press. relief plug screw (LS press. relief valve can be retrofitted) = <b>Q</b> Without LS pressure relief valve (LS press. relief valve <b>cannot</b> be retrofitted) = <b>Z</b>	Housing with measuring ports = <b>M</b> <sup>1)</sup> Housing without measuring ports = <b>Z</b> <sup>1)</sup>	<b>Hand lever (disengaged)</b> G = Hand lever upwards H = Hand lever straight J = Hand lever dwnwrld	
<b>Spool type</b>  = E  = Q  = J		Details required only for type of operation "W2" and "W4" 1 = Supply voltage 24 V 3 = Supply voltage 12 V	
<sup>1)</sup> <b>⚠ Caution!</b> The following combinations are not possible: ZMZ, QZQ, ... Z ...		<b>Operation, cover A</b> M = Mechanical <sup>2)</sup> H = Hydraulic W2 = Electrohydraulic proportional W4 = Electrohydraulic, switchable	
<sup>2)</sup> Always in conjunction with B, F, D, K, L, M, G, H or J		<b>Electronic pilot module</b> CAQ = Digital OBE - CAN-BR protocol CBQ = Digital OBE - CANopen protocol AAQ = Digital OBE - analog interface	
<sup>3)</sup> B, F, D Multiple piece lever K, L, M Single piece lever		... - ... = <b>Flow in L/min, 3 digits</b> e.g. <b>070-070</b> Actuator ports "A" and "B"	

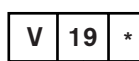
**Extracted from RA 64 278/02.04**

Page 4 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code**

End elements    Supplementary details



Further details in clear text

19 =

Connections with SAE ports to SAE J1626 or ISO 11926-1

End element

A =

End plate, without ports **with** internal LS unloading

Z =

End plate with LS port **without** internal LS unloading

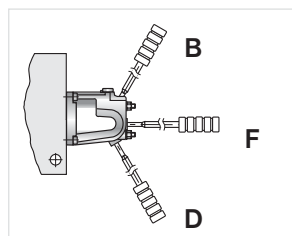
Preferred pressure settings for shock valves with anti-cavitation function (secondary valves)

**Caution:** Shock valves are firmly set!

Pressure setting in bar in actuator ports A and B (standard)					
H050 =	50 bar	H140 =	140 bar	H210 =	210 bar
H063 =	63 bar	H150 =	150 bar	H230 =	230 bar
H080 =	80 bar	H160 =	160 bar	H240 =	240 bar
H100 =	100 bar	H175 =	175 bar	H250 =	250 bar
H125 =	125 bar	H190 =	190 bar	H280 =	280 bar
				H300 =	300 bar
				H320 =	320 bar
				H350 =	350 bar

= Preferred

**Hand lever position**



**Hand Lever (Engaged)**

Multiple Piece Version  
Version B = Hand lever upwards (standard)  
Version F = Hand lever straight  
Version D = Hand lever downwards  
Single Piece Version  
Version K = Hand lever upwards (standard)  
Version L = Hand lever straight  
Version M = Hand lever downwards

**Hand Lever (Disengaged)**

Version G = Hand lever upwards (standard)  
Version H = Hand lever straight  
Version C = Hand lever downwards

**Preferred spool types (with pressure compensator "S", spool types E, J, Q)**

	Flow in L/min (other flows can be set on the stroke limiter)					
	100-100	073-073	052-052	034-034	023-023	014-014
<b>Symmetric spools</b>	085-085	065-065	045-045	030-030	020-020	012-012
	070-070	057-057	038-038	026-026	017-017	010-010
<b>Asymmetric spools</b>	100-073	100-052	052-034	034-023	023-014	
	085-065	085-045	045-030	030-020	020-012	
	070-057	070-038	038-026	026-017	017-010	

Complete control blocks are to be defined in accordance with the type code.

The order text is used to collate the technical features and requirements.

The Rexroth Sales Organization derives a short code and a material number from the order text.

Example of a short code of an M4-12 control block with three directional valve elements:

**M4 - 1234 - 00 / 3M4 - 12**

Control block no.

Number of directional  
valve elements

Serial no./revision index

**Extracted from RA 64 283/10.05**

Page 1 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part number  
and unit price.

## High pressure load sensing control block Sandwich plate design Model M4-15

**Series 2X**

Nominal pressure 5000 psi (350 bar) pump side  
Nominal pressure 6100 psi (420 bar) actuator side  
Maximum flow pump side:  
79 GPM (300 l/min) with central inlet element  
53 GPM (200 l/min) with lateral inlet element  
Maximum flow actuator side:  
53 GPM (200 l/min) with load holding function  
50 GPM (190 l/min) with pressure compensator  
40 GPM (150 l/min) with pressure compensator &  
Load holding function

**System**

- Load pressure-independent flow control
  - Open Center for fixed displacement pump
  - Closed Center for flow-controlled pump

**Design**

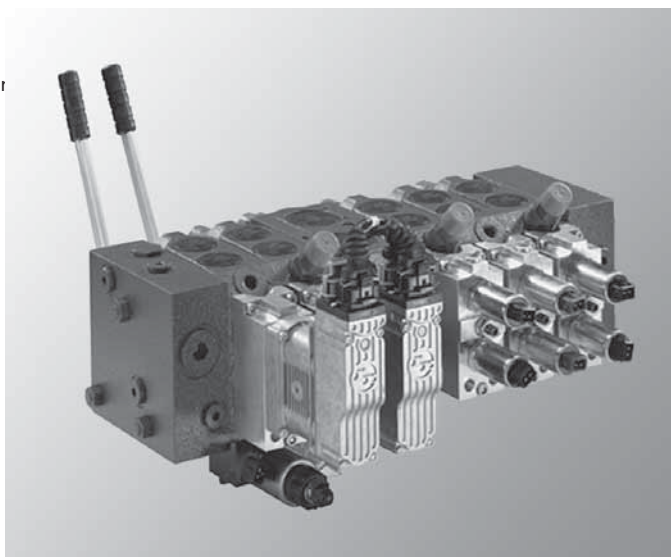
- Sandwich plate design
  - Inlet element
  - Up to 9 directional valve elements
  - Up to 18 directional valve elements with central inlet element
  - End element
- Types of operation
  - Mechanical (moving hand lever)
  - Hydraulic
  - Electrohydraulic (switching, proportional)
  - Electrohydraulic with on-board electronics (OBE)

**Flow**

- Load pressure-compensated
- High repeatability
- Low hysteresis
- Can be adjusted via stroke limiter

**Pressure relief function**

- Inlet element
  - Pilot operated pressure control valves of large nominal width
- Directional valve element / actuator ports
  - Compact shock valves with anti-cavitation function
- LS pressure limitation
  - Adjustable for each actuator port
  - External pressure adjustment possible for each actuator port
  - Electro-proportional per section

**Fields of application**

- Cranes – Drilling equipment
- Large and telescopic fork lifts – Truck applications
- Rock crushers – Municipal vehicles
- Forestry machines – Stationary applications

**Extracted from RA 64 283/10.05**

Page 2 of 4

Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Installation orientation	Optional		
Type of connection	Pipe thread to ISO 228/1		
Weight	Inlet element (lateral)	lbs (kg)	15.4 (7)
	Inlet element with priority valve	lbs (kg)	22 (10)
	Central inlet element	lbs (kg)	18.7 (8.5)
	Directional valve element, hydraulic	lbs (kg)	15.7 (7.1)
	Directional valve element, electrohydraulic	lbs (kg)	16.5 (7.5)
	End element	lbs (kg)	12.8 (5.8)
Hydraulic fluid and ambient temperature range $\vartheta$	$^{\circ}\text{F}$ ( $^{\circ}\text{C}$ )	-4 to +176 (-20 to +80)	

**Hydraulic**

Flow	Port P	$q_{V\max}$	GPM (l/min)	79 (300) with central inlet element	
			GPM (l/min)	53 (200) with lateral inlet element	
	Port A, B	$q_{V\max}$	GPM (l/min)	40 (150) with pressure compensator and load-holding function (version "S")	
			GPM (l/min)	50 (190) with pressure compensator, without load-holding function (version "T")	
			GPM (l/min)	53 (200) without pressure compensator (version "C")	
Nominal pressure		$p_{\text{nom}}$	psi (bar)	5000 (350)	
Operating pressure max. in port	P	$p$	psi (bar)	5000 (350)	
	A, B	$p$	psi (bar)	6100 (420)	
	LS	$p$	psi (bar)	4786 (330)	
	T	$p$	psi (bar)	435 (30)	
	Y	$p$	psi (bar)	At zero pressure to tank	
Pilot pressure max. in port	X	$p$	psi (bar)	508 (35)	
	a, b	$p$	psi (bar)	508 (35)	
Pilot pressure range	Hydraulic	$p$	psi (bar)	123 to 326 (8.5 to 22.5)	
	Electrohydraulic	$p$	psi (bar)	94 to 250 (6.5 to 17.2)	
Required control $\Delta p$ across control block	Versions S; C	$p$	psi (bar)	261 (18)	
	Version T	$p$	psi (bar)	362 (25)	
Recommended hydraulic pilot control devices	TH 6..., characteristic curve 97, see RE 64552				
LS pressure limitation (adjustment ranges)				psi (bar)	725 to 2160; 2175 to 5000 (50 to 149; 150 to 330) (selected in the factory)
Hydraulic fluid	Mineral oil (HL, HLP) to DIN 51524, other hydraulic fluids, e.g. HEES (synthetic esters) to VDMA 24568 and hydraulic fluids as specified in RE 90221 on enquiry				
Viscosity range	$\nu$	SSU (mm <sup>2</sup> /s)		35 to 1760 (10 to 380)	

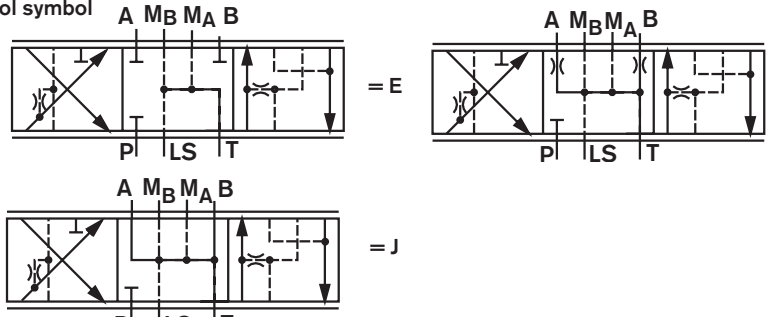
**Electrical**

Electrical pilot control valves	FTWE 2 K...; see RE 58007 FTDRE 2 K...; see RE 58032	} without mating plug <sup>1)</sup>
Recommended amplifiers (further control options on enquiry)	MHVA2A1X/G..F...; 1 axis, see RE 29875 MHVA8/12B1X/G..F...; 4 to 6 axes, see RE 29883 RC control devices, see RE 95200	
On-board electronics (OBE)	Data from page 26	

<sup>1)</sup> Mating plugs are not included in the scope of supply and must be ordered separately.

**Note:** The technical data were determined at a viscosity of  $\nu = 30 \text{ mm}^2/\text{s}$  (HLP46: 50 °C)

# Ordering code

Type code	Inlet elements	Directional valve elements	
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <b>M4 -15 -2X</b> </div>	<div style="border: 1px solid black; width: 40px; height: 20px; display: inline-block;"></div>	<div style="border: 1px solid black; width: 100px; height: 20px; display: inline-block;"></div>	Continued on next page →
No. of directional valves 1 to 18 <sup>1)</sup> Size 15 = 15 Component series 20 to 29 = 2X (unchanged installation and connection dimensions) Closed Center, lateral = J Open Center, lateral = P Closed Center, internal priority actuator, external subordinate actuator = VL Closed Center, external priority actuator, internal subordinate actuator = VR Closed Center, central = JZ Closed Center, central inlet element with priority valve = VZ Without primary pressure relief valve (not with version "P") = Q With primary pressure relief valve (pressure details in bar, 3 digits) = ... Priority valve (with V. only) Static priority valve = A Dynamic priority valve = B LS pressure limitation with priority valve (V.) (pressure details in bar, 3 digits) = ... With pressure compensator, with load-holding function = S With pressure compensator, without load-holding function = T Without pressure compensator, with load-holding function = C With LS pressure relief valve, <sup>2)</sup> (pressure details in bar, 3 digits), or With LS-DB plug screw (LS-DB can be retrofitted), <sup>2)</sup> with measuring ports = Q □ Q <sup>3)</sup> With only 1 LS pressure relief valve <sup>2)</sup> = ... M = Without LS pressure relief valve (LS-DB cannot be retrofitted) = Z □ Z <sup>4)</sup> Housing with measuring ports = M Housing without measuring ports = Z With electroprop. pressure limitation, 210 bar (falling char. curve) <sup>2)</sup> = L <sup>5)</sup> With electroprop. pressure limitation, 210 bar (rising char. curve) <sup>2)</sup> = J <sup>5)</sup> With electroprop. pressure limitation, 350 bar (falling char. curve) <sup>2)</sup> = R <sup>5)</sup> With electroprop. pressure limitation, 350 bar (rising char. curve) <sup>2)</sup> = N <sup>5)</sup>		<b>1st spool axis</b> <div style="border: 1px solid black; width: 100px; height: 20px; display: inline-block;"></div>	
		<b>2nd spool axis</b> <div style="border: 1px solid black; width: 100px; height: 20px; display: inline-block;"></div>	
		<b>3rd spool axis</b> <div style="border: 1px solid black; width: 100px; height: 20px; display: inline-block;"></div>	
		<b>Secondary valves</b> H...H... = Pressure relief/anti-cavitation valve, pilot operated E = Anti-cavitation valve Q = Plug screw (secondary valves can be retrofitted) <b>Operation, cover B</b> - = Standard cover <b>moving hand lever</b> K = Hand lever upwards L = Hand lever straight M = Hand lever downwards <b>Details required only for types of operation "W2" and "W4" and with el.-proportional pressure limitation Junior Timer 2-pin (AMP) <sup>6)</sup></b> 1 = Supply voltage 24 V 3 = Supply voltage 12 V <b>DT04-2P (Deutsch) <sup>6)</sup></b> 8 = Supply voltage 24 V 9 = Supply voltage 12 V <b>Operation, cover A</b> M = Mechanical <sup>6)</sup> H = Hydraulic W2 = Electrohydraulic, proportional W4 = Electrohydraulic, switchable Electronic pilot module AAQ = Digital OBE - analogue interface <sup>7)</sup> CAQ = Digital OBE - CAN-BR protocol <sup>7)</sup> CBQ = Digital OBE - CANopen protocol <sup>7)</sup> ... = Flow in l/min, 3-digit, e.g. 070-070; actuator ports "A" and "B"	
<b>Spool symbol</b> 			

<sup>1)</sup> Max. 9 elements per side  
<sup>2)</sup> Only with S- and T-pressure compensator

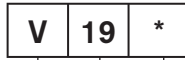
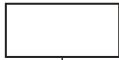
<sup>3)</sup> "Z" impossible  
<sup>4)</sup> "M" impossible

<sup>5)</sup> See also data sheet RE 18139-05  
<sup>6)</sup> Always in conjunction with K, L or M  
<sup>7)</sup> See also data sheet RE 64565-07  
<sup>8)</sup> Mating plugs are not included in the scope of supply and must be ordered separately.

## Ordering code

### End elements

### Supplementary details



Further details in clear text

19 = Connections with SAE ports to SAE J1626 or ISO 11926-1

V = FKM seals; observe compatibility of seals with hydraulic fluids used!<sup>1)</sup>

	With LS unloading	Without LS unloading	External pilot oil supply	Internal pilot oil supply
LA =	•			
LAY =	•			•
LAX =	•		•	
LZ =		•		
LZY =		•		•
LZX =		•	•	

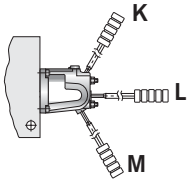
• = Scope of supply

Only in conjunction with inlets "VL", "VZ", "JZ"

LVZ = External priority port (optional connection of a further LS control block)

LU = Diversion plate

### Hand lever position



K Hand lever upwards (standard)

L Hand lever straight

M Hand lever downwards

### Spools - standard types

#### Symmetric spools

Spool type	Pressure compensator	Flow in l/min				
		150-150	120-120	080-080	050-050	032-032
E, J, Q	S	130-130	100-100	070-070	045-045	028-028
		110-110	085-085	060-060	040-040	025-025
		C	175-175	145-145	110-110	080-080
	T	190-190	160-160	100-100	065-065	040-040

#### Asymmetric spools

Spool type	Pressure compensator	Flow in l/min				
		150-120	120-080	080-050	050-032	
E, J, Q	S	130-100	100-070	070-045	045-028	
		110-085	085-060	060-040	040-025	
		C	175-146	145-110	110-080	080-045
	T	190-160	160-100	100-065	065-040	

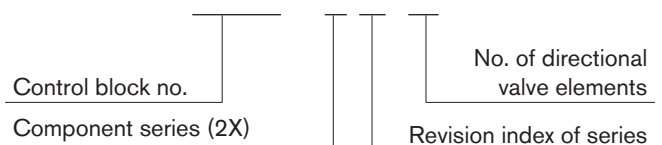
Complete control blocks are defined in accordance with the type code.

The order text can be used to specify technical features and requirements.

The Bosch Rexroth sales organisation derives a short code and a material number from the order text.

Example of a short code for an M4-15 control block with three directional valve elements:

**M4 - 4567 - 2 0 / 3 M4 - 15**



<sup>1)</sup> The hand lever version contains FKM and NBR seals



**Extracted from RE 64 279/06.05**

Page 1 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## High pressure load sensing control block Sandwich plate design Model M4-22

**Series 2X**

Nominal pressure 5000 psi (350 bar) pump side

Nominal pressure 6100 psi (420 bar) actuator side

Maximum flow pump side:

105 GPM (400 l/min) inlet element

158 GPM (600 l/min) with P1 and P2 ports

Maximum flow actuator side:

105 GPM (400 l/min)

**System**

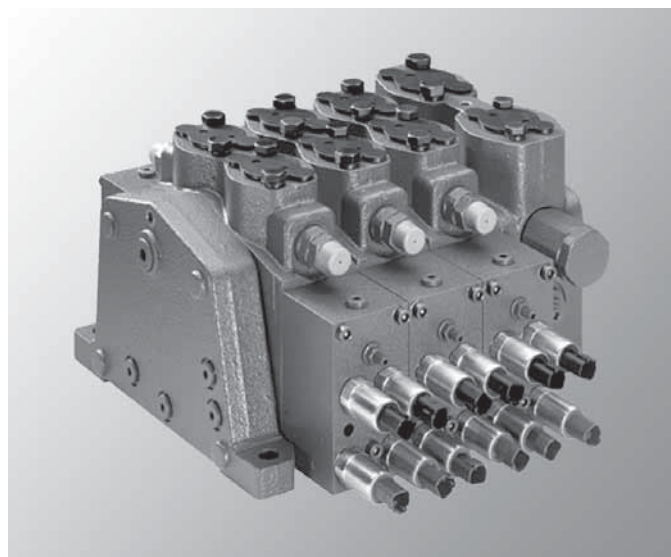
- Load pressure-independent flow control
  - Open center for fixed displacement pump
  - Closed center for flow controlled pump

**Design**

- Sandwich plate design
  - Inlet element
  - Up to 8 directional valve elements
  - End element
- Types of actuation
  - Mechanical (hand lever)
  - Hydraulic
- Types of actuation
  - mechanical
  - hydraulic
  - electrohydraulic (on/off, proportional)

**Flow**

- Load pressure-compensated
- High repeatability
- Low hysteresis
- Adjustable via stroke limiter

**Pressure relief function**

- Inlet element
  - Pilot operated pressure relief valves of large nominal width
- Directional valve element / actuator ports
  - Relief valves with anti-cavitation function
- LS pressure limitation
  - Adjustable for each actuator port
  - External pressure adjustment possible for each actuator

**Fields of Application**

- Cranes
- Drilling machines
- Forestry machines
- Others



**Extracted from RE 64 279/06.05**

Page 2 of 4

Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data** (for applications outside these parameters, please consult us!)

**General**

Design	Sandwich plate design			
System	Load-Sensing (LS)			
Type	M4			
Size	22			
Installation position	optional			
Type of connection	SAE			
Weight	Inlet element:	Open center	kg	28
		Closed center	kg	28
	Directional valve element, mechanical	kg	24	
	Directional valve element, hydraulic	kg	29	
	Directional valve element, electrohydr.	kg	33	
End element	kg	13		
Hydraulic fluid and ambient temperature range $\vartheta$	°C	-20 to +80		

**Hydraulic**

Flow	Port P	$q_{V, \max}$	L/min	400 600 with P1 and P2 ports	
	Port A, B	$q_{V, \max}$	L/min	400 with pressure compensator and load-holding function	
Nominal pressure max.		$p_{\text{nom}}$	bar	350	
Operating pressure max. in port	P / LS	$p$	bar	350	
	A / B	$p$	bar	420	
	T	$p$	bar	30	
	Y	$p$	bar	at zero pressure to tank	
Pilot pressure max. in port	X	$p$	bar	35	
	a, b	$p$	bar	35	
Pilot pressure range	hydraulic	$p$	bar	8.5 to 22.5	
	elektrohydraulic	$p$	bar	8.7 to 26	
Recommended hydraulic pilot control devices	TH 6... characteristic curve 97, see RE 64552				
LS pressure relief function (adjustment ranges) (selected in the factory)				bar	50 to 149 150 to 350
Hydraulic fluid	Mineral oil (HL, HLP) to DIN 51524 Other fluid on enquiry, e.g. HEES (synthetic esters) to VDMA 24568 as well as hydraulic fluids as specified in RE 90221				
Viscosity range	$\nu$	mm <sup>2</sup> /s	10 to 380		
hydraulic fluid max. permissible degree of contamination to ISO 4406 (c)				class 20/18/15	

**Electric**

Electrical pilot control valves	FTWE 4 K...; see RE 58008 FTDRE 4 K...; see RE 58038
Recommended amplifiers (other control options on enquiry)	Analogue amplifier: RA 1.0 and 2.1 (in preparation) Digital amplifier: RC-Family (RE 95200)

**Note:** The technical data was determined at a viscosity range of  $\nu = 30$  mm<sup>2</sup>/s (HLP46: 50°C).

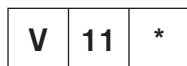


## Ordering code

### End element



### Additional details



11 =

Further details in clear text

Ports as SAE

### End element

A =

Z =

P =

R =

T =

End element without ports, with internal LS unloading

End element with LS port, without internal LS unloading

End element with P2 port

End element with P2 and LS port

End element with T2 port

### Pressure setting in bar in actuator ports A and B

H050 = 50 bar	H140 = 140 bar	H210 = 210 bar	H280 = 280 bar
H063 = 63 bar	H150 = 150 bar	H230 = 230 bar	H300 = 300 bar
H080 = 80 bar	H160 = 160 bar	H240 = 240 bar	H320 = 320 bar
H100 = 100 bar	H175 = 175 bar	H250 = 250 bar	H350 = 350 bar
H125 = 125 bar	H190 = 190 bar		

= Preferred type

### Preferred spool types

#### Symmetric spools

Spool type	Pressure compensator	Flow in L/min (other flows can be set on the stroke limiter)				
		400-400	300-300	200-200	130-130	080-080
E, J, Q	S	360-360	270-270	180-180	115-115	072-072
		320-320	240-240	160-160	100-100	065-065

Complete control blocks are to be defined in accordance with the type code.

The order text is used to collate the technical features and requirements.

The Rexroth Sales Organisation derives a short code and a material number from the order text.

Example of a short code of an M4-22 control block with three directional valve elements.

**M4 - 6789 - 1 0 / 3 M4 - 22**

Control block no.

Series of type (1X)

No. of directional  
valve elements

revision index of series

**Extracted from RA 64 139/10.05**

Page 1 of 4  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Load sensing control block  
Sandwich plate design  
Model SP-08**

Series 2X

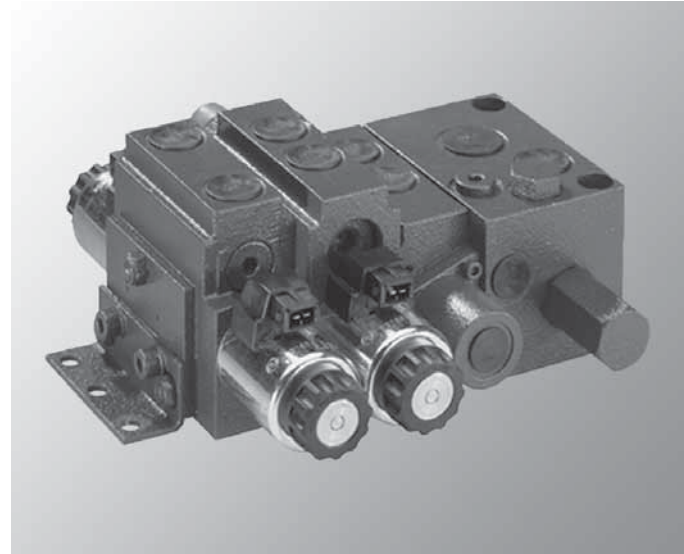
Nominal pressure 3600 psi (250 bar) pump side  
Nominal pressure 4300 psi (300 bar) actuator side  
Maximum flow pump side:  
20 GPM (75 l/min) inlet element  
Maximum flow actuator side:  
13 GPM (50 l/min)

**Features**

- Types of actuation
  - Mechanical (hand lever)
  - Hydraulic
  - Electromagnetic: switchable, proportional

**Flow**

- Load-pressure compensated
- Excellent repeatability
- Low hysteresis
- Adjustable

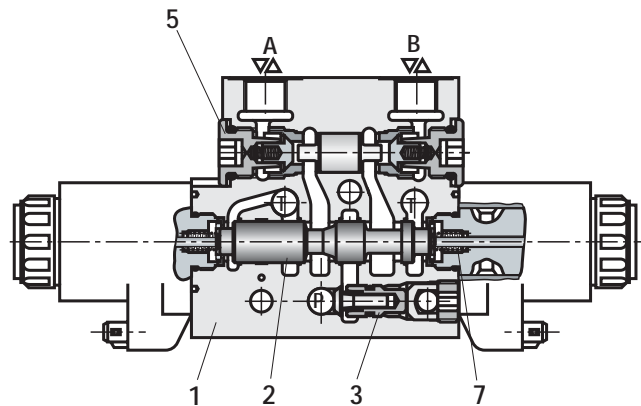
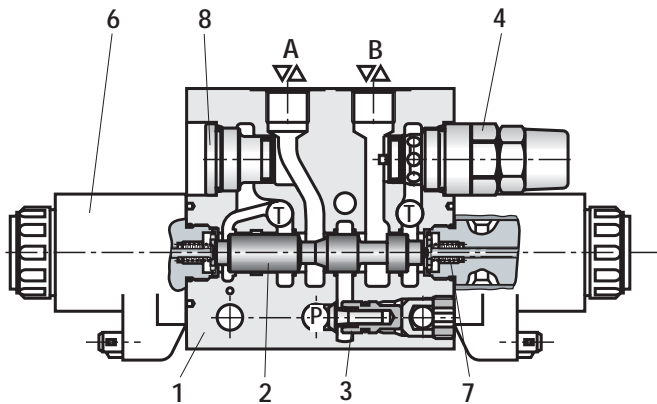


**Pressure relief function**

- Inlet element
  - With primary pressure relief valve
- Directional valve element / actuator ports
  - Pilot operated pressure relief/anti-cavitation valve

**Fields of application**

- Truck applications
- Drilling equipment
- Working platforms
- Cranes
- Construction machines
- Agricultural machines
- Municipal vehicles
- Stationary applications



- 1 Housing
- 2 Main spool
- 3 Adjustable orifice with load-holding function
- 4 Pressure relief/anti-cavitation valve

- 5 Pilot operated check valves
- 6 Solenoid
- 7 Compression spring
- 8 Plug screw

**Extracted from RA 64 139/10.05**

Page 2 of 4

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Type of connection		Pipe thread to ISO 228/1		
<b>Weight</b>				
Inlet elements	– with 3-way pressure compensator "P"	lbs (kg)	5.1 (2.3)	
	– with 2-way pressure compensator "M"; "H"	lbs (kg)	11.5 (5.2)	
	– without pressure compensator "J"; "G"	lbs (kg)	10.8 (4.9)	
Directional valve elements	– with manual actuation	lbs (kg)	4 to 5.1 (1.8 to 2.3)	
	– with hydraulic actuation	lbs (kg)	4.8 (2.2)	
	– with electromagnetic actuation	lbs (kg)	6.6 to 7.7 (3 to 3.5)	
End element	– "LA" (without mounting angle)	lbs (kg)	0.44 (0.2)	
	– "LU" (without mounting angle)	lbs (kg)	0.9 (0.4)	
	– Mounting angle "F", plus	lbs (kg)	0.22 (0.1)	
	– "SV" (with poppet valve)	lbs (kg)	7.3 (3.3)	
Installation orientation		Optional		
Hydraulic fluid and ambient temperature range $\vartheta$		°F (°C)		
		–4 to +176 (–20 to +80)		
<b>Hydraulic</b>				
Max. operating pressure	– Ports P, M, X, LS	$p$	psi (bar)	3600 (250)
	– Port A, B	$p$	psi (bar)	4300 (300)
	– Port T	$p$	psi (bar)	290 (20)
Nominal pressure		$p_{nom}$	psi (bar)	3600 (250)
Max. pilot pressure – ports a, b		$p$	psi (bar)	43 (30)
<b>Max. flow</b>				
Actuation	mechanical, hydraulic	$q_{V,max}$	GPM (l/min)	13 (50)
	electromagnetic, switchable	$q_{V,max}$	GPM (l/min)	8 (30)
	electromagnetic, proportional	$q_{V,max}$	GPM (l/min)	10.5 (40)
Recommended hydraulic pilot control devices		Type 2TH6 (control curve 06) Data sheet RE 64552		
		Type 2TH6R (control curve 06) Data sheet RE 64551		
		Type 4TH6 (control curve 06) Data sheet RE 64555		
Hydraulic fluid		Mineral oil (HL, HLP) to DIN 51524 1); other hydraulic fluids, e.g. HEES (synthetic esters) to VDMA as well as hydraulic fluids as specified in RE 90221, on enquiry		
Viscosity range		$\nu$	SSU (mm <sup>2</sup> /s)	35 to 1760 (10 to 380)
Max. permissible degree of contamination of the hydraulic fluid – cleanliness class to ISO 4406 (c)				Class 20/18/15 2)
Leakage A, B → T at an operating pressure of 2175 psi (150 bar)				
– Standard		$q_{VL}$	ounce/min (cm <sup>3</sup> /min)	1.5 (45)
– With isolator valve		$q_{VL}$	ounce/min (cm <sup>3</sup> /min)	0.07 (2)
<b>Magnetic</b>				
Switching solenoid		12 V		24 V
Current/proportional range		A	2.5	1.25
Resistance		R	Ω	5
		12 V		24 V
Proportional solenoid		12 V		24 V
Current/proportional range		A	0.5 to 2.3	0.25 to 1.5
Resistance		R	Ω	5.3
		12 V		24 V
		12 V		24 V

**Note:** The technical data were determined at a viscosity of  $\nu = 00$  SSU (41 mm<sup>2</sup>/s) and a temperature of  $\vartheta = 120^\circ$  F (50° C).

1) Suitable for NBR and FKM seals

2) For this, we recommend a filter with a minimum retention rate of  $\beta_{10} \geq 75$

**Ordering code**

**Short code**

**Inlet elements**

**Directional valve elements**

**SP-08-2X/**

No. of directional valves **1 to 10**

Component series 20 to 29  
(20 to 29: unchanged installation  
and connection dimensions)

**= 2X**

**Inlet element Open Center**

With 3-way pressure compensator

**= P**

**Inlet element Closed Center**

Without shuttle valve, without pressure compensator

**= J**

With shuttle valve, without pressure compensator

**= G**

Without shuttle valve,

with 2-way pressure compensator

**= M**

With shuttle valve, with 2-way pressure compensator

**= H**

With priority valve

**= V**

With plug screw (primary pressure relief function can be retrofitted),  
without measuring port

**= Q**

With primary pressure relief function, without measuring port  
(pressure indication in bar, 3 digits)

**= ...**

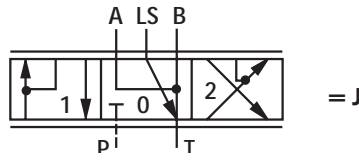
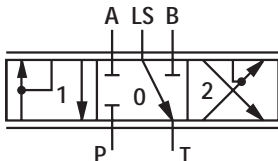
Adjustable orifice with load-holding function

**= F**

Section pressure compensator (on enquiry)

**= S**

**Spool symbol**



Actuator ports "A" and "B"

Flow in L/min, 3 digits, e.g. 030-030 <sup>1)</sup>

**= ...-...**

**Actuation**

Mechanical, encapsulated lever

**= R5**

Mechanical, with double-axis lever

**= R9**

Hydraulic

**= H2**

Electromagnetic, switchable

**= C2**

Electromagnetic, proportional

**= P5**

Indication required only in the case of actuation types "C2" and "P5"

Supply voltage 24 V

**= 1**

Supply voltage 12 V

**= 3**

<sup>1)</sup> **Standard spool types** (spool types E, J)

Symmetric spools	Asymmetric spools
Flow in L/min	
010-010	020-010
020-020	040-020
030-030	
040-040	

Continued on  
next page →

## Ordering code

### Directional valve elements

--	--	--	--

Actuator port A  
Actuator port B

### End elements / supplementary details

		<b>M</b>	<b>19</b>	<b>*</b>
--	--	----------	-----------	----------

Further details in clear text

**19 =** Connections with SAE ports to SAE J1626 or ISO 11926-1

**M =** NBR seals, suitable for mineral oil (HL, HLP) to DIN 51524

**F =** With mounting angle

**O =** Without mounting angle

**LA =** End plate (up to 2-fold control block)

**LU =** End plate with internal tank connection (from 3-fold control block)

**SV =** End plate with poppet valve <sup>4)</sup>

**Z =** Without secondary valve

**H + pressure in bar =** Pressure relief/anti-cavitation valve, pilot operated (pressure indicated in bar, 3 digits)

**Q =** Plug screw

**S =** Pilot operated check valve

(in the case of a pilot operated check valve, this valve is installed in actuator port "B" in the factory – ordering code "**ZS**")

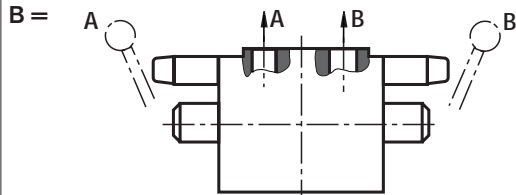
**A =** Hydraulically lockable float function (one-sided)

**B =** Pilot operated check valves with split opening spool (float function) <sup>3)</sup>

#### Arrangement of the actuating element with version "R5"

**A =** Manual actuation on connection side A - lever to the top (standard type)

**B =** Manual actuation on connection side B - lever to the top



**C4 =**

Indication required only for types of actuation "C2" and "P5"  
Cable socket, 2-pin, type: Junior Timer (AMP) <sup>2)</sup>

<sup>2)</sup> Cable sockets are not included in the scope of supply and must be ordered separately, see page 19 of full version catalog.

<sup>3)</sup> Only in conjunction with end element "SV"

<sup>4)</sup> Only in conjunction with directional valve element "B"

The complete control blocks are defined in accordance with the type code.

The ordering text is used to lay down the technical features and requirements.

The Bosch Rexroth sales organisation derives a short code and a material number from the ordering text.

Example of a short code of an SP-08 control block with three directional valve elements.

**SP – 1234 – 20 / 3 SP – 08**

Control block no.

Number of directional valve elements

Serial no./revision index

Extracted from RA 90810/01.06

Page 1 of 5  
Issue: 06.06

**Heavy duty priority flow controls**  
**3-way flow regulator with pressure**  
**compensated and solenoid controlled priority**  
**flow for standard and two pump systems**  
**A-VRFC3C-VEI-VS**

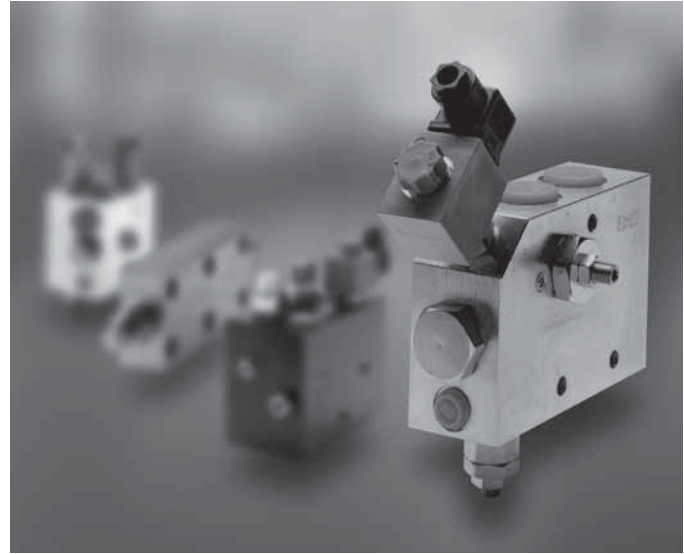
OM.43.20.80 - Y - Z

OM.43.12.80 - Y - Z

Up to 6000 PSI (410 bar)

Up to 100 GPM (380 l/min)

- Precise metering of the pressure compensated priority flow  
"A" independent of all working pressures
- Constant, repeatable priority flow yielding steady beats-per-minute hammer performance or rotations-perminute speed of rotary actuators
- Electronic, solenoid actuated control to engage priority flow, with a wide range of electrical connections and voltages available
- Wide choice of flow ranges, with various port options, from SAE-8 (3/4-16 UNF) up to SAE-20 (1 5/8-12 UN)
- Two pump circuit solution employing only a single priority valve reduces plumbing requirements
- Relief valve for pressure limitation of the priority circuit is standard in all valves
- Low leakage from the priority outlet, with solenoid valve de-energized, means no undesired operation of the actuator (such as "pecking" of and impact hammer)
- Rugged, Zinc plated, steel body for heavy duty applications (pressure up to 5000 psi / 350 bar)
- Unique mounting hole arrangement reduces stress on moving parts from possible misalignment, and minimizes the chance for malfunction in awkward, after-market installations



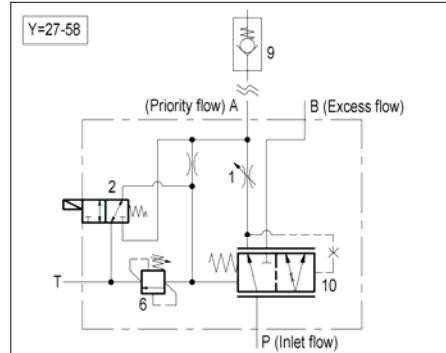
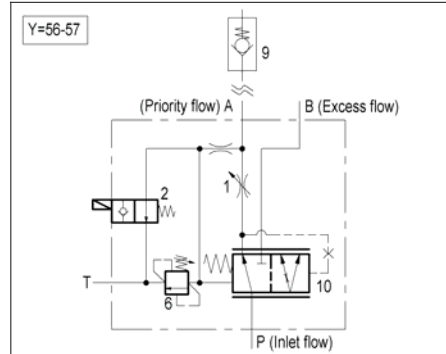
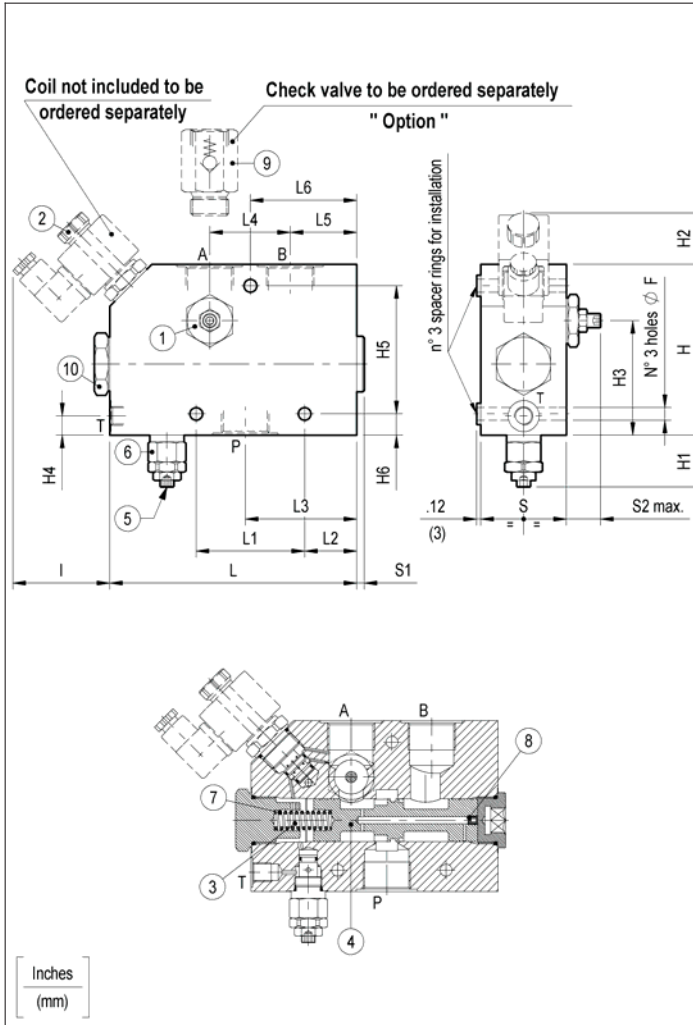


Extracted from RA 90810/01.06

Page 2 of 5  
Issue: 06.06

Standard configuration

OM.43.20.80 - Y - Z



### TECHNICAL DATA

Max working pressure: 5000 psi (350 bar)

Max priority line pressure: depending from relief (1) setting (see table "Z")

Back pressure in "T" (max): 20 psi (1.5 bar)

Drain from "T" with solenoid valve not energized: up to 0.4 gpm (up to 1.5 l/min)

Steel body

0.79 (20)	0.18 (4.5)	2.76 (70)	3.39 (86)	2.15 (54.5)	2.46 (62.5)	3.48 (88.5)	1.89 (48)	2.99 (76)	7.48 (190)	2.68 (68)	0.71 (18)	3.54 (90)	0.55 (14)	3.62 (92)	1.42 (36)	1.50 (38)	5.12 (130)	0.35 (9)	<b>58</b>	27.6 (12.5)
1.18 (30)	0.22 (5.5)	2.36 (60)	2.93 (74.5)	1.83 (46.5)	2.22 (56.5)	3.07 (78)	1.44 (36.5)	2.99 (76)	6.81 (173)	2.68 (68)	0.59 (15)	3.54 (90)	0.53 (13.5)	3.17 (80.5)	1.42 (36)	1.50 (38)	4.72 (120)	0.35 (9)	<b>27</b>	19.8 (9)
1.08 (27.5)	0.20 (5)	1.97 (50)	2.32 (59)	1.46 (37)	1.73 (44)	2.40 (61)	1.34 (34)	1.97 (50)	5.51 (140)	2.87 (73)	0.53 (13.5)	2.87 (73)	0.51 (13)	2.74 (69.5)	1.61 (41)	1.50 (38)	3.93 (100)	0.35 (9)	<b>57</b>	10.6 (4.8)
1.32 (33.5)	0.20 (5)	1.58 (40)	2.15 (54.5)	1.40 (35.5)	1.50 (38)	2.22 (56.5)	1.16 (29.5)	1.97 (50)	5.12 (130)	2.99 (76)	0.34 (8.5)	2.87 (73)	0.49 (12.5)	2.36 (60)	1.61 (41)	1.50 (38)	3.54 (90)	0.34 (8.5)	<b>56</b>	7.5 (3.4)
<b>S2</b>	<b>S1</b>	<b>S</b>	<b>L6</b>	<b>L5</b>	<b>L4</b>	<b>L3</b>	<b>L2</b>	<b>L1</b>	<b>L</b>	<b>I</b>	<b>H6</b>	<b>H5</b>	<b>H4</b>	<b>H3</b>	<b>H2</b>	<b>H1</b>	<b>H</b>	<b>F</b>	<b>Y</b>	Weight lbs (Kg)

Y	PORT SIZE		INLET FLOW (max)	REGULATED PRIORITY FLOW	
	P - A - B	T	gpm (l/min)	gpm (l/min) max	gpm (l/min) per turn
<b>56</b>	3/4-16 UNF-2B	9/16-18 UNF	27 (100)	23 (85)	approx. 4.8 (approx. 18)
<b>57</b>	1 1/16-12 UN-2B	9/16-18 UNF	53 (200)	37 (140)	approx. 5.3 (approx. 20)
<b>27</b>	1 5/16-12 UN-2B	9/16-18 UNF	80 (300)	58 (220)	approx. 6.9 (approx. 26)
<b>58</b>	1 5/8-12 UN-2B	9/16-18 UNF	106 (400)	80 (300)	approx. 7.4 (approx. 28)

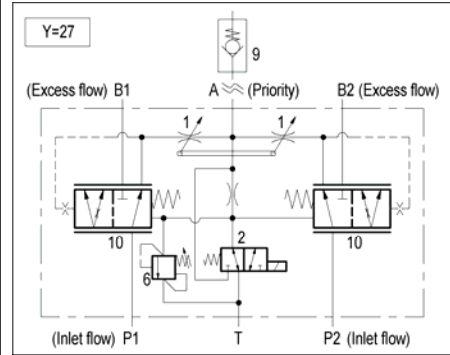
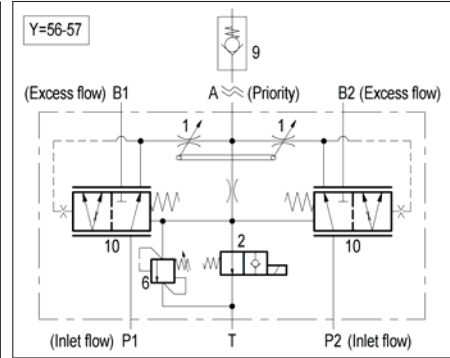
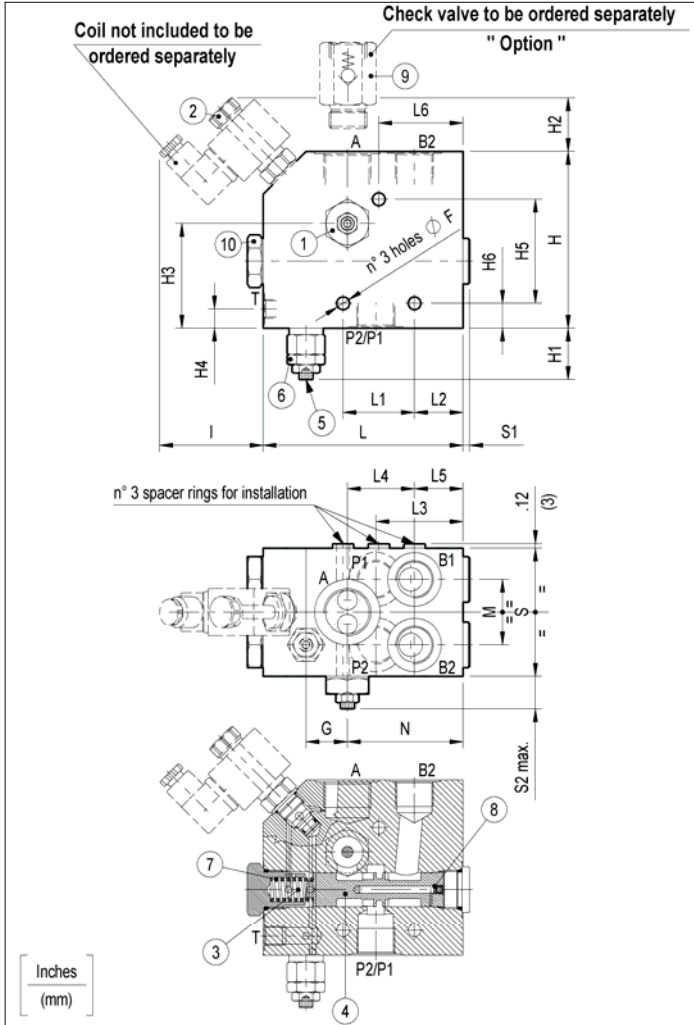
Z	PRIORITY PRESSURE RANGE		
	Adj. press. range psi (bar)	Press. increase psi/turn (bar/turn)	Std. setting psi (bar)
<b>20</b>	725-3000 (50-210)	696 (48)	2900 (200)
<b>35</b>	1450-5000 (100-350)	1378 (95)	5000 (350)

Extracted from RA 90810/01.06

Page 3 of 5  
Issue: 06.06

### Two pump configuration

OM.43.12.80 - Y - Z



#### TECHNICAL DATA

Max working pressure: 5000 psi (350 bar)

Max priority line pressure: depending from relief (1) setting (see table "Z")

Back pressure in "T" max: 20 psi (1.5 bar)

Drain from "T" with solenoid not energized: up to 0.4 gpm (up to 1.5 l/min)

Steel body

1.58 (40)	0.20 (5)	4.33 (110)	2.78 (70.5)	1.65 (42)	2.40 (61)	3.07 (78)	1.28 (32.5)	2.99 (76)	6.81 (173)	2.87 (73)	0.59 (15)	3.54 (90)	0.53 (13.5)	3.17 (80.5)	1.50 (38)	1.52 (38.5)	5.51 (140)	0.35 (9)	1.38 (35)	2.21 (56)	4.06 (103)	<b>27</b>	39.7 (18)
1.26 (32)	0.18 (4.5)	3.54 (90)	2.32 (59)	1.34 (34)	1.85 (47)	2.40 (61)	1.34 (34)	1.97 (50)	5.51 (140)	2.87 (73)	0.69 (17.5)	2.87 (73)	0.53 (13.5)	2.89 (73.5)	1.50 (38)	1.44 (36.5)	4.88 (124)	0.35 (9)	1.14 (29)	1.81 (46)	3.19 (81)	<b>57</b>	23.6 (10.7)
1.26 (32)	0.18 (4.5)	2.76 (70)	2.11 (53.5)	1.50 (38)	1.40 (35.5)	2.22 (56.5)	1.12 (28.5)	1.97 (50)	5.12 (130)	2.87 (73)	0.34 (8.5)	2.48 (63)	0.49 (12.5)	2.36 (60)	1.50 (1.38)	1.44 (36.5)	3.94 (100)	0.34 (8.5)	0.98 (25)	1.30 (33)	2.89 (73.5)	<b>56</b>	14.3 (6.5)
<b>S2</b>	<b>S1</b>	<b>S</b>	<b>L6</b>	<b>L5</b>	<b>L4</b>	<b>L3</b>	<b>L2</b>	<b>L1</b>	<b>L</b>	<b>I</b>	<b>H6</b>	<b>H5</b>	<b>H4</b>	<b>H3</b>	<b>H2</b>	<b>H1</b>	<b>H</b>	<b>F</b>	<b>G</b>	<b>M</b>	<b>N</b>	<b>Y</b>	Weight lbs (Kg)

Y	PORT SIZE			INLET FLOW (max)		REGULATED PRIORITY FLOW	
	P1-P2 B1-B2	A	T	gpm (l/min)		gpm (l/min) max	gpm (l/min) per turn
				P1	P2		
<b>56</b>	3/4-16 UNF-2B	1 1/16-12 UN-2B	9/16-18 UNF-2B	26 (100)	26 (100)	40 (150)	approx. 8.45 (approx. 32)
<b>57</b>	1 1/16-12 UN-2B	1 5/16-12 UN-2B	9/16-18 UNF-2B	53 (200)	53 (200)	65 (250)	approx. 9.25 (approx. 35)
<b>27</b>	1 5/16-12 UN-2B	1 5/8-12 UN-2B	9/16-18 UNF-2B	79 (300)	79 (300)	103 (390)	approx. 12.15 (approx. 46)

Z	PRIORITY PRESSURE RANGE		
	Adj. press. range (psi)	Press. increase (psi/turn)	Std. setting (psi)
<b>20</b>	725-3000 (50-210)	696 (48)	2900 (200)
<b>35</b>	1450-5000 (100-350)	1378 (95)	5000 (350)

**Extracted from RA 90810/01.06**

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The **FLOW CONTROL VALVES** code **OM.43.12.80** are 3 way, with **two separate inlets P1 and P2 and three outlets “A” and “B1 and B2”**, the first outlet **“A” being priority, pressure compensated type**, with pressure relief valve, and available on demand through a solenoid cartridge; the second and third outlets **“B1 and B2” are the by-pass** for all flow in excess of what demanded by priority. All flows from “A”, “B1 and B2” ports can be employed to power different functions of the machine. These valves provide a simple and efficient way to power hydraulic tools (such as hydraulic hammers) from the existing hydraulic system, without any need to modify the directional control valve.

**Applications**

They allow the simultaneous operations, independently from the respective working pressures, of both the hydraulic actuator powered by the priority outlet “A”, and of the normal functions of the machine (traction, slewing, cylinder motions, etc.) supplied by the main directional valve through the bay-pass outlets “B1 and B2”.

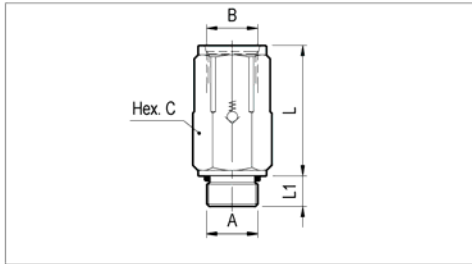
**FITTING AND CONNECTIONS**

The valve must be mounted against a flat surface using the 3 fixing holes, and it must lay **on top of the 3 special mounting spacers** in order to avoid even the smallest distortion of the valve body which could prevent the internal compensating spool from sliding freely.

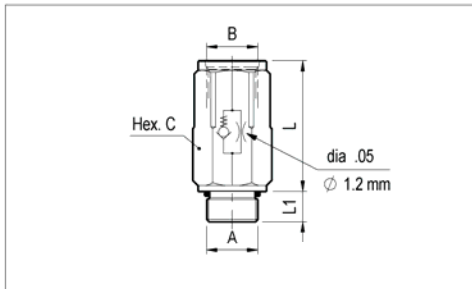
**Connections to the hydraulic system:**

- Ports “P1 and P2” (inlets) to the main line from the pumps.
- Port “A” (priority outlet) to the line feeding the hydraulic hammer, or the attachment. **Important:** for the correct metering of the compensating spool the priority outlet shall be always pressurized, **with a back-pressure of at least 115-130 psi (8-9 bar); if necessary, fit a check valve with the needed cracking pressure.**
- Ports “B1 and B2” (by-pass, or excess flow outlet) to the lines delivering the oil to the main directional valve.
- Port “T” to a tank line. **It is absolutely necessary that port “T” is connected to a low pressure tank line, 15-22 psi max (1-1.5 bar max).**

**SLEEVE TYPE CHECK VALVES**



Port size A - B	Cracking Pressure psi (bar)	Dimensions inches (mm)			Ordering code
		C	L	L1	
3/4-16 UNF	115 (8)	1.18 (30)	2.24 (57)	0.51 (13)	<b>04.31.17.00.56.01.000</b>
1 1/16-12 UN	115 (8)	1.42 (36)	2.72 (69)	0.63 (16)	<b>04.31.17.00.57.01.000</b>
1 5/16-12 UN	115 (8)	1.81 (46)	3.23 (82)	0.71 (18)	<b>04.31.17.00.27.01.000</b>
1 5/8-12 UN	115 (8)	2.17 (55)	4.02 (102)	0.71 (18)	<b>04.31.17.00.58.01.000</b>



Port size A - B	Cracking Pressure psi (bar)	Dimensions inches (mm)			Ordering code
		C	L	L1	
1 1/16-12 UN	115 (8)	1.42 (36)	2.72 (69)	0.63 (16)	<b>04.31.30.12.57.01.010</b>

**Adjustment of priority flow**

The volume of priority flow from port “A” can be easily modified by turning the screw (1): the flow increases by turning the screw counter-clockwise and, once adjusted to the desired level, it remains constant independently from the working pressure.

**Adjustment of maximum priority pressure**

The maximum pressure in the priority line “A” can be adjusted by turning the screw (5) of the small relief cartridge (6) which controls the maximum pressure in the chamber (3): when this “pilot” cartridge opens, the pressure in chamber (3) drops and the priority flow is stopped.

**Note:** the relief cartridge (6) controls only the maximum pressure in the priority outlet “A”, **and does not control the pressure in the by-pass and main line: the main line must be protected by another relief valve, capable to discharge the full oil flow.**

Extracted from RA 90810/01.06

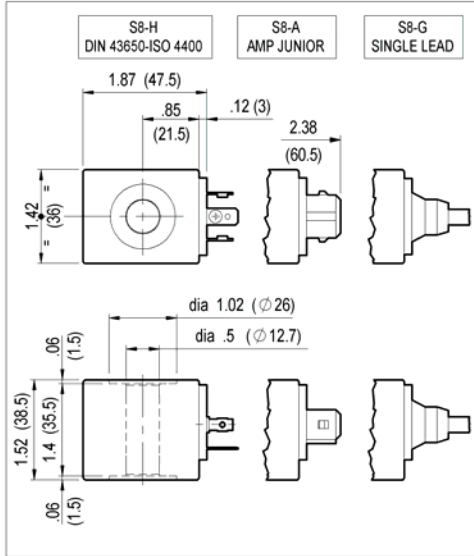
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Ordering code: **OD.02.17 - X - Y - Z**

### COILS

Attention: indicated coils fit every hammer valve versions



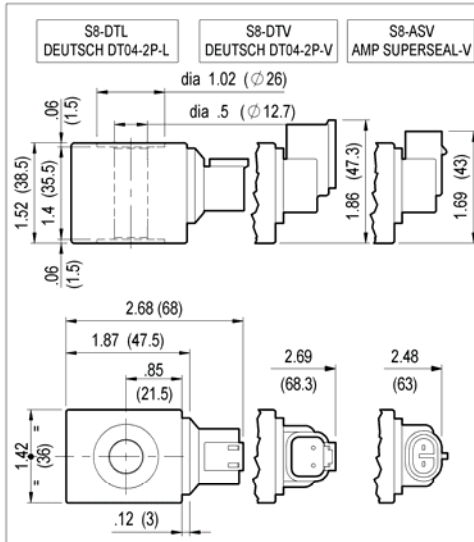
#### TECHNICAL DATA

Weight: 0.397 lbs (0.180 Kg)  
 Encapsulating material: IXEF  
 Heat insulation Class H: 356°F (180°C)  
 Ambient temperature range: -86 +140 °F (-30 + 60 °C)  
 Inlet voltage fluctuations must not exceed ±10% of nominal voltage to obtain correct operation and long life coils.

X	Y	Connections	Circuit	Voltage
01	30	DIN 43650 - ISO 4400	Standard	DC-RAC
07	30	AMP JUNIOR	Standard	DC only
0G	03	SINGLE LEAD	Standard	DC only
14	30	DIN 43650 - ISO 4400	Bidirectional Diode	DC only
15	30	AMP JUNIOR	Bidirectional Diode	DC only
0H	03	SINGLE LEAD	Bidirectional Diode	DC only

Length 11.8 inches  
 Ext. diameter 0.25 inches  
 (∅ 6.3 mm)  
 External and internal Sheath  
 Silicone rubber

Z	Voltage V	Resistance Ω (±7%)	Power W	Current A	ΔT °F (°C)
	Nominal	Ta = 68-77 °F (20-25 °C)	Cold coil	Cold coil	Hot coil
OB	12 DC	7.4	20	1.62	1.19
OC	24 DC	28.5	20	0.85	0.61
OG	14 DC		20		
AC	26 DC	34.3	20	0.76	0.54



X	Y	Connections	Circuit	Voltage
20	30	DEUTSCH DT04-2P-L	Standard	DC only
20	3P	DEUTSCH DT04-2P-L	Standard	DC only
30	3P	AMP SUPERSEAL-V	Standard	DC only
22	30	DEUTSCH DT04-2P-L	Bidirectional Diode	DC only
22	3P	DEUTSCH DT04-2P-L	Bidirectional Diode	DC only
32	3P	AMP SUPERSEAL-V	Bidirectional Diode	DC only

Z	Voltage V	Resistance Ω (±7%)	Power W	Current A	ΔT °F
	Nominal	Ta = 68-77 °F (20-25 °C)	Cold coil	Cold coil	Hot coil
OB	12 DC	7.4	20	1.62	1.19
OC	24 DC	28.5	20	0.85	0.61
AC	26 DC	34.3	20	0.76	0.54

Protection IP69 - DIN 40050 part 9  
 These coils have passed the THERMAL SHOCK DUNK TEST

### SPARE PARTS

SOLENOID CARTRIDGE	
Port size	Ordering code
OM.43.12.80.56.20	<b>OD.15.02.18.11.00</b>
OM.43.12.80.56.35	
OM.43.12.80.57.20	
OM.43.12.80.57.35	
OM.43.12.80.27.20	
OM.43.12.80.27.35	<b>OD.13.20.67.39.00</b>

RELIEF CARTRIDGE	
Port size	Ordering code
OM.43.12.80.56.20	<b>04.11.22.03.99.20</b>
OM.43.12.80.57.20	
OM.43.12.80.27.20	
OM.43.12.80.56.35	<b>04.11.22.03.99.35</b>
OM.43.12.80.57.35	
OM.43.12.80.27.35	

Extracted from RA 90811/01.06

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## Flow diverters

### 6 ways flow diverters

#### VS 311/312/315

L7.53.U.J.W.V.X.Y.Z

Pressure up to 4500 PSI (310 bar)

Flow up to 37.0 GPM (140 l/min)

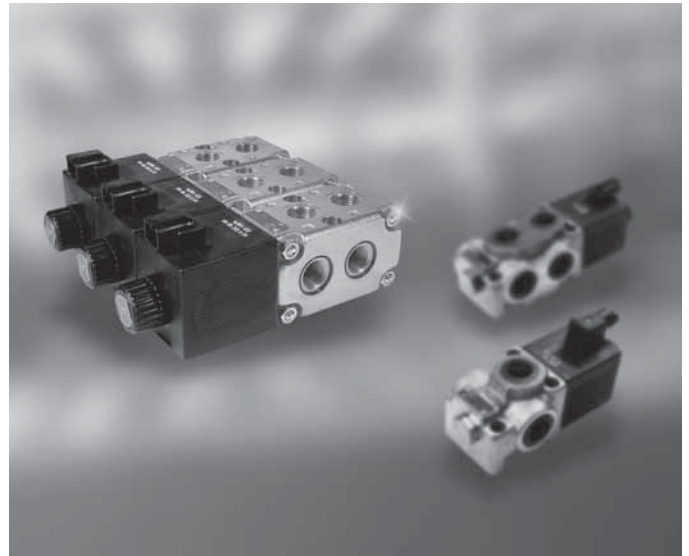
### 6 ways bankable flow diverters

#### VS 281/5/6F

L7.45.U.J.W.V.X.Y.Z

Pressure up to 4500 PSI (310 bar)

Flow up to 23.8 GPM (90 l/min)





Extracted from RA 90811/01.06

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6 ways flow diverters – VS 311/312/315

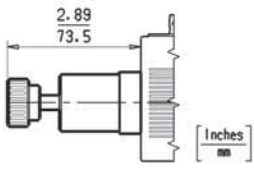
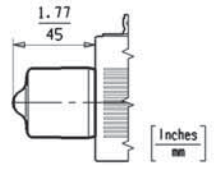
L7.53.U.J.W.V.X.Y.Z

Max. pressure: 4500 psi (310 bar)		Max. flow: 37 gpm (140 l/min)		Ports: 1/2" G - 3/4" G - SAE12				
<b>W</b>	Circuit	Transit position		<b>W</b>	Circuit	Transit position		
6A				6F				
6B				6G				
6E								
<b>V</b>	Drain	Circuit		Spool types			Pressure max	
I	Int. D.I.		6A	6B	6E	6F		6G
E	Ext. D.E.		3626 psi (250bar)	3626 psi (250bar)	3626 psi (250bar)	4500 psi (310bar)		4500 psi (310bar)
Coils		C65		Standard			Pag. 35	
<p><b>Maximum performance</b></p>				<p><b>Pressure drop</b></p>				
Internal leakage on C ports		MIN In <sup>3</sup> /min (cm <sup>3</sup> /min)		MAX In <sup>3</sup> /min (cm <sup>3</sup> /min)		Mineral oil with 32 cSt viscosity, at 104°F (40°C) and 1450 psi (100 bar) pressure.		
		0,7 (12)		1,8 (30)				
<b>U</b>	Ports (A)	Ports (A1)	Model					
4	1/2" G	1/4" G	VS 311					
5	3/4" G	1/4" G	VS 312					
E	SAE12	SAE4	VS 315					
Weights lbs (kg)		11,2 (5,1)						

Extracted from RA 90811/01.06  
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## 6 ways flow diverters – VS 311/312/315

### L7.53.U.J.W.V.X.Y.Z

Tube-Plug Key. 0,75-1,06: 18,4÷19,9 ft-lb (ch. 19-27mm: 25÷27Nm)		Coil retainer nut Dia.1,34: 5,2÷5,9 ft-lb (Ø.34: 7÷8Nm)	Fixing screws N°3 DIN 912-8,8 M8x45: 11,1÷11,8 ft-lb (N°3 DIN 912-8,8 M8x45: 15÷16Nm)	
<b>J</b> _F		<b>J</b> _P		
Screwed manual override EF Reference: LC2DZEF		Push-button manual override EP Reference: 281-0010		

## ORDERING CODE

L 7 5 3 U J W V X Y Z

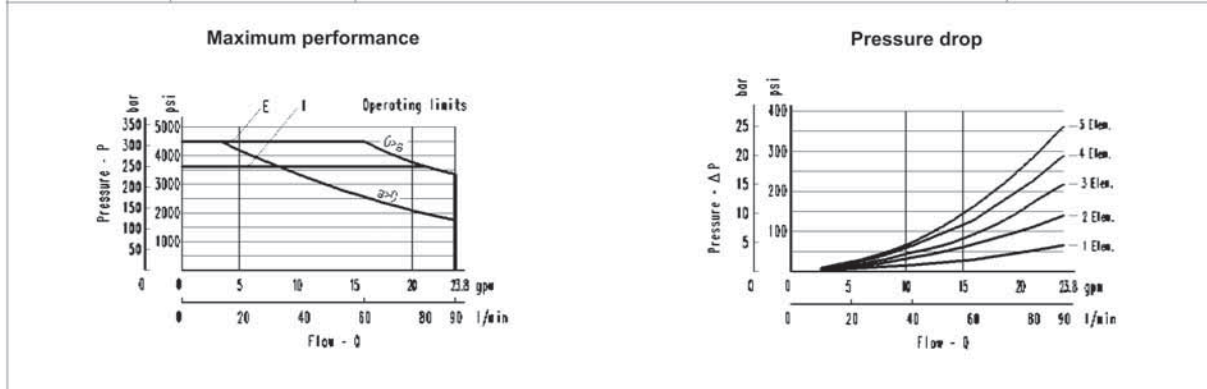
<b>U</b> PORTS	SEE PAGE 19	<b>J</b> OPERATED								
<b>V</b> DRAIN	SEE PAGE 19	<b>14</b>	ELECTRICALLY OPERATED (DZ)							
<b>W</b> CIRCUIT	SEE PAGE 19	<b>4F</b>	ELECTRICALLY OPERATED + EF							
		<b>4P</b>	ELECTRICALLY OPERATED + EP							
<b>X</b> VOLTAGE		<b>Y</b> AVAILABLE CONNECTIONS	00	01	02	03	07	20	31	34
<b>00</b>	WITHOUT COIL	X								
<b>0B</b>	12V DC			X	X	X	X	X	X	X
<b>AD</b>	13V DC			X	X		X			
<b>OC</b>	24V DC			X	X	X	X	X	X	X
<b>AC</b>	27V DC			X	X		X			
<b>OD</b>	48V DC			X	X			X		
<b>OV</b>	24V AC (RAC 21.5 DC)			X	X			X		
<b>OW</b>	110V AC (RAC 98 DC)			X	X			X		
<b>OZ</b>	230V AC (RAC 207 DC)			X	X			X		
<b>Y</b> CONNECTION		<b>Z</b> VERSION								
<b>00</b>	WITHOUT COIL AND CONNECTOR	<b>0</b>	STANDARD							
<b>01</b>	WITH COIL, WITHOUT CONNECTOR	<b>V</b>	SEALS IN VITON							
<b>02</b>	WITH CONNECTOR DIN 43650									
<b>03</b>	AMP JUNIOR									
<b>07</b>	DT04-2P DEUTSCH									
<b>20</b>	Cable 59,05 Inc. (1500 mm)									
<b>31</b>	Cable 13,78 Inc. (350 mm)									
<b>34</b>	Cable 13,78 Inc. (350 mm) + DT04-2P DEUTSCH									

Extracted from RA 90811/01.06

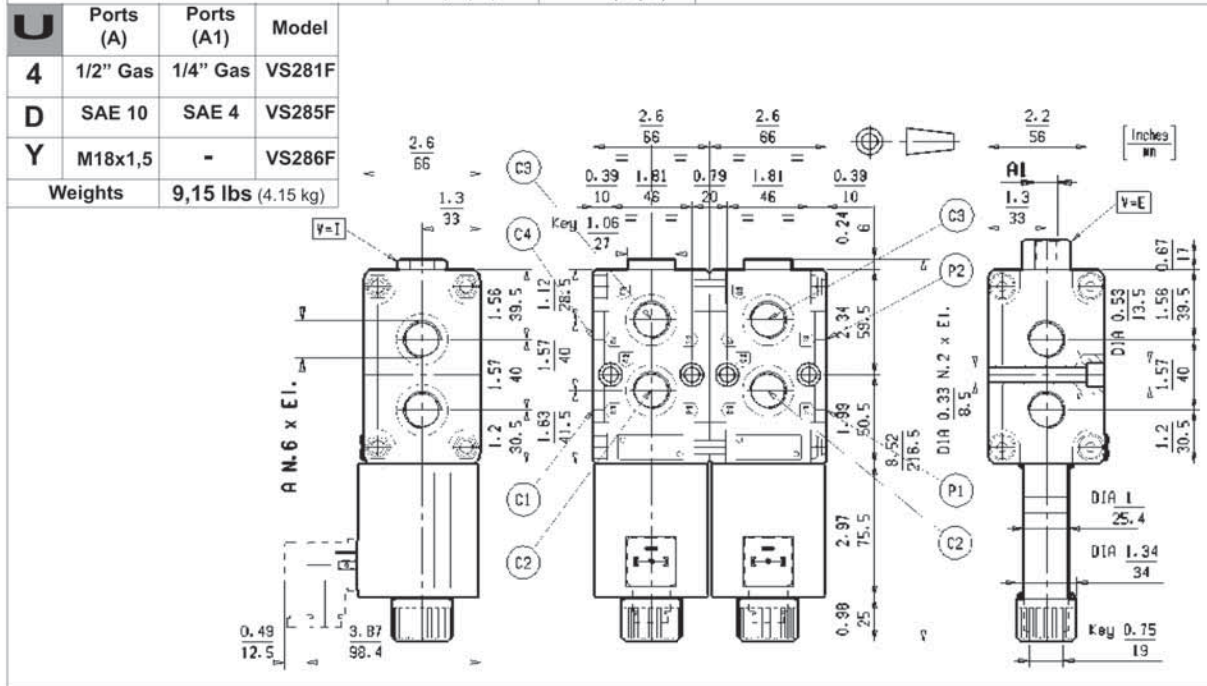
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6 ways bankable flow diverters – VS 281/5/6F  
L7.45.U.J.W.V.X.Y.Z

Max. pressure: 4500 psi (310 bar)			Max. flow: 24gpm (90 l/min)			Ports: 1/2" Gas - SAE10 - M18x1,5		
W	Circuit	Transit position			W	Circuit	Transit position	
6B					6G			
6D								
6E								
V	Drain	Circuit	Spool types				Pressure max	
I	Int. D.I.		6B	6D	6E	6G		6H
E	Ext. D.E.		3626 psi (250bar)	3626 psi (250bar)	3626 psi (250bar)	4500 psi (310bar)		4500 psi (310bar)
Coils		C65	Standard				Pag. 35	



Internal leakage on C ports	MIN	MAX	Mineral oil with 32 cSt viscosity, at 104°F (40°C) and 1450psi (100bar) pressure.
	in <sup>3</sup> /min (cm <sup>3</sup> /min)	in <sup>3</sup> /min (cm <sup>3</sup> /min)	
	0,6 (10)	1,8 (30)	





Extracted from RA 90811/01.06  
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## 6 ways bankable flow diverters – VS 281/5/6F L7.45.U.J.W.V.X.Y.Z

<b>Tube-Plug</b> Key. 0,75-1,06 In: 18,4÷19,9 ft-lb (ch. 19-27mm: 25÷27Nm)		<b>Retainer nut</b> Dia.1,34: 5,2÷5,9 ft-lb (Ø.34: 7÷8 Nm)		<b>Fixing screws</b> DIN 912-8.8 M8x65: 11,1÷11,8 ft-lb (DIN 912-8.8 M8x65: 15÷16Nm)	
<b>J</b> <b>F</b>				<b>J</b> <b>P</b>	
Screwed manual override EF Reference: LC2DZEF		Push-button manual override EP Reference: 281-0010			
<b>CIRCUIT</b>			<b>Ports (D)</b>	<b>Code</b>	<b>Description</b> Modular element with cross pressure limiting valves on C1-C4.
			<b>1/2" Gas</b>	<b>L7404610214SV00</b>	
			<b>SAE10</b>	<b>L740D610214SV00</b>	
<b>Weights</b>	3,1 lbs (1.40 kg)				
<b>P. max psi (bar)</b>	<b>Q gpm (l/min)</b>	<b>Cartridge</b>	EXAMPLE		
3626 (250)	18,5 (70)	VMD1.070.SV			
<b>J</b> <b>H1</b>	<b>X</b> <b>SG</b>	Push-turn manual actuator Ref.: 26-0243000	<b>J</b> <b>P1</b>	<b>X</b> <b>00</b>	Oleopneumatic actuator OP Reference: #####
Key. 0,98: 14,8÷16,2 ft-lb (ch. 25mm: 20÷22Nm)		Key. 1,06: 22,1÷24,3 ft-lb (ch. 27mm: 30÷33Nm)		Key. 1,18: 14,8÷16,2	
				* With external drain (DE). With internal drain (DI), allow for pilot ratio 6,5:1. Example: at 1450 psi (100 bar) pressure (C1,C2,C3,C4), will need a minimum pilot pressure of 1450 (100 bar):6,5 = 223,4 psi (15,4 bar).	

Extracted from RA 90811/01.06

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Issue: 06.06

## 6 ways bankable flow diverters – VS 281/5/6F L7.45.U.J.W.V.X.Y.Z

<b>Model</b>	<b>Port number</b>	<b>L</b> Inches (mm)	<b>Screws - Tie rods</b>	<b>Maximum blocking torque</b> ft-lb (Nm)
VS 281/5/6F-2	8	5,2 (132)	M8x125 (v)	12,5 (17)
VS 281/5/6F-3	10	7,8 (198)	M8x190 (v)	12,5 (17)
VS 281/5/6F-4	12	10,4 (264)	M8x270 (t)	12,5 (17)
VS 281/5/6F-5	14	13,0 (330)	M8x330 (t)	12,5 (17)

<b>ORDERING CODE</b>		<b>L 7 4 5</b> _ <b>J</b> <b>W</b> <b>V</b> <b>X</b> <b>Y</b> <b>Z</b>					
----------------------	--	--	--	--	--	--	--

<b>U</b> PORTS	SEE PAGE 28	<b>J OPERATED</b>						
<b>V</b> DRAIN	SEE PAGE 28	<b>13</b>	ELECTRICALLY OPERATED (DZ)					
<b>W</b> CIRCUIT	SEE PAGE 28	<b>1F</b>	ELECTRICALLY OPERATED + EF					
		<b>1P</b>	ELECTRICALLY OPERATED + EP					
		<b>P1</b>	OLEOPNEUMATICALLY OPERATED (OP)					
		<b>H1</b>	MANUALLY OPERATED (MN)					
<b>X</b> VOLTAGE		<b>Y</b>	Available connections					
<b>00</b> Without coil		<b>00</b>	<b>01</b>	<b>02</b>	<b>03</b>	<b>07</b>	<b>31</b>	<b>34</b>
<b>OB</b> 12V DC		<b>X</b>						
<b>AD</b> 13V DC			X	X	X	X	X	X
<b>OC</b> 24V DC			X	X	X	X	X	X
<b>AC</b> 27V DC			X	X		X		
<b>OD</b> 48V DC			X	X				
<b>OV</b> 24V AC (RAC 21.5 DC)			X	X				
<b>OW</b> 110V AC (RAC 98 DC)			X	X				
<b>OZ</b> 230V AC (RAC 207 DC)			X	X				
<b>Y</b> CONNECTION		<b>Z</b> VERSION						
<b>00</b> Without coil		<b>0</b>	SINGLE ELEMENT					
<b>01</b> With coil without connector		<b>2</b>	2 FLANGED ELEMENTS					
<b>03</b> AMP Junior		<b>3</b>	3 FLANGED ELEMENTS					
<b>07</b> DT04-2P DEUTSCH		<b>4</b>	4 FLANGED ELEMENTS					
<b>31</b> Cable 13,78 Inc. (350 mm)		<b>5</b>	5 FLANGED ELEMENTS					
<b>34</b> Cable 13,78 Inc. (350 mm) + DT04-2P DEUTSCH								

Extracted from RA 90811/01.06

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Issue: 06.06

## Coils for flow diverters – VS 311/312/315 & VS 281/5/6F

C 65

<p><b>Weight:</b> 1,2 kg - <b>Insulation Class:</b> H - <b>Working Duty:</b> ED 100% only if the room temperature does not exceed 104°F (40°C).</p> <p><b>Inlet voltage:</b> should not exceed +5% / -10% of the nominal value.</p> <p><b>Available voltages:</b> Look at table. On request different voltages can be supplied.</p> <p><b>Low voltage:</b> conforms to the 73/23/CEE and 89/336/CEE directives. Standard connections: DIN 43650-ISO 4400.</p> <p>Versions with sheathed cables as well as with Deutsch and AMP JUNIOR connector are equipped with bi-directional diode.</p> <p><b>Protection Class according to DIN 40050:</b> only if the coil is assembled correctly with O'ring and retainer:          - IP65 with DIN 43650 connector, only if it is assembled with rubber sealings and the fixing screw is properly tightened.          - IP69k for versions with Deutsch connector.</p>								<b>J</b>
								<b>14</b>
								<b>4</b>
Reference	Model	Connection	Nominal voltage volt	Marking	Power watt	Nominal current ampere	Resistance	
							Ω	± 7%   T=68°F (20°C)
281-0617	C6501 12DC	DIN 43650 - ISO 4400	12 DC	12 VDC	44	3.60	3.2	
281-06190	C6531 12DC	CABLES	12 DC	12 VDC	44	3.60	3.2	
281-0631	C6503 12DC	AMP JUNIOR	12 DC	12 VDC	44	3.60	3.2	
281-06191	C6534 12DC	CABLE + DEUTSCH	12 DC	12 VDC	44	3.60	3.2	
281-06194	C6507 12DC	DEUTSCH DT04-2P	12 DC	12 VDC	44	3.60	3.2	
281-061700	C6501 13DC	DIN 43650 - ISO 4400	13 DC	13 VDC	44	3.40	3.6	
281-06198	C6507 13DC	DEUTSCH DT04-2P	13 DC	13 VDC	44	3.40	3.9	
281-0618	C6501 24DC	DIN 43650 - ISO 4400	24 DC	24 VDC	44	1.80	12.8	
281-06195	C6531 24DC	CABLES	24 DC	24 VDC	44	1.80	12.8	
281-0632	C6503 24DC	AMP JUNIOR	24 DC	24 VDC	44	1.80	12.8	
281-06196	C6534 24DC	CABLE + DEUTSCH	24 DC	24 VDC	44	1.80	12.8	
281-06197	C6507 24DC	DEUTSCH DT04-2P	24 DC	24 VDC	44	1.80	12.8	
281-061800	C6501 27DC	DIN 43650 - ISO 4400	27 DC	27 VDC	44	1.60	16.9	
281-06199	C6507 27DC	DEUTSCH DT04-2P	27 DC	27 VDC	44	1.60	16.7	
281-0621	C6501 48DC	DIN 43650 - ISO 4400	48 DC	48 VDC	44	0.90	50.5	
281-0622	C6501 24 50 RAC	DIN 43650 - ISO 4400	21.5 DC	21.5 VDC	44	2.00	11	
281-0623	C6501 110 50 RAC	DIN 43650 - ISO 4400	98 DC	98 VDC	44	0.45	98	
281-0624	C6501 230 50 RAC	DIN 43650 - ISO 4400	207 DC	207 VDC	44	0.21	997	

## Notes



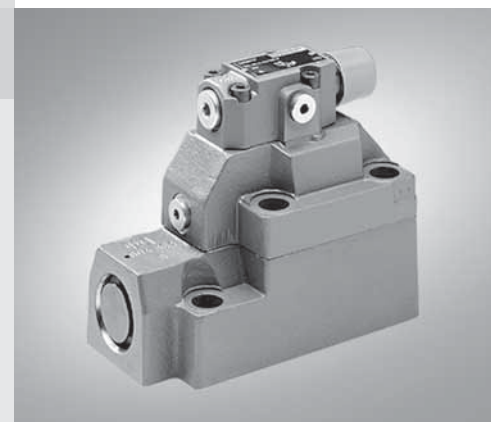
## Section 5

# Pressure Control Valves

### The Drive & Control Company

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For a complete copy of the data sheets in this catalog, visit our website at:  
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**Extracted from RA 25 402/06.98**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Pressure relief valve, direct operated  
Model DBD**

Sizes 6 to 30, Series 1X  
Maximum operating pressure 630 bar (9150 PSI)  
Maximum flow 330 L/min (87 GPM)

- Direct operated, fast response pressure relief valve
- Optional mounting styles
  - Screw-in cartridge valve
  - Cartridge in threaded housing
- Multiple pressure adjustment options



Model DBD A..K 1X/..

- Multiple pressure adjustment ranges available for maximum resolution

**Ordering code**

							DBD				1X/	/	*	
Pressure relief valve, direct operated														
Type of adjustment	Size													
	6	10	15	20	25	30								
Screw adjustment with locknut and protective cap	●	●	●	●	●	●	= S							
Handknob	●	●	●	●	-	-	= H							
<b>Size</b>	= 6	= 10	= 15	= 20	= 25	= 30	e.g.							
<b>SAE</b>	-4; 7/16-20	-8; 3/4-16	-12; 1 1/16-12	-16; 1 5/16-12	-20; 1 5/8-12	-24; 1 7/8-12	= 10							
Type of connection	6	10	15	20	25	30								
for block mounting (cartridge)	●	●	-	●	-	●	= K							
for threaded connections	●	●	●	●	●	●	= G							
Series 10 to 19, (10 to 19, externally interchangeable)											= 1X			
Ordering code for pressure range PSI														
25 bar (365 PSI)	●	●	-	-	-	●	= 25							
50 bar (725 PSI)	●	●	●	●	-	●	= 50							
100 bar (1450 PSI)	●	●	-	●	●	●	= 100							
200 bar (2900 PSI)	●	●	●	●	●	●	= 200							
315 bar (4600 PSI)	●	●	-	●	●	●	= 315							
400 bar (5800 PSI)	●	●	-	●	-	-	= 400							
630 bar (9150 PSI)	-	-	-	-	-	-	= 630							
Thread options – Model "G" only														
SAE threaded housing											= 12			
NBR seals, suitable for petroleum oils (HM, HL, HLP)											= no code			
Further details to be written in clear text														

**Technical data**

Operating pressure range		Size 6	Size 10	Size 15 and 20	Size 25 and 30
Inlet "P"	bar (PSI)	... 400 (5800)	... 630 (9140)	... 400 (5800)	... 315 (4600)
Outlet "T"	bar (PSI)	... 315 (4600)	... 315 (4600)	... 315 (4600)	... 315 (4600)



**Extracted from RE 25408/01.05**

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Issue: 06.06

**Technical data**
**General**

Valve function	Pressure relief valve, directly operated		
Type of mounting	Subplate, mounting hole configuration NG6, ISO 6264		
Mounting position	Optional		
Ambient temperature range	°C (°F)	-25 to +50 (-13 to +122)	
Weight	Horizontal	kg (lbs.)	1.4 (3.09)
	Vertical	kg (lbs.)	1.1 (2.42)

**Hydraulic**

Pressure fluid	Mineral oil (HL, HLP) to DIN 51524, rapidly biodegradable pressure fluids to VDMA 24568 (also see RE 90221), HETG (rapeseed oil), HEPG (polyglycols), HEES (synthetic ester), other pressure fluids available on request		
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 20/18/15 <sup>1)</sup>		
Pressure fluid temperature range	°C (°F)	-25 to +80 (-13 to +176)	
Seals	FPM (Viton® Dupont)		
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 500 (45 to 2320)	
Max. setting pressure	bar (PSI)	80, 160 or 315 (1160, 2320 or 4500)	
Max. working pressure	bar (PSI)	315 (4500)	
Max. flow rate	l/min (GPM)	60 (15.85)	

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems.

Effective filtration prevents problems and also extends the service life of components.

For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.



**Extracted from RE 25722/01.05**

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Issue: 06.06

**Pressure relief valve, directly operated  
Model ZDBY D / Z2DBY D**

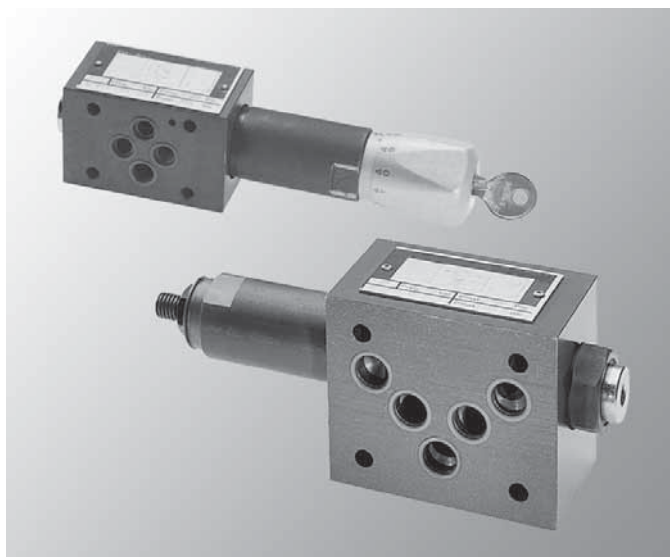
Nominal size 6 and 10

Series 1X

Max. working pressure up to 315 bar (4500 PSI)

Max. flow 60 and 120 l/min (15.85 and 31.70 GPM)

- Modular valve
- Mounting hole configuration to ISO 4401
- 3 pressure stages
- 5 effective directions
- With 1 or 2 pressure valve cartridges
- 2 setting elements:
  - Sleeve with hexagon socket
  - Rotary knob, lockable, with scale
- Subplates as per catalog sections RE 45053 (NG6) and RE 45055 (NG10) (order separately)



Model ZDBY D / Z2DBY D

**Ordering code**

Z	DB	Y	D	1X /	V /	*
Modular valve = Z						Further information in plain text
With 2 pressure valve cartridges (only enter for versions "DC" and "DD") = 2						No code = mounting hole config. ISO 4401, without locating bore
Pressure relief valve = DB						60 = mounting hole config. ISO 4401 with locating bore
Mounting hole configuration to ISO 4401 = Y						V = FPM seals (other seals available on request)
Nominal size 6 = 60						<b>Note</b> Take compatibility of seals and pressure fluid into account!
Nominal size 10 = 10						
Directly operated = D						<b>max. setting pressure</b>
<b>Injection</b>						180 = setting pressure range up to 80 bar (1160 PSI)
P to T = P						160 = setting pressure range up to 160 bar (2320 PSI)
A to T = A						315 = setting pressure range up to 315 bar (4500 PSI)
B to T = B						1X = Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged)
A to T and B to T = C						
A to B and B to A = D						
<b>Setting element</b>						
Sleeve with hexagon socket = 2						
Rotary knob, lockable, with scale <sup>1)</sup> = 3						

<sup>1)</sup> 2H key is included in scope of delivery

**Extracted from RE 25722/01.05**

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**Technical data**
**Size 6 – General**

Valve function	Pressure reducing valve, directly operated		
Type of mounting	Intermediate plate NG6, ISO 4401-03-04-0-94		
Installation position	Optional		
Weight	Version 2	kg (lbs.)	1.4 (3.09)
	Version 3	kg (lbs.)	1.8 (3.97)

**Hydraulic**

Pressure fluid	Mineral oil (HL, HLP) to DIN 51524. Rapidly biodegradable pressure fluids to VDMA 24568 (see also RE 90221), HETG (rapeseed oil), HEPG (polyglycols), HEES (synthetic ester), other pressure fluids available on request		
Maximum permissible degree of contamination of pressure fluid. Purity class to ISO 4406 (c)	Class 20/18/15 <sup>1)</sup>		
Pressure fluid temperature range	°C (°F)	-20 to +80 (-4 to +176)	
Seals	FPM (Viton® Dupont)		
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 500 (45 to 2320)	
Max. setting pressure	bar (PSI)	80, 160 or 315 (1160, 2320 or 4500)	
Max. working pressure	bar (PSI)	315 (4500)	
Max. flow rate	l/min (GPM)	60 (15.85)	

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.

**Size 10 – General**

Valve function	Pressure reducing valve, directly operated		
Type of mounting	Intermediate plate NG10, ISO 4401-05-04-0-94		
Installation position	Optional		
Weight	Version 2	kg (lbs.)	2.9 (6.39)
	Version 3	kg (lbs.)	3.5 (7.71)

**Hydraulic**

Pressure fluid	Mineral oil (HL, HLP) to DIN 51524. Rapidly biodegradable pressure fluids to VDMA 24568 (see also RE 90221), HETG (rapeseed oil), HEPG (polyglycols), HEES (synthetic ester), other pressure fluids available on request		
Maximum permissible degree of contamination of pressure fluid. Purity class to ISO 4406 (c)	Class 20/18/15 <sup>1)</sup>		
Pressure fluid temperature range	°C (°F)	-20 to +80 (-4 to +176)	
Seals	FPM (Viton® Dupont)		
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 500 (45 to 2320)	
Max. setting pressure	bar (PSI)	80 (1160)	160 or 315 (2320 or 4500)
Max. working pressure	bar (PSI)	315 (4500)	315 (4500)
Max. flow rate	l/min (GPM)	90 (23.78)	120 (31.70)

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.

**Extracted from RE 25724/01.05**

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**Pressure relief valve  
 Model (Z)DBT/DZT**

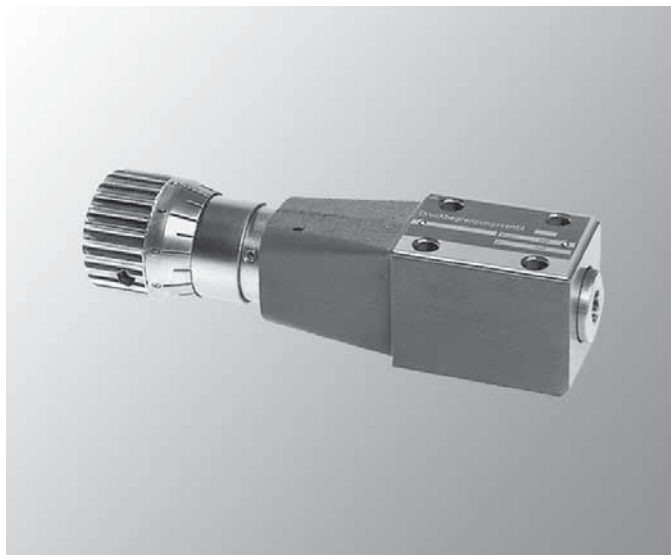
Nominal size 6

Series 1X

Max. working pressure up to 315 bar (4500 PSI)

Max. flow 3 l/min (0.79 GPM)

- Directly operated valves for limiting the system pressure
- Used as a pilot valve
- For subplate mounting:
  - Mounting hole configuration to ISO 4401-03-02-0-94
- Subplates as per catalog sections RE 45052 (order separately)



Model (Z)DBT / DZT

**Ordering code**

		- 1X /			
<b>Subplate mounting</b>				No code =	NBR seals (other seals available on request)
Pressure relief function	= DBT				<b>Note</b>
Pressure sequence function	= DZT				Take compatibility of seals and pressure fluid into account!
<b>Intermediate plate</b>					
Pressure relief function	= ZDBT				
For installation in instrument panel	= G			180 =	setting pressure range 3 to 80 bar (43 to 1160 PSI)
Mounting hole configuration to ISO 4401-03-02-0-94	= X			160 =	setting pressure range 3 to 160 bar (43 to 2320 PSI)
Function in A-duct	= A			315 =	setting pressure range 3 to 315 bar (43 to 4500 PSI)
Function in B-duct	= B				
Function in P-duct	= P			1X =	Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged)
<b>Setting elements</b>					
Handwheel and lock nut	= 1				
External square with lock nut and protective cap	= 2				
Rotary knob, lockable, with scale <sup>1)</sup>	= 3				
Rotary knob with scale	= 7				
External square and lock nut	= 8				

<sup>1)</sup> 2H key is included in scope of delivery

**Extracted from RE 25724/01.05**

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Issue: 06.06

**Technical data**
**General**

Installation position		Optional
Storage temperature range	°C (°F)	-20 to +80 (-4 to +176)
Ambient temperature range	°C (°F)	-20 to +70 (-4 to +158)
Weight	kg (lbs.)	2.0 (4.4)

**Hydraulic** – measured with HLP 46;  $\vartheta_{oil} = 40\text{ °C} \pm 5\text{ °C}$  (104 °F  $\pm$  41 °F),  $\nu = 35\text{ mm}^2/\text{s}$  (162 SUS)

Max. working pressure	Port P	bar (PSI)	350 (5075)
Max. setting pressure	Pressure stage 160 bar (2320 PSI)	bar (PSI)	160 (2320)
	Pressure stage 315 bar (4500 PSI)	bar (PSI)	315 (4500)
	Pressure stage 350 bar (5075 PSI)	bar (PSI)	350 (5075)
Min. setting pressure		bar (PSI)	3 (43)
Return	Port T	bar (PSI)	Separately to tank without pressure
Max. flow rate		l/min (GPM)	3 (0.79)
Pressure fluid			Mineral oil (HL, HLP) to DIN 51524 other pressure fluids available on request
Pressure fluid temperature range		°C (°F)	-20 to +80 (-4 to +176)
Viscosity range		mm <sup>2</sup> /s (SUS)	15 to 380 (70 to 1760)
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 20/18/15 1)
Hysteresis		%	< 5 of max. setting pressure
Control oil volume (V <sub>x</sub> ) (for pressure sequence valves only)		cm <sup>3</sup> (in <sup>3</sup> )	< 0.5 (0.03)

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems.

Effective filtration prevents problems and also extends the service life of components.

For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.



**Extracted from RE 25726/01.05**

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Issue: 06.06

**Technical data****General**

Valve function		Pressure relief valve, pilot operated
Type of mounting		Subplate, mounting hole configuration NG6, ISO 6264
Installation position		Optional
Ambient temperature range	°C (°F)	-25 to +50 (-13 to +122)
Weight	kg (lbs.)	1.4 (3.09)

**Hydraulic**

Pressure fluid		Mineral oil (HL, HLP) to DIN 51524. Rapidly biodegradable pressure fluids to VDMA 24568 (see also RE 90221), HETG (rapeseed oil), HEPG (polyglycols), HEES (synthetic ester), other pressure fluids available on request
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)		Class 20/18/15 <sup>1)</sup>
Pressure fluid temperature range	°C (°F)	-25 to +80 (-13 to +176)
Seals		FPM (Viton® Dupont)
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 500 (45 to 2320)
Max. setting pressure	bar (PSI)	80 or 160 (1160 or 2320)
Max. working pressure	bar (PSI)	315 (4500)
Max. flow rate	l/min (GPM)	60 (15.85)

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems.  
Effective filtration prevents problems and also extends the service life of components.  
For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.





## Extracted from RA 25 764/04.94

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Pressure relief valve – Sandwich plate design Model ZDBK 10

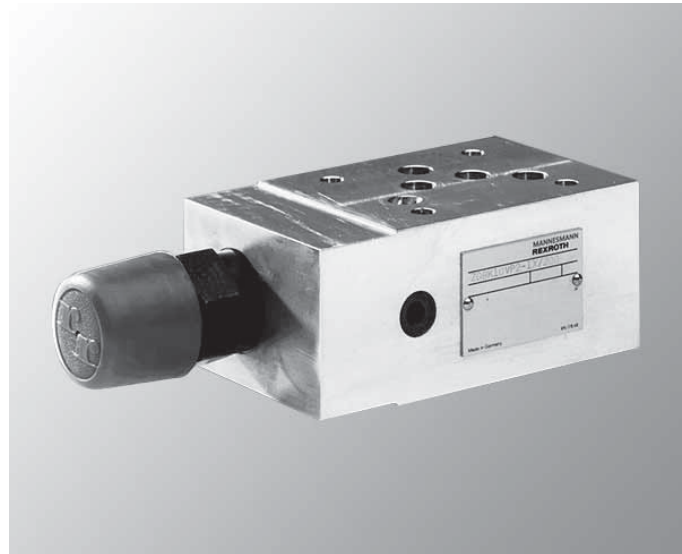
Size 10

Series 1X

Maximum operating pressure 210 bar (3050 PSI)

Maximum flow 80 L/min (21 GPM)

- Mounting pattern to ISO 4401-5, NFPA T3.5.1 MR1 and ANSI B 93.7 D 05
- Sandwich plate design
- Three pressure ranges
- Adjustment type: Screw adjustment with protective cap
- Available with five different pressure control configurations
- With one or two pressure relief cartridges



Model ZDBK 10 VP 2-1X/...V

## Ordering code

Z	DBK	10	- 1X	V	*
Sandwich plate design = Z					Further details to be written in clear text
Port or cross port relief, Omit is single = 2				V =	FPM seals, suitable for Petroleum oils (HM, HL, HLP) Phosphate ester fluids (HFD-R) Other seal types on request
Pressure relief valve = DBK				50 =	Adjustment range up to 50 bar (725 PSI)
Nominal size 10 (D 05) = 10				100 =	Adjustment range up to 100 bar (1450 PSI)
Relief from:				210 =	Adjustment range up to 210 bar (3050 PSI)
A → T = VA				1X =	Series 10 to 19 (10 to 19 = externally interchangeable)
P → T = VP				2 =	Adjustment mechanism Screw adjustment with locknut and protective cap
B → T = VB					
A → T; B → T (Z2DBK) = VC					
A → B; B → A (Z2DBK) = VD					

## Technical data

Nominal size	Size	10
Nominal pressure	bar (PSI)	210 (3050)
Adjustment pressure	bar (PSI)	up to 50 (725), 100 (1450), 210 (3050)
Flow	L/min (GPM)	80 (21)
Weight	Model ZDBK ...	kg (lbs.) 1.3 (2.9)

**Extracted from RA 25 751/06.98**

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 Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Pressure relief valve –  
 Sandwich plate design  
 Models ZDB 6 and Z2DB 6**

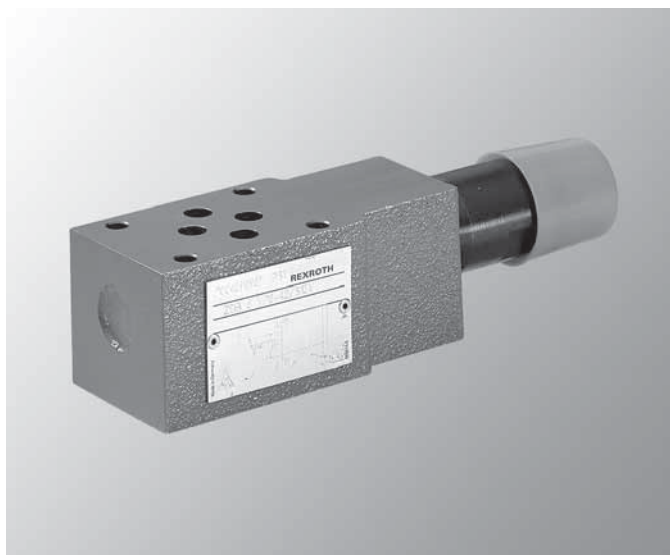
Size 6

Series 4X

Maximum operating pressure 315 (bar) 4600 PSI

Maximum flow 60 L/min (15.9 GPM)

- Sandwich plate design for use in vertical stacking assemblies
- Porting pattern to ISO 4401-3; NFPA T3.5.1 M R1 and ANSI B 93.7 **D 03**
- Two pressure adjustment options
- 1 or 2 pressure relief valve cartridges available
- Five relieving configurations available
- Four pressure adjustment ranges available to 4600 PSI



Model ZDB 6 VA2-4X/...

**Ordering code**

Z		DB	6		-4X	V	*
Sandwich plate design	= Z						Further details to be written in clear text
Two pressure relief cartridges (only available with Models 2VC2 and 2VD2, see below)	= 2					V =	FPM seals, suitable for Petroleum oils (HM, HL, HLP) Phosphate ester fluids (HFD-R) Other seal types on request
Pressure relief valve	= DB					50 =	Adjustment range up to 50 bar (725 PSI)
Nominal size 6 (D 03)	= 6					100 =	Adjustment range up to 100 bar (1450 PSI)
Relief from:						200 =	Adjustment range up to 200 bar (2900 PSI)
A → T						315 =	Adjustment range up to 315 bar (4600 PSI)
P → T						4X =	Series 40 to 49 (40 to 49 = externally interchangeable)
B → T							Adjustment mechanism
A → T and B → T (Z2DB)						1 =	Rotary handwheel
A → B and B → A (Z2DB)						2 =	Screw adjustment with locknut and protective cap

**Technical data**

Operating pressure		bar (PSI)	up to 315 (4600)
Adjustable pressure range		bar (PSI)	up to 50 (725), 100 (1450), 200 (2900), 315 (4600)
Flow		L/min (GPM)	up to 60 (15.9)
Weight (approx.)	Model ZDB 6	kg (lbs.)	1 (2.2)
	Model Z2DB 6	kg (lbs.)	1.2 (2.6)

**Extracted from RA 25 761/06.98**

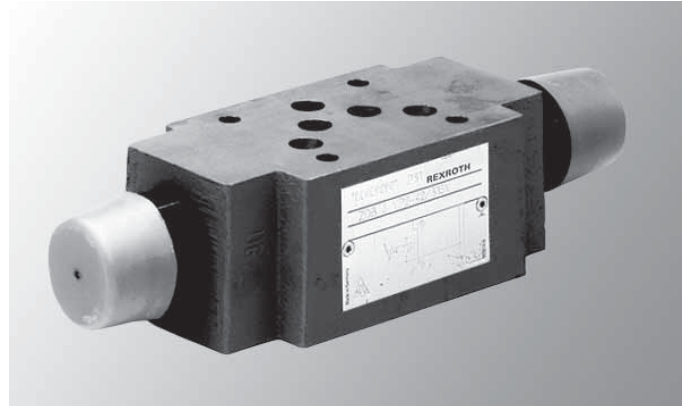
Page 1 of 1  
Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Pressure relief valve –  
Sandwich plate design  
Models ZDB 10 and Z2DB 10**

Size 10  
Series 4X  
Maximum operating pressure 315 bar (4600 PSI)  
Maximum flow 100 L/min (26.4 GPM)

- Sandwich plate design for use in vertical stacking assemblies
- Porting pattern to ISO 4401-5; NFPA T3.5.1 M R1 and ANSI B 93.7 **D 05**
- Pressure adjustment options
- 1 or 2 pressure relief valve cartridges available
- Three relieving configurations available
- Four pressure adjustment ranges available to 4600 PSI



Model Z2DB 10 VD2-4X/...

**Ordering code**

<b>Z</b>	<b>DB 10</b>	<b>-4X</b>	<b>V *</b>
Sandwich plate design = <b>Z</b>	Two pressure relief cartridges (only available with Models "VC" and "VD", see below) = <b>2</b>	Pressure relief valve = <b>DB</b>	Size 10 (D 05) = <b>10</b>
Relief from: P → T = <b>VP</b> A → TB and B → TB (Z2DB) = <b>VC</b> A → B and B → A (Z2DB) = <b>VD</b>		Adjustment range: <b>50</b> = Adjustment range up to 50 bar (725 PSI) <b>100</b> = Adjustment range up to 100 bar (1450 PSI) <b>200</b> = Adjustment range up to 200 bar (2900 PSI) <b>315</b> = Adjustment range up to 315 bar (4600 PSI)	Series 40 to 49 (40 to 49: externally interchangeable) Adjustment mechanism: <b>1</b> = Rotary handwheel <b>2</b> = Screw adjustment with locknut and protective cap
			Further details to be written in clear text V = FPM seals, suitable for Petroleum oils (HM, HL, HLP) Phosphate ester fluids (HFD-R) (other seal types on request)

**Technical data**

Operating pressure	bar (PSI)	up to 315 (4600)
Adjustment pressure	bar (PSI)	up to 50 (725), 100 (1450), 200 (2900), 315 (4600)
Flow	L/min (GPM)	up to 100 (26.4)
Weight (approx.)	Model ZDB 10	kg (lbs.) 2.4 (5.3)
	Model Z2DB 10	kg (lbs.) 2.6 (5.7)

**Extracted from RA 25 802/08.99**

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Pressure relief valve, pilot operated  
Models DB / DBW**

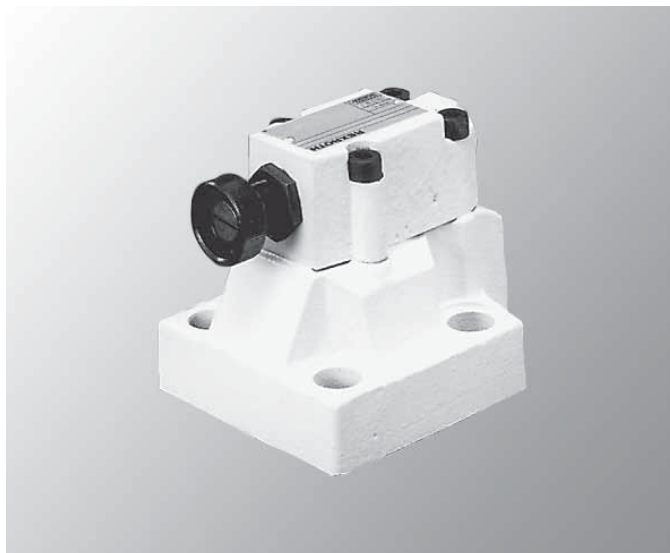
Sizes 10 to 30

Series 5X

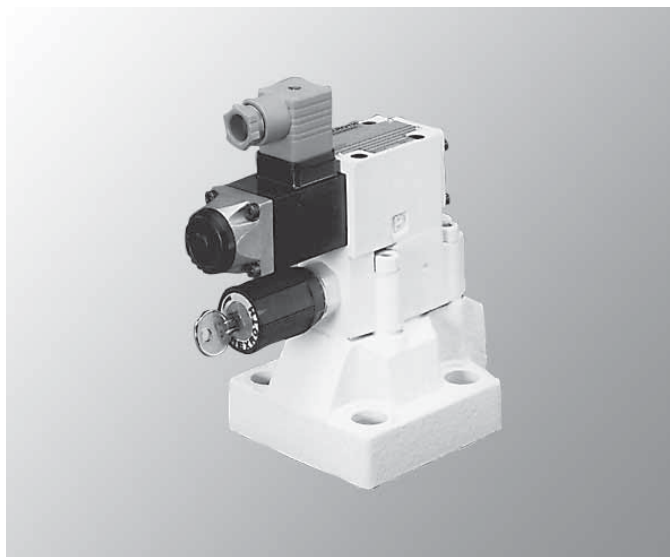
Maximum operating pressure 350 bar (5000 PSI)

Maximum flow 650 L/min (172 GPM)

- Pilot operated pressure relief valve
- Threaded in-line, or subplate mounted
- Porting pattern to ISO 6264-**06, 08, or 10**, NFPA/ANSI  
**R 06, R 08, or R 10** interface  
Porting pattern to DIN 24 340 form E, ISO 6264 and CETOP-  
RP 121 H, For subplates, see datasheet  
RA 45 064 (must be ordered separately)
- Five pressure ranges available, to 5000 PSI
- Pressure adjustment options
- Optional solenoid venting with directional control valve



Model DB 20 -1-5X/315...



Model DBW 20 A3-5X/315-6AG24NZ45

**Extracted from RA 25 802/08.99**

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code**

DB										5X /
----	--	--	--	--	--	--	--	--	--	------

**Without** directional valve

= No code

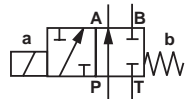
**With** built-on directional spool valve

= W

Pilot operated valve (complete)

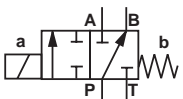
= No code

Nominal size	Valve for	
	Subplate mounting "no code"	Threaded connection "SAE"
	Ordering details	
10	= 10	= 10 SAE-8; 3/4-16
25	= 20	= 20 SAE-16; 1 5/16-12
32	= 30	= 30 SAE-24; 1 7/8-12



Normally closed

= A



Normally open

= B

For subplate mounting

= No code

For threaded connections

= G

**Adjustment elements**

Rotary knob

= 1

Sleeve with hexagon and protective cap

= 2

With main spool Ø 24 mm (0.94") (only in sizes 10, 15, 25 and model DBC 30)

= -

Series 50 to 59

= 5X

(50 to 59: unchanged installation and connection dimensions)

Settable pressure up to 50 bar (725 PSI)

= 50

Settable pressure up to 100 bar (1450 PSI)

= 100

Settable pressure up to 200 bar (2900 PSI)

= 200

Settable pressure up to 315 bar (4600 PSI)

= 315

Settable pressure up to 350 bar (5076 PSI)

= 350



**Extracted from RA 25 802/08.99**
**Page 4 of 4**
**Issue: 01.01**

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Designation	pressure relief valve				
Mounting style	subplate mounting, threaded connections or cartridge valve				
Model of connection	direct via threads; indirect via subplate or manifold, porting pattern to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H				
Nominal size	10	25	30		
Weight	DB. 10	DB. 20	DB. 30		
Subplate mounting	DB...	kg (lbs.)	2.6 (5.73)	3.5 (7.71)	4.4 (9.7)
	DBW...	kg (lbs.)	4.07 (8.98)	4.97 (10.95)	5.87 (12.94)
Threaded connection	DB..G...	kg (lbs.)	5.3 (11.68)	5.1 (11.24)	4.8 (10.58)
	DBW..G...	kg (lbs.)	6.87 (14.93)	6.57 (14.49)	6.27 (13.82)
Installation	optional				

**Hydraulic**

Nominal pressure	bar (PSI)	350 (5100)		
Max. operating pressure at ports A, B, X	bar (PSI)	350 (5100)		
Max. back pressure at port Y				
	DB...	bar (PSI)	315 (4600)	
	DBW...	bar (PSI)	210 (3050) (high performance DC solenoid) (3WE6...6X/E)	
		bar (PSI)	2320 (high performance AC solenoid) (3WE6...6X/E)	
Max. flow		DB. 10	DB. 20	DB. 30
Subplate mounting	L/min (GPM)	250 (66)	500 (132.1)	650 (171.7)
Threaded connection	L/min (GPM)	250 (66)	500 (132.1)	650 (171.7)

**Electrical technical data**

Voltage		DC
Nominal voltage	V	12, 24, 96
Nominal power	W	30
Protection		IP65
Permissible switching frequency	1/h	15000
Voltage		AC
Nominal voltage	V	110, 220, 50/60 Hz
Holding power	VA	50
Inrush current	VA	220
Protection		IP65
Permissible switching frequency	1/h	7200

**Extracted from RA 25 818/08.99**

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Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Pressure relief valve, pilot operated**  
**Models DB..-4X/...W65**  
**and DBW..-4X/...W65**

Sizes 20

Maximum operating pressure 350 bar (5100 PSI)

Maximum flow 400 L/min (105 GPM)

- Pilot operated pressure relief valve
- Mounts on standard ISO 6264-06 or 08, NFPA/ANSI  
R 06 or R 08 interface

For subplates, see datasheet RA 45 064

- Three mounting styles
  - subplate mounting
  - threaded in-line mounting
  - cartridge for manifold mounting
- Two pressure adjustment options
- Five pressure ranges, for excellent resolution



Model DB 10-1-4X/...W65



Model DB 20 K1-1X/...XY

**Technical data**
**General**

Mounting position		Optional	
Weight	– Subplate mounting	kg (lbs.)	Size 20: 2.3 (5.1)
	– Threaded connections	kg (lbs.)	DB – 2.95 (6.5), DBW – 4.25 (9.4)
	– Manifold mounting (cartridge)	kg (lbs.)	0.35 (0.8)
Directional control valve data		See data sheet RA 23 178	

**Hydraulic**

Operating pressure, ports A, B, X	DB	bar (PSI)	... 350 (5100)
Back pressure, port Y	DB	bar (PSI)	... 20 (3625)
Adjustable pressure	min.	bar (PSI)	Flow dependent, see curves page 4
	max.	bar (PSI)	...50 (725), ...100 (1450), ...200 (2900), ...315 (4600), ...350 (5100) [5100 only Model DB]
Maximum flow			Size 20
	– Subplate mounting	L/min (GPM)	... 400 (105)
	– Threaded connections	L/min (GPM)	... 300 (80)





## Extracted from RA 26 076/06.98

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Issue: 01.01

## Multi-function valve, direct operated Model DZ 6 DP

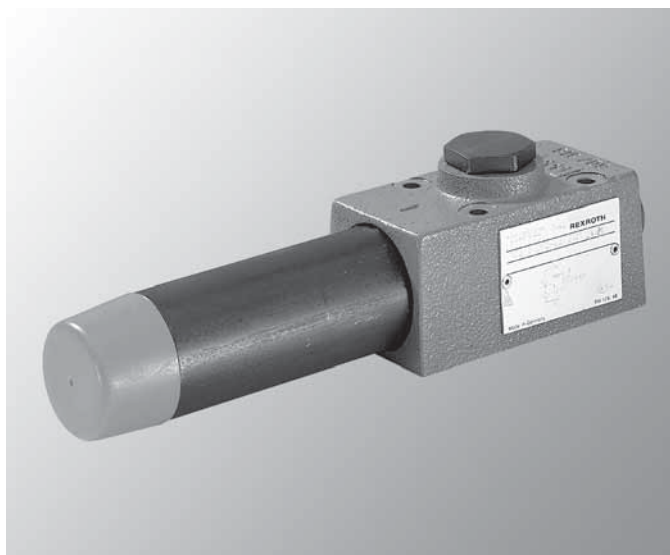
Size 6

Series 5X (Size 6)

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 60 L/min (16 GPM)

- Direct operated multi-function valve
- Mounts on ISO 5781-03 or 08, NFPA/ANSI P 03
- Pressure adjustment options
  - screw adjustment with locknut and protective cap
  - Handknob
- Four pressure adjustment ranges available to 4600 PSI
- Optional built-in reverse free flow check valve
- For subplates, see datasheet RA 45 052



Model DZ 6 DP2-5X/...M...

## Ordering code

DZ	6	D	P	-5X/					*
Multi-function valve, direct operated	= DZ								Further details to be written in clear text
Size 6, NFPA/ANSI P 03	= 6							12 =	Gauge port connection SAE threads
Direct operated		= D						no code =	NBR-seals, suitable for Petroleum oils (HM, HL, HLP)
Subplate mounted			= P					no code =	With reverse free-flow check valve
Adjustable handknob				= 1				no code =	Internally piloted, internally drained
Screw adjustment with locknut and protective cap				= 2				X =	Externally piloted, internally drained
Series 50 to 59 (50 to 59, externally interchangeable)					= 5X			Y =	Internally piloted, externally drained
						25 =			Max. adjustable pressure 25 bar (365 PSI)
						75 =			Max. adjustable pressure 75 bar (1090 PSI)
						150 =			Max. adjustable pressure 150 (2175 PSI)
						210 =			Max. adjustable pressure 210 (3050 PSI)

## Technical data

Nominal size	Size	6
Sequence pressure (adjustable)	bar (PSI)	up to 25 (365); 75 (1090); 150 (2175); 210 (3050)
Operating pressure	Ports P, A, B (X)	bar (PSI) up to 315 (4600)
	Ports T (Y)	bar (PSI) up to 160 (2320)
Maximum flow	L/min (GPM)	up to 60 (16)
Weight (approx.)	kg (lbs.)	1.2 (2.6)

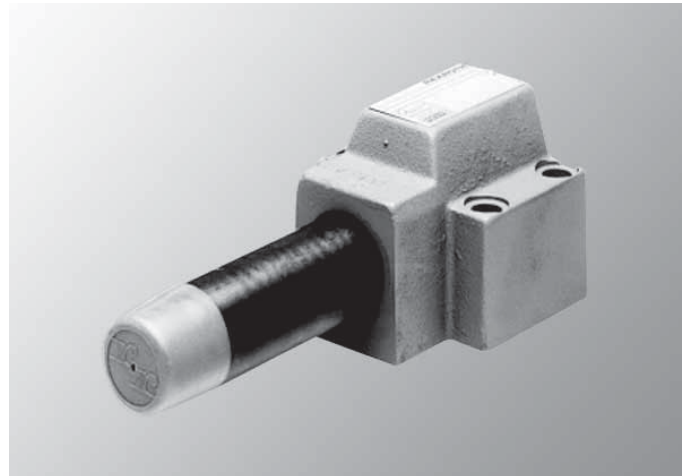
**Extracted from RA 26 099/06.98**

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 Issue: 01.01

**Multi-function valve, direct operated  
 Model DZ 10 DP**

 Size 6, 10  
 Series 4X (Size 10)  
 Maximum operating pressure 210 bar (3050 PSI)  
 Maximum flow 80 L/min (21 GPM)

- Direct operated multi-function valve
- Mounts on ISO 5781-06, NFPA/ANSI P 06 interface
- For subplates, see data sheet RA 45 062
- Four pressure adjustment options
  - Screw adjustment with locknut and protective cap
  - Handknob
  - Key lock hand knob with scale
  - Hand knob with scale



Model DZ 10 DP2-4X/...M...

- Four pressure adjustment ranges available to 3000 PSI 1)
  - Optional built-in reverse free flow check valve
- 1) Maximum spring setting, valve permitted to 4600 PSI

**Ordering code**

<b>DZ</b>   <b>10</b>   <b>D</b>   <b>P</b>   <b>2</b>   <b>-</b>   <b>/</b>   <b>*</b>	Multi-function valve, direct operated = DZ Size 10, P 03 = 10 Direct operated = D Subplate mounted = P Screw adjustment with locknut and protective cap = 2 Series 40 to 59 (40 to 49, externally interchangeable) = 4X	Further details to be written in clear text no code = NBR-seals, suitable for Petroleum oils (HM, HL, HLP) V = FPM seals suitable for phosphate ester oils (HFD--R) no code = With reverse free-flow check valve M = Without reverse fee-flow check valve no code = Internally piloted, internally drained Y = Internally piloted, externally drained XY = Externally piloted, externally drained 75 = Max. adjustable pressure 1.0 ... 75 bar (15...1090 PSI) 210 = Max. adjustable pressure 1.0 ... 210 bar (15...3050 PSI)
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**Technical data** (For applications outside these parameters, please consult us!)

Hydraulic fluid	Petroleum oil (HL; HLP); phosphate ester (HFD-R)	
Temperature range of fluid	°C (°F)	NBR seals: -30 to +80 (-22 to +176) FPM seals: -20 to +80 (-4 to +176)
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 800 (60 to 3710)
Fluid cleanliness	Maximum permissible degree of contamination to ISO 4406, class 18/15. For this, we recommend a filter with a minimum retention rate of B10 ≥ 75.	
Sequence pressure (adjustable)	bar (PSI)	25 (360); 75 (1100); 150 (2100); 210 (3100)
Operating pressure	Ports A, B, X	bar (PSI) 315 (4600)
	Port Y	bar (PSI) 160 (2300)
Max. permissible flow	L/min (GPM)	80 (21)
Installation position	optional	
Weight (approx.)	kg (lbs.)	3 (6.6)





**Extracted from RE 26404/02.03**

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Issue: 06.06

**Technical data** (for applications outside these parameters, please consult us!)

**General**

Installation		Optional
Ambient temperature range	°C (°F)	-30 to +80 (-22 to +176) – NBR seals
		-20 to +80 (-4 to +176) – FKM seals
Weight	Manifold mounting	kg (lbs.) 2.4 (5.29)
	Cartridge valve	kg (lbs.) 0.3 (0.66)
<b>Hydraulic</b>		
Maximum operating pressure at ports B (P)	bar (PSI)	315 (4500) – after switching P to T, A to T
Maximum flow	L/min (GPM)	30 (7.93)
Pressure fluid		Mineral oil (HL, HLP) to DIN 51 524 <sup>1)</sup> ; Fast bio-degradable VDMA 24 568 (also see RE 90 221); HETG (rape seed oil) <sup>1)</sup> ; HEPG (polyglycols) <sup>2)</sup> ; HEES (synthetic ester) <sup>2)</sup> ; Other pressure fluids on request
Pressure fluid temperature range	°C (°F)	- 30 to + 80 (-22 to +176) – NBR seals
		- 20 to + 80 (-4 to +176) – FKM seals
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3720)
Cleanliness class to ISO code		Maximum permissible degree of contamination of the pressure fluid is to ISO 4406 (C) class 20/18/15 <sup>3)</sup>
Switching differential	%	10; 17 (see characteristic curves on page 5)

<sup>1)</sup> Suitable for NBR **and** FKM seals

<sup>2)</sup> **Only** suitable for FKM seals

<sup>3)</sup> The cleanliness class stated for the components must be adhered to in hydraulic systems.

Effective filtration prevents faults from occurring and at the same time increases the component service life.

For the selection of filters see catalogue sheets RE 50 070, RE 50 076 and RE 50 081.

**Extracted from RA 26 572/06.98**

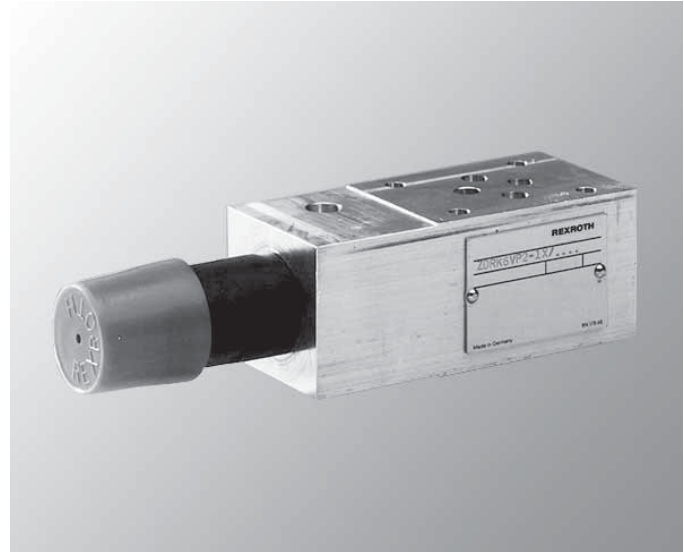
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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Pilot operated pressure reducing valve  
Model ZDRK 6 VP**

Size 6  
Series 1X  
Maximum operating pressure 210 bar (3050 PSI)  
Maximum flow 40 L/min (10.5 GPM)

- Mounting pattern to ISO 4401-03, NFPA T3.5 MR1 and ANSI B 93.7 D 03
- Sandwich plate design
- Three pressure ranges
- Adjustment type: Screw adjustment with protective cap
- Pressure reduction in port P
- Optional pressure gauge port



Model ZDRK 6 VP 5-1X/...V

**Ordering code**

<b>Z</b>	<b>DRK</b>	<b>6</b>	<b>V</b>	<b>P</b>	<b>5</b>	<b>- 1X/</b>	<b>Y</b>	<b>/</b>	<b>*</b>
Sandwich plate design = Z		Pressure reducing valve = DRK		Size 6, D 03 = 6		Pilot operated = V		Pressure reduction in port P1 = P	
<b>Adjustment mechanism</b>		Screw adjustment with locknut and protective cap = 5		Series 10 to 19 (10 to 19; externally interchangeable) = 1X		Y = Internally piloted, externally drained		M = without reverse free-flow check valve	
						V = FPM seals, suitable for phosphate ester oils (HFD-R)		12 = Gauge port connection SAE threads	
						Adjustable secondary "reduced" pressure range		Further details to be written in clear text	
						50 = ... 50 bar (725 PSI)			
						100 = ... 100 bar (1450 PSI)			
						210 = ... 210 bar (3050 PSI)			

**Technical data**

Nominal pressure (inlet)	bar (PSI)	up to 210 (3050)
Secondary pressure (outlet)	bar (PSI)	up to 50 (725), 100 (1450), 210 (3050)
Backpressure port T (Y)	bar (PSI)	up to 160 (2320)
Flow, max	L/min (GPM)	40 (10.5)
Weight	Model VP	kg (lbs.) approx. 1.8 (4.8)



### Extracted from RA 26 570/06.98

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Pressure reducing valve, direct operated Model ZDR 6 D sandwich mounted

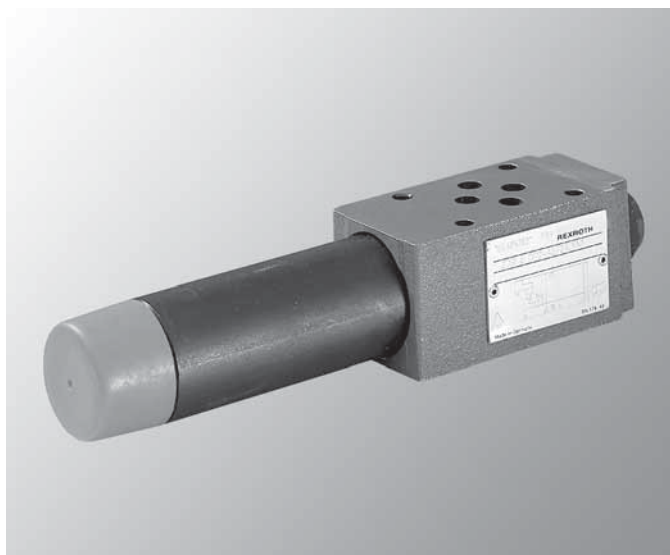
Size 6

Series 4X

Maximum operating pressure 210 bar (3050 PSI)

Maximum flow 50 L/min (13 GPM)

- Direct operated pressure reducing valve, of sandwich plate design, for use in vertical stacking assemblies
- Porting pattern to ISO 4401-03, NFPA T 3.5.1 M R1 and ANSI B 93.7 D 03
- Pressure adjustment options
- Four pressure adjustment ranges available to 3000 PSI
- Optional built-in reverse free flow check valve



Model ZDR 6 DP 2-4X/...YM...

### Ordering code

Z	DR	6	D		-4X/	Y	/	*
Sandwich plate design = Z	Pressure reducing valve = DR	Size 6, D 03 = 6	Direct operated = D					Further details to be written in clear text
								<b>Gauge port connection</b>
								no code = metric threads
								12 = SAE threads
								no code = NBR seals, suitable for petroleum oils (HM, HL, HLP)
								no code = with reverse free-flow check valve (Model ZDR 6 "DA" only)
								M = without reverse free-flow check valve
								Y = Internally piloted, externally drained
								<b>Adjustable secondary "reduced" pressure range</b>
								25 = ... 25 bar (365 PSI)
								75 = ... 50 bar (1090 PSI)
								150 = ... 150 bar (2175 PSI)
								210 = ... 210 bar (3050 PSI)

### Technical data

Nominal Size	Size	6
Hydraulic fluid		Petroleum oils (HM, HL, HLP); Phosphate ester fluids (HFD-R)
Operating pressure (Inlet)	bar (PSI)	... 315 (4600)
Reduced pressure (Outlet)	bar (PSI)	... 25 (365), ... 50 (1090), ... 150 (2175), ... 210 (3050)
Back pressure Port T(Y)	bar (PSI)	... 160 (2320)
Maximum permissible flow	L/min (GPM)	... 50 (13.2)
Weight (approx.)	kg (lbs.)	1.2 (2.6)



## Extracted from RA 26 585/06.98

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Pressure reducing valve, direct operated Model ZDR 10 D sandwich mounted

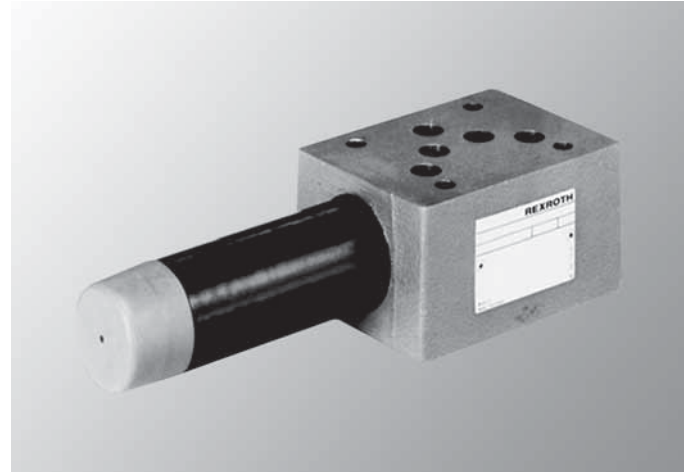
Size 10

Series 5X

Maximum operating pressure 210 bar (3050 PSI)

Maximum flow 80 L/min (21 GPM)

- Direct operated pressure reducing valve, of sandwich plate design, for use in vertical stacking assemblies
- Porting pattern to ISO 4401-05, NFPA T 3.5.1 M R1 and ANSI B 93.7 D 05
- Option of pressure reduction in pressure supply line or in one of the service lines
- Four pressure adjustment options
  - Rotary handwheel
  - Screw adjustment with locknut and protective cap



Model ZDR 10 DP 2-5X/.Y. .

- Key lock rotary handknob with adjustment scale
- Rotary handknob with adjustment scale
- Four pressure adjustment ranges available to 3000 PSI
- Optional built-in reverse free flow check valve
- Maximum spring setting, valve is permitted to 4600 PSI

## Ordering code

<b>Z</b>	<b>DR</b>	<b>10</b>	<b>D</b>	<b>- 5X/</b>	<b>Y</b>	<b>/ 12</b>	<b>*</b>	Further details to be written in clear text
Sandwich plate design = Z	Pressure reducing valve = DR	Size 10, D 05 = 10	Direct operated = D					<b>Gauge port connection</b> 12 = SAE threads no code = NBR seals, suitable for petroleum oils (HM, HL, HLP)
			Pressure reduction in port A2 = A Pressure reduction in port P1 (Pilot control signal from port B) = B Pressure reduction in port P1 = P					no code = with reverse free-flow check valve (Model ZDR 6 "DA" only) M = without reverse free-flow check valve
			<b>Adjustment mechanism</b> Rotary handwheel = 1 Screw adjustment with locknut and protective cap = 2					Y = Internally piloted, externally drained
			Series 50 to 59 (50 to 59; externally interchangeable) = 5X					<b>Adjustable secondary "reduced" pressure range</b> 25 = ... 25 bar (365 PSI) 75 = ... 75 bar (1090 PSI) 150 = ... 150 bar (2175 PSI) 210 = ... 210 bar (3050 PSI)

## Technical data (For applications outside these parameters, please consult us!)

Hydraulic fluid		Petroleum oil (HL; HLP); phosphate ester (HFD-R)
Temperature range of fluid	°C (°F)	NBR seals: -30 to +80 (-22 to +176) FPM seals: -20 to +80 (-4 to +176)
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 800 (60 to 3710)
Fluid cleanliness		Maximum permissible degree of contamination to ISO 4406, class 18/15. For this, we recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$ .
Operating pressure (inlet)	bar (PSI)	315 (4600)
Reduced pressure (outlet)	bar (PSI)	25 (365); 75 (1090); 150 (2175); 210 (3050)
Back pressure	Port T (Y) bar (PSI)	160 (2320)
Maximum permissible flow	L/min (GPM)	80 (21)
Weight (approx.)	kg (lbs.)	2.8 (6.1)



**Extracted from RA 26 864/06.98**

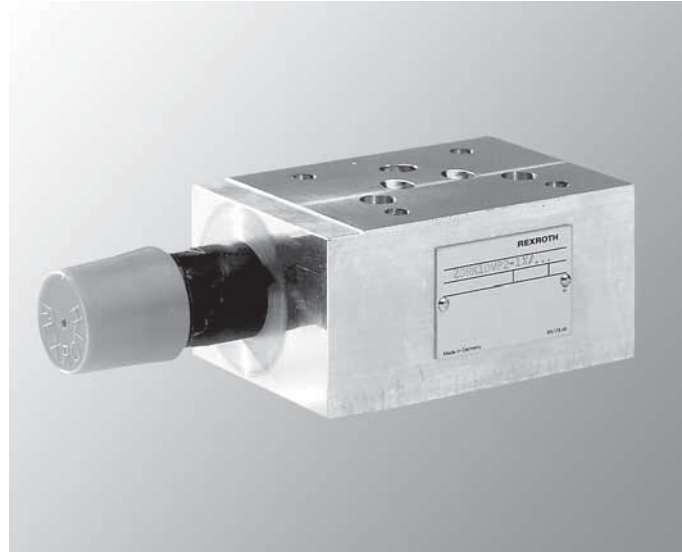
Page 1 of 1  
Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Pilot operated pressure reducing valve  
Model ZDRK 10 V**

Size 10  
Series 1X  
Maximum operating pressure 210 bar (3050 PSI)  
Maximum flow 80 L/min (21 GPM)

- Mounting pattern to ISO 4401-05, NFPA T3.5. MR1 and ANSI B 93.7 D 05
- Sandwich plate design
- Three pressure ranges
- Setting element: Screw adjustment with protective cap
- Check valve option for Models VA and VB
- Optional pressure gauge port



Model ZDRK 10 VP 5-1X/...V

**Ordering code**

<b>Z</b>	<b>DRK</b>	<b>10</b>	<b>V</b>	<b>5</b>	<b>-1X/</b>	<b>Y</b>	<b>/</b>	<b>*</b>
Sandwich plate design = <b>Z</b>	Pressure reducing valve = <b>DRK</b>	Size 6, D 03 = <b>10</b>	Pilot operated = <b>V</b>	Pressure reduction in port A2 = <b>A</b>	Pressure reduction in port B2 = <b>B</b>	Pressure reduction in port P1 = <b>P</b>	<b>Adjustment mechanism</b> Screw adjustment with locknut and protective cap = <b>5</b>	Series 10 to 19 (10 to 19; externally interchangeable) = <b>1X</b>
							Further details to be written in clear text	<b>Gauge port connection</b> <b>12</b> = SAE threads
							<b>V</b> = FPM seals, suitable for phosphate ester oils (HFD-R)	
							<b>no code</b> = with reverse free-flow check valve (Models VA and VB)	
							<b>M</b> = without reverse free-flow check valve	
							<b>Y</b> = Internally piloted, externally drained	
							<b>50</b> = Adjustable secondary "reduced" pressure range ... 50 bar (725 PSI)	
							<b>100</b> = ... 100 bar (1450 PSI)	
							<b>210</b> = ... 210 bar (3000 PSI)	

**Technical data**

Nominal pressure (inlet)		bar (PSI)	up to 210 (3050)
Secondary pressure	(Ports A1, B1 or P2)	bar (PSI)	up to 210 (3050)
Back pressure	(Ports TA, TB)	bar (PSI)	up to 160 (2320)
Flow, max.		L/min (GPM)	80 (21)
Weights	Model VA and VB	kg (lbs.)	approx. 1.5 (3.3)
	Model VP	kg (lbs.)	approx. 1.1 (2.4)

### Extracted from RA 26 861/06.98

Page 1 of 1

Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

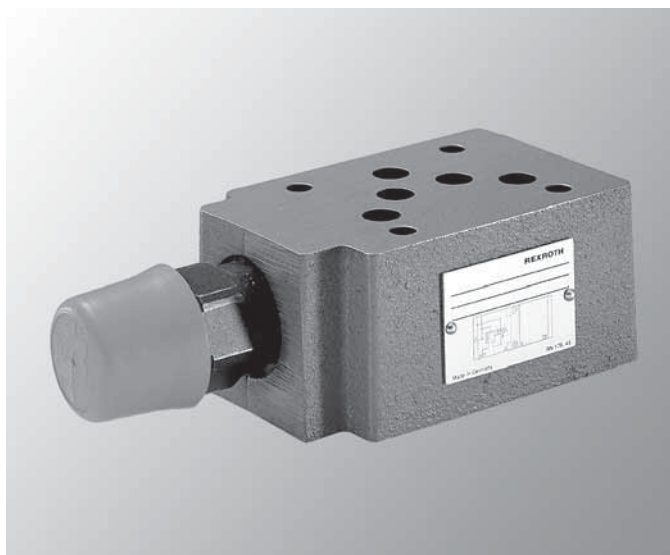
## Pressure reducing valve, pilot operated Model ZDR 10 V, sandwich mounted

Size 10, Series 3X

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 100 L/min (26.5 GPM)

- Pilot operated pressure reducing valve, of sandwich plate design, for use in vertical stacking assemblies
- Porting pattern to ISO 4401-5, NFPA T3.5.1 M R1 and ANSI B 93.7 D 05
- Option of pressure reduction in supply line or in one of the service lines
- Compact design, with excellent pressure override characteristics
- Pressure adjustment options
- Four pressure adjustment ranges available to 315 bar (4600 PSI)
- Optional gauge port connection



Model ZDR 10 VP 2-3X/...YM...

### Ordering code

Z	DR	10	V		-3X/	Y		/	*				
Sandwich plate des. = Z	Pressure reducing valve = DR	Size 10, D 05 = 10	Pilot operated = V	Pressure reduction in port P1 = P	Adjustment mechanism	Rotary handwheel = 4	Screw adjustment w/ locknut and protective cap = 5	Series 30 to 39 (30 to 39; externally interchangeable) = 3X	Adjustable secondary "reduced" pressure range	50 = ... 50 bar (725 PSI)	100 = ... 100 bar (1450 PSI)	200 = ... 200 bar (2900 PSI)	315 = ... 315 bar (4600 PSI)
									Further details to be written in clear text				
									Gauge port connection				
									12 = SAE threads				
									no code = NBR seals, suitable for petroleum oils (HM, HL, HLP)				
									M = without reverse free-flow check valve				
									no code = with pressure gauge connection				
									Y = Internally piloted, externally drained				

### Technical data

Operating pressure (Inlet ports A1, B1 or P2)	bar (PSI)	... 315 (4600)
Reduced pressure (Outlet ports A2, B2 or P1)	bar (PSI)	...50 (725), ...100 (1450), ...200 (2900), ...315 (4600)
Back pressure (Port TA, TB)	bar (PSI)	... 160 (2320)
Maximum permissible flow	L/min (GPM)	... 100 (26.4)
Weight (approx.) (Model VP)	kg (lbs.)	2.3 (5.1)

**Extracted from RE 26868/01.05**

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**Pressure reducing valve, pilot operated  
Model ZDRY 10V**

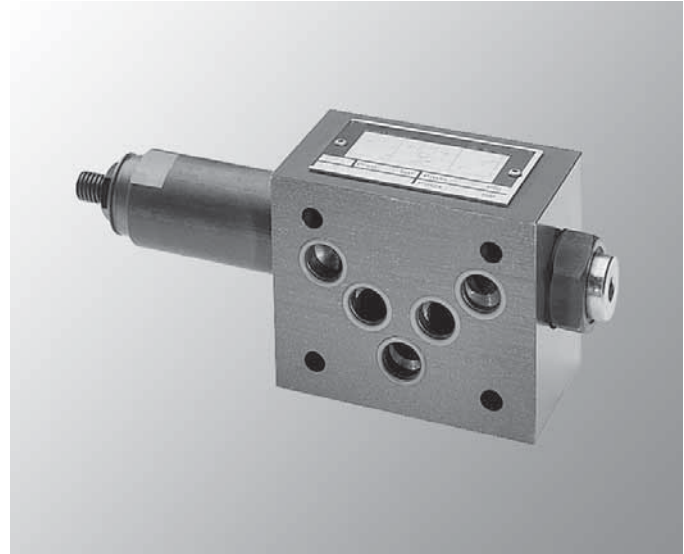
Size 10

Series 1X

Maximum operating pressure 315 bar (4500 PSI)

Maximum flow 120 L/min (31.7 GPM)

- Modular valve
- Mounting hole configuration to ISO 4401-05-04-0-94
- Four pressure stages
- Pressure reduction in duct A, B, or P
- Check valve in versions "VA" and "VB"
- Pressure gauge connection G 1/4
- Setting element:
  - Sleeve with hexagon jacket
  - Rotary knob, lockable, with scale
- Subplate as per catalog section RE 45055 (order separately)



Model ZDRY 10V

**Ordering code**

Z	DR	Y	10	V		1X	/	Y	V	*
Modular valve = Z										Further information in plain text
Pressure reducing valve = DR										No code = FPM seals (other seals available on request)
3-way pressure reducing valve = Y										<b>Note</b> Take compatibility of seals and pressure fluid into account!
Nominal size 10 = 10										
Pilot operated = V										No code = with check valve M = without check valve
Pressure reduction in A-duct = A										Y = Internal control oil supply, external control oil drain
Pressure reduction in B-duct = B										
Pressure reduction in P-duct = P										
<b>Setting elements</b>										
Sleeve with hexagon socket = 2										
Rotary knob, lockable, with scale <sup>1)</sup> = 6										
Unit series 10 to 19 = 1X										
(10 to 19: installation and connection dimensions unchanged)										
130 = Secondary pressure 4 to 30 bar (58 to 435 PSI)										
180 = Secondary pressure 4 to 80 bar (58 to 1160 PSI)										
160 = Secondary pressure 8 to 160 bar (116 to 2320 PSI)										
315 = Secondary pressure 8 to 315 bar (116 to 4500 PSI)										

<sup>1)</sup> 2H key is included in scope of delivery

**Extracted from RE 26868/01.05**

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**Technical data**
**General**

Valve function	Pressure reducing valve, pilot operated
Type of mounting	Intermediate plate NG10, ISO 4401-05-04-0-94
Installation position	Optional
Weight	kg (lbs.) 2.7 (5.95)

**Hydraulic**

Pressure fluid	Mineral oil (HL, HLP) to DIN 51524. Rapidly biodegradable pressure fluids to VDMA 24568 (see also RE 90221), HETG (rapeseed oil), HEPG (polyglycols), HEES (synthetic ester), other pressure fluids available on request			
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 20/18/15 1)			
Pressure fluid temperature range	°C (°F)	-20 to +80 (-4 to +176)		
Seals	FPM (Viton® Dupont)			
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 500 (46 to 2320)		
Max. setting pressure (outlet)	bar (PSI)	30 (435)	80 (1160)	160 (2320)      315 (4500)
Max. working pressure (inlet)	bar (PSI)	Setting pressure +120 (1740)		Setting pressure +200 or 315 (2900 to 4500)
Max. flow rate	l/min (GPM)	120 (31.7)		

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems.  
Effective filtration prevents problems and also extends the service life of components.  
For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.

### Extracted from RA 26 892/06.98

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Pressure reducing valve, pilot operated Model DR

Sizes 10 to 30, Series 5X

Maximum operating pressure 350 bar (5000 PSI)

Maximum flow 400 L/min (105 GPM)

- Pilot operated pressure reducing valve
- Subplate design
- Mounts on standard ISO 5781-06, 08, or 10, NFPA/ANSI P 06, P 08, or P 10 interfaces
- Two pressure adjustment options
- Four pressure ranges available, to 5000 PSI
- Optional built-in reverse free flow check valve



Model DR20-5-5X/315Y..

### Ordering code

Subplate mounting			Adjustment mechanism		Pressure reducing valve		Complete valve		Series		Options	
Ordering code	NFPA/ANSI interface standard	Subplates available SAE	Hand knob	Screw adjustment with locknut and protective cap	DR	no code	no code	no code	5X	Y	*	Further details to be written in clear text
10	P 06	3/8" and 1/2"	= 4	= 5	= DR	= no code	= no code	= no code	5X	Y	*	12 = SAE threaded housing (standard) no code = NBR seals, suitable for petroleum oils (HM, HL, HLP) no code = With reverse free-flow check valve (only for subplate mounted valves) M = Without reverse free-flow check valve Y = Internally piloted; externally drained Maximum pressure setting 50 = ... 50 bar (725 PSI) 100 = ... 100 bar (1450 PSI) 200 = ... 200 bar (2900 PSI) 315 = ... 315 bar (4600 PSI)
20	P 08	3/4" and 1"										
30	P 10	1-1/4" and 1-1/2"										
Subplate mounted = no code											5X = Series 50 to 59 (50 to 59; externally interchangeable)	

### Technical data

Mounting position			Optional		
Weight (approx.)	Valve size		10	20	30
– Subplate mounted	DR	kg (lbs.)	3.4 (7.5)	3.5 (11.7)	8.0 (17.7)
Inlet pressure, port B		bar (PSI)	... 315 (4600)		
Outlet pressure, port A		bar (PSI)	10 to 315 (145 to 4600)		
Backpressure, port Y		bar (PSI)	... 315 (4600)		
Setting pressure	maximum	bar (PSI)	... 50 (725), ... 100 (1450), ... 200 (2900), ... 315 (4600), ... 350 (5000)		
Maximum flow	Valve size		10	20	30
– Subplate mounting <sup>1)</sup>		L/min (GPM)	150 (39.6)	300 (79.2)	400 (105.7)

<sup>1)</sup> For subplates, see data sheet RA 45 062.



**Extracted from RA 26 893/04.92**

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**Pressure reducing valve, pilot operated  
Model DR**

Sizes 10 and 20, Series 4X

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 160 L/min (42 GPM)

- Pilot operated pressure reducing valve
- For subplates, see datasheet RA 45 062
- Mounting style:
  - Threaded in-line mounting
- Pressure adjustment options:
  - Rotary handknob
  - Screw adjustment with locknut and protective cap



DR 20 G-4-4X/..

**Ordering code**

DR		/		/		Y		/12		*	
Pressure reducing valve = DR								12 = SAE threaded housing (standard)		Further details to be written in clear text	
Threaded in-line connections "G"								no code =		NBR seals, suitable for petroleum oils (HM, HL, HLP)	
Ordering code		SAE						M =		Without reverse free-flow check valve	
10		-8; 3/4-16						Y =		Internally piloted; externally drained	
20		-16; 1 5/16-12								<b>Adjustable secondary "reduced" pressure range</b>	
Threaded connection for in-line mounting = G								50 =		10 ... 50 bar (145... 725 PSI)	
Adjustment mechanism								100 =		10 ... 100 bar (145... 1450 PSI)	
Rotary handknob = 4								200 =		10 ... 200 bar (145... 2900 PSI)	
Screw adjustment with locknut and protective cap = 5								315 =		10 ... 315 bar (145... 4600 PSI)	
								4X =		Series 40 to 49 (40 to 49; externally interchangeable)	

**Technical data**

Size		10	20
Hydraulic fluid		Petroleum oils (HM, HL, HLP); Phosphate ester fluids (HFD-R)	
Fluid temperature range	°C (°F)	NBR seals: -30 to +80 (-22 to 176) FPM seals: -20 to +80 (-4 to 176)	
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 800 (60 to 3170)	
Maximum degree of fluid contamination		Class 18/15 according to ISO 4406. Therefore, we recommend a filter with a retention rate of $B_{10} \geq 75$ .	
Operating pressure, port B inlet	bar (PSI)	... 315 (4600)	
Reduced pressure, port A outlet	bar (PSI)	... 50 (725), ... 100 (1450), ... 200 (2900), ... 315 (4600)	
Backpressure, port Y	bar (PSI)	... 250 (3625)	
Flow Threaded housing for in-line mount	L/min (GPM)	80 (21.1)	160 (42.3)



**Extracted from RA 26 580/06.98**

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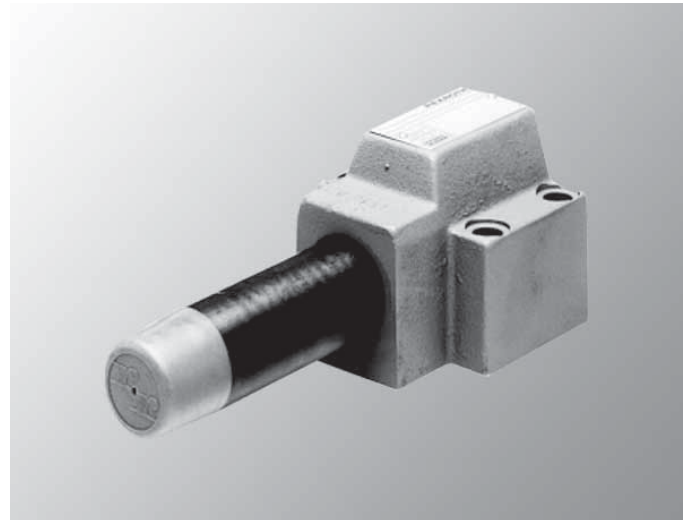
**Pressure reducing valve, direct operated  
 Model DR 10 DP**

Sizes 10, Series 5X

 Maximum operating pressure 210 bar (3050 PSI) <sup>1)</sup>

Maximum flow 80 L/min (21 GPM)

- Direct operated pressure reducing valve
- Mounts on standard ISO 5781-06, NFPA/ANSI P 06 interfaces
- For subplates, see datasheet RA 45 062
- Pressure adjustment options
- Four pressure adjustment ranges available to 210 bar (3050 PSI)
- Optional built-in reverse free flow check valve
- Pressure gauge port



Model DR 10 DP 2-4X/...YM...

<sup>1)</sup> Maximum spring setting, however valve is permitted to 4600 PSI

**Ordering code**

DR	10	D	P	-4X/	Y				*
Pressure reducing valve	= DR								Further details to be written in clear text
Size 10, P 06	= 10								
Direct operated		= D						12 =	SAE threaded gauge port
Subplate mounted			= P					no desig. =	NBR seals suitable for petroleum oils (HM, HL, HLP)
Rotary handknob					= 1			no desig. =	With reverse free-flow check valve
Screw adjustment with locknut and protective cap					= 2			M =	Without reverse free-flow check valve
Series 4X (40 to 49, installation and connection dimensions remain unchanged)				= 4X				Y =	Internally piloted, externally drained
Adjustable secondary "reduced" pressure range									
... 25 bar (365 PSI)					= 25				
... 75 bar (1090 PSI)					= 75				
... 150 bar (2175 PSI)					= 150				
... 210 bar (3050 PSI)					= 210				

**Technical data**

Hydraulic fluid	Petroleum oils (HM, HL, HLP), Phosphate ester fluids (HFD-R)		
Fluid temperature range	°C (°F)	NBR seals: -30 to +80 (-22 to 176) FPM seals: -20 to +80 (-4 ... 176)	
Viscosity range	mm <sup>2</sup> /s (SUS)	10 ... 800 (60 ... 3710) (dependent on fluid)	
Maximum degree of fluid contamination	Class 18/15 according to ISO 4406. Therefore, we recommend a filter with a retention rate of β <sub>10</sub> ≥ 75.		
Operating pressure	Port B	bar (PSI)	up to 315 (4600)
Adjustable secondary pressure (output)	Port A	bar (PSI)	... 25 (365), ... 75 (1090), ... 150 (2175), ... 210 (3050)
Back pressure	Port Y	bar (PSI)	up to 160 (2300)
Maximum flow		L/min (GPM)	up to 80 (21)
Installation position	optional		
Weight		kg (lbs.)	approx. 3 (6.6)



**Extracted from RE 26411/03.98**

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 Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Nominal size		Size 10	Size 25	Size 32
Weight	DA... kg (lbs.)	2.6 (5.7)	13 (28.7)	27 (60)

**Hydraulic technical data**

Nominal pressure		bar (PSI)	315 (4600)		
Maximum operating pressure at port A		bar (PSI)	4500 (after switching from P to T)		
Pressure fluid temperature range		°C (°F)	NBR seals: -30 to +80 (-86 to +176)		
		°C (°F)	FPM seals: -20 to +80 (-68 to +176)		
Viscosity range		mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3720)		
Maximum flow	10% version	L/min (GPM)	40 (10.6)	80 (21.1)	120 (31.7)
	17% version	L/min (GPM)	60 (15.9)	120 (31.7)	240 (63.4)
Degree of contamination			Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We, therefore, recommend a filter with a minimum retention rate of $B_{10} \geq 75$ .		
Maximum set pressure		bar (PSI)	50 (725), 100 (1450), 200 (2900), 315 (4600)		

## Section 6

# Flow Control Valves

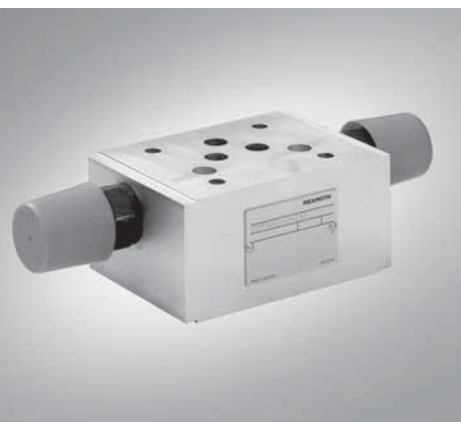
### The Drive & Control Company

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Catalog



**Extracted from RA 27 219/06.98**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

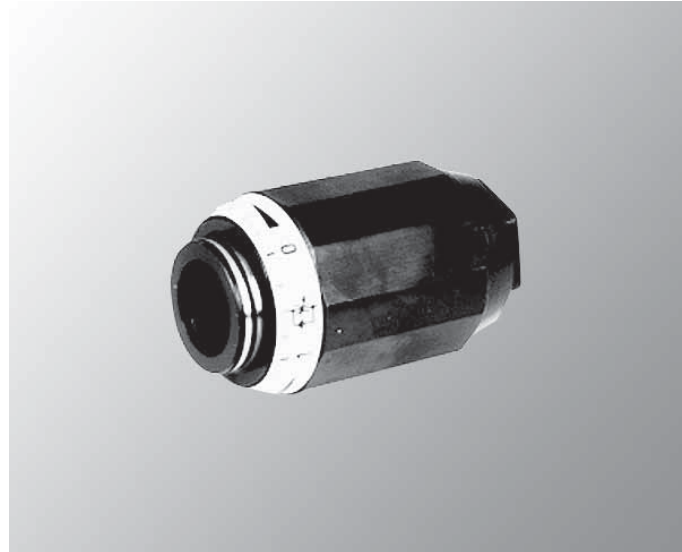
**Throttle and throttle check valves  
Models MG/MK**

Sizes 6 to 25

Series 1X

Maximum operating pressure 315 bar (4600 PSI)

- Throttle and throttle/check valve
- For in-line mounting
- Leak-free closure in one direction
  - Pressure, temperature, and viscosity dependent



Model MK .. G1.2/V

**Ordering code**

		<b>G</b>	<b>1X / V</b>		<b>*</b>	
Throttle valve	= MG					Further details to be written in clear text
Throttle/check valve	= MK					
Size 10 (1/2")	= 10					12 = SAE threads (size 10, 15, 20, 25 only)
Size 15 (3/4")	= 15					V = FPM seals, suitable for Petroleum oils (HM, HL, HLP) Phosphate ester fluids (HFD-R)
Size 20 (1")	= 20					
Size 25 (1-1/4")	= 25					
In-line mounted		= G				1X = Series 1X (10 to 19; externally interchangeable)

**Technical data**

Maximum operating pressure: up to 315 bar (4600 PSI)  
Cracking pressure for check valve: Model MK: 0.5 bar (7 PSI)

### Extracted from RA 27 510/06.98

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Double throttle/check valve Model Z 2 FSK 6

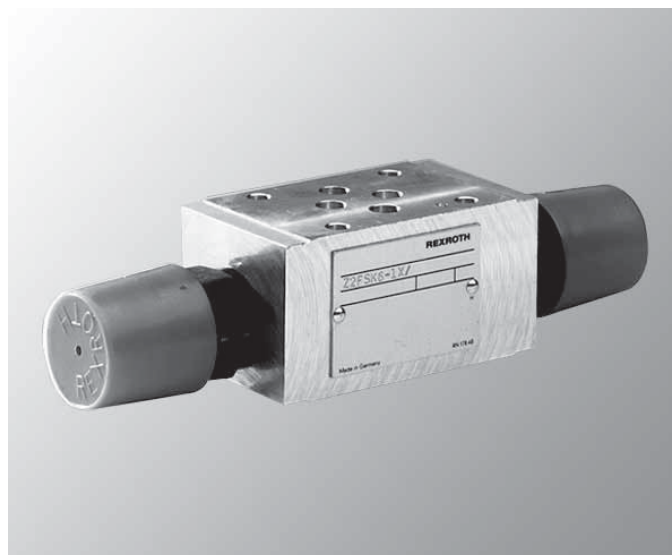
Size 6

Series 1X

Maximum operating pressure 210 bar (3000 PSI)

Maximum flow 40 L/min (10.5 GPM)

- Mounting pattern to ISO 4401-3, NFPA T3.5. MR1, and ANSI B 93.7 D 03
- Sandwich plate design
- Adjustment type:  
Screw adjustment with protective cap
- For throttling the flow to 2 actuator ports, example: control speed of an actuator in both directions
- For meter-in or meter-out control as required
  - O-ring plate included



Model Z 2 FSK 6 – 2-1X/2QV

### Ordering code

Z	2	FSK	6	-	2	-1X/	V	*
Sandwich plate	=Z							Further details to be written in clear text
Dual throttle/checks	=2						V =	FPM seals suitable for petroleum oils (HM, HL, HLP) & phosphate ester fluids (HFD-R) Other seal materials on request
Combination throttle/check valve		=FSK						
Size 6 (D 03)			=6					
Throttle / check valve in ports A and B				= -			2Q =	Throttling spool with two grooves (when used as a main throttle)
<b>Adjustment option</b>								
Screw adjustment with locknut and protective cap				=2			1X =	Series 10 to 19 (10 to 19, externally interchangeable)

**Note:** Model Z 2 FS 6--4X/.. uses the same adjustment mechanism on both sides (A and B).

### Technical data

Operating pressure	bar (PSI)	... 210 (3050)
Maximum flow	L/min (GPM)	40 (10.5)
Weight (approx.)	kg (lbs.)	0.5 (1.1)

**Extracted from RA 27 506/06.98**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

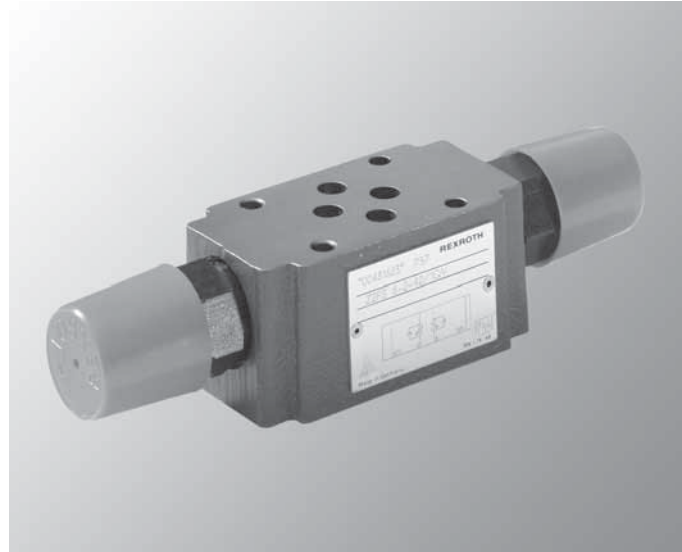
**Double throttle/check valve  
Model Z 2 FS 6**

Size 6  
Series 4X

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 80 L/min (21 GPM)

- Throttle valve with reverse free flow check valves
- Sandwich plate design for use in vertical stacking assemblies
- Used to reduce flow in actuator lines, example: control speed of the actuator in both directions
- Meter-in or meter-out control as required
  - O-ring plate included
- Porting pattern to ISO 4401-3, NFPA T3.4.1 MR1, and ANSI B 93.7 **D 03**



Model Z 2 FS 6 – 2-4X/...

**Ordering code**

	<b>Z</b>	<b>2</b>	<b>FS</b>	<b>6</b>		<b>- 4X /</b>	<b>V</b>	<b>*</b>	
Sandwich plate	=Z								Further details to be written in clear text
Dual throttle/checks		=2					V =		FPM seals suitable for petroleum oils (HM, HL, HLP) & phosphate ester fluids (HFD-R) Other seal materials on request
Combination throttle/check valve			=FS						
Size 6 (D 03)				=6					
Throttle / check valve in ports A and B									
Throttle/check valve in port A									1Q = Throttling spool with one groove (when used as a pilot choke)
Throttle/check valve in port B									2Q = Throttling spool with two grooves (when used as a main throttle)
<b>Adjustment option</b>									
Screw adjustment with locknut and protective cap									4X = Series 40 to 49 (40 to 49, externally interchangeable)

**Note: Model Z 2 FS 6--4X/.. uses the same adjustment mechanism on both sides (A and B).**

**Technical data**

Operating pressure	bar (PSI)	... 315 (4600)
Maximum flow	L/min (GPM)	80 (21.1)
Weight (approx.)	kg (lbs.)	0.8 (1.8)

### Extracted from RA 27 524/06.98

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Double throttle/check valve Model Z 2 FSK 10

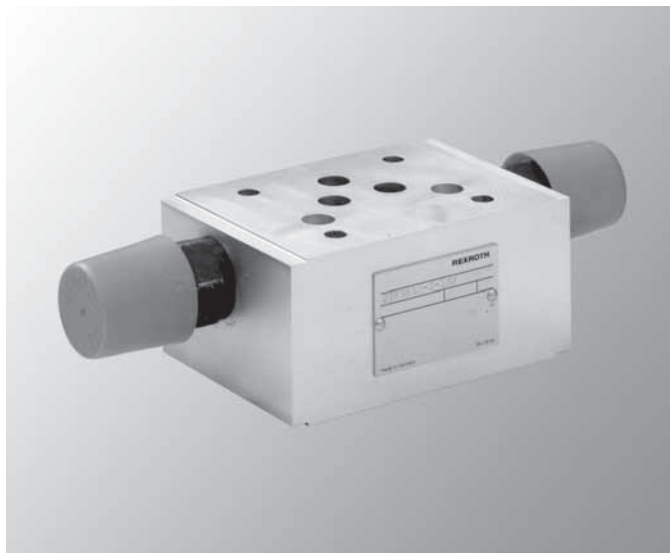
Size 10

Series 1X

Maximum operating pressure 210 bar (3050 PSI)

Maximum flow 80 L/miin (21 GPM)

- Mounting pattern to ISO 4401-5, NFPA T3.5. MR1, and ANSI B 93.7 D 05
- Sandwich plate design
- For throttling the flow to 2 actuator ports, example: control speed of an actuator in both directions
- Adjustment type: Screw adjustment with protective cap
- For meter-in or meter-out control as required
  - O-ring plate included



Model Z2FSK10-2-1X/2QV

### Ordering code

Z	2	FSK	10	-	2	1X	/	V	*	
Sandwich plate	=Z									Further details to be written in clear text
Dual throttle/checks	=2							V =	NBR seals suitable for petroleum oils (HM, HL, HLP) & phosphate ester fluids (HFD-R)	
Combination throttle/check valve		=FSK								
Size 6 (D 03)			=10							
Throttle / check valve in ports A and B				= -						
<b>Adjustment option</b>										
Screw adjustment with locknut and protective cap					=2					
								2Q =		Throttling spool with two grooves (when used as a main throttle)
								1X =		Series 10 to 19 (10 to 19, externally interchangeable)

**Note:** For model Z 2 FS 10--3X/.. the same adjustment option is used on sides A and B.

### Technical data

Operating pressure	PSI	... 3050
Maximum flow	GPM	21
Weight (approx.)	lbs	2.6



**Extracted from RA 27 518/06.98**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Double throttle/check valve  
Model Z 2 FS 10**

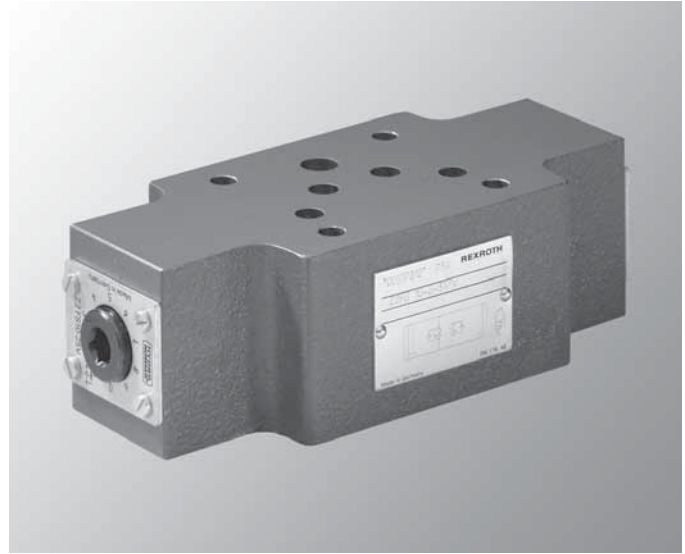
Size 10

Series 3X

Maximum operating pressure 210 bar (3050 PSI)

Maximum flow 120 L/min (32 GPM)

- Mounting pattern to ISO 4401-5, NFPA T3.5. MR1, and ANSI B 93.7 D 05
- Sandwich plate design
- For throttling the flow to 2 actuator ports, example:  
control speed of an actuator in both directions
- Adjustment type: Screw adjustment with protective cap
- For meter-in or meter-out control as required
  - O-ring plate included



**Ordering code**

	<b>Z 2 FS</b>	<b>10</b>		<b>-3X /</b>	<b>V</b>	<b>*</b>	
Dual throttle/check valve							Further details to be written in clear text
Size 10		= 10					V = NBR seals, suitable for petroleum oils (HM, HL, HLP) and phosphate ester fluids (HFD-R)
Throttle/check valve side A and B			= -				no code = (with dual throttle /check valves) meter-in or meter out control (this valve may be turned over)
<b>Adjustment option</b>							3X = Series 30 to 39 (30 to 39, externally interchangeable)
Screw adjustment with locknut and protective cap			= 5				

**Technical data**

Flow direction		The same for both valves; throttle in one direction, reverse free flow across check valve in the other
Operating pressure	bar (PSI)	... 315 (4600)
Maximum flow	L/min (GPM)	120 (32)
Weight (approx.)	kg (lbs.)	3.1 (6.8)

### Extracted from RA 27 526/06.98

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Issue: 06.04

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Double throttle/check valve Model Z 2 FS 16

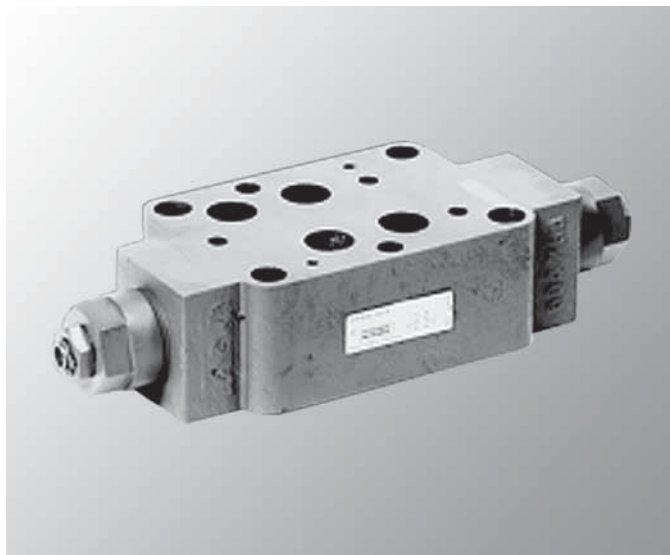
Size 16

Series 3X

Maximum operating pressure 350 bar (5100 PSI)

Maximum flow 250 L/min (66 GPM)

- Throttle valve with reverse free-flow valves
- Sandwich plate design for use in vertical stacking assemblies
- Control speed of the actuator in both directions
- Meter-in or meter-out control as required
- Porting pattern to ISO 4401-7, NFPA T 3.5.1 M R1 and NFPA/ANSI B 93.7 **D 07**



### Ordering code

Z		2		FS		16		3X		/				*			
Sandwich plate	=Z															Further details to be written in clear text	
Dual throttle/checks		=2														no code =	NBR seals, suitable for petroleum oils (HM, HL, HLP)
Combination throttle/check valve				=FS												V =	FPM seals (standard) suitable for phosphate-ester fluids (HFD-R)
Size 16 (D 07)						=16											
Series 3X (30 to 39: externally interchangeable)								=3X								S =	Throttle control meter-in
																S2 =	Throttle control meter-out

### Technical data

Flow direction		The same for both valves; throttled in one direction, reverse free-flow across check valve in the other
Hydraulic fluid		Petroleum oils (HM, HL, HLP) Phosphate-ester fluids (HFD-R)
Fluid temperature range	°C (°F)	NBR seals: -30 to +80 (-22 to +176) FPM seals: -20 to _80 (-4 to +176)
Maximum degree of fluid contamination		Class 18/15 according to ISO 4406. Therefore, we recommend a filter with a retention rate of $\beta_{10} \leq 75$ .
Operating pressure	bar (PSI)	... 350 (5100)
Maximum flow	L/min (GPM)	250 (66)
Weight (approx.)	kg (lbs.)	4.7 (10.4)

**Extracted from RA 27 536/06.98**

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 Issue: 06.04

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Double throttle/check valve  
 Model Z 2 FS 22**

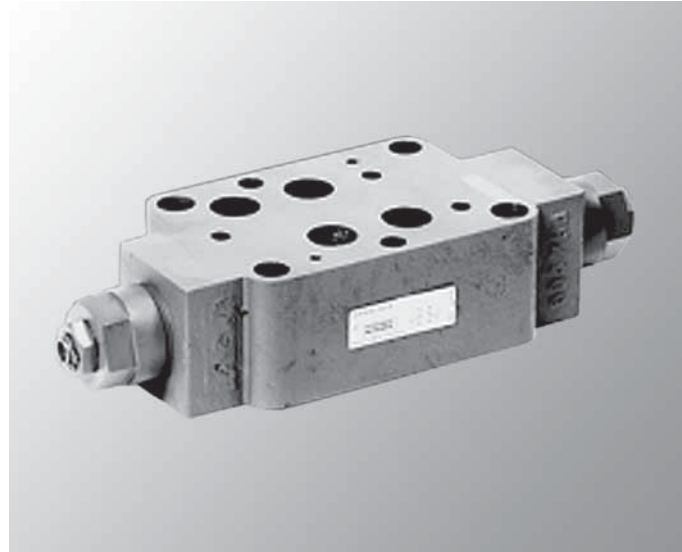
Size 22

Series 3X

Maximum operating pressure 350 bar (5100 PSI)

Maximum flow 360 L/min (95 GPM)

- Throttle valve with reverse free-flow valves
- Sandwich plate design for use in vertical stacking assemblies
- Control speed of the actuator in both directions
- Meter-in or meter-out control as required
- Porting pattern to ISO 4401-8, NFPA T 3.5.1 M R1 and NFPA/ANSI B 93.7 **D 08**


**Ordering code**

	<b>Z</b>	<b>2</b>	<b>FS</b>	<b>22</b>	<b>- 3X /</b>	<b>*</b>	
Sandwich plate	=Z						Further details to be written in clear text
Dual throttle/checks		=2					no code = NBR seals, suitable for petroleum oils (HM, HL, HLP)
Combination throttle/check valve			=FS				V = FPM seals (standard) suitable for phosphate-ester fluids (HFD-R)
Size 22/25 (D 08)				=22			
Series 3X (30 to 39: externally interchangeable)					=3X		S = Throttle control meter-in S2 = Throttle control meter-out

**Technical data**

Flow direction		The same for both valves; throttled in one direction, reverse free-flow across check valve in the other
Hydraulic fluid		Petroleum oils (HM, HL, HLP) Phosphate-ester fluids (HFD-R)
Fluid temperature range	°C (°F)	NBR seals: -30 to +80 (-22 to +176) FPM seals: -20 to +80 (-4 to +176)
Maximum degree of fluid contamination		Class 18/15 according to ISO 4406. Therefore, we recommend a filter with a retention rate of $\beta_{10} \leq 75$ .
Operating pressure	bar (PSI)	... 350 (5100)
Maximum flow	L/min (GPM)	360 (95)
Weight (approx.)	kg (lbs.)	8 (17.6)

**Extracted from RE 27763/10.05**

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Issue: 06.06

**Fine throttle  
Model F6**

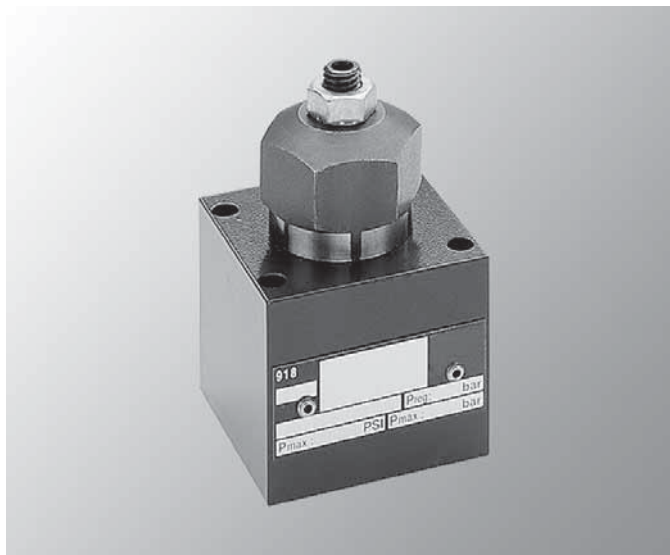
Nominal sizes 6

Series 1X

Max. working pressure up to 315 bar (4500 PSI)

Max. flow 60 l/min (15.85 GPM)

- For subplate mounting
- Throttle valve or throttle check valve



Model F6

**Ordering data**

	F	6	ZP	2	1X / 60	R	V	*	
Throttle valve (fine throttle)	= F								Further information in plain text
Nominal size 6		= 6					V =		FPM seals (other seals available on request)
For subplate mounting to ISO 5781			= ZP						<b>Note</b> Take compatibility of seals and pressure fluid into account!
Setting element Hexagon socket with lock nut				= 2					
Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged)					= 1X		R =		With by-pass check valve
					60 =				Q <sub>max</sub> = 60 l/min (15.85 GPM)

**Extracted from RE 27763/10.05**

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Issue: 06.06

**Technical data**
**General**

Valve function	Throttle valve or throttle check valve	
Type of mounting	Subplate mounting, mounting hole configuration NG6, ISO 5781	
Installation position	Optional	
Ambient temperature range	°C (°F)	-25 to +50 (-13 to +122)
Weight	kg (lbs.)	1.0 (2.2)

**Hydraulic**

Pressure fluid	Mineral oil (HL, HLP) to DIN 51524. Rapidly biodegradable pressure fluids to VDMA 24568 (see also RE 90221), HETG (rapeseed oil), HEPG (polyglycols), HEES (synthetic ester), other pressure fluids available on request	
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 20/18/15 <sup>1)</sup>	
Pressure fluid temperature range	°C (°F)	-25 to +80 (-13 to +176)
Seals	FPM (Viton® Dupont)	
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 500 (45 to 2320)
Max. working pressure	bar (PSI)	315 (4500)
Max. flow rate	l/min (GPM)	60 (15.85)
Min. flow rate	l/min (GPM)	0.2 (0.05)

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems.

Effective filtration prevents problems and also extends the service life of components.

For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.

**Extracted from RE 28155/11.02**

Page 1 of 2

Issue: 06.06

**2-way flow control valve,  
 Model 2 FRM . K**

Nominal sizes 6 and 10

Series 1X

Max. pressure up to 315 bar (4500 PSI)

Max. flow 60 l/min (15.85 GPM)

- Cartridge valve
- Adjustment element with internal hexagon
- With built-in check valve
- Low start-up jump



Model 2FRM 6 K2-1X/6QRV

**Ordering details, preferred types**

	2FRM		K	2	- 1X /		R	V	*	
2-way flow control valve										Further details in clear text
Nominal size 6		= 6								V = FKM seals (other seals on request)
Nominal size 10		= 10								<b>⚠ Attention!</b> The compatibility of the seals and pressure fluid has to be taken into account!
Cartridge valve			= K							R = With check valve
<b>Adjustment element</b>				= 2						<b>Flow (A → B)</b>
Internal hexagon										6Q = Up to 6.0 L/min (1.59 GPM) – nom. size 6
Series 10 to 19										32Q = Up to 32.0 L/min (8.45 GPM) – nom. size 6
(10 to 19: unchanged installation and connection dimensions)										60Q = Up to 60.0 L/min (15.85 GPM) – nom. size 10

**Extracted from RE 28155/11.02**

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Issue: 06.06

**Technical data** (for applications outside these parameters, please consult us!)

General		NS 6		NS 10	
Installation		Optional			
Ambient temperature range		°C (°F) -20 to +50 (-4 to +122)			
Weight		kg (lbs.) 0.19 (0.42)		0.6 (1.32)	
Hydraulic					
Maximum operating pressure, port A		bar (PSI) 315 (4500)		210 (3045)	
Pressure differential $\Delta p$ for free return flow B → A		bar (PSI) See characteristic curves on page 3			
Minimum pressure differential		bar (PSI) 18 (261)		18 (261)	
Pressure stable up to $\Delta p = 315 / 210$ bar (4500 / 3045 PSI)		%		$\pm 3(\rho_{V \max})$ $\pm 3(\rho_{V \min})$	
Flow	$\rho_{V \max}$	L/min (GPM)	6.0 (1.59)	32 (8.45)	60 (15.85)
	$\rho_{V \min}$	cm <sup>3</sup> /min (in <sup>3</sup> /min)	50 (3.05)	250 (15.25)	500 (30.51)
Pressure fluid		Mineral oil (HL, HLP) to DIN 51 524; Fast bio de-gradable pressure fluids to VDMA 24 568 (also see RE 90 221); HETG (rape seed oil); HEPG (polyglycols); HEES (synthetic ester); other pressure fluids on request			
Pressure fluid temperature range		°C (°F) -20 to +80 (-4 to +176)			
Viscosity range		mm <sup>2</sup> /s (SUS) 10 to 800 (46 to 3712)			
Cleanliness class to ISO code		Maximum permissible degree of contamination of the pressure fluid is to ISO 4406 (C) class 20/18/151			

<sup>1)</sup> The cleanliness class stated for the components must be adhered too in hydraulic systems. Effective filtration prevents faults from occurring and at the same time increases the component service life.

### Extracted from RE 28164/02.03

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## Flow control valve, Model Z2FRM

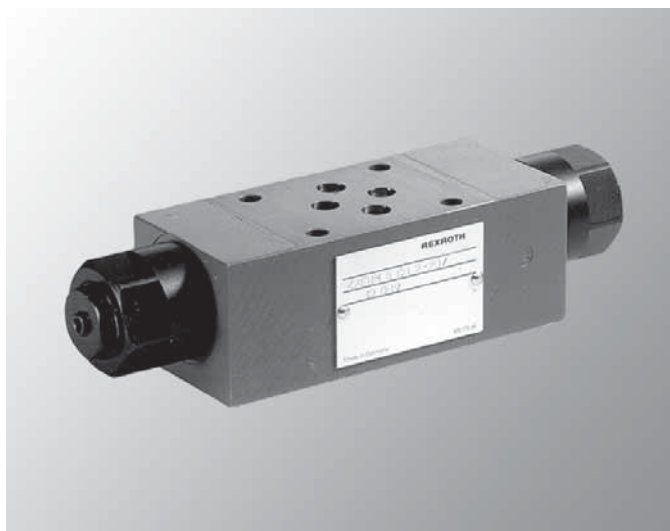
Nominal sizes 6

Series 2X

Max. pressure up to 315 bar (4500 PSI)

Max. flow 32 l/min (8.45 GPM)

- Sandwich plate valve
- Porting pattern to DIN 24 340 Form A, **without** locating pin hole (standard)
- Porting pattern to ISO 4401 and CETOP-RP 121 H, **with** locating pin hole, (ordering code .../60 at the end of the valve type code)
- With 1 or 2 flow control cartridges
- Adjustment element with internal hexagon



Model Z2FRM 6 CB2-2X/32QRV

### Ordering details

Z	2FRM	6	B	2	2X	/	R	V	*
Sandwich plate	= Z								Further details in clear text
2-way flow control valve									No code = <b>Without</b> locating pin hole
Nominal size 6		= 6							/60 <sup>2)</sup> = <b>With</b> locating pin hole
<b>Flow control function (meter-out control) in</b>									V = FKM seals
Port			= A						(other seals on request)
Port B			= B						<b>⚠ Attention!</b>
Ports A and B			= C						The compatibility of the seals and pressure
Port T <sup>1)</sup>			= T						fluid has to be taken into account!
Without closing of the pressure compensator			= B						R = With check valve
<b>Adjustment element</b> with internal hexagon					= 2				<b>Flow</b>
Series 20 to 29						= 2X			6Q = Up to 6.0 L/min (1.59 GPM)
(20 to 29: unchanged installation and connection dimensions)									32Q = Up to 32.0 L/min (8.45 GPM)

<sup>1)</sup> By rotating through the longitudinal axis a flow control function in port P is achieved (meter-in control), also see page 7.

<sup>2)</sup> Locating pin 3 x 8 DIN EN ISO 8752, Material No. **R900005694** (separate order)



**Extracted from RE 28164/02.03**

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Issue: 06.06

**Technical data** (for applications outside these parameters, please consult us!)

**General**

Connection type		<ul style="list-style-type: none"> <li>- Porting pattern to DIN 24 340 Form A, <b>without</b> locating pin hole (standard)</li> <li>- Porting pattern to ISO 4401 and CETOP-RP121H, <b>with</b> locating pin hole, (ordering code .../60 at the end of the valve type code)</li> </ul>
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)
Weight	kg (lbs.)	1.3 (2.87) – flow control function in ports A, B or T
		1.4 (3.09) – flow control function in ports A and B

**Hydraulic**

Nominal pressure		bar (PSI)	315 (4500)
Minimum pressure differential	At $q_{V \max}$	bar (PSI)	18 (260)
	At $q_{V \min}$	bar (PSI)	7 (100)
Pressure stable up to $\Delta p = 315$ bar (4500 PSI)		%	$\pm 3$ ( $q_{V \max}$ )
Flow range	$q_{V \max}$	L/min (GPM)	6 (1.59); 32 (8.45)
	$q_{V \min}$	cm <sup>3</sup> /min (in <sup>3</sup> /min)	50 (3.05); 250 (15.25)
Pressure fluid			Mineral oil (HL, HLP) to DIN 51 524; Fast bio-degradable pressure fluids to VDMA 24 568 (also see RE 90 221); HETG (rape seed oil); HEPG (polyglycols); HEES (synthetic ester); Other pressure fluids on request
Pressure fluid temperature range		°C (°F)	-20 to +80 (-4 to +176)
Viscosity range		mm <sup>2</sup> /s (SUS)	10 to 800 (46 to 3712)
Cleanliness class to ISO code			Maximum permissible degree of contamination of the pressure fluid is to ISO 4406 (C) class 20/18/15 <sup>1)</sup>

<sup>1)</sup> The cleanliness class stated for the components must be adhered too in hydraulic systems. Effective filtration prevents faults from occurring and at the same time increases the component service life.

**Extracted from RA 28 389/06.98**

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Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**2-way flow control valves,  
 pressure compensated  
 Model 2FRM...**

Sizes 10 and 16

Series 3X

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 160 L/min (42.5 GPM)

- Pressure compensated flow control
- Anti-lunge adjustment option on hydrostat, for smooth initial motion of the actuator
- Freewheeling, key lockable handknob adjustment, Model 2FRM
- Mounts on standard ISO 6263-06-2, 07-2, NFPA T3.5.1 MR1 2 FO 6, 2 FO 7 interface, for subplates see RA 45 066
- Linear adjustment characteristics with scale for frequent adjustment reference



Model 2FRM 10 -3X/..

**Ordering code**

2	FR	M	-	3X	/	*
2-Way	= 2					
Flow control valve, Pressure compensated	= FR					Further details to be written in clear text
Manual lockable hand-knob adjustment		= M				no code = NBR seals suitable for petroleum oils (HM, HL, HLP)
Size 10 (2 FO 6)				= 10		V = FPM seals suitable for phosphate ester fluids (HFD-R)
Size 16 (2 FO 7)				= 16		
Series 30 to 39 (30 to 39: externally interchangeable)				= 3X		
Flow range A → B						
<b>Size 10, linear</b>						
up to 10 L/min (2.64 GPM)				= 10L		
up to 16 L/min (4.23 GPM)				= 16L		
up to 25 L/min (6.6 GPM)				= 25L		
up to 50 L/min (13.21 GPM)				= 50L		
<b>Size 16, linear</b>						
up to 60 L/min (15.85 GPM)				= 60L		
up to 100 L/min (26.42 GPM)				= 100L		
up to 160 L/min (42.27 GPM)				= 160L		
Without anti-lunge adjustment				= no code		
With anti-lunge adjustment				= B		

**Extracted from RA 28 389/06.98**

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 Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Weight (approx.)		Size 10	Size 16
Model 2FRM	kg (lbs.)	5.6 (12.3)	11.3 (24.9)
Mounting pos.	Model 2FRM	Optional	

**2FRM...**

		Size 10 (2 FO 6)				Size 16 (2 FO 7)		
Flow $q_{V \max} A \rightarrow B$	L/min (GPM)	10 (2.64)	16 (4.23)	25 (6.60)	50 (13.21)	60 (15.85)	100 (26.42)	160 (42.27)
Dp with reverse free flow B $\rightarrow$ A across check valve $q_V$ -related	bar (PSI)	2.0 (29)	2.5 (36.3)	3.5 (50.8)	6.0 (87)	2.8 (40.6)	4.3 (62.4)	7.3 (106)
Flow	• temperature-stability: $-20$ to $70$ °C ( $-4$ to $158$ °F)	$\pm 2\%$ ( $q_{V \max}$ )						
	• pressure-stability: $\Delta p = 315$ bar (4600 PSI)	$< \pm 5\%$ ( $q_{V \max}$ )						
Operating pressure, port A	bar (PSI)	up to 315 (4600)						
Minimum pressure drop	bar (PSI)	3 to 7 (44 to 102)			5 to 12 (73 to 175)			

### Extracted from RA 28 163/06.98

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## 2-way flow control valve Model 2FRM 6

Size 6

Series 3X

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 32 L/min (8.45 GPM)

- Pressure compensated flow control valve
- Mounts on standard ISO 6263-03, NFPA T3.5.1 M R1 2 FO 3 interface, for subplates see RA 45 052
- External closure of compensator possible
- Available with reverse free-flow check valve
- Handknob with high resolution scale for accurate flow settings and frequent adjustment reference
- Optional lockable handknob adjustment, with keys
- Pressure compensator designed to reduce actuator lunge at start
- Sharp-edged orifice for temperature/viscosity immunity



Models 2FRM 6 .36-3X/..V

### Ordering code

2FRM	6			6 - 3X/		V	*
2-way flow control valve							
Size 6, NFPA 2 FO 3	= 6						
<b>With</b> external closing of the pressure compensator (lunge control)	= A						
<b>Without</b> external closing of the pressure compensator	= B						
<b>Adjustment element</b>							
Lockable handknob with scale 1)	= 3						
Handknob with scale	= 7						
Zero position of the scale at port P				= 6			
Series 30 to 39 (30 to 39, externally interchangeable)				= 3X			
						V =	Further details in clear text
							FPM seals (other seals on request)
							<b>⚠ Attention!</b> The compatibility of the seals and fluid must be taken into account!
						R =	<b>with</b> check valve
						M =	<b>without</b> check valve
							<b>Flow (A → B)</b>
						0.6Q =	up to 0.6 L/min (0.159 GPM)
						1.5Q =	up to 1.5 L/min (0.396 GPM)
						6Q =	up to 6.0 L/min (1.585 GPM)
						10Q =	up to 10.0 L/min (2.642 GPM)
						16Q =	up to 16.0 L/min (4.227 GPM)
						25Q =	up to 25.0 L/min (6.604 GPM)
						32Q =	up to 32.0 L/min (8.454 GPM)

1) H-key with part no. 00008158 is included within the scope of supply.

**Extracted from RA 28 163/06.98**

 Page 2 of 2  
 Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Weight	2FRM 6 A...; 2FRM 6 B...	kg (lbs.)	approx. 1.3 (2.865)						
Ambient temperature range		°C (°F)	-30 to +50 (-86 to +122)						
Maximum operating pressure at port A		bar (PSI)	315 (4600)						
Pressure fluid	Mineral oil (HL, HLP) to DIN 51 524; fast bio-degradable pressure fluids to VDMA 24 568 (also see RA 90 221); HETG (rape seed oil); HEPG (polyglycole); HEES (synthetic ester); other fluids on request								
Pressure fluid temperature range		°C (°F)	-20 to +80) -68 to +176						
Viscosity range		mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3720)						
Flow	q <sub>V max</sub>	L/min (GPM)	0.6 (0.159)	1.5 (0.396)	6.0 (1.585)	10.0 (2.642)	16.0 (4.227)	25.0 (6.604)	32.0 (8.454)
	q <sub>V min</sub> to 100 bar	cm <sup>3</sup> /min (in <sup>3</sup> /min)	15 (0.394)	15 (0.394)	25 (1.526)	50 (3.051)	70 (4.27)	100 (6.1)	250 (15.26)
	q <sub>V min</sub> to 315 bar	cm <sup>3</sup> /min (in <sup>3</sup> /min)	25 (1.526)	25 (1.526)	25 (1.526)	50 (3.051)	70 (4.27)	100 (6.1)	250 (15.26)
Degree of contamination	Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9. We, therefore, recommend a filter with a minimum retention rate of β <sub>10</sub> ≥ 75.								
Pressure differential Δp for free return flow B → A	see characteristic curves on page 6								
Minimum pressure differential		bar IPSI)	6 to 14 (87 to 203)						
Pressure stability up to Δp = 315 bar		%	± 2 (q <sub>V max</sub> )						

**⚠ Attention!** Pressure loss from P at the inlet of the directional valve to A at the inlet of the flow control valve is noticeable at low flows.

# Section 7

## Proportional Valves

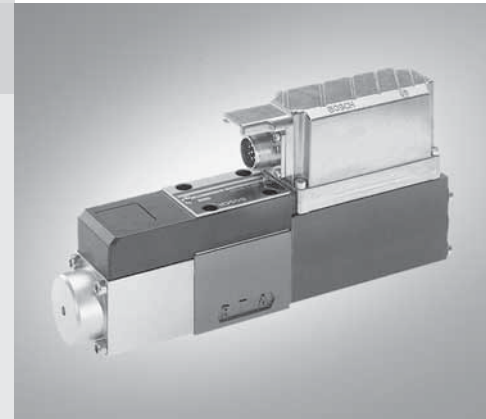
For a complete copy of the data sheets in this catalog, visit our website at:

[www.boschrexroth-us.com](http://www.boschrexroth-us.com)

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    - ▶ Products and Catalogs
      - ▶ Preferred Product Catalog

### The Drive & Control Company

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    - 3DREP(E)6...-2X ..... 352
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- Pilot operated proportional cartridge throttle valve, inductive position transducer – FESXE (OBE)..... 358



**Extracted from RE 29035/01.05**

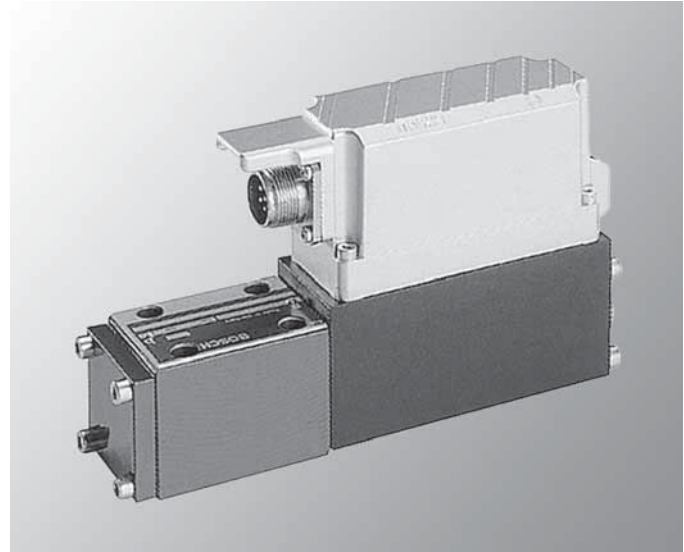
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Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Servo solenoid valves  
with on-board electronics (OBE)  
Model 4WRPEH 6**

Size 6  
Series 2X  
Maximum working pressure: 315 bar (4600 PSI)  
Maximum flow rate: 40 L/min (10 GPM)  
( $\Delta p$  70 bar [1000 PSI])

- Directly operated servo solenoid valve NG6, with control spool and sleeve in servo quality
- Actuated on one side, 4/4 fail-safe position when switched off
- Control solenoid with integral position feedback and on-board electronics (OBE), calibrated at the factory
- Electrical connection 6P+PE  
Signal input difference amplifier with interface  
A1  $\pm 10$  V, or interface F1 4...20 mA ( $R_S$  200  $\Omega$ )
- Suitable for electrohydraulic controllers in production and testing systems



- For subplate attachment, mounting hole configuration to DIN 24 340 Form A, ISO 4401 and CETOP-RP 121 H, NFFA T3.5.1 M R1, and ANSI B 93.7 D 03
- Subplates as per catalog section RE 45 053 (order separately)

**Model code**

4WRP	E	H	6		B		L	-2X/	G24	K0/	M	*
------	---	---	---	--	---	--	---	------	-----	-----	---	---

With **on-board electronics** = E

Control piston/sleeve = H

Size 6 = 6

**Symbols**

4/4-way version

= C3

= C4

**Side of inductive position transducer**

(Standard) = B

**Nominal flow rate at 1015 PSI (70 bar) valve pressure difference: 508 PSI (35 bar) / metering notch**

4 L/min (1.06 GPM)	Size 6 = 04
12 L/min (3.17 GPM)	= 12
24 L/min (6.34 GPM)	= 24
40 L/min (10.57 GPM)	= 40

Further information in plain text

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51 524

**Interface for on-board electronics**

A1 = Setpoint input  $\pm 10$  V

F1 = Setpoint input 4–20 mA

**Electrical connection**

K0 = without mating connector, with plug to DIN 43563-AM6  
Order mating connector separately

**Voltage supply of electronics**

G24 = +24 V DC

2X = Series 20 to 29 (installation and connection dimensions unchanged)

**Flow characteristic**

L = Linear

**Extracted from RE 29035/01.05**

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

Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.



**Technical data**
**General**

Construction	Spool type valve, operated directly, with steel sleeve		
Actuation	Proportional solenoid with position control, OBE		
Type of mounting	Subplate, mounting hole configuration NG 6 (ISO 4401 and CETOP- RP 121 H)		
Installation position	Optional		
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)	
Weight	kg (lbs.)	2.7 (5.95)	
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)		

**Hydraulic** (measured at  $n = 46$  L/min (213 SUS) and  $t = 40$  °C  $\pm$  5 °C (104 °F  $\pm$  41 °F))

Pressure fluid	Hydraulic oil to DIN 51 524 ... 535, other fluids after prior consultation					
Viscosity range,	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (100 to 465)			
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (60 to 3700)			
Pressure fluid temperature range	°C (°F)	-20 to +70 (-4 to +158)				
Purity class to ISO code	Maximum permitted degree of contamination of pressure fluid to ISO 4406 (C) Class 18/16/13 <sup>1)</sup>					
Flow direction	See symbol					
Nominal flow at $\Delta p = 35$ bar (508 PSI) per notch*	L/min (GPM)	4 (1.06)	12 (3.17)	24 (6.34)	40 (10.57)	
Max. working pressure	Port P, A, B: 4600 PSI (315 bar)					
Max. pressure	Port T: 3600 PSI (250 bar)					
Operating limits at $\Delta p$		bar	315	315	315	160
Pressure drop at valve		(PSI)	(4600)	(4600)	(4600)	(2300)
$q_{Vnom.} > q_N$ valves		bar	315	315	250	100
		(PSI)	(4600)	(4600)	(3600)	(1450)
Leakage at 100 bar (1450 PSI)		cm <sup>3</sup> /min (in <sup>3</sup> /min)	< 180 (10.98)	< 300 (18.31)	< 500 (30.51)	< 900 (54.92)
		cm <sup>3</sup> /min (in <sup>3</sup> /min)	—	—	< 300 (18.31)	< 450 (27.46)

**Static/Dynamic**

Hysteresis	≤ 0.2 %
Manufacturing tolerance for $q_{max}$ .	< 10 %
Response time for signal change 0 ... 100 %	≤ 10 ms
Thermal drift	Zero point displacement, 1 % at $\Delta T = 104$ °F
Zero adjustment	Factory-set $\pm 1$ %
Conformity	 EN 50 081-1  EN 50 082-2

1) The purity classes stated for the components must be complied within hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sections RE 50 070, RE 50 076 and RE 50 081.

 \* Flow rate at a different  $\Delta p$   $q_x = q_{nom.} \cdot \sqrt{\frac{\Delta p_x}{35 \text{ bar (507 PSI)}}$



### Extracted from RE 29035/01.05

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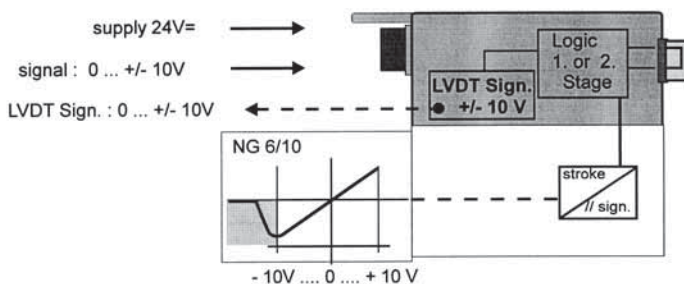
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data (cont.)

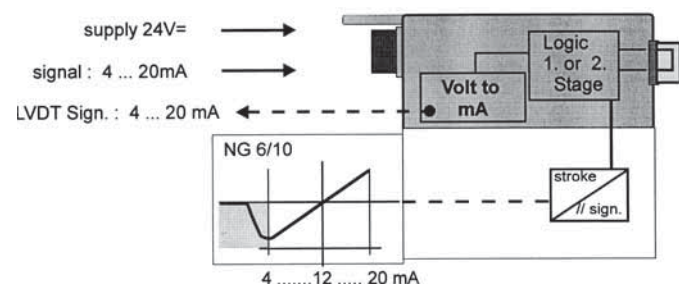
#### Electrical, trigger electronics integrated in the valve

Duty cycle	100 %
Degree of protection	IP 65 to DIN 40 050 and IEC 14 434/5
Connection	Mating connector 6P+PE, DIN 43 563
Power supply	24 V DC <sub>nom.</sub>
Terminal A:	min. 21 V DC/max. 40 V DC
Terminal B: 0 V	Ripple max. 2 V DC
Power consumption	Solenoid <input checked="" type="checkbox"/> 45 mm (1.77 in.) = 40 VA max.
External fuse	2.5 A <sub>F</sub>
Input, "Standard" version	Difference amplifier, R <sub>i</sub> = 100 kΩ
Terminal D: V <sub>E</sub>	0 ... ±10 V
Terminal E:	0 V
Input, "mA signal" version	Load, R <sub>sh</sub> = 200 Ω
Terminal D: I <sub>D-E</sub>	4 ... (12) ... 20 mA
Terminal E: I <sub>D-E</sub>	Current loop I <sub>D-E</sub> feedback
Max. differential input voltage at 0 V	D → B } max. 18 V DC E → B }
Test signal, "Standard" version	LVDT
Terminal F: U <sub>Test</sub>	0 ... +10 V
Terminal C:	Reference 0 V
Test signal, "mA signal" version	LVDT signal 4 ... 20 mA at external load 200 ... 500 Ω max.
Terminal F: I <sub>F-C</sub>	4 ... 20 mA output
Terminal C: I <sub>F-C</sub>	Current loop I <sub>F-C</sub> feedback
Protective conductor and shield	See pin assignment (installation conforms to CE)
Recommended cable	See pin assignment up to 20 m (65 ft.) 7 x 0.75 mm <sup>2</sup> (18 AWG) up to 40 m (131 ft.) 7 x 1 mm <sup>2</sup>
Calibration	Calibrated at the factory, see valve performance curve

#### Version A1: Standard



#### Version F1: mA signal



**Extracted from RE 29037/01.05**

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Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Servo solenoid valves  
with on-board electronics (OBE)  
Model 4WRPEH 10**

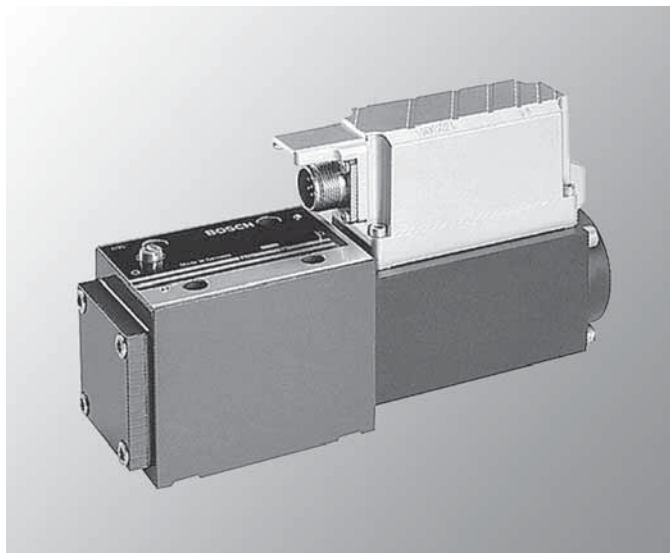
Size 10

Series 2X

Maximum working pressure: 315 bar (4600 PSI)

Maximum flow rate: 100 L/min (26 GPM)  
( $\Delta p$  1450 bar [1000 PSI])

- Direct operated servo solenoid valve NG 10,  
with control spool and sleeve in servo quality
- Actuated on one side, 4/4 fail-safe position when switched off
- Control solenoid with integral position feedback and  
on-board electronics (OBE), calibrated at the factory
- Electrical connection 6P+PE  
Signal input difference amplifier with interface A1, +10 V,  
or interface F1 4...20 mA ( $R_S$  200  $\Omega$ )
- Suitable for electrohydraulic controllers in production and  
testing systems



- For subplate attachment, mounting hole configuration to  
DIN 24 340 Form A, ISO 4401 and CETOP-RP 121 H,  
NFPA T3.5.1 M R1 and ANSI B 93.7 D 05
- Subplates as per catalog section RE 45 055  
(order separately)

**Model code**

<b>4WRP</b>	<b>E</b>	<b>H</b>	<b>10</b>	<b>B</b>	<b>L</b>	<b>-2X/ G24</b>	<b>K0 /</b>	<b>M</b>	<b>*</b>
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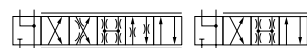
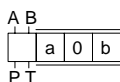
With on-board electronics = E

Control piston/sleeve = H

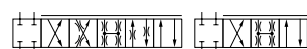
Size 6 = 10

**Symbols**

4/4-way version

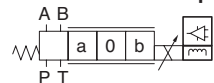


= C3



= C4

**Side of inductive position transducer**



(Standard)

= B

Nominal flow rate at 70 bar (1015 PSI) valve pressure  
difference: 35 bar (508 PSI) / metering notch

50 L/min (13.21 GPM)

Size 10 = 50

100 L/min (26.42 GPM)

= 100

Further information  
in plain text

M = NBR seals,  
suitable for mineral oils  
(HL, HLP) to DIN 51 524

**Interface for  
on-board electronics**

A1 = Setpoint input  $\pm 10$  V

F1 = Setpoint input 4–20 mA

**Electrical connection**

K0 = without mating connector, with plug  
to DIN 43 563-AM6

Order mating connector separately

**Voltage supply of electronics**

G24 = +24 V DC

2X = Series 20 to 29  
(installation and connection dimensions unchanged)

L =







Flow characteristic  
Linear

**Extracted from RE 29037/01.05**

 Page 2 of 3  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Construction	Spool type valve, operated directly, with steel sleeve				
Actuation	Proportional solenoid with position control, OBE				
Type of mounting	Subplate, mounting hole configuration NG 10 (ISO 4401 and CETOP-RP 121 H)				
Installation position	Optional				
Ambient temperature range	°C (°F)	-20 to +50 (-4 ... +122)			
Weight	kg (lbs.)	7.1 (15.65)			
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)				
<b>Hydraulic</b> (measured at $n = 46 \text{ L/min}$ (213 SUS) and $t = 40 \text{ °C} \pm 5 \text{ °C}$ (104 °F $\pm$ 41 °F))					
Pressure fluid	Hydraulic oil to DIN 51 524 ... 535, other fluids after prior consultation				
Viscosity range, recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (100 ... 465)			
max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (60 ... 3700)			
Pressure fluid temperature range	°C (°F)	-20 to +70 (-4 ... +158)			
Purity class to ISO code	Maximum permitted degree of contamination of pressure fluid to ISO 4406 (C) Class 18/16/13 <sup>1)</sup>				
Flow direction	See symbol				
Nominal flow at $\Delta p = 508 \text{ PSI}$ (35 bar) per notch*	L/min (GPM)	50 (13.21)	50 (13.21)	100 (26.42)	100 (26.42)
Max. working pressure	Port P, A, B: 4600 PSI				
Max. pressure	Port T: 3600 PSI				
Operating limits at $\Delta p$ Pressure drop at valve	 bar (PSI)	315 (4600)	315 (4600)	160 (2300)	160 (2300)
$q_{Vnom.} > q_N$ valves	 bar (PSI)	250 (3600)	250 (3600)	100 (1450)	100 (1450)
Leakage at 1450 PSI (100 bar)	 cm <sup>3</sup> /mm (in <sup>3</sup> /min)	< 1200 (73.2)	< 1200 (73.2)	< 1500 (91.5)	< 100 (61.0)
	 cm <sup>3</sup> /mm (in <sup>3</sup> /min)	< 600 (36.6)	< 500 (30.5)	< 600 (36.6)	< 600 (36.6)
<b>Static/Dynamic</b>					
Hysteresis	$\leq 0.2 \%$				
Manufacturing tolerance for $q_{max}$ .	$< 10 \%$				
Response time for signal change 0 ... 100 %	$\leq 25 \text{ ms}$				
Thermal drift	Zero point displacement, 1 % at $\Delta T = 104 \text{ °F}$				
Zero adjustment	Factory-set $\pm 1 \%$				
Conformity	 EN 50 081-1  EN 50 082-2				

1) The purity classes stated for the components must be complied within hydraulic systems. Effective filtration prevents problems and also extends the service life of components.

For a selection of filters, see catalog sections RE 50 070, RE 50 076 and RE 50 081.

$$* \text{ Flow rate at a different } \Delta p \quad q_x = q_{nom.} \cdot \sqrt{\frac{\Delta p_x}{35 \text{ bar} (507 \text{ PSI})}}$$

**Extracted from RE 29037/01.05**

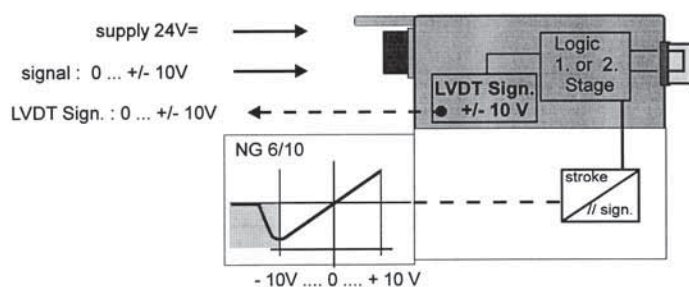
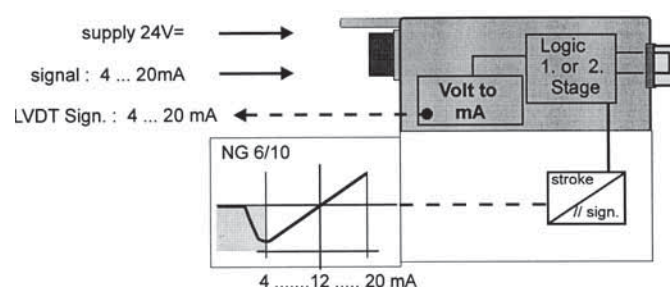
Page 3 of 3

Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data (cont.)**
**Electrical, trigger electronics integrated in the valve**

Duty cycle	100 %
Degree of protection	IP 65 to DIN 40 050 and IEC 14 434/5
Connection	Line socket 6P+PE, DIN 43 563
Power supply	24 V DC <sub>nom.</sub>
Terminal A:	min. 21 V DC/max. 40 V DC
Terminal B: 0 V	Ripple max. 2 V DC
Power consumption	Solenoid <input checked="" type="checkbox"/> 45 mm (1.77 in.) = 40 VA max.
External fuse	2.5 A <sub>F</sub>
Input, "Standard" version	Difference amplifier, $R_i = 100 \text{ k}\Omega$
Terminal D: $V_E$	0 ... $\pm 10 \text{ V}$
Terminal E:	0 V
Input, "mA signal" version	Load, $R_{sh} = 200 \Omega$
Terminal D: $I_{D-E}$	4 ... (12) ... 20 mA
Terminal E: $I_{D-E}$	Current loop $I_{D-E}$ feedback
Max. differential input voltage at 0 V	$D \rightarrow B$ } max. 18 V DC $E \rightarrow B$ }
Test signal, "Standard" version	LVDT
Terminal F: $U_{Test}$	0 ... +10 V
Terminal C:	Reference 0 V
Test signal, "mA signal" version	LVDT signal 4 ... 20 mA at external load 200 ... 500 $\Omega$ max.
Terminal F: $I_{F-C}$	4 ... 20 mA output
Terminal C: $I_{F-C}$	Current loop $I_{F-C}$ feedback
Protective conductor and shield	See pin assignment (installation conforms to CE)
Recommended cable	See pin assignment up to 20 m (65 ft.) 7 x 0.75 mm <sup>2</sup> (18 AWG) up to 40 m (131 ft.) 7 x 1 mm <sup>2</sup>
Calibration	Calibrated at the factory, see valve performance curve

**Version A1: Standard**

**Version F1: mA signal**




**Extracted from RE 29041/01.05**

Page 2 of 3

Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Construction	Spool type valve, operated directly, with steel sleeve							
Actuation	Proportional solenoid with position control, OBE							
Type of mounting	Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)							
Installation position	Optional							
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)						
Weight	kg (lbs.)	2.5 (0.66)						
Vibration resistance, test condition	max. 25 g, shaken in 3 dimensions (24 h)							

**Hydraulic** (measured with HLP 46, qoil = 40 °C ±5 °C (104 °F ±41 °F))

Pressure fluid	Hydraulic oil to DIN 51524 ... 535, other fluids after prior consultation								
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (90 to 450)						
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3700)						
Pressure fluid temperature range	°C (°F)	-20 to +65 (-4 to +149)							
Maximum permissible degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 18/16/13 1)								
Flow direction	See symbol								
Nominal flow at Δp = 35 bar (500 PSI) per notch <sup>2)</sup>	l/min (GPM)	4 (1.06)	8 (2.11)	12 (3.17)	15 (3.96)	24 (6.34)	25 (6.60)	40 (10.57)	
Max. working pressure	bar (PSI)	Port P, A, B: 315 (4500)							
Max. pressure	bar (PSI)	Port T: 100 (1450)							
Operating limits at Δp	bar (PSI)	< 315 (4500)	< 315 (4500)	< 315 (4500)	< 315 (4500)	< 315 (4500)	< 315 (4500)	< 250 (3625)	
Leakage at 100 bar (1450 PSI)		cm <sup>3</sup> /min (in <sup>3</sup> /min)	< 180 (2600)	< 250 (3625)	< 300 (4350)	–	< 500 (7250)	–	< 900 (13050)
		cm <sup>3</sup> /min (in <sup>3</sup> /min)	–	–	–	< 180 (2600)	–	< 250 (3625)	–

**Static/Dynamic**

Hysteresis	%	% 0.2
Manufacturing tolerance for q <sub>max</sub>	%	,10
Response time for signal change 0 ... 100 %	ms	% 5
Thermal drift	Zero point displacement ,1 % at T = 40 °C	
Zero adjustment	Factory-set ±1 %	
Conformity	EN 61000-6-2 EN 61000-6-3	

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems.  
 Effective filtration prevents problems and also extends the service life of components.  
 For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.

<sup>2)</sup> Flow rate at a different Δp 
$$q_x = q_{nom} \cdot \sqrt{\frac{\Delta p_x}{35 \text{ bar (507 PSI)}}$$

## Extracted from RE 29041/01.05

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Technical data

### Electrical, trigger electronics integrated in the valve

Cyclic duration factor	%	100, max. current input 30 VA (24 V DC)						
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5						
Connection	Plug, 11P+PE	Data						
Power supply 24 V DC <sub>nom</sub>	1)	<table border="1"> <tr> <td>1</td> <td>+24 V DC<sub>nom</sub>, fuse 2.5 A<sub>F</sub> (output stages)</td> </tr> <tr> <td>2</td> <td>0 V power ground</td> </tr> </table>	1	+24 V DC <sub>nom</sub> , fuse 2.5 A <sub>F</sub> (output stages)	2	0 V power ground		
	1	+24 V DC <sub>nom</sub> , fuse 2.5 A <sub>F</sub> (output stages)						
2	0 V power ground							
2)	<table border="1"> <tr> <td>9</td> <td>+24 V DC<sub>nom</sub> signal part</td> </tr> <tr> <td>10</td> <td>0 V signal ground</td> </tr> </table>	9	+24 V DC <sub>nom</sub> signal part	10	0 V signal ground			
9	+24 V DC <sub>nom</sub> signal part							
10	0 V signal ground							
Input signal ±10 V	3)	<table border="1"> <tr> <td>4</td> <td>UIN</td> </tr> <tr> <td>5</td> <td>UIN Difference amplifier R<sub>i</sub> = 100 kΩ</td> </tr> </table>	4	UIN	5	UIN Difference amplifier R <sub>i</sub> = 100 kΩ		
4	UIN							
5	UIN Difference amplifier R <sub>i</sub> = 100 kΩ							
Feedback signal (LVDT)		<table border="1"> <tr> <td>6</td> <td>±10 V DC, R<sub>a</sub> = 1 kΩ</td> </tr> <tr> <td>7</td> <td>0 V, reference point</td> </tr> </table>	6	±10 V DC, R <sub>a</sub> = 1 kΩ	7	0 V, reference point		
6	±10 V DC, R <sub>a</sub> = 1 kΩ							
7	0 V, reference point							
Enabling input		<table border="1"> <tr> <td>3</td> <td>&gt; 8.5 V to 24 V DC<sub>nom</sub> (max. 40 V DC) R<sub>i</sub> = 10 kΩ</td> </tr> </table>	3	> 8.5 V to 24 V DC <sub>nom</sub> (max. 40 V DC) R <sub>i</sub> = 10 kΩ				
3	> 8.5 V to 24 V DC <sub>nom</sub> (max. 40 V DC) R <sub>i</sub> = 10 kΩ							
Signals	4)	<table border="1"> <tr> <td>8</td> <td>Enabling acknowledgement +24 V DC</td> </tr> <tr> <td>11</td> <td>Fault signal: no fault +24 V DC</td> </tr> </table>	8	Enabling acknowledgement +24 V DC	11	Fault signal: no fault +24 V DC		
8	Enabling acknowledgement +24 V DC							
11	Fault signal: no fault +24 V DC							
Protective conductor		<table border="1"> <tr> <td>⊕</td> <td>Only connect when transformer of 24 V DC system does not conform to standard VDE 0551</td> </tr> </table>	⊕	Only connect when transformer of 24 V DC system does not conform to standard VDE 0551				
⊕	Only connect when transformer of 24 V DC system does not conform to standard VDE 0551							
Connecting cable		<table border="1"> <tr> <td colspan="2">Recommended Ø 12 ... 14 mm (0.47 ... 0.55 in.): screened</td> </tr> <tr> <td>max. 20 m (65.6 ft.)</td> <td>0.75 mm<sup>2</sup> (0.0012 in<sup>2</sup>)</td> </tr> <tr> <td>max. 40 m (131.2 ft.)</td> <td>1.0 mm<sup>2</sup> (0.0016 in<sup>2</sup>)</td> </tr> </table>	Recommended Ø 12 ... 14 mm (0.47 ... 0.55 in.): screened		max. 20 m (65.6 ft.)	0.75 mm <sup>2</sup> (0.0012 in <sup>2</sup> )	max. 40 m (131.2 ft.)	1.0 mm <sup>2</sup> (0.0016 in <sup>2</sup> )
Recommended Ø 12 ... 14 mm (0.47 ... 0.55 in.): screened								
max. 20 m (65.6 ft.)	0.75 mm <sup>2</sup> (0.0012 in <sup>2</sup> )							
max. 40 m (131.2 ft.)	1.0 mm <sup>2</sup> (0.0016 in <sup>2</sup> )							

24 V DC<sub>nom</sub> – min. 21 V DC  
– max. 40 V DC

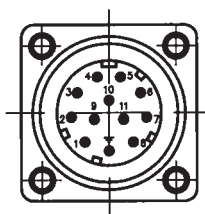
11P+PE

- 1) U<sub>B</sub> (Pin 1) = output stage supply  
– Valve "OFF" < 13.4 V DC  
– Valve "ON" > 16.8 V DC  
No fault signal (Pin 11)

- 2) U<sub>S</sub> (Pin 9) = signal electronics supply  
– Valve "OFF" < 16.8 V DC  
Fault signal (Pin 11)  
– Valve "ON" > 19.5 V DC  
No fault signal (Pin 11)

- 3) Inputs: dielectric strength to withstand up to max. 50 V.

- 4) Signals can bear a load of max. 20 mA and are resistant to shorts to ground.





**Extracted from RE 29045/01.05**

Page 1 of 3  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Servo solenoid valves  
with on-board electronics (OBE)  
Model 5WRPE 10**

Size 10

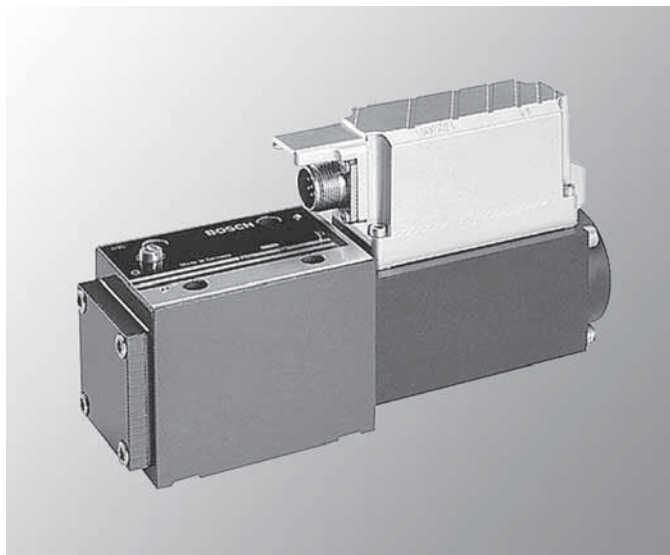
Series 2X

Maximum working pressure: 210 bar (3050 PSI)

Maximum flow rate: 70 L/min (37 GPM)

( $\Delta p$  11 bar [160 PSI])

- Directly operated servo solenoid valve NG 10,  
with pQ 5/3-way symbol in servo quality
- Actuated on one side, A-T fail-safe position when switched off
- Control solenoid with integral position feedback and  
on-board electronics (OBE), calibrated at the factory
- Electrical connection 6P+PE  
Signal input difference amplifier with interface A1, +10 V
- Suitable for electrohydraulic controllers in production and  
testing systems



- For subplate attachment, mounting hole configuration to  
DIN 24 340 Form A, ISO 4401 and CETOP-RP 121 H,  
NFFA T3.5.1 M R1, ANSI B 93.7 D 05
- Subplates as per catalog section RE 45 055  
(order separately)

**Model code**

5WRP	E		10	F	B	70	L	- 2X /	G24	K0	/ A1	M	*
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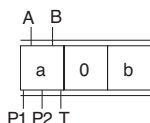
With on-board electronics = E

Without sleeve no designation

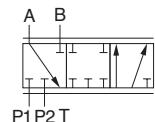
Size 6 = 10

**Symbols**

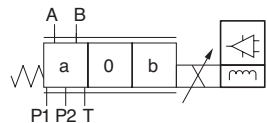
4/4-way version



= F



Side of inductive position transducer



= B

Nominal flow rate at 160 PSI (11 bar) valve pressure  
difference: 11 bar (160 PSI) / metering notch  
70 L/min (18.5 GPM)

Size 10  
= 70

Further information  
in plain text

M = NBR seals,  
suitable for mineral oils  
(HL, HLP) to DIN 51 524

Interface for  
on-board electronics  
A1 = Setpoint input  $\pm 10$  V

Electrical connection  
K0 = without mating connector,  
with plug to DIN 43 563-AM6  
Order mating connector separately

Voltage supply of electronics  
G24 = +24 V DC

2X = Series 20 to 29  
(installation and connection dimensions unchanged)

Flow characteristic  
L = Linear



**Extracted from RE 29045/01.05**




 Page 2 of 3  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Construction	Spool type valve, operated directly	
Actuation	Proportional solenoid with position control, OBE	
Type of mounting	Subplate, mounting hole configuration NG 10 (ISO 4401 and CETOP-RP 121 H)	
Installation position	Optional	
Ambient temperature range	°C (°F)	-20 to +50 (-4 ... +122)
Weight	kg (lbs.)	7.1 (15.65)
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)	

**Hydraulic** (measured at  $n = 46 \text{ L/min}$  (213 SUS) and  $t = 40 \text{ °C} \pm 5 \text{ °C}$  (104 °F  $\pm$  41 °F))

Pressure fluid	Hydraulic oil to DIN 51 524 ... 535, other fluids after prior consultation		
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	100 ... 465
	max. permitted	mm <sup>2</sup> /s (SUS)	60 ... 3700
Pressure fluid temperature range	°F	-20 to +70 (-4 ... +158)	
Purity class to ISO code	Maximum permitted degree of contamination of pressure fluid to ISO 4406 (C) Class 18/16/13 <sup>1)</sup>		
Flow direction	See symbol		
Nominal flow $\alpha t \Delta p = 35 \text{ bar}$ (508 PSI) per notch*	L/min (GPM)	$P_1 \rightarrow A$	18.5 (70)
		$P_1 \rightarrow A + P_2 \rightarrow B$	18.5 + 18.5 (70 + 70)
		$A \rightarrow T$	17.2 (65)
Max. working pressure	bar (PSI)	Port $P_1, P_2, A, B$ : 210 (3045)	
Max. pressure	bar (PSI)	Port T: 50 (725)	
Operating limits at $\Delta p$	bar (PSI)	See diagram	
Leakage at 1450 PSI (100 bar)	 cm <sup>3</sup> /min (in <sup>3</sup> /min)	< 1200 < (73.2)	
<b>Static/Dynamic</b>			
Hysteresis	≤ 0.3 %		
Manufacturing tolerance for $q_{\max}$ .	< 10 %		
Response time for signal change 0 ... 100 %	≤ 25 ms		
Thermal drift	Zero point displacement, 1 % at $\Delta T = 104 \text{ °F}$		
Zero adjustment	Factory-set $\pm 1 \text{ %}$		
Conformity	 EN 50 081-1  EN 50 082-2		

1) The purity classes stated for the components must be complied within hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sections RE 50 070, RE 50 076 and RE 50 081.

 \* Flow rate at a different  $\Delta p$ 

$$q_x = q_{\text{nom.}} \cdot \sqrt{\frac{\Delta p_x}{11 \text{ bar (160 PSI)}}$$

### Extracted from RE 29045/01.05

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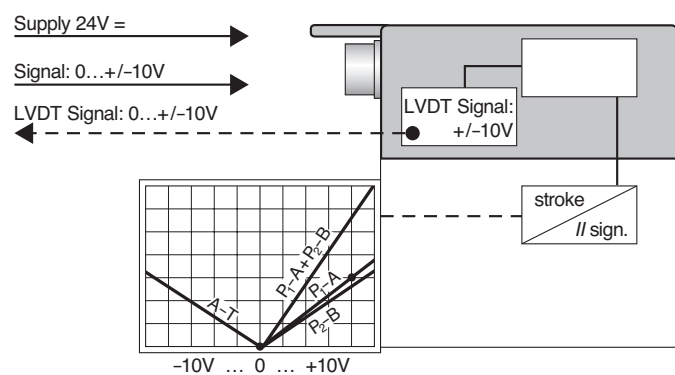
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data (cont.)

#### Electrical, electronics integrated in the valve

Duty cycle	100 %
Degree of protection	IP 65 to DIN 40 050 and IEC 14 434/5
Connection	Mating connector 6P+PE, DIN 43 563
Power supply Terminal A: Terminal B: 0 V	24 V DC <sub>nom.</sub> min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption	Solenoid ☑ 2.36 in. (60 mm) = 60 VA max.
External fuse	2.5 A <sub>F</sub>
Input, "Standard" version Terminal D: $V_E$ Terminal E:	Difference amplifier, $R_1 = 100 \text{ k}\Omega$ 0 ... $\pm 10 \text{ V}$ 0 V
Max. differential input voltage at 0 V	$D \rightarrow B$ $E \rightarrow B$ } max. 18 V DC
Test signal, "Standard" version Terminal F: $U_{\text{Test}}$ Terminal C:	LVDT 0 ... +10 V Reference 0 V
Protective conductor and shield	See pin assignment (installation conforms to CE)
Recommended cable	See pin assignment up to 10 m (65.6 ft.) 7 x 0.75 mm <sup>2</sup> (18 AWG) up to 40 m (131.2 ft.) 7 x 1 mm <sup>2</sup>
Calibration	Calibrated at the factory, see valve performance curve



**Extracted from 9 535 233 903 (10/00)**

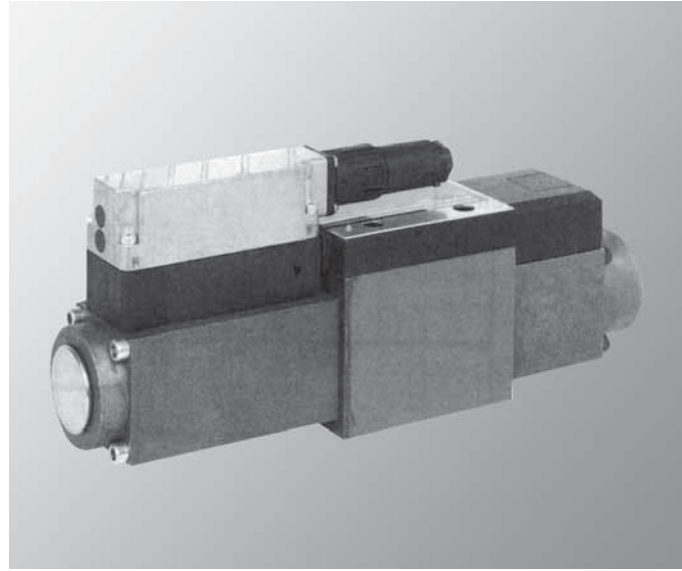
 Page 1 of 2  
 Issue: 06.04

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Direct operated proportional valves  
 4WRPE 10**

The spool is directly operated by the solenoid thus eliminating the hydraulic amplifier of the conventional servo valve.

- Less than 0.1% repeatability
- Flow rates up to 80 L/min (21 GPM)
- Zero lap
- On-board electronics
- Subplates as per catalog section RE 45 055 (order separately)


**Model code**
**4WRPE 10 V 80 M – 2X / G24 K0 / A1M - 837**
**Technical data**

NG10 (D05)	Pressure Rating bar (PSI)	Flow L/min (GPM)	Material Number	Weight kg (lbs.)	Amplifier
	315 (4600)	80 (21.1) at $\Delta p = 5 \text{ bar (73 PSI)}$	0 811 404 552	7.3 (16.0)	OBE 7 PIN
<b>Connectors</b>			<b>Material Number</b>	<b>Old Number</b>	
Mating Connector for OBE – 7 Pin Plastic Solder Type			1 834 482 022	1 834 482 022	
Mating Connector for OBE – 7 Pin Plastic Crimped Type			1 834 482 022	1 834 482 026	
Mating Connector for OBE – 7 Pin MS Solder Type			R 978 713 598	9 536 230 054	

**Extracted from 9 535 233 903 (10/00)**

Page 1 of 2

Issue: 06.04

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data (cont.)**
**General**

Construction	Spool valve, direct operated, without steel sleeve	
Actuation	Proportional solenoid with position control and with integrated amplifier	
Type of mounting	Subplate, ISO 4401	
Assembly position	Optional	
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)
Vibration Test condition	max. 25 g Shaken in 3 dimensions (24 h)	

**Hydraulic**

Pressure medium	Hydraulic oil as per DIN 51524 ... 535. Other fluids after prior consultation.	
Viscosity, recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (100 to 465)
max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (60 to 3700)
Pressure medium temperature	°C (°F)	-20 to +80 (-4 ... +176)
Filtration In line with operational reliability and service life	Permissible contamination level	Achieved using filter $\beta = 75$
	Class 8 (NAS 1638)	X = 10
	17/14 (ISO 4406)	
Flow direction	See symbol	
Max. operating pressure (static)	bar (PSI)	Ports P, A, B: 315 (4600)
	bar (PSI)	Port T: 200 (2900)
Nominal flow at $\Delta p = 5 \text{ bar (75 PSI)*}/\text{land}$	L/min (GPM)	63 (16.6)
Operating limits, GPM	See diagram, 182 L/min (48 GPM) at 200 bar (1450 PSI) 91 L/min (24 GPM) at 315 bar (4600 PSI)	
Leakage at 70 bar (1000 PSI)/land	$\leq 80 \text{ cm}^3/\text{min (5 in}^3/\text{min)}$	

**Static/dynamic**

Hysteresis	$\leq 0.3\%$	
Range of inversion	$\leq 0.2\%$	
Manufacturing tolerance $Q_{\max}$ .	$\leq \pm 3\%$	
Frequency response	$\pm 5\%$	50 Hz
	$\pm 50\%$	20 Hz
Response time 100% signal change	= 40 ms	
10% signal change	= 10 ms	
Thermal drift	$< 1\%$ , at $\Delta T = 22 \text{ °C (72 °F)}$	

\*This always refers to a pressure differential of  $\Delta p = 72.5 \text{ PSI}$  at the throttle point. Where other pressure differentials are involved, flow is calculated according to the following formula:

$$q_x = q_{\text{nom.}} \cdot \sqrt{\frac{\Delta p_x}{5 \text{ bar (72.5 PSI)}}$$

However, the operating limits must be observed. When the operating limits are exceeded, the ensuing flow forces lead to uncontrollable spool movements.

**Extracted from RE 29020/01.05**

Page 1 of 2  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**4/2 servo solenoid valves  
with positive overlap and position  
feedback (LvdT AC/AC)  
Model 4WRP ..EA..**

Size 10

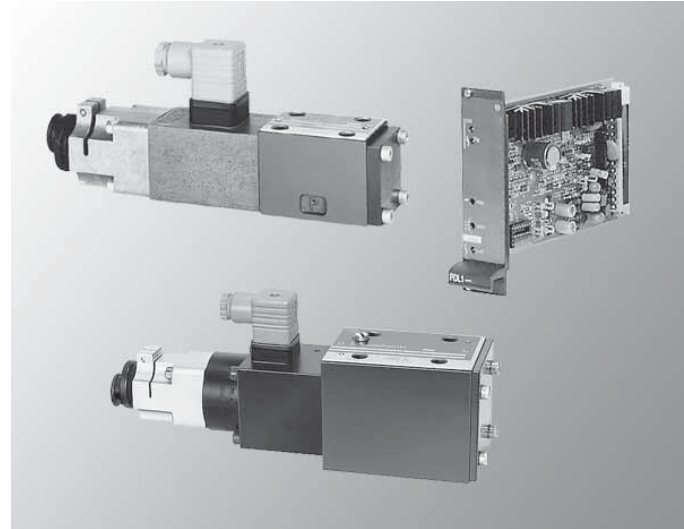
Unit series 1X

Maximum working pressure of P, A, B

315 bar (4600 PSI), T 250 bar (3626 PSI)

Maximum flow 63 L/min (17 GPM)

- Directly operated NG10 valves with positive overlap and external valve electronics
- Actuated on one side, symbol E
- Control solenoid with position feedback (LvdT AC/AC)
- Suitable for use in electrohydraulic controls in production plants
- For subplate attachment, mounting hole configuration NG10 with additional "L" port to ISO 4401-05-06-0-94



- External trigger electronics (order separately), see catalog section RE 30052 and RE 30054
- Solenoid and position transducer connectors included in scope of delivery
- Subplates as per catalog section RE 45053 and RE 45055 (order separately)

**Ordering code**

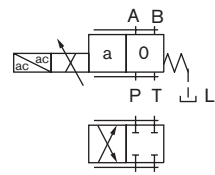
4WRP		10	E	A	28	S	-	1X	/	G24	Z4	/	M	*
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For external electronics = no code

Size 10 = 10

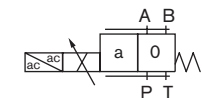
**Symbols**

4/2-way version  
NG10<sup>1)</sup>



= E

**Side of inductive position transducer**



(Standard) = A

<sup>1)</sup> Type 4WRP 10

Mounting hole configuration with additional "L" port

Further information in plain text

M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

Z4 = Electrical connection with plug to DIN 43560 AM2 with mating connector, mating connector included in scope of delivery

G24 = Voltage supply of electronics +24 V DC

1X = Unit series (installation and connection dimensions unchanged)

S = Flow characteristic Progressive

28 = Nominal flow rate at 10 bar (145 PSI) valve pressure difference (5 bar (73 PSI) per metering notch) 28 L/min (7.4 GPM)

### Extracted from RE 29020/01.05

Page 2 of 2

Issue: 07.05


See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data

#### General

Construction	Spool type valve		
Actuation	Proportional solenoid with position control, external amplifier		
Connection type	Subplate, mounting hole configuration NG10 (ISO 4401-05-06-0-94)		
Mounting position	Optional		
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)	
Weight	kg (lbs.)	7.0 (15.4)	
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)		

**Hydraulic** (measured at  $n = 46$  L/min (213 SUS) and  $t = 40$  °C  $\pm$  5 °C (104 °F  $\pm$  41 °F))

Pressure fluid	Hydraulic oil to DIN 51524 ... 535, other fluids after prior consultation		
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (93 to 464)
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (46 to 3708)
Pressure fluid temperature range	°C (°F)	-20 to +80 (-4 to +176)	
Maximum permissible degree of contamination of pressure fluid. Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>		
Direction of flow	See symbol		
Nominal flow at $\Delta p = 5$ bar (72.5 PSI) per notch <sup>2)</sup>	L/min (GPM)	63 (16.6)	
Max. working pressure	bar (PSI)	Port P, A, B: 315 (4600)	
Max. pressure	bar (PSI)	Port T: 250 (3626)	
	bar (PSI)	Port L: 2 (29)	
Leakage per metering edge ( $\Delta p = 100$ bar [1450 PSI])	$I_m = 0$	 $\leq 80$ cm <sup>3</sup> /min (5 in <sup>3</sup> /min)	

#### Electrical

Cyclic duration factor	%	100
Power supply	24 V <sub>nom</sub> (external amplifier)	
Degree of protection	IP 65 to DIN 40050 and IEC 14434/5	
Solenoid connection	Unit plug DIN 43650/ISO 4400, M16 x 1.5 (2P+PE)	
Position transducer connection	Unit plug Pg7 (4P)	
Max. solenoid current	A	3.7
Coil resistance R20	Ω	2.5
Max. power consumption at 100 % load and operating temperature	VA	60

#### Static/Dynamic <sup>3)</sup>

Hysteresis	%	$\leq 0.3$	
Range of inversion	%	$\leq 0.2$	
Manufacturing tolerance for Q <sub>max</sub> .	%	$< 10$	
Response time	100% signal change	ms	$< 25$
	10% signal change	ms	$< 15$

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.

<sup>2)</sup> Flow rate at a different  $\Delta p$   $q_x = q_{nom} \cdot \sqrt{\frac{\Delta p_x}{5 \text{ bar (72.5 PSI)}}$

<sup>3)</sup> All specifications achieved in conjunction with proportional amplifier: **0 811 405 099**

**Extracted from RE 29022/01.05**

Page 1 of 2  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**4/3 servo solenoid valves  
with positive overlap and position  
feedback (LvdT AC/AC)  
Model 4WRP ..E..**

Size 10

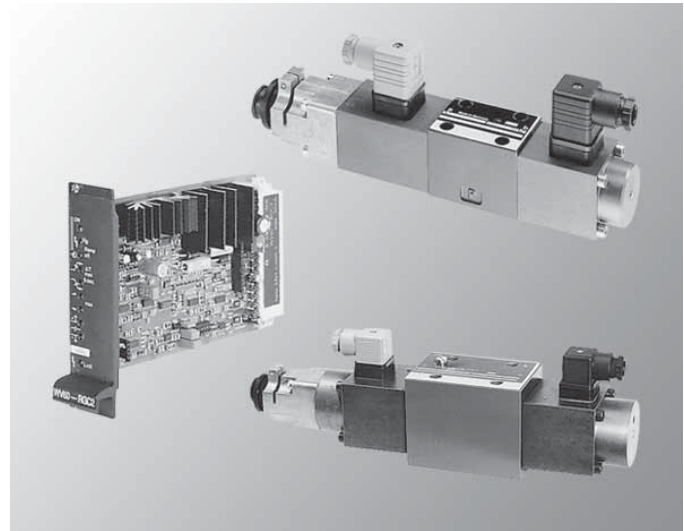
Unit series 1X

Maximum working pressure of P, A, B

315 bar (4600 PSI), T 250 bar (3626 PSI)

Maximum flow 63 L/min (17 GPM)

- Directly operated NG10 valves with positive overlap and external valve electronics
- Actuated on both sides, symbol E
- Control solenoids with A-side position feedback (LvdT AC/AC)
- Suitable for use in electrohydraulic controls in production plants
- For subplate attachment, mounting hole configuration NG10 with additional "L" port to ISO 4401-05-06-0-94



- External trigger electronics (order separately), see catalog section RE 30048 and RE 30047
- Solenoid and position transducer connectors included in scope of delivery
- Subplates as per catalog section RE 45053 and RE 45055 (order separately)

**Ordering code**

4WRP		10	E	63	S	1X / G24	Z4 / M	*
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For external electronics

= no code

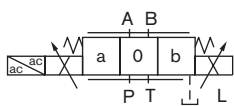
Size 10

= 10

**Symbols**

4/3-way version

NG10 <sup>1)</sup>



= E

<sup>1)</sup> Type 4WRP 10

Mounting hole configuration with additional "L" port

Further information in plain text

**M =** NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524

**Z4 =** Electrical connection with plug to DIN 43560-AM2 with mating connector, mating connector included in scope of delivery

**G24 =** Voltage supply of electronics +24 V DC

**1X =** Unit series (installation and connection dimensions unchanged)

**S =** Flow characteristic Progressive

**63 =** Nominal flow rate at 10 bar (145 PSI) valve pressure difference (5 bar (73 PSI) per metering notch) 63 L/min (16.6 GPM)

**Extracted from RE 29022/01.05**

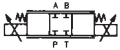
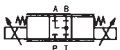
 Page 2 of 2  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Construction	Spool type valve	
Actuation	Proportional solenoid with position control, external amplifier	
Connection type	Subplate, mounting hole configuration NG10 (ISO 4401-05-06-0-94)	
Mounting position	Optional	
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)
Weight	kg (lbs.)	8.0 (17.6)
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)	

**Hydraulic** (measured at  $n = 46$  L/min (213 SUS) and  $t = 40$  °C  $\pm$  5 °C (104 °F  $\pm$  41 °F))

Pressure fluid	Hydraulic oil to DIN 51524 ... 535, other fluids after prior consultation		
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (93 to 464)
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (46 to 3708)
Pressure fluid temperature range	°C (°F)	-20 to +80 (-4 to +176)	
Maximum permissible degree of contamination of pressure fluid. Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>		
Direction of flow	See symbol		
Nominal flow at $\Delta p = 5$ bar (72.5 PSI) per notch <sup>2)</sup>	L/min (GPM)	63 (16.6)	
Max. working pressure	bar (PSI)	Port P, A, B: 315 (4600)	
Max. pressure	bar (PSI)	Port T: 250 (3626)	
	bar (PSI)	Port L: 2 (29)	
Leakage per metering edge ( $\Delta p = 100$ bar [1450 PSI])	$I_m = 0$		A → T = 80 cm <sup>3</sup> /min (5 in <sup>3</sup> /min) B → T = 80 cm <sup>3</sup> /min (5 in <sup>3</sup> /min)
Leakage per metering edge ( $\Delta p = 5$ bar [72.5 PSI])			A → T = 0.4 to 0.8 L/min (0.11 to 0.21 GPM) B → T = 0.4 to 0.8 L/min (0.11 to 0.21 GPM)

**Electrical**

Cyclic duration factor	%	100
Power supply	24 V <sub>nom</sub> (external amplifier)	
Degree of protection	IP 65 to DIN 40050 and IEC 14434/5	
Solenoid connection	Unit plug DIN 43650/ISO 4400, M16 x 1.5 (2P+PE)	
Position transducer connection	Unit plug Pg7 (4P)	
Max. solenoid current	A	3.7
Coil resistance R20	Ω	2.5
Max. power consumption at 100 % load and operating temperature	VA	60

**Static/Dynamic <sup>3)</sup>**

Hysteresis	%	≤ 0.75	
Range of inversion	%	≤ 0.5	
Manufacturing tolerance for Q <sub>max</sub> .	%	< 10	
Response time	100% signal change	ms	< 50
	10% signal change	ms	< 20

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.

<sup>2)</sup> Flow rate at a different  $\Delta p$   $q_x = q_{nom} \cdot \sqrt{\frac{\Delta p_x}{5 \text{ bar (72.5 PSI)}}$ 
<sup>3)</sup> All specifications achieved in conjunction with proportional amplifier: **0 811 405 099**



**Extracted from RE 29024/01.05**

Page 1 of 4  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**4/2 servo solenoid valves  
with on-board electronics (OBE),  
positive overlap and position feedback  
Model 4WRP ..EA..**

Size 6, 10

Unit series 2X

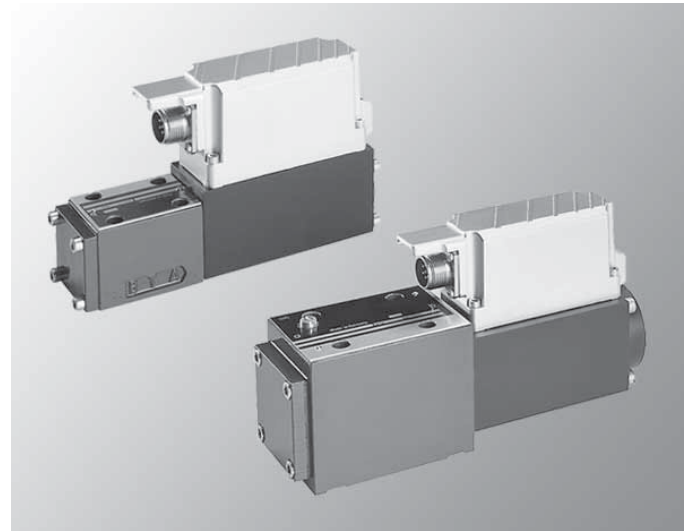
Max. working pressure of P, A, B 315 bar (4600 PSI),  
T 250 bar (3626 PSI) – NG6

Max. working pressure of P, A, B 315 bar (4600 PSI),  
T 200 bar (2900 PSI) – NG10

Maximum flow 32 L/min (8.5 GPM) – NG6

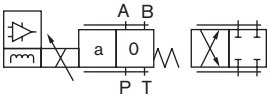
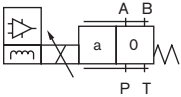
80 L/min (21 GPM) – NG10

- Directly operated NG6 and 10 valves with positive overlap, actuated on both sides and position-controlled, symbol E
- Control solenoid with on-board electronics (OBE), deadband compensation and gain calibrated at the factory
- Electrical connection 6P+PE (standard), signal input: differential amplifier with interface A1 = +10 V



- For subplate attachment, mounting hole configuration NG6 to ISO 4401-03-02-0-94 and NG10 to ISO 4401-05-04-0-94
- Plug-in connectors to DIN 43563-AM6, see catalog section RE 08008 (order separately)
- Subplates as per catalog section RE 45053 and RE 45055 (order separately)

**Ordering code**

<b>4WRP</b>	<b>E</b>	<b>E</b>	<b>A</b>	<b>S</b>	<b>J</b>	<b>2X / G24</b>	<b>K0 / A1</b>	<b>M</b>	<b>*</b>
For external electronics = E		Size 6 = 6 Size 10 = 10		Symbols 4/2-way version  = E		Side of inductive position transducer  (Standard) = A		Nominal flow rate at 10 bar (145 PSI) valve pressure difference (5 bar (73 PSI) per metering notch) 32 L/min (8.5 GPM) – Size 6 = 32 80 L/min (21.1 GPM) – Size 10 = 80	
Further information in plain text		M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524		Interface for electronics A1 = setpoint input +10 V		Electrical connection K0 = without mating connector, with unit plug to DIN 43563-AM6 <sup>2)</sup> Order mating connector separately		Voltage supply of electronics G24 = +24 V DC	
2X = Unit series (installation and connection dimensions unchanged)		Overlap compensating signal J = See curve range 0 ... +0.5		Flow characteristic S = Progressive					

**Extracted from RE 29024/01.05**

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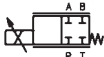
Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.


**Technical data (Model 4WRPE 6 EA..)**
**General**

Construction	Spool type valve		
Actuation	Proportional solenoid with position control, external amplifier		
Connection type	Subplate, mounting hole configuration NG10 (ISO 4401-05-06-0-94)		
Mounting position	Optional		
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)	
Weight	kg (lbs.)	3.0 (6.6)	
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)		

**Hydraulic** (measured at  $n = 46$  L/min (213 SUS) and  $t = 40$  °C  $\pm$  5 °C (104 °F  $\pm$  41 °F))

Pressure fluid	Hydraulic oil to DIN 51524 ... 535, other fluids after prior consultation		
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (93 to 464)
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (46 to 3708)
Pressure fluid temperature range	°C (°F)	-20 to +70 (-4 to 158)	
Maximum permissible degree of contamination of pressure fluid. Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>		
Direction of flow	See symbol		
Nominal flow at $\Delta p = 5$ bar (72.5 PSI) per notch <sup>2)</sup>	L/min (GPM)	32 (8.5)	
Max. working pressure	bar (PSI)	Port P, A, B: 315 (4600)	
Max. pressure	bar (PSI)	Port T: 250 (3626)	
Operating limits	See chart		
Leakage per metering edge ( $\Delta p = 100$ bar [1450 PSI])	$I_m = 0$	 $\leq 80$ cm <sup>3</sup> /min (5 in <sup>3</sup> /min)	

**Static/Dynamic**

Hysteresis	%	$\leq 0.3$		
Range of inversion	%	$\leq 0.2$		
Manufacturing tolerance for Q <sub>max</sub> .	%	$\leq \pm 3$		
Response time	100% signal change	ms	$\sim 12$	
	10% signal change	ms	$\sim 7$	
Thermal drift	$< 1\%$ at $\Delta T = 40$ °C (104 °F)			
Q <sub>N</sub> type	L/min (GPM)		18 (4.8)	30 (8.0)
Calibration (factory setting) $\pm 3\%$ $\Delta p = 5$ bar (72.5 PSI)	L/min (GPM)	$U_{D-E} = 1$ V =	0.45 (0.12)	0.78 (0.21)
		$U_{D-E} = 8$ V =	15 (4.0)	30 (8.0)
Conformity	 EN 61000-6-2 EN 61000-6-3			

<sup>1)</sup> The purity classes stated for the components must be complied within hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.

<sup>2)</sup> Flow rate at a different  $\Delta p$   $q_x = q_{nom.} \cdot \sqrt{\frac{\Delta p_x}{5 \text{ bar (72.5 PSI)}}$

**Extracted from RE 29024/01.05**

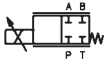
 Page 3 of 4  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.


**Technical data (Model 4WRPE 10 EA..)**
**General**

Construction	Spool type valve, directly operated	
Actuation	Proportional solenoid with position control, OBE	
Connection type	Subplate, mounting hole configuration NG10 (ISO 4401-05-06-0-94)	
Mounting position	Optional	
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)
Weight	kg (lbs.)	7.1 (15.6)
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)	

**Hydraulic** (measured at  $n = 46$  L/min (213 SUS) and  $t = 40$  °C  $\pm$  5 °C (104 °F  $\pm$  41 °F))

Pressure fluid	Hydraulic oil to DIN 51524 ... 535, other fluids after prior consultation		
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (93 to 464)
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (46 to 3708)
Pressure fluid temperature range	°C (°F)	-20 to +70 (-4 to +158)	
Maximum permissible degree of contamination of pressure fluid. Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>		
Direction of flow	See symbol		
Nominal flow at $\Delta p = 5$ bar (72.5 PSI) per notch <sup>2)</sup>	L/min (GPM)	80 (21.1)	
Max. working pressure	bar (PSI)	Port P, A, B: 315 (4600)	
Max. pressure	bar (PSI)	Port T: 200 (2900)	
Operating limits	See chart		
Leakage per metering edge ( $\Delta p = 100$ bar [1450 PSI])	$I_m = 0$	 $\leq 80$ cm <sup>3</sup> /min (5 in <sup>3</sup> /min)	

**Static/Dynamic**

Hysteresis	%	$\leq 0.3$	
Range of inversion	%	$\leq 0.2$	
Manufacturing tolerance for $Q_{max}$ .	%	$\leq \pm 3$	
Response time	100% signal change	ms	$\sim 25$
	10% signal change	ms	$\sim 10$
Thermal drift	$< 1\%$ at $\Delta T = 40$ °C (104 °F)		
$Q_N$ type	L/min (GPM)	50 (13.2)	80 (21.1)
Calibration (factory setting) $\pm 3\%$ $\Delta p = 5$ bar (72.5 PSI)	L/min (GPM)	$U_{D-E} = 0.6$ V =	0.15 (0.04)    0.34 (0.09)
		$U_{D-E} = 8$ V =	40 (10.6)    70 (18.5)
Conformity	 EN 61000-6-2 EN 61000-6-3		

<sup>1)</sup> The purity classes stated for the components must be complied within hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.

<sup>2)</sup> Flow rate at a different  $\Delta p$   $q_x = q_{nom.} \cdot \sqrt{\frac{\Delta p_x}{5 \text{ bar (72.5 PSI)}}$

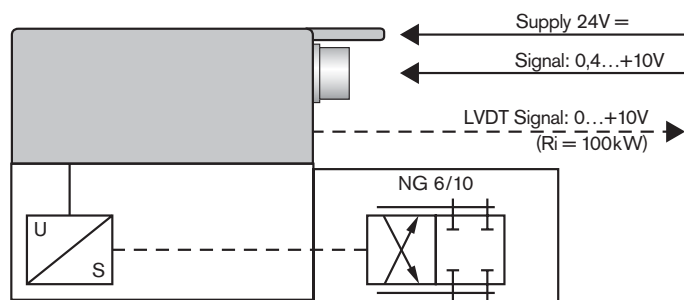
**Extracted from RE 29024/01.05**

 Page 4 of 4  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data (Model 4WRPE .. EA..)**
**Electrical, electronics integrated in the valve**

Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Line socket 6P+PE, DIN 43563
Power supply		24 V DC <sub>nom</sub>
Terminal A:		min. 21 V DC/max. 40 V DC
Terminal B: 0 V		Ripple max. 2 V DC
Power consumption	NG6	Solenoid ☑ 45 mm = 40 VA max.
	NG10	Solenoid ☑ 60 mm = 60 VA max.
External fuse		2.5 A <sub>F</sub>
Input, "Standard" version	A1	Differential amplifier, R <sub>i</sub> = 100 kΩ
Terminal D: U <sub>E</sub>		+0.4 ... +10 V
Terminal E:		0 V
Max. differential input voltage at 0 V		D → B } max. 18 V DC E → B }
Test signal, "Standard" version	A1	LVDT
Terminal F: U <sub>Test</sub>		+0.4 ... +10 V
Terminal C:		Reference 0 V
Safety earth conductor and shield		See pin assignment (installation conforms to CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm <sup>2</sup> up to 40 m 7 x 1 mm <sup>2</sup>
Calibration		Calibrated at the factory, see valve curve

**Version A1:  
Standard**


**Extracted from RE 29025/01.05**

Page 1 of 4  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**4/3 servo solenoid valves  
with on-board electronics (OBE),  
positive overlap and position feedback  
Model 4WRPE ..E.. / ..W..**

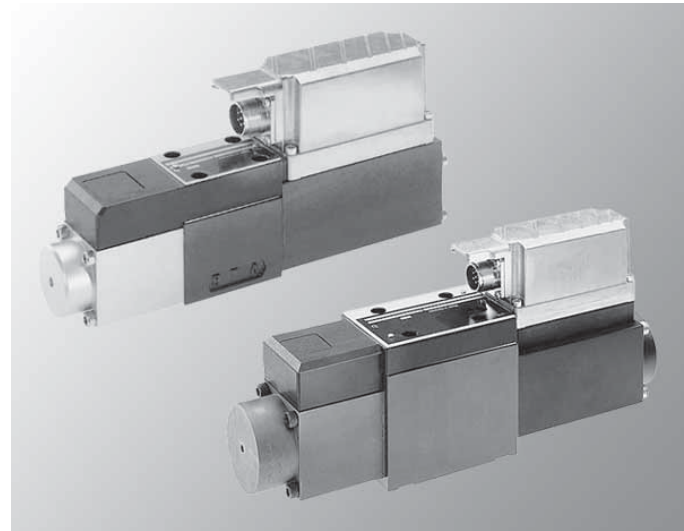
Size 6, 10

Unit series 2X

Max. working pressure of P, A, B 315 bar (4600 PSI),  
T 200 bar (2900 PSI)

Max. flow 18 to 32 L/min (4.8 to 8.5 GPM) – NG6  
50 to 80 L/min (13.2 to 21 GPM) – NG10

- Directly operated NG6 and 10 valves with positive overlap, actuated on both sides and position-controlled, symbol E or W
- Control solenoid with on-board electronics (OBE), deadband compensation and gain calibrated at the factory
- Electrical connection 6P+PE (standard), signal input: differential amplifier with interface A1 = ±10 V (F1 on request)
- For subplate attachment, mounting hole configuration NG6 to ISO 4401-03-02-0-94 and NG10 to ISO 4401-05-04-0-94



- Plug-in connectors to DIN 43563-AM6, see catalog section RE 08008 (order separately)
- Subplates as per catalog section RE 45053 and RE 45055 (order separately)

**Ordering code**

4WRP	E				S	J	2X / G24	K0 /	M	*
------	---	--	--	--	---	---	----------	------	---	---

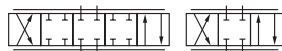
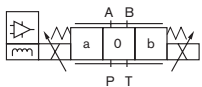
For external electronics = E

Size 6 = 6

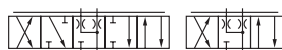
Size 10 = 10

**Symbols**

4/3-way version



= E



= W

**Nominal flow rate at 10 bar (145 PSI)  
valve pressure difference**

**(5 bar (73 PSI) per metering notch)**

Size 6 – 18 L/min (4.8 GPM) = 18

32 L/min (8.5 GPM) = 32

Size 10 – 50 L/min (13.2 GPM) = 50

80 L/min (21.1 GPM) = 80

Further information  
in plain text

M = NBR seals, suitable for  
mineral oils (HL, HLP)  
to DIN 51524

**Interface for electronics**

A1 = setpoint input +10 V

F1 = setpoint input

4...12...20 mA <sup>1)</sup>

**Electrical connection**

K0 = without mating connector,  
with unit plug to DIN 43563-AM6 <sup>2)</sup>

Order mating connector separately

**Voltage supply of electronics**

+24 V DC

G24 =

2X =

Unit series  
(installation and connection dimensions unchanged)

**Overlap compensating signal**

See curve range 0 ... +0.5

J =

**Flow characteristic**

Progressive

S =

**Extracted from RE 29025/01.05**

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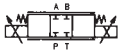
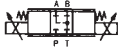
Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.



**Technical data (Model 4WRPE 6 ..)**
**General**

Construction	Spool type valve	
Actuation	Proportional solenoid with position control, external amplifier	
Connection type	Subplate, mounting hole configuration NG10 (ISO 4401-05-06-0-94)	
Mounting position	Optional	
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)
Weight	kg (lbs.)	3.9 (8.6)
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)	

**Hydraulic** (measured at  $n = 46$  L/min (213 SUS) and  $t = 40$  °C  $\pm$  5 °C (104 °F  $\pm$  41 °F))

Pressure fluid	Hydraulic oil to DIN 51524 ... 535, other fluids after prior consultation		
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (93 to 464)
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (46 to 3708)
Pressure fluid temperature range	°C (°F)	-20 to +70 (-4 to +158)	
Maximum permissible degree of contamination of pressure fluid. Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>		
Direction of flow	See symbol		
Nominal flow at $\Delta p = 5$ bar (72.5 PSI) per notch <sup>2)</sup>	L/min (GPM)	18 (4.8)	32 (8.5)
	$Q_A$ at 8 V	13 (3.4) $\pm$ 3%	26 (6.9) $\pm$ 3%
Max. working pressure	bar (PSI)	Port P, A, B: 315 (4600)	
Max. pressure	bar (PSI)	Port T: 200 (2900)	
Leakage per metering edge ( $\Delta p = 100$ bar [1450 PSI])	$l_m = 0$		A $\rightarrow$ T = 80 cm <sup>3</sup> /min (5 in <sup>3</sup> /min) B $\rightarrow$ T = 80 cm <sup>3</sup> /min (5 in <sup>3</sup> /min)
Leakage per metering edge ( $\Delta p = 5$ bar [72.5 PSI])			A $\rightarrow$ T = 0.8 to 1.6 L/min (0.21 to 0.42 GPM) B $\rightarrow$ T = 0.8 to 1.6 L/min (0.21 to 0.42 GPM)

**Static/Dynamic**

Hysteresis	%	$\leq 0.3$	
Range of inversion	%	$\leq 0.2$	
Manufacturing tolerance for $Q_{max}$ .	%	$\leq \pm 3$	
Response time	100% signal change	ms	20
	10% signal change	ms	5
Thermal drift	$< 1\%$ at $\Delta T = 40$ °C (104 °F)		
Conformity	 EN 61000-6-2  EN 61000-6-3		

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.

<sup>2)</sup> Flow rate at a different  $\Delta p$   $q_x = q_{nom.} \cdot \sqrt{\frac{\Delta p_x}{5 \text{ bar (72.5 PSI)}}$

**Extracted from RE 29025/01.05**

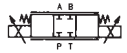
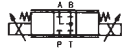
 Page 3 of 4  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.



**Technical data (Model 4WRPE 10 ..)**
**General**

Construction	Spool type valve	
Actuation	Proportional solenoid with position control, external amplifier	
Connection type	Subplate, mounting hole configuration NG10 (ISO 4401-05-06-0-94)	
Mounting position	Optional	
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)
Weight	kg (lbs.)	8.3 (18.3)
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)	

**Hydraulic** (measured at  $n = 46$  L/min (213 SUS) and  $t = 40$  °C  $\pm$  5 °C (104 °F  $\pm$  41 °F))

Pressure fluid	Hydraulic oil to DIN 51524 ... 535, other fluids after prior consultation		
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (93 to 464)
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (46 to 3708)
Pressure fluid temperature range	°C (°F)	-20 to +70 (-4 to +158)	
Maximum permissible degree of contamination of pressure fluid. Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>		
Direction of flow	See symbol		
Nominal flow at $\Delta p = 5$ bar (72.5 PSI) per notch <sup>2)</sup>	L/min (GPM)	50 (16.6)	32 (8.5)
	$Q_A$ at 8 V	40 (10.6) $\pm$ 3%	70 (18.5) $\pm$ 3%
Max. working pressure	bar (PSI)	Port P, A, B: 315 (4600)	
Max. pressure	bar (PSI)	Port T: 200 (2900)	
Leakage per metering edge ( $\Delta p = 100$ bar [1450 PSI])	$l_m = 0$		A $\rightarrow$ T = 80 cm <sup>3</sup> /min (5 in <sup>3</sup> /min)
			B $\rightarrow$ T = 80 cm <sup>3</sup> /min (5 in <sup>3</sup> /min)
Leakage per metering edge ( $\Delta p = 5$ bar [72.5 PSI])			A $\rightarrow$ T = 0.8 to 1.6 L/min (0.21 to 0.42 GPM)
			B $\rightarrow$ T = 0.8 to 1.6 L/min (0.21 to 0.42 GPM)

**Static/Dynamic**

Hysteresis	%	$\leq 0.3$	
Range of inversion	%	$\leq 0.2$	
Manufacturing tolerance for $Q_{max}$ .	%	$\leq \pm 3$	
Response time	100% signal change	ms	40
	10% signal change	ms	10
Thermal drift	$< 1\%$ at $\Delta T = 40$ °C (104 °F)		
Conformity	 EN 61000-6-2  EN 61000-6-3		

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.

<sup>2)</sup> Flow rate at a different  $\Delta p$   $q_x = q_{nom.} \cdot \sqrt{\frac{\Delta p_x}{5 \text{ bar (72.5 PSI)}}$

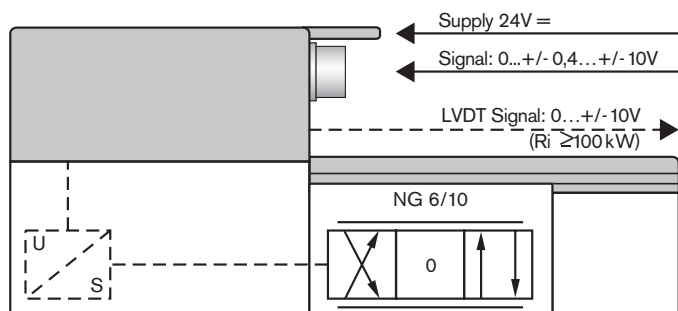
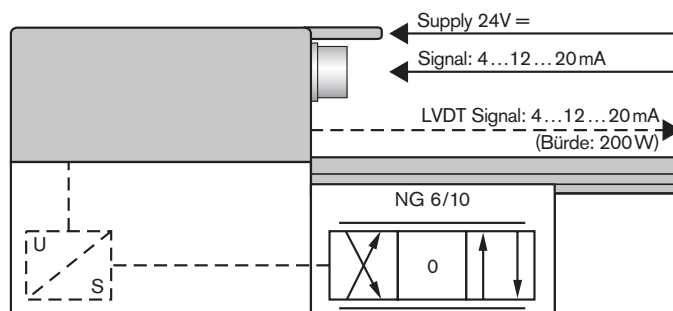
**Extracted from RE 29025/01.05**

 Page 4 of 4  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data (Model 4WRPE ..E.. / ..W..)**
**Electrical**, electronics integrated in the valve

Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Line socket 6P+PE, DIN 43563
Power supply		24 V DC <sub>nom</sub> min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Terminal A:		
Terminal B: 0 V		
Power consumption	NG6	Solenoid $\square$ 45 mm = 40 VA max.
	NG10	Solenoid $\square$ 60 mm = 60 VA max.
External fuse		2.5 A <sub>F</sub>
Input, "Standard" version	A1	Differential amplifier, $R_i = 100 \text{ k}\Omega$ 0 ... $\pm 0.4$ ... $\pm 10 \text{ V}$ Terminal D: $U_E$ Terminal E: 0 V
Input, "mA signal" version	F1	Load, $R_{sh} = 200 \Omega$ 4 ... 12 ... 20 mA Current loop $I_{D-E}$ feedback Terminal D: $I_{D-E}$ Terminal E: $I_{D-E}$
Max. differential input voltage at 0 V		D → B } max. 18 V DC E → B }
Test signal, "Standard" version	A1	LVDT 0 ... $\pm 0.4$ ... $\pm 10 \text{ V}$ Terminal F: $U_{Test}$ Terminal C: Reference 0 V
Test signal, "mA signal" version	F1	LVDT signal 4 ... 12 ... 20 mA at external load 200 ... 500 $\Omega$ 4 ... 20 mA output Current loop $I_{F-C}$ feedback Terminal F: $I_{F-C}$ Terminal C: $I_{F-C}$
Safety earth conductor and shield		See pin assignment (installation conforms to CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm <sup>2</sup> up to 40 m 7 x 1 mm <sup>2</sup>
Calibration		Calibrated at the factory, see valve curve

**Version A1:**  
**Standard**

**Version F1:**  
**mA-Signal**




**Extracted from RE 29047/09.05**

Page 1 of 2  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**4/2 proportional directional control valve,  
without position control  
Model 4WRBA..EA..**

Size 6, 10

Unit series 2X

Maximum working pressure P, A, B

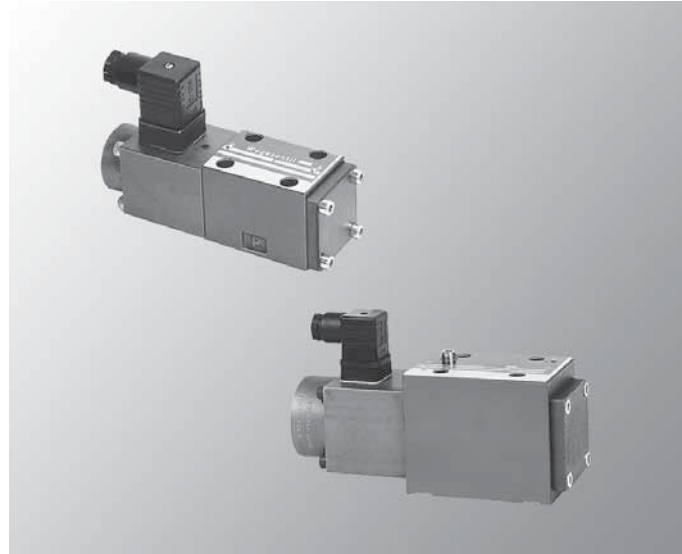
315 bar (4600 PSI), T 250 bar (3600 PSI)

Nominal flow rate  $Q_{nom}$

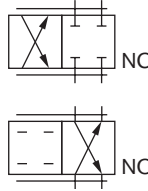
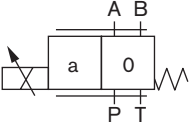
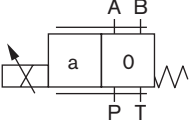
14 to 28 L/min (3.7 to 7.4 GPM) – NG6

32 to 63 L/min (8.5 to 16.6 GPM) – NG10

- Directly controlled NG6 and NG10 valves with positive overlap and external valve electronics
- Actuated on one side, standard symbol EA, normally closed version NC (normally open NO also available, with manual adjustment as optional extra)
- Adjustable by means of the solenoid current, see Characteristic Curve, Technical Data and the selected valve electronics



**Ordering code**

<b>4WRBA</b>		<b>A</b>	<b>- 2X / G24</b>	<b>Z4 / M</b>	<b>*</b>	
4/2 proportional directional control valve, without position control						Further information in plain text
NG6 = 6						-892 = See symbol <sup>1)</sup>
NG10 = 10						-893 = see symbol <sup>2)</sup>
<b>Symbols</b> 4/2-way version						M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524
						Z4 = <b>Electrical connection</b> With unit plug to DIN 43650-AM2 with plug-in connector, included in scope of delivery
						N = <b>Manual adjustment</b> N9 = <b>Manual auxiliary override</b> (covered)
<b>Actuating side</b> 						G24 = <b>Voltage supply of trigger electronics</b> +24 V DC
						2X = <b>Unit series</b> (installation and connection dimensions unchanged)
						<b>Nominal flow rate</b> ( $\Delta p = 5 \text{ bar [72.5 PSI]}$ ) per metering notch)
						NG6
						15 = 14 l/min (3.7 GPM)
						30 = 28 l/min (7.4 GPM)
						NG10
						32 = 32 l/min (8.5 GPM)
						64 = 63 l/min (16.6 GPM)

**Extracted from RE 29047/09.05**

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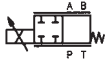
Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Construction	Spool-type valve		
Actuation	Proportional solenoid without position control, external amplifier		
Connection type	Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94) NG10 (ISO 4401-05-04-0-94)		
Mounting position	Optional		
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)	
Weight	NG6	kg (lbs.)	2.0 (4.4) – 2.2 (4.8) with manual adjustment
	NG10	kg (lbs.)	6.9 (15.2)
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)		

**Hydraulic** – measured with HLP 46,  $\vartheta_{oil} = 40^\circ\text{C} \pm 5^\circ\text{C}$  (104 °F  $\pm$  41 °F)

Pressure fluid	Hydraulic oil to DIN 51524...535, other fluids after prior consultation				
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (90 to 450)		
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3700)		
Pressure fluid temperature range	°C (°F)	-20 to +80 (-4 to +176)			
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>				
Direction of flow, see symbol	<b>NG6</b>		<b>NG10</b>		
Nominal flow rate (at $\Delta p = 5$ bar)*	l/min (GPM)	14 (3.7)	28 (7.4) per channel	32 (8.5) 63 (16.6) per channel	
Leakage per metering edge ( $\Delta p = 100$ bar)	$I_m = 0$ cm <sup>3</sup> /min (in <sup>3</sup> /min)		$\leq 80$ (4.9)		$\leq 80$ (4.9)
			$\leq 150$ (9.2)		
Max. working pressure	bar (PSI)	Port P, A, B: 315 (4600) Port T: 250 (3600)			

1) The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of component  
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

**\* Nominal flow**

This is always based on a pressure differential of  $\Delta p = 5$  bar (72.5 PSI) at the throttling point.  
Where other pressure differentials are involved, the flow is calculated according to the following formula:

$$Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{5}}$$

However, the **operating limits** must be born in mind.  
If they are exceeded, the ensuing flow forces lead to uncontrollable spool movements. **Pressure compensators** are used to reliably limit  $\Delta p$ .

**Extracted from RE 29049/09.05**

Page 1 of 2  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**4/3 proportional directional control valve,  
without position control  
Model 4WRBA..E.. / ..W..**

Size 6, 10

Unit series 2X

Maximum working pressure P, A, B

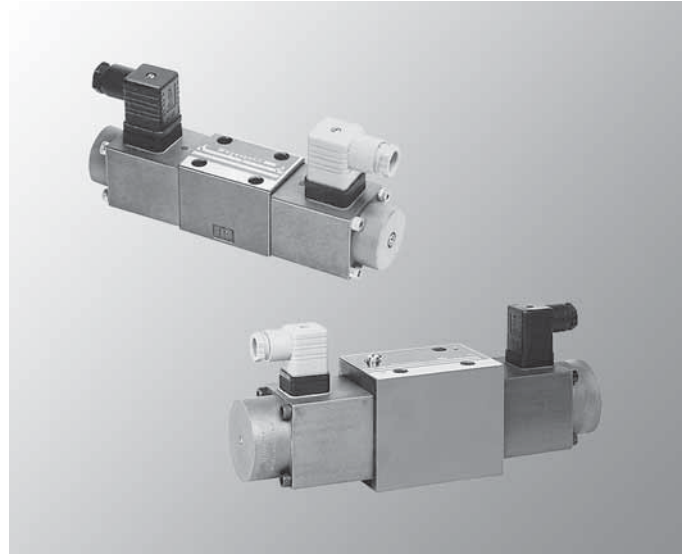
315 bar (4600 PSI), T 250 bar (3600 PSI)

Nominal flow rate  $Q_{nom}$

6 to 28 L/min (1.6 to 7.4 GPM) – NG6

32 to 63 L/min (8.5 to 16.6 GPM) – NG10

- Directly controlled NG6 and NG10 valves with positive overlap and external valve electronics
- Actuated on both sides, standard symbols E and W
- Adjustable by means of the solenoid current, see Characteristic Curve, Technical Data and the selected valve electronics



**Ordering code**

<b>4WRBA</b>	<b>- 2X / G24</b>	<b>N9</b>	<b>Z4 / M</b>	<b>*</b>	
4/3 proportional directional control valve, without position control					Further information in plain text
NG6 = 6					M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524
NG10 = 10					Z4 = <b>Electrical connection</b> With unit plug to DIN 43650-AM2 with plug-in connector, included in scope of delivery
<b>Symbols</b> 4/3-way version					N9 = <b>Manual auxiliary override</b> (covered)
					G24 = <b>Voltage supply of trigger electronics</b> +24 V DC
					2X = <b>Unit series</b> (installation and connection dimensions unchanged)
					<b>Nominal flow rate</b> ( $\Delta p = 5 \text{ bar [72.5 PSI]}$ ) per metering notch
		<b>NG6</b>			
		07 =			6 l/min (1.6 GPM)
		15 =			14 l/min (3.7 GPM)
		30 =			28 l/min (7.4 GPM)
		<b>NG10</b>			
		32 =			32 l/min (8.5 GPM)
		64 =			63 l/min (16.6 GPM)

### Extracted from RE 29049/09.05

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Issue: 06.06

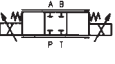
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data

#### General

Construction	Spool-type valve		
Actuation	Proportional solenoid without position control, external amplifier		
Connection type	Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94) NG10 (ISO 4401-05-04-0-94)		
Mounting position	Optional		
Ambient temperature range	°C (°F) -20 to +50 (-4 to +122)		
Weight	NG6	kg (lbs.)	2.6 (5.7)
	NG10	kg (lbs.)	7.7 (17.0)
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)		

#### Hydraulic – measured with HLP 46, $\vartheta_{oil} = 40^\circ\text{C} \pm 5^\circ\text{C}$ (104 °F $\pm 41$ °F)

Pressure fluid	Hydraulic oil to DIN 51524...535, other fluids after prior consultation			
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (90 to 450)	
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3700)	
Pressure fluid temperature range	°C (°F) -20 to +80 (-4 to +176)			
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>			
Direction of flow, see symbol	NG6		NG10	
Nominal flow rate (at $\Delta p = 5$ bar)*	l/min (GPM)	6 (1.6)	28 (7.4) per channel	32 (8.5) 63 (16.6) per channel
Leakage per metering edge ( $\Delta p = 100$ bar)	$I_m = 0$ cm <sup>3</sup> /min (in <sup>3</sup> /min)		A → T = 80 (4.9) B → T = 80 (4.9)	A → T = 80 (4.9) B → T = 80 (4.9)
			$I_m = \text{max.}$ cm <sup>3</sup> /min (in <sup>3</sup> /min)	A → T = 0.8...1.6 (0.05...0.1) B → T = 0.8...1.6 (0.05...0.1)
Max. working pressure	bar (PSI)	Port P, A, B: 315 (4600) Port T: 250 (3600)		

1) The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of component  
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

#### \* Nominal flow

This is always based on a pressure differential of  $\Delta p = 5$  bar (72.5 PSI) at the throttling point.  
Where other pressure differentials are involved, the flow is calculated according to the following formula:

$$Q_x = Q_{\text{nom}} \cdot \sqrt{\frac{\Delta p_x}{5}}$$

However, the **operating limits** must be born in mind.  
If they are exceeded, the ensuing flow forces lead to uncontrollable spool movements. **Pressure compensators** are used to reliably limit  $\Delta p$ .

**Extracted from RE 29051/01.06**

Page 1 of 2  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**4/3 proportional directional control valve,  
without position control,  
with onboard electronics  
Model 4WRBAE..E.. / ..W..**

Size 6, 10

Unit series 2X

Maximum working pressure P, A, B

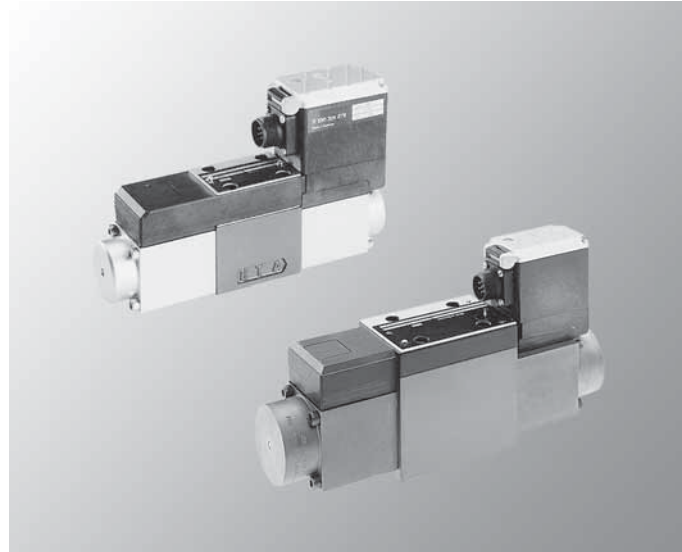
315 bar (4600 PSI), T 250 bar (3600 PSI)

Nominal flow rate  $Q_{nom}$

18 to 32 L/min (4.8 to 8.5 GPM) – NG6

35 to 65 L/min (9.2 to 17.2 GPM) – NG10

- Directly controlled NG6 and NG10 valves with positive overlap and on-board electronics
- Actuated on both sides, standard symbols E and W
- Adjustable by means of the setpoint in the on-board electronics, see Characteristic Curves
- Valves are preset at the factory, ramp is set to minimum ramp time and overlap ( $Q_{min}$  at 0.8 V) to  $Q_{nom}$  at 8 V



**Ordering code**

4WRBA	E		-	J	2X / G24	N9	K31 /	M	*
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4/3 proportional directional control valve,  
without position control

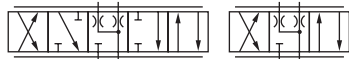
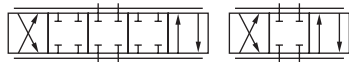
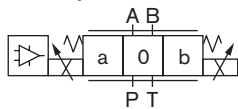
With on-board electronics = E

NG6 = 6

NG10 = 10

**Symbols**

4/3-way version



**Nominal flow rate** ( $\Delta p = 5 \text{ bar [72.5 PSI]}$ )

per metering notch

18 l/min (4.8 GPM)

32 l/min (8.5 GPM)

35 l/min (9.2 GPM)

65 l/min (17.2 GPM)

**NG6**

18 =

32 =

**NG10**

35 =

65 =

Further information in  
plain text

**M =** NBR seals,  
suitable for mineral oils  
(HL, HLP) to DIN 51524

**Interface for  
trigger electronics**

**A1 =** Setpoint input 0... ± 10 V

**F1 =** Setpoint input 4...20 mA

**K31 =** **Electrical connection**  
without plug-in connector, with  
unit plug to DIN 43563-AM6  
Order plug-in connector separately

**N9 =** **Manual auxiliary override**  
(covered)

**G24 =** **Voltage supply of trigger electronics**  
+24 V DC

**2X =** **Unit series**  
(installation and connection dimensions unchanged)

**J =** Step response / deadband compensation

**Extracted from RE 29051/01.06**

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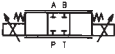
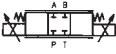
Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.





**Technical data**
**General**

Construction	Spool-type valve		
Actuation	Proportional solenoid without position control, with on-board electronics (OBE)		
Connection type	Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94) NG10 (ISO 4401-05-04-0-94)		
Mounting position	Optional		
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)	
Weight	NG6	kg (lbs.)	3.1 (6.8)
	NG10	kg (lbs.)	8.3 (18.3)
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)		

**Hydraulic** – measured with HLP 46,  $\vartheta_{oil} = 40^\circ\text{C} \pm 5^\circ\text{C}$  (104 °F  $\pm$  41 °F)

Pressure fluid	Hydraulic oil to DIN 51524...535, other fluids after prior consultation				
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (90 to 450)		
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3700)		
Pressure fluid temperature range	°C (°F)	-20 to +70 (-4 to +158)			
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>				
Direction of flow, see symbol			<b>NG6</b>		<b>NG10</b>
Nominal flow rate (at $\Delta p = 5$ bar)*	l/min (GPM)	18 (4.8)   32 (8.5) per metering edge		35 (9.2)   65 (17.2) per metering edge	
		15 $\pm$ 1 (4.0 $\pm$ 0.3)   26 $\pm$ 1 (6.9 $\pm$ 0.3)		28 $\pm$ 2 (7.4 $\pm$ 0.5)   58 $\pm$ 3 (15.3 $\pm$ 0.8)	
Leakage per metering edge ( $\Delta p = 100$ bar [1450 PSI])	$I_m = 0$	cm <sup>3</sup> /min (in <sup>3</sup> /min)	 A → T = 80 (4.9) B → T = 80 (4.9)	 A → T = 80 (4.9) B → T = 80 (4.9)	
					Leakage drain ( $\Delta p = 5$ bar [72.5 PSI])
Max. working pressure	bar (PSI)	Port P, A, B: 315 (4600) Port T: 250 (3600)			

**Static/Dynamic**

Hysteresis	%	≤ 6		≤ 8	
Response sensitivity	%	≤ 3		≤ 5	
Response time 100% signal change (ramp = $T_{min}$ )	ms	50		100	
				90	
					100
					

1) The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of component. For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

**\* Nominal flow**

This is always based on a pressure differential of  $\Delta p = 5$  bar (72.5 PSI) at the throttling point. Where other pressure differentials are involved, the flow is calculated according to the following formula:

$$Q_x = Q_{nom} \cdot \sqrt{\frac{\Delta p_x}{5}}$$

However, the **operating limits** must be born in mind. If they are exceeded, the ensuing flow forces lead to uncontrollable spool movements. **Pressure compensators** are used to reliably limit  $\Delta p$ .

**Extracted from RA 29 057/06.98**

Page 1 of 2  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

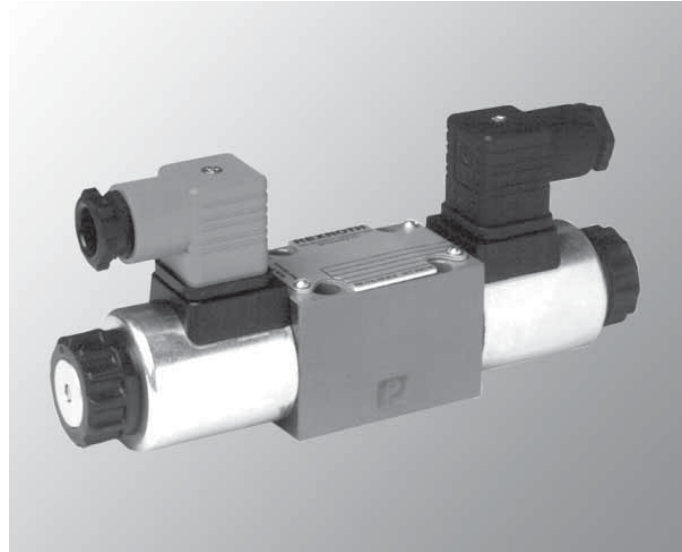
**4/2 and 4/3-way proportional directional  
control valves, direct operated  
Model 4 WRAB**

Size 6  
Series 1X

Maximum operating pressure 350 bar (5100 PSI)

Maximum flow 30 L/min (7.9 GPM)

- Direct operated proportional directional control valves, which control both the direction and volume of a fluid flow
- Mounts on standard ISO 4401-3, NFPA T3.5.1 MR1 **D 03**, and ANSI B 93.7 **D 03** interface
- Two piece solenoid design with removable coils
- Integrated electronics available
- For subplates, see RA 45 052



Model 4 WRAB 6...6X/EG 24 N9K4 with plug-in connector

**Ordering code**

<b>4</b>	<b>WRA</b>	<b>B</b>	<b>6</b>	<b>- 1X /</b>	<b>N9</b>	<b>*</b>
----------	------------	----------	----------	---------------	-----------	----------

4-way	= 4					
Proportional directional control valve, direct operated	= WRA					Further details to be written in clear text
Valve with removable coil	= B					<b>MR =</b> Buna-N (NBR) seats suitable for petroleum oils (HM, HL, HLP)
Size 6 ISO 4401 NFPA/ANSI D 03	= 6					<b>Individual solenoid plug connections</b>
Symbols						<b>K4 =</b> Without angled plug connector(s)
						<b>N9 =</b> Covered manual override
						<b>G12 =</b> solenoid voltage 12 VDC
						<b>1X =</b> Series 10 to 19 (10 to 19 externally interchangeable)
						Nominal flow at 10 bar (145 PSI) pressure drop
						12 = 12 L/min (3.2 GPM)
						25 = 25 L/min (6.6 GPM)

**Extracted from RA 29 057/06.98**

Page 2 of 2

Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Weight (approx.)	valve with 1 solenoid	kg (lbs.)	1.6 (3.5)
	valve with 2 solenoids	kg (lbs.)	2.1 (4.6)
Mounting position	Optional		

**Hydraulic**

Operating pressure	ports A, B, P	bar (PSI)	...350 (5075)
	port T	bar (PSI)	...210 (3050)
Recommended maximum pressure drop		bar (PSI)	< 210 (3050)
Maximum flow		L/min (GPM)	30 (7.9)
Hysteresis		%	< 3.5
Repeatability		%	< 1
Sensitivity		%	< 1
Frequency response (-3 dB, signal $\pm$ 50%)		Hz	24
Switching time to, or Step response	ON or 0 – 100%	ms	18
	OFF or 100% – 0	ms	20

**Electrical**

Supply voltage		vdc	12V ( $\pm$ 10%)
Maximum current (at 24 vdc)		amps	2.5
Maximum power		W	30
Solenoid coil resistance,	cold value 68 °F	$\Omega$	4.8
	warm value 122 °F	$\Omega$	7.2
Inductance		mH	86
Duty cycle	Continuous		
Insulation	IP65, exceeds NEMA class B		
Analog input	( $R_e > 10$ k- $\Omega$ )	vdc	–
Associated electronic amplifier cards (some restrictions apply)	MDSD		



**Extracted from RA 29 055/10.00**Page 1 of 3  
Issue: 01.01See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**4/2 and 4/3-way proportional  
directional valves, direct operated,  
without electrical position feedback  
Model 4WRA and 4WRAE**

Sizes 6 and 10

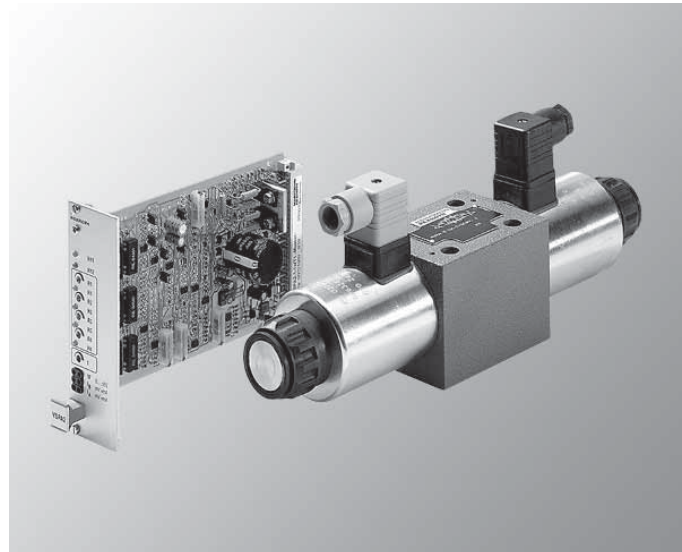
Series 2X

Maximum operating pressure 315 bar (4600 PSI)

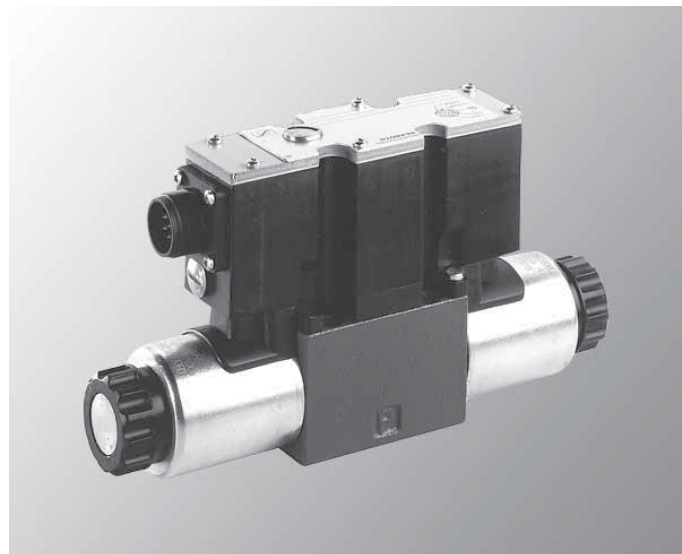
Maximum flow 42 L/min (11.1 GPM) (Size 6)

Maximum flow 140 L/min (37 GPM) (Size 10)

- Direct operated proportional valve for controlling the direction and volume of a flow
- Actuation by means of proportional solenoids with central pole tube and removable coil
- For subplate mounting: Porting pattern to DIN 24 340 form A, ANSI B93.7 D03, D05, NFPA T3.5.1 MR1, ISO 4401 and CETOP-RP 121 H.  
Subplates to datasheets RA 45 052 (Size 6) or RA 45 054 (Size 10, separate order)
- Spring centered control spool
- Integrated control electronics, 0 to  $\pm 10$  V or 4 to 20 mA interface A1 or F1 for Model 4WRAE
- Control electronics for Model WRA:
  - Electrical amplifier VT-VSPA2-1-2X/ in 48F Eurocard format, see RE 30 110



Model 4WRA 10 ...-2X/G24...K4/.V with plug-in connectors and associated control electronics (separate order)



Model 4WRAE 6 ...-2X/G24K31/.V

**Extracted from RA 29 055/06.98**

Page 2 of 3  
Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code**

	<b>4WRA</b>				<b>- 2X / G24</b>				<b>V</b>	<b>*</b>	
<b>Without integrated control electronics</b>	<b>= No code</b>										Further details to be written in clear text
<b>With integrated control electronics</b>	<b>= E</b>										
Nominal size 6	<b>= 6</b>										V = FPM seals, suitable for mineral oil (HL, HLP) to DIN 51 524
Nominal size 10	<b>= 10</b>										
<b>Symbols</b>											No code = For WRA For WRAE: <b>A1</b> = Command value input ±10 V <b>F1</b> = Command value input 4 to 20 mA
	= E = W										
	<b>K4</b> = With component plug DIN 43 650-AM2 Without plug-in connector Plug-in connector (separate order)										<b>Electrical connections</b> <b>For WRAE:</b> <b>K31</b> = With component plug to E DIN 43 563-AM6-3 Without plug-in connector Plug-in connector (separate order)
	<b>No code</b> = Without special protection										
	<b>G24</b> = Supply voltage 24 VDC										
	<b>2X</b> = Series 20 to 29 (20 to 29: unchanged installation and connection dimensions)										
	Nominal flow at a valve pressure differential $D_p = 145$ PSI (10 bar)										
	<b>Size 6</b> <b>07</b> = 7 L/min (1.85 GPM) <b>15</b> = 15 L/min (3.96 GPM) <b>30</b> = 30 L/min (7.93 GPM)										
	<b>Size 10</b> <b>30</b> = 30 L/min (7.92 GPM) <b>60</b> = 60 L/min (15.95 GPM)										

**Extracted from RA 29 055/06.98**

 Page 3 of 3  
 Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Valve type			WRA	WRAE
Installation			optional, preferably horizontal	
Weight	Size 6	kg (lbs.)	2.0 (4.4)	2.2 (4.8)
	Size 10	kg (lbs.)	6.6 (14.5)	6.8 (15)

**Hydraulic** – measured at  $n = 46 \text{ mm}^2/\text{s}$  (208 SUS) and  $t = 40 \text{ °C}$  (104 °F)

Operating pressure	Ports A, B, P	bar (PSI)	up to 315 (4600)	
	Port T	bar (PSI)	up to 210 (3050)	
Nominal flow $q_{V, \text{nom}}$ at $\Delta p = 10 \text{ bar}$ (145 PSI)	Size 6	L/min (GPM)	7 (1.85), 15 (3.96), and 30 (7.92)	
	Size 10	L/min (GPM)	30 (7.92) and 60 (15.85)	
Max. permissible flow	Size 6	L/min (GPM)	42 (11) [80 (21) with double flow]	
	Size 10	L/min (GPM)	75 (19.8) [140 (37) with double flow]	
Hysteresis		%	$\leq 5$	
Reversal error		%	$\leq 1$	
Response sensitivity		%	$\leq 0.5$	
Frequency (at $-90^\circ$ phase response, Signal 50%; $x_e = \pm 40\% x_e \text{ nom}$ )	Size 6	Hz	25	25
	Size 10	Hz	10	10

**Electrical, solenoid**

Voltage			DC		
Signal type			analog		
Command value	Voltage controlled	Size 6	V	$\pm 10$	$\pm 10$
		Size 10	V	$\pm 10$	$\pm 10$
	Current controlled	Size 6	mA	4 to 20	4 to 20
		Size 10	mA	4 to 20	4 to 20
Max. current per solenoid			A	2.5	2.5
Solenoid coil resistance	Cold value at 20 °C		$\Omega$	2	2
	Max. warm value		$\Omega$	3	3
Duty			%	100	

**Electrical, control electronics**

For WRA	Amplifier in Eurocard format		VT-VSPA2-1-2X/... see RA 30 110		
For WRAE			integrated in the valve		
Supply voltage	Nominal voltage	VDC	24		
4WRAE 4WRA <sup>1)</sup>	Lower limiting value		V	21	19
	Upper limiting value		V	35	
Power consumption of the amplifier	$I_{\text{max}}$		A	1.8	1.8
	Max. power impulse current		A	3	3

**Extracted from RA 29 061/06.98**

Page 1 of 3

Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**4/2 and 4/3-way proportional  
directional valves, direct controlled,  
with electrical position feedback  
Model 4WRE and 4WREE**

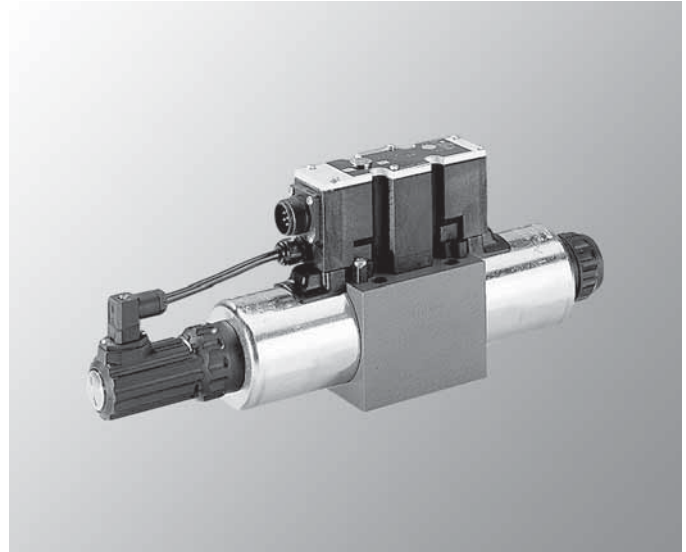
Sizes 6 and 10

Series 2X

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 180 L/min (47.5 GPM)

- Directly controlled proportional valve for the control of direction and magnitude of a flow
- Actuation is by proportional solenoids with central thread and removable coil
- Electrical position feed-back
- For subplate mounting:
  - Porting pattern to DIN 24 340 form A, ISO 4401, and CETOP-RP 121 H
  - NFPA T3.5.1 MR1 and ANSI B 93.7 D 03, D 05
- For subplates, see datasheet RA 45 052 and RA 45 054 (separate order)
- Spring-centered control spool
- Model 4WREE, integrated valve electronics with interface A1 and F1
- Control electronics for model WRE:
  - Electronic amplifier VT-VRPA2-1-1X/.. in Eurocard format (separate order), see RE 30119



Model 4WREE 10 ...-2X/G24K31/..V  
with integrated control electronics

**Extracted from RA 29 061/06.98**

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Issue: 01.01

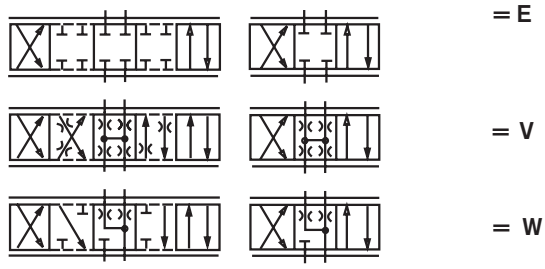
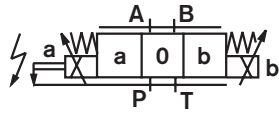
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code**

4WRE					- 2X / G24	/	V	*
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Without integrated control electronics	= No code
With integrated control electronics (standard electronics)	= E
Nominal size 6	= 6
Nominal size 10	= 10

**Symbols**



Further details to be written in clear text

**V =** FPM rectangular rings, suitable for mineral oil (HL, HLP) to DIN 51 524

For WREE:  
**A1 =** command value input ± 10 VDC  
**F1 =** command value input 4 to 20 mA

**Electrical connection for WREE**  
**K4 =** with component plug DIN 43 650-AM2 without plug-in connector  
**Electrical connection for WREE**  
**K31 =** with component plug to E DIN 43 563-AM6-3 without plug-in connector

**G24 =** Power supply voltage 24 VDC

**2X =** Series 20 to 29 (20 to 29: unchanged installation and connection dimensions)

Nominal flows at a valve pressure differential  $D_p = 145 \text{ PSI}$

	<b>Size 6</b>
<b>08 =</b>	8 L/min (2.11 GPM)
<b>16 =</b>	16 L/min (4.23 GPM)
<b>32 =</b>	32 L/min (8.45 GPM)
	<b>Size 10</b>
<b>25 =</b>	25 L/min (6.6 GPM)
<b>50 =</b>	50 L/min (13.21 GPM)
<b>75 =</b>	75 L/min (19.81 GPM)

**Extracted from RA 29 061/06.98**

Page 3 of 3

Issue: 01.01

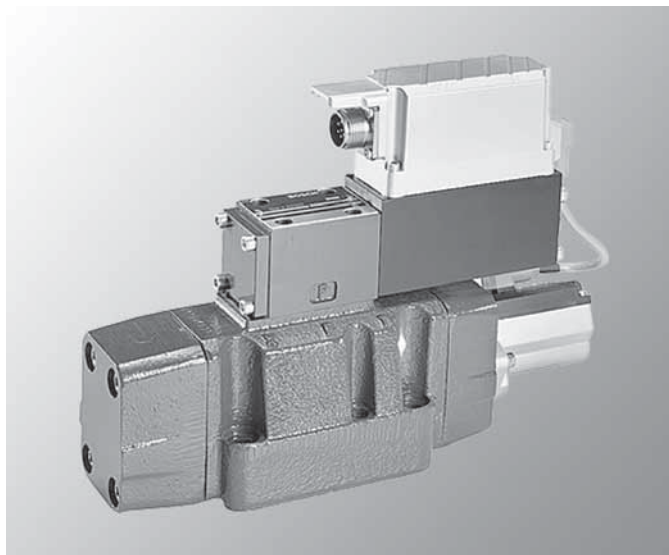
 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

General			Size 6	Size 10
Installation			optional, preferably horizontal	
Weight	4WRE	kg (lbs.)	2.2 (4.85)	6.3 (13.89)
	4WREE	kg (lbs.)	2.4 (5.29)	6.5 (14.33)
<b>Hydraulic</b> – measured at $n = 46 \text{ mm}^2/\text{s}$ (208 SUS) and $t = 40 \text{ °C}$ (104 °F)				
Operating pressure	Ports A, B, P	bar (PSI)	up to 315 (4600)	
	Ports T	bar (PSI)	up to 210 (3050)	
Nominal flow $q_{V \text{ nom}}$ at $\Delta p = 10 \text{ bar}$ (145 PSI)		L/min (GPM)	8 (2.11)	25 (6.6)
			16 (4.23)	50 (13.2)
			32 (8.45)	75 (19.8)
Flow, max. permissible		L/min (GPM)	80 (21.1)	180 (47.5)
Hysteresis		%	≤ 0.1	
Reversal error		%	≤ 0.05	
Response sensitivity		%	≤ 0.05	
<b>Electrical</b> (solenoid)				
Insulation to DIN 40 050			exceeds NEMA class B (IP 65)	
Voltage model			DC	
Signal model			analog	
Command value signal	Voltage input "A1"	V	±10	
	Current input "F1"	mA	4 to 20	
Max. current per solenoid			A 2.5	
Solenoid coil resistance	Cold value at 20 °C	Ω	2	
	Max. warm value	Ω	3	
Duty			% 100	
Coil temperature			°C (°F) up to 150 (302)	
<b>Electrical</b> (inductive position transducer)				
Electrical measuring system			inductive	
Electrical connection			plug-in connector 4-pin + Pg7-G4W1F	
Protection to DIN 40 050			IP 65	

**Extracted from RE 29089/01.05**Page 1 of 4  
Issue: 07.05See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Servo solenoid valves with positive  
overlap and on-board electronics  
Model 4WRLE 10 ... 25, symbols E. / W.****Nominal size 10, 16, 25****Series 3X****Maximum working pressure: 350 bar (5075 PSI)****Nominal flow rate: 92.5 L/min (350 GPM)****( $\Delta p$  10 bar [145 PSI])**

- Pilot operated servo solenoid valves NG 10 to NG 25 with positive overlap, see symbols E. / W. and characteristic curves
- Pilot valve NG 6, with control spool and sleeve in servo quality
- Actuated on one side, 4/4 fail-safe position when switched off
- Control solenoid with integral position feedback and on-board valve electronics (OBE), calibrated at the factory
- Main stage with approx. 20 % overlap and position feedback
- Electronically calibrated overlap compensation see characteristic curve range  $\pm 0.5$  V
- Spool with linear travel, with anti-rotation element
- Flow characteristic
  - S = Progressive
  - NG 16 and 25 with load tap C1 / C2
- Suitable for electrohydraulic controllers in production systems with more demanding requirements



- For subplate attachment, mounting hole configuration to DIN 24340 Form A, ISO 4401, CETOP-RP 121 H, NFPA T3.5.1 M R1, ANSI B 93.7 D05, D07, D08, D10
- For subplates, see datasheets RA 45 054 to RA 45 060 (separate order)

**Extracted from RE 29089/01.05**

Page 2 of 4  
Issue: 07.05

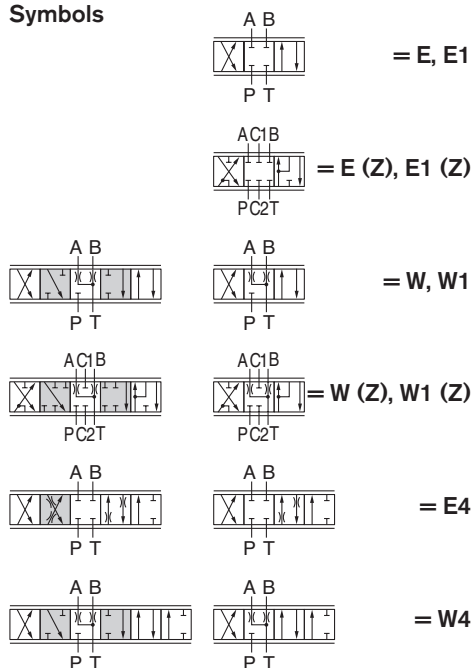
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Model code**

4WRL	E					S	J - 3X / G24		K0 / A1	M	*
------	---	--	--	--	--	---	--------------	--	---------	---	---

With on-board trigger electronics	= E
Nominal size 10	= 10
Nominal size 16	= 16
Nominal size 25	= 25

**Symbols**



**With symbol E1, E1 (Z), E4, W1 (Z), W4:**

P → A: q<sub>v</sub>      B → T: q<sub>v</sub>/2  
P → B: q<sub>v</sub>/2      A → T: q<sub>v</sub>

**With load tap C1 / C2** = Z

Further information  
in plain text

**M =** NBR seals,  
suitable for mineral oils  
(HL, HLP) to DIN 51 524

**Interface for electronics**

**A1 =** Setpoint input ±10 V

Electrical connection

**K0 =** without plug-in connector,  
with plug to DIN 43 563-AM6

Order plug-in connector separately

**Control oil supply "x," control oil outlet "y"**

**No code =** "x" = external, "y" = external

**E =** "x" = internal, "y" = external

**ET =** "x" = internal, "y" = internal

**T =** "x" = external, "y" = internal

**Voltage supply of electronics**

**G24 =** +24 V DC

**3X =** Series 20 to 29  
(installation and connection dimensions unchanged)

**Overlap compensation signal**

**J =** See characteristic curve range: ±0.5 V

**Flow characteristic**

Progressive

**Nominal flow rate at 10 bar (145 PSI) valve pressure difference**

**Nominal size**

<b>50, 80 =</b>	10 – 50 or 80 L/min (13.2 or 21.1 GPM)
<b>180 =</b>	16 – 180 L/min (47.6 GPM)
<b>350 =</b>	25 – 350 L/min (92.5 GPM)



**Extracted from RE 29089/01.05**



 Page 3 of 4  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical Data**
**General**

Construction	Spool type valve, pilot operated		
Actuation	Servo solenoid valve NG 6, with position controller for pilot valve and main stage		
Type of mounting	Subplate, mounting hole configuration NG 10 ... 35 (DIN 24340 Form A and ISO 440) <sup>1)</sup>		
Installation position	Optional		
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)	
Weight	kg (lbs.)	<b>NG 10</b>	<b>NG 16</b>
		8.7 (19)	10.6 (23)
			18.4 (40.5)
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)		

**Hydraulic** – measured at  $n = 46 \text{ mm}^2/\text{s}$  (208 SUS) and  $t = 40 \text{ °C}$  (104 °F)

Pressure fluid	Hydraulic oil to DIN 51524 ... 535, other fluids after prior consultation			
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (100 to 465)	
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (60 to 3700)	
Pressure fluid temperature range	°C (°F)	-20 to +70 (-4 to +158)		
Purity class to ISO code	Maximum permitted degree of contamination of pressure fluid to ISO 4406 (C) Class 18/16/13 1)			
Direction of flow	See symbol			
Nominal flow at $\Delta p = 5 \text{ bar}$ (72 PSI) per notch *	L/min (GPM)	<b>NG 10</b>	<b>NG 16</b>	
		50, 80 (13, 21)	180 (48)	<b>NG 25</b>
			350 (92.5)	
Max. working pressure in P, A, B	bar (PSI)	350 (5076)	350 (5076)	350 (5076)
Max. pressure in X (ext.)	bar (PSI)	280 (4060)		
Max. pressure in P (X = int.)	bar (PSI)	280 (4060)		
Max. pressure in T (Y = ext.)	bar (PSI)	250 (3626)		
Max. pressure in T (Y = int.)	bar (PSI)	250 (3626)		
Max. pressure in Y (ext.)	bar (PSI)	250 (3626)		
Min. control oil pressure of "pilot stage"	bar (PSI)	8 (116)		
$Q_{\text{max}}$	L/min (GPM)	170 (45)	450 (119)	900 (238)
$Q_N$ pilot valve, $\Delta p = 35 \text{ bar}$ (508 PSI)	L/min (GPM)	2 (0.5)	4 (1.0)	12 (3)
Leakage of pilot valve at 100 bar (1450 PSI)	 cm <sup>3</sup> /min (in <sup>3</sup> /min)	< 150 (9.15)	< 180 (11)	< 350 (21)
Leakage of main stage Sb "E" at 100 bar (1450 PSI)	 L/min (GPM)	< 0.25 (0.07)	< 0.4 (0.11)	< 0.6 (0.16)
$Q_N$ : Sb "W", see graph on page 5				

- 1) The purity classes stated for the components must be complied with in hydraulic systems.  
 Effective filtration prevents problems and also extends the service life of components.  
 For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.



$$* \text{ Flow rate at a different } \Delta p \quad q_x = q_{\text{nom.}} \cdot \sqrt{\frac{\Delta p_x}{5 \text{ bar (72.5 PSI)}}$$

**Extracted from RE 29089/01.05**

 Page 4 of 4  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical Data**
**Static/Dynamic**

Overlap in mid position		18 ... 22 % of spool stroke for $U_{D-E} \pm 0.5 \text{ V}$		
Spool stroke, main stage	$\pm \text{ mm (in.)}$	4 (0.157)	7 (0.276)	10 (0.394)
Control oil volume of main stage 100 %	$\text{ cm}^3 (\text{ in}^3)$	1.1 (0.07)	4.3 (0.26)	11.3 (0.69)
Control oil requirement 0 ... 100 %, $x = 100 \text{ bar (1450 PSI)}$	$\text{ L/min (GPM)}$	2.2 (0.58)	4.7 (1.24)	11.7 (3.09)
Hysteresis		< 0.1 %, scarcely measurable		
Manufacturing tolerance		< $\pm 5 \%$ ( $Q_{\text{max}}$ )		
Response time for 0 ... 100 % [ms], $x = 100 \text{ bar (1450 PSI)}$	ms	< 40	< 80	< 80
Response time for 0 ... 100 % [ms], $x = 10 \text{ bar (145 PSI)}$	ms	< 150	< 250	< 250
Switch-off behavior		After electrical shut-off (pilot valve in "fail-safe") Main stage moves to spring centered mid position ( $S_b$ "E.. / W..")		
Thermal drift		< 1 % at $\Delta T = 104 \text{ }^\circ\text{F}$		
Calibration		At factory $\pm 1 \%$		
Conformity		 EN 50081-1  EN 50082-2		

**Electric pilot valve NG 6, valve with on-board electronics**

Duty cycle		100 %
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Power supply Terminal A: Terminal B: 0 V		24 V DC <sub>nom.</sub> min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption		Solenoid $\square$ 45 mm (1.8 in.) = 40 VA max.
External fuse		2.5 A <sub>F</sub>
Input, "Standard" version Terminal D: $V_E$ Terminal E:		Difference amplifier, $R_i = 100 \text{ k}\Omega$ 0 ... $\pm 10 \text{ V}$ 0 V
Max. differential input voltage at 0 V		$\left. \begin{array}{l} D \rightarrow B \\ E \rightarrow B \end{array} \right\} \text{ max. } 18 \text{ V DC}$
Test signal, "Standard" version Terminal F: $U_{\text{Test}}$ Terminal C:		LVDT 0 ... $\pm 10 \text{ V}$ Reference 0 V
Protective conductor and shield		See pin assignment (installation conforms to CE)
Recommended cable		See pin assignment up to 20 m (65 ft.) 7 x 0.75 mm <sup>2</sup> (18 AWG) up to 40 m (131 ft.) 7 x 1 mm <sup>2</sup>
Calibration		Overlap and P-A at +8 V, calibrated at the factory, see valve characteristic curve



**Extracted from RE 29088/01.05**

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Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical Data**
**General**

Construction	Spool type valve, pilot operated			
Actuation	Servo solenoid valve NG 6, with position controller for pilot valve and main stage			
Type of mounting	Subplate, mounting hole configuration NG 10 ... 25 (DIN 24340 Form A and ISO 440) <sup>1)</sup>			
Installation position	Optional			
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)		
Weight	kg (lbs.)	NG 10	NG 16	NG 25
		8.7 (19)	10.6 (23)	18.4 (40.5)
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)			

**Hydraulic** – measured at  $n = 46 \text{ mm}^2/\text{s}$  (208 SUS) and  $t = 40 \text{ °C}$  (104 °F)

Pressure fluid	Hydraulic oil to DIN 51524 ... 535, other fluids after prior consultation					
Viscosity range	recommended	$\text{mm}^2/\text{s}$ (SUS)	20 to 100 (100 to 465)			
	max. permitted	$\text{mm}^2/\text{s}$ (SUS)	10 to 800 (60 to 3700)			
Pressure fluid temperature range	°C (°F)	-20 to +70 (-4 ... +158)				
Purity class to ISO code	Maximum permitted degree of contamination of pressure fluid to ISO 4406 (C) Class 18/16/13 1)					
Direction of flow	See symbol					
Nominal flow at $\Delta p = 5 \text{ bar}$ (72 PSI) per notch *	L/min (GPM)	NG 10		NG 16	NG 25	NG 27
		55 (15)	85 (23)	120 (32)	200 (53)	370 (98)
Max. working pressure	bar (PSI)	Port P, A, B: 350 (5076)				
Max. pressure	bar (PSI)	Port T, X, Y: 250 (3626)				
$Q_{\text{max}}$	L/min (GPM)	170 (45)		450 (119)	900 (238)	
$Q_N$ pilot valve $\Delta p = 35 \text{ bar}$ (508 PSI)	L/min (GPM)	4 (1.1)		12 (3.2)	24 (6.3)	
Leakage of pilot valve at 100 bar (1450 PSI)	 $\text{cm}^3/\text{min}$ ( $\text{in}^3/\text{min}$ )	< 180 (11)		< 300 (18)	< 500 (55)	
Leakage of main stage at 100 bar (1450 PSI)	  $\text{cm}^3/\text{min}$ ( $\text{in}^3/\text{min}$ )	< 400 (24)	< 600 (37)	< 1000 (61)	< 1000 (61)	

1) The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.

\* Flow rate at a different  $\Delta p$

$$q_x = q_{\text{nom.}} \cdot \sqrt{\frac{\Delta p_x}{5 \text{ bar (72.5 PSI)}}$$

**Important**



Pilot operated servo solenoid valves only perform their function in an active closed control loop and do not have a safe basic position when switched off. For this reason, many applications require the use of "additional isolation valves", which must be taken into account during the On/Off switching sequence.

**Extracted from RE 29088/01.05**

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 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical Data (cont.)**
**Static/Dynamic**

Hysteresis	< 0.1 %, scarcely measurable			
Manufacturing tolerance	< ±5 % ( $Q_{max}$ )			
Response time for signal change at x = 100 bar (1450 PSI)	0 ... 100%	25	26	32
	0 ... 10%	14	15	18
Response time for signal change at x = 10 bar (145 PSI)	0 ... 100%	85	80	120
	0 ... 10%	50	30	50
Switch-off behavior	After electrical shut-off (pilot valve in "fail-safe") Main stage moves to spring-centered "offset position": 1 ... 6% P-B/A-T			
Thermal drift	Zero point displacement < 1% at $\Delta T = 40\text{ °C}$ (104 °F)			
Zero adjustment	Factory-set ± 1%			
Conformity	 EN 50081-1  EN 50082-2			

**Electric pilot valve NG 6, valve with on-board electronics**

Duty cycle	100 %
Degree of protection	IP 65 to DIN 40050 and IEC 14434/5
Connection	Plug-in connector 6P+PE, DIN 43563
Power supply Terminal A: Terminal B: 0 V	24 V DC <sub>nom.</sub> min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption	Solenoid $\square$ 45 mm (1.8 in.) = 40 VA max.
External fuse	2.5 A <sub>F</sub>
Input, "Standard" version Terminal D: $V_E$ Terminal E:	Difference amplifier, $R_i = 100\text{ k}\Omega$ 0 ... ±10 V 0 V
Input, "mA signal" version Terminal D: $I_{D-E}$ Terminal E: $I_{D-E}$	Load, $R_{sh} = 200\ \Omega$ 4 ... (12) ... 20 mA Current loop $I_{D-E}$ feedback
Max. differential input voltage at 0 V	$\left. \begin{array}{l} D \rightarrow B \\ E \rightarrow B \end{array} \right\} \text{max. } 18\text{ V DC}$
Test signal, "Standard" version Terminal F: $U_{Test}$ Terminal C:	LVDT 0 ... ±10 V Reference 0 V
Test signal, "mA signal" version Terminal F: $I_{F-C}$ Terminal C: $I_{F-C}$	LVDT signal 4 ... 20 mA at external load 200 ... 500 $\Omega$ max. 4 ... 20 mA output Current loop $I_{F-C}$ feedback
Protective conductor and shield	See pin assignment (installation conforms to CE)
Recommended cable	See pin assignment up to 20 m (65 ft.) 7 x 0.75 mm <sup>2</sup> (18 AWG) up to 40 m (131 ft.) 7 x 1 mm <sup>2</sup>
Calibration	Calibrated at the factory, see valve characteristic curve

**Extracted from Catalogs:**
**ATUS AKY 013/2 US**
**9 535 233 789 (5.97)**

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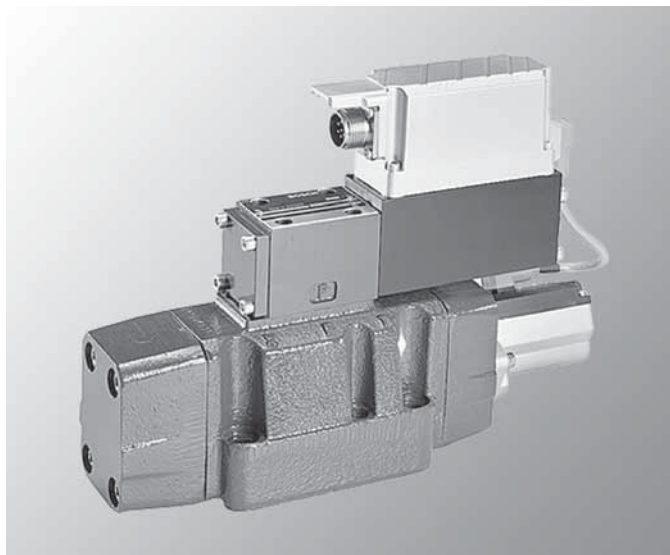
Issue: 04.03

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Injection valves**  
**Model 4WRLE Q**

The injection valve was designed for plastic injection molding applications.

- Sizes in NG10 (D05), NG16 (D07), and NG25 (D08)
- Flow rates up to 1000 L/min (264 GPM) Technical Data
- Up to 62 Hz frequency response
- Position feedback on mainstage
- On-board electronics
- For subplates, see datasheets RA 45 054 to RA 45 060 (separate order)


**Technical Data**

Model	Pressure Rating (PSI)	Flow L/min (GPM)	Material Number	Old Number	Weight kg (lbs.)
4WRLE10 Q4 - 85M -3X/G24T K0/A1M	350 (5000)	85 (22.4)	0811404668	0 811 404 668	8.67 (19.1)
4WRLE10 Q4 - 85M -3X/G24ETK0/A1M	5000	85 (22.4)	0811404670	0 811 404 670	8.67 (19.1)
4WRLE16 Q4 - 200M -3X/G24 K0/A1M	5000	200 (52.8)	0811404276	0 811 404 276	10.6 (23.3)
4WRLE16 Q4 - 200M -3X/G24 TK0/A1M	5000	200 (52.8)	0811404275	0 811 404 275	10.6 (23.3)
4WRLE16 Q4 - 200M -3X/G24ETK0/A1M	5000	200 (52.8)	0811404270	0 811 404 270	10.6 (23.3)
4WRLE16 Q4 - 200M -3X/G24E K0/A1M	5000	200 (52.8)	R978714476	9 811 232 120	10.6 (23.3)
4WRLE25 X - 370M -3X/G24ETK0/A1M-812	5000	370 (98)	0811404434	0 811 404 434	18.4 (40.5)
4WRLE25 X - 370M -3X/G24E K0/A1M-812	5000	370 (98)	0811404435	0 811 404 435	18.4 (40.5)
4WRLE27 Q4 - 430M -3X/G24ETK0/A1M	5000	430 (114)	0811404438	0 811 404 438	18.6 (41.0)
4WRLE27 Q4 - 430M -3X/G24 K0/A1M	5000	430 (114)	0811404441	0 811 404 441	18.6 (41.0)
4WRLE27 Q4 - 430M -3X/G24 TK0/A1M	5000	430 (114)	0811404442	0 811 404 442	18.6 (41.0)

**Connectors**

Mating Connector for OBE - 7 PIN Plastic Solder Type	1834482022	1 834 482 022
Mating Connector for OBE - 7 PIN Plastic Crimped Type	1834482026	1 834 482 026
Mating Connector for OBE - 7 PIN MS Solder Type	R978713598	9 536 230 054

**Extracted from RE 29077/01.05**

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Issue: 07.05

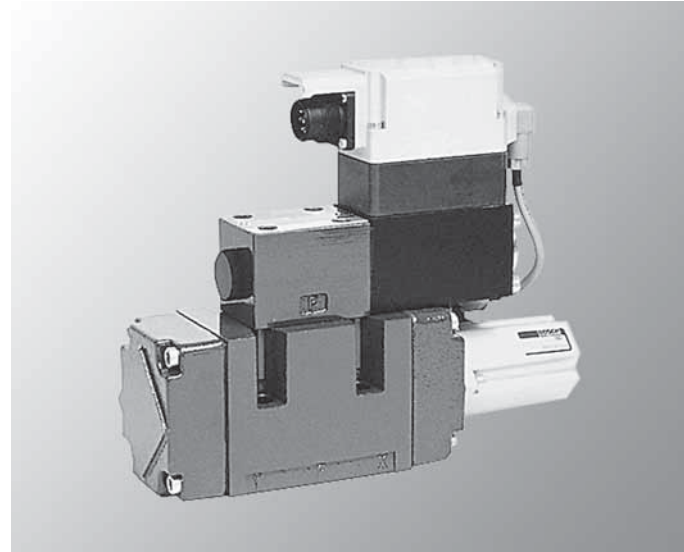
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Servo solenoid valves with  
on-board electronics (OBE)  
Model 4WRVE 10 ... 25**

Size 10, 16, 25  
Series 2X

Maximum working pressure: 350 bar (5075 PSI)  
Nominal flow rate: 370 L/min (98 GPM)  
( $\Delta p$  10 bar [145 PSI])

- Pilot operated High Response servo solenoid valves  
NG 10 to NG 25, with control piston and sleeve in servo quality
- On-board electronics (OBE) with position controller for the pilot  
and main stages, calibrated at the factory
- Main stage in servo quality with position feedback
- Flow characteristic
  - M = Progressive with fine metering notch
- Electrical connection 11P+PE  
Signal input difference amplifier with interface B5  $\pm 10$  V
- Suitable for electrohydraulic controllers in production and test-  
ing systems



- For subplate attachment, mounting hole configuration to  
DIN 24 340 Form A, ISO 4401, CETOP-RP 121 H, NFPA  
T3.5.1 M R1, and ANSI B 93.7 D05, D07, D08
- Subplates as per catalogue section, NG 10 RE 45 055,  
NG 16 RE 45 057 and NG 25 RE 45 059

**Model code**

<b>4WRV</b>	<b>E</b>			<b>M - 2X / G24</b>		<b>K0 / B5</b>	<b>M</b>	<b>*</b>	
With <b>on-board</b> trigger electronics		= E							Further information in plain text
Size 10	= 10								M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51 524
Size 16	= 16								<b>Interface for electronics</b>
Size 25	= 25								B5 = Setpoint input $\pm 10$ V
<b>Symbols</b>									<b>Electrical connection</b>
<b>4/3-way version</b>									K0 = without plug-in connector, with plug to DIN 43 563-AM6 Order separately - 1 834 482 142
									<b>Control oil inlet "x," control oil outlet "y"</b>
									No code = "x" = external, "y" = external
<b>Nominal flow rate at 145 PSI valve pressure difference</b>									<b>Voltage supply of electronics</b>
<b>Size</b>									+24 V DC
10 - 55 or 85 L/min (15 or 23 GPM)	= 55, 85								2X = Series 20 to 29 (installation and connection dimensions unchanged)
16 - 125 or 200 L/min (32 or 53 GPM)	= 125, 200								
25 - 370 L/min (98 GPM)	= 370								
<b>Flow characteristics</b>									
Progressive with linear fine metering									= M



**Extracted from RE 29077/01.05**

Page 2 of 3




Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical Data**
**General**

Construction	Spool type valve, pilot operated		
Actuation	Servo solenoid valve NG 6, with position controller for pilot valve and main stage		
Type of mounting	Subplate, mounting hole configuration NG 10 ... 25 (DIN 24340 Form A and ISO 440 <sup>1)</sup> )		
Installation position	Optional		
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)	
Weight	kg (lbs.)	<b>NG 10</b> 8.0 (19)	<b>NG 16</b> 10.4 (23)
			<b>NG 25</b> 18.2 (40.5)
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)		

**Hydraulic** – measured at  $n = 46 \text{ mm}^2/\text{s}$  (208 SUS) and  $t = 40 \text{ °C}$  (104 °F)  $\pm 5 \text{ °C}$  (41 °F)

Pressure fluid	Hydraulic oil to DIN 51524 ... 535, other fluids after prior consultation		
Viscosity range, recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (100 to 465)	
max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (60 to 3700)	
Pressure fluid temperature range	°C (°F)	-20 to +65 (-4 to +149)	
Purity class to ISO code	Maximum permitted degree of contamination of pressure fluid to ISO 4406 (C) Class 18/16/13 1)		
Direction of flow	See symbol		
Nominal flow		<b>NG 10</b>	<b>NG 16</b>
at $\Delta p = 5 \text{ bar}$ (72 PSI) per notch *	L/min (GPM)	55 (15)   85 (23)	120 (32)   200 (53)
Max. working pressure	bar (PSI)	Port P, A, B: 350 (5076)	
Max. pressure	bar (PSI)	Port T, X, Y: 250 (3625)	
$Q_{\text{max}}$	L/min (GPM)	170 (45)	450 (119)   900 (238)
$Q_N$ pilot valve	$\Delta/\mu\text{m}$ (ΓΠΙΜ)	8 (2)	24 (6)   40 (10.5)
Leakage of pilot valve at 100 bar (1450 PSI)	 cm <sup>3</sup> /in (in <sup>3</sup> /min)	< 180 (11)	< 300 (18)   < 500 (55)
Leakage of main stage at 100 bar (1450 PSI)	  cm <sup>3</sup> /in (in <sup>3</sup> /min)	< 400 (24)   < 600 (37)	< 1000 (61)   < 1000 (61)
Control oil pressure "pilot stage"	min.b bar (PSI)	10 (145)	
	max. bar (PSI)	250 (3626)	

1) The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sections RE 50070, RE 50076 and RE 50081.

\* Flow rate at a different  $\Delta p$

$$q_x = q_{\text{nom.}} \cdot \sqrt{\frac{\Delta p_x}{5 \text{ bar (72.5 PSI)}}$$

**Important**

Pilot operated servo solenoid valves only perform their function in an active closed control loop and do not have a safe basic position when switched off. For this reason, many applications require the use of "additional isolation valves", which must be taken into account during the On/Off switching sequence.




**Extracted from RE 29077/01.05**













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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical Data (cont.)**
**Static/Dynamic**

Hysteresis	%	< 0.1, scarcely measurable		
Manufacturing tolerance	%	< ±5 (Q <sub>max</sub> )		
Response time for signal change at x = 100 bar (1450 PSI)	0 ... 100%	12	15	23
	0 ... 10%	6	7	10
Response time for signal change at x = 100 bar (145 PSI)	0 ... 100%	40	50	90
	0 ... 10%	20	20	30
Switch-off behavior		Undefined, not a fail safe value ?		
Thermal drift		Zero point displacement < 1 % at ΔT = 40 °C (104 °F)		
Zero adjustment		Factory-set ± 1%		
Conformity		 EN 50081-1 EN 50082-2		

**Electrical**, trigger electronics integrated in the valve

Cyclic duration factor		100 %, max. current input 30 VA (24 V DC)		
Degree of protection		IP 65 to DIN 40 050 and IEC 14 434/5		
Connection		Plug, 11P+PE	Data	
Power supply 24 V DC <sub>nom.</sub>	1)	 	+24 V DC <sub>nom.</sub> , fuse 2.5 AF (output stages) 0 V power ground	
	2)	 	+24 V DC <sub>nom.</sub> signal part 0 V signal ground	
Input signal ±10 V	3)	 	$\frac{U_{IN}}{U_{IN}}$ } Difference amplifier, R <sub>i</sub> = 100 kΩ	
Feedback signal (LVDT)		 	±10 V DC, R <sub>a</sub> = 1 kΩ 0 V, reference point	
	Enabling input		> 8.5 V to 24 V DC <sub>nom.</sub> (max. 40 V DC) R <sub>i</sub> = 10 kΩ	
Signals	4)	 	Enabling acknowledgement +24 V DC Fault signal: no fault +24 V DC	
Protective conductor			Only connect when transformer of 24 V DC system does not conform to standard VDE 0551	
Connecting cable		Recommended Ø 12 ... 14 mm: screened up to 20 m (65 ft.) 7 x 0.75 mm <sup>2</sup> (18 AWG) up to 40 mm (131 ft.) 7 x 1 mm <sup>2</sup>		

 24 V DC<sub>nom.</sub> – min. 21 V DC  
 – max. 40 V DC

 1) UB (Pin 1) = output stage supply  
 – Valve "OFF" < 13.4 V DC  
 – Valve "ON" > 16.8 V DC  
 No fault signal (Pin 11)

 2) US (Pin 9) = signal electronics supply  
 – Valve "OFF" < 16.8 V DC  
 Fault signal (Pin 11)  
 – Valve "ON" > 19.5 V DC  
 No fault signal (Pin 11)

 3) Inputs: dielectric strength to withstand  
 up to max. 50 V.

 4) Signals can bear a load of max. 20 mA  
 and are resistant to shorts to ground.

**Extracted from RE 29115/02.02**

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Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**4/3 and 5/3-way proportional  
directional valves, pilot operated  
Models WRZ and WRZE  
External pilot operation, Model WRH**

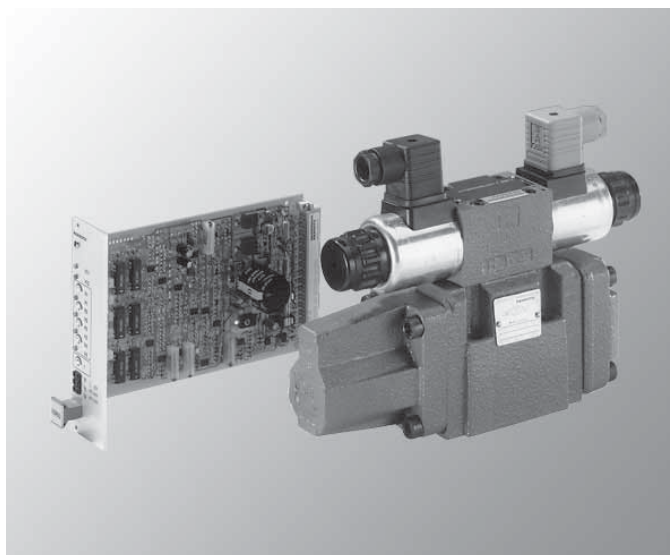
Sizes 10 to 32

Series 7X

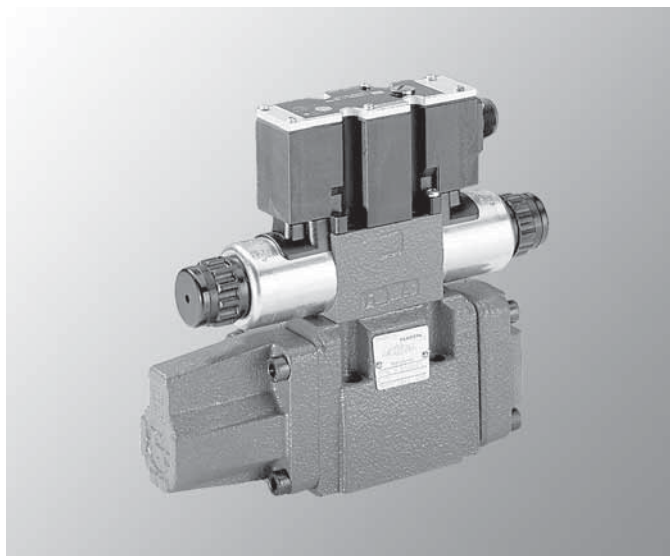
Maximum operating pressure 350 bar (5100 PSI)

Nominal flow 520 L/min (137 GPM)

- Pilot operated 2-stage proportional directional valve for the control of direction and flow rate
- Proportional solenoid operation, with central thread and removable coil
- For subplate mounting:
  - Porting pattern to DIN 24 340 part 2 form A, ISO 4401, and CETOP-RP121H (4WRZ..., NS 10 to 32)
  - NFPA T3.5.1 MR1 and ANSI B 93.7 D 05, D 07, D 08, D 10 (4WRZ..., sizes 10 to 32)
- For subplates, see datasheets RA 45 054 to RA 45 060 (separate order)
- Manual override, optional
- Spring-centered control spool
- Models WRZE with integrated control electronics, interface A1 or F1
- External control electronics for model WRZ:
  - VT-VSPA2-1-2X/, see data sheet RE 30110



Model 4WRZ 10 ...-7X/6EG24N9...K4/V  
with relevant control electronics (subject to separate order)



Model 4WRZE 10 ...-7X/6EG24N9...K31.../V  
with integrated control electronics



**Extracted from RE 29115/02.02**

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 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Valve model			WRZ	WRZE	
Installation position	optional, preferably horizontal (for commissioning guidelines see RA 07 800)				
	Spool symbol	E, E1-, E3-, W6-, W8-, W9-		EA, W6A, EB, W6B	
Weight for version 4WRZ... 0.2 kg (0.44 lbs)	For sub-plate mounting	Size 10	kg (lbs.)	7.8 (17.2)	7.4 (16.3)
		Size 16	kg (lbs.)	13.4 (29.5)	28.0
		Size 25	kg (lbs.)	18 (40.1)	38.6
		Size 32	kg (lbs.)	80 (175.2)	173.0

**Hydraulic** – measured at  $n = 46 \text{ mm}^2/\text{s}$  (208 SUS) and  $t = 40 \text{ °C}$  (104 °F)

Nominal size	Size	10	16	25	32	
Operating pressure						
– Pilot valve	Control pressure, 4WRH	bar (PSI)	to 362, not higher			
	Pilot oil feed external, 4WRZ	bar (PSI)	435 to 1450			
	Pilot oil feed internal, 4WRZ	bar (PSI)	1450 to 4600 only with "D3"			
– Main valve		bar (PSI)	... 315 (4600)	... 5100	... 5100	... 5100
Return line pressure	Port T (port R) (pilot oil drain external)	bar (PSI)	... 4600	... 3626	... 3626	... 2176
	Port T (pilot oil drain internal)	bar (PSI)	... 435	... 435	... 435	... 435
	Port Y	bar (PSI)	... 435	... 435	... 435	... 435
Flow through main valve		L/min (GPM)	... 44.9	... 121.5	... 230	... 423
Hysteresis		%	≤ 6			
Repeatability		%	≤ 3			

**Electrical**

Valve model			WRZ	WRZE
Insulation	exceeds NEMA Class B (IP65)			
Voltage model	DC			
Signal model	analog			
Command value signal	Voltage "A1"	V	–	± 10
	Current "F1"	mA	–	4 to 20
	Input impedance		Ω	30K or higher
Input impedance	Voltage "A1"	Ω	–	30K or higher
	Current "F1"	Ω	–	100

**Control electronics**

For WRZ (separate order) Amplifier in Euro-card format		
	– with 1 ramp time	VT- VSPA2-1-2X/V0/T1, see RA 30 110
	– with 5 ramp time	VT- VSPA2-1-2X/V0/T5, see RA 30 110
For WRZE		integrated into the valve

 Note: For details concerning environmental simulation testing for EMV (electro-magnetic compatibility),  
 climate and mechanical loading see RA 29 115-U (explanation regarding environmental compatibility).

**Extracted from RE 29583/07.03**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Servo directional valve of 4-way design Model 4WS.2E...

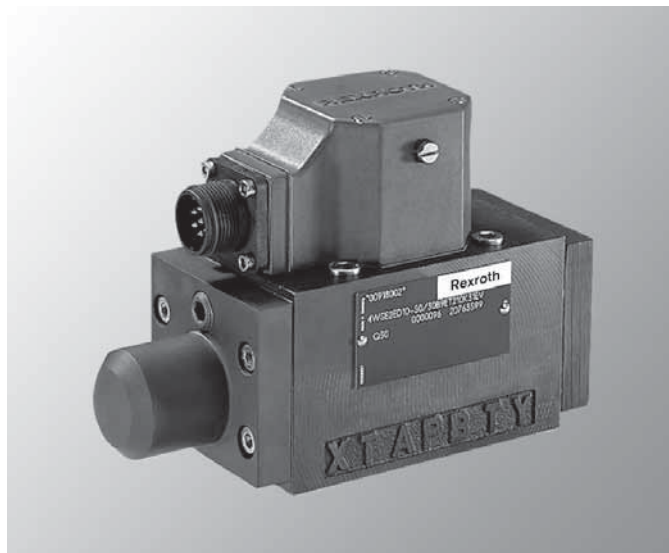
Nominal size 10

Series 5X

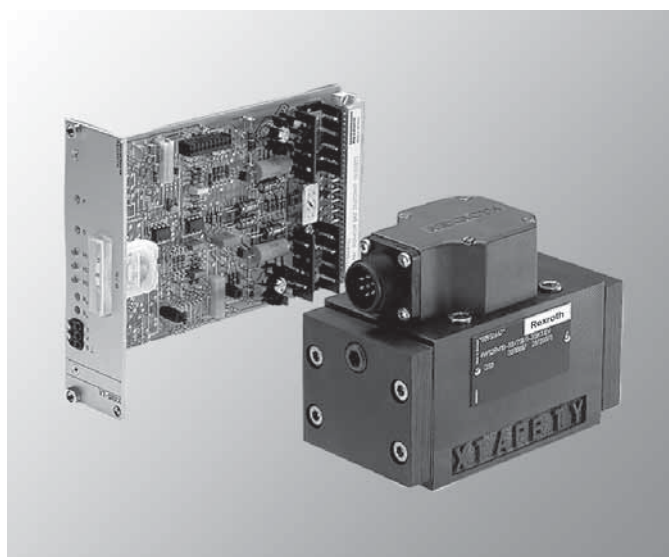
Maximum operating pressure 315 bar (4500 PSI)

Maximum flow 180 l/min (47.55 GPM)

- Valve control for closed loop position, force and speed control
- 2-stage servo valve with mechanical or mechanical and electrical feedback
- 1st stage as jet/flapper plate amplifier
- For subplate mounting,  
Porting pattern to DIN 24 340 form A10 with ports X and Y  
Subplates to catalogue sheet RE 45 054 (separate order)



Model 4WSE2ED 10-5X/...B...K31EV



Model 4WS2EM 10-5X/...B...K31EV

**Extracted from RE 29583/07.03**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Technical data**

		10	5X	/	B				K31	E	V	*	
Electrically actuated 2-stage servo valve in a 4-way version													Further details in clear text
For <b>external</b> control electronics	= 4WS2E												V = FKM seals, suitable for mineral oil (HL, HLP) to DIN 51 524
With <b>integrated</b> control electronics	= 4WSE2E												E = <b>Spool overlap</b> 0 to 0.5 % negative
Mechanical feedback	= M												<b>Electrical connections</b>
Mechanical and electrical feedback (only available with integrated electronics)	= D								K31 = <b>Without</b> plug-in connector, with component plug to DIN EN 175.201-804 Plug-in connector – separate order, see page 7				
Nominal size 10	= 10												<b>Inlet pressure range for the 1st stage</b>
Series 50 to 59 (50 to 59: unchanged installation and connection dimensions)	= 5X								210 = 10 to 210 bar (145 to 3045 PSI)				315 = 10 to 315 bar (145 to 4500 PSI)
<b>Nominal flow</b> With a valve pressure differential $\Delta p = 70$ bar (1015 PSI)													<b>Pilot oil supply and drain</b>
5 L/min (1.32 GPM)	= 5								- = External supply, external drain				E = Internal supply, external drain
10 L/min (2.64 GPM)	= 10								T = External supply, internal drain				ET = Internal supply, internal drain (standard)
20 L/min (5.28 GPM)	= 20								11 = Valves for <b>external</b> control electronics: Coil no. 11 (30 mA / 85 $\Omega$ per coil)				Valves with integrated control electronics: Control:
30 L/min (7.93 GPM)	= 30												
45 L/min (11.89 GPM)	= 45												
60 L/min (15.85 GPM)	= 60												
75 L/min (19.81 GPM)	= 75												
90 L/min (23.78 GPM)	= 90												
									Com. value				Act. value (only provided with 4WSE2ED...)
									9 = $\pm 10$ V				$\pm 10$ V
									13 = $\pm 10$ mA				$\pm 10$ mA

**Extracted from RE 29583/07.03**

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 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Porting pattern		DIN 24 340 form A10
Installation		Optional, it has to be ensured the pilot control is supplied with a dequate pressure, ( $\geq 10$ bar) when starting-up the system!
Storage temperature range	°C (°F)	-20 to +80 (-4 to +176)
Ambient temperature range	°C (°F)	-30 to +70 (-22 to +158) – valves with external control electronics -20 to +60 (-4 to +140 – valve with integrated electronics
Weight	With mechanical feedback	kg (lbs.) 3.56 (7.85)
	With mechanical and electrical feed-back and integrated electronics	kg 3.65 (8.04)

**Hydraulic** – measured with HLP 32,  $\vartheta_{oil} = 40$  °C  $\pm$  5 °C (104 °F  $\pm$  41 °F)

Operating pressure:	Pilot control stage, pilot oil supply	bar (PSI)	10 to 210 (145 to 3045) or 10 to 315 (145 to 4500)							
	Main valve, ports P, A, B	bar (PSI)	Up to 315 (4500)							
Return pressure:	Port T	Internal pilot oil drain	bar (PSI)	Permissible pressure peaks < 100 (1450)						
	Port Y	External pilot oil drain	bar (PSI)	Up to 315 (4500)						
			bar (PSI)	Permissible pressure peaks < 100 (1450), static < 10 (145)						
Pressure fluid			Mineral oil (HL, HLP) to DIN 51 524, other pressure fluids on request!							
Pressure fluid temperature range		°C (°F)	-15 to +80 (+5 to +176); preferably +40 to +50 (+104 to +122)							
Viscosity range		mm <sup>2</sup> /s (SUS)	15 to 380 (70 to 1760); preferably 30 to 45 (140 to 210)							
Cleanliness class to ISO codes			Maximum permissible degree of contamination of the pressure fluid is to ISO 4406 (C) class 18/16/13 <sup>1)</sup>							
Zero flow $q_{V,L}$ <sup>2)</sup> measured without dither signal	L/min (GPM)		$\sqrt{\frac{p_P^4 \cdot 0.7}{70 \cdot (0.24)}}$	$\sqrt{\frac{p_P^4 \cdot 0.9}{70 \cdot (0.18)}}$	$\sqrt{\frac{p_P^4 \cdot 1.2}{70 \cdot (0.32)}}$	$\sqrt{\frac{p_P^4 \cdot 1.5}{70 \cdot (0.40)}}$	$\sqrt{\frac{p_P^4 \cdot 1.7}{70 \cdot (0.45)}}$			
Nominal flow $q_{V,nom} \pm 10\%$ <sup>3)</sup> with a valve pressure differential $\Delta p = 70$ bar (1015 PSI) <sup>5)</sup>	L/min (GPM)		5 (1.3)	10 (2.6)	20 (5.3)	30 (7.9)	45 (11.9)	60 (15.9)	75 (19.8)	90 (23.8)
Control spool stroke	mm (in.)		0.29 (0.011)		0.43 (0.02)	0.74 (0.029)	0.99 (0.04)	1.10 (0.043)		
Max. possible control spool stroke at mechanical end stop referring to the nominal stroke (in the case of a fault)	%		120 to 170			120 to 150	120 to 150			
Feedback system			mechanical (M)			mechanical and electrical (D)				
Hysteresis (dither optimised)	%		$\leq 1.5$			$\leq 0.8$				
Reversal span (dither optimised)	%		$\leq 0.3$			$\leq 0.2$				
Response sensitivity (dither optimised)	%		$\leq 0.2$			$\leq 0.1$				
Pressure amplification 1 % spool stroke change (from the hydraulic zero point)	% of $p_P$		$\geq 30$			$\geq 60$	$\geq 80$			
Balance current over the entire operating pressure range	%		$\leq 3$ , long term $\leq 5$			$\leq 2$				
Zero displacement with changes to:										
Pressure fluid temperature	%/20 °C (68 °F)		$\leq 1$			$\leq 2$				
Ambient temperature	%/20 °C (68 °F)		$\leq 1$			$\leq 2$				
Operating pressure 80 to 120 % of $p_P$	%/100 (1450)		$\leq 2$			$\leq 2$				
Return pressure 0 to 10 % of $p_P$	%/bar (PSI)		$\leq 1$			$\leq 1$				

<sup>1)</sup> The cleanliness class stated for the components must be adhered too in hydraulic systems Effective filtration prevents faults from occurring and at the same time increases the component service life. For the selection of filters see data sheets RE 50 070, RE 50 076 and RE 50 081.

<sup>2)</sup>  $q_{V,L}$  = Zero flow in L/min (GPM)

<sup>3)</sup>  $q_{V,nom}$  = Nominal flow (entire valve) in L/min (GPM)

<sup>4)</sup>  $p_P$  = Operating pressure in bar (PSI)

<sup>5)</sup>  $\Delta p$  = Valve pressure differential in bar (PSI)



## Extracted from RE 29583/07.03

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Technical data

### Electrical

Feedback system		Mechanical "M"	Mechanical and electrical "D"
Valve protection to EN 60 529		IP 65 with mounted and fixed plug-in connector	
Signal type		Analog	
Nominal current per coil	mA	30	
Resistance per coil	$\Omega$	85	
Inductivity at 60 Hz and 100% nom. current:	Serial connection	H	1.0
	Parallel connection	H	0.25
Recommended superimposed dither signal: $f = 400$ Hz		The amplitude is dependent on the hydraulic system: max. 5 % of the nominal current	

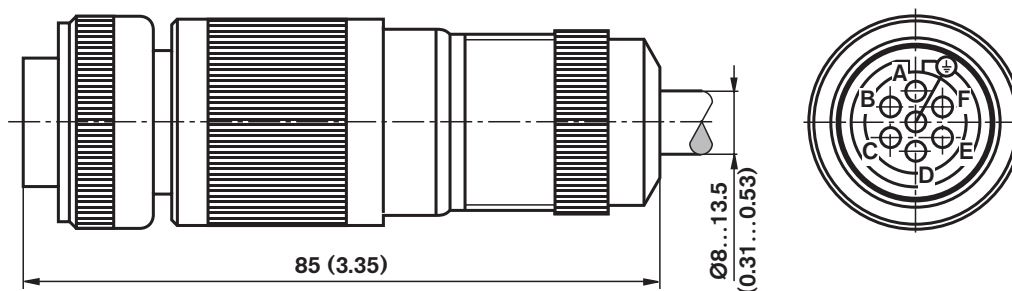
### Electrical, external control electronics (only version "M")

Amplifier (separate order)	Eurocard format	Analog	Type VT-SR2-1X/... to catalog sheet RE 29 980
	Module format	Analog	Type VT 11021 to catalog sheet RE 29 743

**Note:** For details regarding the **environmental simulation test** covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29 583-U (Declaration regarding environmental compatibility).

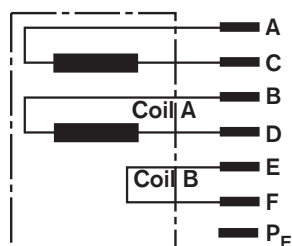
## Plug-in connectors

Plug-in connector to DIN EN 175.201-804  
Separate order under Material No. **R900223890**  
(metal version)



## Electrical connections, external control electronics

### Type 4WS2EM 10-5X...



The electrical connections can be made in either series or parallel. Due to operational safety reasons and the low coil inductivity, we recommend the parallel connection.

The bridge E-F can be used for the electrical recognition that the plug is correctly connected or for cable break recognition.

**Parallel connection:** In the plug-in connector connect contact A with B and C with D.

**Serial connection:** In the plug-in connector connect contact B with C.

Electrical control from A (+) to D (-) causes a flow direction of P to A and B to T.  
By reversing the electrical control the direction of flow is P to B and A to T.

E → F = Bridge





**Extracted from RE 29162/10.04**

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 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

<b>General</b>			<b>DBET</b>	<b>DBETE</b>
Installation			Optional	
Weight		kg (lbs.)	2.0 (4.4)	2.15 (4.7)
<b>Hydraulic</b> – measured with HLP 46; $\vartheta_{oil} = 40\text{ °C} \pm 5\text{ °C}$ (104 °F $\pm$ 41 °F)			<b>DBET</b>	<b>DBETE</b>
Max. operating pressure	Port P	bar (PSI)	350 (5075)	
Max. settable pressure	Pressure stage 100 bar (1450 PSI)	bar (PSI)	100 (1450)	
	Pressure stage 200 bar (2900 PSI)	bar (PSI)	200 (2900)	
	Pressure stage 315 bar (4600 PSI)	bar (PSI)	315 (4600)	
Return pressure	Port T	bar (PSI)	Separate and at zero pressure to tank	
Max. flow		L/min (GPM)	2 (0.5)	
Hysteresis		%	< 4 of the max. settable pressure	
Reversal span		%	< 0.5 of the max. settable pressure	
Response sensitivity		%	< 0.5 of the max. settable pressure	
Linearity (flow 0.8 L/min)		%	$\pm 3$ of the max. settable pressure	
Example spread of the com. value-pressure-char. curves at 0.8 L/min; pressure rising	At com. value 20%	%	< $\pm 1.5$ of the max. settable pressure <sup>3)</sup>	
	At com. value 100%	%	< $\pm 5$ of the max. settable pressure <sup>4)</sup>	< $\pm 1.5$ of the max. settable pressure
Step response ( $T_u + T_g$ ) 0 $\rightarrow$ 100% or 100% $\rightarrow$ 0 Pipe volume < 20 cm <sup>3</sup> (1.22 in <sup>3</sup> ); $q_V = 0.8$ L/min (0.21 GPM)		ms	80 (depending on the system!)	
<b>Electrical</b>			<b>DBET</b>	<b>DBETE</b>
Supply voltage	Nominal voltage	VDC	24	
	Lower limiting value	VDC	21	
	Upper limiting value	VDC	35	
Min. control current (with a 0 V or 4 mA com. value)		mA	100	
Max. control current		mA	1600 <sup>1)</sup>	1600
Coil resistance	Cold value at 20°C (68 °F)	$\Omega$	5.5	
	Max. warm value	$\Omega$	8.05	
Duty		%	100	
<b>Control electronics</b>			<b>DBET</b>	<b>DBETE</b>
			External amplifier	Integrated into the valve
• Amplifier in Eurocard format (separate order) see data sheet RE 30115	Analog		VT-VSPA1-2-1X VT-VSPA1K-2-1X	–
• Amplifier of modular design (separate order) see data sheet RE 30223	Analog		VT-MSPA1-1-1X	–

**Extracted from RE 29161/07.05**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

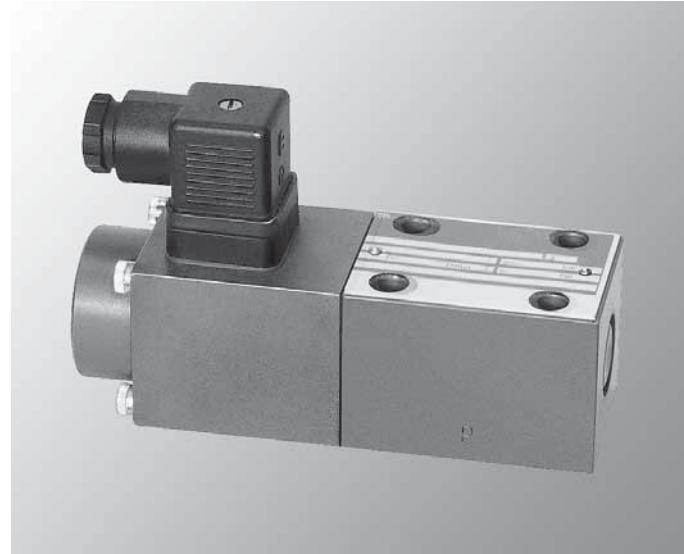
**Proportional pressure relief valve  
Model DBETX**

Nominal sizes 6  
Series 1X

Max. working pressure P 315 bar (4500 PSI)  
T 250 bar (3600 PSI)

Max. flow  $Q_{nom}$  1 l/min (0.26 GPM)

- Directly operated valves (pilot valves) for limiting system pressure
- Adjustable by means of the solenoid current, see Characteristic curve, Technical data and selected valve electronics
- Solenoid versions  $I_{max} = 0.8$  A or  $I_{max} = 2.5$  A
- Pressure limitation to a safe level even with faulty electronics (solenoid current  $I > I_{max}$ )



Model DBETX

**Ordering data**

DBET	X - 1X /	G24 -	N	Z4	M	*
Proportional pressure relief valve						Further information in plain text
Mounting hole configuration to ISO 4401-03-02-0-94	= X				M =	NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524
Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged)	= 1X			Z4 =		<b>Electrical connection</b> Unit plug to DIN 43650-AM2 Plug-in connector included in scope of delivery
Max. pressure stage				N =		<b>Manual auxiliary override</b>
up to 50 bar (725 PSI)	= 50					<b>Solenoid type (current)</b>
up to 80 bar (1160 PSI)	= 80			8 =		Solenoid current 0.8 A max.
up to 180 bar (2610 PSI)	= 180			25 =		Solenoid current 2.5 A max.
up to 250 bar (3600 PSI)	= 250					
up to 315 bar (4500 PSI)	= 315					
Voltage supply of trigger electronics 24 V DC		= G24				

**Extracted from RE 29161/07.05**

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 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Construction	Spool valve				
Actuation	Proportional solenoid without position control, external amplifier				
Connection type	Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)				
Mounting position	Optional				
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)			
Weight	kg (lbs.)	1.9 (4.19)			
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)				

**Hydraulic** (measured with HLP 46,  $\dot{v}_{oil} = 40 \text{ °C} \pm 5 \text{ °C}$  (104 °F  $\pm$  41 °F))

Pressure fluid	Hydraulic oil to DIN 51524...535, other fluids after prior consultation				
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (92 to 460)		
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3700)		
Pressure fluid temperature range	°C (°F)	-20 to +80 (-4 to +176)			
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>				
Direction of flow	See symbol				
Max. set pressure (at Q = 1 l/min)	bar (PSI)	50 (725)	80 (1160)	180 (2600)	250 (3625) 315 (4500)
Minimum pressure (at Q = 1 l/min)	bar (PSI)	2 (29)	3 (43.5)	4 (58)	5 (72.5) 8 (116)
Note: At $Q_{max} = 1.5$ l/min the pressure levels stated here increase					
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$	bar (PSI)	<55 (790)	<85 (1230)	<186 (2700)	<258 (3750) <325 (4700)
Max. working press. (at Q = 1 l/min)	bar (PSI)	Port P: 315 (4500) <sup>2)</sup>			
Max. pressure	bar (PSI)	Port T: 250 (3600)			

**Electrical**

Cyclic duration factor	%	100			
Degree of protection	IP 65 to DIN 40050 and IEC 14434/5				
Solenoid connection	Unit plug DIN 43650/ISO 4400, M16x1.5 (2P+PE)				
Valve with solenoid type		0.8 A		2.5 A	
Max. solenoid current	$I_{max}$	0.8 A		2.5 A	
Coil resistance $R_{20}$	$\Omega$	22		3	
Max. power consumption at 100 % load and operating temperature	VA	25		30	

**Static/Dynamic<sup>3)</sup>**

Hysteresis	%	$\leq 4$
Range of inversion	%	$\leq 3$
Manufacturing tolerance	%	$\leq 10$
Response time 100% signal change	ms	On < 60 / Off < 70

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems.

Effective filtration prevents problems and also extends the service life of components.

For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

<sup>2)</sup> The maximum pressure in P is 315 bar (3500 PSI) in the standard version. 350 bar (5100 PSI) is available on request.

<sup>3)</sup> All characteristic values ascertained using amplifier 0 811 405 079 for the 2.5 A solenoid and 0 811 405 081 for the 0.8 A solenoid.

**Extracted from RE 29166/08.04**

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Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Proportional pressure relief valve  
Model DBETR**

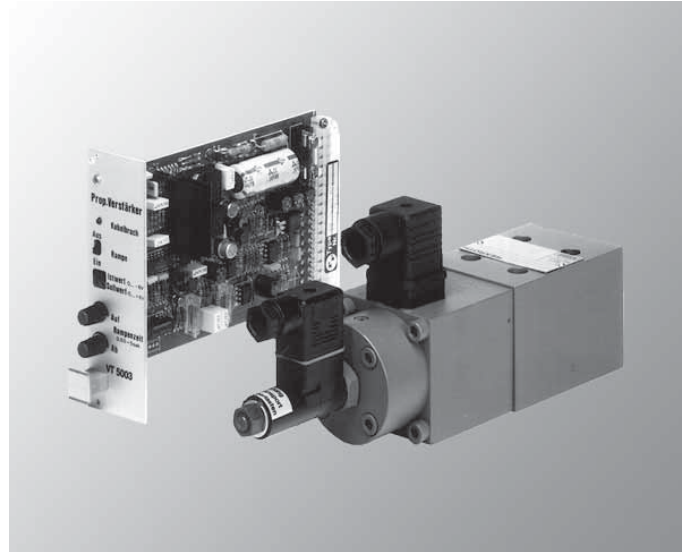
Size 6

Series 1X

Maximum operating pressure 350 bar (5075 PSI)

Maximum flow 3 L/min (0.8 GPM)

- Valve for remote electrical control
- Direct operated proportional pressure relief valve, poppet-type design
- Proportional solenoid operation with inductive positional transducer (pressure balanced)
- For subplate mounting:  
Porting pattern to ISO 4401-03-02-0-94  
Subplates to catalog sheet RE 45052
- Electrical closed loop position control of the spring pretension, hence low hysteresis
- Good repeatability
- Valve and electronic control from one source
- Control electronics:
  - Analog amplifier VT-VRPA1-100-1X/ in Eurocard format (separate order), see RE 30118
  - Analog amplifier of modular design VT-MRPA1-100-1X/V0/0 (separate order), see RE 30221



Model DBETR-1X/...  
with associated electronic control (ordered separately)

**Ordering code**

<b>DBETR</b>	<b>- 1X /</b>	<b>G24</b>	<b>K4</b>	<b>M</b>	<b>*</b>	
Series 10 to 19 (10 to 19: externally interchangeable)		= 1X				
<b>Pressure stage:</b> up to 180 bar (2600 PSI) up to 230 bar (3330 PSI) up to 316 bar (4600 PSI)		= 180 = 230 = 315				
<b>Control electronics supply voltage</b> 24 V DC		= G24				
				Further details to be written in clear text		
				M = NBR seals, suitable for mineral oil (HL, HLP) to DIN 51524		
				K4 = <b>Electrical connections</b> Without plug-in connector with component plug to DIN EN 175301-803 for the proportional solenoid and GSA20 for the position transducer Plug-in connector – separate order		

**Extracted from RE 29166/08.04**

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Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Weight	kg (lbs.)	4.0 (8.8)
Mounting position		Optional

**Hydraulic** – measured at  $n = 41 \text{ mm}^2/\text{s}$  (190 SUS) and  $t = 50 \text{ °C}$  (122 °F)

Operating pressure	Port P	bar (PSI)	... 350 (5075)	
	Port T, with pressure control	bar (PSI)	... 2 (30)	
	without pressure control, T port	bar (PSI)	... 100 (1450)	
Max. pressure setting	pressure stage 180	bar (PSI)	180 (2610)	
	pressure stage 230	bar (PSI)	230 (3335)	
	pressure stage 315	bar (PSI)	350 (5075)	
Max. flow	pressure stage 180	L/min (GPM)	3 (0.8)	
	pressure stage 230	L/min (GPM)	3 (0.8)	
	pressure stage 315	L/min (GPM)	2 (0.5)	
Hysteresis		%	<1 of max. pressure setting	
Repeatability		%	<0.5 of max. pressure setting	
Linearity		%	< 1.5 of max. pressure setting	
Typical variation		%	±3 of max. pressure setting	
Stepped response $T_U + T_G$ (0 to 100%), installation dependent			$p_{\min} - p_{\max}$	$p_{\max} - p_{\min}$
	Pressure stage 30, 80, 180	ms	100	50
	Pressure stage 230, 315	ms	150	100

**Electrical** (Solenoid)

Supply voltage		24 V DC		
Maximum power input	VA	50		
Coil resistance	cold at (20 °C) 68 °F	Ω	10	
	maximum warm valve	Ω	13.9	
Duty		%	100	
Electrical connections		With component plug to DIN EN 175301-803		
		Plug-in connector to DIN EN 175301-803		

**Electrical** (inductive positional transducer)

Coil resistance	Total resistance of the coils at 20 °C (68 °F)		Coil I	Coil II	Coil III
		Ω	56	56	112
Electrical connections		With component plug GSA20			
		Plug-in connector GM 209N with flat seal			
Inductivity	mH	6 to 8			
Oscillator frequency	kHz	2.5			
Protection to EN 60529		IP65 with mounted and fixed plug-in connector			
<b>Control electronics</b> (separate order)					
Amplifier in Eurocard format	Analog	VT-VRPA1-100-1X/ (see data sheet RE 30118)			
Amplifier of modular design		VT-MRPA1-100-1X/V0/0 (see data sheet RE 30221)			

### Extracted from RE 29152/07.05

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Proportional pressure relief valve with linear curve (Lvdt AC/AC) Model DBETFX

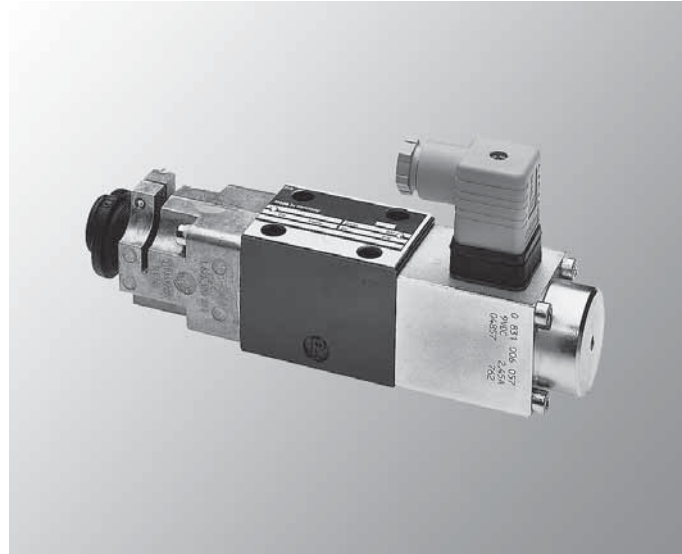
Nominal sizes 6

Series 1X

Max. working pressure P 315 bar (4500 PSI)  
T 200 bar (2900 PSI)

Max. flow  $Q_{nom}$  1 l/min (0.26 GPM)

- Directly operated valves with position feedback for limiting system pressure
- Adjustable through the set position (force) of the cone against the main spring (see Basic principle, page 3)
- Position-controlled, linear curve with minimal hysteresis < 1 %, see Technical data
- Pressure limitation to a safe level even with faulty electronics (solenoid current  $I > I_{max}$ )
- For subplate attachment, mounting hole configuration to ISO 4401-03-02-0-94  
Subplates as per catalog sheet RE 45053 (order separately)
- Plug-in connector for solenoid to DIN 43650-AM2 and plug-in connector for position transducer, included in scope of delivery



Model DBETFX

### Ordering data

DBETF	X	1X	/	G24	27	N	Z4	M	*
Proportional pressure relief valve with linear curve and inductive position transducer on the cone									
Mounting hole configuration to ISO 4401-03-02-0-94 = X									
Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged) = 1X									
<b>Max. pressure stage</b>									
up to 80 bar (1160 PSI) = 80									
up to 180 bar (2600 PSI) = 180									
up to 250 bar (3625 PSI) = 250									
up to 315 bar (4500 PSI) = 315									
Voltage supply of trigger electronics 24 V DC = G24									
Further information in plain text									
M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524									
Z4 = Electrical connection Unit plug to DIN 43650-AM2 Plug-in connector included in scope of delivery									
N = Manual auxiliary override									
27 = Solenoid type (current) Solenoid current 2.7 A max.									



**Extracted from RE 29152/07.05**

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 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Construction	Poppet valve		
Actuation	Proportional solenoid with position control and external amplifier		
Connection type	Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)		
Mounting position	Horizontal, vertical with solenoid at top		
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)	
Weight	kg (lbs.)	2.3 (5.07)	
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)		

**Hydraulic** – measured with HLP 46,  $\vartheta_{oil} = 40^{\circ}\text{C} \pm 5^{\circ}\text{C}$  (104 °F  $\pm 41$  °F)

Pressure fluid	Hydraulic oil to DIN 51524...535, other fluids after prior consultation				
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (92 to 450)		
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3700)		
Pressure fluid temperature range	°C (°F)	-20 to +80 (-4 to +176)			
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>				
Direction of flow	See symbol				
Max. set pressure (at Q = 1 l/min [0.26 GPM])	bar (PSI)	80 (1160)	180 (2600)	250 (3600)	315 (4500)
Minimum pressure (at Q = 1 l/min [0.26 GPM])	bar (PSI)	3 (43)	4 (58)	5 (72)	6 (87)
Note: At Q <sub>max</sub> = 3 l/min [0.80 GPM] the pressure levels stated here increase					
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$	bar (PSI)	<85 (1200)	<186 (2700)	<258 (3700)	<325 (4700)
Max. working pressure (at Q = 1 l/min [0.26 GPM])	bar (PSI)	Port P: 315 (4500)			
Max. pressure	bar (PSI)	Port T: 200 (2900)			

**Electrical**

Cyclic duration factor	%	100
Degree of protection	IP 65 to DIN 40050 and IEC 14434/5	
Solenoid connection	Unit plug DIN 43650/ISO 4400, M16x1.5 (2P+PE)	
Position transducer connection	Special plug	
Max. solenoid current	I <sub>max</sub>	2.7
Coil resistance R <sub>20</sub>	Ω	3
Max. power consumption at 100% load and operating temperature	VA	35

**Static/Dynamic<sup>2)</sup>**

Hysteresis	%	≤ 1
Range of inversion	%	≤ 0.8
Manufacturing tolerance for Q <sub>max</sub>	%	≤ 2
Response time 100% signal change	ms	On <45 / Off <25

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components.

For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

<sup>2)</sup> All characteristic values ascertained using amplifier 0 811 405 095 for the position-controlled 2.7 A solenoid.



**Extracted from RE 29151/07.05**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Proportional pressure relief valve  
with on-board electronics (OBE)  
Model DBETBEX**

Nominal sizes 6  
Series 1X

Max. working pressure P 315 bar (4500 PSI)  
T 250 bar (3600 PSI)

Max. flow  $Q_{nom}$  1 l/min (0.26 GPM)

- Directly operated valves with position feedback and on-board electronics for limiting system pressure
- Adjustable through the position of the armature against the compression spring
- Position-controlled, minimal hysteresis <0.2%, rapid response times, see Technical data
- Pressure limitation to a safe level even with faulty electronics (solenoid current  $I > I_{max}$ )



Model DBETBEX

**Ordering data**

DBETB	E	X - 1X /	G24	K31	M	*	
Proportional pressure relief valve with inductive position transducer on the cone							Further information in plain text
With on-board electronics	= E				M =	NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524	
Mounting hole configuration to ISO 4401-03-02-0-94		= X				<b>Interface for trigger electronics</b>	
Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged)		= 1X			A1 =	Setpoint input 0...+10 V	
Max. pressure stage					F1 =	Setpoint input 4...20 mA	
up to 80 bar (1160 PSI)					K31 =	<b>Electrical connection without plug-in connector, with unit plug to DIN 43563-AM6</b>	
up to 180 bar (2600 PSI)						Order plug-in connector separately	
up to 250 bar (3600 PSI)							
up to 315 bar (4500 PSI)							
Voltage supply of trigger electronics 24 V DC			= G24				

**Extracted from RE 29151/07.05**

 Page 2 of 2  
 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.


**Technical data**
**General**

Construction	Poppet valve		
Actuation	Proportional solenoid with position control and OBE		
Connection type	Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)		
Mounting position	Optional		
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)	
Weight	kg (lbs.)	2.7 (6.0)	
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)		

**Hydraulic** – measured with HLP 46,  $\vartheta_{oil} = 40^\circ\text{C} \pm 5^\circ\text{C}$  (104 °F  $\pm$  41 °F)

Pressure fluid	Hydraulic oil to DIN 51524...535, other fluids after prior consultation				
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (90 to 460)		
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3700)		
Pressure fluid temperature range	°C (°F)	-20 to +70 (-4 to +158)			
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>				
Direction of flow	See symbol				
Max. set pressure (at Q = 1 l/min [0.26 GPM])	bar (PSI)	80 (1160)	180 (2600)	250 (3600)	315 (4500)
Minimum pressure (at Q = 1 l/min [0.26 GPM])	bar (PSI)	3 (43)	4 (58)	5 (72)	8 (116)
		Note: At Q <sub>max</sub> = 1.5 l/min [0.40 GPM] the pressure levels stated here increase			
Max. mechanical pressure limitation level, e.g. when solenoid current I > I <sub>max</sub>	bar (PSI)	<85 (1200)	<186 (2700)	<258 (3700)	<325 (4700)
Max. working pressure (at Q = 1 l/min [0.26 GPM])	bar (PSI)	Port P: 315 (4500)			
Max. pressure	bar (PSI)	Port T: 250 (2900)			

**Static/Dynamic**

Hysteresis	%	≤ 0.2	
Range of inversion	%	≤ 0.1	
Manufacturing tolerance	%	≤ ±5	
Response time	100% signal change	ms	30
	10% signal change	ms	10
Thermal drift	<1% at ΔT = 40°C (104 °F)		
Conformity	 EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08		

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems. Effective filtration prevents problems and also extends the service life of components. For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

**Extracted from RE 29158/11.02**

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Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Proportional pressure relief valve  
Models DBE and DBEE**

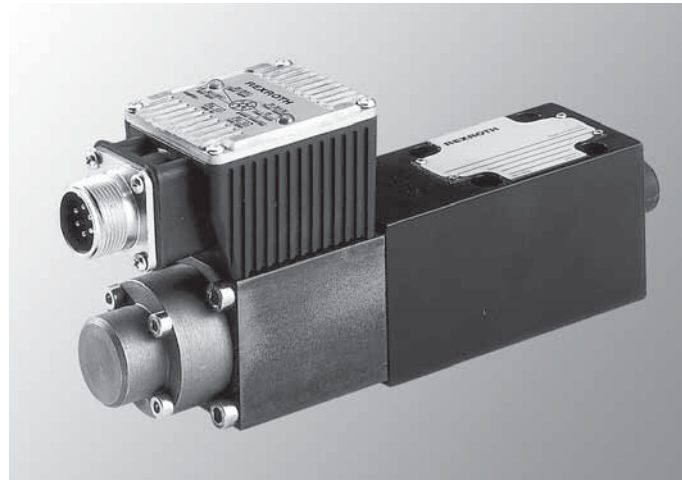
Size 6

Series 1X

Maximum operating pressure 315 bar (4600 PSI)

Maximum flow 30 L/min (8 GPM)

- Valve for limiting system pressure
- Operation via proportional solenoid
- For subplate mounting or of sandwich plate design:
  - Porting pattern to DIN 24 340, Form A6
  - Subplates to data sheet RE 45052
- Valve and control electronics from a single source
- External control electronics for models DBE and ZDBE:
  - Analog amplifier type VT-VSPA1-1 in Eurocard format (separate order), see data sheet RE 30111
  - Analog amplifier of modular design model VT 11131 (separate order), see data sheet RE 29865



Model DBEE 6..-1X/.. with integral control electronics

- Models DBEE and ZDBEE with integrated control electronics:
  - Low example spread of the commnad value-pressure-characteristic curve
  - Independently adjustable up and down ramps

**Ordering code**

	<b>DBE</b>		<b>6</b>		<b>-1X /</b>		<b>G24</b>		<b>*</b>
Subplate mounting = No code									Further details to be written in clear text
Proportional pressure relief valve									<b>M =</b> NBR seals suitable for mineral oil (HL, HLP) to DIN 51 524
For external control electronics With integrated control electronics									<b>Electrical connection for DBE; ZDBE:</b> <b>K4 =</b> Without plug-in connector, with component plug to DIN EN 175 301-803 Plug-in connector, separate order
Size 6			<b>= 6</b>						<b>For DBEE; ZDBEE:</b> <b>K31 =</b> Without plug-in connector, with component plug to E DIN 43 563-AM6-3 Plug-in connector, separate order
Subplate mounting valve									<b>G24 =</b> Supply voltage for control electronics 24 V DC
Series 10 to 19 (10 to 19: unchanged installation and connection dimensions)									<b>No code =</b> Internal pilot oil drain (Subplate mtg. up to $Q_{max} = 15$ L/min (3.9 GPM) recommended)
Pressure stage - 200 bar (2900 PSI)									<b>Y =</b> External pilot oil discharge (only for subplate mounting)
Pressure stage - 315 bar (4600 PSI)									

**Extracted from RE 29158/11.02**

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 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Weight	DBEE and ZDBEE	kg (lbs.)	2.5 (5.5)
Installation position			optional

**Hydraulic**, measured with HLP 46; and  $v_{oil} = 40\text{ °C} \pm 5\text{ °C}$  (104 °F  $\pm$  41 °F)

Operating pressure	Ports P; P1 – P2; A1 – A2; B1 – B2	bar (PSI)	315 (4600)
	Port T	bar (PSI)	50 (725)
Max. set pressure	Pressure stage 200	bar (PSI)	200 (2900)
	Pressure stage 315	bar (PSI)	315 (4600)
Return pressure port A; with external pilot oil discharge (Y)			separate and unpressurized to tank
Max flow		L/min (GPM)	max. 30 (7.9)
Hysteresis		%	$\pm 1.5$ of maximum set pressure
Repeatability		%	$< \pm 2$ of maximum set pressure
Linearity		%	$\pm 3.5$ of maximum set pressure
Stepped response $T_u + T_g$	10% $\rightarrow$ 90%	ms	approx. 80
	90% $\rightarrow$ 10%	ms	approx. 50

} depending on installation

**Electrical**

Type of voltage			24 VDC
Min. control current		mA	100
Max. control current		mA	1600
Coil resistance	Cold value at 20 °C (68 °F)	$\Omega$	5.4
	Max. warm value	$\Omega$	7.8
Duty		%	100
Electrical connections	DBE and ZDBE		With component plug to DIN EN 175 301-803
			Plug-in connector to DIN EN 175 301-803
	DBEE and ZDBEE		With component plug to E DIN 43 563-AM6-3
			Plug-in connector to E DIN 43 563-BF6-3/Pg11
Valve protection to DIN 40 050			IP65 with mounted and fixed plug-in connector
Control electronics	For DBEE and ZDBEE		Integrated into the valve
	For DBE and ZDBE (separate order)		
	• Amplifier in Eurocard format	Analog	VT-VSPA1-1 (see data sheet RE 30111)
• Amplifier of modular design	Analog	VT 11131 (see data sheet RE 29865)	

**Extracted from RE 29156/07.05**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

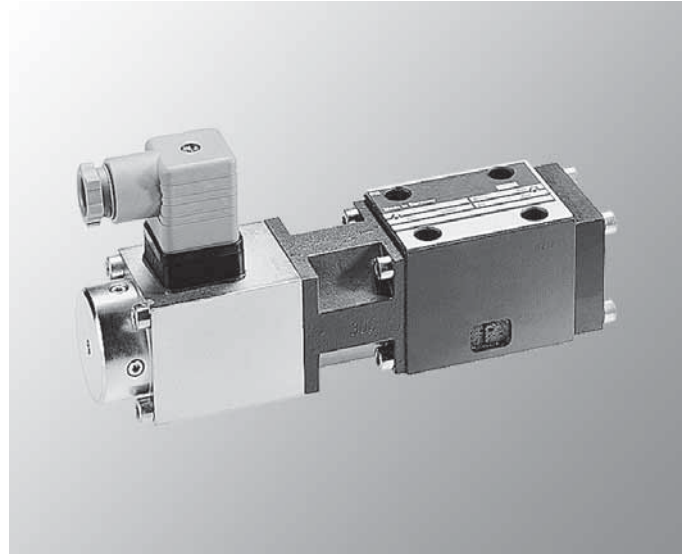
**Proportional pressure relief valve  
pilot operated  
Model DBE6X**

Nominal sizes 6  
Series 1X

Max. working pressure P 315 bar (4500 PSI)  
T 250 bar (3600 PSI)

Max. flow  $Q_{nom}$  40 l/min (10.57 GPM)

- Pilot operated valves (pilot valves) for limiting system pressure (pilot oil internal only)
- Adjustable by means of the solenoid current, see Characteristic curve, Technical data and selected valve electronics
- Solenoid versions  $I_{max} = 0.8$  A or  $I_{max} = 2.5$  A
- Pressure limitation to a safe level even with faulty electronics (solenoid current  $I > I_{max}$ )



Model DBE6X

**Ordering data**

DBE6	X - 1X /	G24 -	N	Z4	M	*
Proportional pressure relief valve NG6, pilot operated						Further information in plain text
Mounting hole configuration to ISO 4401-03-02-0-94	= X				M =	NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524
Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged)	= 1X			Z4 =		<b>Electrical connection</b> Unit plug to DIN 43650-AM2 Plug-in connector included in scope of delivery
Max. pressure stage up to 80 bar (1160 PSI)		= 80		N =		<b>Manual auxiliary override</b>
up to 180 bar (2600 PSI)		= 180				<b>Solenoid type (current)</b>
up to 315 bar (4500 PSI)		= 315				Solenoid current 0.8 A max. Solenoid current 2.5 A max.
Voltage supply of trigger electronics 24 V DC		= G24				
			8 =			
			25 =			

**Extracted from RE 29156/07.05**

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 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Construction	Pilot stage	Poppet valve
	Main stage	Spool valve
Actuation	Proportional solenoid without position control, external amplifier	
Connection type	Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)	
Mounting position	Optional	
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)
Weight	kg (lbs.)	2.2 (4.85)
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)	

**Hydraulic** – measured with HLP 46,  $\vartheta_{oil} = 40^{\circ}\text{C} \pm 5^{\circ}\text{C}$  (104 °F  $\pm 41$  °F)

Pressure fluid	Hydraulic oil to DIN 51524...535, other fluids after prior consultation			
Viscosity range,	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (90 to 460)	
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3700)	
Pressure fluid temperature range	°C (°F)	-20 to +80 (-4 to +176)		
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>			
Direction of flow	See symbol			
Max. set pressure (at $Q = 1$ l/min [0.26 GPM])	bar (PSI)	80 (1160)	180 (2600)	315 (4500)
Minimum pressure (at $Q_{min} = 1$ l/min [0.26 GPM])	bar (PSI)	7 (100)	8 (116)	10 (145)
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$	bar (PSI)	<90 (1300)	<190 (2750)	<325 (4700)
Max. working pressure	bar (PSI)	Port P: 315 (4500)		
Max. pressure	bar (PSI)	Port T: 250 (3625)		
Pilot oil flow	l/min (GPM)	approx. 0.6 (0.16)		
Max. flow	l/min (GPM)	40 (10.57)		

**Electrical**

Cyclic duration factor	%	100		
Degree of protection	IP 65 to DIN 40050 and IEC 14434/5			
Solenoid connection	Unit plug DIN 43650/ISO 4400, M16 x 1.5 (2P+PE)			
Valve with solenoid type		0.8 A	2.5 A	
Max. solenoid current	$I_{max}$	0.8 A	2.5 A	
Coil resistance $R_{20}$	$\Omega$	22	3	
Max. power consumption at 100% load and operating temperature	VA	25	30	

**Static/Dynamic<sup>2)</sup>**

Hysteresis	%	$\leq 4$
Range of inversion	%	$\leq 3$
Manufacturing tolerance for $p_{max}$	%	$\leq 10$
Response time 100% signal change	ms	On 200 / Off < 250

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems.

Effective filtration prevents problems and also extends the service life of components.

For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

<sup>2)</sup> All characteristic values ascertained using amplifier 0811 405 079 for the 2.5 A solenoid and 0811 405 081 for the 0.8 A solenoid.

**Extracted from RE 29159/07.05**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Proportional pressure relief valve, pilot  
operated, with on-board electronics (OBE)  
and position feedback  
Model DBEBE6X**

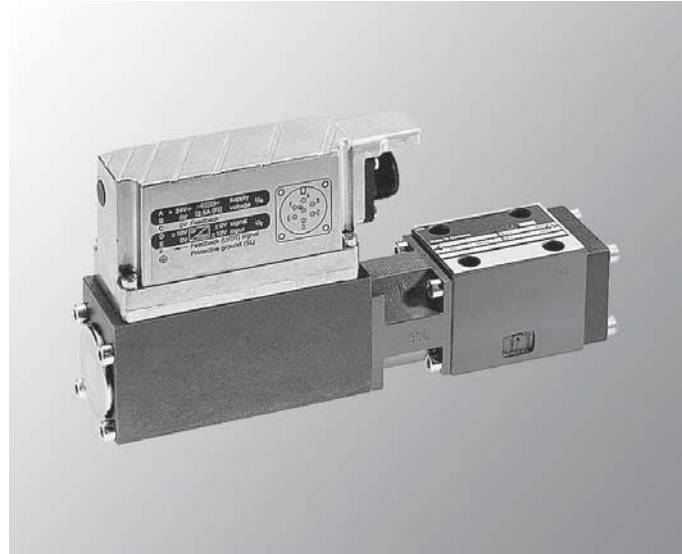
Nominal sizes 6

Series 1X

Max. working pressure P 315 bar (4500 PSI)  
T 250 bar (3600 PSI)

Max. flow  $Q_{nom}$  40 l/min (10.57 GPM)

- Pilot operated valves with position feedback and on-board electronics for limiting system pressure (pilot oil internal only)
- Adjustable through the position of the armature against the compression spring
- Position-controlled, minimal hysteresis <1%, rapid response times, see Technical Data
- Pressure limitation to a safe level even with faulty electronics (solenoid current  $I > I_{max}$ )



Model DBEBE6X

**Ordering data**

<b>DBETB</b>	<b>E</b>	<b>6</b>	<b>X - 1X /</b>	<b>G24</b>	<b>K31</b>	<b>M</b>	<b>*</b>
Proportional pressure relief valve with inductive position transducer on the cone							Further information in plain text
With on-board electronics			= E				M = NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524
Nominal size			= 6				<b>Interface for trigger electronics</b>
Mounting hole configuration to ISO 4401-03-02-0-94			= X				A1 = Setpoint input 0...+10 V F1 = Setpoint input 4...20 mA
Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged)			= 1X				<b>K31 = Electrical connection without plug-in connector, with unit plug to DIN 43563-AM6. Order plug-in connector separately</b>
<b>Max. pressure stage</b>							
up to 80 bar (1160 PSI)			= 80				
up to 180 bar (2600 PSI)			= 180				
up to 315 bar (4500 PSI)			= 315				
Voltage supply of trigger electronics 24 V DC				= G24			



**Extracted from RE 29159/07.05**

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 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.


**Technical data**
**General**

Construction	Pilot stage	Poppet valve
	Main stage	Spool valve
Actuation	Proportional solenoid with position control and OBE	
Connection type	Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)	
Mounting position	Optional	
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)
Weight	kg (lbs.)	3.4 (7.49)
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)	

**Hydraulic** – measured with HLP 46,  $\vartheta_{oil} = 40\text{°C} \pm 5\text{°C}$  (104 °F  $\pm 41$  °F)

Pressure fluid	Hydraulic oil to DIN 51524...535, other fluids after prior consultation			
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (90 to 450)	
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3600)	
Pressure fluid temperature range	°C (°F)	-20 to +70 (-4 to +158)		
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>			
Direction of flow	See symbol			
Max. set pressure (at Q = 1 l/min [0.26 GPM])	bar (PSI)	80 (1160)	180 (2600)	315 (4500)
Minimum pressure (at Q = 1 l/min [0.26 GPM])	bar (PSI)	7 (100)	8 (116)	10 (145)
Max. mechanical pressure limitation level, e.g. when solenoid current $I > I_{max}$	bar (PSI)	<90 (1300)	<190 (2800)	<325 (4700)
Max. working pressure	bar (PSI)	Port P: 315 (4500)		
Max. pressure	bar (PSI)	Port T: 250 (3625)		
Pilot oil flow	l/min (GPM)	approx. 0.6 (0.16)		
Max. flow	l/min (GPM)	40 (10.57)		

**Static/Dynamic**

Hysteresis	%	$\leq 1$		
Manufacturing tolerance	%	$\leq \pm 5$		
Response time	100 % signal change	ms	70	Response time at: Q = 10 l/min (values depend on the dead volume)
	10 % signal change	ms	15	
Thermal drift	<1 % at $\Delta T = 40\text{°C}$			
Conformity	 EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08			

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems.  
 Effective filtration prevents problems and also extends the service life of components.  
 For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.



**Extracted from RE 29160/11.02**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

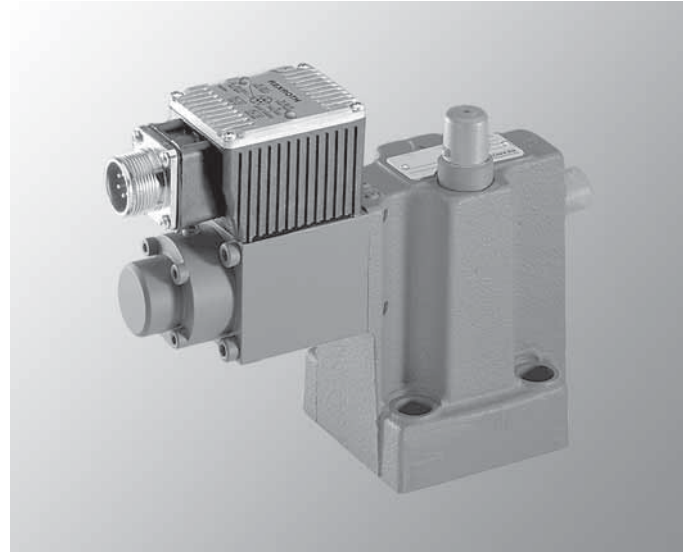
**Proportional pressure relief valve  
Model DBE**

Sizes 10, 25  
Series 5X

Maximum operating pressure 350 bar (5075 PSI)

Maximum flow 400 L/min (106 GPM)

- Pilot operated valve for limiting a system pressure
- Operation via proportional solenoids
- For subplate mounting:  
Porting pattern to DIN 24 340, Form E  
See data sheet RE 45064
- Optional maximum pressure limitation function via spring loaded pilot control valve
- External control electronics for types DBE and DBEM:
  - Analog amplifier model VT-VSPA1-1 in Eurocard format
  - Amplifier model VT 11131 of modular design



Model DBEME 10-5X/... with integrated electronics

- Integrated control electronics for models DBEE and DBEME:
  - Low example spread of the command value-pressure-characteristic curve
  - Independently adjustable ramp time for pressure increase and pressure decrease

**Ordering code**

	DBE			-5X /	Y	G24		*	
Without Maximum pressure protection	= no code								
With Maximum pressure protection	= M								
For external electronic control	= no code								
With integral electronic control	= E								
Size 10 NFPA/ANSI R06	= 10								
Size 25 NFPA/ANSI R08	= 20								
Series 50 to 59 (50 to 59, externally interchangeable)	= 5X								
<b>Pressure range</b>									
up to 725 PSI	= 50								
up to 1450 PSI	= 100								
up to 2900 PSI	= 200								
up to 4600 PSI	= 315								
External drain	= Y								
24 V DC	= G24								
									Further details to be written in clear text
								M =	NBR seals suitable for mineral oil (HL, HLP) to DIN 51 524
								K4 =	<b>Electrical connections for DBE; DBEM:</b> Without plug-in connector, with component plug to DIN EN 175 301-803 Plug-in connector (separate order)
								K31 =	Without plug-in connector, with component plug to E DIN 43 563-AM6-3 Plug-in connector (separate order)

<sup>1)</sup> Note: pushing the manual override may result in uncontrolled motions of the machinery.

**Extracted from RE 29160/11.02**

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Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Weight	DBE and DBEM	kg (lbs.)	Size 10	Size 25
			3.4 (7.5)	3.8 (8.3)
	DBEE and DBEME	kg (lbs.)	3.5 (7.7)	3.9 (8.6)
Installation position	optional			
Hydraulic, measured with HLP 46; and $v_{oil} = 40\text{ °C} \pm 5\text{ °C}$ ( $104\text{ °F} \pm 41\text{ °F}$ )				
Operating pressure	Ports A, B and X	bar (PSI)	350 (5075)	
	Port Y		Separate and at zero pressure to tank	
Max. settable pressure	pressure stage 50 bar	bar (PSI)	50 (725)	
	pressure range 100 bar	bar (PSI)	100 (1600)	
	pressure range 200 bar	bar (PSI)	200 (2900)	
	pressure range 315 bar	bar (PSI)	315 (4600)	
Max. pressure safety (infinitely adjustable)			Adjustment range:	Setting as supplied:
	pressure stage 50 bar	bar (PSI)	30 to 70 (435 to 1015)	up to 70 (1015)
	pressure range 100 bar	bar (PSI)	50 to 130 (725 to 1885)	up to 130 (1885)
	pressure range 200 bar	bar (PSI)	90 to 230 (1305 to 3335)	up to 230 (3335)
	pressure range 315 bar	bar (PSI)	150 to 350 (2175 to 5075)	up to 350 (5075)
Max. flow	L/min (GPM)		200 (53)	400 (106)
Hysteresis (see ideal value pressure curve)	%		$\pm 1.5\%$ of max. preset pressure	
Repeatability	%		$< \pm 2\%$ of max. preset pressure	
Linearity			$\pm 3.5\%$ of max. preset pressure	
Example spread of the com. value-pressure-characteristic curve, referring to the hysteresis char. curve pressure increasing	DBE and DBEM	%	$\pm 2.5\%$ of max. preset pressure	
	DBEE and DBEME	%	$\pm 1.5\%$ of max. preset pressure	
Step function response $T_u + T_g$	0 → 100%	ms	150	} depending on volumetric flow on line volume (A) of the system
	100% → 0	ms	150	
Electrical				
Supply voltage	24 V DC			
Min. control current	mA		100	
Max. control current	DBE and DBEM	mA	1600	
	DBEE and DBEME	mA	1440 to 1760	
Coil resistance	cold at 20 °C (68 °F)	$\Omega$	5.4	
	max. warm value	$\Omega$	7.8	
Duty	%		100	
Electrical connections	DBE and DBEM	With component plug to DIN EN 175 301-803		
		Plug-in connector to DIN 175 301-803		
	DBEE and DBEME	With component plug to E DIN 43 563-AM6-3		
		Plug-in connector to E DIN 43 6=563-BF6-3/Pg11		
Valve protection to DIN 40 050	IP65 with mounted and fixed plug-in connector			
Control electronics	For DBEE and DBEME		Integrated into the valve	
	For DBE and DBEM (separate order)			
	• Amplifier in Eurocard format	Analog	VT-VSPA1-1 (see data sheet RE 30111)	
• Amplifier of modular design	Analog	VT 11131 (see data sheet RE 29865)		

**Extracted from RE 29184/12.02**

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Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Proportional pressure reducing valve,  
3-way design  
Model 3DREP 6... and 3DREPE 6...**

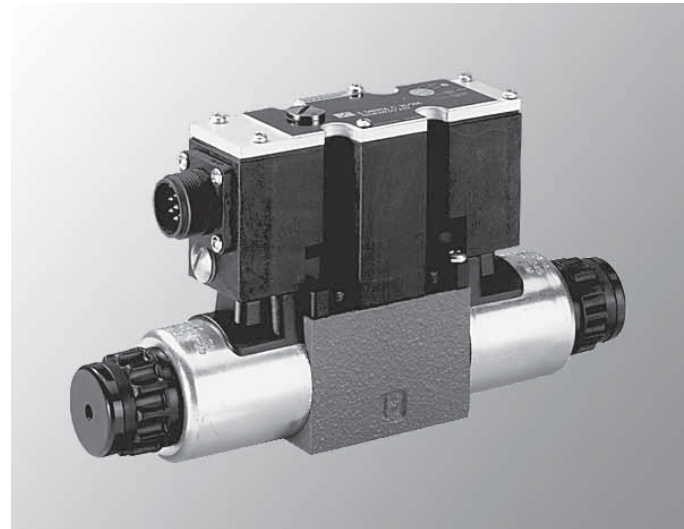
Size 6

Series 2X

Maximum operating pressure 100 bar (1450 PSI)

Maximum flow 15 L/min (4.0 GPM)

- Direct actuated proportional valve for the control of pressure and direction of flow
- Actuated via proportional solenoids with central thread and removable coil
- For subplate mounting:
  - porting pattern DIN 24 340 part 2 form A, ISO 4401 and CETOP-RP121H,
  - NFPA T3.5.1 M R1 and ANSI B93.7 P 03 (D 03)
  - Subplates, see datasheet RA 45 052
- Manual override, optional



**Model 3DREPE 6 .2X/...E...**

- Spring centered control spool
- External control electronics for model 3DREP:
  - Electrical amplifier model VT 11118 of modular design (separate order)
  - Analog amplifier VT-VSPA2-1-2X/ in Eurocard format

**Ordering code**

	<b>3DREP</b>		<b>6</b>		<b>2X /</b>	<b>E</b>	<b>G24</b>			<b>/</b>	<b>V</b>	<b>*</b>
For <b>external</b> control electronics	= No code											
With <b>integrated</b> control electronics	= E											
Nominal size 6	= 6											
<b>Symbols</b> (simplified)												
	= A											
	= B											
	= C											
Series 20 to 29 (20 to 29: unchanged installation and connection dimensions)	= 2X											
Pressure stage 25 bar (362.6 PSI)	= 25											
	Further details to be written in clear text											
	M = NBR seals											
	V = FPM seals,											
	No code = For 3DREP											
	A1 = Command value input ±10 V											
	<b>Electrical connections</b>											
	<b>For 3DREP</b>											
	K4 = Without plug-in connector, with component plug to DIN EN 175 301-803											
	Plug-in connector (separate order)											
	<b>For 3DREPE</b>											
	K31 = Without plug-in connector, with component plug to DIN EN 175 201-804											
	Plug-in connector (separate order)											
	No code = without special protection											
	N9 = with protected manual override											
	<b>Supply voltage for the control electronics</b>											
	G24 = 24 V DC											
	E = proportional solenoid with removable coil											

**Extracted from RE 29184/11.02**

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Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Valve model		3DREP	3DREPE
Installation		optional, preferably horizontal	
Weight	kg (lbs.)	2.0 (4.4)	2.2 (4.9)

**Hydraulic**

Operating pressure range	Port P	bar (PSI)	435 to 1450 for pressure stage 25	
	Port T	bar (PSI)	0 to 435	
Max. flow		L/min (GPM)	15 (4.0) ( $\Delta p = 50$ bar [725 PSI])	
Hysteresis		%	≤ 5	
Repeatability accuracy		%	≤ 1	
Response sensitivity		%	≤ 0.5	
Reversal span		%	≤ 1	

**Electrical, solenoid**

Valve model			3DREP	3DREPE
Voltage model			DC	
Signal model			Analog	
Command value signal	Voltage input "A1"	V	–	± 10
Max. current per solenoid		A	1.5	2.5
Solenoid coil resistance	Cold value at 20 °C (68 °F)	Ω	4.8	2
	Max. warm value	Ω	7.2	3
Duty		%	100	

**Electrical, control electronics**

<b>Integrated</b> , control electronics for model 3DREPE			Integrated into the valve	
Supply voltage	Nominal voltage	VDC	24	
	Lower limiting value	V	19	
	Upper limiting value	V	35	
Amplifier current consumption	$I_{max}$	A	1.8	
	Impulse current	A	4	
<b>External</b> , control electronics for model 3DREP				
Analog amplifier in Eurocard format	– with 1 ramp time		VT-VSPA2-1-2X/V0/T1, see data sheet RE 30110	
	– with 5 ramp times		VT-VSPA2-1-2X/V0/T5, see data sheet RE 30110	
Amplifier of modular design			VT 11118-1X/..., see data sheet RE 30218	

### Extracted from RE 29195/07.05

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Proportional pressure reducing valve, pilot operated, with on-board electronics (OBE) and position feedback Model DREBE6X

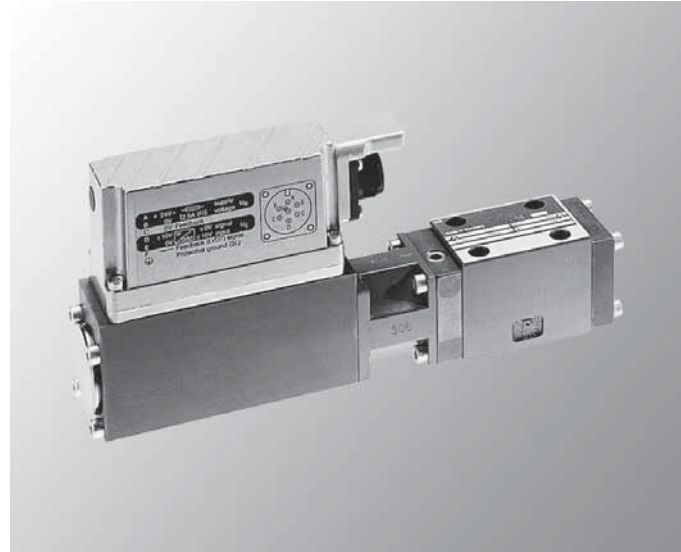
Nominal sizes 6

Series 1X

Max. working pressure P 315 bar (4500 PSI)  
T 250 bar (3600 PSI)

Max. flow  $Q_{nom}$  40 l/min (10.57 GPM)

- Pilot operated valves with position feedback and on-board electronics for reducing system pressure in the consumer (pilot oil internal only)
- 3-way version (P–A/A–T),  $p_{min} = p_T$
- Adjustable through the position of the armature against the compression spring
- Position-controlled, minimal hysteresis < 1%, rapid response times, see Technical data
- Pressure limitation to a safe level even with faulty electronics (solenoid current  $I > I_{max}$ )



Model DREBE6X

### Ordering data

DBEB	E	6	X	– 1X /		G24	K31		M	*
Proportional 3-way pressure reducing valve with inductive position transducer, pilot operated	With on-board electronics = E	Nominal size = 6	Mounting hole configuration to ISO 4401-03-02-0-94 = X	Unit series 10 to 19 (10 to 19: installation and connection dimensions unchanged) = 1X	Max. pressure stage up to 75 bar (1100 PSI) = 75 up to 175 bar (2500 PSI) = 175 up to 310 bar (4500 PSI) = 310	Without non-return valve = M	Voltage supply of trigger electronics 24 V DC = G24		M = Further information in plain text NBR seals, suitable for mineral oils (HL, HLP) to DIN 51524	* Interface for trigger electronics A1 = Setpoint input 0...+10 V F1 = Setpoint input 4...20 mA
								K31 =		Electrical connection without plug-in connector, with unit plug to DIN 43563-AM6 Order plug-in connector separately

**Extracted from RE 29195/07.05**

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 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.


**Technical data**
**General**

Construction	Pilot stage	Poppet valve
	Main stage	Spool valve
Actuation	Proportional solenoid with position control and OBE	
Connection type	Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94)	
Mounting position	Optional	
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)
Weight	kg (lbs.)	3.3 (7.27)
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)	

**Hydraulic** – measured with HLP 46,  $\vartheta_{oil} = 40^{\circ}\text{C} \pm 5^{\circ}\text{C}$  (104 °F  $\pm$  41 °F)

Pressure fluid	Hydraulic oil to DIN 51524...535, other fluids after prior consultation		
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (90 to 450)
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3700)
Pressure fluid temperature range	°C (°F)	-20 to +70 (-4 to +158)	
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>		
Direction of flow	See symbol		
Max. set pressure in A (at $Q_{min} = 1$ l/min)	bar (PSI)	75 (1100)	175 (2500) 310 (4500)
Minimum pressure in A	bar (PSI)	0 (relative) or pressure in T	
Min. inlet pressure in P	bar (PSI)	$p_P = p_A + \geq 5$	
Max. working pressure	bar (PSI)	Port P: 315 (4500)	
Max. pressure	bar (PSI)	Port T: 250 (3600) – B sealed	
Internal pilot oil flow	l/min (GPM)	approx. 0.6 (0.16) – with closed-loop control	
Max. flow	l/min (GPM)	40 (10.57)	

**Static/Dynamic**

Hysteresis	%	$\leq 1$
Manufacturing tolerance	%	$\leq \pm 5$
Response time	100 % signal change	ms 50
	10 % signal change	ms 20
Thermal drift	<1% at $\Delta T = 40^{\circ}\text{C}$	
Conformity	 EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08	

<sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems.  
 Effective filtration prevents problems and also extends the service life of components.  
 For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

**Extracted from RE 29176/11.02**

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Issue: 07.05

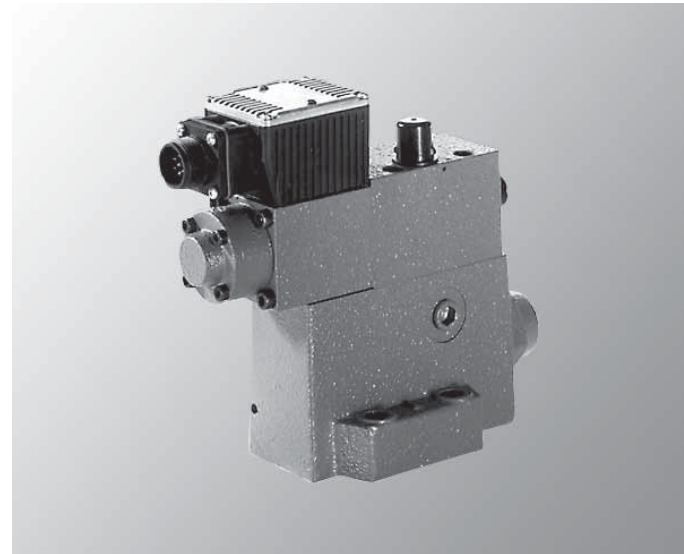
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Proportional pressure reducing valve  
Model DRE, DREM**

Sizes 10, 25  
Series 5X

Maximum operating pressure 315 bar (4600 PSI)  
Maximum flow 300 L/min (80 GPM)

- Valve used for reducing a working pressure
- Proportional solenoid operation
- For subplate mounting: Porting pattern to DIN 24 340 form D  
Subplates, see datasheet RE 45 062 (separate order)
- Third flow path A to Y, 6 mm (0.24 in.) diameter
- Lowest settable pressure 2 bar (29 PSI) at zero command value
- Linearized command value-pressure-characteristic curve
- Main spool closed from B to A in the de-energized position
- Excellent transient response
- Optional check valve between A and B
- Maximum pressure limitation, optional
- Valve and electronics from one source
- Controls for mode DRE:
  - Analog amplifier model VT-VSPA1(K)-1 in Eurocard format (separate order)



Model DREME 20 -5X/...Y... with integrated electronics

- Analog amplifier for model VT 11724 of modular design (separate order)
- Model DREE with integrated electronics
  - Low example spread for the command value-pressure-characteristic curve
  - Independently adjustable ramp times for increasing and decreasing the pressure

**Ordering code**

	<b>DRE</b>			<b>-5X /</b>	<b>Y</b>		<b>G24</b>			<b>*</b>
<b>Without</b> maximum pressure limitation	<b>= no code</b>									
<b>With</b> maximum pressure limitation	<b>= M</b>									
For external electronics	<b>= no code</b>									
with integrated electronics	<b>= E</b>									
Nominal size 10	<b>= 10</b>									
Nominal size 25	<b>= 20</b>									
Series 50 to 59 (50 to 59: unchanged installation and connection dimensions)	<b>= 5X</b>									
<b>Pressure rating:</b>	50 bar (728 PSI)	<b>= 50</b>								
	100 bar (1450 PSI)	<b>= 100</b>								
	200 bar (2900 PSI)	<b>= 200</b>								
	315 bar (4600 PSI)	<b>= 315</b>								
Pilot oil drain always external, separate and at zero pressure to the tank	<b>= Y</b>									
<b>With</b> check valve between A and B	<b>= no code</b>									
<b>Without</b> check valve	<b>= M</b>									
<b>Power supply for the control electronics</b> 24 V DC	<b>= G24</b>									
	<b>M =</b>									
	Further details to be written in clear text									
	NBR seals, suitable for use with mineral oil (HL, HLP) to DIN 51 524									
	<b>Electrical connections for DRE, DREM:</b>									
	<b>K4 =</b>									
	Without plug-in connector, with component plug to DIN EN 175 301 plug-in connector (separate order)									
	<b>For DREE, DREME:</b>									
	<b>K31 =</b>									
	Without plug-in connector with component plug to DIN EN 175 301-803 plug-in connector (separate order)									
	<b>no code =</b>									
	without manual override									
	<b>N =</b>									
	with manual override									



**Extracted from RE 29176/11.02**

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Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

General			Size 10	Size 25
Weight	DRE and DREM	kg (lbs.)	5.1 (11.2)	6.0 (13.2)
	DREE and DREEM	kg (lbs.)	5.2 (11.5)	6.1 (13.4)
Mounting position			optional	
<b>Hydraulic</b> , measured with HLP 46; and $v_{oil} = 40\text{ °C (104 °F)} \pm 5\text{ °C (41 °F)}$ and $p = 100\text{ bar (1450 PSI)}$				
Maximum operating pressure:	ports A and B	bar (PSI)	315 (4600)	
	port Y		Separately connected, pressureless to tank (Inside pipe $\varnothing 5\text{ mm (0.20 in.)}$ ; pipe length $<2500\text{ mm [8.2 ft]}$ )	
Maximum adjustable pressure in port A	Pressure stage 50 bar	bar (PSI)	50 (725)	
	Pressure stage 100 bar	bar (PSI)	100 (1450)	
	Pressure stage 200 bar	bar (PSI)	200 (2900)	
	Pressure stage 315 bar	bar (PSI)	315 (4600)	
Maximum pressure protection valve			Pressure adjustment range:	Factory set:
	Pressure stage 50 bar	bar (PSI)	30 to 70 (435 to 1015)	to 70 (1015)
	Pressure stage 100 bar	bar (PSI)	50 to 130 (725 to 1885)	to 130 (1885)
	Pressure stage 200 bar	bar (PSI)	90 to 230 (1305 to 3335)	to 230 (3335)
	Pressure stage 315 bar	bar (PSI)	150 to 350 (2175 to 5075)	to 350 (5075)
Max. permissible flow of the main valve		L/min (GPM)	200 (53)	300 (80)
Linearity		%	$\pm 2.5$ of maximum settable pressure	
Repeatability		%	$< \pm 2$ of maximum settable pressure	
Hysteresis		%	max. $\pm 2$ of maximum settable pressure	
Example spread of the com. value-pressure-characteristic curve, referring to the hysteresis char. curve, pressure increasing	DRE and DREM	%	$\pm 2.5$ of max. settable pressure	
	DREE and DREME	%	$\pm 1.5$ max. settable pressure	
Step response $T_u + T_g$	10 – 90%	ms	130	measured with standing oil column of 15L/min (4 GPM) at port A
	90 – 10%	ms	120	
<b>Electrical</b>				
Type of supply			24 V DC	
Minimum pilot current	DRE and DREM	mA	50	
	DREE and DREME	mA	100	
Maximum current	DRE and DREM	mA	800 (= 100% command value)	
	DREE and DREME	mA	1440 to 1760	
Coil resistance	Cold value at 20 °C (68 °F)	$\Omega$	19.5 for DRE / DREM	5.4 for DREE / DREME
	Max. warm value	$\Omega$	28.8 for DRE / DREM	7.8 for DREE / DREME
Duty cycle			Continuous	
Control electronics	For DREE and DREME		Integrated in the valve	
	For DRE and DREM (separate order)			
	• Amplifier in Eurocard format	Analog	VT-VSPA1(K)-1, see data sheet RE 30111	
	• Amplifier of modular design	Analog	VT 11724, see data sheet RE 29866	





**Extracted from RE 29216/09.05**

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Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Construction	Cartridge type throttle valve, spool valve with closed-loop position control via OBE					
Actuation	Pilot operated, proportional 3/2-way directional control valve in valve cover, without position control					
Main stage	Position control via OBE and position transducer LVDT DC/DC					
Connection type	Cartridge type, mounting hole configuration to DIN 24342, ISO/DIS 7368					
Mounting position	Horizontal if possible, or position transducer at the bottom					
Ambient temperature range	°C (°F)	-20 to +50 (-4 to +122)				
Vibration resistance, test condition	Max. 25 g, shaken in 3 dimensions (24 h)					
<b>Hydraulic</b> – measured with HLP 46, $\vartheta_{oil} = 40^\circ\text{C} \pm 5^\circ\text{C}$ (104 °F $\pm$ 41 °F)						
Pressure fluid	Hydraulic oil to DIN 51524...535, other fluids after prior consultation					
Viscosity range	recommended	mm <sup>2</sup> /s (SUS)	20 to 100 (90 to 460)			
	max. permitted	mm <sup>2</sup> /s (SUS)	10 to 800 (45 to 3700)			
Pressure fluid temperature range	°C (°F)	-20 to +70 (-4 to +158)				
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)	Class 18/16/13 <sup>1)</sup>					
Direction of flow	A → B or B → A (when X supplied "internally", or "externally" when pressure higher)					
Nominal flow rate at		<b>NG16</b>	<b>NG25</b>	<b>NG32</b>	<b>NG40</b>	<b>NG50</b>
$\Delta p = 5$ bar (72.5 PSI) per edge <sup>2)</sup>	l/min (GPM)	125 (33.02)	210 (55.48)	320 (84.54)	500 (132.09)	980 (258.89)
Weight	kg (lbs.)	3.5 (7.71)	4.6 (10.14)	5.8 (12.78)	7.9 (17.41)	10.5 (23.14)
Max. working pressure in A, B, X	bar (PSI)	315 (4600)	315 (4600)	315 (4600)	315 (4600)	315 (4600)
Max. working pressure in Y	bar (PSI)	100 (1450)	100 (1450)	100 (1450)	100 (1450)	100 (1450)
$Q_{max}$	l/min (GPM)	350 (92.46)	600 (158.50)	1000 (264.17)	1500 (396.26)	3000 (792.52)
$Q_N$ pilot valve (supply)	l/min (GPM)	5 (1.32)	15 (3.96)	15 (3.96)	28 (7.40)	28 (7.40)
$\Delta p = 5$ bar (72.5 PSI)						
Leakage X → Y	cm <sup>3</sup> /min	<150	<200	<200	<400	<400
Pilot valve at 100 bar (1450 PSI)	(in <sup>3</sup> /min)	(9.15)	(12.20)	(12.20)	(24.41)	(24.41)
Min. flow rate at $U_E = 0$ V adjustable	cm <sup>3</sup> /min	2000	2000	3000	3000	4000
Valve active ( $\Delta p = 5$ bar [72.5 PSI])	(in <sup>3</sup> /min)	(122.04)	(122.04)	(183.06)	(183.06)	(244.08)
Leakage in main stage at $\Delta p = 100$ bar (valve shut down electrically)		A → B = tight (poppet valve) B → A = tight (poppet valve) <b>Note:</b> min. leakage X → B possible when X = external				
Minimum supply pressure A → B	bar (PSI)	12 (174)	12 (174)	12 (174)	12 (174)	12 (174)
Minimum supply pressure B → A	bar (PSI)	20 (290)	20 (290)	20 (290)	20 (290)	20 (290)
<b>Static/Dynamic</b>						
Spool stroke/characteristic curve	+ mm (in.)	4 (0.16)	5 (0.20)	7 (0.28)	10 (0.39)	12.5 (0.49)
Overlap on shutdown	- mm (in.)	3 (0.12)	3 (0.12)	3 (0.12)	3 (0.12)	3 (0.12)
Control oil volume of main stage 100 %	cm <sup>3</sup> (in <sup>3</sup> )	1.02 (0.06)	2.66 (0.16)	6.36 (0.39)	12.57 (0.77)	24.54 (1.50)
Required control oil 0...100 %, $x = 100$ bar (1450 PSI)	l/min (GPM)	3 (0.79)	5 (1.32)	7 (1.85)	9 (2.38)	9 (2.38)
Hysteresis	%	<0.2	<0.2	<0.2	<0.2	<0.2
Positioning accuracy	%	<0.5	<0.5	<0.5	<0.5	<0.5
Manufacturing tolerance ( $Q_{max}$ )	%	≤ ±5				
Response time ( $x = 100$ bar)	ms					
Signal change 0...100 %	"open"	<70	<70	<90	<90	<110
Signal change 100... 0 %	"close"	<70	<70	<90	<130	<300
Signal change 0... 10 %	"open"	<50	<50	<70	<70	<80
Signal change 10... 0 %	"close"	<40	<40	<50	<70	<100
Switch-off behavior $U_B = \text{OFF}$ or $U_{D-E} \leq 0.3$ V	After electrical shutdown (pilot valve opens "X" to the main stage), main stage moves to closed end position					
Thermal drift	<1 % at $\Delta T = 40^\circ\text{C}$ (104 °F)					
Calibration	At the factory ±1 %, when $U_{D-E} = 0.5$ V, see characteristic curves					

**Extracted from RE 29216/09.05**

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 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**Electrical, trigger electronics integrated in valve**

Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage		24 V DC <sub>nom</sub>
Terminal A:		Min. 21 V DC/max. 40 V DC
Terminal B: 0 V		Ripple max. 2 V DC
Power consumption		40 VA max.
External fuse		2.5 A <sub>F</sub>
Input, "standard" version		Differential amplifier, R <sub>i</sub> = 100 kΩ
Terminal D: U <sub>D-E</sub>		0...0.5...+10 V (see curve)
Terminal E:		0 V
Max. voltage to differential inputs over 0 V		D → B } max. 18 V DC E → B }
Test signal, "standard" version	A1	LVDT
Terminal F: U <sub>Test</sub>		0...+10 V
Terminal C:		Reference 0 V
Safety earth conductor and shield		See pin assignment (installation in conformity with CE)
Recommended cable		See pin assignment up to 20 m (65.6 ft.) 7 x 0.75 mm <sup>2</sup> (0.0012 in <sup>2</sup> ) up to 40 m (131.2 ft.) 7 x 1 mm <sup>2</sup> (0.0016 in <sup>2</sup> )
Calibration		Calibrated at the factory, see valve curve
Conformity		<b>CE</b> EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08

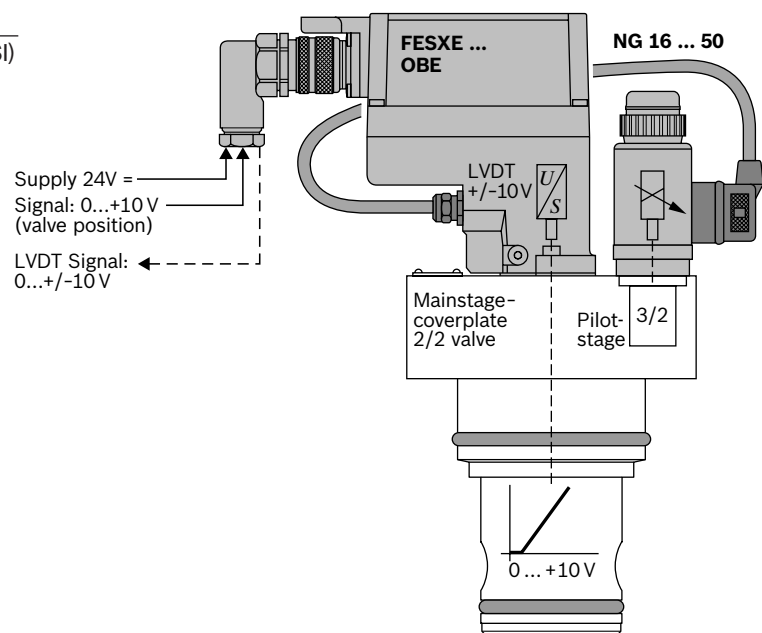
- <sup>1)</sup> The purity classes stated for the components must be complied with in hydraulic systems.  
 Effective filtration prevents problems and also extends the service life of components.  
 For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081.

<sup>2)</sup> Flow for other values of  $\Delta p$   $Q_X = Q_{nom} \cdot \sqrt{\frac{\Delta p_X}{5 \text{ bar (72.5 PSI)}}$

**Note:**

Rapid shutdown takes place if:

- The supply voltage 24 V<sub>nom</sub> (U<sub>A-B</sub>) drops below 18 V DC
- The signal setpoint drops below 0.3 V (see characteristic curve)



# Section 8

## Proportional Electronics

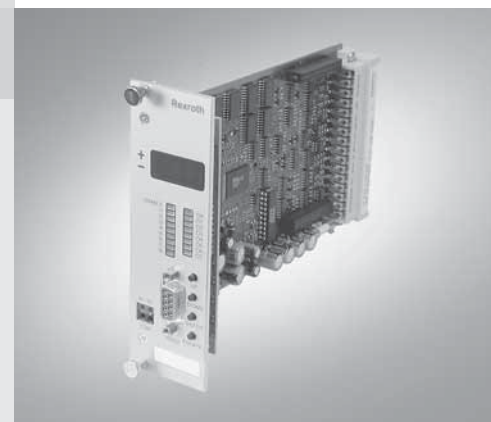
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**Extracted from Catalog AKY 013/1**

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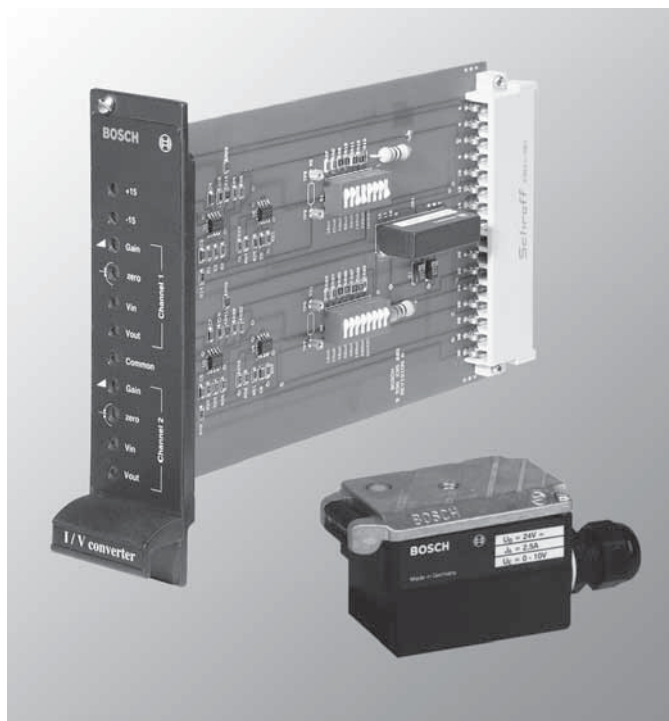
 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.




**Amplifier cards**

The following amplifier cards convert voltage or current commands into the appropriate current signals to operate the associated hydraulic valve. Available card functionality: ramps, set points, failing outputs, etc.

Amplifier cards come in three forms:

- Euro-card (requires card holder)
- DIN module (mounted on standard DIN rail)
- Active plugs (mounts directly on the solenoid)


**Technical data**

Description	Ramp	Model	Material Number
	with ramp	VT-SSPA1-525-20/V0 (AS 2.5 - V) VT-SSPA1-525-20/V0/I (AS 2.5 - mA)	0811405143 0811405145
	with ramp	VT-SSPA1-508-20/V0 (AS 0.8 - V) VT-SSPA1-508-20/V0/I (AS 0.8 - mA)	0811405144 0811405162
	with ramp with ramp	VT-VSPA1-508-10/V0/RTP (1 M 45 - 0.8 A) VT-VSPA1-525-10/V0/RTP (1 M 45 - 2.5 A)	0811405081 0811405079

<sup>1)</sup> See catalog #AKY 13/1 1 987 761 317 for complete description and performance specifications.

**Extracted from RE 30052/05.04**

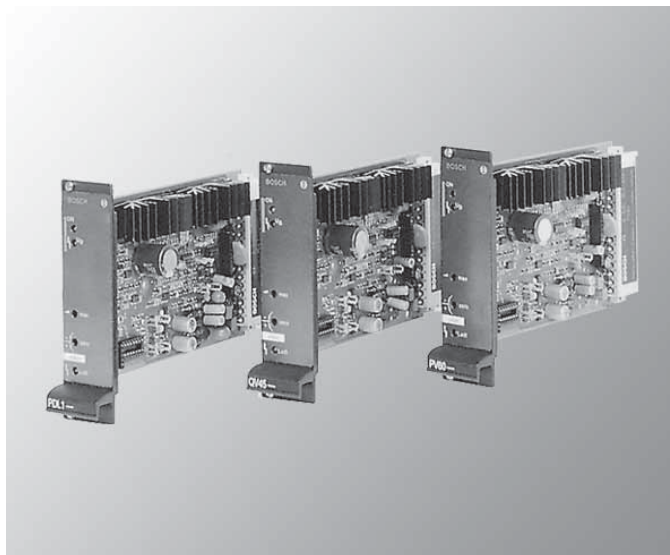
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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Electric amplifiers  
Model VT-VRPA1 (PV/QV)**

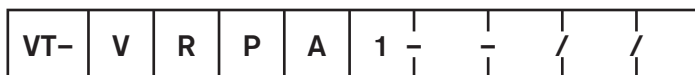
**Series 1X**

- Analog amplifiers in Eurocard format for installation in 19" rack
- Output stage with closed-loop control
- Closed-loop position control with PID action
- Rapid energizing and de-energizing for fast response times
- Enabling input
- Short-circuit-proof outputs
- Open-circuit detection for feedback signal cable (partially)
- Zero and sensitivity adjustment possibilities
- Material numbers: 0811405095  
0811405097  
0811405099



VT-VRPA1

**Ordering code**



**Hydraulic component**

For valves with electrical feedback

= R

**Valve type**

4/2 servo solenoid valves with  
positive overlap

= P

**Actuation**

Analog

= A

**Output stages**

1 output stage

= 1

PV =

**Option**

Pressure valves

QV =

Throttle/flow control valves

V0 =

**Customer version**

Catalog version

1X =

**Series**

Series 10 to 19

Serial numbers for types

527 =

2.7 A solenoid

537 =

3.7 A solenoid

## Extracted from RE 30052/05.04

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Technical data

P.C.B. format	(100 x 160 x approx. 35) mm (W x L x H) Europe format with front panel (7 modular spacings)		
Plug connector	Connector DIN 41612 – F 32		
Power supply $V_B$ to b 16/b 18 and b 2/b 4 (0 V)	24 V DC Battery voltage 21...40 V, Rectified AC voltage $V_{eff} = 21...28$ V (single-phase, full-wave rectification)		
Smoothing capacitor, separately to b 28/b 30 – b 2/b 4	4700 $\mu$ F, 63 V (ELKO) if ripple >10 %		
Solenoid	<b>2.7 A/25 W</b>	<b>3.7 A/50 W</b>	
Power consumption	max. 35 W	max. 60 W	
Current rating	max. 1.5 A	max. 2.5 A	
Solenoid output b 6 – b 8	Square-wave voltage, pulse-modulated $I_{max.} = 2.7$ A   $I_{max.} = 3.7$ A		
Setpoint	$V_{E I} : 0 \dots +10$ V (z 10) $\quad \quad \quad : 0$ V (z 12) } Differential input $V_{E II} : 0 \dots +10$ V $V_{E III} : 0 \dots +10$ V		
Signal source (setpoint)	Potentiometer $R = 1$ k $\Omega$ +10 V supply from b 32 (10 mA) or external source		
Actual value feedback	Oscill. b 26	Test pt. z 28 *	
	0811405095	10.2 $V_{eff}$ / 7.8 kHz	0 ... +10 V DC
	0811405097	10.8 $V_{eff}$ / 7.8 kHz	0 ... +10 V DC
	0811405099	10.8 $V_{eff}$ / 7.8 kHz	0 ... +10 V DC
Output stage enable	To z 16, $V = 8.5 \dots 40$ V; e.g. 10 V from z 32 LED (green) on front panel lights up		
Cable lengths and cross-sections	Solenoid: < 20 m      1.5 mm <sup>2</sup> 20 ... 50 m    2.5 mm <sup>2</sup> Position transducer: max. 50 m at 100 pF/m Supply and capacitor 1.5 mm <sup>2</sup>		
LED displays	green: Enable yellow: Feedback signal open circuit red: $V_B < V_B$ min. (approx. 21 V)		
Fault indication – Feedback signal open circuit – $V_B$ too low – $\pm 15$ V stabilization	z 26: Switching output No fault +24 V (max. 100 mA) Fault 0 V		
Short-circuit-proof outputs	Output stage to solenoid Signal to position sensor Potentiometer supply		
Special features	Open-circuit protection for feedback signal cable Closed-loop position control with PID action Clocked output stage Rapid energizing and de-energizing for fast response times		
Adjustment via trimming potentiometer	1. Zero 2. Sensitivity		



**Extracted from RE 30054/05.04**

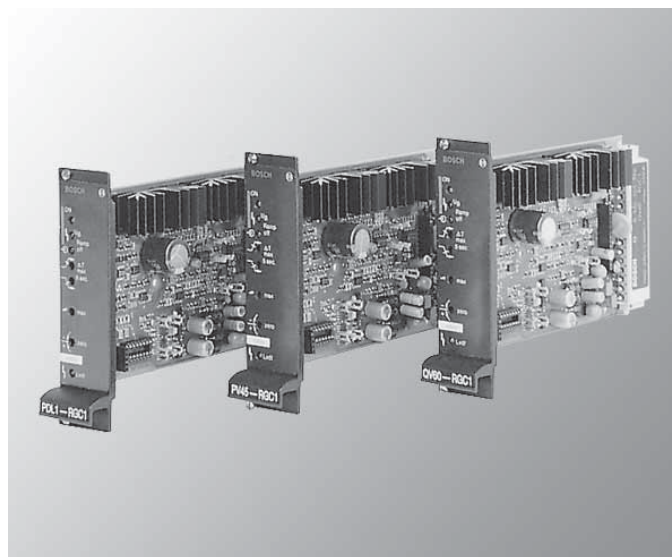
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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Electric amplifiers  
Model VT-VRPA1 (PV-RTP)**

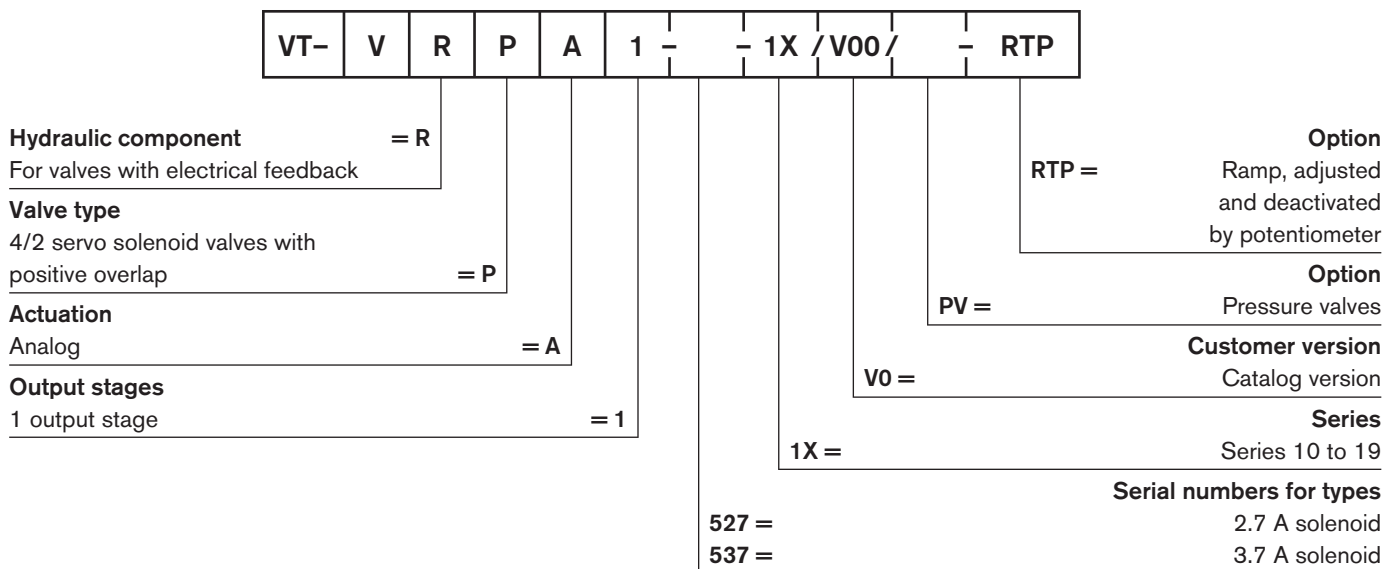
**Series 1X**

- Analog amplifiers in Eurocard format for installation in 19" rack
- Output stage with closed-loop control
- Closed-loop position control with PID action
- Rapid energizing and de-energizing for fast response times
- Enabling input
- Ramp can be adjusted and deactivated
- Open-circuit detection for feedback signal cable
- Short-circuit-proof outputs (partially)
- Adjustment possibilities for zero and sensitivity, acceleration and braking ramps
- Material numbers: 0811405100  
0811405102



VT-VRPA1

**Ordering code**





## Extracted from RE 30054/05.04

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Technical data

P.C.B. format	(100 x 160 x approx. 35) mm (W x L x H) Europe format with front panel (7 modular spacings)	
Plug connector	Connector DIN 41612 – F 32	
Power supply $V_B$ to b 16/b 18 and b 2/b 4 (0 V)	24 V DC Battery voltage 21...40 V, Rectified AC voltage $V_{eff} = 21...28$ V (single-phase, full-wave rectification)	
Smoothing capacitor, separately to b 28/b 30 – b 2/b 4	4700 $\mu$ F, 63 V (ELKO) if ripple >10 %	
Solenoid	<b>2.7 A/25 W</b>	<b>3.7 A/50 W</b>
Power consumption	max. 35 W	max. 60 W
Current rating	max. 1.5 A	max. 2.5 A
Solenoid output b 6 – b 8	Square-wave voltage, pulse-modulated $I_{max.} = 2.7$ A   $I_{max.} = 3.7$ A	
Setpoint	$V_{E I} : 0 \dots +10$ V (z 10) $0$ V (z 12) } Differential input $V_{E II} : 0 \dots +10$ V $V_{E III} : 0 \dots +10$ V	
Signal source (setpoint)	Potentiometer $R = 1$ k $\Omega$ +10 V supply from b 32 (10 mA) or external source	
Actual value feedback	Oscill. b 26	Test pt. z 28 *
	0811405101	10.2 $V_{eff}$ / 7.8 kHz
	0811405102	10.8 $V_{eff}$ / 7.8 kHz
Output stage enable	To z 16, $V = 8.5 \dots 40$ V; e.g. 10 V from z 32 LED (green) on front panel lights up	
Ramp OFF	to b 20; $V = 8.5 \dots 40$ V	
Cable lengths and cross-sections	Solenoid: < 20 m      1.5 mm <sup>2</sup> 20 ... 50 m      2.5 mm <sup>2</sup> Position transducer: max. 50 m at 100 pF/m Supply and capacitor 1.5 mm <sup>2</sup>	
LED displays	green: Enable yellow: Feedback signal open circuit yellow: Ramp OFF red: $V_B < V_B$ min. (approx. 21 V)	
Fault indication – Feedback signal open circuit – $V_B$ too low – $\pm 15$ V stabilization	z 26: Switching output No fault +24 V (max. 100 mA) Fault 0 V	
Short-circuit-proof outputs	Output stage to solenoid Signal to position sensor Potentiometer supply	
Special features	Open-circuit protection for feedback signal cable Closed-loop position control with PID action Clocked output stage Rapid energizing and de-energizing for fast response times Ramp, can be adjusted and deactivated	
Adjustment via trimming potentiometer	1. Zero 2. Sensitivity 3. Acceleration ramp 4. Braking ramp	

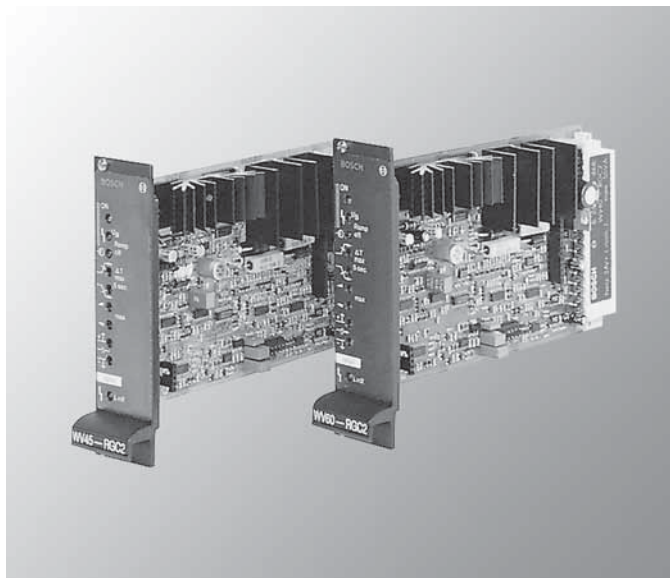
**Extracted from RE 30048/11.02**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Electric amplifiers**  
**Model VT-VRPA2**
**Series 1X**

- Suitable for actuating directly operated servo solenoid valves (type 4WRP, series 1X)
  - Analog amplifiers in Eurocard format for installation in 19" rack
  - Ramp generator can be deactivated
  - Deadband compensation
  - Output stage with closed-loop control
  - Enabling input
  - Inputs and outputs (partially) short-circuit-proof
  - External ramp deactivation
  - Adjustment possibilities
    - Valve zero
    - Sensitivity
    - Ramp times
  - Open-circuit detection for feedback signal cable
- Closed-loop position control with PID action
- Testing and service equipment
- Test box type VT-PE-TB1, see RE 30 063
  - Test adapter type VT-PA-3, see RE 30 070


**Ordering code**

VT-	V	R	P	A	2	-	-1X / V0 / RTP
<b>Hydraulic component</b> For valves with electrical feedback		= R					
<b>Valve type</b> Servo solenoid valve		= P					
<b>Actuation</b> Analog		= A					
<b>Output stage</b> Two output stages per valve				= 2			
							<b>Option</b> Ramp function manually adjusts
							<b>Customer version</b> Catalog version
							<b>Series</b> Series 10 to 19
							<b>Serial numbers for types</b>
						527 =	NG 6
						537 =	NG 10

**Technical data**

P.C.B. format	(100 x 160 x approx. 35) mm (W x L x H) Europe format with front panel (7 modular spacings)
Plug connector	DIN 41 612 - F 32
Ambient temperature	0 °C ... +70 °C, storage temperature min. -20 °C; max. +70 °C
Weight m	0.25 kg
Power supply UB to b 16/b 18 and b 2/b 4	24 V DC nominal, Battery voltage 21...40 V, Rectified AC voltage $U_{\text{eff}} = 21...28$ V (single-phase, full-wave rectification)

**Extracted from RE 30048/11.02**

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 Issue: 06.04

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data (cont.)**

Smoothing capacitor, separately to b 28/b 30 – b 2/b 4	4,700 $\mu$ F/63 V DC, only required if $U_B$ ripple >10 %	
Valve solenoid A/VA max.	<b>2.7/25 (NG 6)</b>	<b>3.7/50 (NG 10)</b>
Current rating	1.5 A	2.5 A
	The current rating can rise at min. $U_B$ and long cable length to control solenoid	
Power consumption (typical)	35 W	60 W
Input signal (setpoint)	0 ... $\pm$ 10 V supply from b 10, z 8, z 10, z 12, z 14/b 14 cumulative ( $R_i = 10$ k $\Omega$ )	
Signal source	Potentiometer 1 k $\Omega$ , +10 V supply from b 32 (50 mA), –10 V from z 22 (50 mA) or external signal source	
Actual-value feedback	Oscil. b 26	Meas. tap z 28*
	0811405119	0 ... $\pm$ 10 V DC
	0811405120	0 ... $\pm$ 10 V DC
Output stage enable	To z 16, $U = 8.5 \dots 40$ V, $R_i = 100$ k $\Omega$ , LED (green) on front panel lights up	
Ramp OFF	To b 20, $U = 8.5 \dots 40$ V	
Solenoid output	Output stage to solenoid Signal to position sensor Potentiometer power supply	
Length of amplifier to valve cables	Solenoid cable: up to 20 m 1.5 mm <sup>2</sup> 20 to 50 m 2.5 mm <sup>2</sup> Position transducer: max. 50 m at 100 pF/m Supply and capacitor 1.5 mm <sup>2</sup>	
Special features	Open-circuit protection for feedback signal cable Closed-loop position control with PID action Clocked output stage Rapid energizing and de-energizing for fast response times Ramps with quadrant recognition Deadband compensation in valve centre position Ramps can be deactivated	
Adjustment via trimming potentiometer	1. Zero $N_{PA}$ and $N_{PB}$ 2. Sensitivity $Q_A$ and $Q_B$ 3. Ramps for acceleration and deceleration $t = 0.05 \dots 5$ s	
LED displays	Green: Enable ON Red: $U_B < U_{B \min.}$ (approx. 21 V) Yellow: Ramp OFF Yellow: Feedback signal open circuit	
Fault signal – Feedback signal open circuit – $U_B$ too low – $\pm$ 15 V stabilization	z 22: Open collector output to $+U_K$ max. 100 mA; no fault: $+U_K$	

Note: Connect power zero b 2 and control zero b 12 separately to central ground (neutral point).

\* Values for potentiometer in end position (cw) and for "zero potentiometer" in centre position.

**Extracted from RE 30111/02.03**

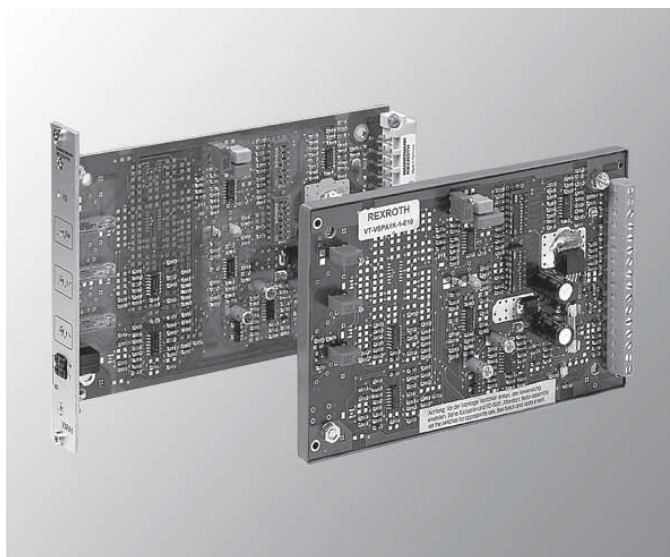
Page 1 of 2  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Electrical amplifiers for the control  
of proportional pressure control valves  
without electrical position feedback  
Models VT-VSPA1-1 and VT-VSPA1K-1**

**Series 1X**

- Suitable for controlling all direct and pilot operated proportional pressure control valves without electrical position feedback and only one solenoid as actuator that are available at the time of publication of this data sheet
- Differential input, can be switched between voltage and current input
- Additional command value input, 0 to + 9 V
- Ramp generator, can be adjusted separately for up and down
- Clocked output stage
- Message "ready for operation" (VT-VSPA1K-1 with LED indicator lamp only)
- Reverse polarity protection for voltage supply
- Cable break detection for current input 4 to 20 mA
- Short-circuit protection of solenoid cable
- Cable break detection for solenoid cable



Models VT-VSPA1-1-1 and VT-VSPA1K-1

**Ordering code**

<b>VT-VSPA1</b>	<b>- 1 - 1X/ *</b>	Further details to be written in clear text
Amplifiers for controlled proportional pressure control valves, analog, with one solenoid		
With 32-pin male connector and front panel With 16-pin terminal strip; without front panel	= No code = K	1X = Series 10 to 19 (10 to 19: Technical data and pin allocation unchanged)

Substitutions for amplifiers VT 2000 (up to series 4X), VT 2010, VT 2013 or VT 2023 installed in racks, blind plate 4TE/3HE must be ordered separately.

**Material no.:** R900021004 or R978887127

**Extracted from RA 30111/02.03**

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 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Operating voltage	$V_o$	24 VDC + 40% – 5%
Operating range:		
– Upper limiting value	$V_o(t)_{\max}$	35 V
– Lower limiting value	$V_o(t)_{\min}$	22 V
Power requirement	$P_s$	< 2 A
Current consumption	$I$	< 1.8 A
Fuse	$I_F$	2.5 A T
Inputs		
– Command value 1	$V$	0 to + 9 V (Reference potential is M0)
– Command value 2 (differential input)	$V$	0 to + 10 V; $R_i = 100\text{ k}\Omega$
	or $I_i$	4 to 20 mA (load $R_i = 100\ \Omega$ )
	or $I_i$	0 to 20 mA (load $R_i = 100\ \Omega$ )
		depending on setting of S11 to 13
Ramp time (adjustment range)	$t$	30 ms to approx. 1 s or 5 s (depending on setting of S14)
Outputs:		
– Final output stage		
• Solenoid current/resistance	$I_{\max}$	800 mA + 20 %; $R_{i(20)} = 19.5\ \Omega$
	or $I_{\max}$	1600 mA + 20 %; $R_{i(20)} = 5.4\ \Omega$
		depending on setting using BR17 or S17 <sup>1)</sup>
• Biasing current	$I_V$	50 mA or 100 mA
at $I_{\max} = 800\text{ mA}$	$I_V$	100 mA
at $I_{\max} = 1600\text{ mA}$	$I_V$	0 to 300 mA + 20%
additionally	$I_V$	0 to 600 mA + 20%
at $I_{\max} = 800\text{ mA}$	$I_V$	
at $I_{\max} = 1600\text{ mA}$	$I_V$	
		adjustable with "Zw" (R130) on the printed board
• Clock-pulse frequency	$f$	100 Hz, 200 Hz, 300 Hz or 370 Hz, $\pm 10\%$ each (depending on setting with S25 to S27)
– Signal "ready for operation" (with VT-VSPA-1 only)		
• Series 10	$V$	approx. $V_o$
when ready for operation	$V$	< 1 V
in the case of a fault		Load resistance > 10 k $\Omega$
• From Series 11	$V$	ca. $V_o$ ; 50 mA
when ready for operation	$V$	0 V; $R_i = 10\text{ k}\Omega$
in the case of fault	$V$	
– Regulated voltage	$V$	$\pm 9\text{ V} \pm 1\%$ ; 25 mA externally loadable
– Measuring sockets		
• Command value "w"	$V$	0 to + 6 V (+ 6 V $\hat{=}$ 100% solenoid current); $R_i = 1\text{ k}\Omega$
• Actual current value "I"	$V$	0 to 1600 mV $\hat{=}$ 0 to 1600 mA $\pm 20\text{ mA}$
Type of connection		
– VT-VSPA1-1		32-pin blade connector, DIN 41 612, form D
– VT-VSPA1K-1		16-pin terminal strip
Card dimensions	mm (in.)	Euro-card 100 x 160 (3.93 x 6.29), DIN 41 494
Front plate dimensions:		
– Height		3 U, 128.4 mm (5.1 in.)
– Width soldering side		1 HP, 5.08 mm (0.2 in.)
– Width component side		3 HP
Permissible operating temperature range	$^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	0 to 50 (0 to 122)
Storage temperature range	$^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	–25 to 85 (–13 to 185)
Weight	kg (lbs.)	0.1

<sup>1)</sup> The maximum current  $I_{\max}$  can be adjusted to the required value with the help of the command value attenuator (potentiometer "Gw").

**Extracted from RE 30115/09.03**

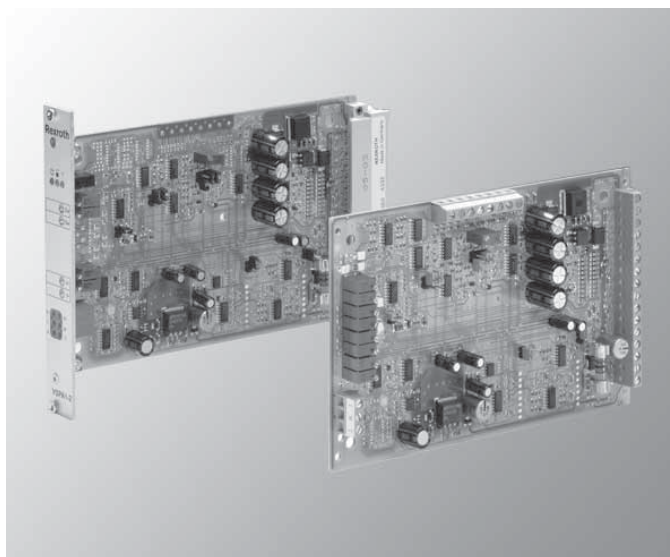
Page 1 of 2  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Electrical amplifiers**  
**Models VT-VSPA1-2 and VT-VSPA1K-2**

**Series 1X**

- Suitable for controlling pressure valves type DBET, series 6X or as universal amplifier (see technical data)
- Differential input (0 to +10V)
- Current input (4 to 20mA)
- 4 command value call-ups (with option A4 only)
- Ramp generator, with separately adjustable "up/down" ramp time
- External ramp time preselection
- Enable input
- Clocked current output stage
- Signal "ready for operation"
- Reverse polarity protection of the supply voltage
- Short-circuit protection of the solenoid cable
- Solenoid cable break detection



VT-VSPA1-2 and VT-VSPA1K-2

**Ordering code**

<b>VT-VSPA1</b>	<b>- 2 - 1X / V0 / 0 / *</b>		
Amplifier for controlled proportional pressure valves, analog, with one solenoid			Further details in clear text (additional functions on enquiry)
With 48-pin male connector and front pane	<b>= No code</b>		<b>0 =</b> Standard option
With 16 or 24-pin terminal strip without front panel	<b>= K</b>		<b>A4 =</b> Variant with 4 command value call-ups
Series 10 to 19 (10 to 19: unchanged technical data and pin assignment)		<b>= 1X</b>	<b>...</b>
			<b>V0 =</b> Basic version

**Extracted from RE 30115/09.03**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Operating voltage	$V_O$	24VDC +40% -20%
Operating range:		
Upper limit value	$V_O(t)_{max}$	35VDC
Lower limit value	$V_O(t)_{min}$	18VDC
Power consumption	$P_S$	<24VA
Current consumption	$I$	<2A
Fuse	$I_F$	2A M, can be replaced
Inputs:		
– Analog		
– Command values 1 to 4 (potentiometer inputs) *	$V_i$	0 to +10V; $R_i > 100k\Omega$
– Differential input	$V_i$	0 to +10V; $R_i > 50k\Omega$
– Current input	$I_i$	4 to 20mA; load $R_B = 100\Omega$
External ramp time	$V_i$	0 to +5V; $R_i > 10k\Omega$
– Digital		
– Command value call-ups *	$V$	8.5V to $U_B$ → call-up activated; $R_i > 100k\Omega$
	$V$	0V to 6.5V → no call-up; $R_i > 100k\Omega$
– Ramp call-ups	$V$	8.5V to $U_B$ → call-up activated; $R_i > 100k\Omega$
	$V$	0V to 6.5V → no call-up; $R_i > 100k\Omega$
– Ramp ON/OFF	$V$	8.5V to $U_B$ → ramp ON; $R_i > 100k\Omega$
	$V$	0V to 6.5V → ramp OFF; $R_i > 100k\Omega$
– Enable	$V$	8.5V to $U_O$ → ON; $R_i > 100k\Omega$
* provided only for option A4	$V$	0 to 6.5V → OFF; $R_i > 100k\Omega$
Clock-pulse frequency:	$f$	250 Hz ±10% with J6 and J7 = open
Adjustment ranges:		
– Zero balancing (potentiometer “Zw”)		±30%
– Command values (potentiometers “w1” to “w4”)		0 to +100%
– Ramp times (potentiometers “t<” and “t>”)		20ms to 5s; can be changed over to 0.2s to 50s
– Amplitude attenuator (potentiometer “Gw”)		0 to +120%
– Frequency adjustment with potentiometer (J7 activated)		see explanation: Clock-pulse generator
Outputs		
– Command value signal	$V$	0 to +10V ±2%; $I_{max} = 2mA$
– Actual value signal	$V$	0 to +10V ±2%; $I_{max} = 2mA$
– Ready for operation	$V$	>16V; $I_{max} = 50mA$ (in the event of a fault: $U < 1V$ ; $R_i = 10k\Omega$ )
– Output “command value reached” – on enquiry	$V$	>16V; $I_{max} = 50mA$ (when command value reached) (when command value not reached: $U < 1V$ ; $R_i = 10k\Omega$ )
– Regulated voltage	$V$	+10V ±2%; $I_{max} = 25mA$ ; short-circuit-proof
– Ramp signal measuring socket	$V$	+100mV to +5V ±10%; +10mV to +100mV ±50%
– Current output stage	$I$	0 to 1.9A; short-circuit-proof; clocked
Type of connection:		
– VT-VSPA1-2		48-pin male connector; DIN 41612; form F
– VT-VSPA1K-2		16- or 24-pin terminal strip
Card dimensions:		Euro-card 100 x 160 mm (3.93 x 6.29 in.); DIN 41494
Front panel dimensions (refers to VT-VSPA1-2)		
– Height		3HE, 128.4 mm (5.1 in.)
– Width soldering side		1TE, 5.08 mm (0.2 in.)
– Width component side		3TE, 15.24 mm (0.6 in.)
Permissible operating temperature range	°C (°F)	0 to 50 (0 to 122)
Storage temperature range	°C (°F)	–25 to 85 (–13 to 185)
Weight	kg (lbs.)	0.15 (0.33) net



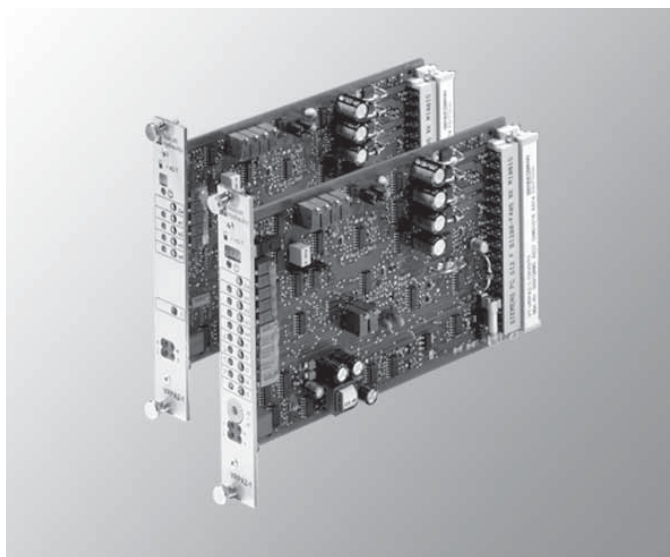
**Extracted from RE 30110/10.04**

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 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Analog amplifier card  
 Model VT-VSPA2-1-2X/...**
**Series 2X**

- Suitable for controlling valve types 4WRA sizes 6 and 10, series 2X and 4WRZ series 7X
- Built-up in the form of a board in the Euro-format
- Command value inputs:
  - Differential input  $\pm 10\text{ V}$
  - Four command value inputs,  $\pm 10\text{ V}$  that can be called up
  - Current input 4 to 20 mA
- Inverting the internal command value signal via the 24V input or jumper
- Selecting the ramp time via quadrantal recognition (24V input) or ramp time call-ups (24V inputs) (option T5)
- Switching over the ramp time range via jumpers
- Characteristic curve correction by separately adjustable jump heights and maximum values
- Enable input
- "Ramp on/off" input



VT-VSPA2-1-2X/...

- Output signal "operational"
- Switchable measuring socket (option T5)
- Polarity protection for the supply voltage
- Power supply with DC/DC convertor without a raised zero point

**Ordering code**

<b>VT-VSPA2</b>	-	<b>1</b>	-	<b>2X</b>	/	<b>V0</b>	/	/	*
Analog amplifier in Eurocard format									
For controlling valve types: 4WRA 6-2X; 4WRA 10-2X; 4WRZ-7X				= 1					
Series 20 to 29: (20 to 29 unchanged technical data and connection allocation)				= 2X					
						<b>T1 =</b> With one ramp time <b>T5 =</b> With five ramp times			
						<b>V0 =</b> Basic version			

**Technical data**

Operating voltage	$V_B$	24 VDC + 40% - 20%
Functional range:		
- Upper limiting value	$V_B(t)_{\max}$	35 V
- Lower limiting value	$V_B(t)_{\min}$	18 V
Power consumption	$P_S$	< 50 VA
Current consumption	$I$	< 2A
Fuse	$I_S$	2 A M, replacable

*continued on next page*



**Extracted from RE 30110/10.04**

 Page 2 of 2  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data (cont.)**

Inputs:		
– Analog		
• Com. value 1 to 4 (potentiometer inputs)	$V_e$	0 to $\pm 10$ V; $R_e > 100$ k $\Omega$ (ref. is M0)
• Com. value 5 (differential input)	$V_e$	0 to $\pm 10$ V; $R_e > 50$ k $\Omega$
• Com. value 6 (current input)	$I_e$	4 to 20 mA; load $R_B = 100$ $\Omega$
• External ramp time	$V_e$	0 to +10 V; $R_e = 10$ k $\Omega$ (raised internally to +15 V; ref. is M0)
– Digital		
• Command value call-ups	V	8.5 V to $V_B$ $\rightarrow$ call-up actuated; $R_e > 100$ k $\Omega$
	V	0 to 6.5 V $\rightarrow$ no call-up; $R_e > 100$ k $\Omega$
• Ramp call-up	V	8.5 V to $V_B$ $\rightarrow$ call-up actuated; $R_e > 100$ k $\Omega$
	V	0 to 6.5 V $\rightarrow$ no call-up; $R_e > 100$ k $\Omega$
• Quadrant recognition	V	8.5 V to $V_B$ $\rightarrow$ ON; $R_e > 100$ k $\Omega$
	V	0 to 6.5 V $\rightarrow$ OFF; $R_e > 100$ k $\Omega$
• Command value inversion	V	8.5 V to $V_B$ $\rightarrow$ ON; $R_e > 100$ k $\Omega$
	V	0 to 6.5 V $\rightarrow$ OFF; $R_e > 100$ k $\Omega$
• Enable	V	8.5 V to $V_B$ $\rightarrow$ ON; $R_e > 100$ k $\Omega$
	V	0 to 6.5 V $\rightarrow$ OFF; $R_e > 100$ k $\Omega$
• Ramp	V	8.5 V to $V_B$ $\rightarrow$ ON; $R_e > 100$ k $\Omega$
	V	0 to 6.5 V $\rightarrow$ OFF; $R_e > 100$ k $\Omega$
Setting ranges		
– Zero compensation (potentiometer „Zw“)		$\pm 30\%$
– Command value (potentiometers „w1“ to „w4“)		0% to 110%
– Ramp times (potentiometers „t1“ to „t5“)		20 ms to 5 s; switchable 0.2 to 50 s
– Jump height (potentiometers „S+“ and „S-“)		0% to 50%
– Amplitude attenuation (potentiometers „G+“ and „G-“)		0% to 110% (valid when setting the jump height from 0%)
Outputs		
– Command value signal	V	$\pm 10$ V $\pm 2\%$ ; $I_{max} = 2$ mA
– Actual value signal	V	$\pm 2.5$ V $\pm 2\%$ ; $I_{max} = 2$ mA (mV $\triangleq$ mA)
– Measuring point signal (option 5)	V	$\pm 10$ V $\pm 2\%$ ; $I_{max} = 2$ mA
– Operational	V	$> 16$ V; 50 mA (with a fault: $U < 1$ V; $R_i = 10$ k $\Omega$ )
– Controlled voltages	V	$\pm 10$ V $\pm 2\%$ ; 25 mA; short circuit-proof
– Current output stage	I	0 to 2.5 A; short circuit-proof; clocked approx. 5 kHz
– Measurement sockets		$\pm 10$ V $\pm 2\%$ ; $I_{max} = 2$ mA
Command value signal		$\pm 2.5$ V $\pm 2\%$ ; $I_{max} = 2$ mA (mV $\triangleq$ mA)
Actual value signal		$\pm 2.5$ V $\pm 2\%$ ; $I_{max} = 2$ mA (mV $\triangleq$ mA)
Clock frequency		
– WRA6	f	300–370 Hz (at 24 V $V_B$ and 0 V $V_{com.} = 370$ Hz)
– WRA10	f	180–410 Hz (at 24 V $V_B$ and 0 V $V_{com.} = 410$ Hz)
– WRZ	f	170 Hz
Connection type		48-pin blade connector, DIN 41 612, form F
Card dimensions		Eurocard 100 x 160 mm (3.93 x 6.29 in.)
Front plate dimensions		
– Height		3 HE, 128.4 mm (5.1 in.)
– Width soldered side		1 TE, 5.08 mm (0.2 in.)
– Width component side		3TE
Permissible operating temperature range	$^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	0 to 50 (32 to 122)
Storage temperature range	$^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	–25 to 85 (–13 to 185)
Weight	kg (lbs.)	0.17 (0.38) net

**Extracted from RA 29 864/06.98**

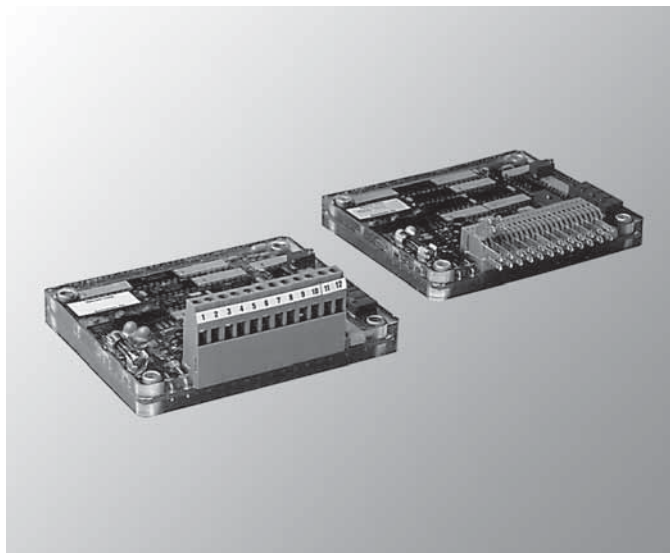
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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Mobile dual solenoid driver  
Model MDSD**

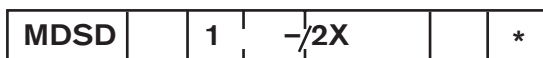
**Series 2X**

- Wide supply voltage range: 10–28 VDC
- On board, replaceable fuse
- Reverse voltage protection
- Pulse Width Modulated (PWM) outputs
- PWM frequency adjustable from 75–275 Hz
- Max. and min. current separately adjustable for both solenoids
- High current driver, regulated to within 1.0%, continuous operation
- Infinite duration short circuit protection on both outputs
- Reference voltage provided for control via an external potentiometer (>1K Ohm)
- Differential inputs for external voltage sources ( $\pm 2.5$  or  $\pm 5.0$  VDC)
- Neutral position deadband for joysticks
- Ramp time 0.2 to 10.0 sec., separately adjustable for both solenoids (A = up/down; B = up/down)
- All adjustments are made via multi-turn potentiometers
- EMI/RFI resistant
- Rugged, environmental packaging
- Temperature range: -25 to 80 °C (-13 to 176 °F)



MDSD Mobile Dual Solenoid Driver

**Ordering code**



**Mobile Dual Solenoid Driver**

**Electrical deadband**

+/- 10% neutral deadband,  
for joysticks  
No deadband  
(\*for other applications)

= No code

= 1

**Connector**

Flat tabs (standard)  
Screw terminals

= No code

= K

**Design series**

Series 20 to 29

= 20 to 29

\* **Minimum pots P5, P6 can be  
adjusted to eliminate spool overlap  
on MDSD 1 cards.**

Further details to be written in clear text

**Adjustment option for MDSD-2X/**

**0 =** All other models  
**1, 2, 3, 4 =** See preset adjustment table

**No code =** Ramp time  
0.2 – 10 sec.

**No code =** Ramp type  
A/B solenoid ramp

**Preset Adjustments**

	P1, P2	P5, P6	P3, P4	P7
<b>1 =</b>	2 sec.	700 mA	1800 mA	180 Hz
<b>2 =</b>	2 sec.	400 mA	1200 mA	100 Hz
<b>3 =</b>	2 sec.	300 mA	800 mA	180 Hz
<b>4 =</b>	2 sec.	200 mA	600 mA	100 Hz
<b>0 =</b>	don't care			

Only applies to MDSD-2X/1, MDSD-2X/2, MDSD-2X/3, and MDSD-2X/4.

**Extracted from RA 29 864/06.98**Page 2 of 2  
Issue: 01.01See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Technical data**

Power supply voltage	VDC	VDC = 10 to 28
Power requirement	W	$P = I^2_{\max} \cdot R_{\text{SOL}} \cdot 1.2$ (Refer to valve or pump data sheet for max. solenoid current and hot solenoid resistance)
Power supply current	Amp	$I = \frac{P}{\text{VDC}}$
Ramp time	sec.	0.2 to 10 (standard) 1.2 to 60 (R60) 2.4 to 120 (R120) 4.8 to 240 (R240)
Control potentiometer	KΩ	1 to 10
Pulse frequency	P7 Hz	75 to 275
Fuse – 5x20 mm fast acting	Amp	4
Ambient temperature	°C (°F)	-25 to 80 (-13 to 176)
Weight	kg (lbs.)	0.16 (0.36)

**Extracted from RE 30119/06.03**

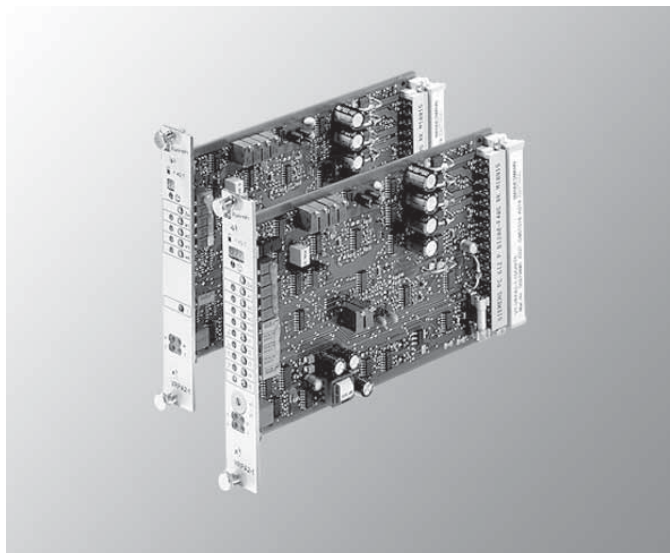
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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Analog amplifier card  
Model VT-VRPA2-.-1X/...**

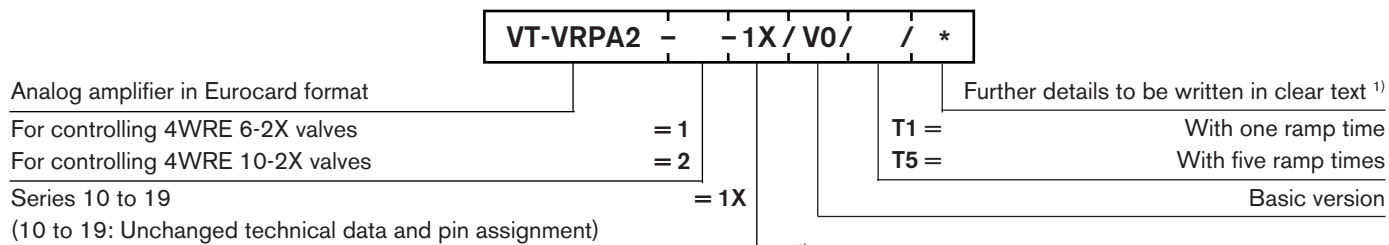
**Series 1X**

- Suitable for controlling 4WRE valves with position feedback sizes 6 and 10, series 2X
- Designed as printed circuit board in Euro-format 100 x 160 mm and suitable for installation in a rack
- Command value inputs:
  - Differential input  $\pm 10$  V
  - Four callable command value inputs  $\pm 10$  V
  - Current input 4 to 20 mA
- Inversion of the internal command value signal via 24V input or jumper
- Characteristic curve correction by means of separately adjustable step-change heights and maximum values
- Ramp time selection via quadrant recognition (24V input) or ramp time call-ups (24V inputs) (option T5)
- Changeover of ramp time range by means of jumpers
- Enable input
- "Ready for operation" output signal
- Switchable measuring socket (option T5)
- Polarity reversal protection for voltage supply
- Power supply unit with DC/DC converter without elevated zero point



Type VT-VRPA2-.-1X/...

**Ordering code**



<sup>1)</sup> Additional functions – e.g. output stage monitoring, actual value monitoring or ramp-steady signal on inquiry

**Extracted from RA 30119/06.03**

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 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Operating voltage	$V_O$	24 VDC + 40 % – 20 %
Operating range:		
– Upper limit value	$V_O(t)_{\max}$	35 V
– Lower limit value	$V_O(t)_{\min}$	18 V
Power consumption	$P_S$	< 24 VA
Current consumption	$I$	< 2 A
Fuse	$I_s$	2 A M, can be replaced
Inputs:		
– Analog		
• Command values 1 to 4 (potentiometer inputs)	$V_i$	0 to $\pm 10$ V; $R_i > 100$ k $\Omega$ (reference is M0)
• Command value 5 (differential input)	$V_i$	0 to $\pm 10$ V; $R_i > 50$ k $\Omega$
• Command value 6 (current input)	$I_i$	4 to 20 mA; load $R_i = 100$ $\Omega$
• Ramp time external	$V_i$	0 to +10 V; $R_i = 10$ k $\Omega$ (internally raised to +15 V; reference is M0)
– Digital		
• Command value call-ups	$V$	8.5 V to $V_O$ → call-up activated; $R_i > 100$ k $\Omega$
	$V$	0 to 6.5 V → no call-up; $R_i > 100$ k $\Omega$
• Ramp call-ups	$V$	8.5 V to $V_O$ → call-up activated; $R_i > 100$ k $\Omega$
	$V$	0 to 6.5 V → no call-up; $R_i > 100$ k $\Omega$
• Quadrant recognition	$V$	8.5 V to $V_O$ → ON; $R_i > 100$ k $\Omega$
	$V$	0 to 6.5 V → OFF; $R_i > 100$ k $\Omega$
• Command value inversion	$V$	8.5 V to $V_O$ → ON; $R_i > 100$ k $\Omega$
	$V$	0 to 6.5 V → OFF; $R_i > 100$ k $\Omega$
• Enable	$V$	8.5 V to $V_O$ → ON; $R_i > 100$ k $\Omega$
	$V$	0 to 6.5 V → OFF; $R_i > 100$ k $\Omega$
Adjustment ranges:		
– Zero balancing (potentiometer “Zw”)		$\pm 30$ %
– Command value (potentiometers “w1” to “w4”)		0 to 110 %
– Ramp times (potentiometers “t1” to “t5”)		20 ms to 5 s; can be changed over, 0.2 to 50 s
– Step-change height (potentiometers “S+” and “S-”)		0 % to 50 %
– Amplitude attenuator (potentiometers “G+” and “G-”)		0 % to 110 % (valid for setting of step-change height to 0 %)
Outputs:		
– Command value signal	$V$	$\pm 10$ V $\pm 2$ %; $I_{\max} = 2$ mA
– Actual value signal	$V$	$\pm 10$ V $\pm 2$ %; $I_{\max} = 2$ mA
– Measuring point signal (option 5)	$V$	$\pm 10$ V $\pm 2$ %; $I_{\max} = 2$ mA
– Ready for operation	$V$	> 16 V; 50 mA (in case of fault: $U < 1$ V; $R_i = 10$ k $\Omega$ )
– Regulated voltages	$V$	$\pm 10$ V $\pm 2$ %; 25 mA; short-circuit-proof
– Current output stages	$I$	0 to 2.5 A; short-circuit-proof; clocked ca. 5 kHz
– Oscillator	$V$	$\pm 5$ $V_{SS}$ per output; 10 mA
	$F$	5.6 kHz $\pm 10$ %
– Measuring sockets	$V$	$\pm 10$ V $\pm 2$ %; $I_{\max} = 2$ mA
Type of connection		48-pin male connector, DIN 41 612, form F
Card dimensions		Euro-card 100 x 160 mm, DIN 41 494
Front panel dimensions:		
– Height		3 HE, 128.4 mm (5.1 in.)
– Width soldering side		1 TE, 5.08 mm (0.2 in.)
– Width component side		3 TE
Permissible operating temperature range	$^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	0 to 50 (0 to 122)
Storage temperature range	$^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	– 25 to 85 (–13 to 185)
Weight	kg (lbs.)	0.17 (0.38) net

**Extracted from RE 30118/04.04**

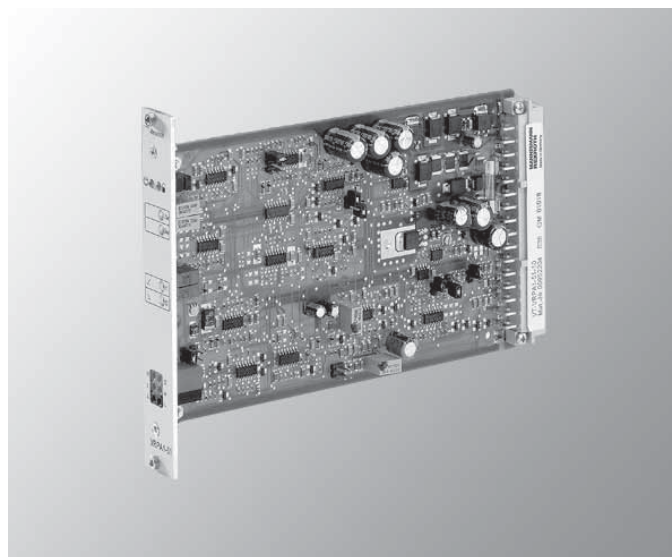
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Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Analog amplifier  
Model VT-VRPA1-100**

**Series 1X**

- Suitable for controlling direct operated proportional pressure control valves with electrical position feedback, type DBETR,
- Plug-in connections compatible with those of amplifier type VT 5003
- Power supply with raised zero point
- Command value signal inputs:
  - 0 to + 6 V; 0 to + 9 V; 0 to + 10 V
  - 0 to 20 mA; 4 to 20 mA (plug-in bridges)
- Potentiometer adjustment on the front plate for the zero point and amplitude attenuation
- Measurement sockets for the ramp time
- Enable input and "ramp off" input
- Plug-in bridges for switching the maximum ramp times 0.02 to 5 s or 0.2 to 50 s
- Outputs for command value (0 to + 6 V) and actual value (0 to - 6 V)
- LED display "operational"
- Polarity protection



VT-VRPA1-100

**Ordering code**

VT-VRPA1 - -1X / V0 / 0 / \*

Amplifier for proportional valves with electrical feedback, analog, with one output stage

Amplifier for proportional pressure valves  
DBETR-1X

**= 100**

**1X =**

Further details in clear text  
Component series 10 to 19  
(10 to 19: unchanged technical data  
and connection allocation)

When replacing the VT 5003 amplifier in a rack , a 4TE/3HE blanking plate must be ordered separately.

**Material no.: R900021004**

**Extracted from RE 30118/04.04**

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 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Operating voltage	$V_B$	24 VDC + 40 % – 5 %
Functional range		
– Upper limiting value	$V_B(t)_{\max}$	35 V
– Lower limiting value	$V_B(t)_{\min}$	22 V
Power consumption	$P_s$	< 35 W
Current consumption	$I$	< 1.5 A
Fuse	$I_s$	2.5 A T
Inputs		
– Command value 1	$V_e$	0 V to + 9 V (ref. potential is M0)
– Command value 2	$V_e$	0 V to + 6 V (ref. potential is M0)
– Command value 3 (differential input)	$V_e$	0 V to + 10 V
	or	$I_e$
	or	$I_e$
		0 mA to 20 mA ( $R_i = 100 \Omega$ )
		4 mA to 20 mA ( $R_i = 100 \Omega$ )
– Enable		
• Active	$V_F$	> 10 V
• Not active	$V_F$	< 9 V
– External ramp switch off		
• Without ramp	$V_R$	> 10 V
• With ramp	$V_R$	< 9 V
Adjustment ranges		
– Zero point “Zw”		– 5 % up to max. + 30 %
– Command value attenuation “Gw”		0 % to 105 %
– Ramp time “up”		
• Short (bridge X9 fitted)	$t_{\text{up } 1}$	< 20 ms to 5 s $\pm 20 \%$ ( $U_{t1}$ : – 0.02 V $\triangleq$ approx. 5 s; – 5 V $\triangleq$ approx. 20 ms)
• Long (bridge X8 fitted)	$t_{\text{up } 2}$	< 0.2 s to 50 s $\pm 20 \%$ ( $U_{t1}$ : – 0.02 V $\triangleq$ approx. 50 s; – 5 V $\triangleq$ approx. 0.2 s)
– Ramp time “down”		
• Short (bridge X9 fitted)	$t_{\text{down } 1}$	< 20 ms to 5 s $\pm 20 \%$ ( $U_{t2}$ : 0.02 V $\triangleq$ approx. 5 s; – 5 V $\triangleq$ approx. 20 ms)
• Long (bridge X8 fitted)	$t_{\text{down } 2}$	< 0.2 s to 50 s $\pm 20 \%$ ( $U_{t2}$ : 0.02 V $\triangleq$ approx. 50 s; – 5 V $\triangleq$ approx. 0.2 s)
Outputs		
– Output stage		
• Solenoid current/resistance	$I_{\max}$	2.2 A $\pm 10 \%$ / $R_{(20)} = 10 \Omega$ (VT-VRPA1-100)
• Clock frequency	$f$	2.2 A $\pm 10 \%$ / $R_{(20)} = 5.4 \Omega$ (VT-VRPA1-150)
– Driver for the inductive position transducer		2.2 A $\pm 10 \%$ / $R_{(20)} = 10 \Omega$ (VT-VRPA1-151)
• Oscillator frequency	$f$	Free clocking (approx. 1.5 kHz)
– Regulated voltage	$V$	2.5 kHz $\pm 10 \%$
– Measurement sockets		$\pm 9 \text{ V} \pm 1 \%$ (with a raised zero point); $\pm 25 \text{ mA}$ externally loadable
• Command value “w”	$V_w$	0 V to + 6 V ( $R_i = 1 \text{ k}\Omega$ )
• Actual value “x”	$V_x$	0 V to – 6 V ( $R_i = 1 \text{ k}\Omega$ )
• Upwards ramp “t1”	$V_{t1}$	– 0.02 V up to approx. – 5 V (delayed adjustment range)
• Downwards ramp “t2”	$V_{t2}$	0.02 V up to approx. 5 V (delayed adjustment range)
Connection type		32-pin blade connection, DIN EN 60603-2, form D
Card dimensions		Euro card 100 x 160 mm, DIN 41494
Front plate dimensions		
– Height		3 HE, 128.4 mm (5.1 in.)
– Width solder side		1 TE, 5.08 mm (0.2 in.)
– Width component side		3 TE
Permissible operating temperature range	$^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	0 to 50 (32 to 122)
Storage temperature	$^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	– 25 to 70 (–13 to 158)
Weight	kg (lbs.)	0.15 (0.33)

**Extracted from RE 29955/09.04**

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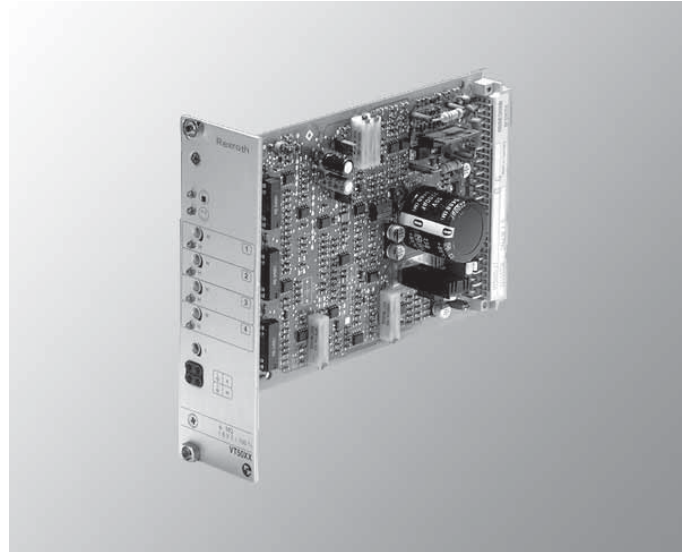
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Electrical amplifier for flow control  
with proportional valves  
Model VT 5035**

**Series 1X**

VT 5035 amplifiers are used for adjusting the flow of variable displacement pumps of types A4VSO and A4VSG (see RE 92050, RE 92076, and RE 92100).

- Differential input
- Enable input with LED indicator lamp
- "Ready for operation" signalled by LED
- Ramp generator
- Four command values that can be adjusted by means of a potentiometer; call-up is signalled by LEDs
- Controller for swivel angle
- Two clocked current output stages
- Oscillator and demodulator for inductive position measurement with cable break detection
- Reverse polarity protection for power supply



VT 5035

**Ordering code**

VT 5035 - 1X/ \*

Amplifier for the flow adjustment of A4VSO and A4VSG variable displacement axial piston pumps

Further details to be written in clear text

**1X =** Component series 10 to 19  
(10 to 19: unchanged technical data and pin allocation)



**Extracted from RE 29955/09.04**

 Page 2 of 2  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Operating voltage	$V_B$	24 VDC + 40 % – 5 %
Functional range:		
– Upper limit	$V_B(t)_{\max}$	35 V
– Lower limit	$V_B(t)_{\min}$	22 V
Power consumption		< 50 VA
Power requirement	$I$	< 2 A
Fuse	$I_S$	2.5 A T
Inputs:		
– Command value 1 to 4	$V_e$	$\pm 9$ V (reference potential is M0)
– Command value 5	$V_e$	0 to $\pm 10$ V
– Enable		
• active	$V_F$	> 8.5 V
• inactive	$V_F$	< 6.5 V
Relay data:		
– Nominal voltage	$V$	operating voltage $V_B$
– Response voltage	$V$	16.8 V
– Release voltage	$V$	2.4 V
– Coil resistance	$R$	2150 $\Omega$
Ramp time (adjustment range)	$t$	30 ms to approx. 1 s or 5 s (each $\pm 20$ %)
Outputs:		
– Output stage		
• solenoid current / resistance	$I_{\max}$	1.8 A $\pm 20$ %; $R_{(20)} = 5.4 \Omega$ , 2.2 A $\pm 20$ %; $R_{(20)} = 10 \Omega$ for pump size 500
• clock frequency	$f$	clock frequency up to approx. 1.5 kHz
– Driver for the inductive position transducer		
• oscillator frequency	$f$	2.5 kHz $\pm 10$ %
• max. loading	$I$	30 mA
• voltage amplitude (Vss)	$V_a$	5 V per output
– Regulated voltage	$V$	$\pm 9$ V $\pm 1$ %; $\pm 25$ mA externally loadable
– Measurement sockets		
• command value "w"	$V_w$	0 to 6 V (– 6 V $\cong$ +100 %; + 6 V $\cong$ –100 %); $R_i = 100 \Omega$
• actual swivel angle value "x"	$V_x$	0 to $\pm 6$ V (+ 6 V $\cong$ +100 %; – 6 V $\cong$ –100 %); $R_i = 100 \Omega$
Connection model		32-pin blade connector, DIN 41 612, form D
Card dimensions		Eurocard 3.94 x 6.3 inches (100 x 160 mm), DIN 41 494
Front plate dimensions:		
– Height		3 U, 128 mm (5.1 in.)
– Width connector side		1 HP, 5.08 mm (0.2 in.)
– Width component side		7 HP
Permissible operating temperature range	$^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	0 to 50 (32 to 122)
Storage temperature	$^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	–25 to 85 (–13 to 185)
Weight	kg (lbs.)	0.15 (0.33)

**Extracted from RE 30241/02.03**

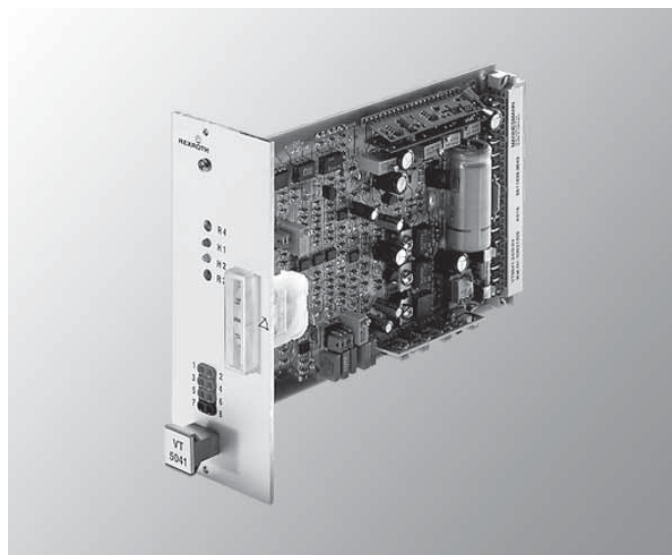
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Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**External control electronics for the DFE1  
control of A10VSO axial piston pumps  
Model VT 5041**

**Series 25**

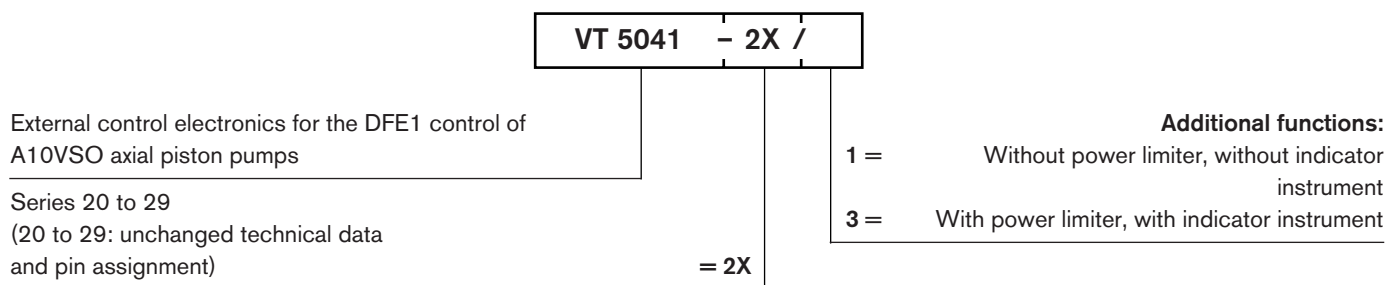
- Integral part of the SYDFE1 pressure and flow control system (series 1X and 2X) for controlling A10VSO... axial piston units with DFE1 control
- Implementation of the electronic functions of the DFE1 control; pressure and swivel angle control; optional power limiter
- Circuitry of the pressure controller can be matched to existing hydraulic fluid volumes (actuator plus lines)
- Differential amplifier inputs
- Controller for valve spool position
- Minimum value generator for pressure and swivel angle controller
- Self-locking output stage
- Pressure-related leakage compensation (can be switched off)
- Polarity reversal protection for power supply
- Switchable actual pressure value input (current, voltage, range)
- LED lamps on the front panel:
  - Error / no enable "H1"
  - Internal supply voltage "H2"



Model VT 5041-2X/.

- Indicator instrument for actual swivel angle value on the front panel (optional)
- Power limiter with internal or external command value feedforward (optional)

**Ordering code**



**Extracted from RE 30241/02.03**

 Page 2 of 2  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Operating voltage	$V_B$	24 VDC + 40 % – 10 %
Operating range:		
– Upper limit value	$v_B(t)_{\max}$	35 V
– Lower limit value	$v_B(t)_{\min}$	21 V
Power consumption	$P_S$	35 VA
Current consumption	$I_{\text{nom}}$	0.6 A ( $I_{\max} = 1.25$ A)
Fuse	$I_F$	1.6 A T
Inputs:		
– Command values (pressure, swivel angle)	$V_i$	0 to 10 V; $R_e = 100$ k $\Omega$
– Actual value (pressure)	$V_i$	0 to 5 V or 0 to 10 V; $R_e = 100$ k $\Omega$
	$I_i$	0 to 20 mA or 4 to 20 mA; $R_e = 500$ $\Omega$
– Power selection ( $p \cdot a$ ) <sub>comm</sub> (only with VT 5041-2X/3...)	$V_i$	0 to 10 V; $R_e > 100$ k $\Omega$
– Enable	$V_e$	> 21 V (use relay with contact for currents < 10 mA)
Outputs:		
– Output stage		
• Solenoid current / resistance	$I_{\max}$	2.5 A; $R_{(20)} = 2$ $\Omega$
– Drivers for inductive transducers:		
• Oscillator frequency	$f$	ca. 5 kHz
• Voltage amplitude ( $U_{SS}$ )	$V_a$	10 V
– Signal voltages		
• Actual value (pressure, swivel angle)	$V$	0 to 10 V
• Swivel angle control active	$V$	$U_b - 1$ V
• Power limiter active (only with VT 5041-2X/3...)	$V$	$U_b - 1$ V
– Auxiliary voltages	$V$	$\pm 15$ V $\pm 3$ %; 10 mA
– Error signal		
• L-active	$V_o$	$\geq V_B - 5$ V; 10 mA (short-circuit-proof); error at $V_o < 1$ V
• H-active	$V_o$	$< 1$ V; error at $\geq V_B - 5$ V; 10 mA
– Measuring sockets		
• Pressure command value ( $p_{\text{comm}}$ ) "1"	$V$	+ 10 V = 100 %
• Actual pressure value ( $p_{\text{act}}$ ) "2"	$V$	+ 10 V = 100 %
• Swivel angle command value ( $a_{\text{comm}}$ ) "3"	$V$	- 10 V = 100 %
• Actual swivel angle value ( $a_{\text{act}}$ ) "4"	$V$	+ 10 V = 100 %
• Spool position command value ( $s_{\text{comm}}$ ) "5"	$V$	$\pm 10$ V = $\pm 100$ %
• Actual spool position value ( $s_{\text{act}}$ ) "6"	$V$	$\pm 10$ V = $\pm 100$ %
Type of transducer:		
– for pump		IW 9 (throttle circuit; $\pm 4$ mm; 3-wire connection)
– for valve		DM2 (transformer circuit; $\pm 0.6$ mm; 4-wire connection)
Type of connection		32-pin male connector, DIN 41 612, form D
Card dimensions		Euro-card 100 x 160 mm, DIN 41 494
Front panel dimensions:		
– Height		3 HE, 128.4 mm (5.1 in.)
– Width circuit board conductor side		1 TE
– Width component side		
• VT 5041-2X/1...		5 TE
• VT 5041-2X/3...		9 TE

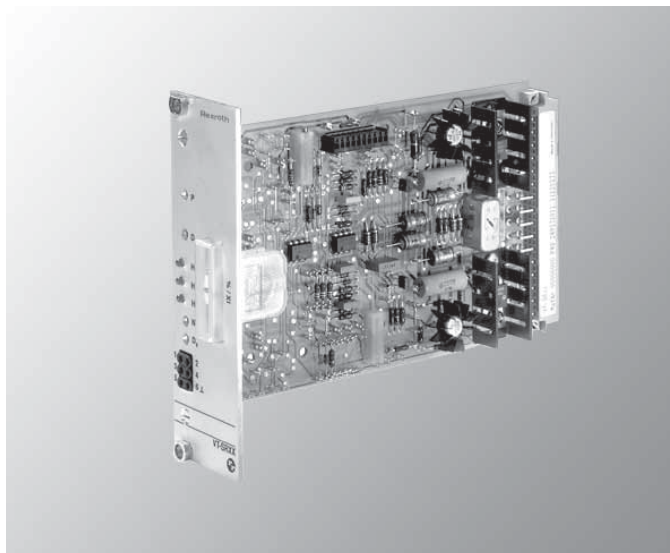
**Extracted from RE 29980/02.03**

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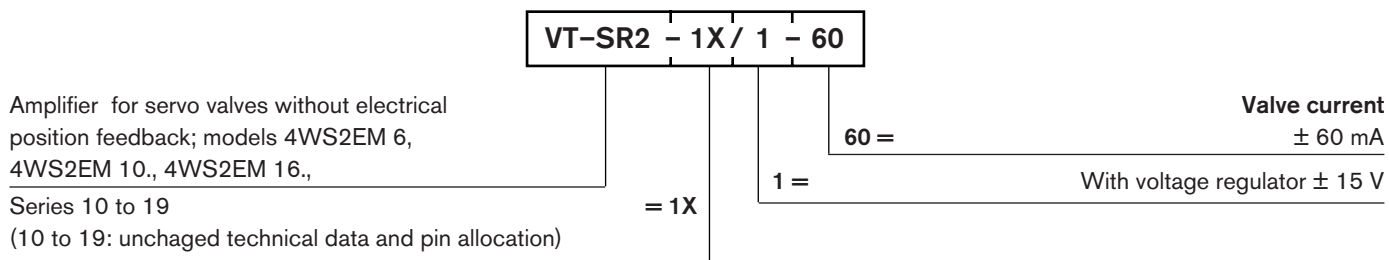
 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Electrical amplifier for the control  
 of servo valves without electrical  
 position feedback  
 Model VT-SR2**
**Series 1X**

- Suitable for controlling single and two-stage servo-valves without electrical position feedback (types 4WS2EM 6, 4WS2EM 10., 4WS2EM 16)
- Regulator for valve current
- Dither signal generator
- Push-pull output stage
- Enable circuit with relay
- Measuring instrument for displaying servo-valve current
- Reverse polarity protection for voltage supply
- Optional extensions:
  - PID-controller<sup>1)</sup> with controller changeover
  - Relay with potential-free changeover contact (28 V / 2 A)



VT-SR2-1X/...

**Ordering code**


**Extracted from RA 29980/02.03**

 Page 2 of 2  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Operating voltages:		
<b>With</b> voltage regulator	VDC	±24 VDC
– Upper limit	$V_o(t)_{\max}$	±28 VDC
– Lower limit	$V_o(t)_{\min}$	±22 VDC
<b>Without</b> voltage regulator	$V_o; V_M$	±24 VDC; ±15,0 VDC
– Upper limits	$V_o(t)_{\max}; V_M(t)_{\max}$	±28 VDC; ±15,2 VDC
– Lower limits	$V_o(t)_{\min}; V_M(t)_{\min}$	±22 VDC; ±14,8 VDC
Power consumption (without valve) at $V_o = \pm 24 \text{ V}^1$	I	<150 mA
Inputs:		
– Command signal 1 (main spool position)	$V_e$	0 to ±10 V ( $R_i = 50 \text{ k}\Omega$ )
– Command signal 2 (main spool position) with J9	$V_e$	0 to ±10 V ( $R_i = 50 \text{ k}\Omega$ )
– Enable	$V_e$	+24 V with J13; 0 V with J12 ( $R_i = 700 \Omega$ ; relay circuit)
– Changeover of controller	$V_e$	+24 V with J13; 0 V with J12 ( $R_i = 700 \Omega$ ; relay circuit)
– Reserved relay	$V_e$	+24 V with J13; 0 V with J12 ( $R_i = 700 \Omega$ ; relay circuit)
Outputs:		
– Regulated output voltage <sup>1)</sup>	$V_M$	±15 V ± 2%; 150 mA
– Valve current	$I_{\max}$	±60 mA
– Valve current command value (with J10)	$V_a$	–10 V $\triangleq$ + 60 mA (measuring output)
– Relay selection voltage	V	+24 V (+ $V_o$ )
Dither signal	f	340 Hz ± 5% (ISS = 3 mA)
Relay data:		
– Nominal voltage	V	+26 V
– Response voltage	V	>13 V
– Release voltage	V	1.3 V to 6.5 V
– Switching time	t	<4 ms
– Coil resistance (at 25 °C [77 °F])	R	700 $\Omega$
Connection type		32 pin terminal connector, DIN 41 612, form D
Card dimensions		Euro card 100 x 160 mm, DIN 41 494
Front panel dimensions:		
– Height		3 HE, 128.4 mm (5.1 in.)
– Width soldering side		1 TE, 5.08 mm (0.2 in.)
– Width component side		7 TE
Permissible ambient temperature range	°C (°F)	0 to 50 (32 to 122)
Storage temperature range	°C (°F)	–20 to 70 (–4 to 158)
Weight	kg (lbs.)	0.19 (0.44)

<sup>1)</sup> Only for version **with** voltage regulator

**Extracted from Catalog AKY 013/4**

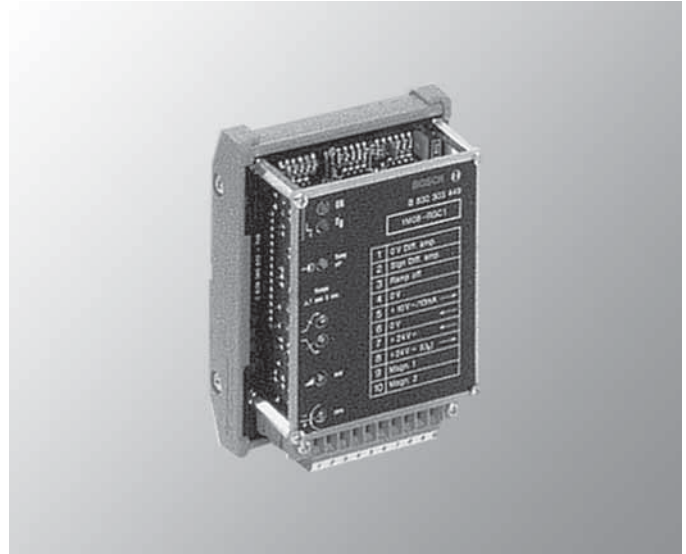
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Issue: 04.03

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.


**Auxiliary cards & accessories**

The following auxiliary cards can be used with an on-board electronic valve or with a valve and amplifier combination. Several cards provide closed loop control and others provide set point generation. These auxiliary cards come in two forms:

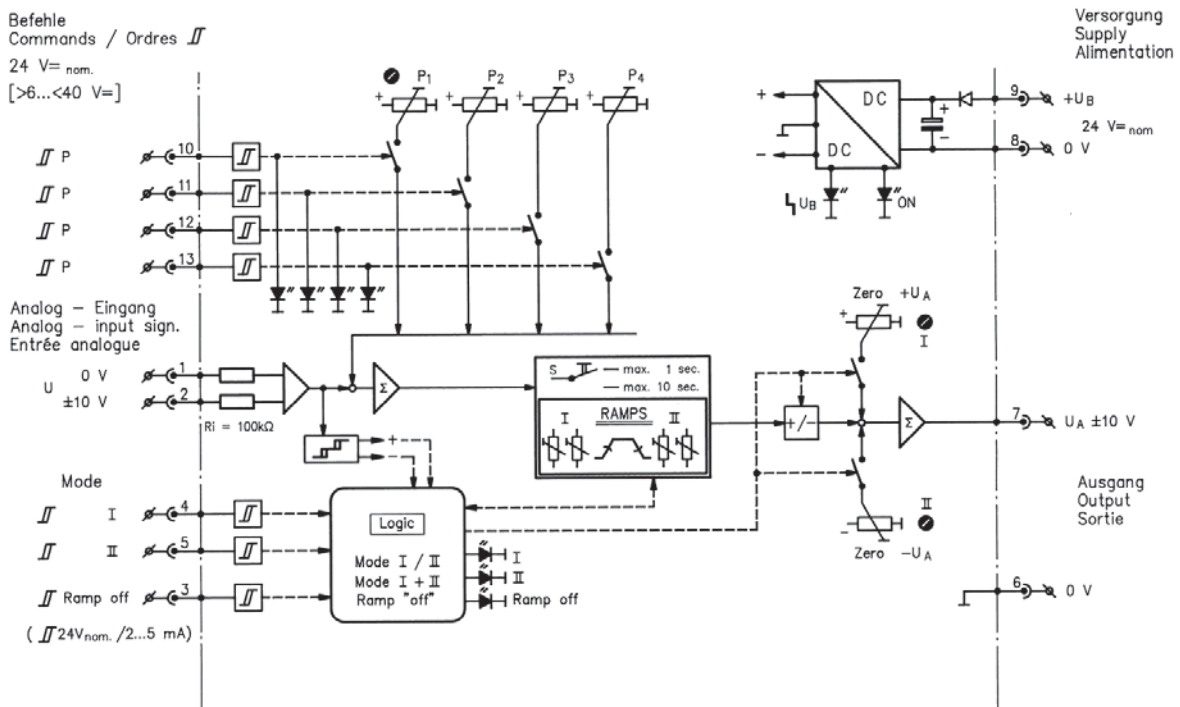
- Euro-card (requires card holder)
- DIN module (mounts on standard DIN rail)



**Technical data**

	Model	Description	Material Number
	VT-SWMA3-5-1X/V0/0	POTM-RAMP	081 1405108

<sup>1)</sup> See catalog #AKY 013/4 for complete description and performance specifications.



**Extracted from RE 30058/03.04**

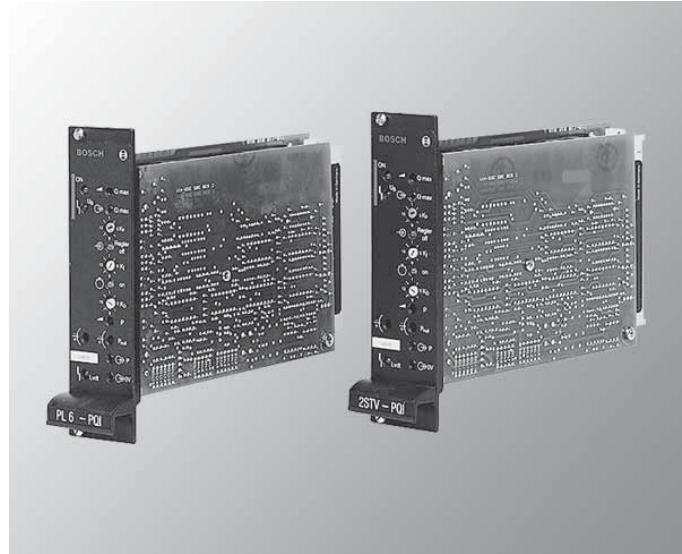
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Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**p/Q Amplifiers  
Model VT-VARAP1**

**Series 2X**

- Suitable for actuating directly operated and pilot operated servo solenoid valves
- Analog amplifiers in Eurocard format for installation in 19" rack
- Output stage with closed-loop control
- Rapid energizing and de-energizing for fast response times
- Enabling input
- Short-circuit-proof outputs
- External control shutoff
- Open-circuit detection for feedback signal cable and pressure sensor
- Suitable for pressure sensors (1...6-V, 0...10-V, 4...20 mA)
- Closed-loop position control with PID action
- Material numbers: 0811405152  
0811405153



VA-VARAP1

**Ordering code**



Hydraulic component  
(actuation)

Axis control

= A

Valve type

Servo solenoid valve

= R

Actuation

Analog

= A

Function

p/Q control

= P

Output stages

1 output stage

= 1

**Customer version**  
Catalog version

V0 =

**Series**

Series 20 to 29

2X =

**Serial numbers for types**

527 =

2.7 A solenoid

537 =





3.7 A solenoid

### Extracted from RE 30058/03.04

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Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data

P.C.B. format	(100 x 160 x approx. 35) mm (B x L x H) Europe format with front panel (7 modular spacings)	
Plug connector	Connector DIN 41612 – F 32	
Weight <i>m</i>	0.25 kg (0.6 lbs.)	
Power supply $V_B$ to z-2 – b-2	24 V DC Battery voltage 21...40 V Rectified AC voltage $V_{eff} = 21...28$ V (single-phase, full-wave rectification)	
Smoothing capacitor, separately to b-4, z-4	4700 $\mu$ F/63 V DC, only required if $V_B$ ripple >10-%	
Valve solenoid A/VA max.	<b>2.7/40 (NG 6)</b>	<b>3.7/60 (NG 10)</b>
Current rating	1.7 A	2.7 A
	The current rating can rise at min. $V_B$ and long cable length to control solenoid	
Power consumption (typical)	37 W	55 W
Input signal (setpoint <i>Q</i> )	b 20: 0...±10 V } Difference amplifier z 20: 0...±10 V } ( $R_i = 100$ k $\Omega$ )	
Input signal (setpoint <i>p</i> )	z 12: 0...10 V } Difference amplifier z 10: 0 V }	
Feedback signal from pressure sensor	z 14: 4...20 mA current input b 16: 0...+10 V/-1...+6 V voltage input b 18: 0 V reference	
Pressure control OFF	b 10: 6...40 V DC	
External scanning of controller	z 24: 24 V/0.1 A max.	
Limit frequency	For applications $\leq 30$ Hz	
Signal source	Potentiometer 10 k $\Omega$ , $\pm 10$ V supply from b 32, z 32 (10 mA) or external signal source	
Output stage enable	To z 16, $V = 8.5...40$ V, $R_i = 100$ k $\Omega$ , LED (green) on front panel lights up	
Sensor power supply	z 6: +15 V/35 mA, $R_i \sim 25$ $\Omega$	
Position transducer	Power supply	b 30: -15 V/25 mA; z 30: +15 V/35 mA
	Pilot stage signal	b 22: 0 ... $\pm 10$ V, $R_L > 10$ k $\Omega$ /ref. b 24
	Main stage signal	b 26: 0 ... $\pm 10$ V, $R_L > 10$ k $\Omega$ /ref. b 28
Solenoid output b 6 – b 8	Clacked current regulator $I_{max.} = 2.7$ A <span style="float: right;"><math>I_{max.} = 3.7</math> A</span>	
Length of amplifier to valve cables	Solenoid cable: up to 20 m 1.5 mm <sup>2</sup> 20 up to 60 m 2.5 mm <sup>2</sup> Position transducer: 4 x 0.5 mm <sup>2</sup> (shielded) Pressure sensor: 4 x 0.5 mm <sup>2</sup> (shielded)	
LED displays	Green: Enable <span style="float: right;"><math>V_B</math> ON</span> Yellow: Position transducer open circuit  Red: Supply voltage too low  Yellow: Pressure control OFF  Yellow: Pressure control working  Both yellow LED's flashing: Pressure sensor open circuit	
Special features	Open-circuit protection for feedback signal cable and pressure sensor Closed-loop position control with PID action Clacked output stage Rapid energizing and de-energizing for fast response times Short-circuit-proof outputs External control shutoff	
Error signal – Position transducer open circuit – $V_B$ too low – $\pm 15$ V stabilization	z 22: No fault: + $V_K$ ; max. 100-mA Fault: 0-V	

**Note:** Connect power zero b 2 and control zero b 12, b 14 or z 28 separately to central ground (neutral point).



**Extracted from RE 30134/05.04**

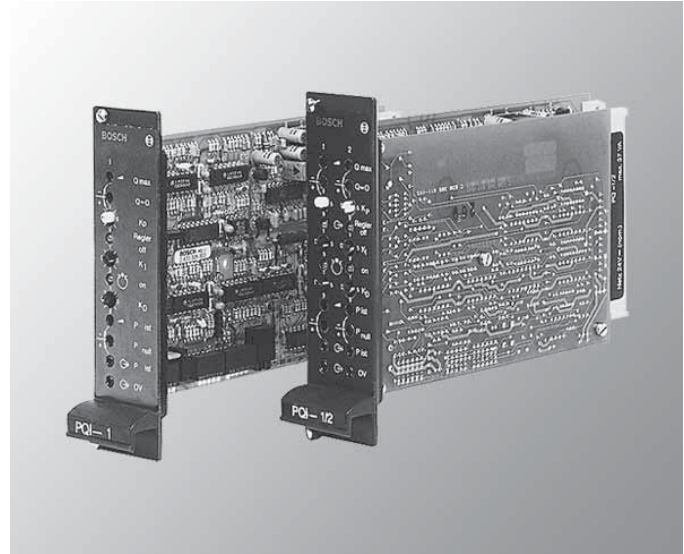
Page 1 of 2  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**p/Q Controller  
Model VT-VACAP**

**Series 2X**

- Analog amplifiers in Europe card format for installation in 19" rack
- Suitable for servo solenoid valves with on-board electronics
- Closed-loop position control with PID action
- Short-circuit-proof outputs
- External deactivation for pressure controller
- Suitable for pressure sensors (1...6-V, 0...10-V, 4...20 mA)
- Supply for pressure sensors
- Detection of open circuit to pressure sensors
- Material number: 0811405157



VT-VACAP

**Ordering code**

**VT- V A C A P - 500 - 2X / V0**

Hydraulic component  
(actuation)  
Axis control  
Valve type  
Controller  
Actuation  
Analog  
Function  
p/Q control

= A

= C

= A

= P

V0 =

2X =

500 =

**Customer version**  
Catalog version

**Series**

Series 20 to 29

**Serial numbers for types**  
Standard version without valve  
amplifier function

**Extracted from RE 30134/05.04**

 Page 2 of 2  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

PCB format	(100 x 160 x approx. 35) mm (W x L x H), Europe format with front plate (7 modular spacings)	
Plug connection	Connector DIN 41612-F32	
Power supply $V_B$ at z2–b2	24 V DC nominal Battery voltage 21...40 V Rectified AC voltage $V_{\text{eff}} = 21...28$ V (single phase, full-wave rectification)	
Smoothing capacitor at z4–b2	4700 $\mu\text{F}/63$ V DC, only if ripple $V_B > 10\%$	
Current rating	0-811-405-157 max. 160 mA (1 channel)	
	0-811-405-158 max. 220 mA (2 channel)	
	<b>Basis card</b> (1 channel)	<b>Daughter card</b> (2 channel)
Pressure sensor (1-...-6 V/0-...-10 V)	b26 – ref. b28	b16 – ref. b18
Pressure sensor (4-...-20 mA)	b24 – ref. b28	z14 – ref. b18
Pressure sensor supply – V	z6 (+15 V)/b8 (0 V)	
Pressure setpoint (0-...-10) V	b12/b14 (0 V)	z12/z10 (0 V)
External controller deactivation	z28: 6-...-40 V DC	b10: 6-...-40 V DC
External controller readout	z26: 24 V DC, max. 20 mA	z24: 24 V DC, max. 20 mA
Monitor signal $p_{\text{actual}}$	z16: 0-...-10 V DC	z18: 0-...-10 V DC
External channel selection mode	z30: 6-...-40 V DC	
Flow setpoint	z22: 0-...- $\pm 10$ V DC	z20: 0-...- $\pm 10$ V DC
	b22: 0 V	b22: 0 V
Potentiometer supply	z32: +10 V, max. 10 mA	
Output	$V_{A_i}$ ; b4/b8 (0 V): 0 ... $\pm 10$ V Load $R_L > 1$ k $\Omega$	$V_{A_{II}}$ ; b6/b8 (0 V): 0 ... $\pm 10$ V Load $R_L > 1$ k $\Omega$
Cable: Pressure sensor Valve PLC signals	4 x 0.5 mm <sup>2</sup> (shielded) 5 x 0.5 mm <sup>2</sup> (shielded) 0.5 mm <sup>2</sup> (shielded)	
LED displays/channel	Pressure controller OFF Controller operating Open circuit to pressure sensor (both above-mentioned LED's flash)	
Special features	Monitoring for open circuit to pressure sensor Test connections for major parameters External deactivation of pressure controller External channel selection mode For use with various pressure sensors	



**Extracted from RE 30050/03.04**

 Page 2 of 2  
 Issue: 06.04

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Format/design		(86 x 110 x 95) mm/module
Fastening/connection		DIN rail/connector + terminals
Power supply (8), (9)		$V_B = 24 V_{nom/batt.}$ : 21 ... 40 V DC Single-phase full wave: 21 ... 28 V DCeff
Current rating		Max. 200 mA
Signal input (1), (2)	VT-MACAS-500-10/V0	$V_{set}$ : $\pm 10$ V, difference amplifier $R_i = 100$ k $\Omega$
Feedback signal (3), (4)	VT-MACAS-500-10/V0	$V_{feed}$ : $\pm 10$ V, difference amplifier $R_i = 100$ k $\Omega$
Valve signal (5), (6), (7)		$V_V = \pm 10$ V (max. 10 mA) or $I_V = 4 ... 20$ mA (average 12 mA)
Deadband compensation		Can be deactivated, effective in a range of $\pm 4$ %
Enable signal (10)		8.5 ... 40 V DC
Fault signal (11)		No fault: $24 V_{nom}$ ( $V_B$ ) max. 50 mA Fault: $< 2$ V
IN POS signal (12)		IN POS: $24 V_{nom}$ ( $V_B$ ) max. 50 mA Not IN POS: $< 2$ V
Ramp ranges		I: 0.1 ... 1 s II: 1 ... 10 s
Area ratio adjustment $A_K:A_R$		Min. 1:1; max. 1:4
Feedback signal adjustment		Zero: $-5 ... 10$ % Gain: $50 ... 110$ %
Type of controller		Position: PT <sub>1</sub> Velocity: PI
Valve zero		$\pm 5$ %
Special features		<ul style="list-style-type: none"> <li>– Module can be switched from position to velocity control</li> <li>– Position window can be switched over</li> <li>– Measurement taps on front panel</li> <li>– Short-circuit-proof interfaces</li> </ul>

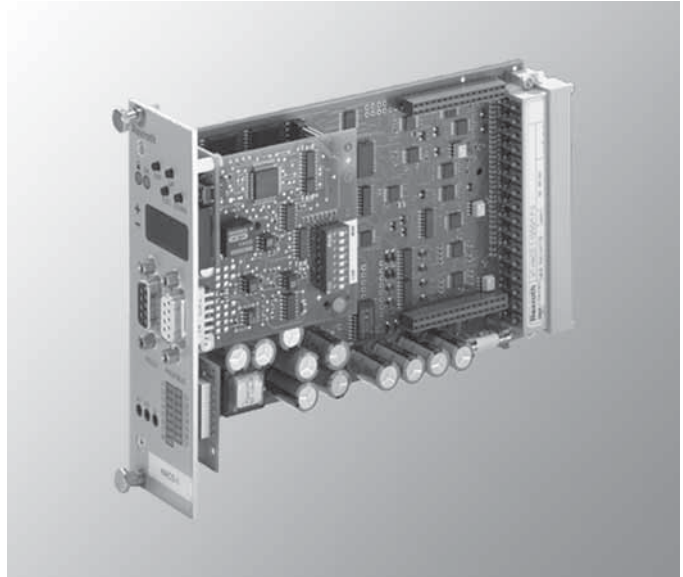
**Extracted from RE 30143/05.05**

Page 1 of 3  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

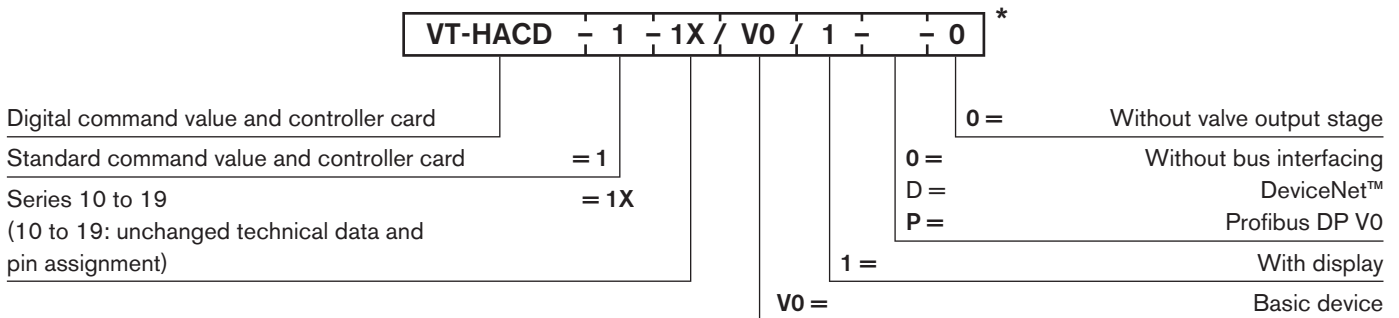
**Digital command value  
and controller card  
Model VT-HACD-1**

Series 1X



Model VT-HACD-1

**Ordering code**



\* Kit includes CD-ROM with BODAC software

**Extracted from RE 30143/05.05**

 Page 2 of 3  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Operating voltage	$V_O$	24 VDC + 40 % – 10 %
Operating range:		
– Upper limit value	$v_O(t)_{\max}$	35 V
– Lower limit value	$v_O(t)_{\min}$	21 V
Current consumption	$I_{\max}$	Stand-by current consumption 250 mA
Fuse	$I_F$	4 AT
Digital inputs	Signal	log 0 = 0 to 5 V log 1 = 15 V to $V_O$
Digital outputs	Signal	log 0 = 0 to 5 V log 1 = 15 V to ( $V_O - 3$ V) $I_{\max} = 30$ mA
Analogue inputs A1...6		
Configuration as voltage input		
Range	$V$	0 to 10 V or $\pm 10$ V (can be configured)
Input resistance	$R_i$	100 k $\Omega$ , > 10 M $\Omega$ for input AI 3
Resolution		5 mV for range $\pm 10$ V 2,5 mV for range 0...10
Non-linearity		< 10 mV
Configuration as current input		
Range	$I$	0...20 mA or 4...20 mA (can be configured)
Input resistance	$R_e$	100 $\Omega$
Power loss		0.15 % (at 500 $\Omega$ between pin AI x – and 0 V)
Resolution		5 $\mu$ A
Analogue outputs		
AO 1 configuration as voltage output		
Output voltage	$V$	0 ... 10V or $\pm 10$ V (can be configured)
Output current	$I_{\max}$	20 mA
Load	$R_{\min}$	500 $\Omega$
Resolution		1.25 mV (14 bits)
Residual ripple content		$\pm 15$ mV (without noise)
AO 1 configuration as current output		
Output current	$I$	0...20 mA or 4...20 mA (can be configured)
Load	$R_{\max}$	500 $\Omega$
Resolution		1.25 $\mu$ A
Residual ripple content		$\pm 15$ $\mu$ A (without noise)
AO 2 / AO 3		
Output voltage	$V$	$\pm 10$ V
Output current	$I_{\max}$	10 mA
Load	$R_{\min}$	1 k $\Omega$
Resolution		10 mV (11 bits)
Residual ripple content		$\pm 25$ mV (without noise)
Reference voltage	$V$	$\pm 10$ V
	$I_{\max}$	30 mA
Residual ripple content		< 20 mV

**Extracted from RE 30143/05.05**

 Page 3 of 3  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data (cont.)**

Scanning time	$t$	2 ms
Serial interface		RS 232 (front panel), D-Sub socket
Type of connection		64-pin male connector, DIN 41612, form G
Card dimensions		Euro-card 100 x 160 mm, DIN 41494
Front panel dimensions:		
– Height		3 HE, 128.4 mm (5.1 in.)
– Width soldering side		1 TE, 5.08 mm (0.2 in.)
– Width component side		7 TE
Permissible operating temperature range	°C (°F)	0 to 50 (32 to 122)
Storage temperature range	°C (°F)	–20 to 70 (–4 to 158)
Weight	kg (lbs.)	0.2 (0.4)

**Note:** For details with regard to **environment simulation testing** in the fields of EMC (electromagnetic compatibility), climate and stress, see RE 30143-U (declaration on environmental compatibility).

**Pin assignment of male connector**

Pin	Row z	Row b	Row d	Row f
2	n.c.	Analogue input AI 3 +	Digital input DI 1	Digital output DO 7
4	n.c.	Analogue input AI 3 –	Digital input DI 2	SSI clock +
6	n.c.	Analogue input AI 2 + <sup>1)</sup>	Digital input DI 3	SSI clock –
8	n.c.	Analogue input AI 2 – <sup>1)</sup>	Digital input DI 4	SSI data +; Inc Ua1
10	Shield	Analogue input AI 1 + <sup>3)</sup>	Digital input DI 5	SSI data –; Inc /Ua1
12	n.c.	Analogue input AI 1 – <sup>3)</sup>	Digital input DI 6	Inc Ua2
14	n.c.	Analogue input AI 4 + <sup>1)</sup>	Digital input DI 7	Inc /Ua2
16	n.c.	Analogue input AI 4 – <sup>1)</sup>	Digital input DI 8	Inc Ua0
18	n.c.	Analogue input AI 5 + <sup>1)</sup>	Enable	Inc /Ua0
20	System ground	Analogue input AI 5 – <sup>1)</sup>	Digital output DO 1	n.c.
22	Digital output DO 3	Analogue input AI 6 + <sup>1)</sup>	OK	n.c.
24	Digital output DO 4	Analogue input AI 6 – <sup>1)</sup>	n.c.	n.c.
26	Digital output DO 5	Analogue output AO 3, ±10V	Digital output DO 2	n.c.
28	Digital output DO 6	Analogue GND <sup>4)</sup>	n.c.	n.c.
30	$U_O$ : +24 V	–10 V	Analogue output AO 1 <sup>2)</sup>	n.c.
32	L0: 0 V	+10 V	Analogue output AO 2, ±10V	n.c.

<sup>1)</sup> Inputs AI 2, 4, 5 and 6 can be set to 0...10 V, ±10 V, 0...20 mA or 4...20 mA by means of software.

n.c. ... not assigned in the basic version, but reserved for extensions.

<sup>2)</sup> Output AO 1 can be set to 0...10 V, ±10 V, 0...20 mA or 4...20 mA by means of software.

<sup>3)</sup> This input has an input resistance  $R_i > 10 \text{ M}\Omega$

<sup>4)</sup> Reference potential for AO 1, AO 2, AO 3, +10 V and –10 V

### Extracted from RA 30 916/07.05

Page 1 of 1  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

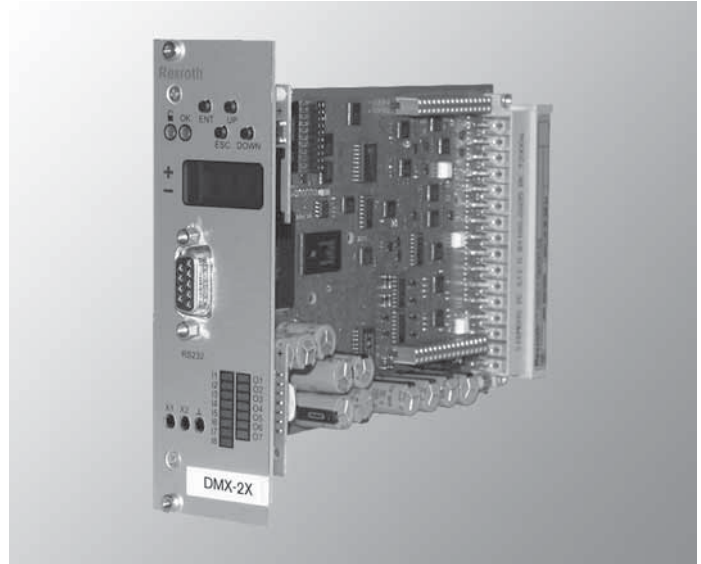
## Digital controller for position and pressure/force control Model DMX

### Series 2X

- Absolute digital input for 24-bit SSD position transducer
  - High resolution input for analog position transducer
  - Accepts 2 pressure transducers or load cell as force feedback
  - Fine Positioning integration for superior accuracy
  - Analog input for external velocity control
  - Active Damping for low natural frequency systems
  - Gain matching for a differential area cylinder
  - Internal tables of stored command values
  - 4–20 mA, 10 V, or  $\pm 10$  V options for most analog inputs
  - Range checking on analog inputs
  - Outputs  $\pm 10$  Vdc or 4–20 mA to valve amplifier
  - Multifunction analog output to monitor control values
  - Program accessible by pushbuttons with front display
  - WinHost software included for setup and commissioning
  - RS232 communication ports
  - Allen Bradley SLC communication interface
  - Password protection available
  - 24 Vdc powered digital platform
  - Optimizes hydraulic axis for closed loop control
  - Achievable position accuracy of  $\pm 0.05\%$  with analog feedback,  $< 0.001$  in ( $< 25 \mu\text{m}$ ) with SSD\*
  - Achievable steady state, pressure accuracy of  $\pm 0.1\%$ \*
- \* (typical, but not guaranteed)

### Ordering code

	DMX	2X	0
<b>Digital Controller for Position and Pressure Regulation</b>			
<b>Series</b> (20 to 29 externally interchangeable)			
<b>Valve Type</b> Valve type selected by user See DMX Setup Instructions to select valve codes			= 0



Model DMX-2X

### Technical data

<b>Power supply voltage:</b>	$V_{DC}$	21 V to 35 V
<b>Power requirement:</b> (additional power for sensors)	P	8 W
<b>Digital position transducer:</b>		SSD 24-bit a gray code increasing
<b>Analog inputs and outputs:</b>	$V_{IN}$	0 V to 10 V 0 to $\pm 10$ V I/O 4 to 20 mA
* current not available on all		
<b>Input impedance (analog inputs):</b>		
Voltage inputs	$R_{IN}$	200 k $\Omega$ or higher
Current inputs		100 $\Omega$
<b>Minimum load (analog outputs):</b>		
$\pm 10$ V	$R_L$	1 k $\Omega \pm 10$ V
4–20 mA		500 $\Omega$ 4–20 mA
<b>Discrete input voltage:</b>		
log 0 (high)		10 V to 35 V
log 1 (low)		$< 5$ V
<b>Input impedance (discrete inputs):</b>	$R_D$	1 k $\Omega$
<b>Discrete input voltage:</b>		10 V to 35 V ( $V_{DC}$ )
<b>Minimum load (discrete outputs):</b>	$R_L$	500 $\Omega$ (50 mA)
<b>Internal reference voltage:</b>	$V_{REF}$	+10 Vdc, –10 Vdc
<b>Minimum load on <math>\pm 10</math> V:</b> from card $\pm 10$ V @ $\pm 30$ mA	$R_L$	400 $\Omega$
<b>Serial interface:</b>		RS232
<b>Fuse (5 mm x 20 mm):</b>		4 A
<b>Connector type: (DIN 41494, type G)</b>		64-pin, rows z, b, d, f
<b>Card dimension: (DIN 41494)</b>		Eurocard, 100 x 160mm
<b>Space requirements:</b>		
Height	3U	5.05 in. (128 mm)
Conductor side		1 division 0.20" (5.08 mm)
Component side	8HP	7 divisions
Face plate		8 divisions
<b>Ambient temperature range:</b>	T	32 to 122 $^{\circ}$ F (–20 to 70 $^{\circ}$ C)
<b>Storage temperature:</b>	T	–4 to 158 $^{\circ}$ F (–20 to 70 $^{\circ}$ C)
<b>Weight:</b>		0.6 lb (0.27 kg)



**Extracted from RE 29902/02.03**

Page 1 of 2  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Analog command value module  
Model VT-SWMA-1**

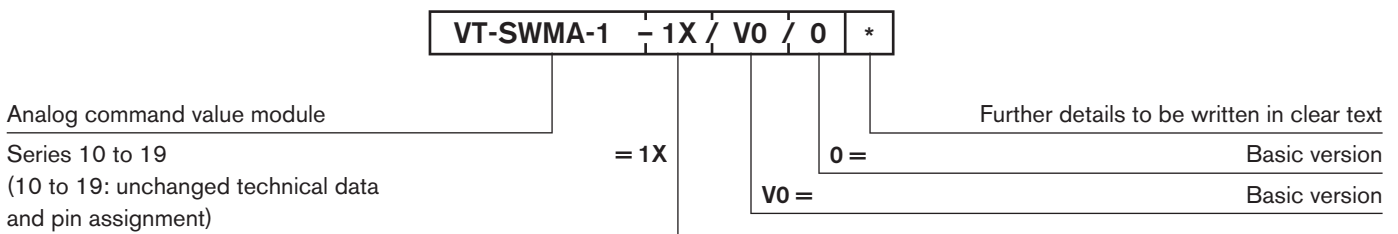
**Series 1X**

- Suitable for the control of valves with integrated electronics
- Possibility of realizing basic hydraulic functions via digital controlling
- Adjustment elements:
  - 1 potentiometer for zero point adjustment (command value offset)
  - 1 potentiometer for command value attenuation (for differential input)
  - 4 potentiometers for command value presets
  - 5 potentiometers for ramp time adjustment
- LED displays: Command value call-up (4 x)
  - Active ramp time (4 x)
  - Quadrant recognition
  - Polarity reversal
  - Power indication
- Measurement socket for command value and ramp time
- Differential input
- 4 call-up possibilities for each command value and ramp time
- Ramp generator with 5 ramp times; 4 quadrant recognition
- Control signal output
- Power supply without raised zero point
- Without power part



Model VT-SWMA-1

**Ordering code**



**Extracted from RE 29902/05.00**

Page 2 of 2

Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Operating voltage	$V_O$	24 VDC + 40 % – 10 %
Operating range:	$v_O(t)_{max}$	35 V
– Upper limit value	$v_O(t)_{min}$	18 V
– Lower limit value		
Power consumption	$P_S$	12 VA
Current consumption	$I_{max}$	0.5 A
Fuse		Thermal overload protection (reactivation when temperature falls below threshold)
Inputs		
– Command value (differential input with attenuator)	$V_i$	0 to $\pm 10$ V; $R_i > 50$ k $\Omega$
– Quadrant operation “4-Q”		
• active	$V_{4-Q}$	8.5 V to 35 V; $R_i > 50$ k $\Omega$
• inactive	$V_{4-Q}$	0 to 6.5 V
– Command value inversion “Inv”		
• active	$V_{Inv}$	8.5 V to 35 V; $R_i > 50$ k $\Omega$
• inactive	$V_{Inv}$	0 to 6.5 V
– Command value call-ups 1 to 4		
• active	$V$	8.5 V to 35 V; $R_i > 50$ k $\Omega$
• inactive	$V$	0 to 6.5 V
Adjustment ranges:		
– Zero balancing (potentiometer “Z”)		$\pm 30$ %
– Amplitude attenuator (potentiometer “G”)		0 % to ca. 110 %
– Command values (potentiometers “w1” to “w4”)		0 % to ca. 110 % (factory setting 100 %)
– Ramp times (potentiometers “t1” to “t5”)		20 ms to 5 s
Outputs:		
– Control variable	$V$	0 to $\pm 10$ V; $\pm 2$ mA; $R_L > 5$ k $\Omega$
– Measuring socket for control variable “w”	$V_w$	0 to $\pm 10$ V (+ 100 % $\cong$ + 10 V; – 100 % $\cong$ – 10 V)
– Measuring socket for ramp time “t”	$V_t$	0.01 V to + 10 V ( $t_{min} = 10$ V $\cong$ ca. 10 ms; $t_{max} = 0.01$ V $\cong$ ca. 10 s)
Type of connection		12 screw terminals
Type of mounting		Carrier rail NS 35/7.5 to DIN 50 022
Type of protection		IP 20 to DIN 40 050
Dimensions (W x H x D)		40 x 79 x 85.5 mm
Permissible operating temperature range	$^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	0 to 50 (0 to 122)
Storage temperature range	$^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	–25 to 85 (4 to 185)
Weight	kg (lbs.)	0.13 (0.29)

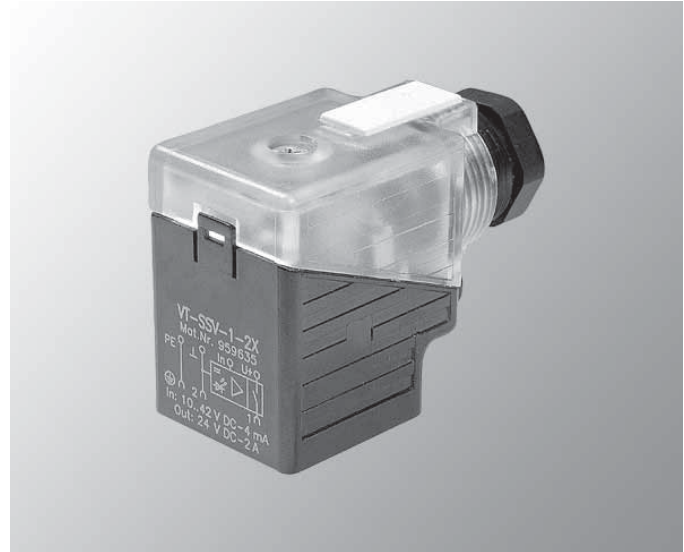
**Extracted from RE 30262/07.99**

 Page 1 of 1  
 Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Plug-in switching amplifier  
 Model VT-SSV-1**
**Series 2X**

- Suitable for control of switching valves with direct current solenoid operation through signals with low control power
- Activation can be carried out direct with the switch output signals of an open loop control
- Output with constant short circuit protection
- Status indication of switching condition with LED



Model VT-SSV-1-2X

**Ordering code**

VT-SSV-1 - 2X/ \*

Plug-in switching amplifier

Further details to be written in clear text

 Series 20 to 29  
 (20 to 29: technical data and terminal connection unchanged)

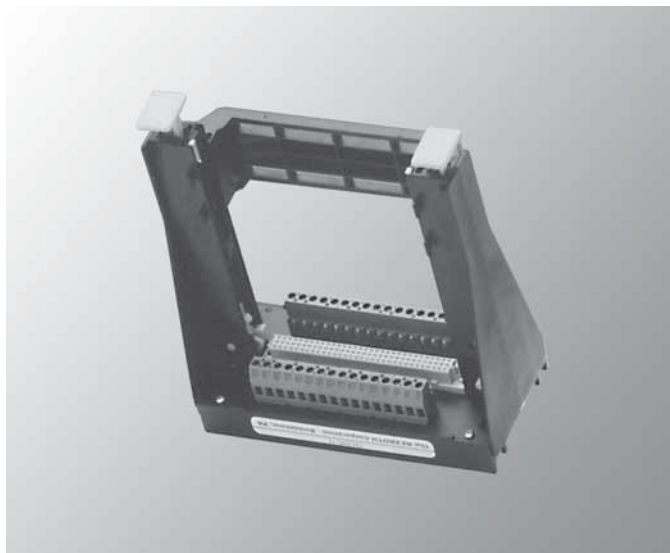
= 2X

**Technical data**

Operating voltage	$V_+$	24 VDC; + 20%; – 10% (residual ripple < 15%)
Output current	$I_{\max}$	2 A (at 100% duty)
Output voltage	$V_{\max}$	$V_+ - 0.2$ V (typical at 2 A)
Control voltage:		
– ON	$V_{IN}$	10 to 35 VDC
– OFF	$V_{IN}$	0 to 6 VDC
Control current	$I_{IN}$	$\leq 3$ mA
Switching frequency	$f_{\max}$	approx. 4 Hz
Cable connection:		Screw-type terminals max. 1.5 mm <sup>2</sup>
– Fitting		Pg 11
– External cable diameter	$d$	4 to max. 10 mm
Solenoid connection		Plug-in connector 2-pin + PE; DIN 43650/ISO 4400 (Z5L)
Connection cable (recommendation)		Olflex 4 x 1.5 mm <sup>2</sup> 16 AWG (not included in delivery)
Permissible operating temperature range	°C (°F)	–25 to +70 (–13 to 158)
Storage temperature range	°C (°F)	–25 to +70 (–13 to 158)
Weight	$m$	approx. 45 g

**Extracted from RA 29 921/06.01**Page 1 of 1  
Issue: 04.03See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Card holder for mounting circuit boards  
of Euro card format  
Model CH32****Series 1X**

- Fastens to 35mm DIN rail or directly screws to panel
- Sturdy base and card guide assembly
- Circuit board hold downs
- Ejector buttons smoothly release card
- Compression screw terminals for wire connections
- Terminal connections on both sides of card holder
- Fits Rexroth 32-pin and 64-pin plug-in cards



32-pin card holder, CH32 C-1X

**Ordering code**

<b>CH</b>	<b>- 1X</b>	
Card Holder		1X = Series 10 to 19
Mating Connector per DIN 41612, female 32 contacts, type C 64 contacts, type G	= 32C = 64G	

**Technical data****Mating connector, female per DIN 41612:**

CH32 Type C 32 contacts (rows a & c, 2 – 32 even)  
CH64 Type G 64 contacts (rows f/d/b/z, 2 – 32 even)

**Mounting:**

Clip onto 35mm rail  
90° DIN rail adapter included  
2 clearance holes,  
0.165 in. (4.2 mm) dia. x 3/8 in. (9.5 mm) depth

**Maximum wire size:**12AWG (4 mm<sup>2</sup>)**Recommended wire size (2 wires per terminal max.):**16AWG or smaller (2 mm<sup>2</sup>)**Recommended box depth with card inserted:**

9" or larger (225 mm)

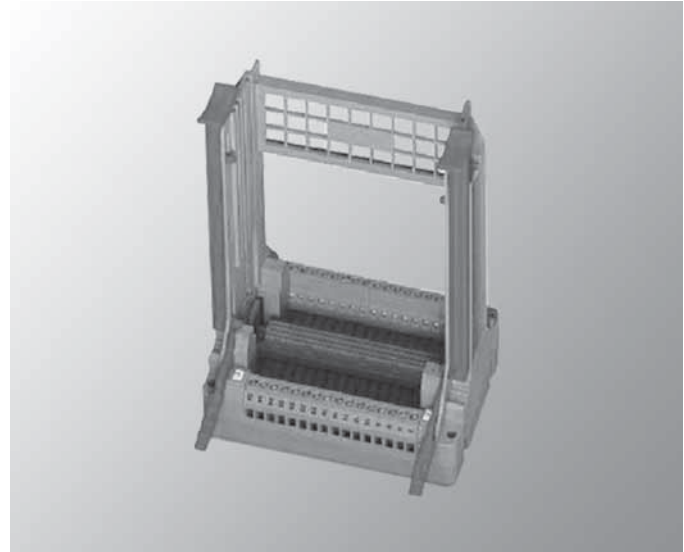
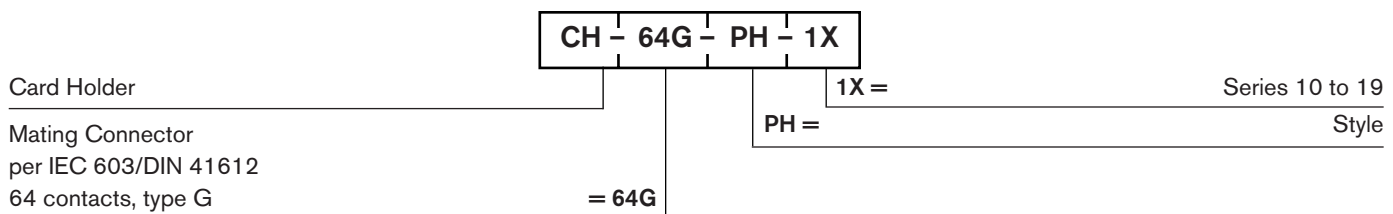
**Weight:**

CH32C 0.5 lb.

CH64G 0.8 lb.

**Extracted from RA 30 108/11.03**Page 1 of 1  
Issue: 06.04See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Card holder for mounting circuit boards  
of Euro card format  
Model CH64-G****Series 1X**

- Fastens to 35mm DIN rail or directly screws to panel
- Loose adapter included for DIN rail mounting to mount horizontally or vertically
- Sturdy base and card guide assembly
- Circuit board hold downs
- Ejector buttons release card smoothly
- Compression screw terminals for wire connections
- Terminal connections on both sides of the cardholder
- Fits Bosch Rexroth 64-pin type G plug-in Euro card format cards

**Ordering code****Technical data****Mating connector, female epr DIN41612 Type G:**

CH64-G 64 contacts (rows z, b, d &amp; f 2-32 even)

**Mounting:**

- Guiderail 35 mm (1.38 in.) horizontal or vertical (NS35/7.5)
- M4 x 30mm or 6-32 x 1-1/4" screws  
(hole diameter 4.2 mm [0.165 in.])
- Tightening torque 0.5 Nm (0.369 lb-ft)

**Technical data:**

- Connection according to standard IEC/DIN VDE
- Nominal current  $I_n$  1A
- Nominal voltage  $U_n$  250V
- Stripping length 8 mm

**Connection data in AWG (mm<sup>2</sup> [in<sup>2</sup>]):**

Minimum conductor cross section rigid	24 (0.2 [0.0003])
Maximum conductor cross section rigid	12 (4.0 [0.0062])
Minimum conductor cross section flexible	24 (0.2 [0.0003])
Maximum conductor cross section flexible	14 (2.5 [0.0038])

**Recommended box depth with card inserted:**

228 mm (9 in.) or larger

**Weight in kg (lbs.):**

CH64 type G 0.34 (0.75)

**Extracted from 1 987 761 327 / 12.00 (AKY 13/4)**

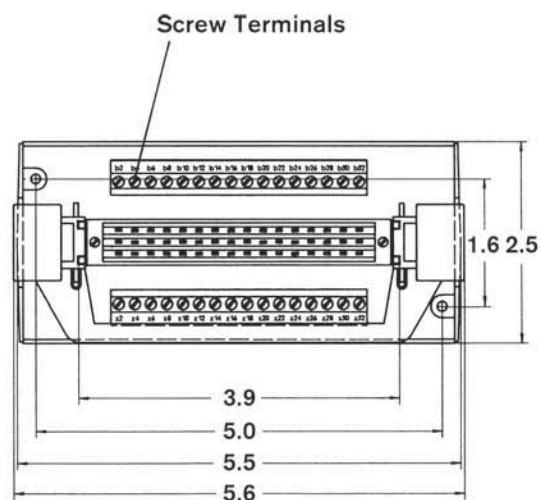
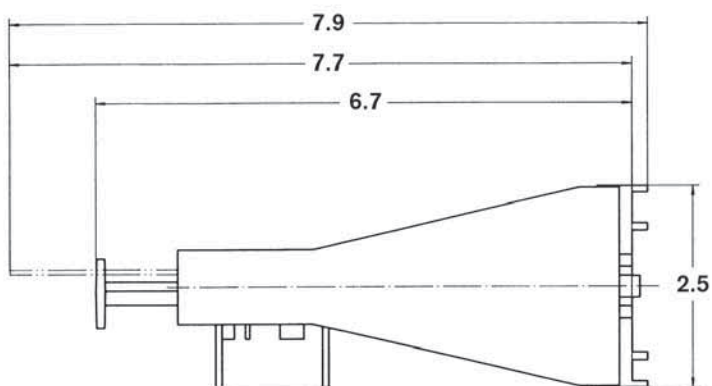
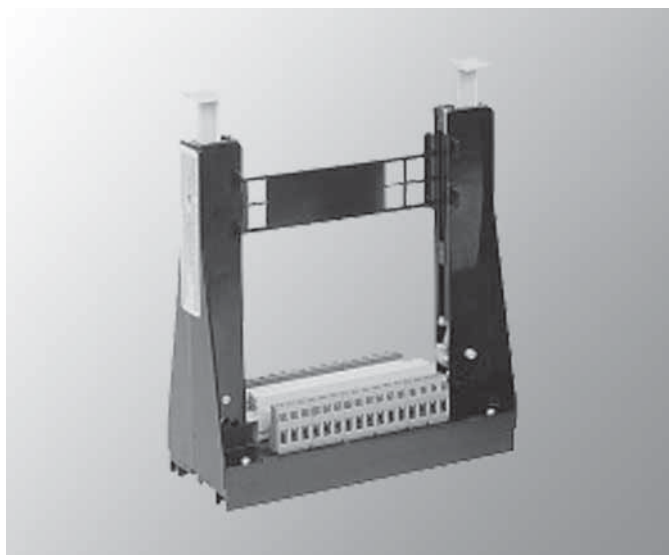
Page 1 of 1

Issue: 06.04

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Card Connector**

Material Number: 1 834 486 001


**Technical data**

Clamp voltage to VDE 0110	V	max. 125 V AC
Current load	I	max. 4 A
Cable cross-section	AWG (mm <sup>2</sup> )	max. 12 (4)
Type of connection:		32-pin spring contact strip, model F, DIN 41 612
Terminal connections:		even-numbered, row b, z
Permissible ambient temperature	°C (°F)	-15 to 70 (4 to 158)
Weight	kg (lbs.)	0.5 (1.1)

## Extracted from RE 29928/11.03

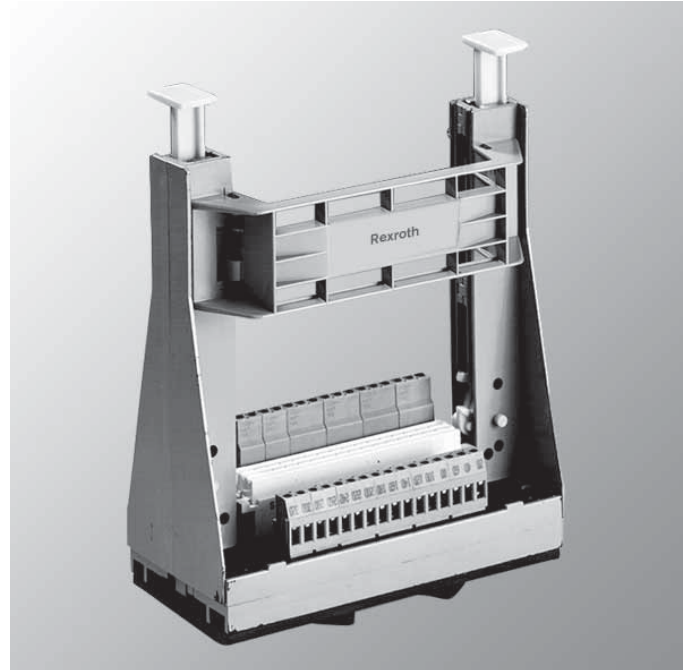
Page 1 of 1  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Card holder Model VT 3002

### Series 2X

- Card holders allow the simple installation and wiring of individual electronic cards in Euro format, e.g. in switching cabinets
- Can be screwed on or snapped onto DIN rails
- Vertical mounting onto a DIN rail, possible with an additional adaptor (included within the scope of supply)
- Stable base
- Card locking and releasing by lever operation
- Connection via screw terminals



Card Holder Model VT 3002-2X/48

## Ordering code

	<b>VT 3002 - 2X /</b>	<b>*</b>	
Card Holder			Further details to be written in clear text
Series 20 to 29 (20 to 29: externally interchangeable)	<b>= 2X</b>	<b>32D =</b> <b>48F =</b>	32-pin spring contact strip, form D 48-pin spring contact strip, form F

## Technical data

Terminal voltage to VDE 0110 C	V	Max. 125 VAC	
Current loading capacity	– VT 3002-2X/32D – VT 3002-2X/48F	/ /	4 A 4 A
Cross-section connection	A	Screw terminals max. 4mm <sup>2</sup> , (form H - 6 mm <sup>2</sup> )	
Connection type: (socket connection)	– VT 3002-2X/32D – VT 3002-2X/48F		32-pin spring contact strip, form D DIN 41612 48-pin spring contact strip, form F DIN 41612
Pin allocation:	– VT 3002-2X/32D – VT 3002-2X/48F		Even numbered, rows a/c Even numbered, rows d/b/z
Permissible ambient temperature range	°C (°F)	–20 to 70 (–4 to 158)	
Weight	kg (lbs.)	0.5 (1.1)	

**Extracted from RA 30 151/06.98**

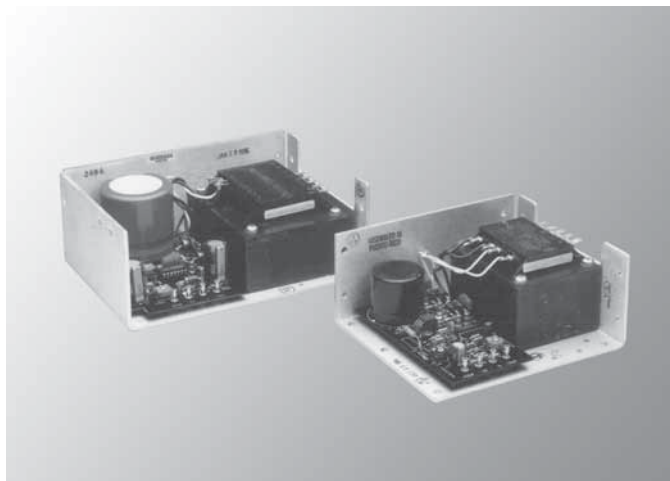
 Page 1 of 1  
 Issue: 04.03

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Power supply**  
**24 V and  $\pm 15$  V**

- Output 24 VDC single polarity models
- Output  $\pm 15$  VDC or  $\pm 12$  VDC bi-polar models
- Voltage regulation  $\pm 0.05\%$
- Low output ripple  $< 5$  mV peak to peak
- Short circuit and overload protection
- Input voltage 100, 120, 220, 230–240 VAC
- Frequency input 47 to 63 Hz
- UL recognized, CSA certified, also IEC, VDE, BPO, ECMA, CEE

Regulated power supply units are used for proportional amplifiers, servos, transducers, and instrumentation. All supply outputs are foldback current limited, if a short circuit or excess load is applied. Output voltage may be adjusted within  $\pm 5\%$ . The power supplies are open-frame designs that can be panel mounted. Standoffs are generally recommended to allow air circulation.



24 V Power Supply

**Order by Rexroth Part Number**

Output Voltage	Output Current <sup>1)</sup>	Material No.
24 VDC	2.4 A	<b>R978887102</b>
24 VDC	3.6 A	<b>R978887103</b>
24 VDC	4.8 A	<b>R978887104</b>
$\pm 15$ VDC	0.8, 0.8 A	<b>R978887105</b>
$\pm 15$ VDC	1.5, 1.5 A	<b>R978887106</b>

<sup>1)</sup> Output current @58–63 Hz, derated all by 10% below 58 Hz.

**Technical data**

Input voltage (supplied as 120, unless noted)	VAC	87 ... 110 104.4 ... 132 191.4 ... 242 207 ... 264	Output ripple	24 V models $\pm 15$ V models	mV <sub>p-p</sub>	<3 <5
Input frequency	Hz	47 ... 63	Operating temperature		°C (°F)	0 to 50 (0 ... 122)
Efficiency, typical @120 V – 60 Hz	%	55	– above 50 °C (122 °F), 12 CFM fan recommended			
Output current @58–63 Hz*	Amp		– for convection cooling, 50 ... 70 °C (122 to 158 °F) derate linearly 0 ... 40%			
R978887102 (HC24-2.4-A)		2.4	Storage temperature		°C (°F)	–43 to 55 (–47 ... 132)
R978887103 (HN24-3.6-A)		3.6	Weight			
R978887104 (HD24-4.8-A)		4.8	R978887102 (HC24-2.4-A)	kg (lbs.)		2.0 (4.4)
R978887105 (HAA15-0.8-A)		0.8, 0.8	R978887103 (HN24-3.6-A)	kg (lbs.)		3.1 (6.8)
R978887106 (HBB15-1.5-A)		1.5, 1.5	R978887104 (HD24-4.8-A)	kg (lbs.)		3.6 (7.9)
*derated all by 10% below 58 Hz			R978887105 (HAA15-0.8-A)	kg (lbs.)		1.1 (2.5)
Output voltage adjustment range	%	$\pm 5$	R978887106 (HBB15-1.5-A)	kg (lbs.)		2.0 (4.4)
Voltage regulation @ 10% line change	%	$\pm 0.05$				
Voltage regulation @ 50% load change	%	$\pm 0.05$				



**Extracted from RA 29 785/06.98**

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Issue: 04.03

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**VT patch cord**

Flexible Patch Cords are supplied with a 2 mm diameter plug on one end and a 4 mm diameter plug on the other. They are connected by a 40 inch (100 cm) length of silicone insulated wire (0.55 sq. mm/20 AWG), and are available in red or black color.

**Typical application:**

- Used for connecting between a VT card faceplate test jack and an analog/digital meter for the purpose of measuring voltage of the amplifier card
- For servicing or trouble-shooting
- Can also be used with Rexroth test point and systems cards

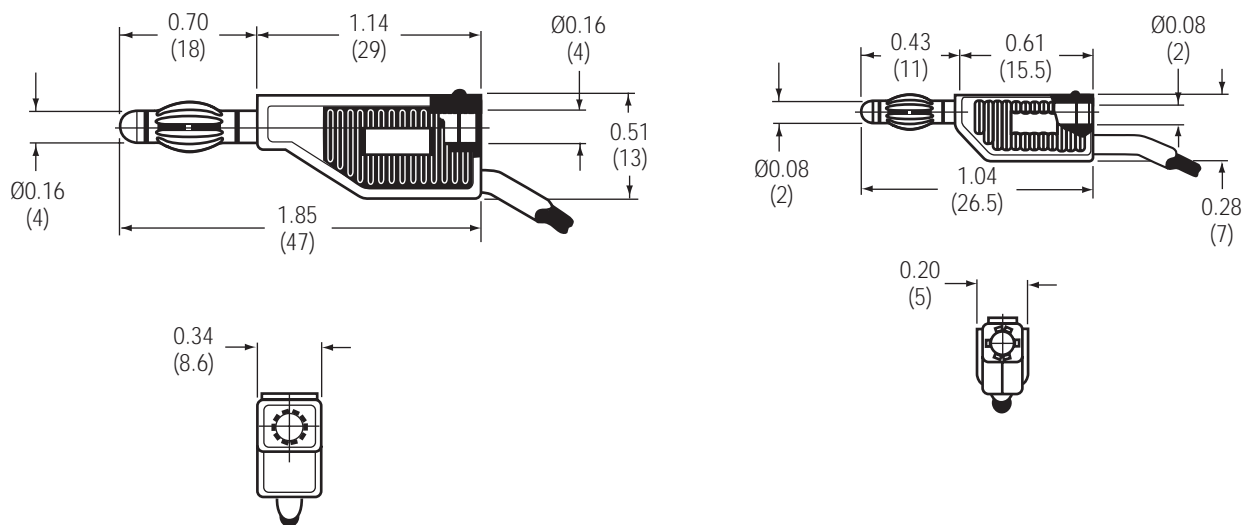
**Ordering material number:**

- R978807707 (Red version)
- R978807708 (Black version)



Patch cords for convenient testing

**Unit dimensions:** dimensions in inches (millimeters)



**Extracted from RA 29 784/06.98**

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Issue: 04.03

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

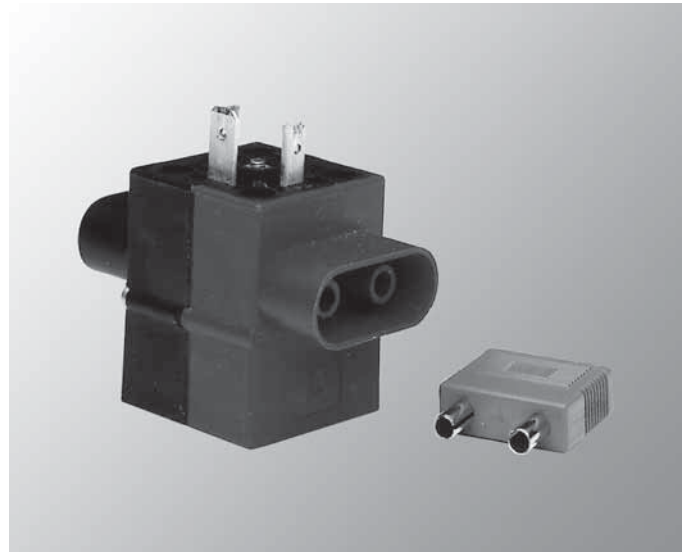
**Test adapter for measuring voltage  
and/or current  
Model MESAP 43650**

The new MESAP 43650 test adapter, is installed between the ISO 4400/DIN 43650 A male and female connectors used on the valve.

The adapter allows for uninterrupted voltage and/or current measurement in the field while the valve is in operation.

Once installed, the MESAP test fixture enables the technician to facilitate servicing or trouble-shooting tests and/or measurements without stopping production.

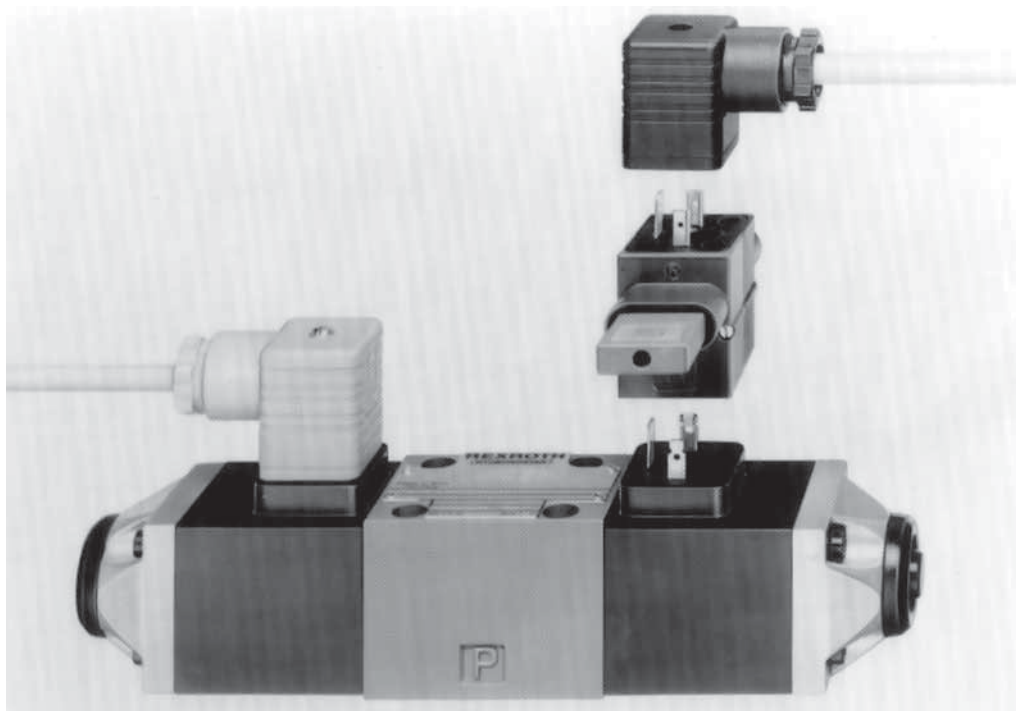
- Easy to use
- Compact design
- Ampere reading during operation of unit by removing a shorting link
- Voltage reading between contacts 1 and 2, also during operation of unit
- One shunt jumper supplied with each tester  
4 mm banana jack test leads must be ordered separately.



Model MESAP 43650

**Ordering information**

Order by Material No. R900021194



MESAP 43650 adaptor used in conjunction with a 4 WE6 directional valve

**Extracted from RE 29685/02.99**

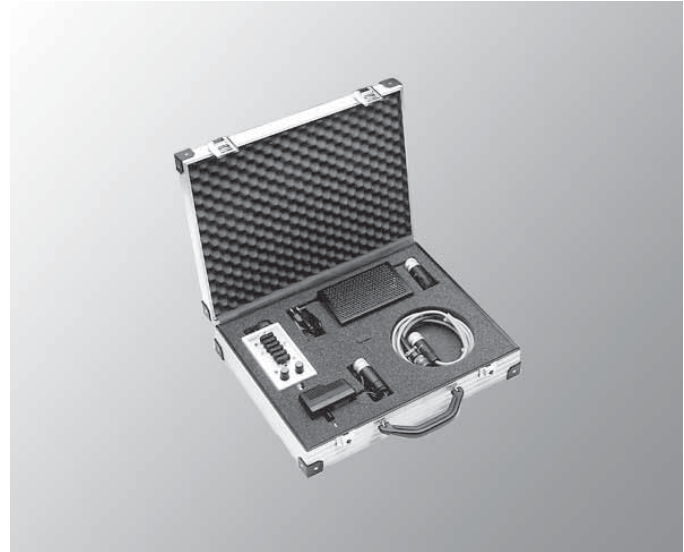
Page 1 of 2  
Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Service case with test unit  
for proportional and servo valves  
with integrated electronics  
Model VT-VETSY-1**

**Series 1X**

- The service case contains a test unit as well as optional power supply units, connecting cables and adaptor cables (see ordering code)
- The test unit can be used for the control and functional testing of proportional and servo valves with integrated electronics and an operating voltage of  $\pm 15\text{ V}$  or  $+24\text{ V}$
- Simplifies commissioning and troubleshooting in hydraulic systems that use proportional and servo valves
- Service case:
  - Dimensions (W x H x D) 450 x 100 x 350 mm (17.7 x 4.0 x 13.7 in.)
  - Weight Empty 2 kg (4.5 lbs.)  
Complete 4.3 kg (9.5 lbs.)



Model VT-VETSY-1

**Ordering code**

VT-VETSY-1 - 1X/ 1 - 1 - 1 - A - 0

Service case with test unit for proportional and servo valves with integrated electronics

**0 =** Power supply 15 V; 0.25 A  
Without power supply

Series 10 to 19  
(10 to 19: unchanged technical data and connection allocation) = 1X

Test unit Model VT-VET-1-1X = 1

**Valve connection cable:**  
With 1 off 6-pin connecting cable Model VT-VETK-1-1X = 1

**Adaptor cable for valve Model 4WSE2EM6-1X:**  
With adaptor cable Model VT-VETAK-1-1X = 1

**A =** Power supply 24 V  
VT-VETNT-1-1X/G24

**Extracted from RE 29685/02.99**

Page 2 of 2

Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Operating voltages			
"power selector" switch:			
- Switch position "24 V"	$V_B$		24 V; - 20 % + 40 %
- Switch position "± 15 V"	$V_B$		± 15 V; ± 10 %
Current consumption of the test unit	$I$		0.1 A
Max. current carrying capacity of pins A and B of input plug ES and output socket AB when testing 24 V proportional or high-response control valves	$I_{max}$		6 A
Input:			
- Input plug ES			
Command values to pins E and D	$V_i; I_i$		according to valve details
Enable signal to pin C (24 V operation)	not active	$V_E$	0 to 10 V
	active	$V_E$	16 to $V_B$
- Output socket AB			
Actual value to pin F	$V_i; I_i$		according to the actual value output of the valve
- BNC socket	$V_i$		0 bis ± 10 V
Outputs (all short-circuiting links plugged):			
- Input plug ES			
Actual value to pin in F	$V_0; I_0$		according to the actual value output of the valve
- Output socket AB			
Enable signal to pin C (24 V operation)			
• "setpoint selector" switch			
- Switch position "intern" or "BNC"			
"enable" switch to position "off"	$V_E$		0 V
"enable" switch to position "on"	$V_E$		$U_B$
- Switch position "control"			
"enable" switch to position "off"	$V_E$		0 V
"enable" switch to position "on"	$V_E$		according to pin C of input plug ES
Command values to pins D and E			
• "setpoint selector" switch			
- Switch position "intern" or "BNC"	pin E		Reference potential
	pin D	$V_{comm}$	0 to ± 10 V, falls $R_{i\ valve} > 500 \Omega$
		$I_{comm}$	0 to ± 20 mA, falls $R_{i\ valve} < 500 \Omega$
- Switch position "control"	pins E and D	$V_{comm}$	according to input plug ES (pins E and D)
Dimensions (W x H x D)	mm (in.)		94 x 54 x 160 mm (3.7 x 2.1 x 6.3 in.)
Weight	kg (lbs.)		0.36 (0.8)

### Extracted from RA 29 977/09.95

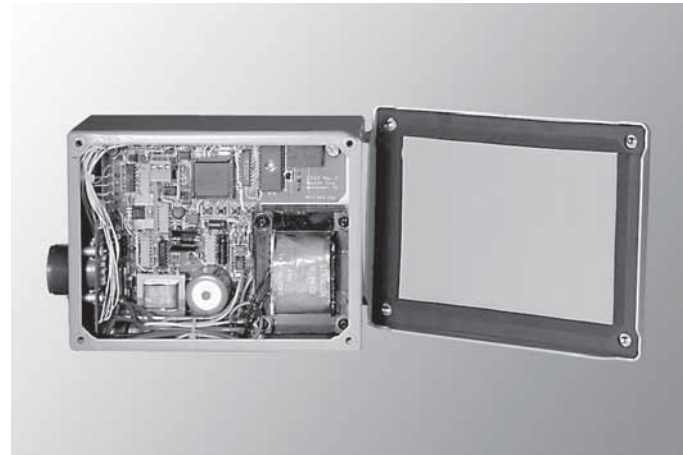
Page 1 of 1  
Issue: 04.03

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Generator speed controller Model GSC 1

### Series 2X

- Self contained controller for driving electrical power generators with a hydrostatic transmission
- 16 Bit microprocessor based controller
- 50 or 60 Hz generator operation
- Tunable PID controller to accommodate a wide range of pump/motor/generator combinations
- Fault safety shutdown
- Simple machine interface



Generator Speed Control GSC-2X

- Mechanical and electrical "plug-in" compatibility with the Rexroth GSC1-1X controller

### Ordering code

<b>GSC 1 - 2X / 120 M 1</b>		
Generator Speed Controller		
Series 20 to 29 (20 to 29 externally interchangeable)	=2X	
Running voltage (120 VAC/50-60 Hz)	= 120	
Running voltage (240 VAC/50-60 Hz)	= 240	
		1 = With RFI filter
	M =	*14 pin MS connector
		* Mating Connector is included

### Technical data

Power supply	Starting	VDC	+ 10 to 35, negative ground 2 Amp maximum
	Running	VAC	120 to 240, 50/60 Hz $\pm$ 10% 50 VA maximum
Output Drive		A	Up to 2.5 maximum to drive A4V pump solenoid, current controlled, Pulse Width Modulation 80 to 250 Hz
Frequency control range		Hz	50 or 60 $\pm$ 0.5 Hz ( $\pm$ 10 Hz adjustment)
Load response			15 kw load step, $\pm$ 1% Hz error, recovery to steady state typical
Speed			Input change of 1000 rpm/sec. cause max of $\pm$ 3 Hz frequency change, recovery to steady state
START/STOP change response		sec.	Start/stop in 1 sec. typical. Settle to stable speed $\leq$ 2 sec.
START/STOP circuit requirements			3 wire, 12 VDC control, optically isolated inputs, 15 mA max.
Frequency shutdown		Hz	Selectable up to 30 Hz deviation
Overvoltage shutdown		VAC	Selectable 0–300
Pulse pickup input		VAC	5 to 30 any non-monotonic waveshape
LED output		mA	10 nominal, short circuit proof
Setup interface			Alpha-numeric display, 4-character, red LED 4 pushbuttons – up, down, enter, escape
Communications port			RS-485, 19,200 baud
Enclosure			NEMA 12, screw cover plate
Ambient temperature		$^{\circ}$ C ( $^{\circ}$ F)	–18 to 60 (0 to 140)
Connector	Multiturn	M	Type GSC... /M MS3102E22 - 19P
			Mating connector MS3106E22 - 19S (solder)
Size (approximately)		mm (in.)	235 x 159 x 99 (9.25 x 6.25 x 3.50)
Weight (approximately)		kg (lbs)	4.54 (10)
Mounting position			Optional

**Warning! Do not unplug with power applied!**

## Section 9

# Mobile Electronics

### The Drive & Control Company

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For a complete copy of the data sheets in this catalog, visit our website at:

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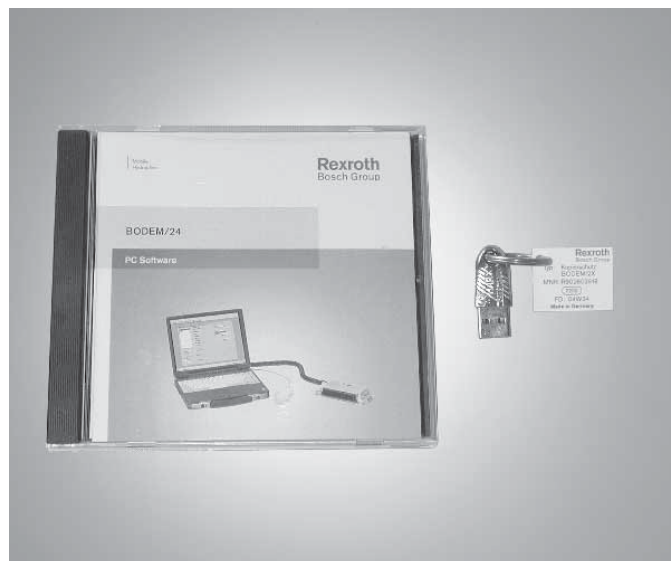
### Extracted from RE 95 085/09.04

Page 1 of 2  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## BODEM

PC software, version 24  
Adjustment and diagnostic service tool  
for control units



### Features

The BODEM PC software provides a convenient and user-friendly method of executing service functions for the RC control unit in the Rexroth range (see RE 95200). Such functions as setting parameters and displaying process data or errors can now be commanded with a PC or laptop. BODEM is a convenient alternative to the BB-3, VT 12321 control box (see RE 29798 and RE 95080).

#### System requirements

PC hardware:

- IBM-compatible personal computer with Pentium 1 processor (minimum)
- VGA video adapter or video adapter with higher resolution and at last 256 colours, compatible with the installed version of Microsoft Windows
- Microsoft mouse or compatible pointer
- Minimum 8 MB working storage (RAM) (depends on the operating system used)
- One free serial interface COM1...COM4
- One free USB-Hardlock interface (1.1 or 2.0)
- Available hard disk capacity > 5 MB

Operating system:

- Windows 95 / 98 / 2000 / XP

### Main component parts

- CD-ROM
- USB-Hardlock, to be connected to the PC
- A connecting cable between PC interface (RS232) and control unit RC is also required.

#### Special characteristics

- Extremely user-friendly, with WINDOWS user interface and online assistance
- Simultaneous display of several parameters for changing settings
- Graphic or numerical display of current process data
- Printout facility for all settings and process data for documentation
- Clear and easy-to-understand display of error messages
- Datalogger: measured values (process data) are saved on the hard disk
- The display can be set to German, English, French or Spanish, as preferred. The language of the function-related texts is determined by the application-related programming in the respective control unit.



### Extracted from RE 95 085/09.04

Page 2 of 2  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Program installation

Windows 95 / 98 / 2000 / XP

- Using the "RUN" function in the "Start" menu, start SETUP.EXE in the English/Install directory on the CD-ROM. SETUP.EXE can also be started directly from the CD-ROM with the Explorer. All further instructions are provided on the screen.
- Using the "RUN" function in the "Start" menu, start CBNSETUP.EXE in the English/Install directory on the CD-ROM. CBNSETUP.EXE can also be started directly from the CD-ROM with the Explorer. Select "CRYPTOBOX-USB" in the online dialogue. All further instructions are provided on the screen.

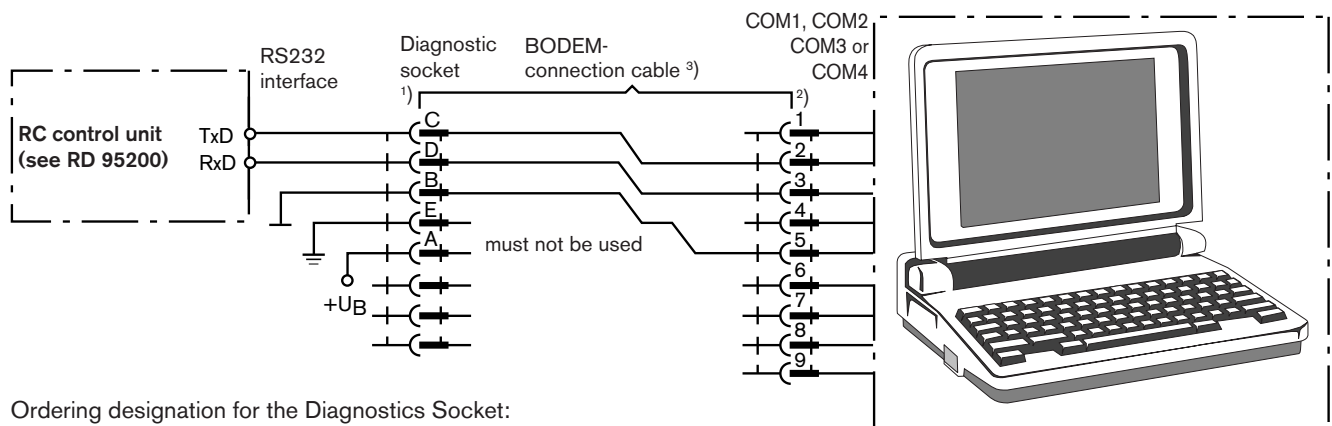
**Note:** System administrator rights will be needed to install the BODEM software on Windows 2000 and Windows XP. If the software is installed without system administrator rights, the hardlock will not be recognized and the BODEM functions will only work to a limited extent.

You may find a present driver for the dongle in the internet under [www.boschrexroth.com/bodem-driver](http://www.boschrexroth.com/bodem-driver).

### Ordering Code

<b>BODEM / 24</b>	
<b>Software</b>	CD-ROM and Hardlock
	<b>BODEM</b>
<b>Version</b>	24

### Pin Layout



- <sup>1)</sup> Ordering designation for the Diagnostics Socket:  
Metalock-Bantam UTG012-8S 8-pin socket  
(Manufacturer: FCI) Mat. No.: 09831291

comprising:	FCI Ordering Designation
– Socket	UTG012-8S
– 8 female contacts	RC16M23K
– Cable clip	UTG12PG
– Dust cap	UTP12DCG

The diagnostics socket is not included in the supply.  
Available from Rexroth on request.

- <sup>2)</sup> Sub-D connector, 9-pin

- <sup>3)</sup> Available from Rexroth on request.

#### Important:

When connecting the control unit RC with the PC, please use only the BODEM connecting cable. The BB-3 connecting cable must not be used.

Wrong connecting cables or mismatched wiring can lead to destruction of the PC interface.

**Note:** The control unit and the PC must be switched off when connecting or disconnecting the BODEM connecting cable.



**Extracted from RE 95 200/06.05**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

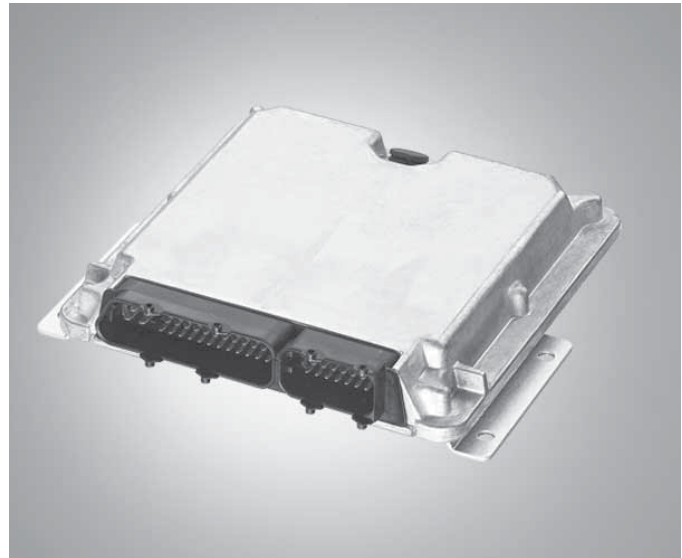
**BODAS  
Controller RC****Series 2**

For open and closed-loop control  
of hydraulic components

- Component of BODAS system for mobile applications
- Robust design meeting specifications for mobile applications
- High electromagnetic compatibility (EMC)
- Inputs and outputs with fault detection
- Safety features such as redundant inputs and central safety cut-off for all outputs
- Pulse-width-modulated (PWM) solenoid currents for minimum hysteresis
- Closed-loop control of solenoid currents, i.e. not dependent on voltage and temperature
- Sturdy, sealed aluminum housing
- Watertight with suitable mating connector

**Main components**

- Powerful 16-bit microcontroller module
- Protected watchdog for program run monitoring
- Serial data interface for diagnostics, parameterization and display of process variables
- CAN bus interface
- Power supply and ground connections for potentiometers and sensors



**Extracted from RE 95 200/06.05**

Page 2 of 4

Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Ordering code and description**

<b>RC</b>			/	<b>2</b>	
01	02	03		04	05

**Type**

01	BODAS Controller	<b>RC</b>
----	------------------	-----------

**CAN extension module**

02	without extension	
	I/O-extension	<b>E</b>

**Design**

		RC	RCE	
03	1. digit = no. of proportional outputs 2. digit = no. of switch outputs	●	-	<b>2-2</b>
		●	-	<b>4-4</b>
		●	-	<b>6-9</b>
		-	●	<b>12-4</b>
		●	-	<b>12-18</b>

**Series**

04		<b>2</b>
----	--	----------

**Index**

05	RC2-2, 4-4, 6-9, 12-18	<b>0</b>
	RCE12-4	<b>2</b>

**Note:**

The BODAS Controller cannot operate without software. BODAS Standard software and programs for specific applications are available from Rexroth.

The BODAS Controller RC are used for the programmable control of proportional solenoids and additional switching functions. They can therefore be used for both simple and complex open and closed-loop control, e.g. for hydrostatic travel drives, work hydraulics or transmission control in mobile machinery.

BODAS Controller RC were specially developed for use in mobile machinery, and satisfy the relevant safety requirements with regard to ambient temperature, tightness, resistance to shock and vibration, as well as electromagnetic compatibility (EMC). Internally, BODAS Controller RC comprise a powerful 16-bit microcontroller and all input and output circuitry.

Analog voltages in the range 0...5 V, currents from 0...20 mA, frequencies from 0 Hz...10 kHz and switching information are processed as input signals. The inputs are protected against over-voltage and electrical interference. The voltage inputs can be monitored to detect any broken wires or short circuits.

The proportional solenoid outputs are pulse-width-modulated (PWM) and optimally adapted for proportional control of axial piston units and valves to ensure high accuracy and minimum hysteresis.

The switch outputs are designed for the direct switching of relays, lamps and switch solenoids. The serial interface RS232 permits the connection either of the BB-3 control panel (RE 29 798 and RE 95 080) or a laptop with BODEM software for personal computers (RE 95 085) for service functions such as diagnostics, parameterization or display of process variables.

CAN bus interfaces are available with all BODAS Controller RC for exchanging data with other bus users or electronic systems (e.g. RC or RCE, joysticks, diesel engine injection, display). The CAN bus interfaces can each be run with different protocols.

BODAS Standard programs are available for the BODAS Controller software. If more extensive functions are required, special program packages for specific applications can also be compiled using a program library and adapted to the application in question with the aid of service tools. Programming with BODAS-design (RE 95 110) is also possible.

Combined with pumps, motors, valves, sensors, transducers and actuators from Rexroth, BODAS Controller RC and corresponding software can be used to create complete system solutions.

The BODAS CAN-I/O extension module RCE serves to provide an inexpensive I/O extension of a controller, in the event that the number of controller inputs and outputs is insufficient for the intended application. Connection to the master controller is established via a CAN interface using the CANopen protocol. The BODAS CAN-I/O extension module RCE is delivered with standard software. Parameters can be configured with a default routine in CANopen using Service Data Objects (SDO). Details are available in the electronic datasheet (EDS).

## Extracted from RE 95 200/06.05

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Technical Data

Controller		RC2-2	RC4-4	RC6-9	RC12-18	RCE12-4
<b>Nominal voltage</b>	12 and 24 V	✓	✓	✓	✓	✓
Residual ripple (DIN 40839, Part 1)	max. ± 2 V	✓	✓	✓	✓	✓
Supply voltage, permitted range	8...32 V	✓	✓	✓	✓	✓
<b>Current consumption</b>						
without load	mA	250	400	400	800	400
with load, max.	A	8	15	18	36	19
<b>Fuse</b>						
internal:		–	–	–	–	–
external: for switch and proportional solenoid outputs	AT	8	15	20	2x20	20
for electronics and sensors	AT	1	1	1	2x1	1
<b>Stabilized voltage source</b>						
e.g. for setpoint potentiometer 1-5 kΩ	5 V ± 0,1 V	2	2	4	8	1
with current monitoring:	15 mA	2	–	–	–	–
with voltage monitoring:	20 mA	–	–	2	4	–
	100 mA	–	2	2	4	1
<b>Stabilized voltage source</b>						
e.g. for setpoint potentiometer 1-5 kΩ	8 V ± 0,25 V 100 mA	–	–	–	–	1
<b>Analog voltage inputs</b>						
(may also be used as switch input) <sup>1)2)</sup>	0...5 V	2	5	8	16	10
	0...8 V	–	–	–	–	5
<b>Analog current inputs</b>						
(may also be used as switch input) <sup>1)</sup>	0...20 mA	2	4	4	8	–
<b>Analog resistor inputs</b>	900 ... 1800 Ω	–	–	–	–	2
<b>Switch inputs</b>						
(may be used as analog voltage input)	low < 1,5 V; high > 4,5 V	4	6	8	12	14
High active only	low < 1,5 V; high > 4,5 V	2	6	8	–	–
Switch between high/low active	low < 1,5 V; high > 4,5 V	4	1	2	–	7
Low active only	low < 1,5 V; high > 4,5 V	–	5	6	12	–
Low active only	low < 1,5 V; high > 4,5 V	–	–	–	–	7
<b>Frequency inputs</b>						
(may be used as switch input) <sup>1)</sup>	0...10 kHz; > 1 V <sub>rms</sub>	2	3	5	10	–
for DSM 1-10	0...5 kHz	–	–	–	–	2
<b>Proportional solenoid outputs (PWM)</b>						
Current range	0...1,8 A	2	4	6	12	12
	0...2,3 A	–	–	2	4	–
	0...2,3 A	2	4	4	8	12
Pulse frequency	100...400 Hz	2	4	–	–	–
	100, 160 oder 220 Hz	–	–	6	12	–
	100, 167, 250, 333 Hz	–	–	–	–	12
<b>Switch outputs (MOSFET)</b>						
	max. 20 mA	2	4	9	18	6
	max. 1,3 A	–	–	–	–	2
	max. 1,3 A	–	2	6	12	–
	max. 2 A	2	–	–	–	4
	max. 2,6 A	–	2	3	6	–
<b>Analog voltage outputs</b>						
	0...5 V	–	1	1	2	1
	0...10 V	–	–	–	–	1
<b>Interfaces</b>						
RS 232 C		1	1	1	2	–
CAN 2.0 B	ISO 11898	1	2	2	2	1
<b>LED indicators</b>	red / green	2	–	–	–	–
<b>Fault detection for broken wires and short circuit</b>						
Analog inputs <sup>3)</sup>		✓	✓	✓	✓	✓
Proportional solenoid outputs		✓	✓	✓	✓	✓
<b>Protection against short circuit</b>						
to supply voltage and ground for all inputs and outputs <sup>4)</sup>		✓	✓	✓	✓	✓
<b>Reverse polarity protection</b>						
supply / battery		✓	✓	✓	✓	✓

**Extracted from RE 95 200/06.05**

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 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical Data**

Controller		RC2-2	RC4-4	RC6-9	RC12-18	RCE12-4
<b>Microcontroller</b>		C164CI	C167CS	C167CS	2xC167CS	
<b>Clock frequency</b>	MHz	20	40	40	40	
<b>Memory capacities</b>						
RAM	k Byte	128	256	256	512	
Flash-EPROM	k Byte	256	512	512	1024	
EEPROM	k Byte	2	8	8	16	
<b>Software installation</b>						
download to flash memory		✓	✓	✓	✓	Standard software
<b>Electromagnetic compatibility</b>						
Spurious interference (motor vehicles directive 95/54/EG)	100 V <sub>rms</sub> /m; (Details on request)	✓	✓	✓	✓	✓
Line-bound interference (ISO 7637-1/-2/-3)	Values on request	✓	✓	✓	✓	✓
Load Dump	max. 70 V	✓	✓	✓	✓	✓
<b>max. dissipated loss</b>	W at 32 V	8,0	8,0	8,25	16,5	8,0
<b>Operating temperature, housing</b>	-40...85°C	✓	✓	✓	✓	✓
<b>Storage temperature, housing</b>	-40...85°C	✓	✓	✓	✓	✓
<b>Vibration resistance:</b>						
Sinusoidal vibration (IEC 60068-2-6)	10 g / 57...2000 Hz					
	20 Cycles per axis	✓	✓	✓	✓	-
	10 Cycles per axis	-	-	-	-	✓
Random vibration (IEC 60068-2-36)	0,05g <sup>2</sup> / Hz	✓	✓	✓	✓	-
	30 min per axis					
Random vibration (IEC 60068-2-64)	0,05g <sup>2</sup> / Hz	-	-	-	-	✓
	30 min per axis					
<b>Shock resistance:</b>						
Transport shock (IEC 60068-2-27)	15 g / 11 ms					
	3x in each direction (pos./neg.) and in each axis	✓	✓	✓	✓	✓
Continuous shock (IEC 60068-2-29)	25 g / 6 ms					
	1000x in each direction (pos./neg.) and in each axis	✓	✓	✓	✓	✓
<b>Resistance to moisture</b> (IEC 60068-2-30Db; Variant 2)	95 % (+25°C bis +55°C)	✓	✓	✓	✓	✓
<b>Resistance to salt spray</b>						
(IEC 60068-2-11)	72 h, 35°C, 5% NaCl	✓	✓	✓	✓	-
(IEC 60068-2-52)	72 h, 35°C, 5% NaCl	-	-	-	-	✓
<b>Type of protection (DIN / EN 60529) with fitted mating connector</b>	IP 65	✓	✓	✓	✓	✓
<b>Housing material</b>	Diecast aluminum	✓	✓	✓	✓	✓
<b>Weight</b>	approx. kg	0,5	0,7	0,7	1,5	0,7
<b>Outer dimensions</b>	Length (in mm)	114	187	187	187	187
	Width (in mm)	204	202	202	202	202
	Height (in mm)	45	45	45	83	45
<b>Mating connector</b>	52-pin	1	1	1	2	1
	28-pin	-	-	1	2	1

1) switched with supply voltage

2) not for RCE

3) For RCE with sensor signal 0,5...4,5/7,5 VDC only

4) For RCE the frequency inputs are not continuously protected against short circuits to the battery voltage of 24 V

**Extracted from RE 95 230/03.06**Page 1 of 4  
Issue: 06.06See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Analog amplifier RA**For control of hydraulic components  
Series 10

The electronic analog amplifier activates up to two proportional solenoids and a switching function:

- Optional deadlock of actuation for proportional solenoids
- Supply voltage for external setpoint potentiometer
- Monitoring of setpoint potentiometer for cable breakage and short circuit
- Externally actuated switching output
- Error output
- Separately adjustable time for each rising and falling ramp on solenoid
- Overload protection, overvoltage protection, conditional short-circuit protection
- Separately adjustable  $I_{\min}$  and  $I_{\max}$  for every solenoid
- Externally adjustable PWM frequency

**Description**

The analog amplifier activates up to two proportional solenoids. The specified control voltage is processed in the amplifier as an input variable. The analog amplifier provides a regulated electric current as an output variable for actuation of proportional solenoids.

Amplifier outputs for proportional solenoids are activated through a deadband of approx. 5% of the maximum setpoint voltage at the input, i.e. the minimum output current is applied. The level of this minimum output current can be adjusted separately for both proportional outputs using a trimming potentiometer. If the setpoint voltage at the input is increased, the output current for each respective proportional solenoid increases linearly.

The maximum output current can also be separately adjusted using a trimming potentiometer for the outputs. The gradient of the output curve is influenced by this.

The analog amplifier contains time ramp functions which can be used to adjust the period in which the output current can be adapted to match a modified setpoint. The ramp time adjustment range extends from 100 ms to 10 s. The time ramp functions can be adjusted using trimming potentiometers for each solenoid.

**Service options**

The RA1–0/10 analog amplifier is used to actuate an individual proportional solenoid.

The RA2–1/10 analog amplifier can be used to actuate two proportional solenoids in a single device (for example a reversible axial piston unit or a valve section with separate actuation of the proportional solenoids) or to actuate two devices independently of each other (for example two individual axial piston units or valves).

**Extracted from RE 95 230/03.06**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Ordering code**

	<b>RA</b>		/	<b>1</b>	<b>0</b>
<b>Type</b>	Analog amplifier				
	RA				
<b>Design</b>	1. digit = no. of proportional outputs				
		2-1			
	2. digit = no. of switching outputs				
		1-0			
<b>Series</b>					
				1	
<b>Index</b>					
					0

**Material numbers**

Analog amplifier RA				Material number
RA	2-1	/	10	R902091800
RA	1-0	/	10	R902091900

**Mating Connector**

Order designation for Bosch 25-pin mating connector consisting of:

Designation	Material number
Handle shell, angled	Bosch 1 928 401 013
Contact carrier	Bosch 1 928 400 952
Screw for contact carrier	Bosch 1 928 491 082
Flat sealing ring for screws	Bosch 1 928 300 198
Locking piece, lilac color	Bosch 1 928 401 566
Clamping collar, large	Bosch 1 928 400 890
2 screws for clamping collar	Bosch 1 928 491 151
Sleeve, angled, 18 mm	Bosch 1 928 300 284
Seal for contact carrier	Bosch 1 928 300 191
Clamping band for sleeve	Bosch 1 928 401 280
25 contacts	AMP 927775-3

The mating connector is not included in supply. It is available from Rexroth with material number R902603063.

**Extracted from RE 95 230/03.06**

 Page 3 of 4  
 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

		RA1-0	RA2-1
<b>Nominal voltage</b> Residual ripple (DIN 40839, Section 1) Supply voltage, perm. range	12 and 24 V max. $\pm 2$ V 10...32 V	✓	✓
<b>Current consumption</b> Without load With load, max.	mA A	150 3	150 6
<b>Fuse</b> Internal: External: For switching & proportional solenoid outputs and for electronics	A T	– 3	– 7.5
<b>Potentiometer supply voltage</b> (for setpoint potentiometer 2...5 k $\Omega$ )	7.2 V...8.5 V 4.0 V		
<b>Voltage input (differential amplifier)</b> (setpoint voltage)	0...8.5 V	1	2
<b>Switch input</b>	> 5.0 V	–	1
<b>Proportional solenoid outputs (PWM)</b> Current range Pulse frequency	0...2.3 A 100, 200 or 350 Hz	1	2
<b>Switch output (MOSFET)</b>	Max. 1 A	–	1
<b>LED displays:</b> Red Green Yellow Yellow	Error indication Operational status indicator PWM current Channel 1 PWM current Channel 2	✓ ✓ ✓ –	✓ ✓ ✓ ✓
<b>Error detection</b> Potentiometer: For broken wires and short circuit (With exception of wiper) Proportional solenoid outputs: Current overload limit Supply voltage: Undervoltage monitoring		✓ ✓ ✓	✓ ✓ ✓
<b>Short-circuit resistant</b> To supply voltage and ground for all inputs and outputs (Exception: potentiometer supply 4.0 V to supply voltage)		✓	✓
<b>Reverse polarity protection</b> Supply/Battery		✓	✓
<b>Electromagnetic compatibility</b> Spurious interference (KFZ-RL95/54/EG) Line-bound interference (ISO 7637-1/-2/-3) Load Dump	100 V <sub>ms</sub> /m; (Details on request) Values on request Max. 70 V	✓	✓
<b>Max. power loss</b>	W at 32 V	4	4
<b>Operating temperature, housing</b>	–40...85°C	✓	✓
<b>Storage temperature, housing</b>	–40...85°C	✓	✓
<b>Vibration resistance</b> Sinusoidal vibration (IEC 60086-2-6) Random vibration (IEC 60086-2-36)	10 g / 57...2000 Hz 20 cycles per axis 0.05 g <sup>2</sup> / Hz 30 min per axis	✓	✓

**Extracted from RE 95 230/03.06**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

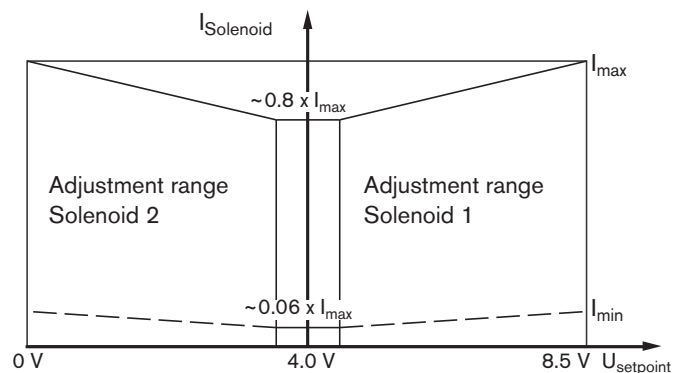
**Technical data**

		RA1-0	RA2-1
<b>Shock resistance:</b>			
Transport shock (IEC 60068-2-27)	15 g / 11 ms 3x in each direction (pos./neg.) and in each axis	✓	✓
Continuous shock (IEC 60068-2-29)	25 g / 6 ms 1000x in each direction (pos./neg.) and in each axis		
<b>Resistance to moisture</b> (IEC 60068-2-30Db; Variant II)	90% (+25°C up to +55°C)	✓	✓
<b>Resistance to salt spray</b> (IEC 60068-2-11)	72 h, 35°C, 5% NaCl	✓	✓
<b>Type of protection (DIN / EN 60529):</b> With mounted mating connector <sup>1)</sup>	IP65	✓	✓
<b>Housing material</b>	Plastic injection molding PA66 GF 35	✓	✓
<b>Weight</b>	approx. kg	0.3	0.3
<b>Outer dimensions</b>	Length (in mm) Width (in mm) Height (in mm)	108 135 42	108 135 42

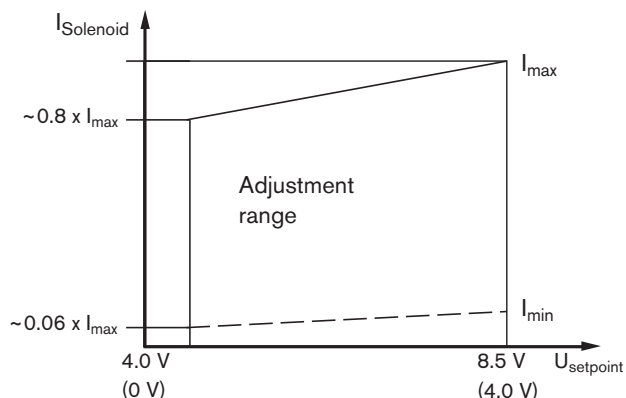
<sup>1)</sup> For suitable routing of connecting cable, see "Installation position"

**Curves**

**For 2 solenoids with interlocked  
actuation (reversible mode)**



**For 2 solenoids with independent actuation  
(parallel mode)**





**Extracted from RE 95 138/01.05**

Page 1 of 2  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**BODAS**  
**Pressure Sensor PR2****Series 1**

Thin film technology sensor to measure pressure

- Measuring range to 160, 250, 400, 600 bar
- Shock and vibration resistant
- Type of protection IP67 to IP69K
- Electrical connection versions: male connector or cable
- Ratiometric output signal
- Additional versions upon request

**Description**

---

This sensor is especially suited for use in mobile hydraulics due to its excellent features. Shock and vibration resistance, type of protection, resistance to pressure peaks, resistance to temperature shock, EMC characteristics (up to 100 V/m). The measuring principle uses a hermetically welded thin film measuring cell which provides long-term density.

**Extracted from RE 95 138/01.05**

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Issue: 06.06

**Ordering code**
**BODAS- PR2 - G S 05 / 1 0**
**Type**

Pressure sensor

PR2

**Pressure range**

0 ... 160 bar	160
0 ... 250 bar	250
0 ... 400 bar	400
0 ... 600 bar	600

**Mechanical connection (pressure side)**

G 1/4" DIN 3852-E

G

**Electric connection**

AMP Superseal

S

Cable output (upon request)

K

**Supply voltage**

5 VDC ± 0.5 VDC

**output signal**

0.5 ... 4.5 VDC ratiometr.

05

**Series**

1

**Index**

0

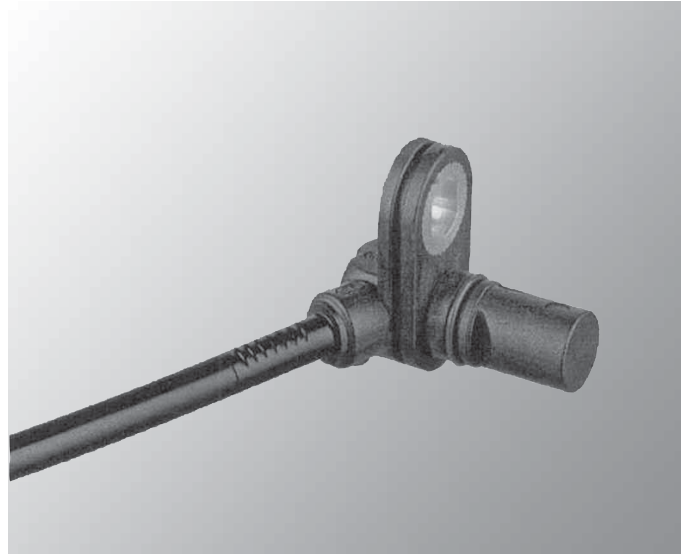
**Material numbers**

Sensors									Materials number
PR2	-	160	G	S	05	/	1	0	R902603031
PR2	-	250	G	S	05	/	1	0	R902603032
PR2	-	400	G	S	05	/	1	0	R902603033
PR2	-	600	G	S	05	/	1	0	R902603034
<i>Additional versions</i>									<i>Upon request</i>

**Extracted from RE 95 132/07.05**Page 1 of 2  
Issue: 06.06See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Speed sensor DSM****Series 1**Hall effect sensor for contactless  
speed measurement

Detects direction of speed

- Diagnostic signals
  - Standstill recognition
  - Critical air gap
  - Critical mounting position
- Detects even low speeds
- Specially developed for the tough requirements of mobile applications
- Automotive quality
- Easy to install without adjustment work
- Current interface
- Degree of protection IP69K

**Ordering code**

	DSM	1	-	10
Mobile speed sensor				
Series				
Version				

**Part number: R917-000-301****Description**

The DSM1-10 Hall-effect speed sensor was specially developed for tough use in mobile work machines. The sensor detects the speed signal of ferromagnetic gear wheels or cut panels. In this process, as an active sensor it supplies a signal with constant amplitude independent of the rotational speed. The sensor excels not just in its ability to detect the direction of rotation, but also through additional diagnostic functions, such as:

- Standstill recognition
- Critical air gap
- Critical mounting position



Example: External gear motor with integrated DSM speed sensor

**Extracted from RE 95 132/07.05**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Type	DSM1
Nominal voltage	12-V
Sensor operating voltage	4.5 V ... 20.0 V
Current consumption	max. 16.8 mA
Signal current level	
$I_{low}$	7 mA $\pm$ 20-%
$I_{high}$	14 mA $\pm$ 20-%
Signal ratio $I_{high}/I_{low}$	$\geq$ 1.9
Signal frequency	1 ... 5000 Hz
Direction of rotation signal	PWM signal (see page 5)
Electromagnetic compatibility Stripline (DIN 1145 2-5) 1 MHz – 400 MHz Free field (DIN 1145 2-2) 200 MHz – 1 GHz	200-V/m 150-V/m
Overvoltage protection	24 V 10--5 min
Inverse-polarity protection Inverse-polarity current	$\leq$ 195 mA Protective circuit must be arranged for in controller or externally!
Vibration resistance (IEC 68-2-34) Random vibration	0.05g <sup>2</sup> Hz 20...2000 Hz
Shock resistance (IEC 68-2-27)	1000 m/s <sup>2</sup> /6 ms 12x in each direction (pos./neg.)
Saltspray resistance (DIN 50-021-SS)	168-h
Degree of protection (DIN 40-050-9)	IP69K
Operating temperature Sensor zone Cable zone	-40-°C ... +150-°C -40-°C ... +115-°C
Storage temperature (IEC 68-2-1 Aa, IEC 68-2-2 Ba)	-40-°C...+50-°C
Housing material	Plastic/brass
Weight	55-g
Mounting position	see page 7
Measuring distance	max. 3 mm
Pressure resistance of measuring surface	5 bar

**Example applications**

Due to its compact, sturdy design, the sensor is suitable for the following applications, among others

- In Rexroth external gear motors
- In the wheel bearing for measuring the wheel speed
- In power shift transmission
- In fan drives for buses, trucks and construction machinery from

7 to 20 kW

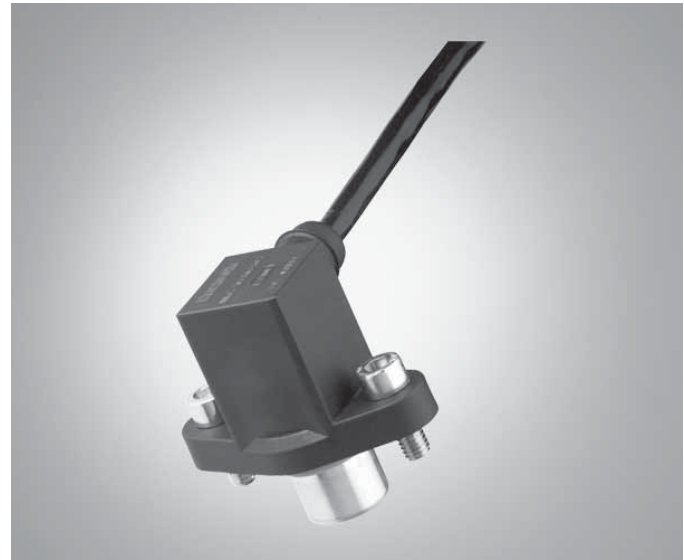
- As a vibration drive for road rollers and road construction machinery

**Extracted from RE 95 135/06.03**Page 1 of 2  
Issue: 06.06See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Hall-effect speed sensor  
HDD****Series 2**

- Easy installation without adjustment
- Detects even low speeds
- Large temperature range
- Protection against Short-circuit, reverse polarity protection
- Pressure-resistant sensor measuring surface
- O-ring seal
- High type of protection IP69k
- Available in a set with A2FM and A6VM/E axial piston motors
- Due to asymmetrical screw attachment the mounting of the axial piston units is encoded.

**Main components**

- Two integrated Hall semiconductors with permanent magnet and amplifier
- Robust plastic housing
- Moulded connecting cable

**Description**

The HDD Hall-effect speed sensor is used for contactless speed measurement of even very low speeds of rotation. Two Hall-effect semiconductor elements in the sensor measure a change in magnetic flux caused by a ferromagnetic gear on the sensor. This magnetic flux change is converted into square-wave pulse signals by the built-in electronic system. The frequency  $f$  of the square-wave voltage emitted by the sensor is calculated from the number of teeth  $z$  on the circumference of the gear wheel and the speed of the drive shaft or PTO shaft, using the following formula:

$$f = \frac{z \cdot n}{60} \quad \begin{array}{l} f \text{ in sec}^{-1} \\ n \text{ in rpm} \\ z = \text{number of teeth} \end{array}$$

The number of teeth is specified in the catalogue sheet for the relevant axial piston motor.

The sensor is suitable for installation in various devices, including the following Rexroth axial piston motors:

A2FM \_\_\_\_\_ see RE 91001

A6VM \_\_\_\_\_ see RE 91604

A6VE \_\_\_\_\_ see RE 91606

Before the sensor can be installed, the motors must be prepared for speed measurement by HDD (boss for flange-on connection).

The sensor is available in four basic variants.

HDD1 delivers a square-wave signal proportional to the speed of rotation and a switch signal that identifies the direction of rotation.

HDD2 delivers two square-wave signals that are offset with a 90° phase delay suitable for redundant speed detection. Additionally, these signals can be used to calculate the direction of rotation using e.g. a Rexroth MC control unit (RE 95050) or RC control unit (RE 95200).

Both variants are available with NPN (default) or PNP output circuit.

**Extracted from RE 95 135/06.03**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code**

HDD / 2 0

**Type**

Hall-effect speed sensor	HDD
--------------------------	-----

**Version**

One frequency output, One output for direction of rotation	1
Two frequency outputs	2

**Installation depth**

16 mm	L16
32 mm	L32

**Output circuit**

NPN	N
PNP	P

**Connection**

	HDD 1L16 HDD 1L32 HDD 2L32		HDD 2L16		
	N	P	N	P	
Core end sleeve	●	●	●	●	A
DEUTSCH DT04-4P-EP04 male connector	●	-	-	-	D

**Series**

	2
--	---

**Index**

	0
--	---

- = Available
- = Not available

## Extracted from RE 95 130/04.05

Page 1 of 2  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Inductive speed sensor ID

For frequency proportional speed measurement  
Series 2

- No external voltage supply required
- Easy to install with fixed lengths of thread engagement ensured by spacer rings on the hydraulic motors
- Sealing surface for O-ring seal

### Main components

- Permanent solenoid with coil
- Steel housing, galvanized and corrosion-protected
- Pressure resistant sensor measuring surface
- Water-tight plug-in connector



## Ordering code

<b>ID</b>	<b>R</b>	<b>18</b>	<b>/</b>	<b>2</b>	<b>0</b>	<b>-</b>	
01	02	03		04	05		06

### Typ

01	Inductive speed sensor	<b>ID</b>
----	------------------------	-----------

### Model

02	with circular connector conforming to DIN 72585	<b>R</b>
----	---	----------

### Thread

03	M18x1.5	<b>18</b>
----	---------	-----------

### Series

04		<b>2</b>
----	--	----------

### Index

05		<b>0</b>
----	--	----------

### Length of thread engagement

06	Fixed length of thread engagement	L = 25.0 mm	<b>L250</b>
		L = 40.0 mm	<b>L400</b>

### Note:

Due to the inductive measuring principle, low speeds result in only a low voltage amplitude in the sensor signal. Therefore, in order to record slow speeds, e.g. to detect standstill for travel drives, an HDD Hall-effect speed sensor (see RE 95135) must be used instead of the ID speed sensor. (different installation conditions).

### Material Number for Speed Sensor ID without Mounting Parts

Sensors	Material number
ID R 18/2 0 - L 250	R902600621
ID R 18/2 0 - L 400	R902600622

**Extracted from RE 95 130/04.05**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

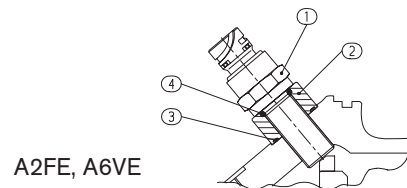
**Material number for speed sensor ID with mounting parts**

Fixed displacement motor A2FM / AA2FM Size	23-32	45-56-63-80-90-107-125	160-180
Material number	R902073689	R902065633	R902063990
Fixed displacement motor A2FE Size	45	56-63	80-90-107-125
Material number	on request	on request	R902060223
Variable displacement motor A6VM Size	28-55-80-107		140-160-200
Material number	R902033162		R902033161
Variable displacement motor AA6VM Size	55-80-107		160-200
Material number	on request		R902063854
Variable displacement motor A6VE Size	28-55-80-107-160		
Material number	R902063767		
Fixed displacement motor A10FM Size	23-28	37-45	58-63
Material number	R902428802	R902433368	R902437556
Variable displacement motor A10VM Size	28	45	63
Material number	R902428802	R902437557	R902428802

**Adapter parts**

Item 1-4 included in the material number

- Item 1 Inductive speed sensor
- Item 2 Spacer ring
- Item 3 O-ring
- Item 4 O-ring





**Extracted from RA 95 140/02.04**

Page 1 of 2  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Angle of rotation sensor WS1**

Series 10

Inductive sensor for angular measurement

- Hall-effect semiconductor elements and integrated amplifiers
- Robust plastic housing with moulded plug
- Metal inner housing and line filter for high electromagnetic compatibility (EMC)
- Guide lever with fixing hole

**Special features**

- Life span designed for more than 30 million cycles
- Resistant to shock and vibration
- Molded-in metal bushing for low-wear on lever arm

The angle of rotation sensor is used for measuring rotary movements of an adjusting shaft or the angle positions of levers, e.g. to determine the setting of the injection pump lever of a diesel engine.

The sensor has a robust, sealed housing and an integrated electronic system specially developed for automotive applications.

The voltage supply for the WS1 angle of rotation sensor can be delivered directly by the control units (MC or RC).

As output variable, the WS1 angle of rotation sensor delivers a voltage proportional to the angle of rotation.

The sensor contains two internal contact-free measuring systems with a common power supply.

For safety-related system solutions, the output signals are partially redundant.



**Ordering code**

	<b>WS1</b>	<b>T</b>	<b>90</b>	<b>/</b>	<b>1</b>	<b>0</b>
<b>Type</b>	Angle of rotation sensor					
	WS1					
<b>Safety</b>	Partially redundant (2 output signals)					
						T
<b>Version / Measuring range</b>	90° angle of rotation					
					90	
<b>Series</b>						1
<b>Index</b>						0

**Extracted from RA 95 140/02.04**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Technical data**

Type	WS 1 T 90 / 10
Supply voltage $U_b$	5V DC $\pm$ 0.25 V
Input Current	max. 11 mA
Output voltage $U_a$	0.5 ... 4.5 V (for 5 V power supply)
Linearity of the output voltage $U_a$	$\pm 0.5$ % at $-45^\circ \leq \alpha \leq -15^\circ$ $\pm 0.25$ % at $-15^\circ \leq \alpha \leq +15^\circ$ $\pm 0.5$ % at $+15^\circ \leq \alpha \leq +45^\circ$
Accuracy of output voltage $U_a$ at 20°C	$\pm 2$ %
Load impedance to earth	min. 10 k $\Omega$ max. 22 nF
Short-circuit resistance of the signal outputs to	Supply voltage and earth
Polarity mismatch protection	Supply voltage to earth
Electromagnetic compatibility Broadcast noise (ISO 11452) Line-borne interference (ISO 7637-1)	200 V <sub>eff</sub> /m Values on request
Operating temperature, housing	-40°C ... +100°C, max. +120°C for 1 h
Storage temperature, housing	-40°C ... +100°C, max. +130°C for 16 h
Vibration resistance (IEC 60086-2): Oscillation, sinusoidal Oscillation, noise	10 g / 50...500 Hz 4.5 g rms/ 5...500 Hz
Protection class (DIN/EN 60529) with connected mating plug	IP 6k6 IP 6k9k
Housing material	Plastic
Mass	Approx. 95 g
Angle of rotation, mechanical	360° (spinnable)
Angle of rotation, measuring range	$\alpha = \pm 45^\circ$
Actuating torque at lever arm	$\leq 0.1$ Nm
Installation position	any

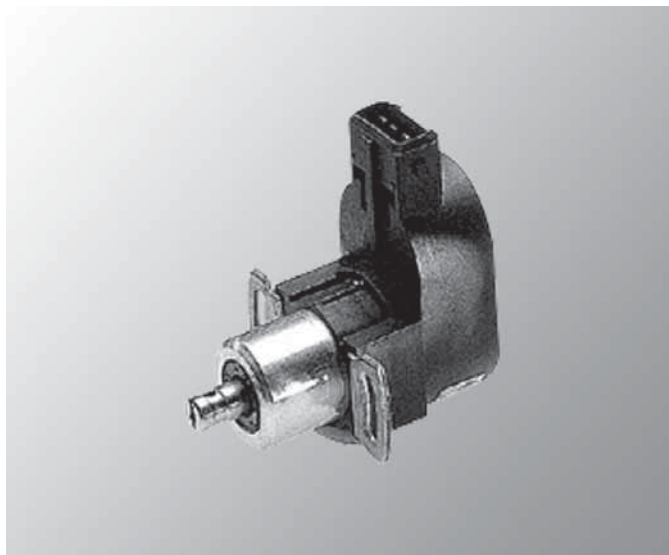
**Extracted from RE 95 142/06.05**Page 1 of 2  
Issue: 06.06See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Inductive Angle Sensor AN1****Series 2**

Inductive sensor for angular measurement

- Inductive angle sensor element based on the differential-throttle principle
- Shaft can be turned mechanically
- Integrated electronics with temperature compensation
- Output signal ratiometrically proportional to angle
- Precise balance adjustment for zero point and sensitivity

**Installation instructions**

- As far as possible, the angle sensor shaft should be coupled to the object to be measured in such a way that it is free of play and tensile force.

**Material number**

Sensors								Material Number
AN1	V1	B	35	10	/	2	0	R917002690
AN1	V1	A	41	10	/	2	0	R917002691
AN1	V2	A	36	10	/	2	0	R917002692
AN1	V1	A	44	10	/	2	0	R917002693
AN1	V3	A	28	10	/	2	0	R917002694
AN1	V1	A	17	10	/	2	0	R917002695
AN1	V2	A	41	10	/	2	0	R917002696
AN1	V3	A	41	10	/	2	0	R917002697

**Extracted from RE 95 142/06.05**

Page 2 of 2

Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Ordering code**

<b>AN1</b>				<b>10</b>	<b>/</b>	<b>2</b>	<b>0</b>
01	02	03	04	05		06	07

**Type**

01	Inductive Angle Sensor	<b>AN1</b>
----	------------------------	------------

**Version**

02	without pin	<b>V1</b>
	with pin to the bottom	<b>V2</b>
	with pin to the top	<b>V3</b>

**Characteristics**

03	positive course	<b>A</b>
	negative course	<b>B</b>

**Angles**

04	$\pm 17^\circ$	<b>17</b>
	$\pm 28^\circ$	<b>28</b>
	$\pm 35^\circ$	<b>35</b>
	$\pm 36^\circ$	<b>36</b>
	$\pm 41^\circ$	<b>41</b>
	$\pm 44^\circ$	<b>44</b>

**Supply / Signal**

05	$U_{\text{sup}}: 8 \dots 12V$ / Signal: $0.25$ to $0.75 * U_{\text{sup}}$	<b>10</b>
----	---	-----------

**Series**

06		<b>2</b>
----	--	----------

**Index**

07		<b>0</b>
----	--	----------

**Specification**

The angle sensor AN1 is used for the angular measurement up from  $\pm 17^\circ$  till  $\pm 44^\circ$ .

The sensor is supplying a ratiometric voltage, available with increasing curve (positive course) or inverted curve (negative course).

This sensor is a typical part of an electronic-hydraulic hitch control (EHR).

### Extracted from RE 95 160/12.04

Page 1 of 2  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Inductive position sensor PO1

Inductive sensor for position measurement  
Series 2

- Axially-adjustable button with spring pretension
- Inductive position sensor element according to differential throttle measuring principle
- Integrated electronics with temperature compensation
- Output signal, ratiometric and proportional to position
- Zero point and sensitivity matched
- Housing with M 24x1.5 external thread for fastening and alignment
- Also available on request with 5 VDC supply voltage



**Extracted from RE 95 160/12.04**

 Page 2 of 2  
 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Ordering code**

		PO1			10	/	2	0
<b>Type</b>								
Mobile position sensor		PO1						
<b>Version</b>								
Without bellows			1					
With bellows			2					
<b>Characteristic</b>								
Standard				S				
Inverted				V				
<b>Supply voltage</b>								
8 ... 12 VDC					10			
5 ± 0.5 VDC (on request)					05			
<b>Series</b>							2	
<b>Index</b>								0

**Order number**

Sensors							Order number
PO1	2	S	10	/	2	0	R917001941
PO1	1	S	10	/	2	0	R917001942
PO1	2	V	10	/	2	0	R917001943
PO1	1	V	10	/	2	0	R917001944
PO1	2	S	05	/	2	0	On request
PO1	1	S	05	/	2	0	On request
PO1	2	V	05	/	2	0	On request
PO1	1	V	05	/	2	0	On request

### Extracted from RE 95 170/12.04

Page 1 of 3  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Draft Sensor KMB

Sensor for draft measurement  
Series 3

- Draft sensor according to Category 3 rear three-point attachment ISO 730-1
- Sensor element with magnetoelastic measuring principle
- Integrated electronics
- Output signal ratiometric and proportional to draft
- Zero point and sensitivity matched



**Extracted from RE 95 170/12.04**

Page 2 of 3

Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Ordering code**

KMB		A		A		/		3		0		-	
<b>Type</b>													
Draft sensor											KMB		
<b>Load range</b>													
± 25 kN											025		
± 40 kN											040		
± 50 kN											050		
± 60 kN											060		
± 90 kN											090		
± 110 kN											110		
± 150 kN											150		
<b>Diameter</b>													
Ø 37.5											A		
<b>Cable variants</b>													
Cable without protecting sleeve											1		
Cable with spiral protecting sleeve											2		
Cable with metal protecting sleeve											3		
Cable with plastic protecting sleeve											4		
<b>Plug</b>													
AMP plug; 3-pin											A		
<b>Model series</b>													
											3		
<b>Index</b>													
											0		
<b>Cable length</b>													
300 mm											03		
800 mm											08		
1000 mm											10		
1500 mm											15		
1600 mm											16		
2700 mm											27		



**Extracted from RE 95 170/12.04**

Page 3 of 3  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Description**

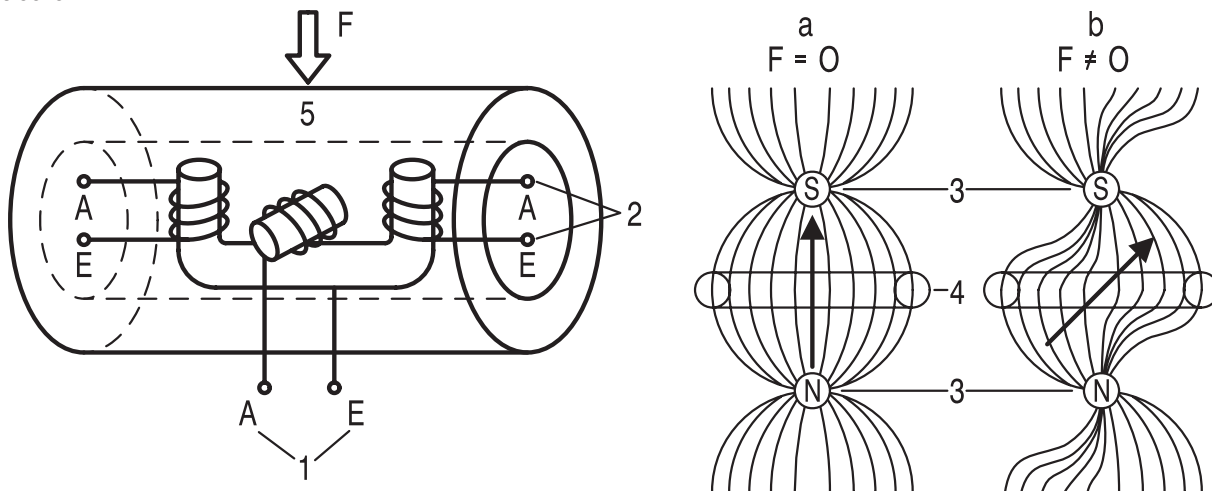
The draft sensor is designed as a bearing bolt. Shearing stress occurs at the bearing position, which is evaluated as a magnetoelastic effect. In unloaded condition a symmetrical magnetic field is formed by the primary coil between the poles. If pulling or pressure drafts are induced, then the magnetic properties of the original isotropic material is altered. As a consequence the magnetic field is rendered asymmetrical. This in turn induces a magnetic potential difference between the secondary poles. This causes a magnetic flux through the secondary circuit so that a voltage is induced in the secondary coils. This voltage is proportional to the acting draft. It is amplified and rectified in an integrated evaluation circuit.

The sensor supplies a ratiometric voltage (25% .. 75% of supply voltage). It is available in various measuring ranges and cable versions. This sensor is a typical part of an electronic-hydraulic hitch control (EHR).

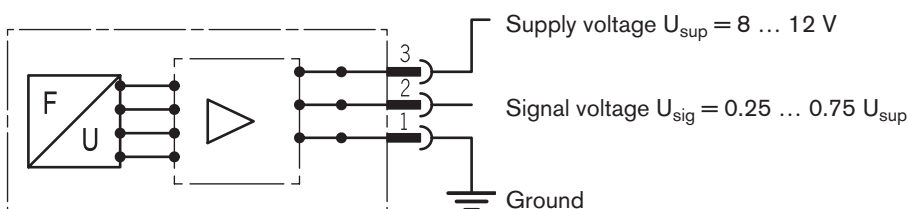
**Operating principle**

- 1 Primary coil
- 2 Secondary coil
- 3 Primary pole surface
- 4 Secondary pole surface
- 5 Steel sleeve

- a Symmetrical magnetic field
- b Asymmetrical magnetic field



**Block circuit diagrams / Terminal connections**



**Extracted from RE 95 300/04.04**

Page 1 of 6  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Application software  
Speed control SPC**

Electronic speed control and  
speed regulation for hydraulic drives  
Version 10

Hydraulic drives are often operated on diesel engines whose speed in operation cannot be kept constant due to different drive profiles.

Electronic speed control is an easily configurable software for controlling and/or regulating hydraulic drives. It is used to keep the drive speed constant independently of diesel engine and pump speeds.

Three variants are available:

- **Variant A** for speed control (SPCA)
- **Variant C** for speed regulation (SPCC)
- **Variant D** for speed regulation in concrete mixer vehicles (SPCD)

The speed control is designed for use with Rexroth hydraulic pumps.

The user can easily configure the application software for various combinations of pumps, combustion engines, sensors and equipment.

The speed control is suitable for diesel engines with or without a CAN bus interface (SAE J1939 protocol for SPCA).

Fault diagnosis and parameter assignment can be carried out using the BODEM PC software or the BB-3 control box.



### Extracted from RE 95 300/04.04

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Ordering code

	AS/	SPC		10
<b>Type</b>				
Application software	AS/			
<b>Software</b>				
SPC speed control				
<b>Variant A</b>				
Speed control with speed pick-up in the diesel engine			A	
<b>Variant C</b>				
Speed regulation with speed pick-up in the hydraulic motor			C	
<b>Variant D</b>				
Speed regulation for concrete mixer vehicles			D	
<b>Version</b>				
				10

### Ordering information

The AS/SPC application software can only be used with the RC2-2/20 control unit and other add-on components (see page 5 for variant A, page 9 for variant C and page 14 for variant D). When ordering, link the hardware and software type codes with a "+",

for example:

RC2-2/20+AS/SPCA10

### Variant SPCA

The electronic speed control SPCA is an easily configurable software program for controlling hydraulic drives. These drives usually consist of a hydraulic pump and one or more hydraulic motors. The speed control serves to keep the drive speed constant, irrespective of the speeds of the diesel engine and the pump.

The SPCA electronic speed control is designed to control a variable displacement pump in an open or closed hydraulic circuit.

The following hydraulic design is used in an open circuit:

- A variable displacement pump A11VO, A7VO or KVA with electroproportional control EP together with one or more fixed displacement motors A2FM, A2FE, A4FM, A10FM or MCR

In a closed hydraulic circuit the following design is used:

- A variable displacement pump A4VG or A10VG with electroproportional control EP together with one or more fixed displacement motors A2FM, A2FE, A4FM, A10FM or MCR

Two different designs of diesel engine can be used:

- In the case of diesel engines without a CAN bus interface, the actual speed is sent to the speed control by a speed sensor on the starter gear ring.
- In diesel engines with a CAN bus interface, the speed control receives the actual speed of the engine via the CAN bus.

### Functional description

In order to keep the speed of hydraulic drives constant and independent of the diesel engine speed and the pump speed, the displacement angle of the hydraulic variable displacement pump is adjusted by electroproportional control.

### Speed control

A setpoint generator supplies the reference drive speed. An external speed sensor, or the CAN bus, determines the actual speed of the diesel engine. If the actual speed of the diesel engine exceeds a set minimum speed (start of control), the software's speed control starts to operate. With further increasing diesel speed, the software reduces the electric control current (PWM signal) to the pump. This reduction is inverse proportional to the increase in diesel speed. This causes the flow rate of the pump to stay constant. The output speed of a hydro motor connected to the pump therefore also stays constant. The SPCA speed control thus holds the output speed to the desired value independently of the diesel engine speed.

When the speed control is not active, the pump control uses adjustable time ramps to achieve linear adjustment according to the desired setpoint value. The time ramps are set for the setpoint generator deflection (without the intervention of the speed control).

SPCA speed control can be used for variable displacement pumps in both open and closed hydraulic circuits.

When a pump is used in an open circuit, only one direction can be used for the drive (either forwards or backwards).

The speed control can be switched on or off with a switch in the vehicle.

**Extracted from RE 95 300/04.04**

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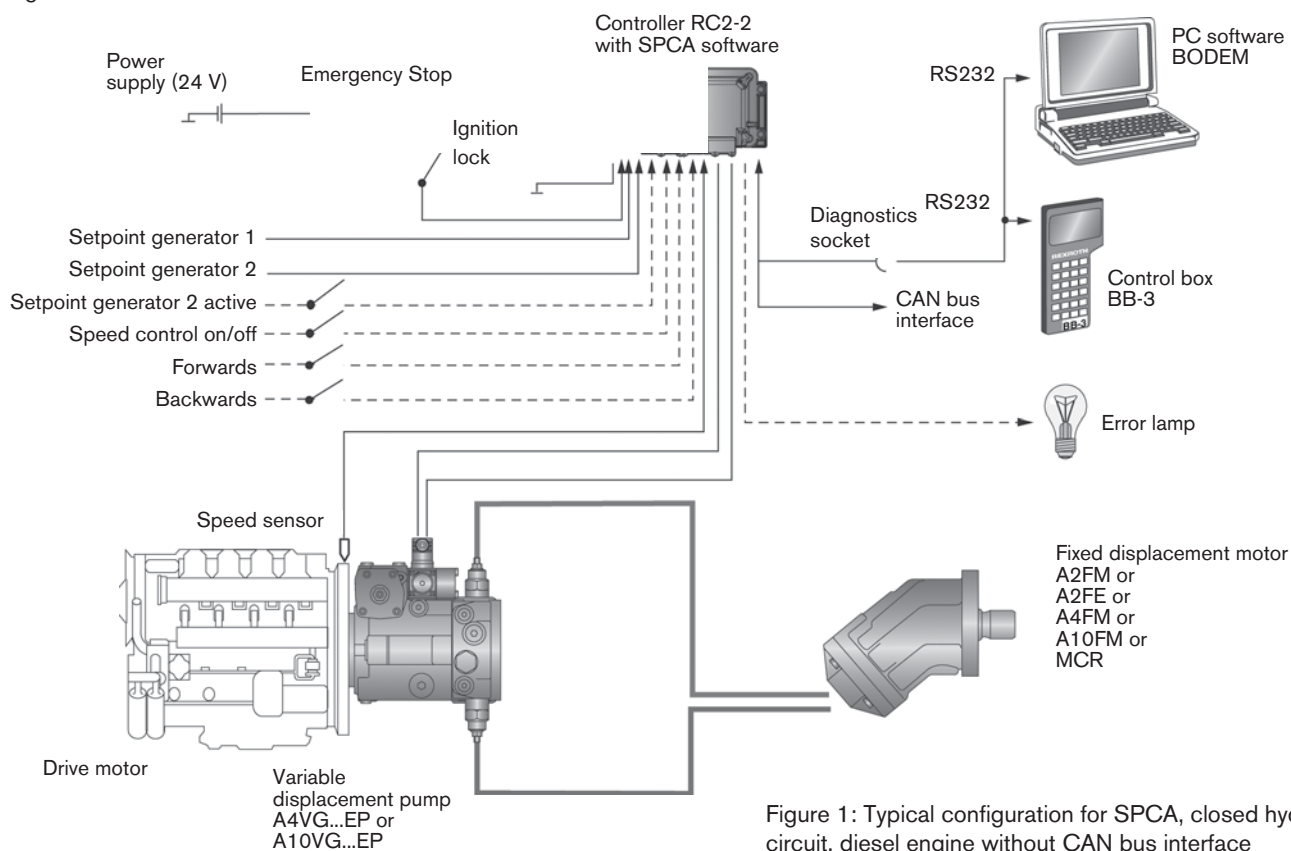


Figure 1: Typical configuration for SPCA, closed hydraulic circuit, diesel engine without CAN bus interface

## Setpoint definition

The setpoint generator specifies the drive speed or the volumetric flow. It can be a lever or a simple potentiometer.

It is also possible to use two setpoint generators in the vehicle. The second generator can also be a lever or a simple potentiometer. A switch can then be used to switch between the two setpoint generators, for example if there is one potentiometer in the driver's compartment and another on the rear of the vehicle. Switching is only possible when the drive is at a standstill.

Two direction switches in the vehicle set the direction of the drive (forwards or backwards).

## Working behavior

The working behavior of the drive is controlled by three parameters:

- The setpoint generator supplies the reference value for the drive speed.
- The direction switch determines whether the drive runs forwards or backwards.
- The acceleration behavior selected using the time ramp settings determines how quickly the control is changed at the PWM output to the pump. The time ramps can be set separately for the deflection of the setpoint generator (without intervention from the speed control) and for speed control intervention.

The setpoint generator is in the neutral position if it is positioned within a certain range around the zero position. This range is called the dead band. A fixed value has been pre-set in the software and cannot be altered.

When the setpoint generator is in the neutral position, the PWM outputs for controlling the proportional solenoids of the pump are switched off (there are two PWM outputs in the closed circuit and one in the open circuit).

If the setpoint generator is moved to a position outside the dead band, the current at the relevant PWM output (forwards or backwards) increases depending on the position of the setpoint generator, the direction switch and the time ramp that has been set. The corresponding proportional solenoid of the pump is controlled.

## Safety functions

Various options are available for monitoring working behavior:

- Start condition

The start condition is used to prevent the drive from starting unintentionally.

After switching on the control unit (ignition on) the setpoint generator that has been switched to active must be in the neutral position. Additionally the direction switches must be off so that the drive can be started.

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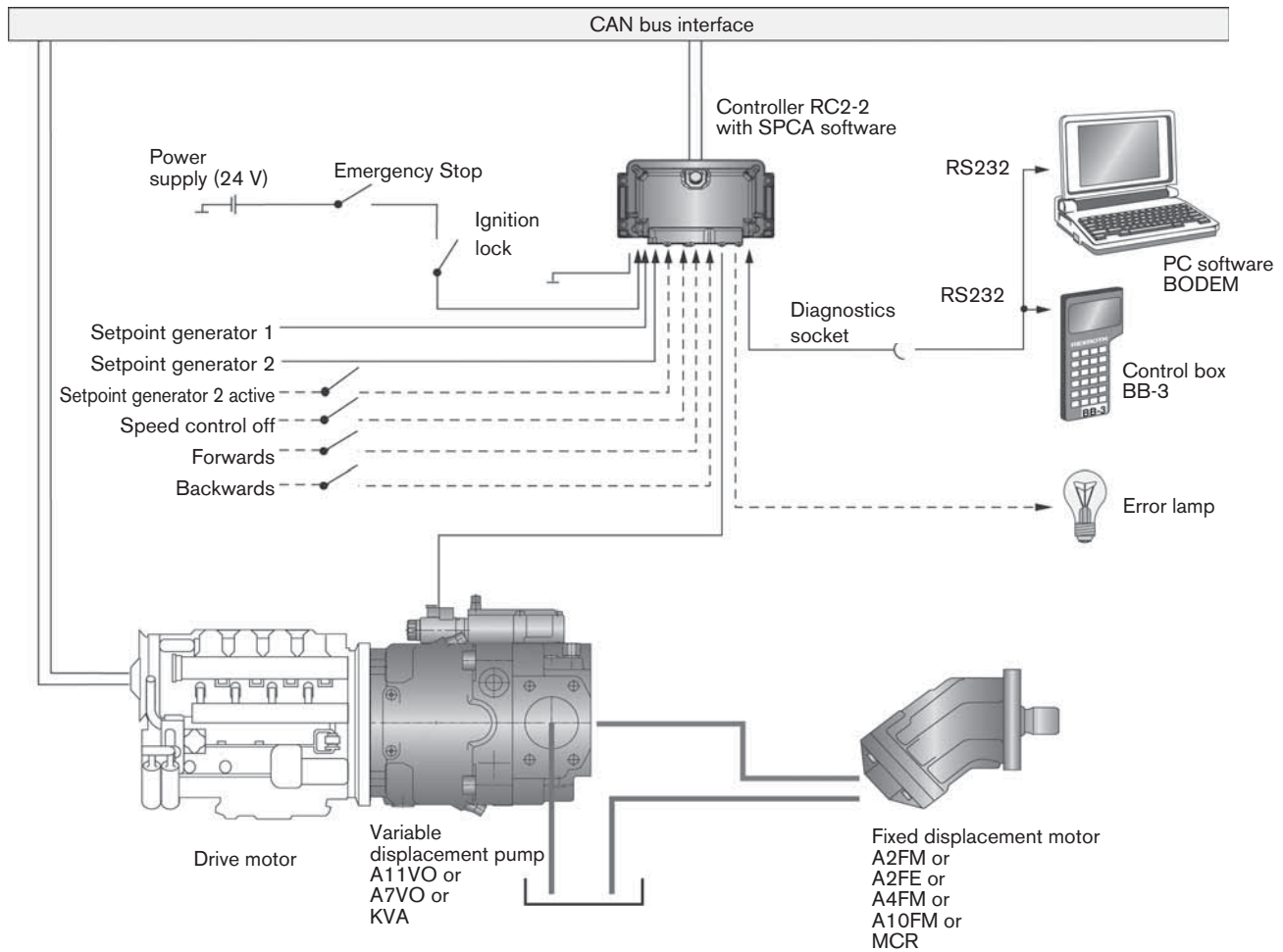
See  
Prefc

Figure 2: Typical configuration for SPCA, open hydraulic circuit, diesel engine with CAN bus interface

To acknowledge faults, the setpoint generator that has been switched to active must be moved to the neutral position and the direction switches must be turned off.

- Monitoring the diesel engine speed

At diesel engine speeds below the idling speed the drive is switched to a fixed low output speed.

- Monitoring the inputs and outputs

The lines for reference value inputs and outputs and the proportional solenoid outputs are monitored for wire breaks and short circuits.

In the event of a fault, or if the emergency stop switch is actuated, the drive switches off immediately.

An external error lamp also lights up if there is a fault (if installed).

### Important features

- It is possible to switch between two setpoint generators to set the reference value.

- The acceleration and deceleration times can be set separately for the setpoint generator deflection (without the intervention of the speed control) and speed control intervention.
- A switch in the vehicle can be used to switch the speed control on or off.
- A speed sensor or the CAN bus determines the actual value of the diesel engine speed.
- The behavior of the drive is monitored by safety functions such as the starting condition and the diesel engine speed monitor.
- The inputs and outputs of the control unit (e.g. setpoint generator) are monitored for cable breaks and short circuit. The drive switches off immediately in the event of a fault or if the emergency stop switch is actuated.
- Faults can be displayed via the error lamp.
- All faults that occur can be output with protocol SAE J1939 via the CAN bus interface.
- All faults that occur are stored in the control unit and can also be read out later in plain text using the BODEM or BB-3 diagnostic tools.

## Extracted from RE 95 300/04.04

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Issue: 06.06

See Section 16 for applicable Preferred/Spotlight part numbers and unit price.

### Variant SPCC

The electronic speed regulator (Speed Control, SPCC) is an easily configurable software program for controlling hydraulic drives. The hydraulic drive consists of a pump and one or more hydraulic motors. The speed control serves to keep the drive speed constant, irrespective of the speeds of the diesel engine and the pump.

The SPCC electronic speed regulator is designed to control a variable displacement pump in a closed hydraulic circuit.

The following hydraulic design is used:

- An A4VG or A10VG variable displacement pump with electroproportional control EP together with one or more A2FM, A2FE, A4FM, A10FM or MCR fixed displacement motors

The following design of diesel engine is used:

- Diesel engine with or without CAN bus interface

The SPCC speed regulator does not use the CAN bus. Neither the setpoint speed nor the actual speed of the diesel engine is used for speed regulation. The regulation depends on the setpoint speed and actual speed of the hydraulic motor.

### Functional description

In order to keep the speed of hydraulic drives constant and independent of the diesel engine speed and the pump speed, the displacement angle of the hydraulic variable displacement pump is adjusted by electroproportional control.

### Speed regulation

A switch in the vehicle can be used to switch the speed regulator on or off.

When the speed regulator is switched on, the following applies: the setpoint speed of the drive is given by the drive potentiometer. The actual speed of the drive is measured by a speed sensor in the hydraulic motor. When the actual speed changes, the output signal to the pump is changed by the software such that the pump's flow rate stays constant. The output speed of a hydraulic motor connected to the pump therefore also stays constant.

When the speed regulator is switched off, the pump control adjusts itself in a linear fashion using the set time ramps to reach the desired setpoint value.

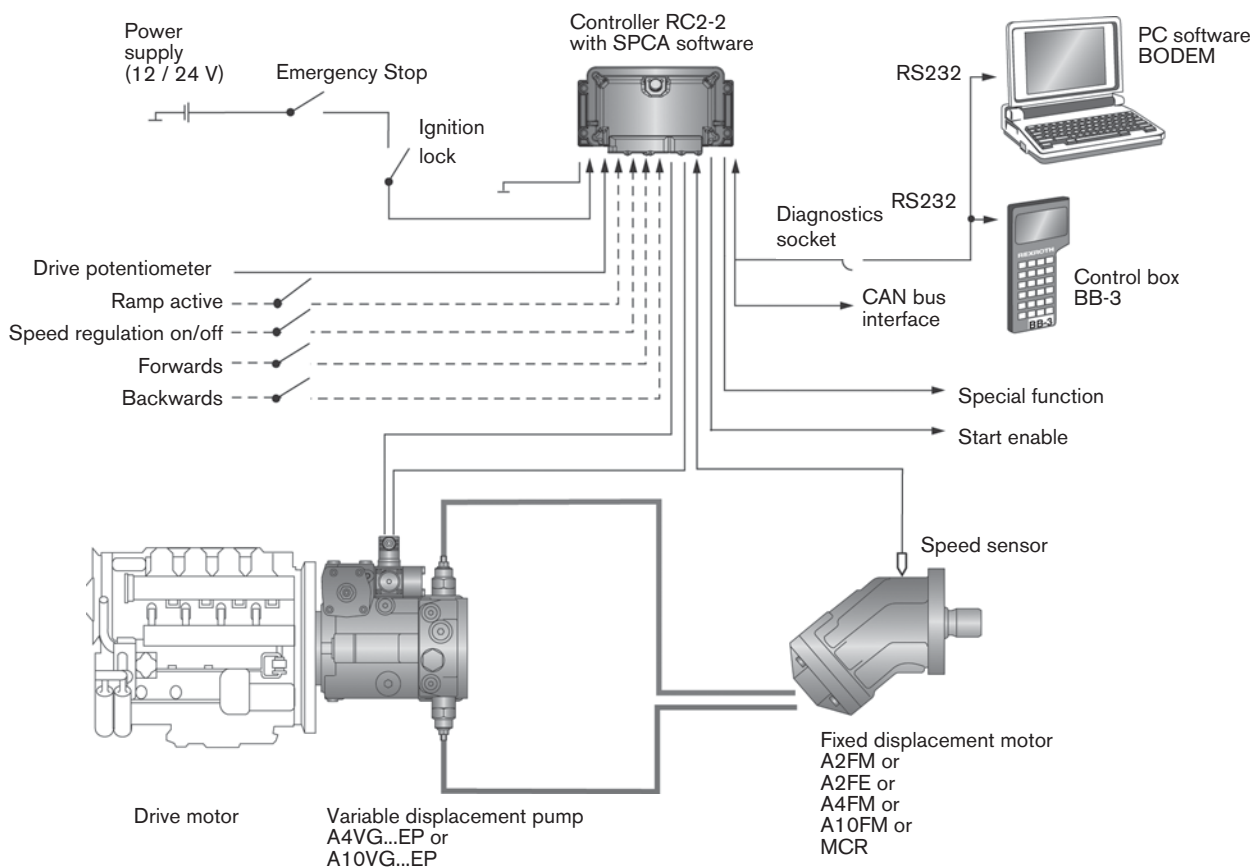


Figure 5: Typical configuration for the SPCC speed regulator



## Extracted from RE 95 300/04.04

### Variant SPCD

The electronic speed regulator (Speed Control, SPCD) is an easily configurable program for controlling hydraulic drives in concrete mixer vehicles. The hydraulic drive consists of a pump and a hydraulic motor. It is used to turn the mixer drum of the vehicle. The SPCD speed regulator is used to keep the hydraulic drive speed constant, irrespective of the speeds of the diesel engine and the pump.

The SPCD electronic speed regulator is designed to control a variable displacement pump in a closed hydraulic circuit.

The following hydraulic design is used:

- An A4VTG, A4VG or A10VG variable displacement pump with electroproportional control EP together with an A2FM, A2FE, A4FM, A10FM or MCR fixed displacement motor

The following design of diesel engine is used:

- Diesel engine with or without CAN bus interface
- The speed regulator does not use the CAN bus. Neither the setpoint speed nor the actual speed of the diesel engine is used for speed regulation. The regulation depends on the setpoint speed and actual speed of the hydraulic motor.

### Functional description

In order to keep the speed of hydraulic drives constant and independent of the diesel engine speed and the pump speed, the displacement angle of the hydraulic variable displacement pump is adjusted by electroproportional control.

### Speed regulation

The setpoint speed of the drum is set by means of two pushbuttons (right/left) in the vehicle. The actual speed of the drum is measured by a speed sensor in the hydraulic motor. When the actual speed changes, the output signal to the pump is changed by the software such that the pump's flow rate stays constant. The output speed of a hydraulic motor connected to the pump therefore also stays constant. This keeps the drum revolving at a constant speed irrespective of the diesel motor and pump speeds.

This is achieved by regulating the displacement angle of the hydraulic variable displacement pump in the closed circuit by electroproportional control. The pump control varies according to the time ramp that has been set for the working behavior.

The speed regulation can be switched off or on when starting up.

If speed regulation has been switched off on starting up, the pump is controlled in proportion to the setpoint speed and the speed of the diesel engine. All displacement angles are then possible in the range 0 to 100%.

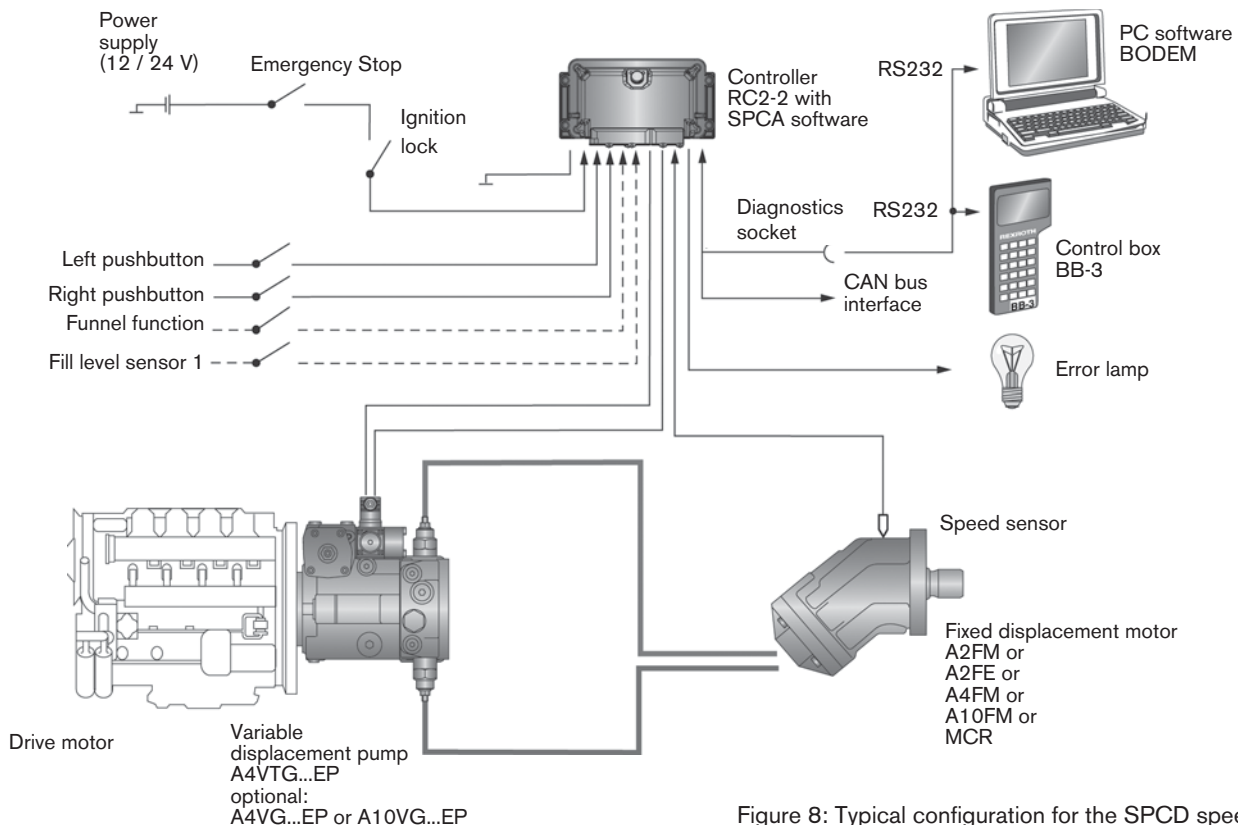


Figure 8: Typical configuration for the SPCD speed regulator

**Extracted from RE 95 310/02.04**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Application software**  
**Load limiting control LLC**

Electronic load limiting control system for  
power management in hydraulic systems  
Version 10

The electronic load limiting control system is easy-to-customize  
software for managing power in hydraulic systems.

- The load limiting control system always matches the power  
input of an adjustable hydraulic pump with the available power  
from the internal combustion engine.
- It prevents overloading of the internal combustion engine.
- At all times the hydraulic pumps converts the maximum avail-  
able power.

Two variants of the load limiting control system are available: Vari-  
ant A "Universal software" and variant B "Slew drive mode" for  
controlling slew drive irrespective of the diesel engine speed.

The load limiting control system is designed for Rexroth hydraulic  
pumps.

Setting parameters enable the user to easily customize the soft-  
ware for different configurations of pumps, internal combustion  
engines, sensors and devices.

The load limiting control system is suitable for diesel engines with  
or without a CAN bus interface, protocol SAE J1939

Fault diagnosis and parameter assignment can be carried out us-  
ing the BODEM PC software or the BB-3 control panel.



**Ordering code**

	AS/	LLC		10
<b>Type</b>				
Application software	AS/			
<b>Software</b>				
Load Limiting Control	LLC			
<b>Variant A</b>				
Load limiting control for two pumps Option: CAN bus, Option: Constant speed control				A
<b>Variant B</b>				
Load limiting control for one pump, Option: Slewing gear Option: Power mode (switchable diesel power and speed drop)				B
<b>Version</b>				
				10



**Extracted from RE 95 310/02.04**Page 2 of 4  
Issue: 06.06See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Ordering information**

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The AS/LLC application software must only be used with the RC2-2/20 control unit and other add-on components (Variant A see Page 6, Variant B see Page 9). When placing an order, the hardware and software type codes should be linked by a "+".

E.g. RC2-2/20+AS/LLCA10

**Variant LLCA**

---

Electronic load limiting control LLCA enables the size of the diesel engine in the hydraulic system to be determined by the average power requirement. The power consumption of the individual consumers (pumps) is reduced in the event of overload. Load limiting control thus ensures optimum use of power from the diesel engine with varying loads.

Electronic load limiting control supports different hydraulic layouts and different diesel engine designs. These can be used in any combination.

The electronic load limiting control system is designed for controlling displacement pumps in an open hydraulic circuit.

A distinction is made between the following hydraulic layouts for the purpose of control:

- With **negative ID** the hydraulic system includes one or two A11VO displacement pumps or displacement double pumps A8VO or A20VO, with hydraulic power and load limiting controllers (LG1, LE, LA1) respectively.

Each pump is adjusted for 100% of the available diesel power.

The control unit controls the pump controller (LE) and/or the pressure-reduction valves (DRE) directly; the latter turn down the setting on the pump power controller (LG1, LA1) by means of an increased pilot pressure.

- With **positive ID** the hydraulic system includes one or two A10VO displacement pumps with an EP/EK pump controller.

The total installed pump capacity exceeds the diesel engine power.

The control unit controls the pressure reduction valves (DRE) which in turn override the control pressures at the pumps, thereby reducing the flow rate.

A third, uncontrolled pump can be used with both hydraulic layouts. This pump is prioritized in the system, and thus receives the power it requires with no reduction. Whatever power remains available is then divided between pumps 1 and 2.

Two different designs of diesel engine can be used:

- In the case of **diesel engines without a CAN bus interface**, the control unit receives the diesel engine's rated speed from an angle sensor (accelerator pedal position as rated speed) or from a fixed speed value set in the control unit. The actual speed is measured using a speed sensor on the starter ring gear.
- In the case of **diesel engines with a CAN bus interface** the control unit receives the necessary data for load limiting control (rated and actual speed and/or torque and engine temperature) directly via the CAN bus.

It is also possible to use a combination of analog sensors and CAN bus data.

**Extracted from RE 95 310/02.04**

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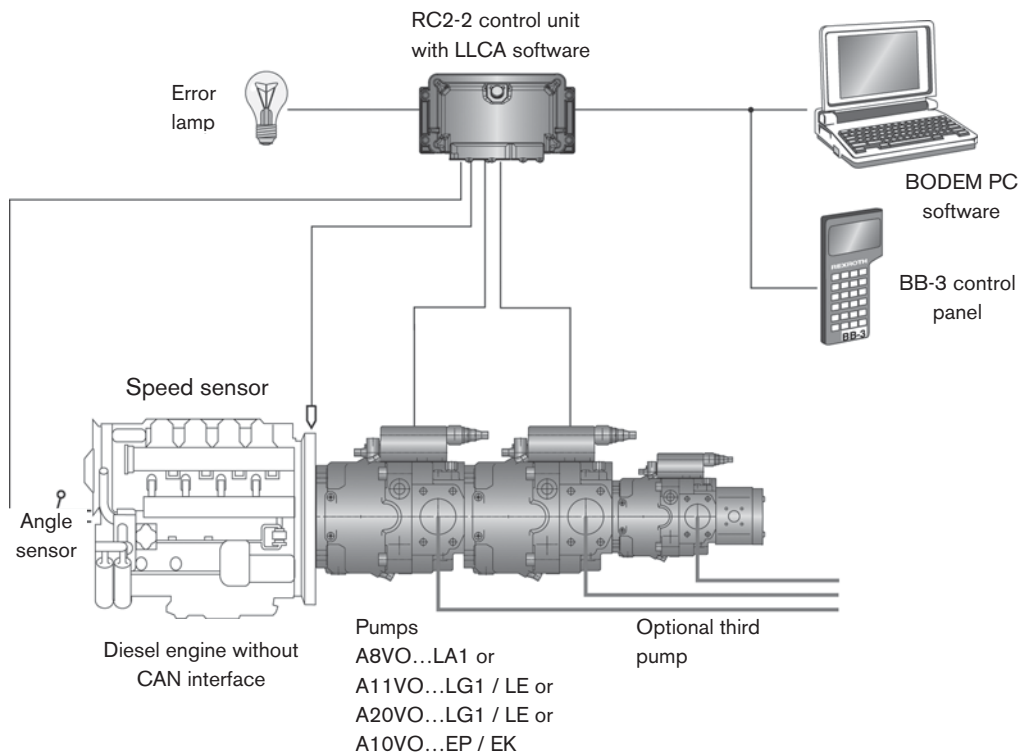


Figure 1: Typical configuration for LLCA without CAN bus interface

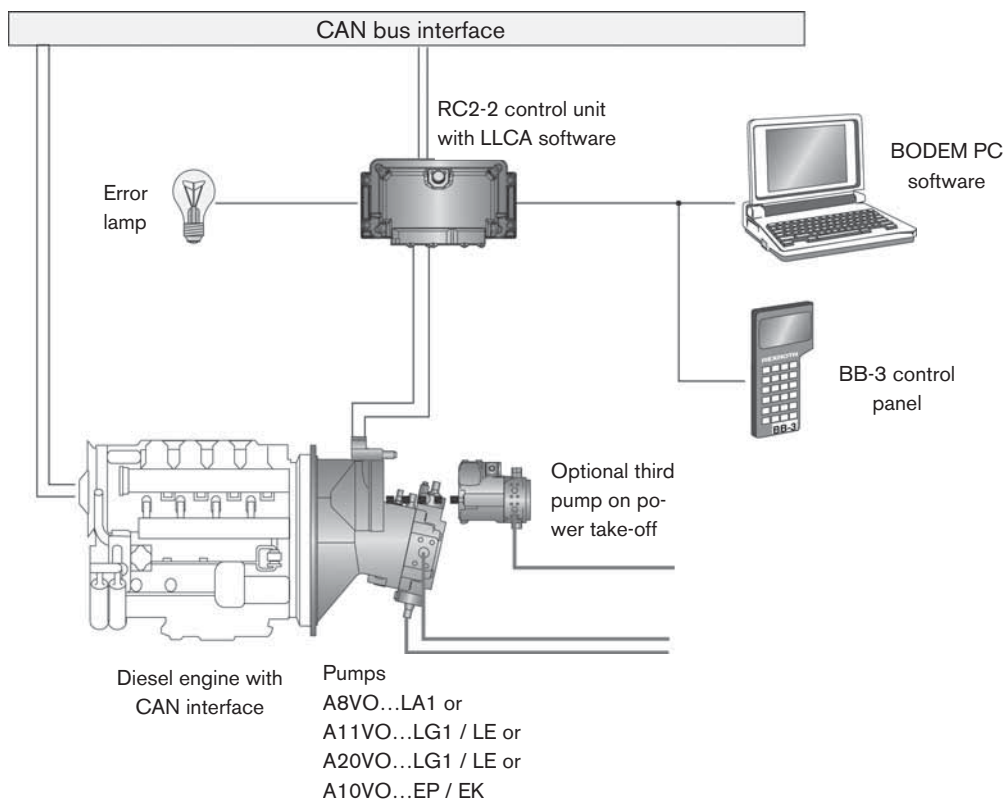


Figure 2: Typical configuration for LLCA with CAN bus interface

## Extracted from RE 95 310/02.04

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Variant LLCB

The LLCB electronic load limiting control system works in basically the same way as the LLCA variant, but is only designed for controlling one pump rather than two.

Instead, the valve for the slew drive is controlled in such a way that the flow rate for the slew drive motor is maintained irrespective of the diesel engine speed. As a result the slew drive always turns at the same speed whatever speed the diesel engine is running at.

The electronic load limiting control system is designed for controlling displacement pumps in an open hydraulic circuit.

The following hydraulic layout can be used for control purposes:

- The hydraulic system comprises the axial piston pumps A8VO or A11VO with a hydraulic or electrohydraulic power controller and load limiting controller (LA1, LG1, LE) together with a control block (e.g. M7) with a pressure reduction valve (DRE) on the slew drive spool.

The RC2-2/20 control unit controls the pump controller and the pressure reduction valve in the control block.

The following diesel engine configuration can be used:

- Diesel engine with or without CAN bus interface  
The control unit receives the rated speed for the diesel engine from an angle sensor (accelerator pedal position as rated speed). The actual speed is measured using a speed sensor on the starter ring gear.

The LLCB variant does not evaluate the CAN bus.

### Functional Description

The diagram below illustrates how load limiting control works:

- From the rated and actual speed values the load limiting control system calculates the current speed drop of the diesel engine.
- Load limiting control compares the current speed drop with the definable limit values. Different limit values can be defined for different rated speeds.
- As long as the total of the hydraulic power does not exceed the installed diesel power, the speed drop will not exceed the defined limit values. Load limiting control will not intervene.
- If, however, the diesel engine speed drop exceeds the limit value, then the load limiting controller will intervene and reduce the pump power.
- The maximum permissible speed drop of the diesel engine can be adjusted in three steps using the "power mode" switches.

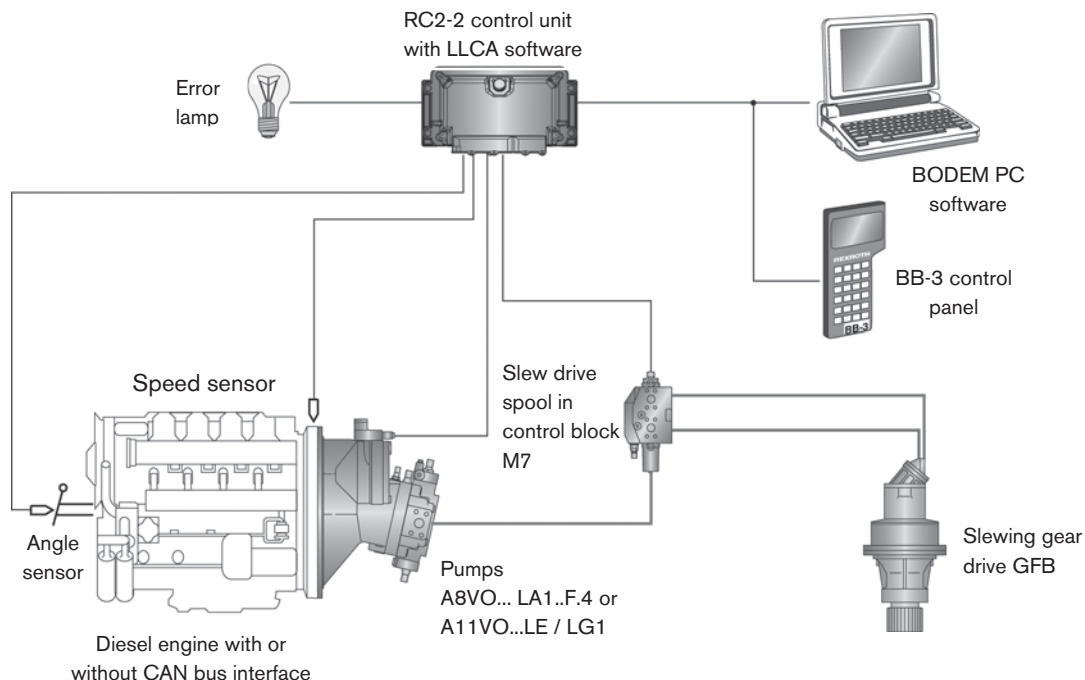


Figure 6: Configuration for LLCB

**Extracted from RE 95 320/02.04**

Page 1 of 3  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Application software  
Drive control DRC**

Electronic drive control for  
managing hydraulic drives  
Version 10

Electronic drive control is an easy-to-customize software application for managing hydraulic drives. With its integral reversing and hydrostatic braking functions it enables soft start-up, accelerating and reversing operations.

Drive control also provides acceleration and deceleration behavior that can be selected and adjusted externally.

The integral, adjustable inching function enables the setpoint limitation to be adjusted continuously.

Three variants (A, B and C) are available to define the setpoint and direction.

- Variant A: Setpoint and direction set by means of joystick
- Variant B: Setpoint by acceleration pedal, direction by direction switches
- Variant C: Setpoint defined externally, direction defined externally or using direction switches

Drive control DRC is designed for use with Rexroth A4VG and A10VG pumps with electrical adjustment (proportional solenoid).

The software can be easily customized by the user.

Fault diagnosis and parameter assignment can be carried out using the BODEM PC software or the BB-3 control panel.

The control system offers a diagnostic capability via the CAN bus.



**Extracted from RE 95 320/02.04**

Page 2 of 3  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Model code**

		<b>AS/</b>	<b>DRC</b>		<b>10</b>
<b>Type</b>					
Application Software		AS/			
<b>Software</b>					
Drive control			DRC		
<b>Variant A</b>					
Actuation via joystick					A
<b>Variant B</b>					
Actuation via acceleration pedal with direction switches					B
<b>Variant C</b>					
Actuation via external voltage with direction switches					C
<b>Version</b>					
					<b>10</b>

**Ordering Information**

The AS/DRC application software should only be used with the RC2-2/20 control unit and other add-on components (see page 8). When placing an order, the hardware and software type codes should be linked by a "+".

Example:

RC2-2/20+AS/DRCA10S

**How it works**

The electronic drive control system is designed to actuate a variable displacement pump in a closed hydraulic circuit.

Actuation is based on the following hydraulic configuration:

- An A4VG or A10VG variable displacement pump with electro-proportional (EP) control combined with one or more A2FM, A2FE, A4FM or A10FM fixed displacement motors.

The following diesel engine configuration can be used:

- Diesel engine with or without CAN bus interface  
The drive control receives the actual speed from a speed sensor.

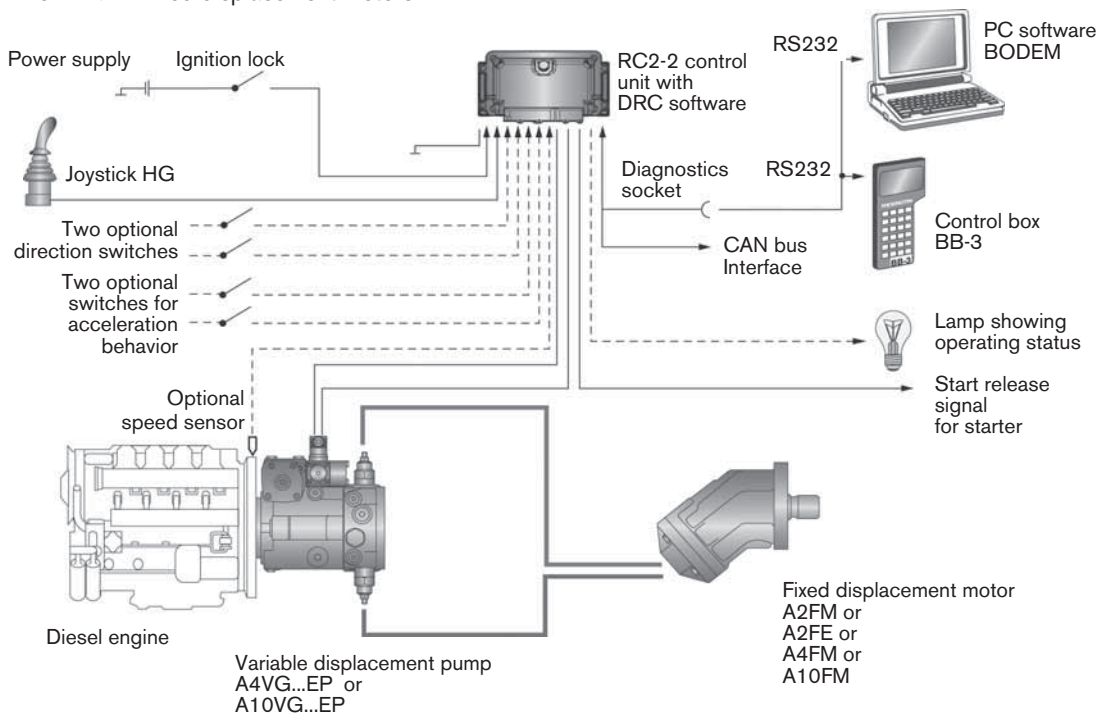


Figure 1: Typical configuration for drive control

## Extracted from RE 95 320/02.04

Page 3 of 3

Issue: 06.06

See Section 16 for applicable Preferred/Spotlight part numbers and unit price.

## Functional description

The purpose of the software is to implement simple, reversible hydraulic drives. Figure 1 shows a typical drive control configuration.

### Setpoint definition

By defining a setpoint the desired speed and direction of travel are specified. There are three different ways of doing this:

- **Variant A:** joystick

If the drive is controlled by means of a joystick, then the setpoint and direction of travel are specified using the joystick. The potentiometer for the joystick is monitored for wire breakage and short-circuit.

- **Variant B:** acceleration pedal

If the drive is controlled using an acceleration pedal, two direction switches must also be connected (for forwards/backwards travel). The setpoint is specified via the acceleration pedal, the travel direction via the direction switches. The potentiometer connected to the acceleration pedal is monitored for wire breakage and short-circuit.

- **Variant C:** external control voltage

If the drive is controlled using an external voltage, by a PLC for instance, two additional direction switches (for forwards/backwards travel) can also be connected. The setpoint is specified via the external control voltage, the travel direction via a control signal or the direction switches.

If the setpoint is specified via an external control voltage, no monitoring is carried out by the drive control. Undefined statuses at the inputs can cause the drive to start unintentionally.

Safety monitoring must be guaranteed by the connected signal source (e.g. PLC).

### Inching

A second potentiometer can be connected to allow continuously variable setpoint limitation.

For **Variants A and B**, the inching potentiometer is monitored for wire breakage and short-circuit.

For **Variant C**, the values at the input for the inching potentiometer are specified by an external control voltage. In this case safety must be guaranteed by the connected signal source.

### Travel Behavior

Travel behavior is controlled by three inputs and parameters.

- The setpoint is specified via the joystick, the acceleration pedal or the external control voltage (depending on the variant).
- The control of the PWM output for the specified setpoint is defined in the travel behavior curve.
- The acceleration behavior selected by the position of the time ramp selection switch determines how quickly the control at the PWM output changes.

Figure 2 shows how drive control works. The following is a description of travel behavior for Variant A. The principles are the same for Variants B and C:

- The joystick is in the neutral position if it is positioned within a user-definable range around the zero position (dead band). If the joystick is in the neutral position, the PWM outputs for the forwards and backwards directions that actuate the proportional solenoids of the pump are switched off.
- If the joystick is moved to a position outside the dead band, the current at the relevant PWM output (for forwards or backwards travel) increases according to the position of the joystick and the defined curve. The corresponding proportional solenoid is actuated. In addition, the acceleration behavior can be selected via the time ramp selection switch. There is a choice between three different types of acceleration behavior (hard, medium or soft).

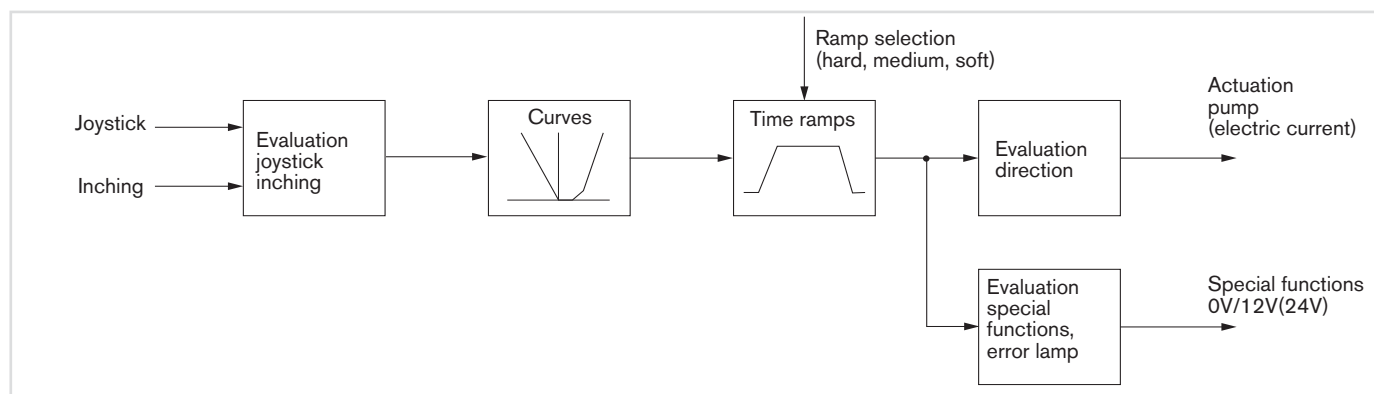


Figure 2: How drive control works

**Extracted from RE 95 325/03.04**

Page 1 of 6  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Application software  
Dual path control DPC**

Electronic drive control for  
dual path drives  
Version 10

The electronic dual path control system is an easily adaptable software package for the drive management of reversible dual path drives.

The dual path control system is available in three variants:

- **Variant A** for tracked vehicles (DPCA)
- **Variant B** for pavers (DPCB)
- **Variant B** offers an automatic steering function.
- **Variant C** for pavers (DPCB)
- **Variant C** offers additional tamper and vibration functions.

The dual path control system is designed for use with Rexroth hydraulic pumps and motors.

The dual path control system can easily be adapted by the user for different configurations of pumps, internal combustion engines, sensors or instruments, by altering the parameters.

The dual path control system is suitable for diesel engines with or without a CAN bus interface (protocol SAE J1939).

Diagnostics and parameter setting are carried out with BODEM PC software or the BB-3 control panel.



**Ordering code**

	<b>AS/</b>	<b>DPC</b>		<b>10</b>
<b>Type</b>				
Application software	<b>AS/</b>			
<b>Software</b>				
Dual path control	<b>DPC</b>			
<b>Variant A</b>				
Use with tracked vehicles: Controlled via joystick, with load limiting control				<b>A</b>
<b>Variant B</b>				
Used with paver: Controlled via lever, with manual or automatic steering				<b>B</b>
<b>Variant C</b>				
Used with paver: Controlled via lever, with manual steering, with control of additional drives				<b>C</b>
<b>Version</b>				
				<b>10</b>



**Extracted from RE 95 325/03.04**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering information**

---

The application software AS/DPC must only be used with the control unit RC6-9/20 and other add-on components (variant A see page 7, variant B/C see page 16). When ordering, link the ordering codes of hardware and software with a "+" symbol.

For example: RC6-9/20+AS/DPCA10

**Note**

You can find a description of variant B/C on page 7.

**Variant DPCA**

---

The electronic dual path control system DPCA allows you to control the driving and steering behavior of hydraulic dual path drives of tracked vehicles.

The electronic dual path control system is designed to actuate two variable displacement pumps and two variable displacement motors in a closed circuit.

Control is based on the following hydraulic configuration:

- Two variable displacement pumps A4VG or A10VG with electro-proportional (EP) control, combined with two variable displacement motors A6VM, A6VE or A10VM with electro-proportional (EP) control

The following diesel engine configuration can be used:

- Diesel engine with or without CAN bus interface  
The dual path control system receives the actual speed from a speed sensor and the set speed from the throttle potentiometer. The DPCA variant does not evaluate the CAN bus.

**Functional Description**

The swivel angles of two hydraulic variable displacement pumps and two hydraulic variable displacement motors in the closed circuit with electro-proportional control are varied in order to control the driving and steering behavior.

One pump and one motor are assigned to each side of the vehicle. Steering is achieved by controlling the pumps differently.

The output torque depends on the swivel angle of the motors. At the minimum swivel angle, the speed is highest and the output torque is lowest.

A synchronization control and a load limiting control are available for controlling the driving and steering behavior.

In addition, the travel behavior can be monitored to increase safety and drive comfort.

**Assignment Setpoint**

A two-axis joystick is used to define the direction and speed of travel and the steering direction.

Setting is carried out redundantly:

- electronically with an analog value
- and in parallel via the CAN bus

The dual path control system checks to ensure that the values correspond. If there is too great a difference between the analog value and the value sent via the CAN bus, an error message appears.



**Extracted from RE 95 325/03.04**

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 Issue: 06.06

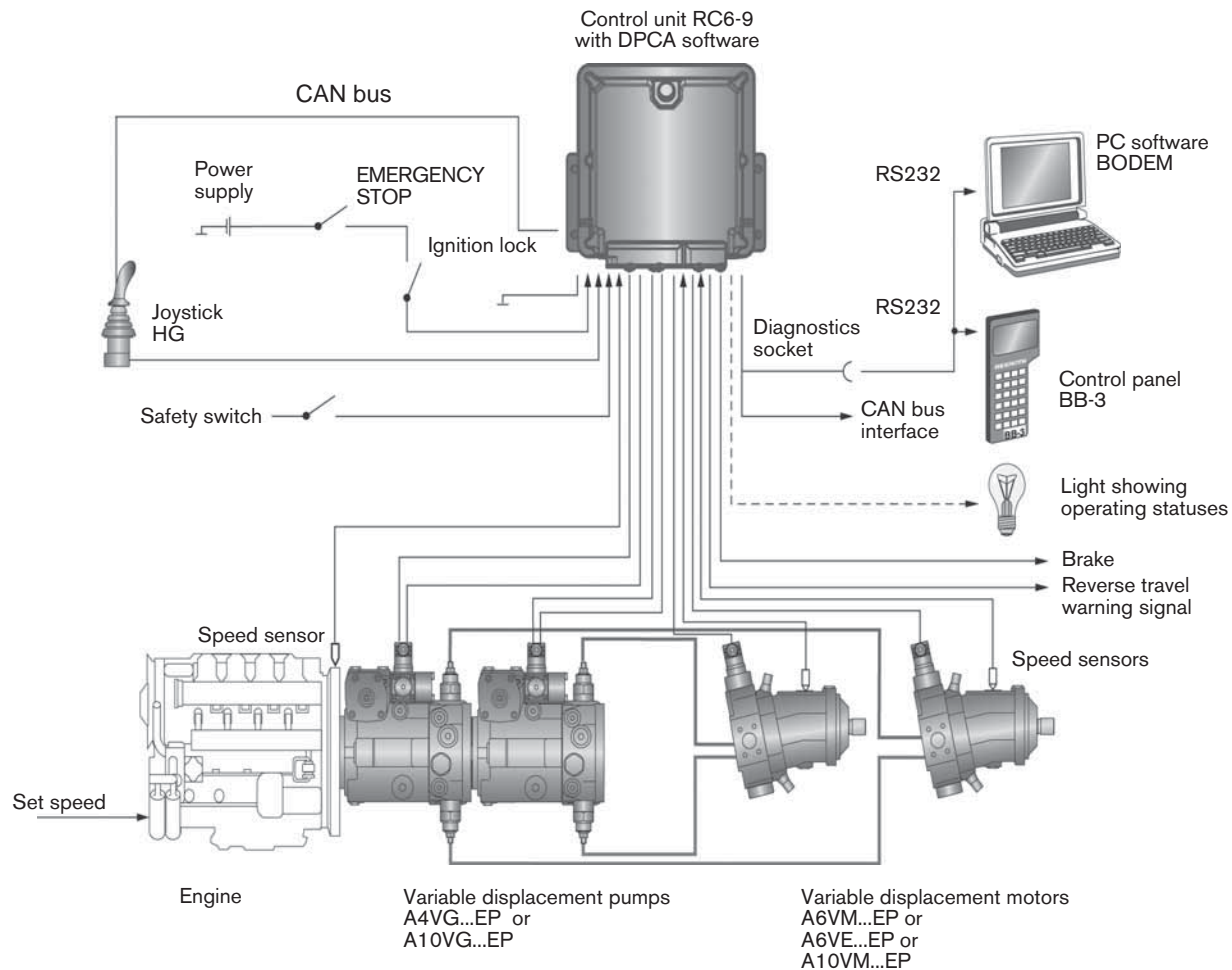
 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.


Figure 1: Typical configuration for DPCA

## Travel behavior

Travel behavior is controlled by two variables:

- The setpoint is defined with the joystick.
- The acceleration behavior is defined by time ramps. These variable time ramps determine how quickly the actuation at the PWM output is altered.

The joystick is in the neutral position in terms of travel direction (forwards or backwards) and steering direction (left or right), if it is positioned within a user-definable range around the zero position. This range is called the dead band. The dead band can be set for both deflection directions separately.

When the joystick is in the neutral position, the PWM outputs for the forwards and backwards travel directions for actuating the proportional solenoids of the left and right pumps are turned off. If the joystick is moved forwards or backwards to a position out-

side the dead band, the current at the relevant PWM outputs (for forwards or backwards travel direction) increases according to the position of the joystick and the chosen time ramp. The corresponding proportional solenoids of the left and right pumps are actuated. The park brake is released.

Two pushbuttons are incorporated into the joystick. When deflecting the joystick, these pushbuttons can also be used for very fine stepwise increase or reduction of the maximum travel speed. Pressing the button changes the speed range which corresponds to full deflection of the joystick.

When the joystick is returned to the neutral position, the park brake is activated after a user-definable period.

When the travel direction is changed, the park brake is not activated. Deceleration and acceleration for the change of travel direction are determined by a common, adjustable time ramp.

### Extracted from RE 95 325/03.04

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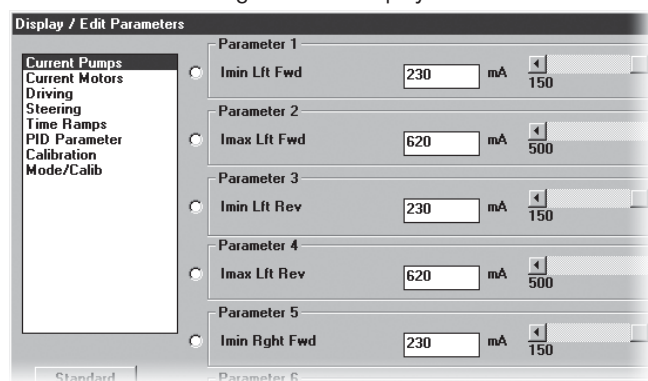
Issue: 06.06

See Section 16 for applicable Preferred/Spotlight part numbers and unit price.

## Parameter setting and diagnostics

The parameters which have to be set for commissioning the DPCA dual path control system can easily be adjusted with the BODEM PC software.

For fault diagnosis and troubleshooting, the main process variables and error messages can be displayed with BODEM.



Instead of BODEM, you can also use the BB-3 control panel for defining parameters and diagnostics.

### Components Required

The following electronic components are required:

- RC6-9/20 control unit with mating connector (RE 95200)
- AS/DPCA software, Version 10
- HG405GF/11-S joystick
- IDR speed sensor (RE 95130) with mating connector
- HDD speed sensors (RE 95135) with mating connectors
- WS1 angle sensor (RE 95140) with mating connector
- Switch for external start release

The following hydraulic components are required:

- Variable displacement pumps with appropriate control unit  
A4VG...EP (RE 92003) or  
A10VG...EP (RE 92750)
- Variable displacement motors with appropriate control unit  
A6VM...EP (RE 91604) or  
A6VE...EP (RE 91606) or  
A10VM...EP (RE 91703)

The following items are required for commissioning and service:

- Diagnostics socket (RE 95085)
- BODEM PC software with BODEM connecting cable (RE 95085), or
- BB-3 control panel with BB-3 connecting cable (RE 29798 and RE 95080)

### Variant DPCB/C

The electronic dual path control system DPCB/C allows you to control the driving and steering behavior of hydraulic dual path drives of pavers.

**Variants B and C** use the same hydraulic configuration for controlling.

**Variant B:**

- Two variable displacement pumps A4VG or A10VG with electro-proportional (EP) control, combined with two variable displacement motors A6VM, A6VE or A10VM with electrical two-point actuation (EZ) for the travel drive

**Variant C:**

- Two variable displacement pumps A4VG or A10VG with electro-proportional (EP) control, combined with two variable displacement motors A6VM, A6VE or A10VM with electrical two-point actuation (EZ) for the travel drive
- Two variable displacement pumps A4VG or A10VG with electro-proportional (EP) control for the additional functions

The following diesel engine configuration can be used:

- Diesel engine with or without CAN bus interface

The dual path control system receives the actual speed from the speed sensors of the two hydraulic motors and the set speed from the speed potentiometer (diesel engine speed is not detected). The DPCB and DPCC variants do not evaluate the CAN bus.

### Functional Description

The swivel angles of two hydraulic variable displacement pumps and two hydraulic variable displacement motors in the closed circuit are varied in order to control the driving and steering behavior.

One pump and one motor are assigned to each side of the vehicle. Steering is achieved by controlling the pumps differently.

Either transport or working speed can be selected by switching the displacement of the variable displacement motors to one of two values (minimum and maximum).

With **variant B**, the dual path control system offers automatic steering.

With **variant C**, two additional functions, tamper and vibration, are available. Two additional variable displacement pumps are actuated for this purpose.

Speed and steering regulation are available for controlling the driving and steering behavior.

**Extracted from RE 95 325/03.04**

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 Issue: 06.06

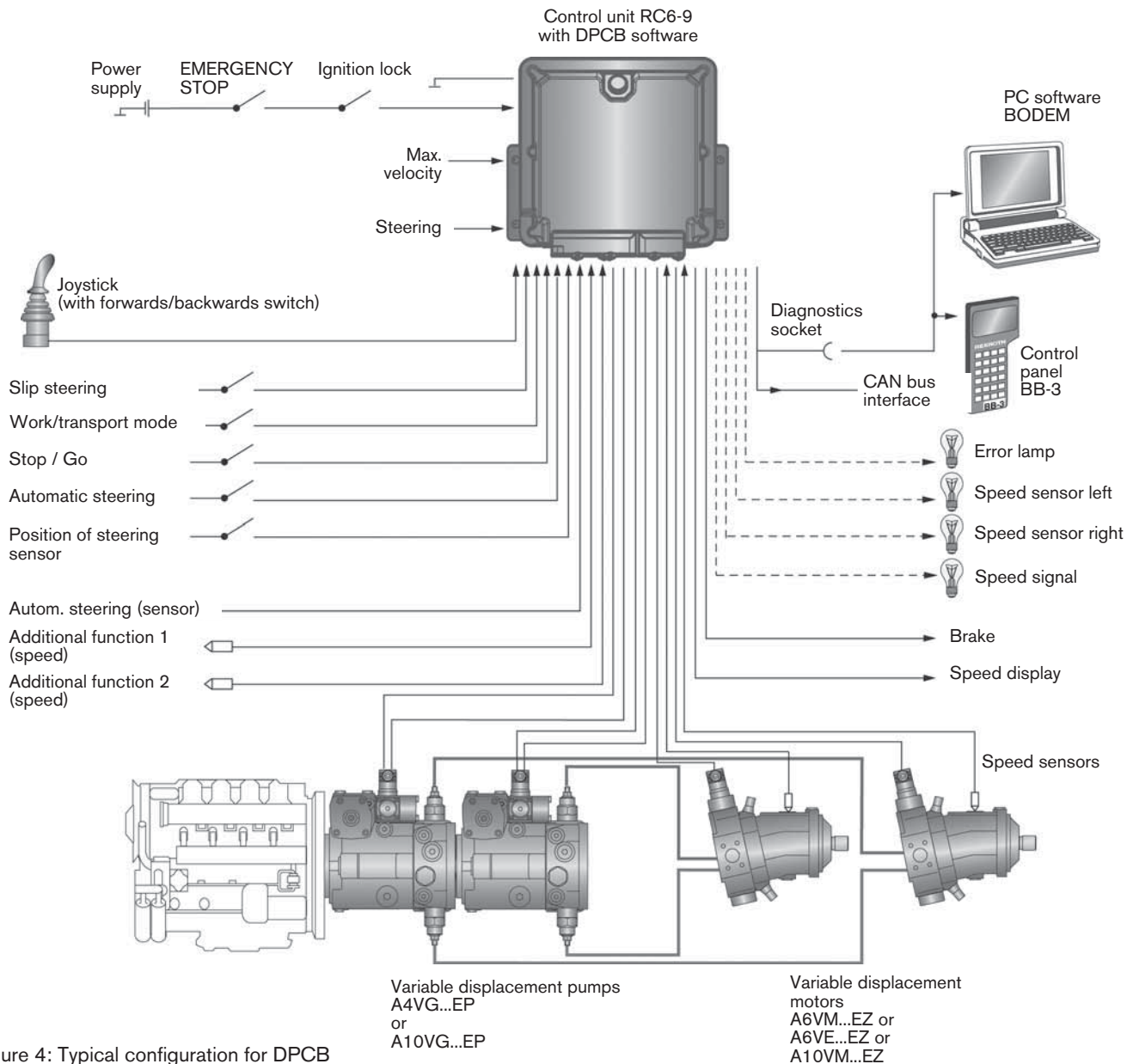
 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.


Figure 4: Typical configuration for DPCB

## Automatic steering

For **variant B**, automatic steering can be activated by operating a switch on the vehicle. Automatic steering can only be activated in work mode.

When automatic steering is switched on, the vehicle is steered automatically via a steering sensor.

Another switch on the vehicle indicates whether the sensor is mounted on the left or right side of the vehicle.

### Extracted from RE 95 325/03.04

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

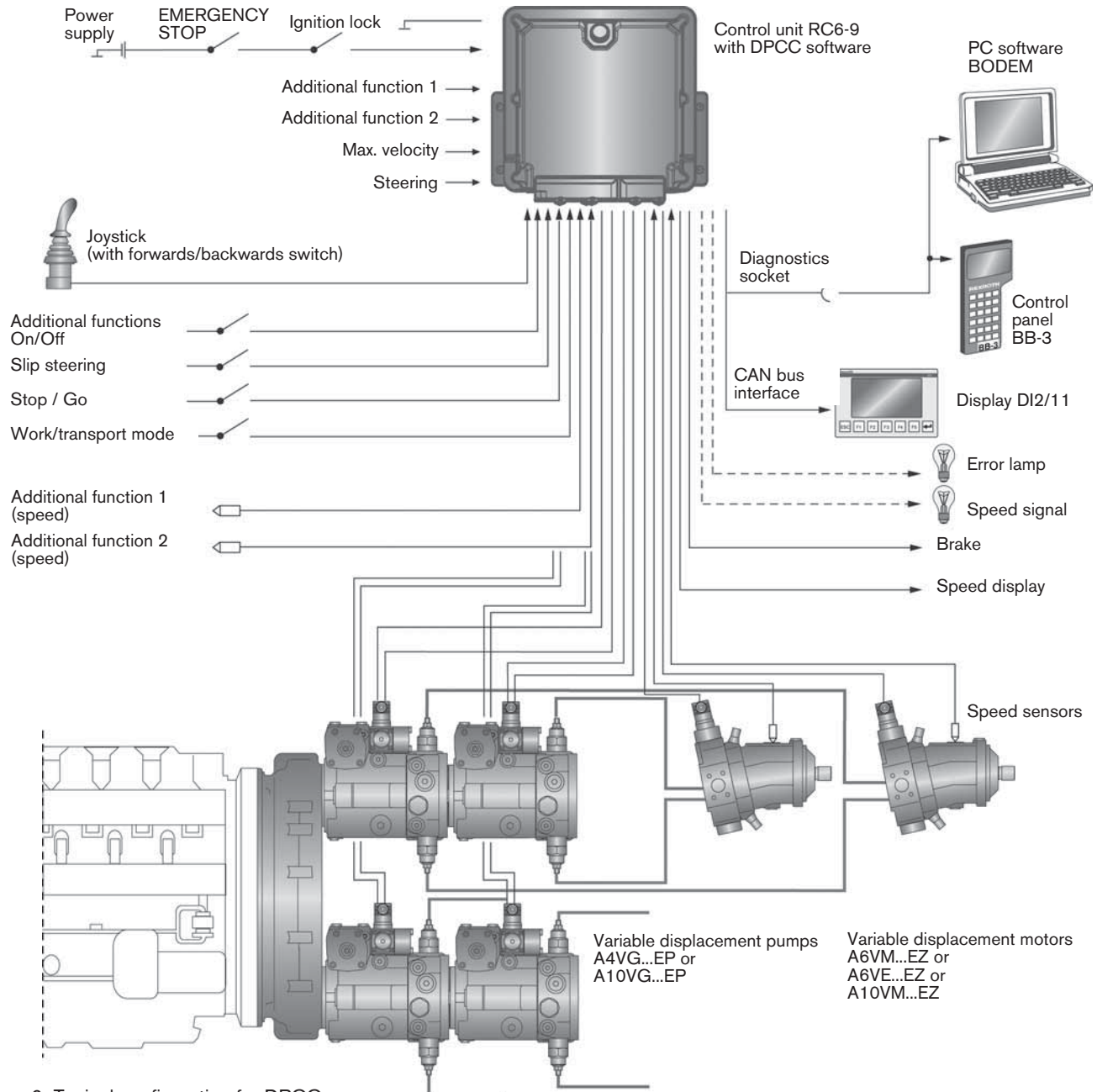


Figure 6: Typical configuration for DPCC

### Tamper/Vibration

For **variant C**, two additional functions are available, namely tamper and vibration. These can be used, for example, when compacting construction material with a paver. Two additional drives are actuated for this purpose.

The two additional functions are activated together by means of a switch on the vehicle. They can be operated separately from one

another, by activating them individually when putting the vehicle into operation.

In each case the setpoint is defined with a potentiometer. The acceleration times can be set for each of the two additional functions separately. The current speed of the additional drives can be detected via speed sensors and shown on the connected display.

**Extracted from RE 95 360/07.05**

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Application software**  
**Fan control AFC**

Electronic fan control for hydrostatic fan drives  
Version 10

- The electronic AFC fan control is an easily adjustable software package for control of hydrostatic fan drives.
- The electronic control controls one or two fan drives, which relate to up to four temperature values and up to four digital inputs.
- Improved control quality reduces energy consumption, noise emission, fuel consumption and exhaust values compared with conventional solutions.
- Digital inputs allow the control behavior to be modified depending on the status.
- The response behavior can be adjusted using time ramps.
- The AFC fan control is designed for Rexroth hydraulic pump A10VO with ED electrohydraulic pressure control and an fixed displacement motor.
- Diagnostics and configuration are carried out with BODEM PC software or the BB-3 control panel.
- The outputs are monitored for wire breakage and short circuits.



**Extracted from RE 95 360/07.05**

Page 2 of 3  
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Ordering code**

	<b>AS/</b>	<b>AFC</b>	<b>10</b>
<b>Type</b>	Application Software		
	AS/		
<b>Software</b>	Fan Control		
		AFC	
<b>Version</b>			
			10

**Order information**

The AS/AFC10 application software must only be used with the RC2-2/20 control unit and other add-on components (see page 5). When placing an order, the hardware and software type codes should be linked by a "+".

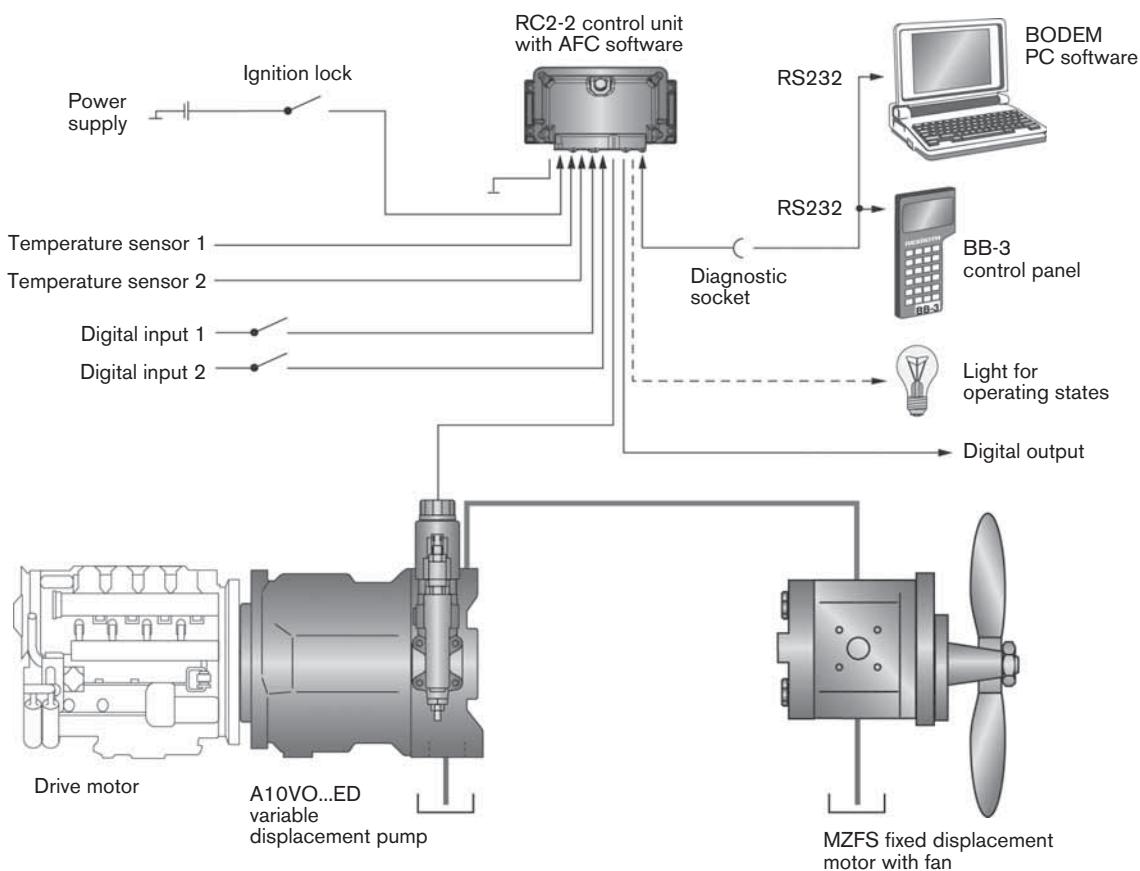
Example: RC2-2/20+AS/AFC10

**How it works**

The electronic fan control is designed to actuate up to two variable displacement pumps in the open hydraulic circuit with electrohydraulic pressure control.

Actuation employs the following hydraulic concept:

One or two A10VO variable displacement pumps with ED electrohydraulic pressure control, each in conjunction with one fixed displacement motor (A10FE or MZFS)





**Extracted from RE 95 360/07.05**Page 3 of 3  
Issue: 06.06See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Function**

---

The fan control controls up to two fans independently of each other. Temperature inputs (via sensors) and digital inputs (via switches) are measured separately for each fan.

Each fan can be configured according to which of the connected sensors are used to determine the setpoint.

The diagram on page 2 illustrates how a fan with two sensors and two digital inputs is actuated. The instructions for a fan are below. The second fan operates in the same way.

**Setpoint Definition**

The fan control determines the fan's required power by reading the temperature inputs. For each sensor, you can configure the temperatures at which the different fan power levels are required. This results in a setpoint definition for each temperature input:

- If a measured value falls below the associated lower temperature threshold, the setpoint definition is set to 0.
- If a measured value exceeds the associated upper temperature threshold, the setpoint definition is set to its maximum value.
- Between thresholds, the setpoint definition increases in proportion to the temperature.

The fan control controls the fan drive with the highest of all the required outputs.

**Working Behavior**

The working behavior of the fan control is controlled by various variables:

- The temperature inputs define the setpoint for the fan power.
- The digital inputs can be used to influence this setpoint.
- The time ramps at all inputs and outputs determine how quickly the fan actuation is modified or how quickly the digital output responds to temperature changes.

**Digital output**

As well as to actuate the fan, the fan control can also be used to actuate a digital output. To do this, the temperature inputs are compared with set switching thresholds and the switching signal is calculated:

- If the measured value falls below the lower temperature threshold, the digital output is set to 0.
- If the measured value exceeds the upper temperature threshold, the digital output is set to 1.
- The range between the two thresholds is used as the hysteresis.

**Safety Functions**

The inputs and outputs are monitored for wire breakage and short circuit.

In the event of a fault, the maximum setpoint is set.

**Important features**

- Up to four temperature inputs
- There are default curves for Bosch temperature sensors. A user-specific characteristic curve can be configured.
- Up to two independent fan drives
- Up to four digital outputs to influence the setpoints via configurable functions
- Digital output can be actuated via temperature thresholds
- Inputs and outputs are monitored for short circuits and cable breakage
- Error lamp displays overtemperature warning and faults
- Any faults that occur are logged in the control unit and can be read later on using BODEM or BB-3 in plain text.

**Main Setting Variables**

- Sensor curves
- Time ramps for temperature inputs
- Temperature thresholds for setpoints
- Digital input function module
- Switching threshold for digital output
- Output time ramps for fans
- Minimum and maximum solenoid current for pumps

## Section 10 Accessories

### The Drive & Control Company

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- ▶ Products and Solutions
  - ▶ Industrial Hydraulics
    - ▶ Products and Catalogs
      - ▶ Preferred Product Catalog





**Extracted from Catalog AKY 013/4**

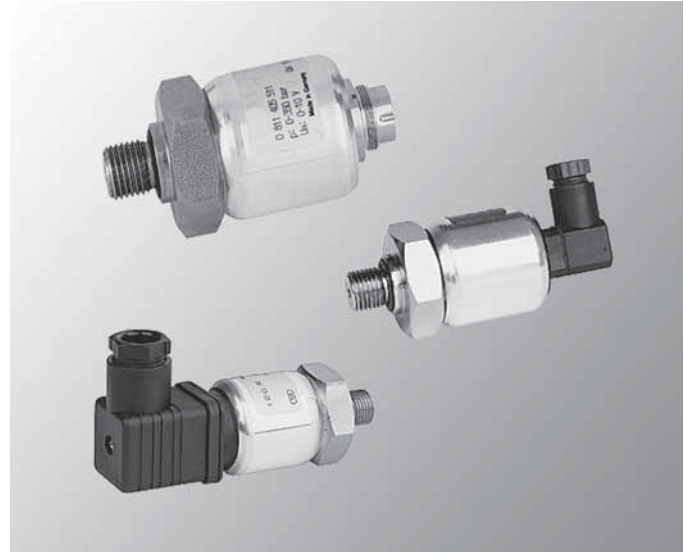
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Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Pressure transducer  
with on-board electronics  
Model HM 18**

**Series 1X**

- Suitable for measuring pressure and converting the measured values into electric signals, e.g. for use in measurement and closed-loop control systems
- Sensor with thin-film technology
- Various line connectors, see catalogue section RE 08008
- Accuracy class 0.5
- Measuring range up to 350 bar (5100 PSI) max.
- Connecting thread G<sup>1</sup>/<sub>4</sub>
- Parts in contact with the pressure medium are of stainless steel
- Compact design
- Operational reliability thanks to high bursting pressure and protection against reversed polarity, overvoltage and short circuit
- CE mark



**Technical data**

<table border="1" style="margin: auto;"> <tr> <td style="padding: 2px;">HM 18</td> <td style="padding: 2px;">-</td> <td style="padding: 2px;">1X</td> <td style="padding: 2px;">/</td> <td style="padding: 2px;">-</td> <td style="padding: 2px;">-</td> <td style="padding: 2px;">/</td> <td style="padding: 2px;">V0</td> <td style="padding: 2px;">/</td> <td style="padding: 2px;">0</td> </tr> </table>		HM 18	-	1X	/	-	-	/	V0	/	0
HM 18	-	1X	/	-	-	/	V0	/	0		
Pressure transducer with on-board electronics							0 =		No options		
Unit series 10 to 19 (10 to 19: technical data and terminal assignment unchanged)	= 1X						V0 =		Standard version		
<b>Measuring ranges</b>							S =		Small cubic connector		
up to 210 bar (3045 PSI)	= 210						B =		Large cubic connector		
up to 350 bar (5100 PSI)	= 350						R =		7-pin concentric connector		
					C =		Current output		4 ... 20 mA		
					V =		Voltage output		0 ... 10 V		

**Extracted from Catalog AKY 013/4**

 Page 2 of 2  
 Issue: 07.05

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

"Dynamic" overload capacity		$2 \times p_{nom}$ (up to $20 \times 10^6$ load changes)
"Static" overload capacity		$3 \times p_{nom}$ (up to $10 \times 0.5$ s each time)
Bursting pressure	bar (PSI)	> 1,500 (21,800)
Linearity error incl. hysteresis		< $\pm 0.5\%$
Zero spread		< $\pm 0.5\%$
Sensitivity spread		< $\pm 0.5\%$
Temp. coefficient of zero (typical)		< $\pm 0.2\%/10$ °C (50°F)
Temp. coefficient of sensitivity (typical)		< $\pm 0.25\%/10$ °C (50°F)
Measuring temp. range (compensated)	°C (°F)	10 to 70 (50 to 158)
Operating temperature range	°C (°F)	-10 to 80 (14 to 176)
Storage temperature range	°C (°F)	-30 to 90 (-22 to 194)
Hydr. dead volume		approx. $0.5 \text{ cm}^3$
Measuring frequency (-3 dB)		~ 1 kHz
Natural frequency		$\geq 10$ kHz
Max. acceleration		~ 25-g ( $g = 9.81 \text{ ms}^{-2}$ )
Connecting piece (hydr.) material		X 5 Cr Ni 1810
Diaphragm material		X 5 Cr Ni Cu Nb 17 4
Hydraulic connection		G <sup>1</sup> / <sub>4</sub> (ISO 228)
Weight	kg (lbs.)	0.2 (0.44)
Conformity		EN 61000-6-2 EN 61000-6-3

**Extracted from Catalog 9 535 233 184**Page 1 of 1  
Issue: 04.03See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Bladder accumulators**

Hydraulic bladder accumulators can be used in a variety of applications such as energy storage, emergency power source, compensation for losses due to leakage, damping of periodic shocks and volume variations.

- 3000 PSI (207 bar) and 4800 PSI (330 bar) rated
- 1/4 gallon to 14 gallon sizes
- 3000 PSI (207 bar) has ASME approval
- 4800 PSI (330 bar) has CE approval

**Technical data**

Liquid Volume gal (liter)	Max Pressure (PSI/bar)	Fluid Connection	Bladder Material	SAP Material Number	Description
0.25 (1)	3000/207	SAE 1-3/16 12UN 2B	Buna N	R978700573	HAB1-207-2X/5U12G-2N111-ASME
1 (4)	3000/207	SAE 1-5/8 12UN 2B	Buna N	R978700584	HAB4-207-2X/5U08G-2N111-ASME
2.5 (10)	3000/207	SAE 1-7/8 12UN 2B	Buna N	R978700595	HAB10-207-2X/5U09G-2N111-ASME
5 (20)	3000/207	SAE 1-7/8 12UN 2B	Buna N	R978700612	HAB20-207-2X/5U09G-2N111-ASME
10 (35)	3000/207	SAE 1-7/8 12UN 2B	Buna N	R978700617	HAB35-207-2X/5U09G-2N111-ASME
14 (50)	3000/207	SAE 1-7/8 12UN 2B	Buna N	R978700627	HAB50-207-2X/5U09G-2N111-ASME

See catalog 9 535 233 184 for complete description and performance specifications.

**Extracted from Catalog 9 535 233 184**

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Issue: 04.03

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Diaphragm accumulators**

Hydraulic diaphragm accumulators can be used in a variety of applications such as energy storage, emergency power source, compensation for losses due to leakage, damping of periodic shocks and volume variations.

- Pressure rating up to 350 bar (5075 PSI)
- 0.075 L to 2.8 L (4.6 in<sup>3</sup> to 170 in<sup>3</sup>) sizes


**Technical data**

Liquid Volume liter (gal)	Max Pressure bar (PSI)	Fluid Connection	Bladder Material	Material Number	Description
0.075 L (4.6 in <sup>3</sup> )	250 (3625)	SAE 9/16-18UNF-2B	Buna N	0531610632	HAD0.075-250-1X/0U12S2N111-USA
0.16 L (10 in <sup>3</sup> )	250 (3625)	SAE 9/16-18UNF-2B	Buna N	0531600611	HAD0.16-250-1X/0U12S2N111-USA
0.16 L (10 in <sup>3</sup> )	250 (3625)	3/8-18 NPTF	Buna N	0531600600	HAD0.16-250-1X/0F02A2N111-USA
0.35 L (21 in <sup>3</sup> )	160 (2320)	SAE 3/4-16 UNF-2B	Buna N	0531601549	HAD0.35-160-1X/0U04A2N111-USA
0.35 L (21 in <sup>3</sup> )	207 (3000)	SAE 3/4-16 UNF-2B	Buna N	0531601572	HAD0.35-207-1X-0U04A2N111-USA
0.35 L (21 in <sup>3</sup> )	160 (2320)	1/2-14 NPTF	Buna N	0531601533	HAD0.35-160-1X/0F08A2N111-USA
0.50 L (31 in <sup>3</sup> )	160 (2320)	SAE 3/4-16 UNF-2B	Buna N	0531611527	HAD0.5-180-1X/0U04A2N111-USA
0.50 L (31 in <sup>3</sup> )	211 (3058)	SAE 3/4-16 UNF-2B	Buna N	0531611603	HAD0.5-207-1X/0U04A2N111-USA
0.70 L (43 in <sup>3</sup> )	180 (2600)	SAE 3/4-16 UNF-2B	Buna N	0531602560	HAD0.7-180-1X/0U04A2N111-USA
0.70 L (43 in <sup>3</sup> )	207 (3000)	1/2-14 NPTF	Buna N	0531602581	HAD0.7-207-1X/0F08A2N111-USA
0.70 L (43 in <sup>3</sup> )	207 (3000)	SAE 3/4-16 UNF-2B	Buna N	0531602588	HAD0.7-207-1X/0U04C2N111-USA
0.70 L (43 in <sup>3</sup> )	180 (2600)	1/2-14 NPTF	Buna N	0531602553	HAD0.7-180-1X/0F08A2N111-USA
1.4 L (85 in <sup>3</sup> )	207 (3000)	SAE 3/4-16 UNF-2B	Buna N	0531603501	HAD1.4-207-1X/0U04C2N111-USA
1.4 L (85 in <sup>3</sup> )	207 (3000)	1/2-14 NPTF	Buna N	0531603500	HAD1.4-207-1X/0F08C2N111-USA
2.0 L (122 in <sup>3</sup> )	207 (3000)	SAE 3/4-16 UNF-2B	Buna N	0531623500	HAD2.0-207-1X/0U04C2N111-USA
2.8 L (170 in <sup>3</sup> )	207 (3000)	1/2-14 NPTF	Buna N	0531613500	HAD2.8-207-1X/0F08C2N111-USA
2.8 L (170 in <sup>3</sup> )	207 (3000)	SAE 3/4-16 UNF-2B	Buna N	0531613503	HAD2.8-207-1X/0U04C2N111-USA

**Extracted from Catalog 9 535 233 184**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Accumulator brackets**

Brackets allow secure, easy installation of accumulator in either vertical position for bladder type or unrestricted orientation for diaphragm type. Brackets can be bolted or welded to the supporting structure. Rubber cushioning on straps helps prevent noise from being transmitted through metal to metal contact.

Base bracket available for support of vertical mounting of large sizes.



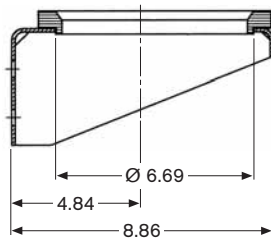
**Technical data**

Material Number	Description	Accumulator Size
1531316017	Bracket	21 in <sup>3</sup>
1531316016	Bracket	85 – 122 in <sup>3</sup>
1531316020	Bracket	170 in <sup>3</sup>
1531316022	Bracket	1 gal.
1531316026	Bracket	2-1/2 – 10 gal.
1531316005	Bracket	14 gal.

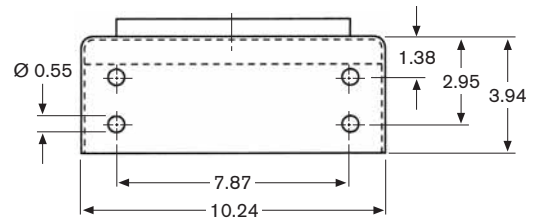
See catalog #9 535 233 184 for complete description, performance specifications and charge & test units.

**Accumulator accessories**

Support bracket / rubber ring  
for 2-1/2 – 14 gallon bladder accumulators



Rubber Backring (1530221042)

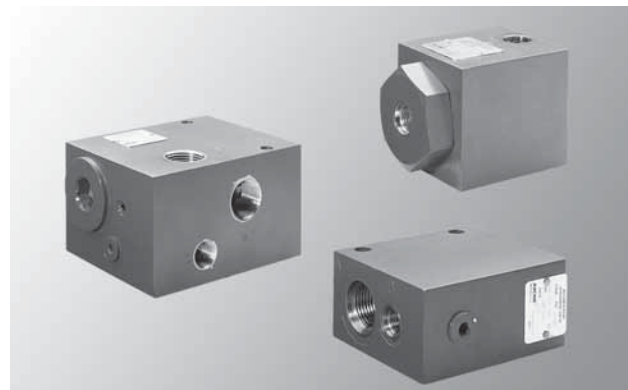


Support Bracket (1531334008)

**Accumulator discharge valves**

Accumulator discharge valves allow for the safe and efficient discharge of accumulators.

- 3000 PSI rating
- 12 to 80 GPM



**Technical data**

Material Number	Description	Pressure Rating (PSI)	Maximum Flow (GPM)	Port Size	Approximate Weight (lbs)
R978715257	AD P1 51F 10	3000	12	#6 SAE	4
R978715255	AD C3 54F 10	3000	40	#12 SAE	6
R978715258	AD C4 58F 10	3000	80	#20 SAE	12

Engineering data G-95, G-100, G-105.

See catalog #9 535 233 184 for complete description and performance specifications.

**Extracted from RE 30276/01.06**

Page 1 of 3  
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**Electronic pressure switch  
with integrated analog output  
Model HEDE 10**

**Series 2X**

- Suitable for measuring pressures and converting the measured values into electrical signal variables in hydraulic systems
- EMC properties allow the use of this pressure switch also in critical applications
- Ceramic / capacitive sensor
- Connecting cable with 4-pin M12 plug on housing
- Accuracy class 1.0
- Connection thread G1/4
- Parts in contact with media are made of stainless steel, ceramic and FKM
- Compact design



Model HEDE 10.../1/

- One switching output and one analog output

**Ordering data**

HED	E	10	A1	2X /		K41	G24 /	1 /	V /	*
Hydraulic electrical pressure switch										Further details in clear text
Integrated electronics	= E								V =	FKM seals
Component type		= 10								<b>⚠ Caution!</b> Observe compatibility of seals with hydraulic fluid used!
Hydraulic interface 1/4"			= A1							
Component series				= 2X						1 = One switching and one analog output
Pressure stages										G 24 = Supply voltage
100 bar (1450 PSI)				= 100						
250 bar (3600 PSI)				= 200						
400 bar (5800 PSI)				= 400						
600 bar (8700 PSI)				= 600						
						K41 =				Plug variant M12, 4-pin as standard

**Extracted from RE 30276/01.06**

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Issue: 06.06

**Technical data**
**Input variables**

Auxiliary energy	$U_O$	18 to 36 VDC			
Current consumption	$I$	< 50 mA			
Measuring range	$p_N$ in bar (PSI)	100 (1450)	250 (3600)	400 (5800)	600 (8700)
Overload safety	$p_{max}$ in bar (PSI)	300 (4350)	400 (5800)	600 (8700)	800 (11600)
Burst pressure	$p$ in bar (PSI)	650 (9400)	850 (12000)	1000 (14500)	1200 (17400)

**Output variables**

Analog output	$U$	0 to 10 VDC minimum load 2600 $\Omega$			
	$I$	4 – 20 mA (max. load $[U_O - 10] \times 50 \Omega$ )			
Switching output	Rise time (10 to 90 %)	$t$	3 ms		
	Current carrying capacity	$I$	250 mA		
	Response time	$t$	< 3 ms (with response time set to dAP = 3)		
	Max. switching frequency	$f$	170 Hz (at dAP = 3)		
Characteristic curve deviation: (initial point setting according to DIN16086)			< $\pm 0.5$ %		
Temperature coefficient within nominal temperature range					
– Highest TC of zero point			0.2 % / 10 k		
– Highest TC of span			0.2 % / 10 k		
Hysteresis			< $\pm 0.1$ %		
Repeatability			0.1 %		
Long-term drift under reference conditions (6 months)			0.05 %		

**Ambient conditions**

Limit temperature range	$\vartheta$	-20 to +80 °C (-4 to +176 °F) at $U_O < 32$ V -20 to +60°C (-4 to +140) at $U_O > 36$ V
Storage temperature range	$\vartheta$	-40 to +100 °C (-40 to +212 °F)
Medium temperature range	$\vartheta$	-25 to +80 °C (-13 to +176 °F)

**Mechanical data**

Pressure port	G1/4
Electrical connection	M12 plug-in connection

**Extracted from RE 30276/01.06**

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**Technical data**

<b>Programming options</b>		Hysteresis / window; normally open / normally closed; pick-up, drop-out delay; attenuation; display unit / analogue output: voltage or current			
Pressure stages		100	250	400	600
Switching point SP	bar (PSI)	1 ... 100 (14.5 ... 1450)	2 ... 250 (29...3625)	4 ... 400 (58 ... 5800)	6 ... 600 (87 ... 8700)
Release position, rP	bar (PSI)	0.5 ... 99.5 (7.25 ... 1440)	1 ... 249 (14.5 ... 3611)	2 ... 398 (29 ... 5772)	3 ... 597 (43.5 ... 8658)
In increments of	bar (PSI)	0.5 (7.25)	1 (14.5)	2 (29)	3 (43.5)
Adjustable response time of a switching output and resulting switching frequency	Response time (dAP) ms	3 ... 500			
	Hz	170 ... 1			
Adjustable delay time dS, dr	s	0.0; 0.2 ... 50.0			
<b>Environmental compatibility</b>					
Type of protection / housing to IEC 60529		IP67			
Class of protection EN 50178		III			
Insulation resistance	MΩ	> 100 (500 VDC)			
Resistane to shock to IEC 60068-2-27	g	50 g, 11 ms			
Resistance to vibration to IEC 60068-2-6	g	20 g, 10 ... 2000 Hz			
Switching cycles min.		100 million / 50 million with pressure stage 600 bar			
Approval		cULus			
EMC	EN 61000-4-2 ESD	4 / 8 kV			
	EN 61000-4-3 HF radiated	10 V/m			
	EN 61000-4-4 burst	2 kV			
	EN 61000-4-5 surge	0.5 / 1 kV			
	EN 61000-4-6 HF cable-bound	10 V			
Housing material		EPDM/X (Santoprene); FKM; PBTP (Pocan); PC (Macrolon); V2A (1.4301)			
Materials in contact with the medium		V2A (1.4305); ceramic; FKM			
Connection		M12 plug-in connection, gold-plated contacts			



**Extracted from RA 50 040/06.98**

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Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Pressure switch, piston type  
switching differential dependent  
on pressure setting  
Model HED 1**

Series 4X

Maximum operating pressure 5075 PSI

- Piston type pressure switch
- Drain port for increased repeatability
- Optional indicator light
- SAE straight thread O-ring ports



Model HED 1 KA 4X/..

**Ordering code**

<b>HED 1</b>	<b>A</b>	<b>4X /</b>	<b>/</b>	<b>*</b>	
Pressure switch	= HED 1				Further details to be written in clear text
<b>With</b> drain port	= <b>K</b>				<b>12 =</b> SAE threaded connections
<b>Without</b> drain port	= <b>O</b>				<b>no code =</b> NBR seals suitable for petroleum oils (HM, HL, HLP)
Threaded connections	= <b>A</b>				<b>V =</b> FPM seals suitable for phosphate ester fluids (HFD-R)
Series 4X (40 to 49: externally interchangeable)		= <b>4X</b>			<b>L 24 =</b> Connection with lights light for 24V (20V to 35V)
HED 1 K {	max. adjustable pressure 1450 PSI	= <b>100</b>			<b>L 110 =</b> light for 110V (90V to 130V)
	max. adjustable pressure 5075 PSI	= <b>350</b>			
HED 1 O {	max. adjustable pressure 725 PSI	= <b>50</b>			
	max. adjustable pressure 1450 PSI	= <b>100</b>			
	max. adjustable pressure 5075 PSI	= <b>350</b>			

**Extracted from RA 50 040/06.98**

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Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Switching accuracy (repeatability)		< ±2% of pressure setting			
Switching frequency	HED 1 KA 4X/..	cycles/min	up to 300		
	HED 1 OA 4X/..	cycles/min	up to 50 (briefly ... 100)		
Pressure at drain connection		PSI	30		
Setting ranges for HED 1 KA 4X/.. all values in PSI					
Pressure rating	Max. operating pressure (briefly)	Falling pressure		Rising pressure	
		minimum	maximum	minimum	maximum
1450	...8700	44	1335	87	1450
5075	...8700	87	4715	145	5075
7250	...8700	145	6745	290	7250
Setting ranges for HED 1 OA 4X/.. all values in PSI					
Pressure rating	Max. operating pressure (briefly)	Falling pressure		Rising pressure	
		minimum	maximum	minimum	maximum
725	...1160	29	655	51	725
1450	...5075	44	1190	116	1450
5075	...5075	87	4280	290	5075
Electrical connection		Conduit connection max. cable dia. 0.43 in Plug-in connector			
Contact loading	– AC voltage		460 V; 15 A		
	– DC voltage		40 V; 1.0 A or 125 V; 0.4 A or 250 V; 0.2 A		
With higher DC voltages arc suppression is recommended to increase working life					
Insulation		Exceeds NEMA class B			
Weight (approx.)		kg (lbs.)	1.2 (2.6)		



**Extracted from RA 50 045/06.98**

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Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Switching accuracy (repeatability)		< ± 1 % of setting range				
Setting accuracy (to scale)		± 2 % of max. setting pressure				
Switching frequency		Up to 30 cycles/minute				
Setting range						
Pressure rating	Max. operating pressure in PSI	Fixed switching differential over complete setting range in PSI	Falling pressure in PSI		Rising pressure in PSI	
			minimum	maximum	minimum	maximum
365	435	7.3	22	365	29	370
915	1015	14.5	58	915	73	930
1450	1600	22.0	87	1450	109	1470
2900	3050	58.0	145	2900	203	2960
5800	6090	87.0	290	5800	377	5890
Electrical connection (Parts supplied as loose items)			Conduit connection Pg 11 [max. cable dia. 0.43 in (11 mm)]			
Contact load		– AC voltage	380 V; 10 A			
		– DC voltage	25 V; 1.0 A or 125 V; 0.2 A or 250 V; 0.1 A			
DC voltages with inductive load, arc suppression is recommended to increase service life.						
Insulation to DIN 40 050			Exceeds NEMA class B (IP 65)			
Weight		kg (lbs.)	1.0 (2.2)			

**Note for bourdon tube pressure switch application**

Bourdon tube pressure switches should be shock mounted to avoid mechanical vibrations.

To compensate for pump pulsation, we recommend the use of small diameter hose, 0.1" (2 mm) for pressure switch connection, approximately 3.28 ft (1 meter) long.

**Extracted from RA 50 050/06.98**

Page 1 of 2  
Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Bourdon tube pressure switch, infinitely  
variable switching pressure differential  
Model HED 3**

Series 3X

Maximum operating pressure 5800 PSI

- Bourdon tube type pressure switch
- Available with or without light
- Highly resistant to contamination
- SAE straight thread port connection
- Highly accurate
- No internal leakage (Bourdon tube)
- Variable pressure differential, selectable via two independent adjustments



HED 3 OA 3X/..

**Ordering code**

<b>HED 3 OA</b>		<b>3X</b>	/		/	*
Series 30 to 39 (30 to 39: externally interchangeable)	=	<b>3X</b>				Further details to be written in clear text
Max. adjustment pressure ... 365 PSI	=	<b>25</b>				<b>12</b> = SAE threaded connections
Max. adjustment pressure ... 915 PSI	=	<b>63</b>				<b>No Code</b> = Without lockable cap
Max. adjustment pressure ... 1450 PSI	=	<b>100</b>				<b>No Code</b> = Without light
Max. adjustment pressure ... 2900 PSI	=	<b>200</b>				<b>L110</b> = Light for 110V (90V to 130V)
Max. adjustment pressure ... 5800 PSI	=	<b>400</b>				<b>No Code</b> = Conduit connection

**Extracted from RA 50 050/06.98**

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Issue: 01.01

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**

Switching accuracy			< ± 1 % of pressure setting range			
Switching frequency			Up to 30 cycles/minute			
Setting range						
Pressure rating	Max. operating pressure in PSI	Fixed switching differential over complete setting range in PSI	Falling pressure in PSI		Rising pressure in PSI	
			minimum	maximum	minimum	maximum
365	435	14.5 ... 340	22	365	36	375
915	1015	29.0 ... 855	58	915	87	945
1450	1600	43.5 ... 1365	87	1450	130	1495
2900	3050	116 ... 2755	145	2900	260	3015
5800	6090	175 ... 5510	290	5800	365	5975
Contact load		– AC voltage	380 V; 10 A			
		– DC voltage	25 V; 1.0 A or 125 V; 0.2 A or 250 V; 0.1 A			
DC voltages with inductive load, arc suppression is recommended to increase service life.						
Insulation to DIN 40 050			Exceeds NEMA class B (IP 65)			
Weight		kg (lbs.)	0.8 (1.8)			

**Notes on application of bourdon tube pressure switches**

Bourdon tube pressure switches should be shock mounted to avoid mechanical vibrations.

To compensate for pump pulsation, we recommend the use of small diameter hoses 0.1" (2 mm), approximately 3.28 ft (1 meter) long for pressure switch connection.

## Extracted from RE 50061/02.06

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Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Hydro-electric pressure switch Model HED 8

Component series 2X

Max. working pressure up to 630 bar (9100 PSI)

- For subplate mounting
- For in-pipe installation
- For flange connection, position of ports to ISO 16873
- As vertical stacking element, position of ports to DIN 24340 form A
- In horizontal stacking assemblies
- Five pressure stages, optional
- Four adjustment elements, optional:
  - Spindle with hexagon socket, with or without protective cap (protective cap sealable)
  - Spindle with hexagon socket and scale, with or without protective cap
  - Rotary knob with scale
  - Lockable rotary knob with scale



Model HED 8

- Cable socket with circuitry (indicator lamp) (separate order)

## Ordering data

HED 8		- 2X /		K14		* 1)	
Piston type pressure switch							Further details in clear text
Flange connection (ISO 16873) <sup>2)</sup>	= OH						<b>Seal material</b>
Subplate mounting	= OP						NBR seals
In-pipe installation	= OA						V = FKM seals (other seals on enquiry)
Component series 20 to 29 (20 to 29: unchanged installation and connection dimensions)		= 2X					<b>⚠ Caution!</b> Observe compatibility of seals with hydraulic fluid used!
Max. set pressure 50 bar			= 50				<b>No code =</b> Spindle without scale, without protective cap
Max. set pressure 100 bar			= 100				<b>S =</b> Spindle without scale, with protective cap
Max. set pressure 200 bar			= 200				<b>A <sup>6)</sup> =</b> Spindle with scale, without protective cap
Max. set pressure 350 bar			= 350				<b>AS <sup>6)</sup> =</b> Spindle with scale, with protective cap
Max. set pressure 630 bar <sup>3)</sup>			= 630				<b>KS <sup>5; 6)</sup> =</b> Lockable rotary knob with scale
<b>Electrical connection</b>							<b>KW <sup>6)</sup> =</b> Rotary knob with scale
Without cable socket				= K14 <sup>4)</sup>			
Individual connection with component plug to DIN EN 175301-803							

<sup>1)</sup> The HED 8-1X/ product line will be replaced by HED 8-2X/ through year 2006. Current "preferred" part numbers will be updated to series "2X" as applicable.

<sup>2)</sup> Sandwich plate for vertical stacking assembly, separate order, see pages 11 to 14

<sup>3)</sup> Not permitted for vertical stacking assembly

<sup>4)</sup> Cable sockets, separate order, see page 4

<sup>5)</sup> H-key, material no. R900008158, included in scope of supply

<sup>6)</sup> The switching pressure can only be set exactly with the help of a pressure gauge (scale serves only for orientation)

**Extracted from RE 50061/02.06**

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 Issue: 06.06

 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Technical data**
**General**

Weight	– Pressure switch	kg (lbs.)	0.8 (1.76)
	– Sandwich plate for vertical stacking assembly	• Size 6	kg (lbs.)
		• Size 10	kg (lbs.)
			0.8 (1.76) – plate height 40.5 mm (1.60 in.), see pages 11 and 12 3 (6.61) – plate height 120 mm (4.72 in.), see pages 11 and 12 2 (4.41) – see pages 13 and 14
Installation orientation			Optional
Ambient temperature range			–30 to +50 (–22 to +122) – NBR seals –20 to +50 (–4 to +122) – FKM seals
Vibration test to DIN EN 60068-2-6:1996			g 20 (testing time 30 minutes)
Shock test to DIN EN 60068-2-27:1993			g 25

**Hydraulic**

Maximum operating pressure	bar (PSI)	630 (9100)
Hydraulic fluid	Mineral oil (HL, HLP) to DIN 51524 <sup>1)</sup> ; fast bio-degradable hydraulic fluids to VDMA 24568 (see also RE 90221); HETG (rape seed oil) <sup>1)</sup> ; HEPG (polyglycols) <sup>2)</sup> ; HEES (synthetic esters) <sup>2)</sup> ; other hydraulic fluids on enquiry	
Hydraulic fluid temperature range	°C (°F)	–30 to +80 (–22 to +176 – for NBR seals –20 to +80 (–4 to +176– for FKM seals)
Viscosity range	mm <sup>2</sup> /s (SUS)	10 to 800 (59 to 3700)
Max. permissible degree of contamination of the hydraulic fluid; cleanliness class to ISO 4406 (c)	Class 20/18/15 3)	
Load cycles	≥ 5 x 10 <sup>6</sup>	

**Electrical**

Electrical connection / cable socket	Plug-in connection to DIN EN 175301-803, 3-pin + PE		
Maximum connection cross-section / cable socket	mm <sup>2</sup> (in <sup>2</sup> )	1.5 (0.06)	
Maximum switching frequency	1/h	7200	
Type of protection to EN 60529 IEC	IP 65 with cable socket mounted and locked		
Switching accuracy (repeatability)	< ± 1 % of adjustment range		
Switch	According to VDE 0630/DIN EN 61058		
Transfer resistance 1-2; 1-3	mΩ	< 50	
Coordination of insulation	Overvoltage category 3		
Contamination	Degree of contamination 3		
Bounce time	– ON	ms	
	– OFF	ms	
			< 5 < 5

<sup>1)</sup> Suitable for NBR and FKM seals

<sup>2)</sup> Suitable only for FKM seals

<sup>3)</sup> The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.



### Extracted from RE 50031/02.00

Page 1 of 1  
Issue: 01.03

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Pressure gauge – isolator valve Model AF 6

Nominal size 6

Series 4X

Maximum operating pressure 4350 PSI

- 3-way longitudinal valve
- For subplate mounting
- Push button operated



Model AF 6 EA4X/XV12

### Ordering code

	A	F	6	E		4X	X	V	12	*		
Isolator valve	= A											Further details in clear text
Spring return		= F										12 = SAE threaded housing
Nominal size 6			= 6									V = FKM seals (other seals on request)
Single valve				= E								<b>⚠ Attention!</b> The compatibility of the seals and pressure fluid has to be taken into account!
For threaded connections					= A							
Series 40 to 49 (40 to 49: unchanged installation and connection dimensions)						= 4X						X = Without accessories

### Technical data

#### Hydraulic

Pressure fluid			Mineral oil (HL, HLP) to DIN 51 524; Fast bio-degradable pressure fluids to VDMA 24 568 (also see RE 90 221); HETG (rape seed oil); HEPG (polyglycol); HEES (synthetic ester); other fluids on request
Pressure fluid temperature range	°C (°F)		–15 to 80 (4 to 176)
Viscosity range	mm <sup>2</sup> /s (SUS)		7.5 to 500 (35 to 2318)
Degree of contamination			Maximum degree of contamination of the pressure fluid is to NAS 1638 class 9. We, therefore, recommend a filter with a minimum retention rate of β <sub>10</sub> ≥ 75.
Max. operating pressure	– Port P	bar (PSI)	300 (4350)
	– Port T	bar (PSI)	10 (145) (actuation force approx. 10 N)
Pressure gauge indicating range	bar (PSI)		Up to 60 (870), up to 100 (1450), up to 160 (2320), up to 250 (3625) and up to 400 (5800)—the indicating range should be approx. 30 % above the max. operating pressure.

**Extracted from SUB/BMK/06.98**

Page 1 of 1

Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Subplates to ISO, ANSI B 93.7,  
and NFPA T 3.5.1 M R1, with SAE ports**

Subplate	Valve	Port Size	Mounting Bolts <sup>1)</sup>
G66/12	WE10	SAE-6; 9/16-18	1/4-20 UNC (4)
G67/12	WE10	SAE-8; 3/4-16	1/4-20 UNC (4)
G154/12	WEH22, 25	SAE-20; 1 5/8-20	1/2-13 UNC (6)
G155/12	WEH25	SAE-16; 1 5/16-12	1/2-13 UNC (6)
G156/12	WEH22, 25	SAE-24; 1 7/8-20	1/2-13 UNC (6)
G174/12	WEH16	SAE-16; 1 5/16-12	3/8-16 UNC (4), 1/4-20 UNC (2)
G273/12	SE6	SAE-6; 9/16-28	1/4-20 UNC (4)
G279/12	FRM10	SAE-8; 3/4-16	5/16-18 UNC (4)
G341/12	WE6	SAE-4; 7/16-20	10-24 UNC (4)
G342/12	WE6	SAE-6; 9/16-18	10-24 UNC (4)
G409/12	DB20...5X	SAE-16; 1 5/16-12	5/8-11 UNC (4)
G411/12	DB30...5X	SAE-24; 1 7/8-12	3/4-10 UNC (4)
G413/12	DR20...5X	SAE-16; 1 5/16-12	3/8-16 UNC (4)
G415/12	DR30...5X	SAE-24; 1 7/8-12	3/8-16 UNC (6)
G461/12	DZ10...DP-4X	SAE-8; 3/4-16	3/8-16 UNC (4)
G502/12	FRM6	SAE-8; 3/4-16	10-24 UNC (4)
G534/12	WEH10	SAE-12; 1 1/16-12	1/4-20unc (4)
G546/12	DB10...5X	SAE-8; 3/4-16	1/2-13 UNC (4)

<sup>1)</sup> Mounting bolts are not supplied (separate order)

## Notes

# Section 11

## Manifolds

### The Drive & Control Company

– BM, Bar Manifold D03 and D05 .....	482
– ABM, Automotive Bar Manifold D03 .....	483
– SP, Subplates D03 and D05 .....	484
– CP, Coverplates D03 and D05 .....	485
– TP, Tapping Plates D03 and D05 .....	486
– AP, Valve Adaptors D03, D05, and D07 .....	487
– LCB, Logic Control Block 16, 25, 32 .....	488

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Catalog



**Extracted from RA 09 907**

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Issue: 06.04

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

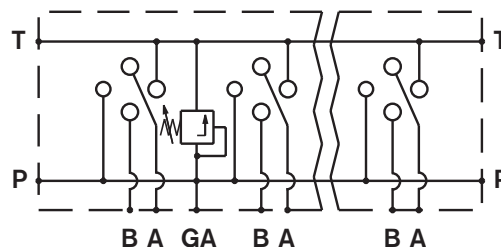
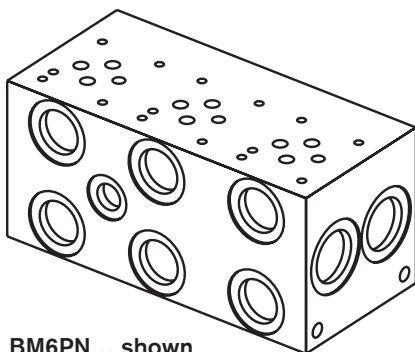
**Bar manifold**  
**Parallel circuit, normal flow**

D03 (Size 6) and D05 (Size 10)

**Ordering code**

	<b>BM</b>	<b>P</b>	<b>XX</b>	<b>/</b>	<b>12</b>	
<b>Nominal Size</b>						<b>SAE Threaded Ports</b>
D03	= 6					<b>Valve Spacing</b>
D05	= 10					
<b>Parallel Circuit</b>		= P				
<b>Flow Range</b>						
Normal (Sizes 6, 10, 16)			= N			
<b>Revision</b>				= XX		
<b>Number of Station(s)</b>						
Sizes 6				= 01-08		
Sizes 10				= 01-06		
<b>Material</b>						
Aluminum 6061-T6, 3000 PSI						= A
Ductile Iron <sup>1</sup> 65-45-12, 5000 PSI						= D

<sup>1)</sup> Blackened



Mounting kit included

**Extracted from RA 09 907**

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Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

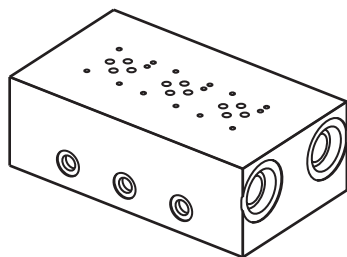
**Bar manifold**  
**Parallel circuit normal flow**

D03 (Size 6)

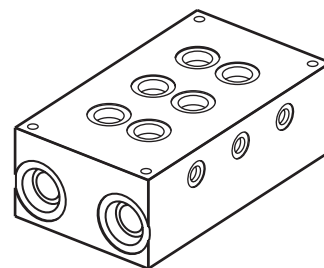
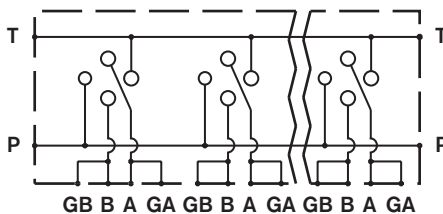
**Ordering code**

	<b>ABM</b>	<b>6</b>	<b>P</b>	<b>N</b>	<b>-</b>	<b>XX</b>	<b>/</b>	<b>D</b>	<b>2</b>	<b>-</b>	<b>01</b>	<b>G</b>	<b>M</b>	
<b>Nominal Size</b> D03	= 6												M = Metric Mounting Bolts	
<b>Parallel Circuit</b>	= P												G = Gauge Ports for A & B	
<b>Flow Range</b> Normal			= N										01 = BSPP Threaded Ports	
<b>Revision</b>					= XX								2 = Valve Spacing 2.125" D03 (6)	
<b>Number of Station(s)</b> D03 (Size 6)							= 02-08							
<b>Material</b> Ductile Iron <sup>1</sup> 65-45-12, 5000 PSI							= D							

<sup>1</sup>) Blackened



ABM6PN... shown



Mounting kit inot ncluded

**Extracted from RA 09 907**

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Issue: 06.04

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

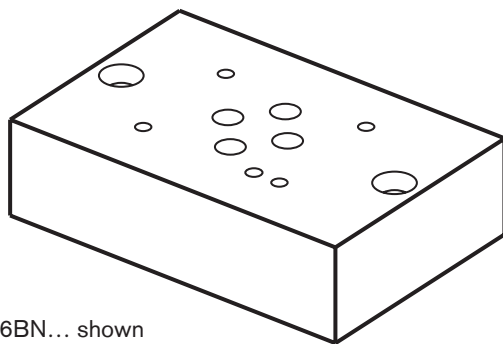
**Subplates**  
**Bottom or side ported**

D03 (Size 6) and D05 (Size 10)

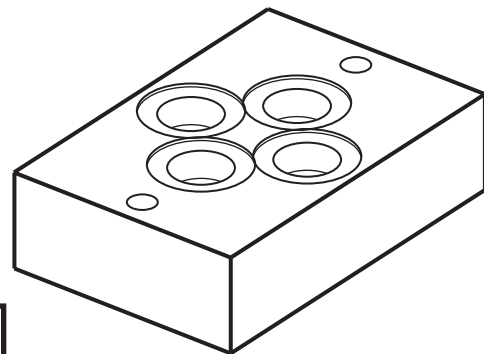
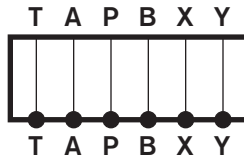
**Ordering code**

	<b>SP</b>			- <b>XX</b> / - <b>12</b>	
<b>Subplate Size</b>					
D03	=	6			
D05	=	10			
<b>Porting</b>					
Bottom Ported	=	B			
Side Ported	=	S			
<b>Flow</b>					
Normal	=	N			
					<b>Ports</b>
				12 =	SAE Threaded Ports
					<b>Material</b>
				A =	Aluminum 6061-T6, 3000 PSI
				D =	Ductile Iron <sup>1)</sup> 65-45-12, 5000 PSI
				<b>XX =</b>	<b>Revision</b>

<sup>1)</sup> Blackened



SP6BN... shown



Subplate Size	Mounting Bolts <sup>2)</sup>	
SP6	(2) 1/4"-20 x 0.75"	SHCS
SP10	(4) 3/8"-16 x 1.50"	SHCS

<sup>2)</sup> Included in supply

**Extracted from RA 09 907**

Page 1 of 1  
Issue: 06.04

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Coverplates**  
**Parallel and series circuits**

D03 (Size 6) and D05 (Size 10)

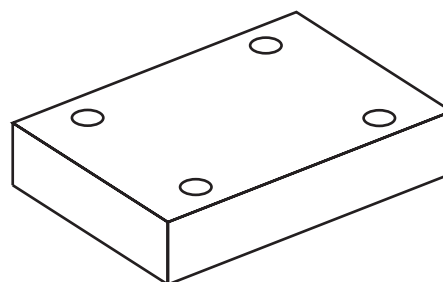
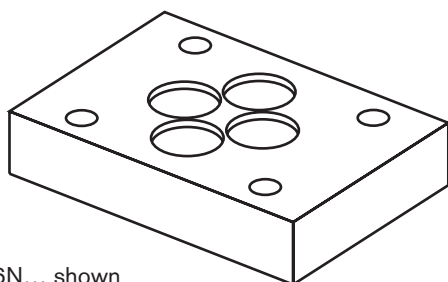
**Ordering code**

	<b>CP</b>			<b>N</b>	<b>XX</b>	<b>/</b>		<b>12</b>	
<b>Coverplate Size</b>									
D03				= 6					
D05				= 10					
<b>Internal Connections</b>									
Parallel Circuit (All Ports Blocked)				= N					
<b>Additional Ports</b>									
No Ports				= N					
<b>Revision</b>					= XX				

<b>01</b>	<b>12</b>	
		<b>Mounting Bolts</b>
		Metric
		SAE
		<b>Material</b>
<b>A</b>		Aluminum 6061-T6, 3000 PSI
<b>D</b>		Ductile Iron <sup>1)</sup> 65-45-12, 5000 PSI

<sup>1)</sup> Blackened



Coverplate Size	Mounting Bolts <sup>1)</sup>	O-Rings <sup>2)</sup>
CP6	(4) 10-24 x 0.75" SHCS	(4) 2-012
CP10	(4) 1/4"-20 x 1.00" SHCS	(5) 12 x 2 mm (2) 10 x 2 mm



<sup>2)</sup> Included in supply



**Extracted from RA 09 907**

Page 1 of 1  
Issue: 06.04

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

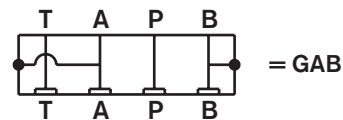
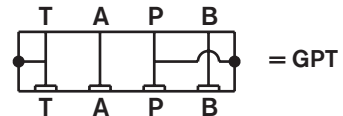
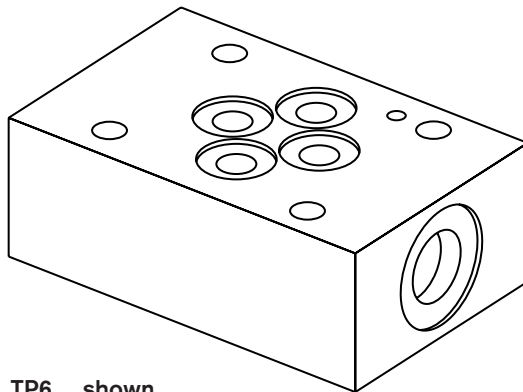
**Tapping plates**

D03 (Size 6) and D05 (Size 10)

**Ordering code**

		<b>TP</b>		- <b>XX</b> / - <b>12</b>			
<b>Tapping Plate Size</b>						<b>Port Style</b>	
D03	= 6					01 =	BSPP
D05	= 10					12 =	SAE
<b>Connections</b>						<b>Material</b>	
Gauge Port	P + T	= <b>GPT</b>				<b>A =</b>	Aluminum 6061-T6, 3000 PSI
Gauge Port	A + B	= <b>GAB</b>				<b>D =</b>	Ductile Iron <sup>1)</sup> 65-45-12, 5000 PSI
<b>Revision</b>				= <b>XX</b>			

<sup>1)</sup> Blackened



**Extracted from RA 09 907**

Page 1 of 1  
Issue: 06.04

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

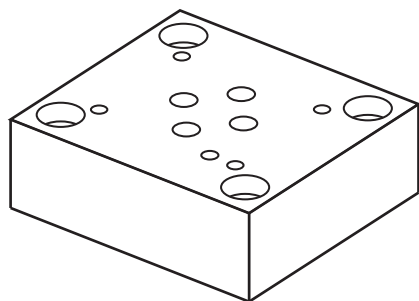
**Valve adaptors**

Various Sizes

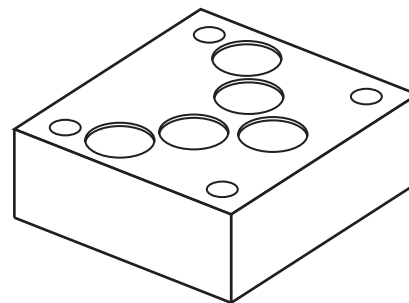
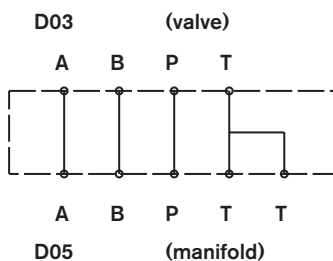
**Ordering code**

	<b>AP</b>	-	<b>XX</b>	/	-	<b>12</b>	
<b>Valve Adaptors:</b>							
D03 → D05			= 6-10				Omit = No Options
D03 → D07			= 6-16				<b>Mounting Bolts</b>
D05 → D07			= 10-16			12 =	SAE
<b>Revision</b>				= XX			<b>Material</b>
							A = Aluminum 6061-T6, 3000 PSI
							D = Ductile Iron <sup>1</sup> 65-45-12, 5000 PSI

<sup>1)</sup> Blackened



AP6-10-1X/... shown



Valve Adaptors	Mounting Bolts <sup>1)</sup>	O-Rings <sup>2)</sup>
AP6-10	(4) 1/4"-20 x 1.25" SHCS	(5) 12 x 2 mm
AP6-16	(4) 3/8"-16 x 1.25" SHCS	(4) 22 x 2.5 mm
	(2) 1/4"-20 x 1.50" SHCS	(2) 10 x 2 mm
AP10-16	(4) 3/8"-16 x 1.25" SHCS	(4) 22 x 2.5 mm
	(2) 1/4"-20 x 1.50" SHCS	(3) 10 x 2 mm

<sup>2)</sup> Included in supply

**Extracted from RA 09 907**

Page 1 of 1  
Issue: 06.04

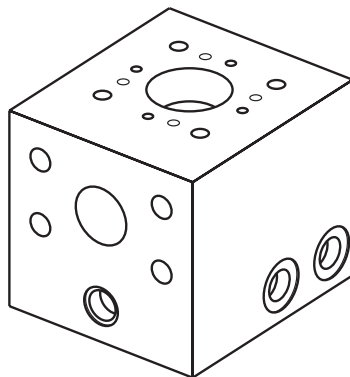
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Logic manifold  
Logic control block**

**Ordering code**

	<b>LCB</b>		<b>N - XX - D</b>	<b>1 - 07</b>	
<b>Nominal Size</b>	= 16-32				07 = SAE Flange
<b>Pressure Range</b> Normal 3000 PSI (Code 61)	= N				1 = Number of Cartridge per Block
<b>Revision</b>	= XX				
<b>Material</b> Ductile Iron <sup>1</sup> 65-45-12	= D				

<sup>1)</sup> Blackened



LCB16N... shown

Additional Plug configurations available. See RA 09 907 for details.

Size	Position 1, 2, 3, 4	Position 5, 6, 7
16	10-24 UNC	1/16-27 NPT
25	1/4-20 UNC	1/16-27 NPT
32	1/16-27 NPT	1/16-27 NPT

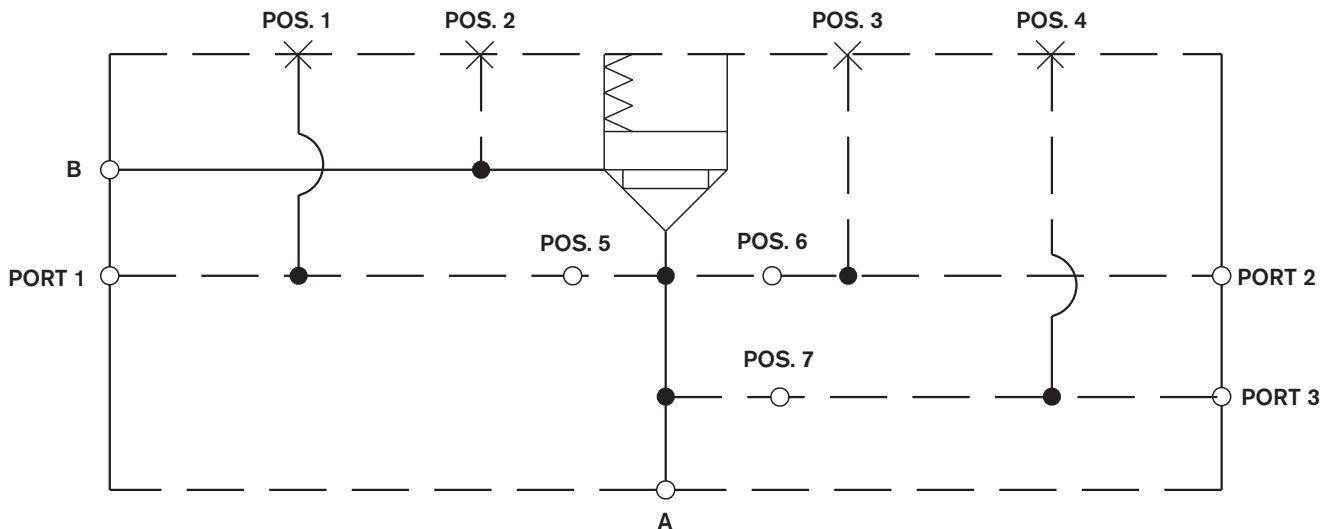


Illustration of "standard" plug configuration

## Section 12

# Tie Rod Cylinders

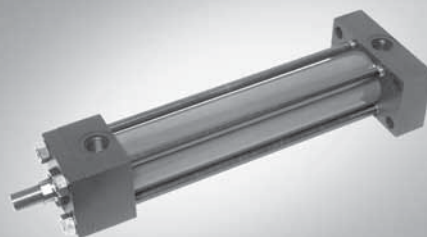
### The Drive & Control Company

- CDT4 NFPA tie rod cylinders  
(up to 3000 PSI) .....490
- CDT3 ISO tie rod cylinders .....492
- CDT1 NFPA tie rod cylinders  
(up to 1500 PSI) .....494

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### Extracted from RA 17 041/07.05

Page 2 of 2

Issue: 04.03

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data (for applications outside these parameters, please consult us)

**Standards:** Meets or exceeds all J.I.C. and NFPA requirements.

**Nominal Pressure:** 3000 PSI

**Static proof pressure:** 5000 PSI

With extreme shock loads the mounting styles and piston rod threads have to be considered, taking the fatigue limits into account.

**Maximum operating pressure up to:** 3,000 PSI

**Static non-shock:** 5,000 PSI

**Installation position:** Various

**Pressure fluid:** Mineral oils (HL, HLP)

**Hydraulic fluid temperature range:** (-4°F to 176°F)

**Viscosity range:** 32 to 1760 SUS

**Degree of contamination:**

Max. permissible degree of contamination of the pressure fluid is to NAS 1638 class 10. We therefore recommend a filter with a minimum retention rate of  $\eta \geq 75$ .

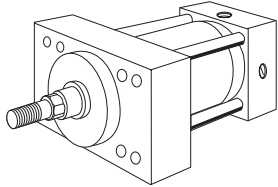
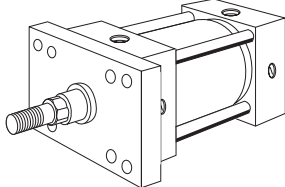
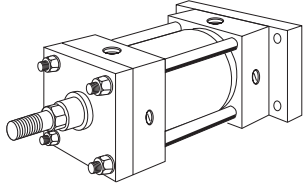
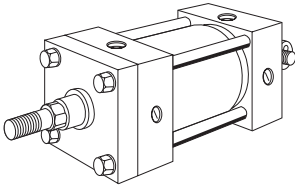
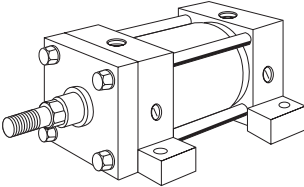
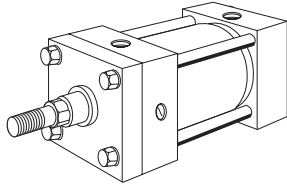
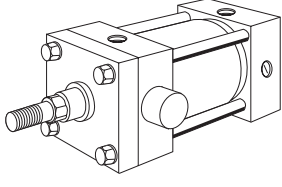
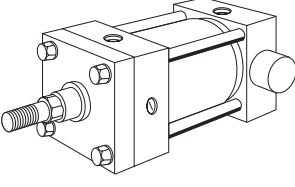
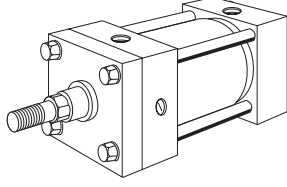
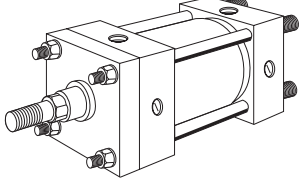
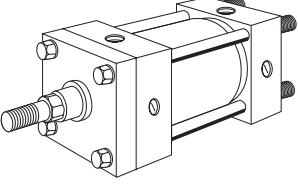
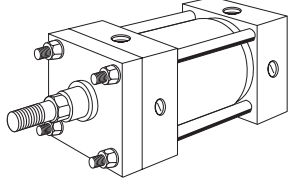
**Stroke speed:** 20 in/sec  
(dependent on the connection port)

**Air bleed standard:** Secured against removal

**Acceptance:** Each cylinder is tested to Bosch Rexroth standards.

Cylinders, outside the above parameters are also available.  
See data sheet RA 17 041.

### Mounting Type Overview

<p><b>ME5</b></p> 	<p><b>MF1</b></p> 	<p><b>MF2</b></p> 
<p><b>MP1</b></p> 	<p><b>MS2</b></p> 	<p><b>MS4</b></p> 
<p><b>MT1</b></p> 	<p><b>MT2</b></p> 	<p><b>MX0</b></p> 
<p><b>MX1</b></p> 	<p><b>MX2</b></p> 	<p><b>MX3</b></p> 

**Extracted from RA 17 032/05.00**

Page 1 of 2  
Issue: 01.01

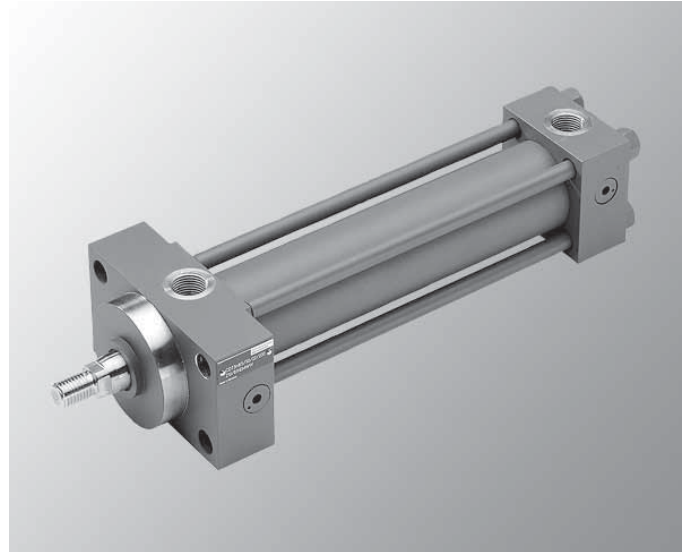
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Hydraulic cylinder  
Model CDT3**

Series 1X

Nominal pressure 160 bar (16 MPa)

- ISO 6020/2, DIN 24 554, NF E 48-016
- Maximum operating pressure up to 210 bar
- Ten mounting types
- Piston Ø: 25 to 100 mm
- Piston Rod Ø: 12 to 70 mm
- Stroke lengths up to 1.5 meters
- Self-adjusting end position cushioning



CDT3ME5/...

**Ordering code**

CD T3 / / / Z 1X/B 1 H H D M W W \*

Double acting cylinder = CD

Series = T3

**Mounting types**

- Fork clevis mounting = MP1
- Rectangular flange at head = ME5
- Rectangular flange at cap = ME6
- Foot mounting = MS2

Piston Ø (AL) 25 to 100 mm

Piston rod Ø (MM) 12 to 70 mm

Stroke length in mm

**Design principle**

Head and cap connected by tie rods = Z

Series = 1X

10 to 19 unchanged installation and connection dimensions

**Port connections/ types**

Port threads to ISO 1179-1 = B

**Remarks:**

<sup>1)</sup> Location "3" obtained by rotating the cylinder

**Order example:**

CDT3MP1/80/56/350/Z1X/B1HHUMWW

Further details to be  
written in clear text

**Option 2**

W = Without options

**Option 1**

W = Without options

**Seal version**

M = Suitable for mineral oil to  
DIN 51 524 HL, HLP and HFA  
Standard seal system

**End position cushioning**

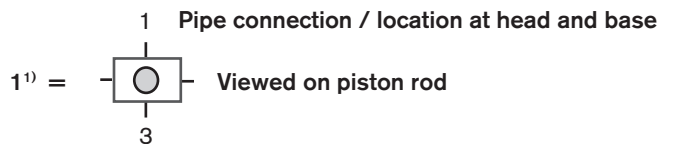
D = Both sides, self-adjusting

**Piston rod end <sup>5)</sup>**

H = Thread (ISO/DIN) for self-aligning clevis CGKA

**Piston rod version**

H = Surface-hardened and hard chromium plated



**Note:** For complete cylinder prices, use Base Price plus Stroke Adder per 100 mm.

**Extracted from RA 17 032/05.00**

Page 2 of 2

Issue: 01.01

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Technical data**

**Standards:** The cylinder installation and mounting types conform to the standards ISO 6020/2, DIN 24 554, and NF E 48-016.

**Nominal pressure:** 160 bar

**Static proof pressure:** 240 bar

Higher operating pressures, consult factory.

**Max. operating pressure up to:** 210 bar  
(dependent on cylinder version and the application, suitable for operating pressures up to 210 bar)

**Installation position:** Various

**Pressure fluid:** Mineral oils DIN 51 524 (HL, HLP)  
Phosphate ester (HFD-R)

**Hydraulic fluid temperature range:** -20 °C to +80 °C

**Viscosity range:** 2.8 to 380 mm<sup>2</sup>/s

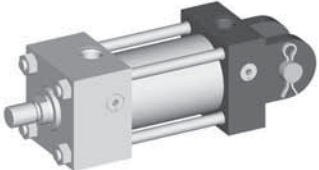
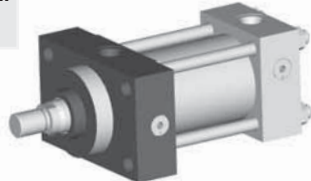
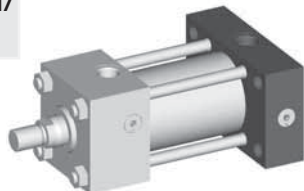
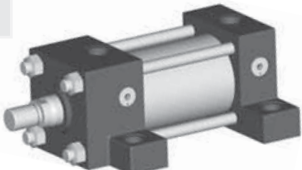
**Degree of contamination:** Max. permissible degree of contamination of the pressure fluid is to NAS 1638 class 10. We therefore recommend a filter with a minimum retention rate of  $b_{10} \geq 75$ .

**Stroke speed:** 0.5 m/s (dependent on the connection port)

**Bleeding standard:** Secured against unscrewing  
(Piston - Ø 40 to 100 mm)

**Acceptance:** Each cylinder is tested to Rexroth standards.  
Cylinders, outside the above parameters are also available, if required. See datasheet RA 17 032.

**Mounting type overview**

		<b>MP1</b> <b>ISO</b> 
<b>ME5</b> <b>ISO/DIN/</b> <b>NF E</b> 	<b>ME6</b> <b>ISO/DIN/</b> <b>NF E</b> 	<b>MS2</b> <b>ISO/DIN/</b> <b>NF E</b> 



**Extracted from RA 17 038/07.05**

Page 1 of 2  
Issue: 06.04

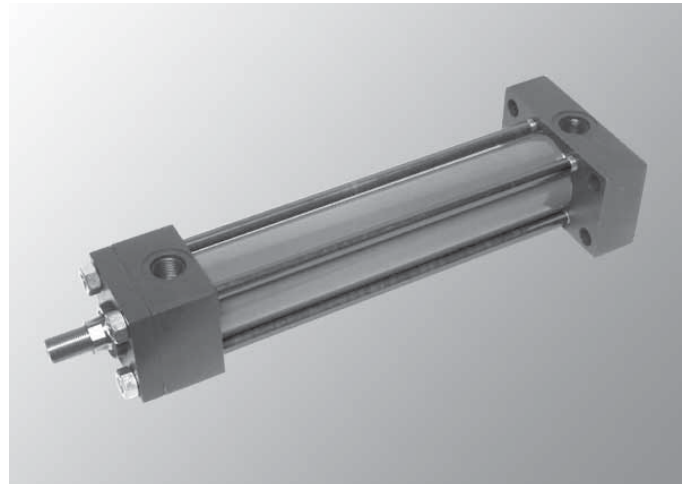
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Hydraulic Cylinder, Model CDT1,  
NFFPA Industrial Type**

Series 1X

Nominal pressure: 1500 PSI

- Duty, up to 1,500 PSI
- Standards, meets or exceeds all JIC and NFFPA requirements
- Bore Sizes, 1-1/2" – 4"
- Piston Rods, 1/2" – 1-3/8"
- Mountings, 9 standard NFFPA mountings
- Ports, SAE o-ring straight thread ports
- Stroke, standard strokes furnished in 1/8" increments. Normal stroke tolerance + 1/16" / - 0". Closer stroke tolerances available; consult factory.



Model CDT1

- Rod End Threads, standard KK1. Other rod end styles optional.
- Cushions, available for all bore sizes, at both ends.

**Ordering code**

<b>CD</b>	<b>T1</b>	<b>/</b>	<b>/</b>	<b>/</b>	<b>Z</b>	<b>1X/S</b>	<b>1</b>	<b>1</b>	<b>H</b>	<b>H</b>	<b>M</b>	<b>W</b>	<b>W</b>	<b>*</b>
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Single rod cylinder = **CD**

**Series** = **T1**

**Mounting types**

Rectangular flange at head	= <b>MF1</b>
Rectangular flange at cap	= <b>MF2</b>
Clevis mounting	= <b>MP1</b>
Side lug	= <b>MS2</b>
Side tapped	= <b>MS4</b>
Basic version	= <b>MX0</b>
Extended tie rods, both ends	= <b>MX1</b>
Extended tie rods, at cap	= <b>MX2</b>
Extended tie rods, at head	= <b>MX3</b>

**Bore Dia. Ø 1.50 to 4.00 inch**

**Piston rod Ø 0.50 to 1.38 inch**

**Stroke length in inches (ex. 12.00)**

**Design principle**

Head and cap connected by tie rods = **Z**

**Series**

10 to 19 unchanged installation and connection dimensions = **1X**

**Port connections/ types**

SAE straight thread port (ISO 11926-1) = **S**

**Remarks:**

<sup>1)</sup> Only 1" to 1-3/8" diameter piston rods are case hardened and hard chrome plated.

<sup>2)</sup> With extreme shock loads the piston rod threads have to be selected, taking the fatigue limits into account. Rod end clevis, installed parts, etc. must always be firmly clamped against the piston rod shoulder.

\* Consult factory for other bore sizes and mounting options.

Further details in clear text

**Option 2**

**W =** Without options

**Option 1**

**W =** Without options

**Seal version**

**Suitable for mineral oil to DIN 51 524 HL, HLP and HFA**

**M =** Polyurethane seal system

**End position cushioning**

**U =** Without

**D =** Both sides, adjustable


**Piston rod end <sup>2)</sup>**

**H =** Small male thread KK1


**Piston rod version**

**H =** Case hardened and hard chromium plated <sup>1)</sup>

**Port connection / location at cap**

**1 =**  Viewed on piston rod

**Port connection / location at head**

**1 =**  Viewed on piston rod

### Extracted from RA 17 038/07.05

Page 1 of 2  
Issue: 06.04

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

### Technical data

**Standards:** Meets or exceeds all JIC and NFPA requirements.

**Nominal pressure:** up to 1,500 PSI

With extreme shock loads the mounting styles and piston rod threads have to be considered, taking the fatigue limits into account.

**Maximum operating pressure up to:** 1,500 PSI depending on bore size

**Installation position:** Various

**Pressure fluid:** Mineral oils (HL, HLP),  
Phosphate ester (HFD-R) (-4°F to 300°F), HFA (41°F to 131°F),  
Water glycol HFC (-4°F to 140°F)

**Hydraulic fluid temperature range:** (-4°F to 176°F)

**Viscosity range:** 32 to 1760 SUS

Degree of contamination: Max. permissible degree of contamination of the pressure fluid is to NAS 1638 class 10.

We therefore recommend a filter with a minimum retention rate of  $\beta_{10} \geq 75$ .

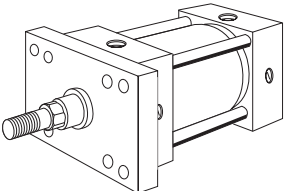
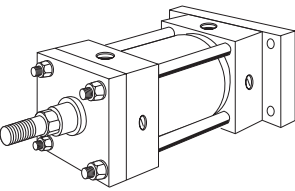
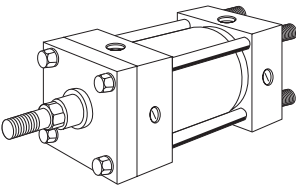
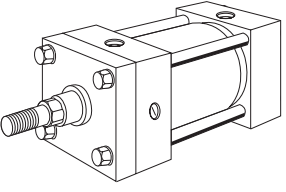
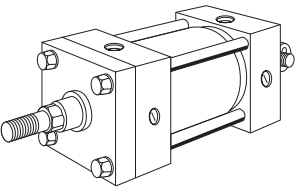
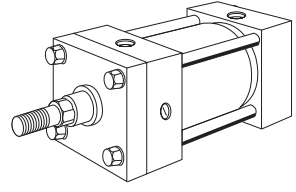
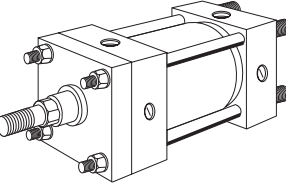
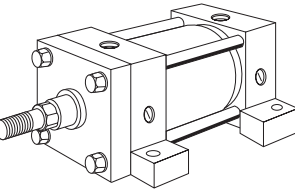
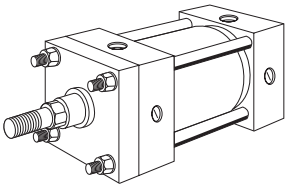
**Stroke speed:** 20 in/sec (dependent on the connection port)

**Air bleed standard:** Secured against removal,  
2" – 4" bore sizes only

**Acceptance:** Each cylinder is tested to Bosch Rexroth standards.

Cylinders, outside the above parameters are also available.  
Consult factory

### Mounting Type Overview

<p><b>MF1</b></p> 	<p><b>MF2</b></p> 	<p><b>MX2</b></p> 
<p><b>MS4</b></p> 	<p><b>MP1</b></p> 	<p><b>MX0</b></p> 
<p><b>MX1</b></p> 	<p><b>MS2</b></p> 	<p><b>MX3</b></p> 

## Notes

## Section 13

# Power Packs

### The Drive & Control Company

- Close-Coupled Motor Pump Groups, 2–20 HP  
Axial Piston Variable Displacement.....498
- Close-Coupled Motor Pump Groups, 25–100 HP  
Axial Piston Variable Displacement.....499
- Fixed Displacement Industrial Hydraulic  
Power Packs .....500
- Variable Displacement Industrial Hydraulic  
Power Packs .....501
- Air/Oil Heat Exchangers.....502

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  - ▶ Industrial Hydraulics
    - ▶ Products and Catalogs
      - ▶ Preferred Product Catalog



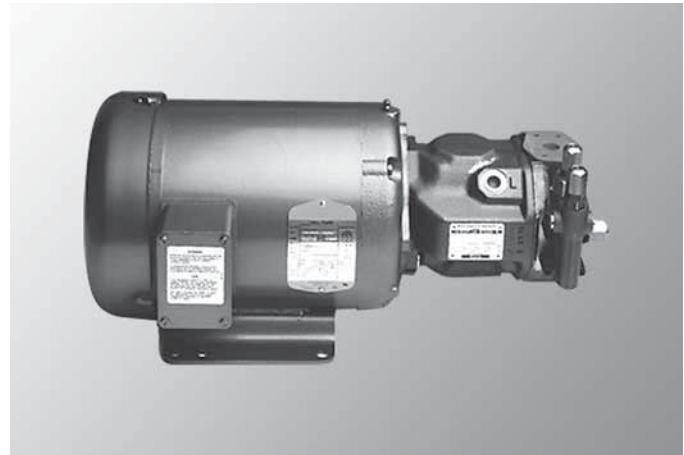
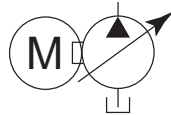
**Extracted from RA 12 740/08.04**

Page 1 of 1  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Close-coupled motor pump groups  
Axial piston variable displacement**

- Flow: up to 20 GPM (76 L/min)
- Electric motor: 2-20 HP @ 1750 rpm, 230/460 V,  
1.15 S.F., TEFC



**Ordering Code**

Bold Selections are Preferred

<b>MPGB</b>	<b>XXXH</b>	<b>TYZ</b>	<b>46</b>	<b>XX</b>	<b>F</b>	<b>S</b>	<b>X</b>	<b>H</b>	<b>A10</b>	<b>XXX</b>	<b>XXXX</b>	<b>K</b>	<b>NN</b>	<b>1</b>	<b>XX</b>	<b>XXXXX</b>
<b>Horsepower: (XXX)H</b>																
002	003	005	7.5	010	015	020										
2HP	3HP	5HP	7.5HP	10HP	15HP	20HP										
<b>No. of Poles/Hertz</b>																
No. Poles		6														
4		60 Hertz														
		1750 rpm														
<b>Standard Voltage Options:</b>																
Std. Volt	BF	EZ	EZ	EZ	EZ	EZ	EZ									
HP	2	3	5	7.5	10	15	20									
B - 50HZ/190/380V																
F - 60HZ/230/460V																
EZ - 60HZ/208-230/460V																
<b>Windings: F - Full Version</b>																
<b>Efficiency: S - Standard</b>																
<b>Junction Box Location:</b>																
1 - F1																
<b>Mounting Position: H - Horizontal</b>																
<b>Pump: A10</b>																
<b>2 HP or 3 HP</b>																
010	AA10VS010	018	A10VS018													
<b>5 HP</b>																
010	A10VS010	018	A10VS018													
028	AA10VS028															
<b>7.5 HP or 10HP</b>																
010	A10VS010	018	A10VS018													
028	AA10VS028	045	AA10VS045													
<b>15 HP or 20HP</b>																
028	AA10VS028	045	AA10VS045													
<b>Control: DR, DFR</b>																
<b>Shaft: K - Keyed</b>																
<b>NN (No through drive)</b>																
<b>Pump Suction Port Orientation:</b>																
1	Down, Inline with Motor Feet															
<b>Mounting Rails: NN - None</b>																
<b>Internal Reference Number:</b>																

\* Standard orientation provided with pressure up and suction down, customer can rotate pump if required.

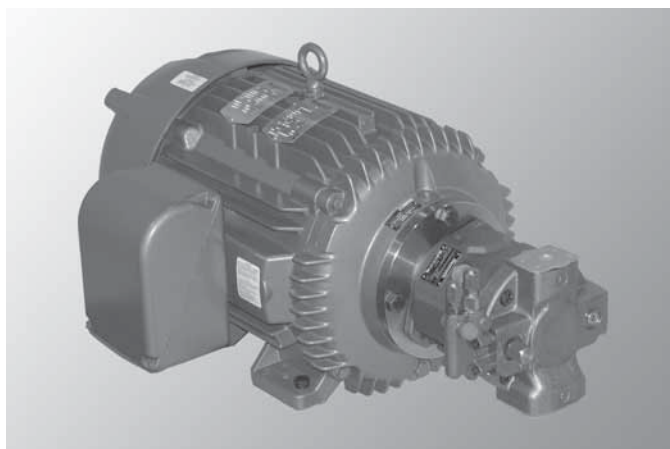
**Extracted from RA 12 742/08.04**

Page 1 of 1  
Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Close-coupled motor pump groups  
Axial piston variable displacement**

- Flow: up to 64 GPM (242 L/min)
- Electric motor: 25-100 HP @ 1750 rpm, 50/60 Hertz  
230/460 V, 1.15 S.F., TEFC



**Ordering Code**

Bold Selections are Preferred

<b>MPGB</b>	<b>XXXH</b>	<b>TYM</b>	<b>4D</b>	<b>XX</b>	<b>W</b>	<b>S</b>	<b>X</b>	<b>X</b>	<b>A10</b>	<b>XXX</b>	<b>XXXX</b>	<b>X</b>	<b>NN</b>	<b>X</b>	<b>XX</b>	<b>XXXXX</b>
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**Horsepower: (XXX)H**

<b>025</b>	<b>030</b>	<b>040</b>	<b>050</b>	<b>060</b>	<b>075</b>	<b>100</b>
25HP	30HP	40HP	50HP	60HP	75HP	100HP

**No. of Poles/Hertz**

<b>No. Poles</b>	<b>D</b>
4	50/60 Hertz
	1450/1750 rpm

**Standard Voltage Options:**

<b>Std. Volt</b>	<b>OP</b>	<b>OP</b>	<b>PR</b>	<b>PR</b>	<b>PR</b>	<b>PR</b>	<b>RS</b>
HP	25	30	40	50	60	75	100

O - 50HZ/190/380,200/400,208/416V  
P - 60HZ/200/400,208/416,230/460,240/480V  
R - 50HZ/190/380,200/400,208/416,230/460V  
S - 60HZ/230/460,240/480V

**Windings: W - WYE Delta**

**Efficiency: S - Standard**

**Junction Box Location:**

<b>1 - F1</b>	<b>3 - F3</b>	25-75 HP standard F1, 100 HP standard F3
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**Mounting Position: H - Horizontal**

**Pump: A10**

**25 HP or 30 HP**

<b>018</b>	A10V018	<b>045</b>	A10V045
<b>028</b>	A10V028	<b>071</b>	A10V071

**40 HP or 50 HP**

<b>028</b>	A10V028	<b>071</b>	A10V071
<b>045</b>	A10V045	<b>100</b>	A10V100

**60 HP, 75 HP or 100 HP**

<b>045</b>	A10V045	<b>100</b>	A10V100
<b>071</b>	A10V071	<b>140</b>	A10V140

**Control: DR, DFR**

**Shaft: S - Spline**

**NN (No through drive)**

**Pump Suction Port Orientation:**

<b>1</b>	Down, Inline with Motor Feet	Customer can rotate pump if required.
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**Mounting Rails: NN - None**

**Internal Reference Number:**



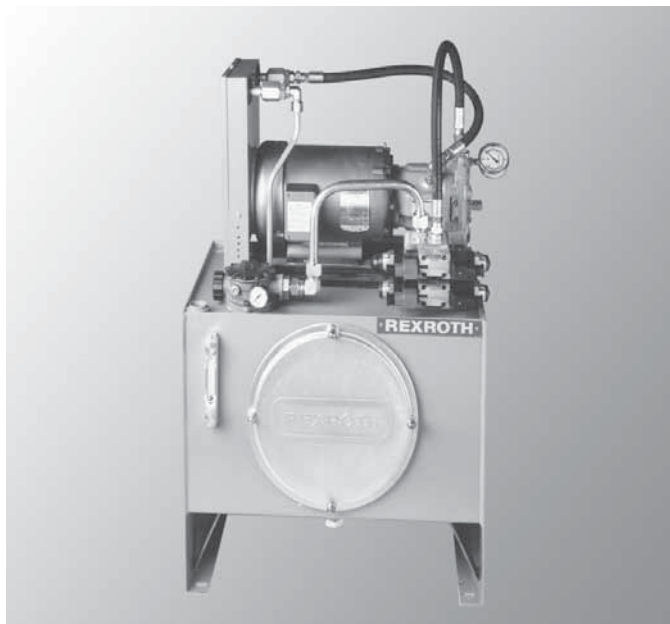
**Extracted from RA 51 073**

Page 1 of 1  
Issue: 04.03

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Variable displacement  
Industrial hydraulic power packs**

- Pressures up to 3000 PSI (200 bar) max.
- Flow: 4.2 to 20 GPM (16 to 76 L/min)
- Variable displacement pumps
- Electric Motor: 2-20 HP @ 1750 rpm
- System Relief Valve and Gauge
- 20µ absolute In-tank return filter/filler/breather
- In-tank return down line
- Tank Capacities: 20, 40, & 60 gal. (76, 152, & 227 L)



**Ordering Code**

Power Pack Variable		PPV				RV	Valve Options
<b>Reservoir Size</b>							Relief Valve and Gauge
20 Gallon (76 L)	= 20						<b>Motor Horsepower</b> See price list for horsepower (hp based on reservoir & pump size)
40 Gallon (152 L)	= 40						
60 Gallon (227 L)	= 60						
<b>Pump Size</b>							
A10VSO 10 DR - 20 Gallon (76 L)	= A						
A10VSO 10 DFR - 20 Gallon (76 L)	= B						
A10VSO 18 DR - 20 Gallon (76 L)	= 1						
A10VSO 18 DFR - 20 Gallon (76 L)	= 2						
AA10VSO 28 DR - 40 Gallon (152 L)	= 3						
AA10VSO 28 DFR - 40 Gallon (152 L)	= 4						
AA10VSO 45 DR - 60 Gallon (227 L)	= 5						
AA10VSO 45 DFR - 60 Gallon (227 L)	= 6						



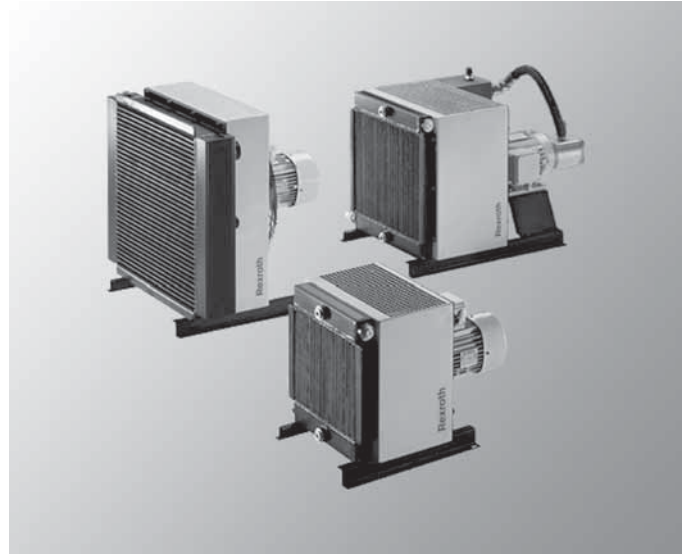
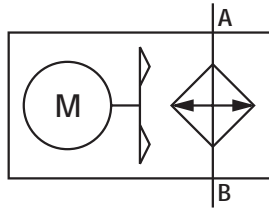
**Extracted from RE 50111/04.04**

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Issue: 07.05

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Air/Oil Heat Exchangers**

- Heat removal 3–120 kW (2.2–160 HP)
- Electric motor – 50/60 Hz operation



**Ordering Code**

<b>Design</b> Oil/air cooler	= KOL	<b>Seal material</b> NBR seals
<b>Cooling capacity</b> (at $q_{Vmax}$ ; $\Delta t = 40$ K)		<b>Design Principle</b>
3 kW	= 3 <sup>1)</sup>	A = Cooler with an axial fan wheel (3–10 kW)
5 kW	= 5 <sup>1)</sup>	R = Cooler with a radial fan wheel (20–120 kW)
8 kW	= 8 <sup>1)</sup>	
10 kW	= 10 <sup>1)</sup>	<b>1X =</b> Component series 10 to 19 (10 to 19: unchanged installation and connections dimensions)
20 kW	= 20	
30 kW	= 30	
40 kW	= 40	
45 kW	= 45	
65 kW	= 65	
80 kW	= 80	
120 kW	= 120	
		<b>Supply voltage</b> N = 230 / 265 / 400 V / 460 V 50/60 Hz (3 phases)

<sup>1)</sup> Only in conjunction with a radial fan wheel

Ports	
KOL3	G 3/4
KOL5	G 3/4
KOL8	G 3/4
KOL10	G 3/4
KOL20	G 1-1/4
KOL30	G 1-1/4
KOL40	G 1-1/4
KOL45	G 1-1/2
KOL65	G 1-1/2
KOL80	G 1-1/2
KOL120	SAE 2

## Section 14

# Gear Drives

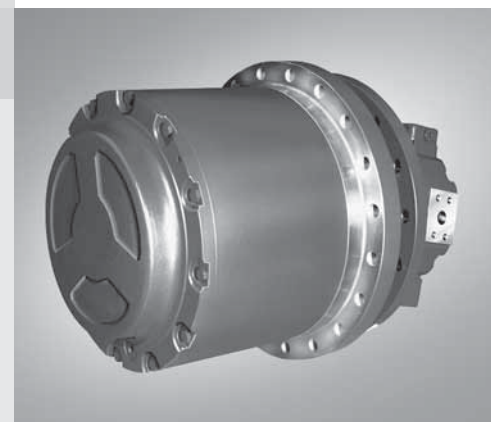
### The Drive & Control Company

- Compact hydrostatic drive, HYDROTRAC GFT,  
for fixed or variable displacement motors.....504
- Compact hydrostatic drive, HYDROTRAC GFT  
with integrated, Hydraulic two-speed  
motor A10VT.....516
- Winch drives, HYDROTRAC GFT-W,  
for fixed or variable displacement motors.....521
- Swing drives, MOBILEX GFB.....533

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Catalog



**Extracted from RE 77 110/07.04**Page 1 of 12  
Issue: 06.06See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Compact hydrostatic drive  
HYDROTRAC GFT  
for fixed or variable displacement motors**Output torques from 5160 to 339,100 lb-ft  
(7000 to 450,000 Nm)

- Compact, space saving planetary design
- Full complement planet gear bearing system
- Robust main bearing system
- Easy mounting
- Comfortable oil changing
- Integrated multiplate parking brake
- Low noise running characteristics
- Many design variants

**Description**

Rexroth compact hydrostatic HYDROTRAC GFT drives are the ideal driving components for wheeled or track-laying vehicles and other mobile equipment. They are the perfect choice for every conceivable moving or turning application.

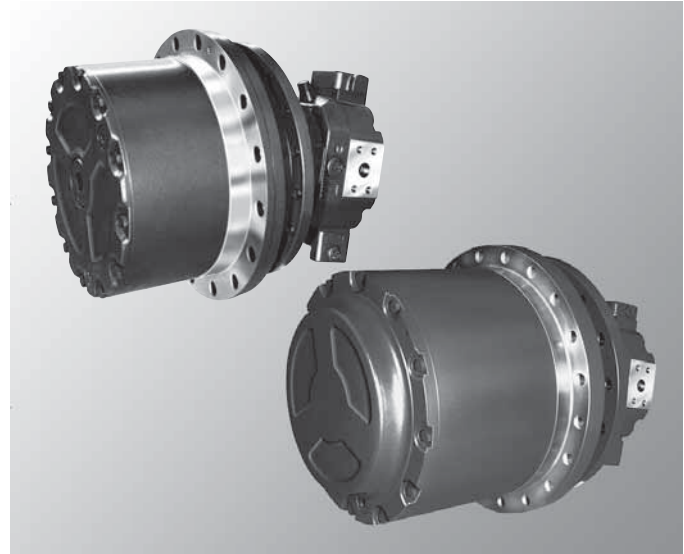
The drives are extremely compact and thus may also be installed in space-critical mounting configurations. The drives' load capacity and availability is extraordinary thanks to the use of case-hardened gearwheels as well as quenched and tempered, surface-hardened annulus gears. The gear teeth design reflects both standard requirements and in-house operating strength calculations based on our comprehensive know-how and optimally adapted to our modern fabrication processes. The drives feature maximum total efficiency ratings which, inter alia, is due to the use of Rexroth plug-type motors. The drives described in this bulletin are constantly reviewed and advanced. Other design variants with deviating transmission, dimensions and power characteristics are available if so requested for specific applications.

**Gearbox Design**

Gearbox design is based on long years of experience and reflects not only the customary standard design regulations but also satisfies operational strength requirements as per DIN 3990, ISO 6336, AGMA, GL or DNV. The output torque values indicated are short-term admissible peak torques meant for excavator travel drive applications. For other applications deviating output torques differing from those specified may apply to the respective gearbox. Even in the project stage we are prepared to offer application specific consultation to customers aimed at finding the optimum drive configuration.

**Hydraulic Motors**

Rexroth hydraulic motors are preferably integrated in a space-saving manner as flanged-on fixed or variable displacement units plugged into the gearbox.

**Multiplate Parking Brake**

As a standard supply feature a spring-loaded hydraulically released multiplate parking brake is arranged on the input end of the gearbox. The parking torque of the brake will suit the respective motor torque.

**Disconnecting Device**

If requested, some of the drive systems may also be provided with a mechanical disconnecting device so that, if time is of essence, the equipment can be towed without damaging the hydraulic system.

**Sealing System**

An axial mechanical seal is mounted between the stationary and rotating gearbox sections. This prevents moisture and dirt from entering the drive even under extreme operating conditions. Gearbox model GFT 7 is also available with a cartridge seal or shaft seal ring to suit individual application needs.

**Oil Changes**

Save for regular oil changes the drives do not require maintenance. Oil changes may conveniently be made from the outside. Recommendations as to lube oils are given in the operating manual.

**Design Variants**

Model designations 1000 - 9000 indicate basic size and design variants that are readily available to our customers. To suit specific application requirements other models can also be furnished upon request. Depending on currently furnished units and transmission ratios many drives are available on preferential terms offering favorable prices and improved delivery times. If you are interested, please let us know.

To suit the required ratio the garboxes are of two- (T2) or three-stage (T3) design. If so requested, gear models 330 and 450 may be provided with an additional preliminary stage and in that case will be of four-stage design (T4).

**Extracted from RE 77 110/07.04**

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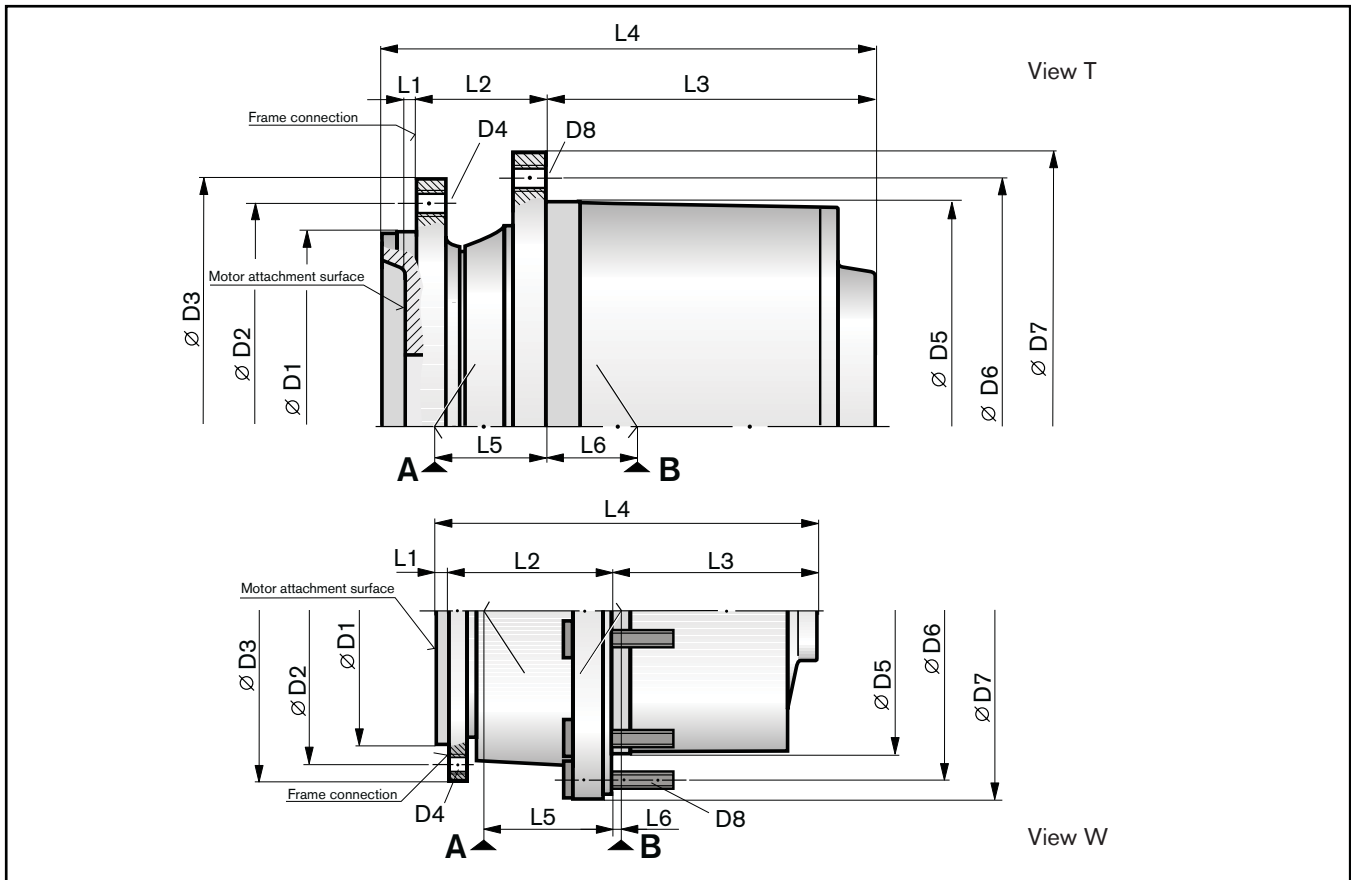
See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Technical data****Compact Hydrostatic Drives HYDROTRAC GFT in summary**

Type/Design Variant GFT	Output Torque $T_{2 \max}$ Nm	Ratio i
GFT 0007 T2	7000	30.9 - 62.6
GFT 0009 T2	9500	25.1 - 55.3
GFT 0013 T2	13000	16.3 - 37.6
GFT 0017 T2	17000	26.4 - 54.0
GFT 0017 T3	17000	77.9 - 102.6
GFT 0024 T3	24000	90.1 - 137.2
GFT 0026 T2	26000	42.9 - 62.0
GFT 0028 T3	28000	64.3 - 79.3
GFT 0034 T2	34000	42.9 - 50.5
GFT 0036 T3	36000	66.9 - 161.0
GFT 0040 T2	40000	35.9 - 59.1
GFT 0050 T3	50000	73.9 - 146.4
GFT 0060 T2	60000	23.0
GFT 0060 T3	60000	94.8 - 197.0
GFT 0080 T3	80000	76.7 - 185.4
GFT 0110 T3	110000	95.8 - 215.0
GFT 0160 T3	160000	161.8 - 251.0
GFT 0220 T3	220000	188.9 - 365.0
GFT 0330 T3	330000	168.9 - 302.4
GFT 0450 T4	450000	320.3 - 421.7

For information on our currently available compact hydrostatic HYDROTRAC GFT drives please visit [www.boschrexroth.com/gears](http://www.boschrexroth.com/gears)

Should you need a special driving solution deviating from our standard product range please let us know. Differently sized units and additional design variants can be furnished if so requested.

**Dimensions**



**Technical Data**

Type/Design Variant GFT	Output Torque $T_{max}$ Nm	Ratio $i$	Braking Torque $T_{Br max}$ Nm	Hydraulic Motor
GFT 0007 T2 6000	7000	30.9 • 35.8 • 43.0 • 51.0 • 62.6	225	A10VM 28 • 45
GFT 0007 T2 7000/1 • 7000/2	7000	30.9 • 35.8 • 43.0	225	A10VM 28 • 45
GFT 0007 T2 9000	7000	30.9 • 35.8 • 43.0 • 51.0 • 62.6	-	A10VM 28 • 45
GFT 0009 T2 8000	9000	38.3 • 47.6	215	A10VE 45
GFT 0013 T2 4000/1	13000	16.3 • 22.6 • 32.1 • 37.6	400	A6VE 55
GFT 0013 T2 4000/2	13000	16.3 • 22.6 • 32.1 • 37.6	400	A10VE 63
GFT 0013 T2 7000/1	13000	42.7 • 60.2	350	A10VE 45
GFT 0013 T2 7000/2	13000	42.7 • 60.2	350	A6VE 55/A2FE 45 • 56
GFT 0017 T2 2000	17000	26.4 • 32.1 • 37.6 • 45.4	450	A6VE 55/A2FE 45 • 56 • 63
GFT 0017 T2 3000/1	17000	54.0	350	A6VE 55
GFT 0017 T2 3000/2	17000	54.0	350	A10VE 63/A2FE 45 • 56 • 63
GFT 0017 T3 1000/1	17000	77.9 • 88.2 • 102.6	250	A6VE 28/A2FE 28 • 32
GFT 0017 T3 1000/2 • 1000/3	17000	77.9 • 88.2 • 102.6	250	A10VE 45
GFT 0017 T3 2000	17000	77.9 • 88.2 • 102.6	250	A6VE 55/A2FE 45 • 56
GFT 0017 T3 7000	17000	92.5	200	A10VE 45
GFT 0017 T3 9000/2 SL • 9000/3 SL	17000	77.9 • 88.2 • 102.6	-	A6VE 28/A2FE 28 • 32

**Dimensions, Bearing Load Ratings and Weights**

See Section 16 for applicable

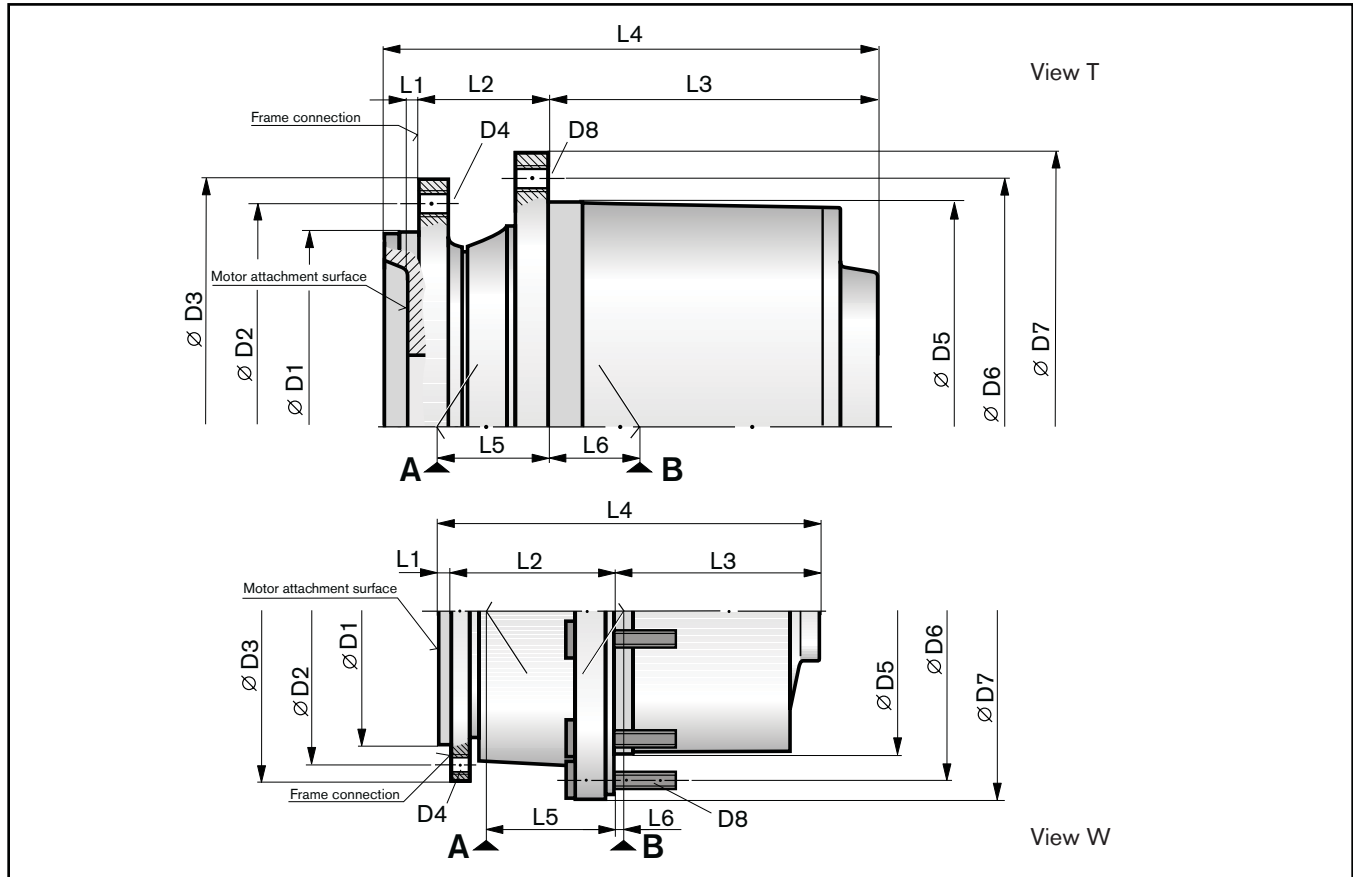
Type/Design Variant GFT	D1	D2	D3	D4	D5	D6	D7	D8
mm								
GFT 0007 T2 6000	178	209.5	240	6x 5/8in-11UNC-2B	200.2	241.3	280	9x 5/8in-18UNF-2A
GFT 0007 T2 7000/1	178	209.5	240	6x 5/8in-11UNC-2B	200.2	241.3	280	9x M12
GFT 0007 T2 7000/2	178	209.5	240	6x 5/8in-11UNC-2B	200.2	241.3	280	9x 5/8in-18UNF-2A
GFT 0007 T2 9000	178	209.5	240	6x 5/8in-11UNC-2B	200.2	241.3	280	9x 5/8in-18UNF-2A
GFT 0009 T2 8000	190	230	268	12x M16	230	260	284	8x M16
GFT 0013 T2 4000/1	240	275	300	18x M16	270	305	335	16x M16
GFT 0013 T2 4000/2	240	275	300	18x M16	270	305	335	16x M16
GFT 0013 T2 7000/1	203	241.3	268	8x 5/8in-11UNC-2B	279.7	334.95	370	10x 3/4in-16UNF-2A
GFT 0013 T2 7000/2	240	275	300	16x M16	279.7	334.95	370	10x 3/4in-16UNF-2A
GFT 0017 T2 2000	250	290	320	16x M20	280	305	330	16x M16
GFT 0017 T2 3000/1	250	290	320	16x M20	280	305	330	16x M16
GFT 0017 T2 3000/2	250	290	320	16x M20	280	305	330	16x M16
GFT 0017 T3 1000/1	240	275	300	18x M16	270	305	330	16x M16
GFT 0017 T3 1000/2	240	275	300	18x M16	270	305	330	16x M16
GFT 0017 T3 1000/3	240	275	300	18x M16	270	305	330	16x M16
GFT 0017 T3 2000	250	290	320	16x M20	280	305	330	16x M16
GFT 0017 T3 7000	203.2	241.3	268	8x 5/8in-11UNC-2B	280	334.95	370	10x 3/4in-16UNF-2A
GFT 0017 T3 9000/2 SL	240	275	310	12x M16	260	300	335	10x M22x1.5
GFT 0017 T3 9000/3 SL	250	305	330	18x M16 (S)	260	300	335	10x M22x1.5

Type/Design Variant GFT	L1	L2	L3	L4	L5	L6	A + B C	Co	Weight	View
mm							kN	kg		
GFT 0007 T2 6000	10	106	109	225	84	2	194	325	45	W
GFT 0007 T2 7000/1	10	106	109	225	84	2	194	325	45	T
GFT 0007 T2 7000/2	10	106	109	225	84	2	194	325	45	W
GFT 0007 T2 9000	10	106	109	225	84	2	194	325	45	W
GFT 0009 T2 8000	12	60	156	228	18	64	132	255	67	T
GFT 0013 T2 4000/1	8	75	149	232	49	54	140	290	85	T
GFT 0013 T2 4000/2	30	75	149	254	49	54	140	290	85	T
GFT 0013 T2 7000/1	36	104	153	292.5	64	39	140	290	92	W
GFT 0013 T2 7000/2	44	90	153	286.5	64	39	140	290	92	W
GFT 0017 T2 2000	30	82	152	264	78	69	108	142	90	T
GFT 0017 T2 3000/1	8	82	152	242	78	69	108	142	90	T
GFT 0017 T2 3000/2	30	82	152	264	78	69	108	142	90	T
GFT 0017 T3 1000/1	27	75	181	283	71	76	108	142	97.5	T
GFT 0017 T3 1000/2	8	75	181	272	71	76	108	142	95	T
GFT 0017 T3 1000/3	43	75	181	299	71	76	108	142	95	T
GFT 0017 T3 2000	30	82	174	286	78	69	108	142	100	T
GFT 0017 T3 7000	36	104	184.5	324.5	64	39	140	290	105	W
GFT 0017 T3 9000/2 SL	5	75	184	267	49	54	140	290	95	W
GFT 0017 T3 9000/3 SL	8	75	184	267	49	54	140	290	95	T

**Extracted from RE 77 110/07.04**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Dimensions**

**Technical Data**

Type/Design Variant GFT	Output Torque $T_{max.}$ Nm	Ratio $i$	Braking Torque $T_{Br max.}$ Nm	Hydraulic Motor
GFT 0024 T3 1000	24000	90.1 • 102.6 • 120.5 • 137.2	300	A6VE 55/A2FE 45 • 56 • 63
GFT 0024 T3 9000/4	24000	90.1 • 102.6 • 120.5 • 137.2	300	A6VE 55/A2FE 45 • 56 • 63
GFT 0026 T2 1000/1	26000	42.9 • 50.5 • 62.0	715	A6VE 55/A2FE 45 • 56 • 63
GFT 0026 T2 1000/2 • 9000	26000	42.9 • 50.5 • 62.0	715	A6VE 80/A2FE 80 • 90
GFT 0028 T3 9000/3 • 9000/4	28000	64.3 • 72.7 • 79.3	440	A6VE 80
GFT 0034 T2 4000	34000	42.9 • 50.5	-	A6VE 107/A2FE 107 • 125
GFT 0036 T3 3000/1	36000	66.9 • 79.3 • 99.1 • 115.0 • 138.8	715	A6VE 55/A2FE 45 • 56 • 63
GFT 0036 T3 3000/2	36000	66.9 • 79.3 • 99.1 • 115.0 • 138.8	715	A6VE 80/A2FE 80 • 90
GFT 0040 T2 1000 • 1000 SL	40000	35.9 • 41.0 • 48.3 • 59.1	800	A6VE 80 • 107/A2FE 80 • 90
GFT 0040 T2 2000 SL	40000	35.9 • 41.0 • 48.3 • 59.1	800	A6VE 107/A2FE 107 • 125
GFT 0040 T2 9000/1 • 9000/2	40000	35.9 • 41.0 • 48.3 • 59.1	800	A6VE 107 • 160/A2FE 107 • 125

## Dimensions, Bearing Load Ratings and Weights

See Section 16 for applicable

Type/Design Variant GFT	D1	D2	D3	D4	D5	D6	D7	D8
	mm							
GFT 0024 T3 1000	240	285	320	20x M20	280	305	330	20x M16
GFT 0024 T3 9000/4	270	310	340	16x M20	320	350	375	20x M16
GFT 0026 T2 1000/1	270	310	350	16x M20	320	350	380	20x M16
GFT 0026 T2 1000/2	270	310	350	16x M20	320	350	380	20x M16
GFT 0026 T2 9000	290	325	352	16x M18	355	370	405	24x M18
GFT 0028 T3 9000/3	330	370	400	16x M20	365	405	435	22x M16
GFT 0028 T3 9000/4	330	370	400	16x M20	286	330	355	20x M16
GFT 0034 T2 4000	410	380	420	20x ø18	325	381	420	12x M22x1.5
GFT 0036 T3 3000/1	270	310	350	16x M20	320	350	380	20x M16x1.5
GFT 0036 T3 3000/2	270	310	350	16x M20	320	350	380	20x M16x1.5
GFT 0040 T2 1000	270	310	350	16x M20	350	400	440	16x M20
GFT 0040 T2 1000 SL	270	310	350	16x M20	350	400	440	16x M20
GFT 0040 T2 2000 SL	330	370	410	20x M20	360	400	440	16x A20 **
GFT 0040 T2 9000/1	330	370	410	20x M20	360	400	440	16x M20
GFT 0040 T2 9000/2	380	425	460	20x M20	420	470	510	24x M20

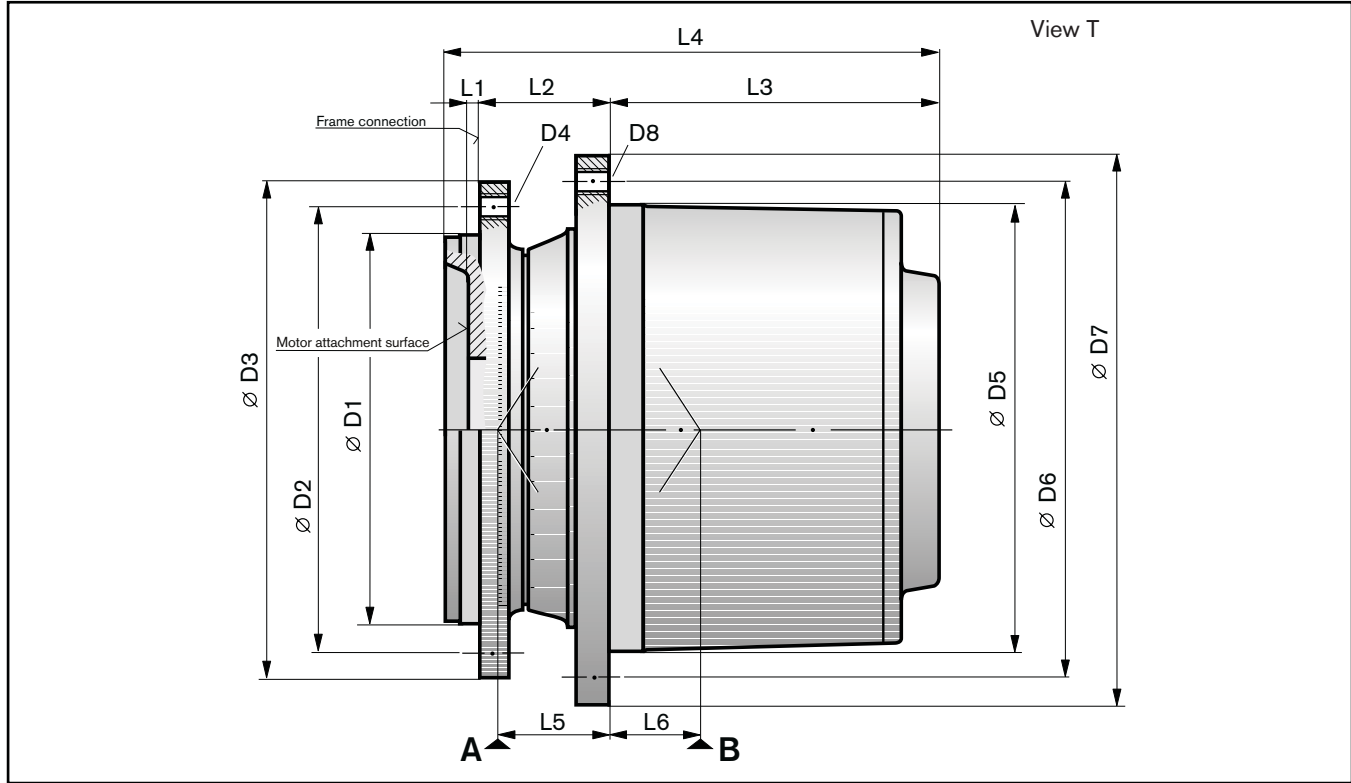
Type/Design Variant GFT	L1	L2	L3	L4	L5	L6	C	A + B Co	Weight	View
	mm							kN	kg	
GFT 0024 T3 1000	30	82	189.5	301.5	56	47	140	290	105	T
GFT 0024 T3 9000/4	30	90	181.5	301.5	64	39	140	290	110	T
GFT 0026 T2 1000/1	20	90	220	330	58	50	186	400	145	T
GFT 0026 T2 1000/2	30	90	220	340	58	50	186	400	150	T
GFT 0026 T2 9000	33	80	227	340	51	57	186	400	155	T
GFT 0028 T3 9000/3	18	100.5	208	326.5	39.5	62	140	290	140	T
GFT 0028 T3 9000/4	18	120	188.5	326.5	59	42	140	290	140	T
GFT 0034 T2 4000	12	151	226	389	60	62	399	806	170	W
GFT 0036 T3 3000/1	43	90	210 *	333	56.5	57	170	405	165	T
GFT 0036 T3 3000/2	10	90	210 *	300	56.5	57	170	405	170	T
GFT 0040 T2 1000	39.5	82	243	364.5	57	54	212	425	205	T
GFT 0040 T2 1000 SL	15	82	279.5	376.5	45.5	80	A 393	A 881	205	T
GFT 0040 T2 2000 SL	25	114	237.5	376.5	87	38	B 473	B 895	210	W
GFT 0040 T2 9000/1	25	90	261.5	376.5	38	73	212	425	210	T
GFT 0040 T2 9000/2	18	111	253	381.5	47	64	212	425	215	T

\*L3 = 200 at i = 99.1/115/138.8

\*\*Wheel nut A20 DIN 74361-8



**Dimensions**



**Technical Data**

Type/Design Variant GFT	Output Torque $T_{max}$  Nm	Ratio $i$	Braking Torque $T_{Br max}$  Nm	Hydraulic Motor
GFT 0050 T3 1000/1	50000		800	A6VE 80 • 107/A2FE 80 • 90
GFT 0050 T3 1000/2	50000		800	A6VE 55/A2FE 45 • 56 • 63
GFT 0050 T3 1000/3	50000		800	A6VE 80 • 107/A2FE 80 • 90
GFT 0050 T3 3000	50000	66.3 • 73.9 • 84.2 • 91.1 • 99.8 • 125.7 • 146.4	800	A6VE 80 • 107/ A2FE 80 • 90 • 107 • 125
GFT 0050 T3 9000 SL • 9000/1	50000		800	A6VE 80 • 107/A2FE 80 • 90
GFT 0050 T3 9000/2	50000		800	A6VE 107/A2FE 107 • 125
GFT 0050 T3 9000/3	50000		800	A6VE 80 • 107/A2FE 80 • 90
GFT 0060 T2 7000	60000	23,0	1475	A6VM 200
GFT 0060 T3 3000/1	60000	94.8 • 105.5 • 119.8 • 139.9 • 169.9	725	A6VE 80 • 107/ A2FE 80 • 90
GFT 0060 T3 5000 • 7000/1	60000	94.8 • 105.5 • 119.8 • 139.9 • 169.9	725	A6VE 80 • 107/A2FE 80 • 90
GFT 0060 T3 7000/2	60000	94.8 • 105.5 • 119.8 • 139.9 • 169.9	725	A6VE 107/A2FE 107 • 125
GFT 0060 T3 9000	60000	94.8 • 105.5 • 119.8 • 139.9 • 169.9	725	A6VE 80 • 107/A2FE 80 • 90
GFT 0080 T3 1000 • 2000 • 9000	80000	76.7 • 99.0 • 110.9 • 126.9 • 149.9 • 185.4	1025	A6VE 107 • 160/ A2FE 107 • 125 • 160 • 180
GFT 0110 T3 1000 • 9000/1	110000	95.8 • 114.8 • 128.6 • 147.2 • 173.9 • 215.0	1025	A6VE 107 • 160/ A2FE 107 • 125 • 160 • 180
GFT 0110 T3 9000/3 SL	110000	95.8 • 114.8 • 128.6 • 147.2 • 173.9 • 215.0	1100	A6VE 107 • 160/ A2FE 107 • 125 • 160 • 180

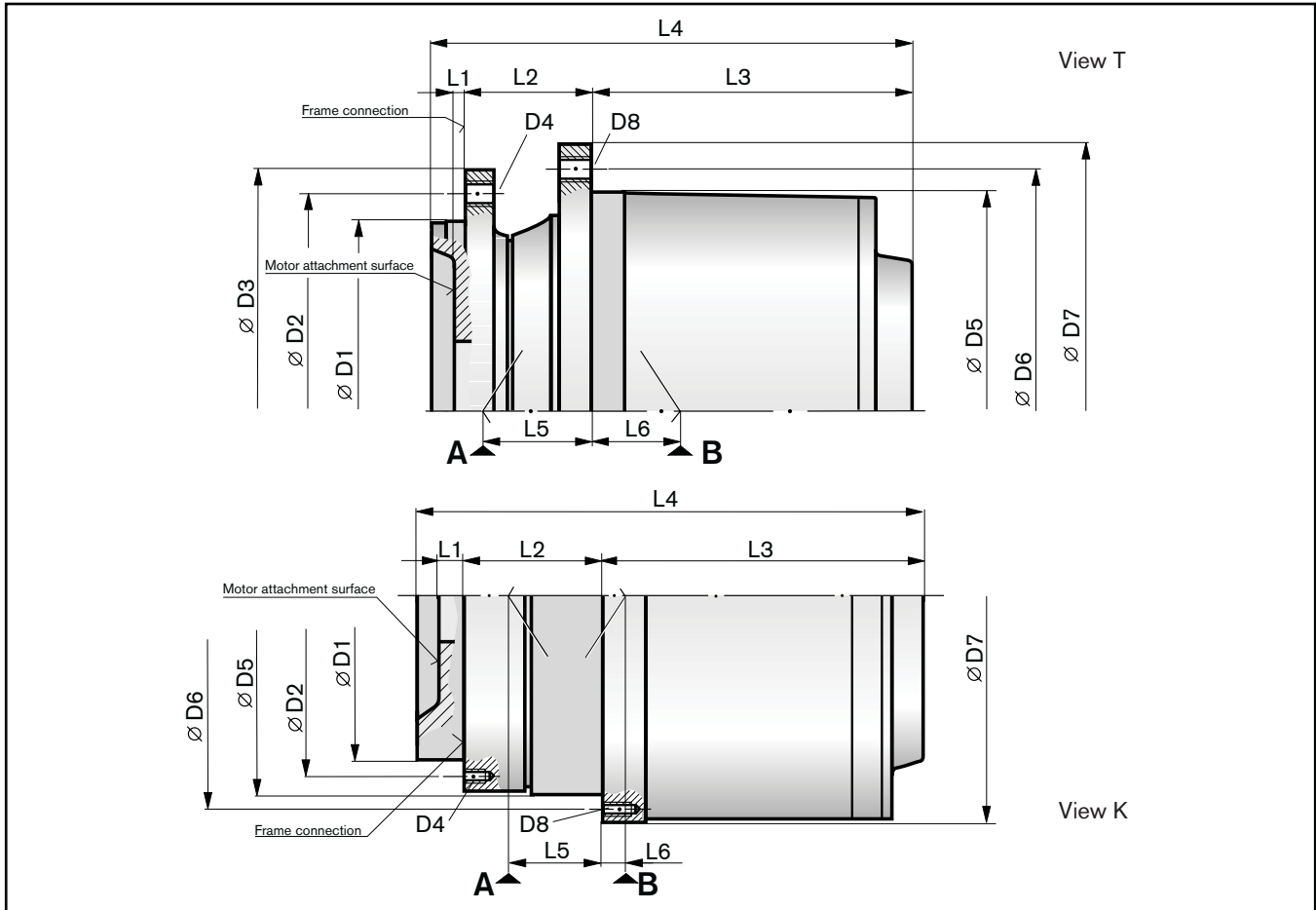
**Technical Data, Bearing Load Ratings and Weights**

See Section 16 for applicable

Type/Design Variant GFT	D1	D2	D3	D4	D5	D6	D7	D8
	mm							
GFT 0050 T3 1000/1	270	310	350	20x M20x1.5	350	400	430	16x M20x1.5
GFT 0050 T3 1000/2	270	310	350	16x M20	350	400	430	16x M20x1.5
GFT 0050 T3 1000/3	270	310	350	16x M20	350	400	430	16x M20x1.5
GFT 0050 T3 3000	330	370	410	20x M20	360	400	440	16x M20
GFT 0050 T3 9000 SL	270	310	350	16x M20	350	400	440	16x M20
GFT 0050 T3 9000/1	330	370	408	16x M20	365	405	435	22x M16
GFT 0050 T3 9000/2	330	370	410	20x M20	360	400	440	16x M20
GFT 0050 T3 9000/3	270	310	350	16x M20	350	400	430	16x M20x1.5
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GFT 0060 T2 7000	330	370	410	20x M20x1.5	400	450	490	20x M20x1.5
<hr/>								
GFT 0060 T3 3000/1	330	370	410	20x M20x1.5	370	410	450	20x M20
GFT 0060 T3 5000	350	400	445	24x M24x2	375	425	466	24x M24x2
GFT 0060 T3 7000/1	330	370	410	20x M20x1.5	400	450	490	20x M20x1.5
GFT 0060 T3 7000/2	330	370	410	20x M20x1.5	400	450	490	20x M20x1.5
GFT 0060 T3 9000	340	380	417	20x M20	450	490	529	18x M20
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GFT 0080 T3 1000	420	460	500	24x M20	460	510	550	24x M20
GFT 0080 T3 2000	380	430	480	20x M24	430	480	520	20x M24
GFT 0080 T3 9000	380	430	480	20x M24	515	566	614	16x M24
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GFT 0110 T3 1000	420	460	500	24x M24	460	500	540	36x M18x1.5
GFT 0110 T3 9000/1	380	430	480	20x M24	515	566	614	16x M24
GFT 0110 T3 9000/3 SL	460	520	570	24x M30	460	500	540	36x M18x1.5

Type/Design Variant GFT	L1	L2	L3	L4	L5	L6	A + B C	Co	Weight	View
	mm						kN		kg	
GFT 0050 T3 1000/1	40	82	282	403	56.5	54	212	425	220	T
GFT 0050 T3 1000/2	20	82	281.5	383.5	56.5	54	212	425	220	T
GFT 0050 T3 1000/3	40	82	282	403	56.5	54	212	425	220	T
GFT 0050 T3 3000	25	114	276	415	62	48	212	425	220	T
GFT 0050 T3 9000 SL	15	82	318	415	45.5	80	393	895	220	T
GFT 0050 T3 9000/1	25	100.5	277.5	403	60.5	50	212	425	220	T
GFT 0050 T3 9000/2	25	90	300	415	38	73	212	425	220	T
GFT 0050 T3 9000/3	20	82	282	383.5	56.5	54	212	425	220	T
<hr/>										
GFT 0060 T2 7000	20	90	276	386	55	62	250	520	205	T
<hr/>										
GFT 0060 T3 3000/1	-11	114	284	423	79	38	250	520	230	T
GFT 0060 T3 5000	3	130	254	409	109	8	250	520	240	T
GFT 0060 T3 7000/1	-11	90	308	423	55	62	250	520	240	T
GFT 0060 T3 7000/2	-9	90	308	418	55	62	250	520	240	T
GFT 0060 T3 9000	-12	102	297	419	66	51	250	520	260	T
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GFT 0080 T3 1000	0	165	300	486.5	108	25			370	T
GFT 0080 T3 2000	22	148	295	465	112	18	A 509 B 480	A 1080 B 950	350	T
GFT 0080 T3 9000	22	120	323	465	85	48			405	T
<hr/>										
GFT 0110 T3 1000	0	165	305	491.5	107	25	A 509 B 480	A 1080 B 950	395	T
GFT 0110 T3 9000/1	22	120	328	470	85	48			410	T
GFT 0110 T3 9000/3 SL	45	170	314.5	529.5	155	35	710	1560	505	T

**Dimensions**



**Technical Data**

Type/Design Variant GFT	Output Torque $T_{max}$ Nm	Ratio $i$	Braking Torque $T_{Br max}$ Nm	Hydraulic Motor
GFT 0160 T3 1000 • 9000	160000	161.8 • 210.8 • 251.0	1020	A6VE 107 • 160/ A2FE 107 • 125 • 160 • 180
GFT 0220 T3 2000 • 9000 SL • 9000/1	220000	188.9 • 246.1 • 293.0 • 365.0	1100	A6VE 107 • 160/ A2FE 107 • 125 • 160 • 180
GFT 0220 T3 9000/2	220000	97.7 • 145.4	0	A6VM 355
GFT 0220 T3 9000/3	220000	97.7 • 145.4	1400	A6VM 200
GFT 0220 T3 9000/4	220000	188.9 • 246.1 • 293.0 • 365.0	1100	A6VE 107 • 160/ A2FE 107 • 125 • 160 • 180
GFT 0330 T3 2000 • 3000/1	330000	168.9 • 209.9 • 252.0 • 302.4	2500	A2FE 355
GFT 0330 T3 3000/2	330000	168.9 • 209.9 • 252.0 • 302.4	2500	A6VE 250/A2FE 250
GFT 0330 T3 9000/1	330000	168.9 • 209.9 • 252.0 • 302.4	2500	A2FE 355
GFT 0330 T3 9000/2	330000	168.9 • 209.9 • 252.0 • 302.4	2500	A6VE 250 • A2FE 250
GFT 0330 T4 3000	330000	451.7 • 839.4 • 1008.0 • 1209.7	625	A6VE 107 • 160/ A2FE 107 • 160 • 180
GFT 0450 T4 1000	450000	320.3 • 347.1 • 421.7	1450	A6VE 250/A2FE 250

## Dimensions, Bearing Load Ratings and Weights

See Section 16 for applicable

Type/Design Variant GFT	D1	D2	D3	D4	D5	D6	D7	D8
	mm							
GFT 0160 T3 1000	450	510	560	30x M24x2	535	600	650	30x M24x2
GFT 0160 T3 9000	450	510	560	20x M30	535	600	650	30x M24x2
GFT 0220 T3 2000	460	600	650	30x M30	610	680	735	24x M30
GFT 0220 T3 9000 SL	580	640/760	810	30x M30	615	680/800	850	30x M30
GFT 0220 T3 9000/1	460	520	570	24x M30	610	656	712	34x M24
GFT 0220 T3 9000/2	460	520	570	24x M30	610	680	735	24x ø33
GFT 0220 T3 9000/3	460	600	650	30x M30	610	680	735	24x M30
GFT 0220 T3 9000/4	425	485	545	30x M30x2	550	595	640	40x M27x2
GFT 0330 T3 2000	580	680	735	30x M30	660	730	785	30x M30
GFT 0330 T3 3000/1	580	680	735	30x M30	660	730	785	30x M30
GFT 0330 T3 3000/2	580	680	735	30x M30	660	730	785	30x M30
GFT 0330 T3 9000/1	450	515	568	32x M30x2	570	620	670	44x M24x2
GFT 0330 T3 9000/2	450	515	568	32x M30x2	570	620	670	44x M24x2
GFT 0330 T4 3000	580	680	735	30x M30	660	730	785	30x M30
GFT 0450 T4 1000	450	515	568	29x M36x3	570	620	670	42x M30x2

Type/Design Variant GFT	L1	L2	L3	L4	L5	L6	A + B C	Co	Weight	View
	mm						kN		kg	
GFT 0160 T3 1000	30	168	340	538	138	26	688	1520	680	T
GFT 0160 T3 9000	30	168	340	538	138	26	688	1520	660	T
GFT 0220 T3 2000	45	170	350 <sup>1)</sup>	565	155	35	710	1560	830	T
GFT 0220 T3 9000 SL	40	240	405	685	160	53	1460	3150	1370	T
GFT 0220 T3 9000/1	45	170	350 <sup>1)</sup>	565	155	35	710	1560	830	T
GFT 0220 T3 9000/2	115	170	350	635	155	35	710	1560	830	T
GFT 0220 T3 9000/3	45	170	350	565	155	35	710	1560	830	T
GFT 0220 T3 9000/4	12	218	231 <sup>2)</sup>	598	150	20	710	1560	830	K
GFT 0330 T3 2000	150	125	400 <sup>3)</sup>	675	190	25	1040	2450	1250	T
GFT 0330 T3 3000/1	87	188	400 <sup>3)</sup>	675	190	25	1040	2450	1230	T
GFT 0330 T3 3000/2	47	188	400 <sup>3)</sup>	675	190	25	1040	2450	1230	T
GFT 0330 T3 9000/1	45	255	410 <sup>4)</sup>	710	180	35	1040	2450	1210	K
GFT 0330 T3 9000/2	-30	255	410 <sup>4)</sup>	710	180	35	1040	2450	1210	K
GFT 0330 T4 3000	87	188	400 <sup>5)</sup>	675	190	25	1040	2450	1320	T
GFT 0450 T4 1000	13	255	512	810	175	19	1040	2450	1240	K

<sup>1)</sup> L3 = 357 at i = 365:1

<sup>2)</sup> L3 = 238 at i = 365:1

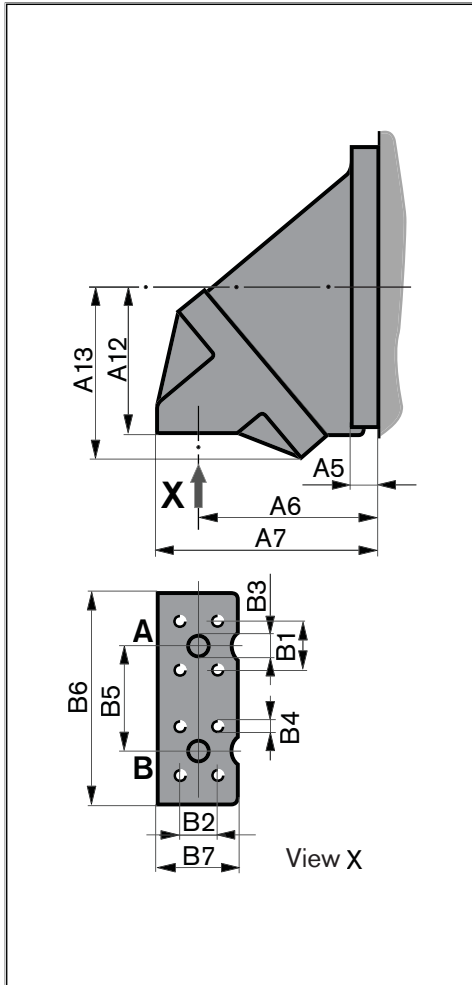
<sup>3)</sup> L3 = 430 at i = 365:1

<sup>4)</sup> L3 = 440 at i = 252 - 302.4

<sup>5)</sup> L3 = 430 at i = 1008.0 - 1209.7

**Hydraulic Motors: Dimensions and Weights**

**Fixed-displacement motor A2FE**



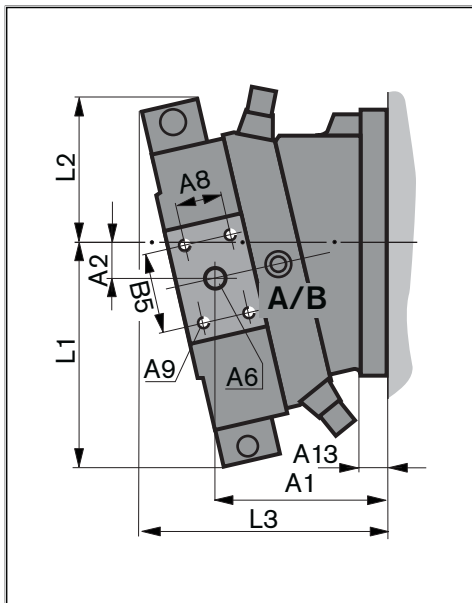
Nominal size	A5	A6	A7	A12	A13	B1	B2	B3	Weight kg
mm									
28	16	94	114	91	106	40.5	18.2	13	10.5
32	16	94	114	91	106	40.5	18.2	13	10.5
45	18	109	133	102	119	50.8	23.8	19	15.0
56	18	122	146	107	130	50.8	23.8	19	18.0
63	18	122	146	107	130	50.8	23.8	19	19.0
80	20	127	157	121	145	57.2	27.8	25	23.0
90	20	127	157	121	145	57.2	27.8	25	25.0
107	20	143	178	136	157	66.7	31.8	32	34.0
125	20	143	178	136	157	66.7	31.8	32	36.0
160	20	169	211	149	188	66.7	31.8	32	47.0
180	20	169	211	149	188	66.7	31.8	32	48.0
250	25	*	230	*	172	*	*	*	*
355	30	183	231	148	199	66.7	31.8	32	110.0

Nominal size	B4	B5	B6	B7	A / B
mm					
28 32	M8x15	59	115	40	SAE 1/2in
45	M10x17	75	147	49	SAE 3/4in
56 63	M10x17	75	147	49	SAE 3/4in
80 90	M12x17	84	166	60	SAE 1in
107 125	M14x19	99	194	70	SAE 1 1/4in
160 180	M14x19	99	194	70	SAE 1 1/4in
250	*	*	*	*	*
355	M14x22	120	*	*	SAE 1 1/4in

For further technical data see bulletin RE 91008

\* dimensions to be indicated on request

**Variable-displacement motor A6VE**



Nominal size	A1	A2	A13	L1	L2	L3	Weight kg
mm							
28	91	20	14	162	163	153	16
55	123	24	16	151	111	179	26
80	130	28	18	167	116	190	34
107	137	30	18	175	122	208	45
160	171	34	20	200	154	245	64
250	204	44	25	248	188	302	90

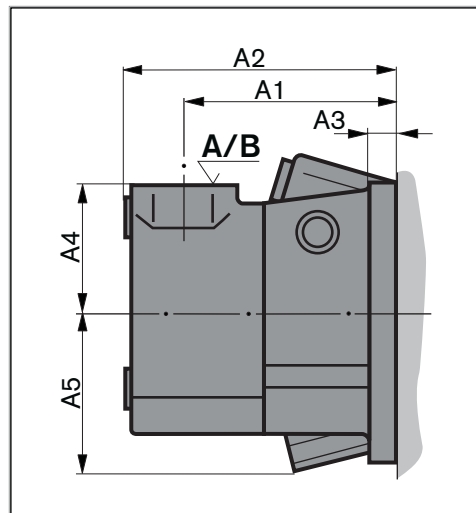
Nominal size	A6	A7	A8	A9	A / B
mm					
28	19	50.8	23.8	M10x17	SAE 3/4in
55	19	50.8	23.8	M10x17	SAE 3/4in
80	25	57.2	27.8	M12x17	SAE 1in
107	25	57.2	27.8	M12x17	SAE 1in
160	32	66.7	31.8	M14x19	SAE 1 1/4in
250	32	66.7	31.8	M14x19	SAE 1 1/4in

## Hydraulic Motors: Dimensions and Weights

### Variable-displacement motor A10VE

Nominal size	A1	A2	A3	A4	A5	A / B	Weight kg
			mm				
45	94	125	14	78	87	SAE 3/4in	18
63	111	154	18	101	93	SAE 3/4in	26

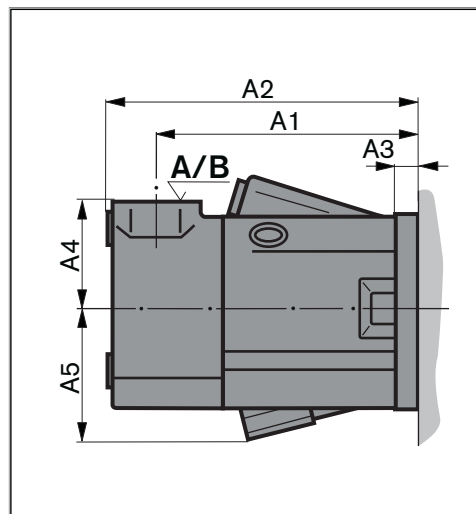
For further technical data see bulletin RE 91703



### Variable-displacement motor A10VM

Nominal size	A1	A2	A3	A4	A5	A / B	Weight kg
			mm				
28	161	189	12	67.5	82.8	SAE 3/4in	14
45	175	200	12	78	87	SAE 3/4in	18

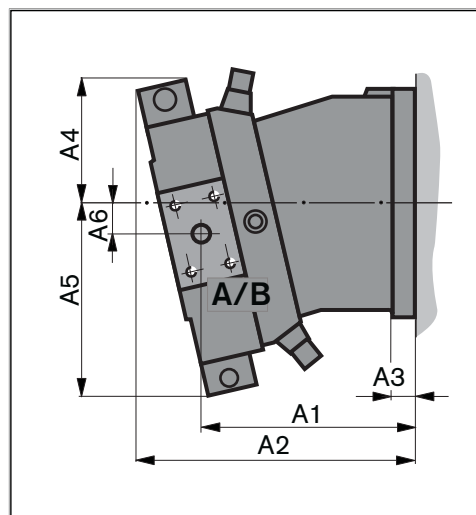
For further technical data see bulletin RE 91703



### Variable-displacement motor A6VM

Nominal size	A1	A2	A3	A4	A5	A6	A / B	Weight kg
			mm					
200	267	345	32	143	209	36	SAE 1 1/4in	80
355	322	432	28	203	279	49	SAE 1 1/2in	170

For further technical data see bulletin RE 91604



**Extracted from RE 77 111/07.04**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Compact hydrostatic drive  
 HYDROTRAC GFT with integrated  
 Hydraulic two-speed motor A10VT**

 Output torques from 5160 to 29,500 lb-ft  
 (7000 to 40,000 Nm)

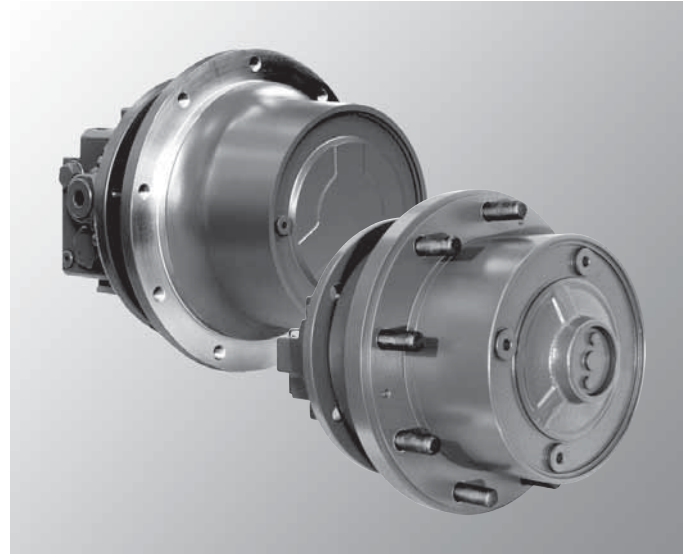
- Suited for track laying and wheel driven equipment
- Compact, space saving planetary design
- Sturdy taper roller bearings
- Tailored sealing systems
- Easily mounted as a complete unit
- For open or closed circuit systems
- For open circuit systems with complete valving equipment (brake release valve, pressure relief valve) integrated into the motor's baseplate
- For closed circuit systems with external brake release connection.
- Integrated multiplate parking brake

**Description**

Rexroth Hydrostatic HYDROTRAC GFT drives comprise a two- or three-stage planetary gear unit and an integrated hydraulic motor. They are used in tracklaying as well as wheeled vehicles. Since the two-speed motor forms an integral part of drive extremely compact units can be built and arranged inside the track or tire of the respective vehicles. The outer contour of the two-speed motor fits into the equipment frame opening enabling the drive to be accommodated as a complete unit. Taper roller bearings absorb the weight of the equipment and make sure that smooth running characteristics are attained. Depending on drive variant and to suit the respective application, rotating and stationary gear sections are sealed off by means of a radial shaft seal ring, a cartridge seal or an axial mechanical seal.

Arranged within the motor and surrounded by hydraulic oil, the spring-loaded multiple plate parking brake is released hydraulically and will safely stop the equipment in the event the pressure falls below the brake release pressure. To enable the equipment to be moved in case of a hydraulic system failure the drives can be equipped with a mechanical disconnecting device put into effect by means of customary tools. The two-speed motor design includes a hydraulic two-position control feature (HZ). By applying external control pressure at port X the operating piston is pressurized via a switching valve thus setting a minimum swash-plate angle.

The positioning pressure is derived internally from the respective high-pressure side. Basically, the motors can only be operated between  $V_{g \max}$  and  $V_{g \min}$ .



In case of open-circuit applications the baseplate will accommodate the complete valving system. The required brake release pressure is derived internally from the high-pressure side. In closed-circuit systems the brake is released via port X3 ( $13 \text{ bar} < p_{\text{Lift}} > 300 \text{ bar}$ ) to which external pressure is to be applied.

For GFT 9 T2 with A10VT 45 a mechanical brake release function by means of screw-type cartridge (patented) is available as option for closed-circuit systems.

**Lube Oil Recommendations and Preservation for the Gear Section**

The drives are furnished either with or without oil filling. Suitable lube oil brands can be seen from the relevant operating manual.

The units are internally preserved with SHELL oil S.7249 SAE 30/50, for external flanges, shaft ends and flange attachment faces TEKTYL 502 is used.

**Notes on Axial Piston Motor**

- See RE 90220 for the use of hydraulic liquids on mineral oil basis
- Refer to RE 90223 for the use of HF hydraulic liquids
- Refer to RE 90270 for installation instructions

**Hydraulic Two-Position Control Feature HZ**

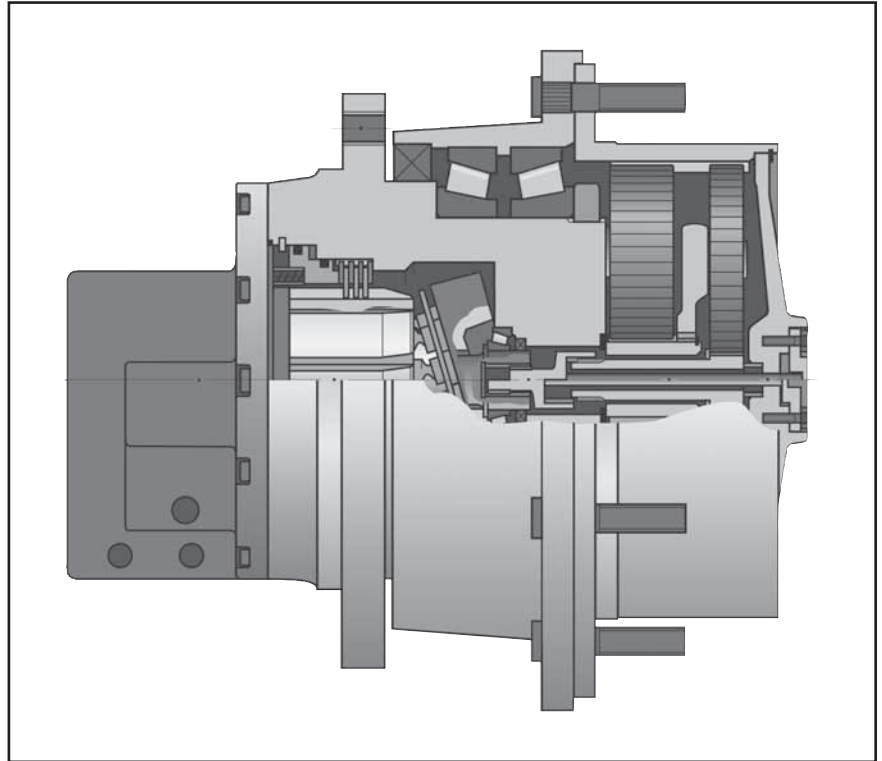
Control pressure at port X = 0 bar =  $V_{g \max}$   
 Control pressure at port X = 10 bar =  $V_{g \min}$

**Design Variants**

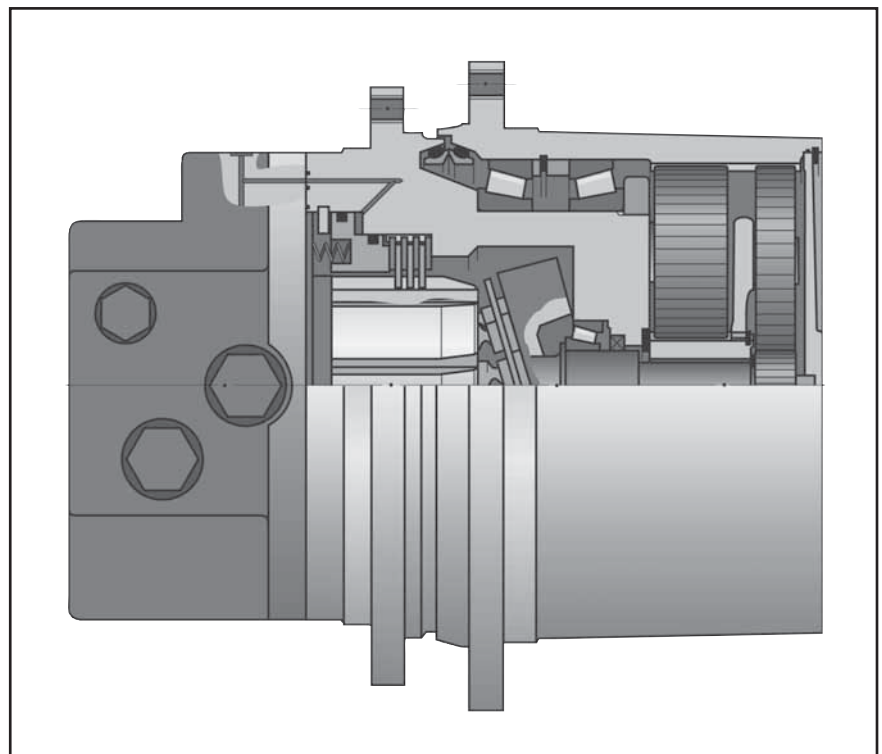
Designations 2000 to 9000 identify dimensional variants, T2 and T3 indicate that the unit has two or three planetary stages.

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Issue: 06.06See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Travel Drives  
for Wheeled Vehicles**

These drives have hub studs and are intended for a direct wheel rim attachment. A radial shaft seal or cartridge seal is mounted between rotating and stationary sections to seal off the unit reliably. To enable the equipment to be towed if necessary the gear unit been equipped with a mechanical disconnecting device that can be put into effect using customary tools.

**Travel Drives  
for Tracklaying Vehicles**

These drives are intended for attachment to a sprocket. An axial mechanical seal reliably prevents dirt and moisture from entering the unit.



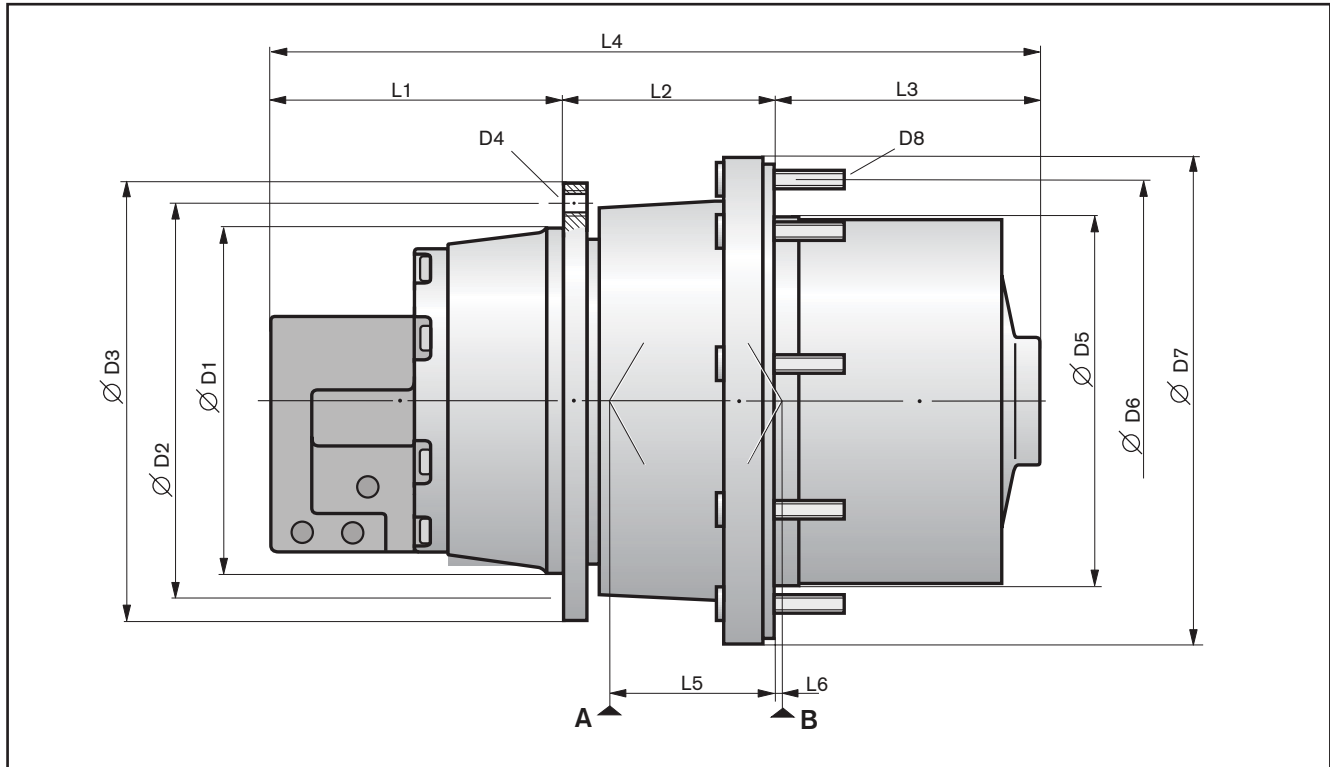


**Extracted from RE 77 111/07.04**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Wheel Drive (with Hub Studs)**



**Technical Data**

Type/Design Variant GFT	Output Torque $T_{max}$ Nm	Ratio $i$	Braking Torque $T_{Br max}$ Nm	Hydraulic Motor	Circuit Diagram
GFT 0007 T2 4000/1	7000	30.9 • 35.8 • 43.0 • 51.0 • 62.6	120	A10VT 28	C

**Dimensions, Bearing Load Ratings and Weights**

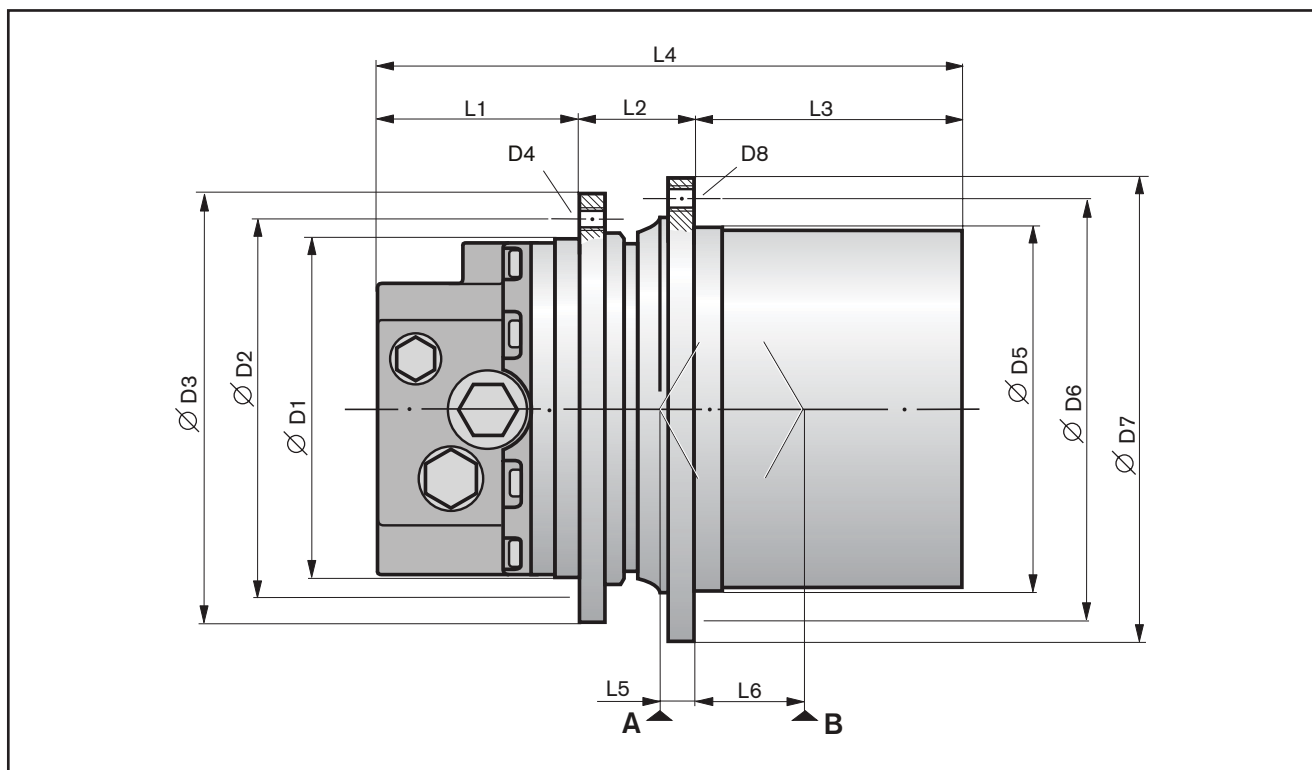
Type/Design Variant GFT	D1	D2	D3	D4	D5	D6	D7	D8
	mm							
GFT 0007 T2 4000/1	177.8	209.55	240	6x 5/8in-11UNC-2B	200.2	241.3	280	9x 5/8"-18UNF-2A

Type/Design Variant GFT	L1	L2	L3	L4	L5	L6	A + B C	Weight o
	mm						kN	kg
GFT 0007 T2 4000/1	127	106	109	342	84	2	194	325

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Track or Wheel Drive (Sprocket or Rim)**

**Technical Data**

Type/Design Variant GFT	Output Torque $T_{max}$ Nm	Ratio $i$	Braking Torque $T_{Br max}$ Nm	Hydraulic Motor	Circuit Diagram
GFT 0007 T2 4000/2	7000	30.9 • 35.8 • 43.0 • 51.0 • 62.6	120	A10VT 28	C
GFT 0007 T2 5000	7000	30.9 • 35.8 • 43.0 • 51.0 • 62.6	120	A10VT 28	A
GFT 0009 T2 2000/1	9500	25.1 • 38.3 • 47.6 • 55.3	215	A10VT 45	C
GFT 0009 T2 2000/2	9500	25.1 • 38.3 • 47.6 • 55.3	215	A10VT 45	B
GFT 0017 T3 1000	17000	70.2 • 78.0 • 88.2 • 102.6 170.2	215 150	A10VT 45	B
GFT 0024 T3 5000	24000	137.2	215	A10VT 45	B
GFT 0032 T2 9000	32000	50.7	780	A10VT 140	B
GFT 0036 T3 3000	36000	99.1 • 115.0 • 138.8 • 161.0	385	A10VT 45	B
GFT 0040 T2 3000	40000	61.9	780	A10VT 140	B

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Dimensions, Bearing Load Ratings and Weights**

Type/Design Variant GFT	D1	D2	D3	D4	D5	D6	D7	D8
	mm							
GFT 0007 T2 4000/2	200	240	264	12x M14	230	262	286	12x M14
GFT 0007 T2 5000	200	240	264	12x M14	230	262	286	12x M14
GFT 0009 T2 2000/1	210	244	268	12x M14	230	260	284	16x M16
GFT 0009 T2 2000/2	210	244	268	12x M14	230	260	284	16x M16
GFT 0017 T3 1000	240	275	300	18x M16	270	305	330	16x M16
GFT 0024 T3 5000	240	275	304	18x M16	280	305	330	20x M16
GFT 0032 T2 9000	330	370	400	16x M20	456.12	496	530	16x M20
GFT 0036 T3 3000	270	310	350	14x M20	320	350	380	20x M16 x 1,5
GFT 0040 T2 3000	330	370	400	16x M20	350	400	440	16x M20

Type/Design Variant GFT	L1	L2	L3	L4	L5	L6	C	A + B o kN	Weight kg
	mm								
GFT 0007 T2 4000/2	89	68	147	304	35	60	194	325	70
GFT 0007 T2 5000	104	68	147	319	35	60	194	325	70
GFT 0009 T2 2000/1	116	60	149	325	18	64.5	132	255	70
GFT 0009 T2 2000/2	116	60	149	325	18	64.5	132	255	70
GFT 0017 T3 1000	119	75	181	375	71	76	108	142	98
GFT 0024 T3 5000	119	82	190	390.5	56	47	140	290	120
GFT 0032 T2 9000	196	109.5	189	494.5	72.5	60.5	170	405	250
GFT 0036 T3 3000	104	90	200	394	56.5	56.5	170	405	310
GFT 0040 T2 3000	196.5	100.5	203	500	64.7	65.2	250	520	335

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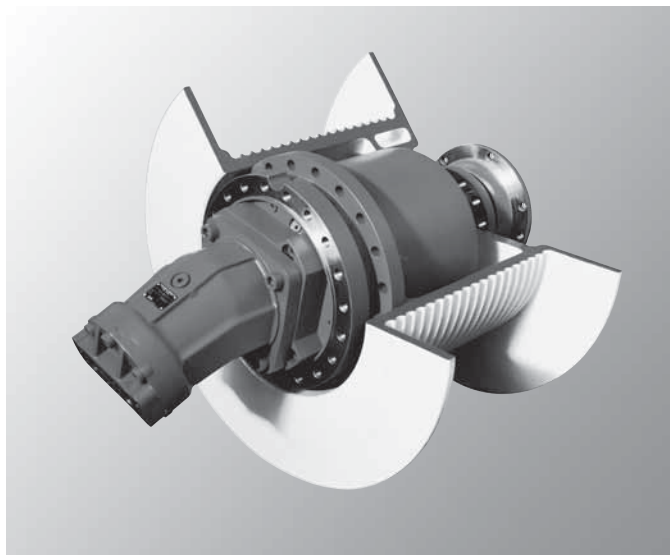
Issue: 06.06

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

## Winch drives HYDROTRAC GFT-W for fixed or variable displacement motors

Winch drives for rope pull  
Forces from 50 to 595 kN

- Compact, space saving planetary gearbox design
- Full complement planet gear bearing system
- Robust bearing system absorbing the forces exerted by the cable pull
- Simple mounting
- Easy oil change
- Integrated multi-disk holding brake
- Low noise operation



### Description

MOBILEX GFT-W hydrostatic winch drives from Rexroth are ideal drive components for winches. They have proven their worth in the most arduous applications and under tough operating conditions. MOBILEX GFT-W winch drives are used in all kinds of winches - mobile and crawler cranes, railroad cranes, shipboard, dockside and container cranes. Due to their extremely compact design, the gear units can be mounted inside the cable drum in a space-saving manner. They are designed for ease of installation and maintenance. High-quality manufacturing processes and the use of case-hardened gear-wheels as well as quenched, tempered and surface-hardened ring gears warrant outstanding load-carrying capacity, operational safety and low-noise running characteristics.

The teeth of the gearwheels are designed according to standard specifications and our own strength calculations, which have been developed based on our comprehensive know-how and are optimally adapted to our manufacturing processes. The drives provide optimum total efficiency due to the use of Rexroth hydraulic motors, among other things. The gear units described in this document are subject to constant updating and technical advancement. To suit the specific needs of our customers in terms of dimensions and output characteristics, further variants can be supplied. That's why we provide advice and support even in the project stage to help you find the most appropriate solution for your requirement.

#### Lubrication

The gears and bearings are splash-lubricated. The drive units are maintenance-free save for periodic oil changes, which are convenient to make. Only the oils specified in the operating manual should be used in the gearboxes. The change intervals for different operating conditions are also specified in the operating manual.

#### Brake

A spring-loaded, hydraulic released multiple-disk parking brake arranged on the input side is provided.

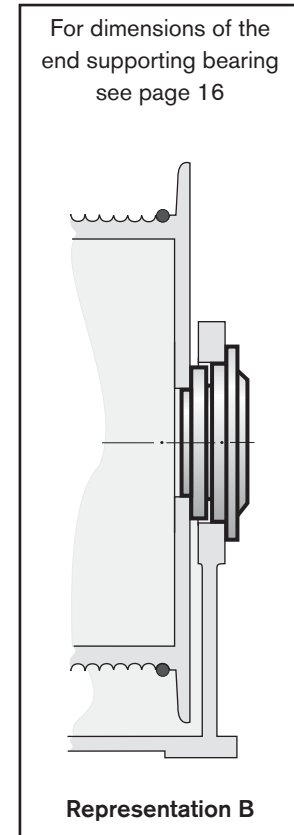
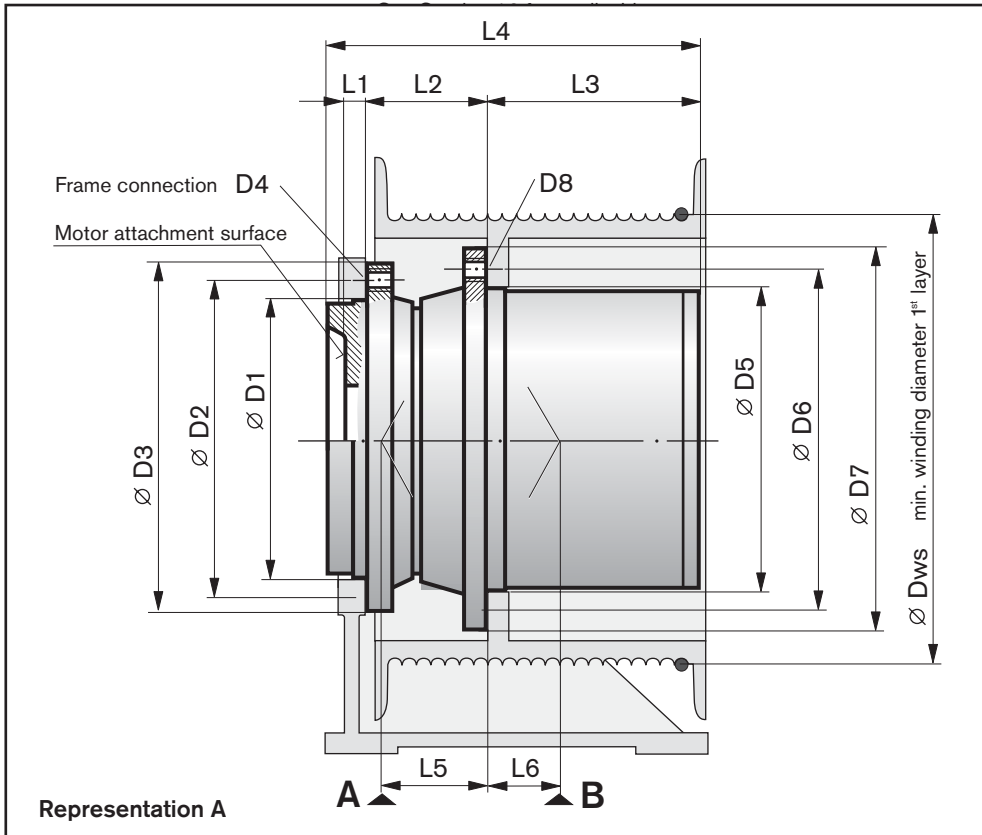
$$T_{\text{Br sta. min}} = 1.6 \cdot T_1 \text{ (input torque)}$$

**The multiple-disk holding brake is not a service brake, but a static holding brake.** Where required, a service or emergency brake should be provided by the equipment supplier/ operator. The static holding torque multiplies in accordance with the transmission ratio selected.

#### Hydraulic Motors

The gearbox is designed for direct flange-attachment of a variable or fixed-displacement motor (preferably a Rexroth hydraulic motor). If requested, the motor is supplied with the gearbox.

**Dimensions**



**Technical Data**

Type/Design GFT-W	Output Torque $T_{2 \text{ max.}}$ Nm	Cable Pull max. kN	Transmission Ratio $i$	Braking Torque $T_{Br \text{ max.}}$ Nm	Hydraulic Motor
GFT 0013 W2 2000/1	9500	50	16.3 • 22.6 • 32.1 • 37.6	460	A6VE 55
GFT 0013 W2 2000/2	9500	50	16.3 • 22.6 • 32.1 • 37.6	460	A2FE 45 • 56 • 63
GFT 0013 W2 4000/1	9500	50	16.3 • 22.6 • 32.1 • 37.6	460	A6VE 55
GFT 0013 W2 4000/2	9500	50	16.3 • 22.6 • 32.1 • 37.6	460	A2FE 45 • 56 • 63
GFT 0017 W2 2000	14000	67	26.4 • 32.1 • 37.6 • 45.4	460	A6VE 55/A2FE 45 • 56 • 63
GFT 0017 W2 4000	14000	67	26.4 • 32.1 • 37.6 • 45.4	460	A6VE 55/A2FE 45 • 56 • 63
GFT 0017 W3 2000	14000	74	77.9 • 88.2 • 102.6	460	A6VE 55/A2FE 45 • 56 • 63
GFT 0017 W3 4000	14000	74	77.9 • 88.2 • 102.6	460	A6VE 55/A2FE 45 • 56 • 63
GFT 0024 W3 2000	19000	99	90.1 • 102.6 • 120.5 • 137.2	460	A6VE 55/A2FE 45 • 56 • 63
GFT 0024 W3 4000	19000	99	90.1 • 102.6 • 120.5 • 137.2	460	A6VE 55/A2FE 45 • 56 • 63
GFT 0026 W2 2000/1	18000	84	42.9 • 50.5 • 62.0	710	A6VE 55/A2FE 45 • 56 • 63
GFT 0026 W2 2000/2	18000	84	42.9 • 50.5 • 62.0	710	A6VE 80 • 107/A2FE 80 • 90
GFT 0026 W2 4000/1	18000	84	42.9 • 50.5 • 62.0	710	A6VE 55/A2FE 45 • 56 • 63
GFT 0026 W2 4000/2	18000	84	42.9 • 50.5 • 62.0	710	A6VE 80 • 107/A2FE 80 • 90
GFT 0026 W2 6000/1	18000	84	42.9 • 50.5 • 62.0	710	A6VE 55/A2FE 45 • 56 • 63
GFT 0026 W2 6000/2	18000	84	42.9 • 50.5 • 62.0	710	A6VE 80 • 107/A2FE 80 • 90

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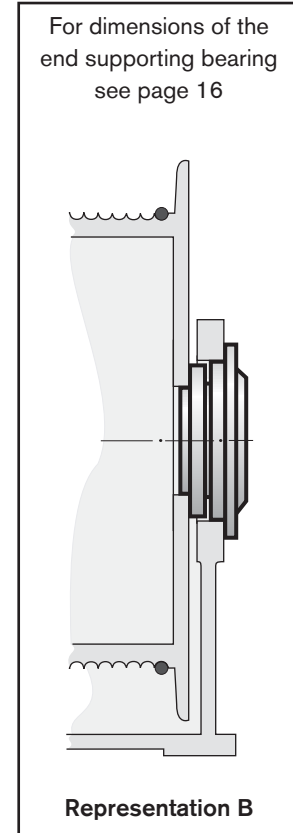
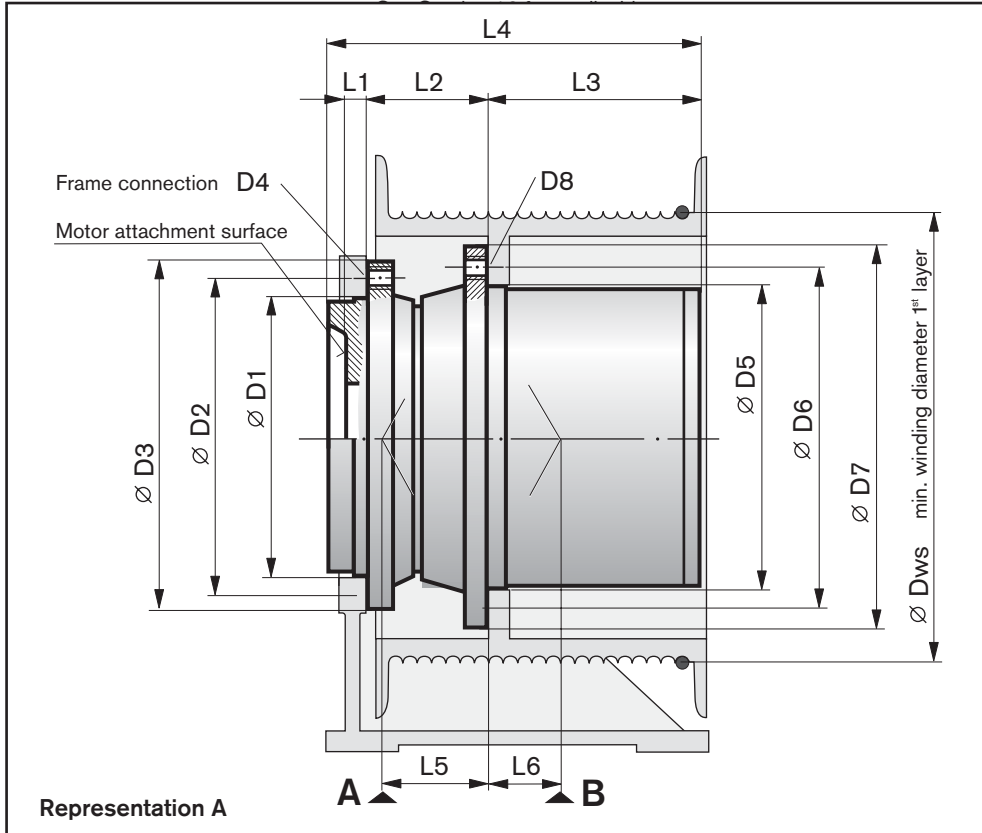
 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Dimensions**

Type/Design GFT-W	D1	D2	D3	D4	D5	D6	D7	D8	Dws	Repr.
	mm									
GFT 0013 W2 2000/1	240	275	300	18x M16	270	305	335	16x M16	380	A
GFT 0013 W2 2000/2	240	275	300	18x M16	270	305	335	16x M16	380	A
GFT 0013 W2 4000/1	240	275	300	16x M16	270	305	335	16x 17.5	380	B
GFT 0013 W2 4000/2	240	275	300	16x M16	270	305	335	16x 17.5	380	B
GFT 0017 W2 2000	250	290	320	16x M20	280	305	330	16x M16	380	A
GFT 0017 W2 4000	250	290	320	14x M20	280	305	330	16x 17.5	380	B
GFT 0017 W3 2000	250	290	320	16x M20	280	305	330	16x M16	380	A
GFT 0017 W3 4000	250	290	320	14x M20	280	305	330	16x 17.5	380	B
GFT 0024 W3 2000	240	285	320	20x M20	280	305	330	20x M16	385	A
GFT 0024 W3 4000	250	290	320	20x M20	280	305	330	20x 18	385	B
GFT 0026 W2 2000/1	270	310	350	16x M20	320	350	380	20x M16	430	A
GFT 0026 W2 2000/2	270	310	350	16x M20	320	350	380	20x M16	430	A
GFT 0026 W2 4000/1	270	310	350	12x M20	320	350	380	20x 18	430	B
GFT 0026 W2 4000/2	270	310	350	14x M20	320	350	380	20x 18	430	B
GFT 0026 W2 6000/1	210	310	350	14x M20	320	350	380	20x 17.5	430	B
GFT 0026 W2 6000/2	210	310	350	14x M20	320	350	380	20x 17.5	430	B

Type/Design GFT	L1	L2	L3	L4	L5	L6	A + B		Mass	Repr.
	mm						C	Co	kg	
							kN			
GFT 0013 W2 2000/1	8	75	149	232	49	54	140	290	85	A
GFT 0013 W2 2000/2	30	75	149	254	49	54	140	290	85	A
GFT 0013 W2 4000/1	8	75	149	232	49	54	140	290	80	B
GFT 0013 W2 4000/2	30	75	149	254	49	54	140	290	80	B
GFT 0017 W2 2000	30	82	152	264	56	47	108	142	105	A
GFT 0017 W2 4000	30	82	152	264	56	47	108	142	105	B
GFT 0017 W3 2000	30	82	174	286	56	47	140	290	115	A
GFT 0017 W3 4000	30	82	174	286	56	47	140	290	115	B
GFT 0024 W3 2000	30	82	189.5	301.5	56	47	140	290	130	A
GFT 0024 W3 4000	30	82	189.5	301.5	56	47	140	290	130	B
GFT 0026 W2 2000/1	20	90	220	330	58	50	186	400	136	A
GFT 0026 W2 2000/2	30	90	220	340	58	50	186	400	136	A
GFT 0026 W2 4000/1	20	90	220	330	58	50	186	400	136	B
GFT 0026 W2 4000/2	30	90	220	340	58	50	186	400	136	B
GFT 0026 W2 6000/1	20	90	220	330	58	50	186	400	140	B
GFT 0026 W2 6000/2	30	90	220	340	58	50	186	400	140	B

**Dimensions**



**Technical Data**

Type/Design GFT-W	Output Torque $T_{2 \max.}$ Nm	Cable Pull max. kN	Transmission Ratio $i$	Braking Torque $T_{Br \max.}$ Nm	Hydraulic Motor
GFT 0036 W3 2000/1	26000	118	67.0 • 79.4 • 99.1 • 115.0 • 138.8	680	A6VE 55/A2FE 45 • 56 • 63
GFT 0036 W3 2000/2	26000	118	67.0 • 79.4 • 99.1 • 115.0 • 138.8	680	A6VE 80/A2FE 80 • 90
GFT 0036 W3 4000/1	26000	118	67.0 • 79.4 • 99.1 • 115.0 • 138.8	680	A6VE 55/A2FE 45 • 56 • 63
GFT 0036 W3 4000/2	26000	118	67.0 • 79.4 • 99.1 • 115.0 • 138.8	680	A6VE 80/A2FE 80 • 90
GFT 0040 W2 2000/1	27000	108	35.9 • 41.0 • 48.3 • 59.1	1080	A6VE 80 • 107 /A2FE 80 • 90
GFT 0040 W2 2000/2	27000	108	35.9 • 41.0 • 48.3 • 59.1	1080	A6VE 107 • 160 /A2FE 107 • 125
GFT 0040 W2 4000/1	27000	108	35.9 • 41.0 • 48.3 • 59.1	1080	A6VE 80 • 107 /A2FE 80 • 90
GFT 0040 W2 4000/2	27000	108	35.9 • 41.0 • 48.3 • 59.1	1080	A6VE 107 • 160 /A2FE 107 • 125
GFT 0050 W3 2000/1	37500	150	84.2 • 91.1 • 99.8 • 125.6 • 146.4	800	A6VE 80 • 107 /A2FE 80 • 90
GFT 0050 W3 2000/2	37500	150	84.2 • 91.1 • 99.8 • 125.6 • 146.4	800	A6VE 107 • 160 /A2FE 107 • 125
GFT 0050 W3 4000/1	37500	150	84.2 • 91.1 • 99.8 • 125.6 • 146.4	800	A6VE 80 • 107 /A2FE 80 • 90
GFT 0050 W3 4000/2	37500	150	84.2 • 91.1 • 99.8 • 125.6 • 146.4	800	A6VE 107 • 160 /A2FE 107 • 125
GFT 0060 W3 2000	42500	164	86.5 • 94.8 • 105.5 • 119.8 • 139.9 • 169.9	720	A6VE 80 • 107 /A2FE 80 • 90
GFT 0060 W3 4000	42500	164	86.5 • 94.8 • 105.5 • 119.8 • 139.9 • 169.9	720	A6VE 80 • 107 /A2FE 80 • 90
GFT 0060 W3 6000	42500	164	63.8 • 86.5 • 94.8	1620	A6VM 107 • 160 • 200 • 250/ A2FM 107 • 125 • 160 • 180 • 200 • 250
GFT 0060 W3 8000	42500	164	63.8 • 86.5 • 94.8	1620	A6VM 107 • 160 • 200 • 250/ A2FM 107 • 125 • 160 • 180 • 200 • 250

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

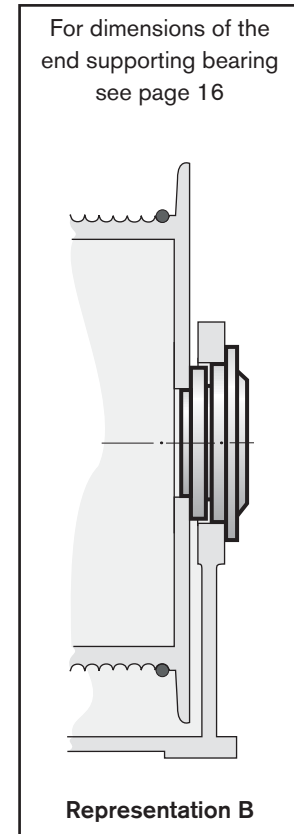
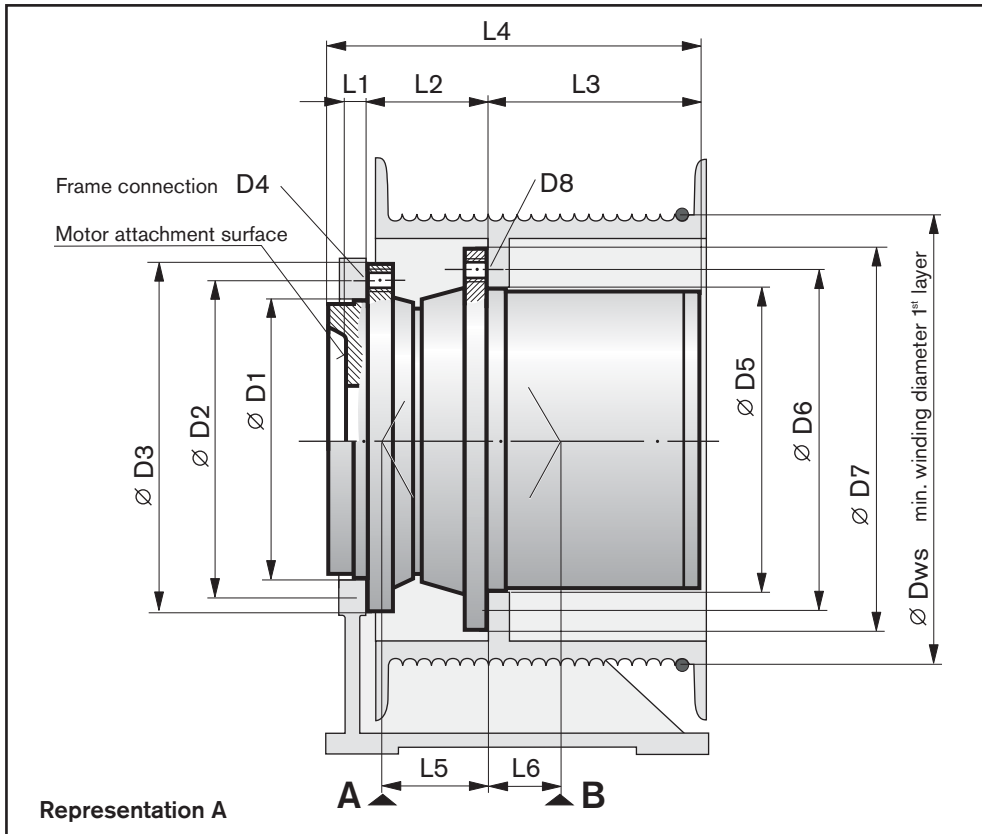
**Dimensions**

Type/Design GFT-W	D1	D2	D3	D4	D5	D6	D7	D8	Dws	Repr.
mm										
GFT 0036 W3 2000/1	270	310	350	16x M20	320	350	380	20x M16x1.5	440	A
GFT 0036 W3 2000/2	270	310	350	16x M20	320	350	380	20x M16x1.5	440	A
GFT 0036 W3 4000/1	270	310	350	16x M20	320	350	380	20x 18	440	B
GFT 0036 W3 4000/2	270	310	350	16x M20	320	350	380	20x 18	440	B
GFT 0040 W2 2000/1	270	310	350	16x M20	350	400	440	16x M20	500	A
GFT 0040 W2 2000/2	330	370	410	20x M20	350	400	440	16x M20	500	A
GFT 0040 W2 4000/1	270	310	350	17x M20x1,5	350	400	440	16x 22	500	B
GFT 0040 W2 4000/2	330	370	410	18x M20	350	400	440	16x 22	500	B
GFT 0050 W3 2000/1	270	310	350	20x M20x1,5	350	400	430	16x M20x1.5	500	A
GFT 0050 W3 2000/2	330	370	410	20x M20	350	400	430	16x M20x1.5	500	A
GFT 0050 W3 4000/1	270	310	350	18x M20x1,5	350	400	430	16x 22	500	B
GFT 0050 W3 4000/2	330	370	410	18x M20	350	400	430	16x 22	500	B
GFT 0060 W3 2000	330	370	410	20x M20x1,5	370	410	450	20x M20x1.5	520	A
GFT 0060 W3 4000	330	370	410	20x M20x1,5	370	410	450	20x 22	520	B
GFT 0060 W3 6000	360	405	440	12x M24	370	405	440	16x 22	520	B
GFT 0060 W3 8000	360	405	440	12x M24	370	405	440	16x 22	520	B

Type/Design GFT	L1	L2	L3	L4	L5	L6	A + B		Mass	Repr.
mm							C	Co	kg	
							kN			
GFT 0036 W3 2000/1	43	90	210	343	56.5	56.5	170	405	155	A
GFT 0036 W3 2000/2	10	90	200	300	56.5	56.5	170	405	155	A
GFT 0036 W3 4000/1	43	90	210	343	56.5	56.5	170	405	155	B
GFT 0036 W3 4000/2	10	90	200	300	56.5	56.5	170	405	155	B
GFT 0040 W2 2000/1	39.5	82	243	364.5	56.5	54	212	425	192	A
GFT 0040 W2 2000/2	20	90	261.5	376.5	38	73	212	425	219	A
GFT 0040 W2 4000/1	39.5	82	243	364.5	57	54	212	425	192	B
GFT 0040 W2 4000/2	25	108.5	243	376.5	56.5	54	212	425	219	B
GFT 0050 W3 2000/1	39.5	82	281.5	403	62	48	212	425	212	A
GFT 0050 W3 2000/2	25	109	281.5	415.5	56.5	54	212	425	238	A
GFT 0050 W3 4000/1	39.5	82	281.5	403	56.5	54	212	425	212	B
GFT 0050 W3 4000/2	25	109	281.5	415.5	56.5	54	212	425	238	B
GFT 0060 W3 2000	- 11	114	284	387	79	38	250	520	230	A
GFT 0060 W3 4000	- 11	114	284	423	79	38	250	520	230	B
GFT 0060 W3 6000	48.5	115	271	434.5	84	25	250	520	230	B
GFT 0060 W3 8000	48.5	115	271	434.5	84	25	250	520	230	B



**Dimensions**



**Technical Data**

Type/Design GFT-W	Output-Torque $T_{2 \max.}$ Nm	Cable Pull max. kN	Transmission Ratio $i$	Braking Torque $T_{Br \max.}$ Nm	Hydraulic Motor
GFT 0080 W3 2000	67000	231	76.7 • 99.0 • 110.0 • 126.9 • 149.9 • 185.4	1020	A6VE107•160/ A2FE107•125 • 160 • 180
GFT 0080 W3 4000	67000	231	76.7 • 99.0 • 110.0 • 126.9 • 149.9 • 185.4	1020	A6VE107•160/ A2FE107•125 • 160 • 180
GFT 0080 W3 6000/1	67000	231	61.3 • 79.1 • 99.0 • 110.9 • 149.5	1890	A6VM 160/A2FM 160 • 180
GFT 0080 W3 6000/2	67000	231	61.3 • 79.1 • 99.0 • 110.9 • 149.5	1890	A6VM 200 • 250/A2FM 200
GFT 0080 W3 8000/1	67000	231	61.3 • 79.1 • 99.0 • 110.9 • 149.5	1890	A6VM 160/A2FM 160 • 180
GFT 0080 W3 8000/2	67000	231	61.3 • 79.1 • 99.0 • 110.9 • 149.5	1890	A6VM 200 • 250/A2FM 200
GFT 0080 W3 8000/3	67000	231	61.3 • 79.1 • 99.0 • 110.9 • 149.5	1890	A6VM 107/A2FM 107 • 125
GFT 0110 W3 2000	100000	300	95.8 • 114.8 • 128.6 • 147.2 173.9 • 215.0	1100 750	A6VE 107 • 160 A2FE 107 • 125 • 160 • 180
GFT 0110 W3 4000	100000	300	95.8 • 114.8 • 128.6 • 147.2 173.9 • 215.0	1100 750	A6VE 107 • 160 A2FE 107 • 125 • 160 • 180
GFT 0110 W3 6000/1	100000	300	79.5 • 95.8 • 114.8 • 128.6 • 147.2 • 173.9	1890	A6VM 200 • 250/A2FM 200
GFT 0110 W3 6000/2	100000	300	79.5 • 95.8 • 114.8 • 128.6 • 147.2 • 173.9	1890	A2FM 250
GFT 0110 W3 6000/3	100000	300	79.5 • 95.8 • 114.8 • 128.6 • 147.2 • 173.9	1890	A6VM 160/A2FM 160 • 180
GFT 0110 W3 6000/4	100000	300	79.5 • 95.8 • 114.8 • 128.6 • 147.2 • 173.9	1890	A6VM 107/A2FM 107 • 125
GFT 0110 W3 8000/1	100000	300	79.5 • 95.8 • 114.8 • 128.6 • 147.2 • 173.9	1890	A6VM 200 • 250/A2FM 200
GFT 0110 W3 8000/2	100000	300	79.5 • 95.8 • 114.8 • 128.6 • 147.2 • 173.9	1890	A6VM 160/A2FM 160 • 180
GFT 0110 W3 8000/3	100000	300	79.5 • 95.8 • 114.8 • 128.6 • 147.2 • 173.9	1890	A6VM 107/A2FM 107 • 125

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Dimensions**

Type/Design GFT-W	D1	D2	D3	D4	D5	D6	D7	D8	Dws	Repr.
mm										
GFT 0080 W3 2000	380	430	480	20x M24	430	480	520	20x M24	600	A
GFT 0080 W3 4000	380	430	480	18x M24	430	480	520	20x 26	600	B
GFT 0080 W3 6000/1	380	430	470	28x M24	430	460	495	24x 22	580	B
GFT 0080 W3 6000/2	380	430	470	28x M24	430	460	495	24x 22	580	B
GFT 0080 W3 8000/1	380	430	470	28x M24	430	460	495	24x 22	580	B
GFT 0080 W3 8000/2	380	430	470	28x M24	430	460	495	24x 22	580	B
GFT 0080 W3 8000/3	380	430	470	28x M24	430	460	495	24x 22	580	B
<hr/>										
GFT 0110 W3 2000	420	460	400	24x M24	460	500	540	36x M18x1.5	640	A
GFT 0110 W3 4000	420	460	500	24x M24	460	500	540	36x 20	640	B
GFT 0110 W3 6000/1	380	430	470	28x M24	490	530	567	24x 26	650	B
GFT 0110 W3 6000/2	380	430	470	28x M24	490	530	567	24x 26	650	B
GFT 0110 W3 6000/3	380	430	470	28x M24	490	530	567	24x 26	650	B
GFT 0110 W3 6000/4	380	430	470	28x M24	490	530	567	24x 26	650	B
GFT 0110 W3 8000/1	380	430	470	28x M24	490	530	567	24x 26	650	B
GFT 0110 W3 8000/2	380	430	470	28x M24	490	530	567	24x 26	650	B
GFT 0110 W3 8000/3	380	430	470	28x M24	490	530	567	24x 26	650	B

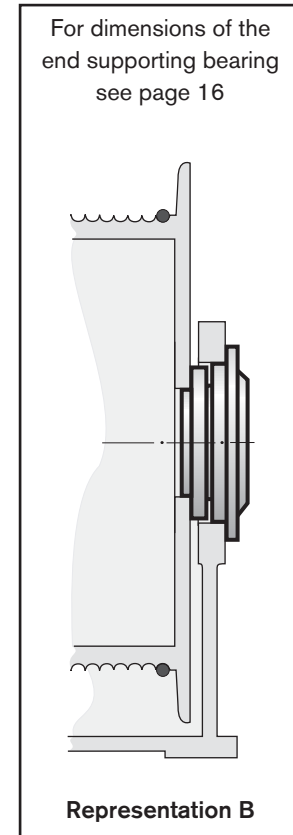
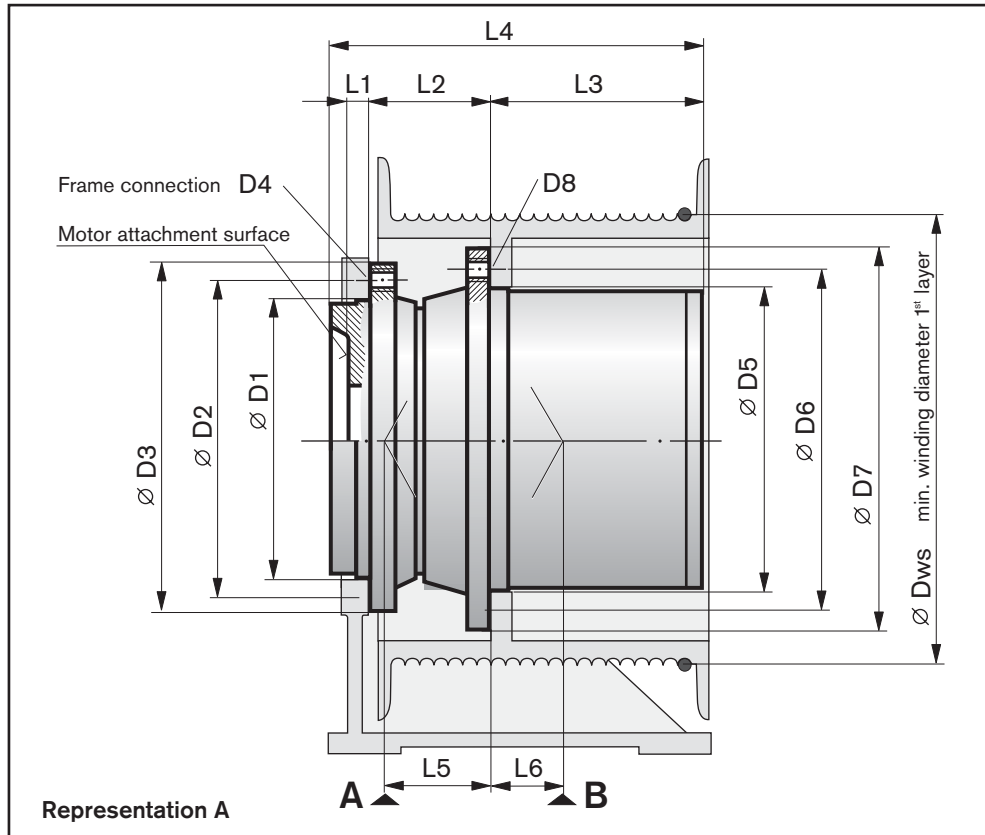
Type/Design GFT	L1	L2	L3	L4	L5	L6	A + B		Mass	Repr.
mm							C	Co	kg	
							kN			
GFT 0080 W3 2000	22	148	295	465	112	19	480	950	430	A
GFT 0080 W3 4000	22	148	295	465	112	19	480	950	430	B
GFT 0080 W3 6000/1	69	120	295	484	76	19	212	425	430	B
GFT 0080 W3 6000/2	69	120	295	484	76	19	212	425	430	B
GFT 0080 W3 8000/1	189	120	295	604	76	19	212	425	430	B
GFT 0080 W3 8000/2	189	120	295	604	76	19	212	425	430	B
GFT 0080 W3 8000/3	168	120	295	583	76	19	212	425	430	B
<hr/>										
GFT 0110 W3 2000	0	165	305	491.5	107	25	A 509 B 480	A 1080 B 950	440	A
GFT 0110 W3 4000	0	165	305	491.5	107	25			440	B
GFT 0110 W3 6000/1	69	140	280	489	96	- 2	212	425	460	B
GFT 0110 W3 6000/2	69	140	280	489	96	- 2	212	425	406	B
GFT 0110 W3 6000/3	69	140	280	489	96	- 2	212	425	515	B
GFT 0110 W3 6000/4	61	140	280	481	96	- 2	212	425	460	B
GFT 0110 W3 8000/1	178	140	280	598	96	- 2	212	425	460	B
GFT 0110 W3 8000/2	178	140	280	598	96	- 2	212	425	460	B
GFT 0110 W3 8000/3	168	140	280	588	96	- 2	212	425	460	B

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Dimensions**



**Technical Data**

Type/Design GFT-W	Output Torque $T_{2 \max.}$ Nm	Cable Pull max. kN	Transmission Ratio $i$	Brake Torque $T_{Br \max.}$ Nm	Hydraulic Motor
GFT 0160 W3 2000	140000	373	161.8 • 210.8 • 251.0	1360	A6VE 107 • 160/ A2FE 107 • 125 • 160 • 180
GFT 0160 W3 4000	140000	373	161.8 • 210.8 • 251.0	1360	A6VE 107 • 160/ A2FE 107 • 125 • 160 • 180
GFT 0220 W3 2000/1	200000	471	188.9 • 246.1 • 293.0	1360	A6VE 107 • 160/ A2FE 107 • 125 • 160 • 180
GFT 0220 W3 2000/2	200000	471	97.7 • 105.9 • 143.3 • 155.4 • 188.9	2200	A6VM 200 • 250/A2FM 200
GFT 0220 W3 4000/1	200000	471	188.9 • 246.1 • 293.0	1360	A6VE 107 • 160/ A2FE 107 • 125 • 160 • 180
GFT 0220 W3 4000/2	200000	471	97.7 • 105.9 • 143.3 • 155.4 • 188.9	2200	A6VM 200 • 250/A2FM 200
GFT 0220 W3 6000/1	200000	471	188.9 • 246.1 • 293.0	1360	A6VE 107 • 160/ A2FE 107 • 125 • 160 • 180
GFT 0220 W3 6000/2	200000	471	97.7 • 105.9 • 143.3 • 155.4 • 188.9	2200	A6VM 200 • 250/A2FM 200
GFT 0330 W3 2000	275000	595	168.9 • 209.9 • 252.0 • 302.4	2860	A6VE 250/A2FE 250
GFT 0330 W3 4000	275000	595	168.9 • 209.9 • 252.0 • 302.4	2860	A6VE 250/A2FE 250
GFT 0330 W3 6000	275000	595	168.9 • 209.9 • 252.0 • 302.4	2860	A6VE 250/A2FE 250

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Dimensions**

Type/Design GFT-W	D1	D2	D3	D4	D5	D6	D7	D8	Dws	Repr.
	mm									
GFT 0160 W3 2000	450	510	560	30x M24x2	535	600	650	30x M24x2	750	A
GFT 0160 W3 4000	450	510	560	30x M24x2	535	600	650	30x 30	750	A
GFT 0220 W3 2000/1	460	600	650	30x M30	610	680	735	24x M30	850	A
GFT 0220 W3 2000/2	460	600	650	30x M30	610	680	735	24x M30	850	A
GFT 0220 W3 4000/1	460	600	650	30x M30	610	680	735	24x 33	850	B
GFT 0220 W3 4000/2	460	600	650	30x M30	610	680	735	24x 33	850	B
GFT 0220 W3 6000/1	460	600	650	30x M30	610	680	735	24x 33	850	B
GFT 0220 W3 6000/2	460	600	650	30x M30	610	680	735	24x 33	850	B
GFT 0330 W3 2000	580	680	735	30x M30	660	730	785	30x M30	925	A
GFT 0330 W3 4000	580	680	735	28x M24	660	730	785	30x 33	925	B
GFT 0330 W3 6000	580	680	735	28x M24	660	730	785	30x 33	925	B

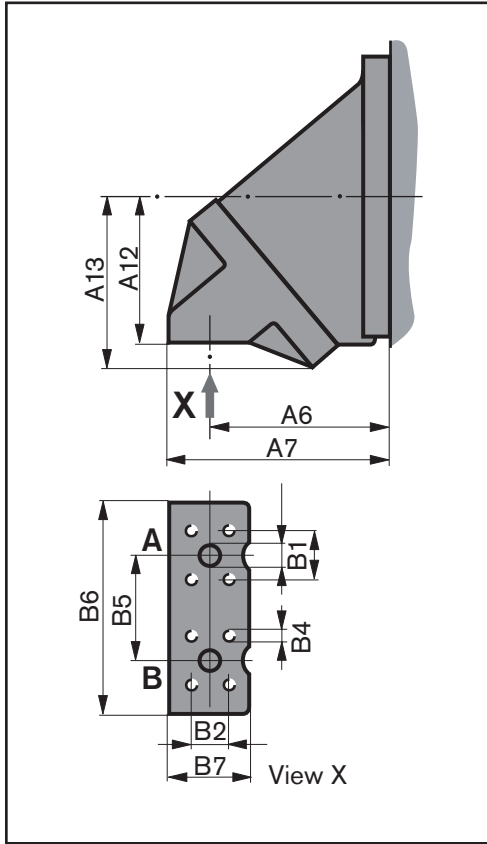
Type/Design GFT	L1	L2	L3	L4	L5	L6	A + B	Mass	Repr.	
	mm						C	Co	kg	
							kN			
GFT 0160 W3 2000	30	168	340	538	138	26	688	1520	680	A
GFT 0160 W3 4000	30	168	340	538	138	26	688	1520	680	A
GFT 0220 W3 2000/1	45	170	350	565	155	35	710	1560	820	A
GFT 0220 W3 2000/2	40	170	350	560	155	35	710	1560	820	A
GFT 0220 W3 4000/1	45	170	350	565	155	35	710	1560	820	B
GFT 0220 W3 4000/2	40	170	350	560	155	35	710	1560	820	B
GFT 0220 W3 6000/1	45	170	350	565	155	35	710	1560	820	B
GFT 0220 W3 6000/2	40	170	350	560	155	35	710	1560	820	B
GFT 0330 W3 2000	47	188	430	705	190	25	1040	2450	1380	A
GFT 0330 W3 4000	47	188	430	705	190	25	1040	2450	1380	B
GFT 0330 W3 6000	47	188	430	705	190	25	1040	2450	1380	B

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Fixed-Displacement Motor A2FE, Series 61**



Nominal Size	A6	A7	A12	A13	Mass (kg)
45	109	133	102	119	15
56	122	146	107	130	18
63	122	146	107	130	19
80	127	157	121	145	23
90	127	157	121	145	25
107	143	178	136	157	34
125	143	178	136	157	36
160	169	211	149	188	47
180	169	211	149	188	48
250 <sup>1)</sup>	*	230	*	172	*

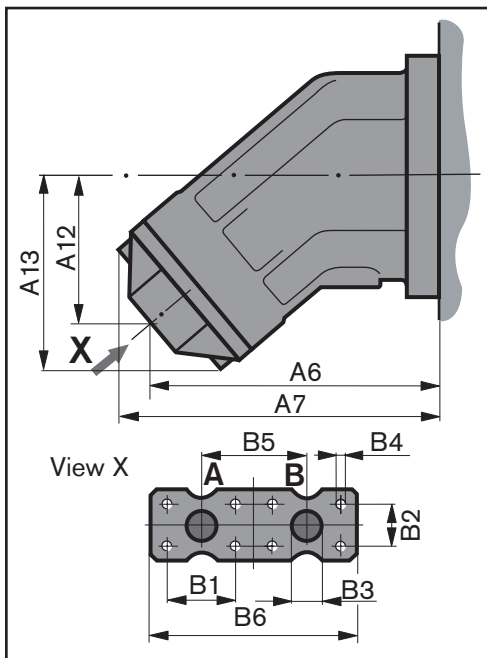
Nominal Size	B1	B2	B3	B4	B5	B6	B7	A / B
45	50.8	23.8	19	M10x17	75	147	49	SAE 3/4"
56 63	50.8	23.8	19	M10x17	75	147	49	SAE 3/4"
80 90	57.2	27.8	25	M12x17	84	166	60	SAE 1"
107 125	66.7	31.8	32	M14x19	99	194	70	SAE 1 1/4"
160 180	66.7	31.8	32	M14x19	99	194	70	SAE 1 1/4"
250 <sup>1)</sup>	*	*	*	*	*	*	*	*

<sup>1)</sup> Series 60

For further technical data see RE 91008

\* Missing dimensions upon request

**Fixed-Displacement Motor A2FM, Series 61**



Nominal Size	A6	A7	A12	A13	Mass (kg)
107 125	225.5	252	120	159	32
160 180	252	294	134	188	32
200 <sup>1)</sup>	284	309	84	165	32
250 <sup>2)</sup>	288	314	93	172	45
					45

Nominal Size	B1	B2	B3	B4	B5	B6	A / B
107 125	66.7	31.8	32	M14x19	99	194	SAE 1 1/4"
160 180	66.7	31.8	32	M14x19	99	194	SAE 1 1/4"
200 <sup>1)</sup>	66.7	31.8	32	M14x19	99	204	SAE 1 1/4"
250 <sup>2)</sup>	66.7	31.8	32	M14x19	100	210	SAE 1 1/4"

<sup>1)</sup> Series 63

<sup>2)</sup> Series 60

For further technical data see RE 91001

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

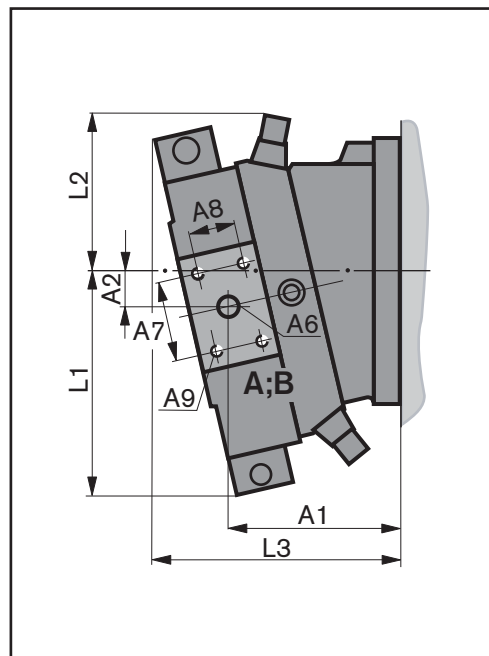
**Variable-Displacement Motor A6VE, Series 63**

Nominal Size	A1	A2	L1 *	L2 *	L3 *	Mass (kg)
55	123	24	151	111	179	26
80	130	28	167	116	190	34
107	137	30	175	122	208	45
160	171	34	200	154	245	64
250	204	44	248	188	302	90

\* Dimensions vary, depending on type of displacement

Nominal Size	A6	A7	A8	A9	A / B
55	19	50.8	23.8	M10x17	SAE 3/4"
80	25	57.2	27.8	M12x17	SAE 1"
107	25	57.2	27.8	M12x17	SAE 1"
160	32	66.7	31.8	M14x19	SAE 1 1/4"
250	32	66.7	31.8	M14x19	SAE 1 1/4"

For further technical data see RE 91606



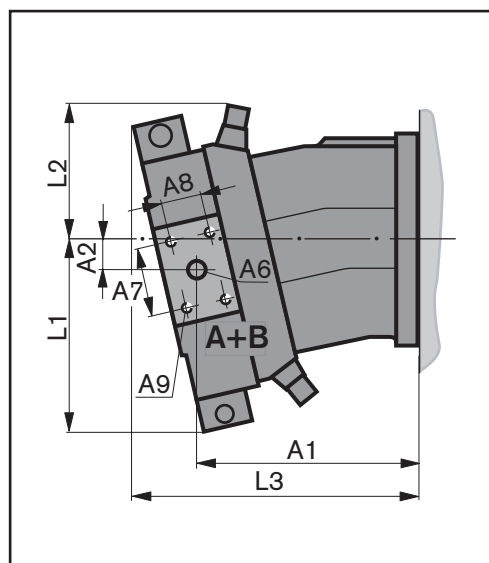
**Variable-Displacement Motor A6VM, Series 63**

Nominal Size	A1	A2	L1 *	L2 *	L3 *	Mass (kg)
107	220	30	175	122	290	47
160	254	34	197	137	329	64
200	267	36	209	143	345	80
250	287	44	248	188	383	90

\* Dimensions vary, depending on type of displacement

Nominal Size	A6	A7	A8	A9	A / B
107	25	57.2	27.8	M12x1.75	SAE 1"
160	32	66.7	31.8	M12x1.75	SAE 1 1/4"
200	32	66.7	31.8	M12x1.75	SAE 1 1/4"
250	32	66.7	31.8	M12x1.75	SAE 1 1/4"

For further technical data see RE 91604

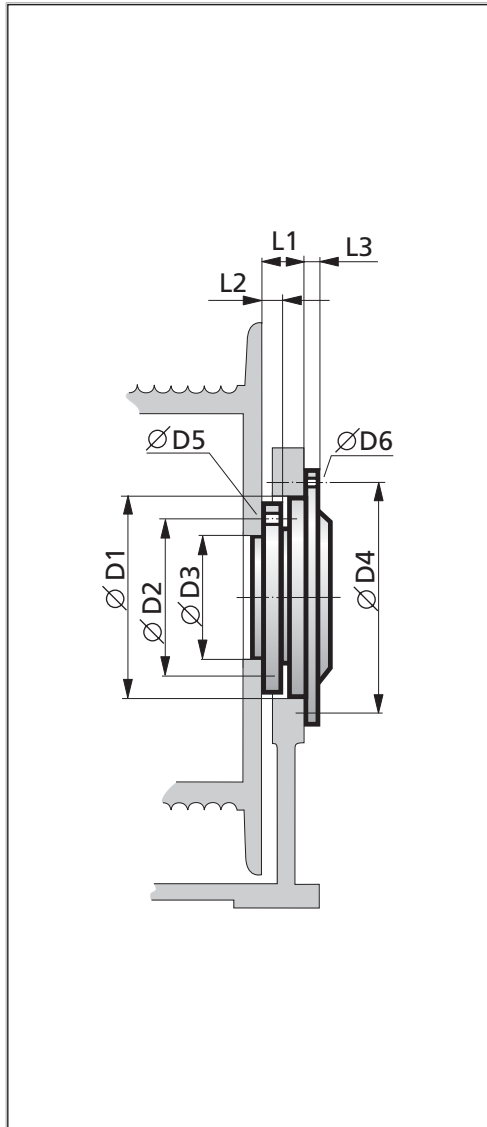


**Extracted from RE 77 502/05.04**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Standard End Supporting Bearing**



Gearbox Size	D1 H7/j6	D2	D3 H7/j6	D4	D5
GFT 0013 W	140	115	90	157	12 x ø 14
GFT 0017 W					
GFT 0024 W	175	145	115	198	12 x ø 18
GFT 0026 W					
GFT 0036 W	200	170	140	230	12 x ø 18
GFT 0040 W					
GFT 0050 W	225	190	150	260	12 x ø 22
GFT 0060 W					
GFT 0080 W					
GFT 0110 W	260	220	180	295	12 x ø 22
GFT 0160 W					
GFT 0220 W					
GFT 0330 W	Dimensions upon request				

Gearbox Size	D6	L1	L2	L3	Mass appr. (kg)
GFT 0013 W	6 x ø 9	76	13	10	9
GFT 0017 W					
GFT 0024 W	6 x ø 11	76	20	15	15
GFT 0026 W					
GFT 0036 W	6 x ø 14	77	20	15	21
GFT 0040 W					
GFT 0050 W	6 x ø 18	91	25	17	30
GFT 0060 W					
GFT 0080 W					
GFT 0110 W	8 x ø 18	102	25	20	30
GFT 0160 W					
GFT 0220 W					
GFT 0330 W	Dimensions upon request				

**Extracted from RE 77 201/05.06**Page 1 of 10  
Issue: 06.06See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Swing drives**  
**MOBILEX GFB**Output torques from 2950 to 191,770 lb-ft  
(4 to 260 kNm)

- Compact, space saving two or three stage planetary design
- Easy mounting
- Integrated multi-disk parking brake
- Low noise operation
- High efficiency
- Long service life
- Convenient oil change

**Description**

Rexroth MOBILEX GFB planetary gearboxes are hydrostatic swing gears. They are suitable for use in excavators and cranes of all types, in ship unloading equipment, forestry equipment and in all applications where accurate positioning is called for. The drive consists of a two or three-stage gearbox with an integrated multi-disk parking brake, an output pinion as well as a hydraulic motor, preferably from Rexroth.

A dedicated team of R&D, design and sales engineers makes sure that the clients' wishes and concepts are quickly translated into technically and economically viable solutions. In their work, they are assisted by modern computer software for gearing design and component optimization. The information provided in this bulletin serves to help you select the planetary gearbox best suited for your application. In addition, our field personnel are available to you to provide advisory services even at the project stage.

**Lubrication**

The gear teeth and bearings are splash lubricated. Aside from periodic oil changes, the drive units are maintenance-free. Oil changes are easy to do. The oil brands recommended in the operating manual shall be exclusively used.

The change intervals for the relevant application conditions are also given in the operating manual. The pinion-side antifriction bearing of the output shaft is grease-lubricated for life.

**Brake**

The standard supply scope includes a spring-loaded, hydraulically released multiple-disk parking brake arranged on the input side. The multiple-disk holding brake is not a service brake.

**Hydraulic Motors**

The gearbox is designed for direct flange attachment of a variable or fixed displacement motor (preferably a Rexroth hydraulic motor). If requested, the motor can be supplied along with the gearbox.

**Gearbox Supply**

Rexroth MOBILEX planetary gearboxes are delivered ready for installation, but without oil filling. The standard gearbox version comes with a priming coat of grey color (similar to RAL 7032) and is internally protected with a temporary corrosion preventive that preserves the gearbox for 24 months, if stored in a dry location. External flanges, shaft extensions and mating faces are protected with TECTYL 502 C.

**Weights, Oil Volumes, Dimensions**

The specified weights are average figures. As far as oil volumes are concerned, gearbox operators should rely on oil level readings rather than specified oil volumes. Figures and dimensions are not strictly binding. We reserve the right to make changes in line with technical progress.

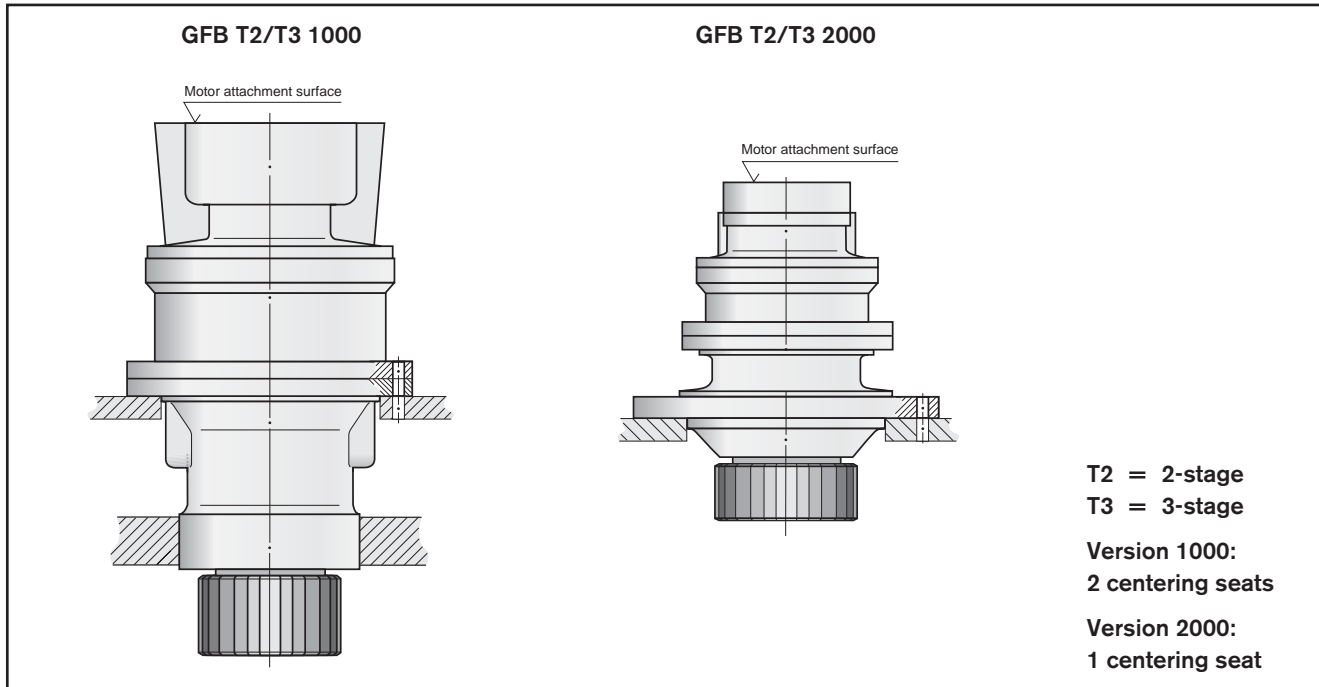
**Further Notes**

As prescribed by statutory provisions, all rotating parts must be protected by guards against accidental contact. Local safety regulations must be complied with.

Commissioning and maintenance of the gearboxes must be performed in line with the instructions given in our operating manual.



## Type of Construction



## Ordering Example

**MOBILEX GFB 0026 T2 1 ...**

Gearbox Type \_\_\_\_\_ e.g. 2 centering seats  
Version \_\_\_\_\_ 2-stage

## Swing Drives MOBILEX GFB - Overview

Type/Version GFB	Output Torque		Gear Ratio from/to i
	Excavator	Crane	
	$T_{2 \max}$ Nm		
GFB 0009 T2	4000	7000	26.10 - 48.60
GFB 0017 T2	7700	12700	17.27 - 45.66
GFB 0017 T3	7700	12700	78.95 - 105.63
GFB 0024 T3	10600	17500	91.13 - 138.20
GFB 0026 T2	10000	16500	31.36 - 63.00
GFB 0036 T2	17500	28500	20.71 - 28.93
GFB 0036 T3	17500	28500	67.96 - 117.55
GFB 0040 T2	18000	29000	42.04 - 60.13
GFB 0050 T3	22000	38000	126.66 - 147.39
GFB 0060 T2	27800	48500	40.41
GFB 0060 T3	27800	48500	87.46 - 170.89
GFB 0080 T2	38200	68300	62.28 - 186.43
GFB 0084 T2	38200	68300	35.13
GFB 0110 T3	52000	93300	174.86
GFB 0144 T2	54000	94500	49.30

**Classification Examples** See FEM Section I, 3rd Edition, Table T.2.1.3.5.

Type of Crane (Designation)	Component Operated <sup>1)</sup>	Type of Driver				
		Hoisting	Swinging	Level Luffing	Trolley Travelling	Crane Travelling
Erection cranes		M 2 – M 3	M 2 – M 3	M 1 – M 2	M 1 – M 2	M 2 – M 3
Loading bridges	hook	M 5 – M 6	M 4	–	M 4 – M 5	M 5 – M 6
Loading bridges	grab or magnet	M 7 – M 8	M 6	–	M 6 – M 7	M 7 – M 8
Workshop cranes		M 6	M 4	–	M 4	M 5
Overhead travelling cranes, ram cranes, scrap yard cranes	grab or magnet	M 8	M 6	–	M 6 – M 7	M 7 – M 8
Unloading bridges, container gantry cranes	hook or spreader	M 6 – M 7	M 5 – M 6	M 3 – M 4	M 6 – M 7	M 4 – M 5
Other gantry cranes (with trolley and/or live ring)	hook	M 4 – M 5	M 4 – M 5	–	M 4 – M 5	M 4 – M 5
Unloading bridges, container gantry cranes (with trolley and/or live ring)	grab or magnet	M 8	M 5 – M 6	M 3 – M 4	M 7 – M 8	M 4 – M 5
Berth cranes, shipyard cranes, dismantling cranes	hook	M 5 – M 6	M 4 – M 5	M 4 – M 5	M 4 – M 5	M 5 – M 6
Dockside cranes (sleuable, gantry type, ...), floating cranes, floating shearlegs	hook	M 6 – M 7	M 5 – M 6	M 5 – M 6	–	M 3 – M 4
Dockside cranes (sleuable, gantry type, ...), floating cranes, floating shearlegs	grab or magnet	M 7 – M 8	M 6 – M 7	M 6 – M 7	–	M 4 – M 5
Floating cranes and floating shearlegs for very high loads (normally above 100 tons)		M 3 – M 4	M 3 – M 4	M 3 – M 4	–	–
Shipboard cranes	hook	M 4	M 3 – M 4	M 3 – M 4	M 2	M 3
Shipboard cranes	grab or magnet	M 5 – M 6	M 3 – M 4	M 3 – M 4	M 4 – M 5	M 3 – M 4
Tower cranes for construction sites		M 4	M 5	M 4	M 3	M 3
Derrick tower gantries		M 2 – M 3	M 1 – M 2	M 1 – M 2	–	–
Railroad cranes, approved for service on trains		M 3 – M 4	M 2 – M 3	M 2 – M 3	–	–
Vehicle-mounted cranes	hook	M 3 – M 4	M 2 – M 3	M 2 – M 3	–	–

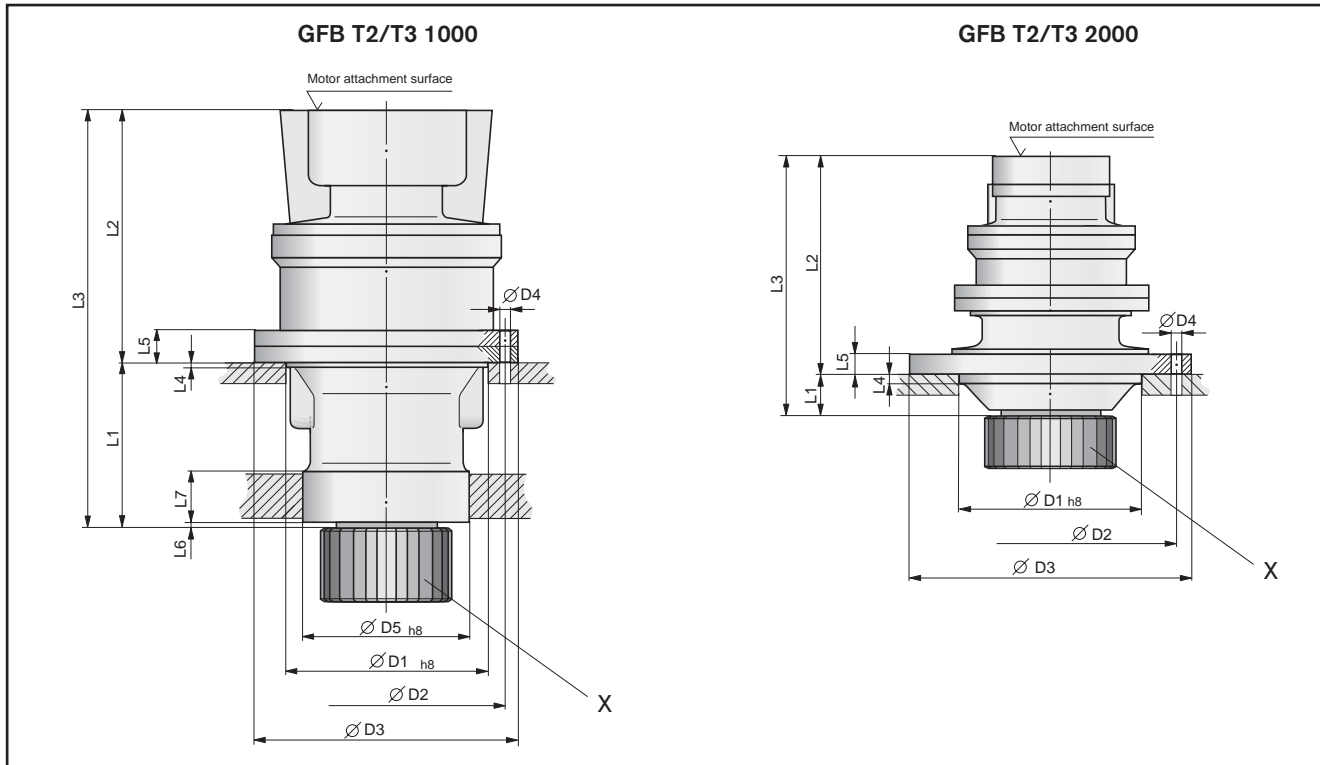
1) This column shows some typical uses for general information

**Extracted from RE 77 201/05.06**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

**Dimensions**



Dimensions and technical data for output torques from  
4000 Nm to 10600 Nm for excavators  
7000 Nm to 17500 Nm for cranes

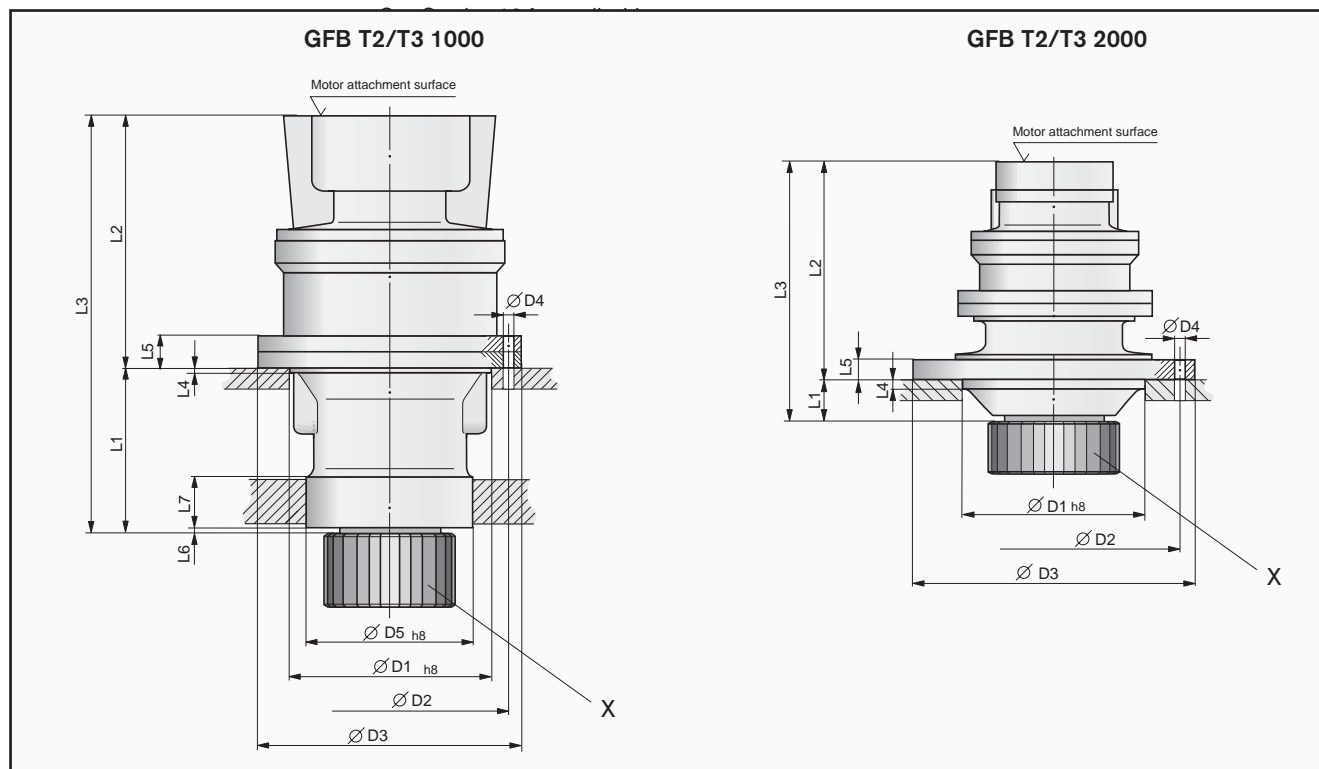
X The gearing of the output pinion (module, number of teeth, tooth width, etc.) is governed by the customer's ring gear.

**Technical Data**

Type/Version GFB	Output Torque		Gear Ratio i	Braking Torque T <sub>Br max.</sub> Nm	Hydraulic Motor
	Excavator T <sub>2 max.</sub> Nm	Crane Nm			
GFB 0009 T2 1000/1	4000	7000	26.1 • 29.2 • 33.4 • 39.3 • 48.6	245	A2FE 28 • 32
GFB 0009 T2 1000/2	4000	7000	26.1 • 29.2 • 33.4 • 39.3 • 48.6	245	A2FE 45 • 56
GFB 0009 T2 2000/1	4000	7000	26.1 • 29.2 • 33.4 • 39.3 • 48.6	245	A2FE 28 • 32
GFB 0009 T2 2000/2	4000	7000	26.1 • 29.2 • 33.4 • 39.3 • 48.6	245	A6VM 55
GFB 0017 T2 1000	7700	12700	17.27 • 32.47 • 45.66	390	A2FE 45 • 56 • 63
GFB 0017 T2 2000	7700	12700	17.27 • 32.47 • 45.66	390	A2FE 45 • 56 • 63
GFB 0017 T3 1000	7700	12700	78.95 • 89.21 • 103.62 • 105.63	249	A2FE 28 • 32
GFB 0017 T3 2000	7700	12700	78.95 • 89.21 • 103.62 • 105.63	249	A2FE 28 • 32
GFB 0024 T3 1000/1	10600	17500	91.13 • 103.63 • 121.5 • 138.2	249	A2FM 28 • 32
GFB 0024 T3 1000/3	10600	17500	91.13 • 103.63 • 121.5 • 138.2	249	A2FM 45 • 56 • 63

GFB 0024 T3 1000/3 = Identification number for different overall lengths/diameters and motor attachment variants.

## Dimensions



Dimensions and technical data for output torques from  
 10000 Nm to 18000 Nm for excavators  
 16500 Nm to 29000 Nm for cranes

X The gearing of the output pinion (module, number of teeth, tooth width, etc.) is governed by the customer's ring gear.

## Technical Data

Type/Version GFB	Output Torque		Gear Ratio	Braking Torque	Hydraulic Motor
	Excavator	Crane			
	$T_{2 \text{ max.}}$ Nm		$i$	$T_{Br \text{ max.}}$ Nm	
GFB 0026 T2 1000	10000	16500	31.36 • 43.87 • 51.52 • 63	332	A2FE 80 • 90
GFB 0026 T2 2000	10000	16500	31.36 • 43.87 • 51.52 • 63	332	A2FE 80 • 90
GFB 0036 T2 2000	17500	28500	20.71 • 24 • 28.93	390	A2FE 107
GFB 0036 T3 1000/1	17500	28500	67.96 • 80.36 • 101.02 • 117.55	332	A2FM 45 • A6VM 55
GFB 0036 T3 1000/2	17500	28500	67.96 • 80.36 • 101.02 • 117.55	332	A2FE 45 • 56 • 63
GFB 0036 T3 1000/3	17500	28500	67.96 • 80.36 • 101.02 • 117.55	332	A2FE 80 • 90
GFB 0036 T3 2000	17500	28500	67.96 • 80.36 • 101.02 • 117.55	332	A2FE 45 • 56 • 63
GFB 0040 T2 1000/1	18000	29000	42.04 • 49.28 • 60.13	588	A2FE 45 • 56 • 63
GFB 0040 T2 1000/2	18000	29000	42.04 • 49.28 • 60.13	588	A2FE 80 • 90
GFB 0040 T2 1000/3	18000	29000	42.04 • 49.28 • 60.13	588	A2FE 107 • 125
GFB 0040 T2 1000/4	18000	29000	42.04 • 49.28 • 60.13	588	A2FE 45 • 56 • 63
GFB 0040 T2 1000/5	18000	29000	42.04 • 49.28 • 60.13	588	A2FM 125
GFB 0040 T2 2000/1	18000	29000	42.04 • 49.28 • 60.13	588	A2FE 45 • 56 • 63
GFB 0040 T2 2000/2	18000	29000	42.04 • 49.28 • 60.13	588	A2FE 80 • 90
GFB 0040 T2 2000/3	18000	29000	42.04 • 49.28 • 60.13	588	A2FE 107 • 125

GFB 0040 T2 1000/5 = Identification number for different overall lengths/diameters and motor attachment variants.

**Extracted from RE 77 201/05.06**

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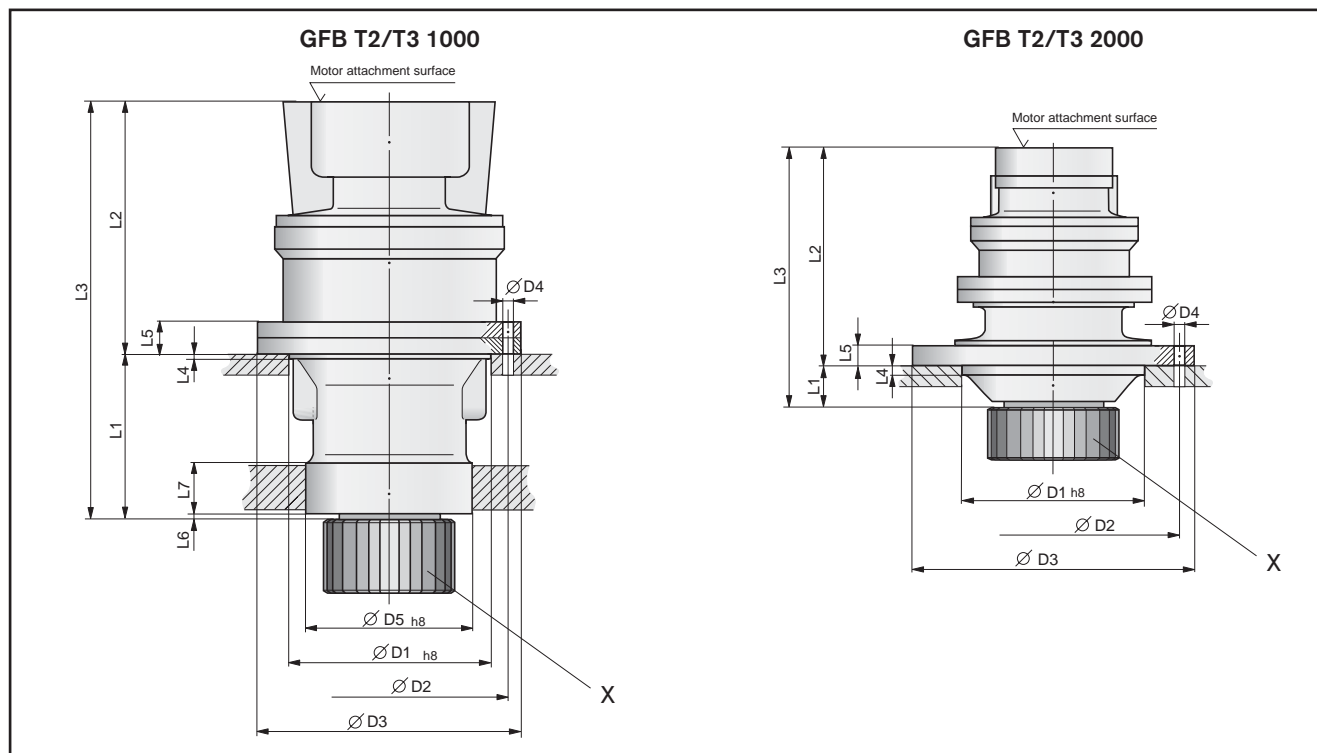
 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Dimensions**

Type/Version GFB	D1	D2	D3	D4	D5	Mass
	mm					kg
GFB 0009 T2 1000/1	170	250	270	16x 13.5	165	55
GFB 0009 T2 1000/2	170	250	270	16x 13.5	165	80
GFB 0009 T2 2000/1	250	310	345	12x 17.5	-	80
GFB 0009 T2 2000/2	175	260	288	12x 17.5	-	85
GFB 0017 T2 1000	256	290	320	16x 17.5	225	130
GFB 0017 T2 2000	250	305	340	16x 17.5	-	130
GFB 0017 T3 1000	256	290	320	16x 17.5	225	130
GFB 0017 T3 2000	250	305	340	16x 17.5	-	130
GFB 0024 T3 1000/1	265	315	355	20x 17.5	230	165
GFB 0024 T3 1000/3	265	315	355	20x 17.5	230	165

Type/Version GFB	L1	L2	L3	L4	L5	L6	L7
	mm						
GFB 0009 T2 1000/1	120	259.5	379.5	50	36.5	14	46
GFB 0009 T2 1000/2	120	277	397	50	36.5	14	46
GFB 0009 T2 2000/1	51	303.5	354.5	15	20	-	-
GFB 0009 T2 2000/2	40	325.5	365.5	26	22	-	-
GFB 0017 T2 1000	200	300	500	6	38	6	55
GFB 0017 T2 2000	57	443	500	46	23	-	-
GFB 0017 T3 1000	200	325	525	6	38	6	55
GFB 0017 T3 2000	57	468	525	46	23	-	-
GFB 0024 T3 1000/1	245	387	632	15	34	8	75
GFB 0024 T3 1000/3	245	394	639	15	34	8	75

## Dimensions



Dimensions and technical data for output torques from  
 22000 Nm to 54000 Nm for excavators  
 38000 Nm to 94500 Nm for cranes

X The gearing of the output pinion (module, number of teeth, tooth width, etc.) is governed by the customer's ring gear.

## Technical Data

Type/Version GFB	Output Torque		Gear Ratio $i$	Braking Torque $T_{Br \max.}$ Nm	Hydraulic Motor
	Excavator	Crane			
	$T_2 \max.$ Nm				
GFB 0050 T3 1000/1	22000	38000	126.66 • 147.39	332	A2FE 45 • 56 • 63
GFB 0050 T3 1000/2	22000	38000	126.66 • 147.39	332	A2FE 80 • 90
GFB 0050 T3 1000/3	22000	38000	126.66 • 147.39	332	A2FE 107 • 125
GFB 0050 T3 1000/4	22000	38000	126.66 • 147.39	332	A2FM 63
GFB 0060 T2 1000/1	27800	48500	40.41	613	A2FE 107 • 125
GFB 0060 T2 1000/2	27800	48500	40.41	613	A2FE 107 • 125
GFB 0060 T3 1000	27800	48500	87.46 • 95.8 • 140.86 • 170.89	613	A2FM 80 • 90
GFB 0060 T3 2000/1	27800	48500	87.46 • 95.8 • 140.86 • 170.89	613	A2FE 80 • 90
GFB 0060 T3 2000/2	27800	48500	87.46 • 95.8 • 140.86 • 170.89	613	A2FE 107 • 125
GFB 0080 T3 1000/1	38200	68300	62.28 • 111.86 • 186.43	975	A2FE 80 • 90
GFB 0080 T3 1000/2	38200	68300	62.28 • 111.86 • 186.43	975	A2FE 107 • 125
GFB 0080 T3 1000/3	38200	68300	62.28 • 111.86 • 186.43	975	A2FM 90
GFB 0084 T2 2000/1	38200	68300	35.13	1661	A2FM 180 • 200
GFB 0084 T2 2000/2	38200	68300	35.13	1661	A2FM 180 • 200
GFB 0110 T3 1000/1	52000	93300	174.86	588	A2FE 80 • 90
GFB 0110 T3 1000/2	52000	93300	174.86	588	A6VM 200
GFB 0144 T2 2000	54000	94500	49.3	1423	A2FM 180 • 200

GFB 0080 T3 1000/3 = Identification number for different overall lengths/diameters and motor attachment variants.

**Extracted from RE 77 201/05.06**

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 See Section 16 for applicable  
 Preferred/Spotlight part numbers  
 and unit price.

**Dimensions**

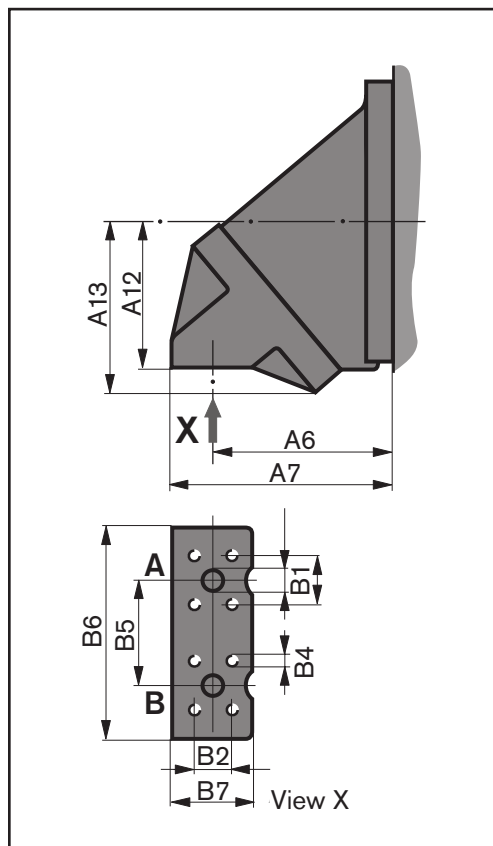
Type/Version GFB	D1	D2	D3	D4	D5	Mass
	mm					kg
GFB 0050 T3 1000/1	330	375	411	24x 17.5	300	315
GFB 0050 T3 1000/2	330	375	411	24x 17.5	300	310
GFB 0050 T3 1000/3	330	375	411	24x 17.5	300	310
GFB 0050 T3 1000/4	330	375	411	24x 17.5	300	315
GFB 0060 T2 1000/1	400	490	542	16x 22	325	390
GFB 0060 T2 1000/2	400	490	542	16x 22	325	380
GFB 0060 T3 1000	380	425	462	24x 17.5	300	425
GFB 0060 T3 2000/1	340	450	500	24x 26	-	420
GFB 0060 T3 2000/2	340	450	500	24x 26	-	420
GFB 0080 T3 1000/1	440	480	530	24x 26	370	120
GFB 0080 T3 1000/2	440	480	530	24x 26	370	120
GFB 0080 T3 1000/3	440	480	530	24x 26	370	540
GFB 0084 T2 2000/1	400	470	510	24x 26	-	515
GFB 0084 T2 2000/2	400	460	510	24x 26	-	515
GFB 0110 T3 1000/1	475	520	570	24x 26	390	630
GFB 0110 T3 1000/2	475	520	570	24x 26	390	680
GFB 0144 T2 2000	460	520	562	24x 26	-	1050

Type/Version GFB	L1	L2	L3	L4	L5	L6	L7
	mm						
GFB 0050 T3 1000/1	290	353.5	643.5	15	38	40	75
GFB 0050 T3 1000/2	290	389.5	679.5	15	38	40	75
GFB 0050 T3 1000/3	290	427.5	717.5	15	38	40	75
GFB 0050 T3 1000/4	290	396.5	686.5	15	38	40	75
GFB 0060 T2 1000/1	450	225	675	25	40	19	95
GFB 0060 T2 1000/2	360	399.5	759.5	9	32	19	102
GFB 0060 T3 1000	485	246	731	40	30	4	129
GFB 0060 T3 2000/1	111	638	749	98	40	-	-
GFB 0060 T3 2000/2	111	676	787	98	40	-	-
GFB 0080 T3 1000/1	331	516.5	847.5	14	40	58	121
GFB 0080 T3 1000/2	331	552.5	883.5	14	40	58	121
GFB 0080 T3 1000/3	314	554.5	868.5	14	40	41	121
GFB 0084 T2 2000/1	64	721	785	10	465	-	-
GFB 0084 T2 2000/2	81	704	785	10	448	-	-
GFB 0110 T3 1000/1	339	513	852	15	30	8	160
GFB 0110 T3 1000/2	371	550	921	15	30	40	160
GFB 0144 T2 2000	85	857	942	55	655	-	-

**Extracted from RE 77 201/05.06**

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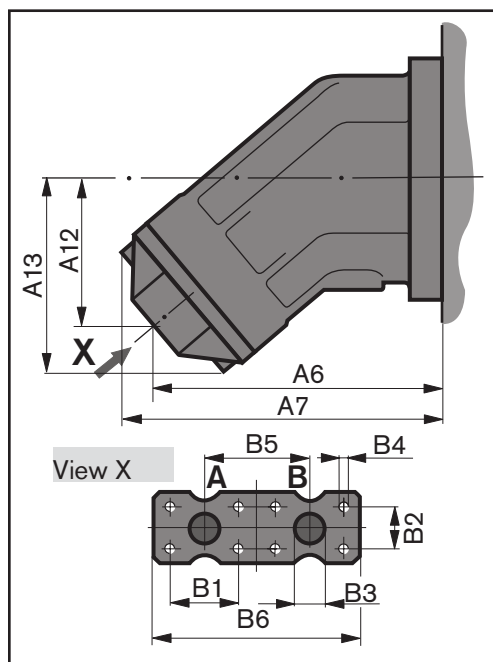


**Fixed-displacement Motor A2FE, Series 61**

Nominal Size	A6	A7	A12	A13	Mass (kg)
28	94	114	91	106	10.5
32	94	114	91	106	10.5
45	109	133	102	119	15
56	122	146	107	130	18
63	122	146	107	130	19
80	127	157	121	145	23
90	127	157	121	145	25
107	143	178	136	157	34
125	143	178	136	157	36

Nominal Size	B1	B2	B3	B4	B5	B6	B7	A / B
28 32	40.5	18.2	13	M8x15	59	115	40	SAE 1/2"
45	50.8	23.8	19	M10x17	75	147	49	SAE 3/4"
56 63	50.8	23.8	19	M10x17	75	147	49	SAE 3/4"
80 90	57.2	27.8	25	M12x17	84	166	60	SAE 1"
107 125	66.7	31.8	32	M14x19	99	194	70	SAE 1 1/4"

For further technical data see RE 91008



**Fixed-displacement Motor A2FM, Series 61 (Series 63)**

Nominal Size	A6	A7	A12	A13	Mass (kg)
28 32	153	173	78	106	9.5
45	166	194	89	122	13.5
56 63	182	206	96	130	18
80 90	203	233	104.5	145	23
125	225.5	252	120	159	32
180	252	294	134	188	45
200 <sup>1)</sup>	284	309	84	165	66

Nominal Size	B1	B2	B3	B4	B5	B6	A / B
28 32	40.5	18.2	13	M8x15	59	115	SAE 1/2"
45	50.8	23.8	19	M10x17	75	147	SAE 3/4"
56 63	50.8	23.8	19	M10x17	75	147	SAE 3/4"
80 90	57.2	27.8	25	M12x17	84	166	SAE 1"
125	66.7	31.8	32	M14X19	99	194	SAE 1 1/4"
180	66.7	31.8	32	M14x19	99	194	SAE 1 1/4"
200 <sup>1)</sup>	66.7	31.8	32	M14x19	99	204	SAE 1 1/4"

For further technical data see RE 91001



**Extracted from RE 77 201/05.06**

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See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.

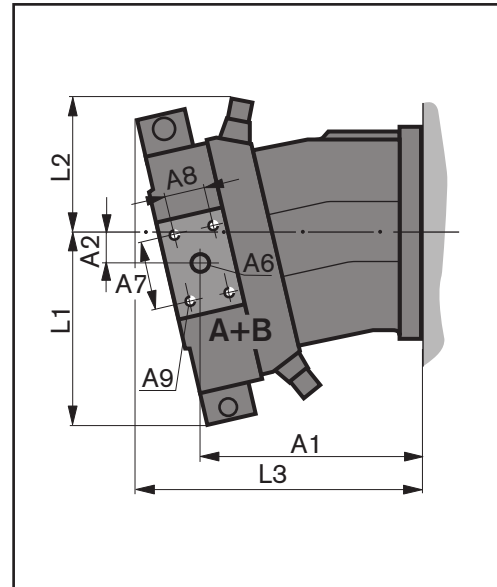
**Variable-displacement Motor A6VM, Series 63**

Nominal Size	A1	A2	L1 *	L2 *	L3 *	Mass (kg)
55	183	24	151	111	238	26
200	267	36	209	143	345	80

\* Dimensions vary depending on the displacement

Nominal Size	A6	A7	A8	A9	A / B
55	19	50.8	23.8	M10x1.5x17	SAE 3/4"
200	32	66.7	31.8	M14x2x19	SAE 1 1/4"

For further technical data see RE 91604



**Driver Groups and Service Time Categories to FEM, Section I, 3rd Edition 1987**

Service time category				T 2	T 3	T 4	T 5	T 6	T 7	T 8
Assumed average service time per day in hours				0.25 - 0.5	0.5 - 1	1 - 2	2 - 4	4 - 8	8 - 16	>16
Theoretic service life in hours				400 - 800	800 - 1600	1600 - 3200	3200 - 6300	6300 - 12500	12500 - 25000	25000 - 50000
Collective load class				Driver group with K factor						
Collective groups	L 1	low	Maximum loads occur only in exceptional cases; low loads are present at all times	M 1 0.90	M 2 0.90	M 3 0.90	M 4 0.90	M 5 0.95	M 6 1.05	M 7 1.2
	L 2	medium	Low, medium and high loads are present for roughly equal periods of times	M 2 0.90	M 3 0.95	M 4 0.95	M 5 1	M 6 1.15	M 7 1.30	M 8 1.50
	L 3	high	Loads are always near the maximum	M 3 1.05	M 4 1.05	M 5 1.10	M 6 1.25	M 7 1.40	M 8 1.60	M 8 1.80
	L 4	very high	Always maximum loads	M 4 1.25	M 5 1.30	M 6 1.45	M 7 1.65	M 8 1.85	M 8 2.10	M 8 2.40

## Section 15

# Seal Kits

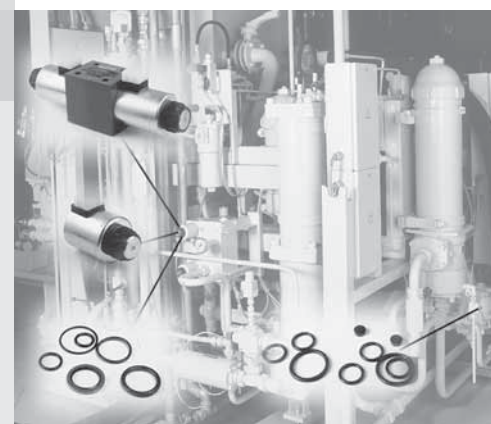
### The Drive & Control Company

- ISO Tie Rod Type Hydraulic Cylinders,  
CDT3 .....544
- NFPA Tie Rod Type Hydraulic Cylinders,  
CDT4 .....545
- Variable Displacement Vane Pumps,  
Model VPV .....546

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- ▶ Products and Solutions
  - ▶ Industrial Hydraulics
    - ▶ Products and Catalogs
    - ▶ Preferred Product Catalog



**Extracted from RE 17039/05.04**Page 1 of 1  
Issue: 06.04See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**ISO Tie Rod Type Hydraulic Cylinders****CDT3****CDT3 Seal Kits – Single Rod**

Piston Ø	Rod Ø	Mineral Oil Seals Seal Kit Part Number	
		"M"	List
25	12	R900874070	\$ 150.00
	18	R900874071	
32	14	R900874072	\$ 176.00
	22	R900874073	
40	18	R900874074	\$ 208.00
	28	R900874075	
50	22	R900874076	\$ 242.00
	36	R900874077	
63	28	R900874078	\$ 291.00
	45	R900874079	
80	36	R900874080	\$ 346.00
	56	R900874081	
100	45	R900874082	\$ 459.00
	70	R900874083	

**Extracted from RA 17041/06.04**

Page 1 of 1

Issue: 06.04

See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**NFPA Tie Rod Type Hydraulic Cylinders****CDT4****CDT4 Preferred Product Seal Kit and Cartridge Seal Kits****Piston and Tube Seal Kits\***

Bore Ø (Inches)	M	LIST PRICE
1.500	R978006830	\$ 40.00
2.000	R978006831	\$ 47.00
2.500	R978006832	\$ 49.00
3.250	R978006833	\$ 62.00
4.000	R978006834	\$ 84.00

**Rod Cartridge Seal Kits (w / Rod Bearing)<sup>†§</sup>**

Rod Ø (Inches)	M	LIST PRICE
0.625	R978006773	\$ 86.00
1.000 (1.500" bore)	R978006774	\$ 99.00
1.000 (2.000"-2.500" bore)	R978006775	\$ 109.00
1.375 (2.000" bore)	R978006776	\$ 124.00
1.375 (2.500"-3.250" bore)	R978006777	\$ 138.00
1.750	R978006778	\$ 145.00
2.000	R978006779	\$ 179.00

**Cushion Valve**

Bore Size	M	LIST PRICE
1-1/2", 2", 2-1/2"	R987053909	\$ 33.00
3-1/4", 4"	R978904325	\$ 38.00

**M** = Polyurethane seal system (standard)**NOTE:**

\* **Piston/Tube Seal Kits include:** one (1) double-acting piston seal;  
two (2) wear bands; two (2) o-rings and two (2) back-up rings

† **Rod Cartridge Seal Kits include:** one (1) double-lip wiper set;  
one (1) u-cup rod seal; one (1) rod  
bearing; one (1) back-up ring

**Extracted from 9 535 233 797/07.03**Page 1 of 1  
Issue: 06.04See Section 16 for applicable  
Preferred/Spotlight part numbers  
and unit price.**Variable Displacement Vane Pumps****Model VPV****VPV Repair Kits, Preferred**

R978711809	VPV25/32 SAE PUMP REP KIT 210	\$ 1026.00
R978711812	VPV16 SAE PUMP REPAIR KIT 210	\$ 777.30
R978711814	VPV16 SAE COMBO PUMP KIT 210	\$ 848.20
R978711825	VPV25/32 SAE REP KIT P1 210BAR	\$ 1,070.50
R978711838	KIT REPAIR VPV45/63 210BAR SAE	\$ 1,268.40
R978711840	VPV80 SAE 210 BAR REPAIR KIT	\$ 1,903.10
R978711841	KIT REPAIR VPV45/63 210BAR SAE/P1	\$ 1,531.00
R978711842	KIT P1 VPV80 210 BAR PUMP REP.	\$ 2,300.00
R978711849	KIT REPAIR VPV100/130 210BAR SAE	\$ 2,537.00
R978711850	KIT REPAIR VPV164 210BAR SAE	\$ 2,883.30
R978711851	KIT REPAIR VPV100/130 210BAR SAE/P1	\$ 2,775.20
R978711852	KIT REPAIR VPV164 210BAR SAE/P1	\$ 3,302.25

**VPV Seal Kits, Preferred**

9511230605	VPV16 PUMP ORING KIT 210 BAR	\$ 139.00
9511230597	VPV25/32 ORING KIT ISO/SAE	\$ 161.80
9511230658	SEAL KIT VPV45/80 SAE/ISO-210	\$ 198.50
951123065	SEAL KIT VPV130/164SAE/ISO-210	\$ 222.50

# Section 16

## Preferred & Spotlight Delivery Programs Section



## **Important Notice**

Specifications, descriptive materials, illustrations, and prices contained herein were accurate as shown at the time this publication was approved for printing.

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The specified data is for product description purposes only and must not be interpreted as warranted characteristics in a legal sense.

Contact your local distributor or Bosch Rexroth Corporation, Industrial Hydraulics Division, for verification of all critical specifications:

Bosch Rexroth Corporation  
2315 City Line Road  
Bethlehem, PA 18017-213  
(610) 694-8300



**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
0513850216	0513R18C3VPV100SM21HYB04	S	121226901	2 WKS	\$3,735.00		25
0513850214	0513R18C3VPV100SM21HYB04P1	S	121226901	2 WKS	\$4,250.00		25
0513860250	0513R18C3VPV130SM21HYB04	S	121226931	2 WKS	\$4,362.00		25
0513860258	0513R18C3VPV130SM21HYB04P1	S	121226931	2 WKS	\$4,913.00		25
0513870226	0513R18C3VPV164SM21HYB04	S	121226961	2 WKS	\$5,331.00		25
0513300212	0513R18C3VPV16SM21HYB03	S	121226161	2 WKS	\$1,122.00		25
0513300246	0513R18C3VPV16SM21HYB03P1	S	121226161	2 WKS	\$1,486.00		25
0513400212	0513R18C3VPV25SM21HYB03	S	121226251	2 WKS	\$1,354.00		25
0513400248	0513R18C3VPV25SM21HYB03P1	P	121226251	4 WKS	\$1,717.00		25
0513500220	0513R18C3VPV32SM21HYB03	S	121226321	2 WKS	\$1,442.00		25
0513500254	0513R18C3VPV32SM21HYB03P1	S	121226321	2 WKS	\$1,809.00		25
0513600214	0513R18C3VPV45SM21HYB05	S	121226451	2 WKS	\$2,113.00		25
0513600234	0513R18C3VPV45SM21HYB05P1	S	121226451	2 WKS	\$2,538.00		25
0513700218	0513R18C3VPV63SM21HYB05	S	121226631	2 WKS	\$2,266.00		25
0513700242	0513R18C3VPV63SM21HYB05P1	S	121226631	2 WKS	\$2,707.00		25
0513800248	0513R18C3VPV80SM21HYB05	S	121226801	2 WKS	\$2,544.00		25
0513800238	0513R18C3VPV80SM21HYB05P1	S	121226801	2 WKS	\$2,921.00		25
R900424887	2FRM10-3X/10L	S	111432103	2 WKS	\$517.00		271
R900427774	2FRM10-3X/10LV	P	111432103	4 WKS	\$568.00		271
R900423251	2FRM10-3X/16L	P	111432103	4 WKS	\$517.00		271
R900423252	2FRM10-3X/16LB	P	111432103	4 WKS	\$521.00		271
R900423255	2FRM10-3X/25L	S	111432103	2 WKS	\$517.00		271
R900423256	2FRM10-3X/25LB	P	111432103	4 WKS	\$521.00		271
R900427523	2FRM10-3X/25LV	P	111432103	4 WKS	\$568.00		271
R900420286	2FRM10-3X/50L	S	111432103	2 WKS	\$517.00		271
R900423261	2FRM10-3X/50LB	P	111432103	4 WKS	\$521.00		271
R900427776	2FRM10-3X/50LV	S	111432103	2 WKS	\$568.00		271
R900424905	2FRM16-3X/100L	S	111432163	2 WKS	\$765.00		271
R900420287	2FRM16-3X/100LB	P	111432163	4 WKS	\$770.00		271
R900429596	2FRM16-3X/100LV	P	111432163	4 WKS	\$842.00		271
R900424906	2FRM16-3X/160L	S	111432163	2 WKS	\$765.00		271
R900424902	2FRM16-3X/160LB	P	111432163	4 WKS	\$770.00		271
R900427777	2FRM16-3X/160LV	P	111432163	4 WKS	\$842.00		271
R900423271	2FRM16-3X/60L	P	111432163	4 WKS	\$765.00		271
R900424904	2FRM16-3X/60LV	P	111432163	4 WKS	\$842.00		271
R900205507	2FRM6B36-3X/1.5QRV	P	111432063	4 WKS	\$516.00		273
R900205509	2FRM6B36-3X/10QRV	S	111432063	2 WKS	\$516.00		273
R900205510	2FRM6B36-3X/16QMV	S	111432063	2 WKS	\$511.00		273
R900205511	2FRM6B36-3X/16QRV	P	111432063	4 WKS	\$516.00		273
R900205513	2FRM6B36-3X/25QRV	P	111432063	4 WKS	\$516.00		273
R900205517	2FRM6B36-3X/3QRV	P	111432063	4 WKS	\$516.00		273
R900209927	2FRM6B76-3X/10QRV	P	111432063	4 WKS	\$503.00		273
R900205526	2FRM6B76-3X/32QRV	P	111432063	4 WKS	\$503.00		273
R900205528	2FRM6B76-3X/6QRV	P	111432063	4 WKS	\$503.00		273
R900955887	3DREPE6C-2X/25EG24N9K4/M	P	112233062	4 WKS	\$986.00		352
R900925526	3DREPE6A-2X/25EG24N9K31/A1V	P	112233062	4 WKS	\$1,522.00		352
R900925484	3DREPE6C-2X/25EG24N9K31/A1V	P	112233062	4 WKS	\$1,798.00		352
R900958848	3DREPE6C-2X/25EG24N9K31/F1M	P	112233062	4 WKS	\$1,593.00		352
R900592014	3WE10A3X/CG24N9K4	P	111131103	4 WKS	\$318.00		164
R978908487	3WE10A4X/CW110N9DA	P	111131104	4 WKS	\$308.00		164
R978017740	3WE6A6X/EG24N9K4/62	P	111131066	4 WKS	\$177.00		162
R978878347	3WE6A6X/EW110N9DA/62	P	111131066	4 WKS	\$181.00		162
R978017790	3WE6A6X/EW110N9K4/62	P	111131066	4 WKS	\$177.00		162
R978017859	3WE6A6X/EW110N9K4/62=CSA	P	111131066	4 WKS	\$177.00		162



## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978017741	3WE6A6X/EW230N9K4/62	P	111131066	4 WKS	\$177.00		162
R978017816	3WE6B6X/EG96N9K4/62	P	111131066	4 WKS	\$188.00		162
R978017781	3WE6B6X/EW110N9DAL/62	P	111131066	4 WKS	\$197.00		162
R978015854	3WE6B6X/EW110RN9DAL/62	P	111131066	4 WKS	\$233.00		162
R978017743	3WE6B6X/EW230N9K4/62	P	111131066	4 WKS	\$177.00		162
08351544	4TH6E06-1X/VT03/M05	P	852146401	4 WKS	\$647.00		188
08351127	4TH6E06-1X/VT23/M05 (RIGHT HAND)	P	852146401	4 WKS	\$647.00		188
08350011	4TH6E06-1X/VT43/M05 (LEFT HAND)	P	852146401	4 WKS	\$647.00		188
R900593277	4WE10C3X/CG24N9K4	S	111131103	2 WKS	\$318.00		164
R900706674	4WE10C3X/CG24N9K4=CSA	S	111131103	2 WKS	\$318.00		164
R900906473	4WE10C3X/CW110N9K4	S	111131103	2 WKS	\$281.00		164
R900500925	4WE10C3X/OFCG24N9K4	P	111131103	4 WKS	\$486.00		164
R900562032	4WE10C3X/OFCW110N9K4	P	111131103	4 WKS	\$417.00		164
R978908877	4WE10C4X/CG24N9DA	S	111131104	2 WKS	\$344.00		164
R978908965	4WE10C4X/CG24N9DK25L	P	111131104	4 WKS	\$399.00		164
R978908696	4WE10C4X/CW110N9DA	S	111131104	2 WKS	\$308.00		164
R900734198	4WE10C4X/CW110N9DAL	P	111131104	4 WKS	\$315.00		164
R978909736	4WE10C4X/OFCW110N9DA	P	111131104	4 WKS	\$449.00		164
R900922999	4WE10D3X/CG12N9K4	P	111131103	4 WKS	\$318.00		164
R900589933	4WE10D3X/CG24N9K4	S	111131103	2 WKS	\$318.00		164
R900958087	4WE10D3X/CG24N9K4=CSA	S	111131103	2 WKS	\$318.00		164
R900598925	4WE10D3X/CW110N9K4	S	111131103	2 WKS	\$281.00		164
R900942175	4WE10D3X/CW110N9K4=CSA	S	111131103	2 WKS	\$281.00		164
R900591664	4WE10D3X/OFCG24N9K4	S	111131103	2 WKS	\$486.00		164
R900957770	4WE10D3X/OFCG24N9K4=CSA	P	111131103	4 WKS	\$486.00		164
R900594948	4WE10D3X/OFCW110N9K4	S	111131103	2 WKS	\$417.00		164
R900943503	4WE10D3X/OFCW110N9K4=CSA	S	111131103	2 WKS	\$417.00		164
R978908826	4WE10D4X/CG12N9DA	S	111131104	2 WKS	\$344.00		164
R978908490	4WE10D4X/CG24N9DA	S	111131104	2 WKS	\$344.00		164
R978908419	4WE10D4X/CG24N9DAL	P	111131104	4 WKS	\$353.00		164
R978908769	4WE10D4X/CG24N9DK24L2	P	111131104	4 WKS	\$390.00		164
R978908566	4WE10D4X/CW110N9DA	S	111131104	2 WKS	\$308.00		164
R900713654	4WE10D4X/CW110N9DAL	S	111131104	2 WKS	\$315.00		164
R900617543	4WE10D4X/CW110N9DAL=CSA	S	111131104	2 WKS	\$315.00		164
R978908770	4WE10D4X/OFCG24N9DK24L2	P	111131104	4 WKS	\$564.00		164
R978908591	4WE10D4X/OFCW110N9DAL	S	111131104	2 WKS	\$464.00		164
R900245920	4WE10D4X/OFCW110N9DAL=CSA	P	111131104	4 WKS	\$464.00		164
R978909383	4WE10D4X/OFCW110N9DK25L	P	111131104	4 WKS	\$503.00		164
R900945576	4WE10E3X/CG12N9K4	S	111131103	2 WKS	\$450.00		164
R900712119	4WE10E3X/CG12N9K4=CSA	S	111131103	2 WKS	\$450.00		164
R900588201	4WE10E3X/CG24N9K4	S	111131103	2 WKS	\$450.00		164
R900934305	4WE10E3X/CG24N9K4=CSA	S	111131103	2 WKS	\$450.00		164
R900597186	4WE10E3X/CW110N9K4	S	111131103	2 WKS	\$380.00		164
R900934306	4WE10E3X/CW110N9K4=CSA	P	111131103	4 WKS	\$380.00		164
R900594348	4WE10E3X/CW230N9K4	P	111131103	4 WKS	\$380.00		164
R978907461	4WE10E4X/CG12N9DA	S	111131104	2 WKS	\$480.00		164
R978908742	4WE10E4X/CG24N9DA	P	111131104	4 WKS	\$480.00		164
R978909385	4WE10E4X/CG24N9DAL	P	111131104	4 WKS	\$498.00		164
R978909871	4WE10E4X/CG24N9DK24L2	P	111131104	4 WKS	\$526.00		164
R978908567	4WE10E4X/CW110N9DA	S	111131104	2 WKS	\$413.00		164
R900979378	4WE10E4X/CW110N9DAL	S	111131104	2 WKS	\$428.00		164
R900700430	4WE10E4X/CW110N9DAL=CSA	S	111131104	2 WKS	\$428.00		164
R900974964	4WE10E4X/CW110N9DK25L	P	111131104	4 WKS	\$466.00		164
R900595532	4WE10EA3X/CG24N9K4	P	111131103	4 WKS	\$318.00		164

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R900704311	4WE10EA3X/CW110N9K4=CSA	P	111131103	4 WKS	\$281.00		164
R978908810	4WE10EA4X/CW110N9DAL	P	111131104	4 WKS	\$315.00		164
R978909018	4WE10EB3X/CG12N9K4CSA	P	111131103	4 WKS	\$318.00		164
R900977203	4WE10EB4X/CW110N9DK25L	P	111131104	4 WKS	\$363.00		164
R978906366	4WE10G3X/CG12N9K4CSA	P	111131103	4 WKS	\$478.00		164
R900594277	4WE10G3X/CG24N9K4	S	111131103	2 WKS	\$478.00		164
R900712708	4WE10G3X/CG24N9K4=CSA	P	111131103	4 WKS	\$478.00		164
R900506008	4WE10G3X/CG96N9K4	P	111131103	4 WKS	\$576.00		164
R900536428	4WE10G3X/CW110N9K4	S	111131103	2 WKS	\$407.00		164
R900246791	4WE10G3X/CW110N9K4=CSA	P	111131103	4 WKS	\$407.00		164
R978908592	4WE10G4X/CG12N9DA	S	111131104	2 WKS	\$510.00		164
R978909069	4WE10G4X/CG12N9DAL	P	111131104	4 WKS	\$526.00		164
R978908907	4WE10G4X/CG24N9DA	P	111131104	4 WKS	\$510.00		164
R978909405	4WE10G4X/CG24N9DAL	P	111131104	4 WKS	\$526.00		164
R900745485	4WE10G4X/CG24N9DAL=CSA	P	111131104	4 WKS	\$526.00		164
R978909554	4WE10G4X/CG24N9DK25L	P	111131104	4 WKS	\$565.00		164
R978908695	4WE10G4X/CW110N9DA	S	111131104	2 WKS	\$437.00		164
R978908815	4WE10G4X/CW110N9DAL	S	111131104	2 WKS	\$454.00		164
R978913287	4WE10G73-3X/CG12N9K4/A12	P	111131103	4 WKS	\$625.00		168
R900940459	4WE10G73-3X/CG96N9K4/A12	P	111131103	4 WKS	\$747.00		164
R900597986	4WE10H3X/CG24N9K4	S	111131103	2 WKS	\$450.00		164
R900934307	4WE10H3X/CG24N9K4=CSA	P	111131103	4 WKS	\$450.00		164
R900517315	4WE10H3X/CW110N9K4	S	111131103	2 WKS	\$380.00		164
R978909608	4WE10H4X/CG12N9DA	P	111131104	4 WKS	\$480.00		164
R978908593	4WE10H4X/CW110N9DA	S	111131104	2 WKS	\$413.00		164
R978909071	4WE10H4X/CW110N9DAL	P	111131104	4 WKS	\$428.00		164
R900961221	4WE10H73-3X/CG96N9K4/A12	P	111131103	4 WKS	\$711.00		168
R900598662	4WE10HA3X/CG24N9K4	P	111131103	4 WKS	\$318.00		164
R900930080	4WE10J3X/CG12N9K4	S	111131103	2 WKS	\$450.00		164
R900589988	4WE10J3X/CG24N9K4	S	111131103	2 WKS	\$450.00		164
R900957006	4WE10J3X/CG24N9K4=CSA	P	111131103	4 WKS	\$450.00		164
R900556235	4WE10J3X/CG96N9K4	P	111131103	4 WKS	\$548.00		164
R978908904	4WE10J3X/CG96N9K4/A12CSA	P	111131103	4 WKS	\$577.00		168
R900592338	4WE10J3X/CW110N9K4	S	111131103	2 WKS	\$380.00		164
R900940565	4WE10J3X/CW110N9K4=CSA	P	111131103	4 WKS	\$380.00		164
R978909072	4WE10J4X/CG24N9DA	P	111131104	4 WKS	\$480.00		164
R900732331	4WE10J4X/CG24N9DAL	S	111131104	2 WKS	\$498.00		164
R900616837	4WE10J4X/CG24N9DAL=CSA	P	111131104	4 WKS	\$498.00		164
R900961324	4WE10J4X/CG24N9DK24L	P	111131104	4 WKS	\$526.00		164
R978908771	4WE10J4X/CG24N9DK24L2	P	111131104	4 WKS	\$526.00		164
R900977484	4WE10J4X/CG24N9DK25L	P	111131104	4 WKS	\$537.00		164
R978908568	4WE10J4X/CW110N9DA	S	111131104	2 WKS	\$413.00		164
R900708880	4WE10J4X/CW110N9DAL	S	111131104	2 WKS	\$428.00		164
R900619145	4WE10J4X/CW110N9DAL=CSA	P	111131104	4 WKS	\$428.00		164
R900963610	4WE10J4X/CW110N9DK25L	P	111131104	4 WKS	\$466.00		164
R900560858	4WE10J73-3X/CG24N9K4/A12	P	111131103	4 WKS	\$590.00		168
R900914044	4WE10J73-3X/CG96N9K4/A12	P	111131103	4 WKS	\$711.00		168
R900591095	4WE10JA3X/CG24N9K4	P	111131103	4 WKS	\$318.00		164
R978909598	4WE10JA3X/CG24N9K4CSA	P	111131103	4 WKS	\$318.00		164
R900522760	4WE10JB3X/CG24N9K4	P	111131103	4 WKS	\$318.00		164
R978901350	4WE10JB3X/CG24N9K4CSA	P	111131103	4 WKS	\$318.00		164
R978909287	4WE10JB4X/CG24N9DA	P	111131104	4 WKS	\$344.00		164
R900500932	4WE10M3X/CG24N9K4	P	111131103	4 WKS	\$450.00		164
R900961858	4WE10M4X/CW110N9DAL	P	111131104	4 WKS	\$428.00		164

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978909691	4WE10M4X/CW110N9DALCSA	P	111131104	4 WKS	\$428.00		164
R900934309	4WE10W3X/CG24N9K4=CSA	P	111131103	4 WKS	\$380.00		164
R978908963	4WE10W4X/CW110N9DAL	P	111131104	4 WKS	\$428.00		164
R900702475	4WE10Y3X/CG12N9K4=CSA	P	111131103	4 WKS	\$318.00		164
R900595531	4WE10Y3X/CG24N9K4	P	111131103	4 WKS	\$318.00		164
R978908802	4WE10Y4X/CG24N9DK24L	P	111131104	4 WKS	\$390.00		164
R978878229	4WE6C6X/EG24N9DA/62	P	111131066	4 WKS	\$181.00		162
R978017853	4WE6C6X/EG24N9DAL/62	S	111131066	2 WKS	\$197.00		162
R978017836	4WE6C6X/EG24N9DK24L/62	P	111131066	4 WKS	\$244.00		162
R978017805	4WE6C6X/EG24N9DK25L/62	P	111131066	4 WKS	\$254.00		162
R978017744	4WE6C6X/EG24N9K4/62	S	111131066	2 WKS	\$177.00		162
R978017849	4WE6C6X/EG24N9K4/62=CSA	S	111131066	2 WKS	\$177.00		162
R978017829	4WE6C6X/EG96N9K4/62	P	111131066	4 WKS	\$188.00		162
R978874587	4WE6C6X/EW110N9DA/62	S	111131066	2 WKS	\$181.00		162
R978874588	4WE6C6X/EW110N9DAL/62	S	111131066	2 WKS	\$197.00		162
R978898150	4WE6C6X/EW110N9DK23/62	P	111131066	4 WKS	\$214.00		162
R978875821	4WE6C6X/EW110N9DK23L/62	P	111131066	4 WKS	\$226.00		162
R900901748	4WE6C6X/EW110N9K4	S	111131066	2 WKS	\$177.00		162
R978017780	4WE6C6X/EW110N9K4/62	P	111131066	4 WKS	\$177.00		162
R978017774	4WE6C6X/EW110N9K4/62=CSA	P	111131066	4 WKS	\$177.00		162
R978017811	4WE6C6X/OEG24N9K4/62	P	111131066	4 WKS	\$212.00		162
R978017773	4WE6C6X/OFEG24N9DAL/62	P	111131066	4 WKS	\$279.00		162
R978017835	4WE6C6X/OFEG24N9DK24L/62	P	111131066	4 WKS	\$306.00		162
R978017758	4WE6C6X/OFEG24N9K4/62	P	111131066	4 WKS	\$237.00		162
R978875037	4WE6C6X/OFEW110N9DA/62	P	111131066	4 WKS	\$246.00		162
R978878237	4WE6D6X/EG12N9DA/62	S	111131066	2 WKS	\$181.00		162
R978878238	4WE6D6X/EG12N9DAL/62	P	111131066	4 WKS	\$197.00		162
R978017812	4WE6D6X/EG12N9K4/62	P	111131066	4 WKS	\$177.00		162
R978905132	4WE6D6X/EG12N9K4/62CSA	P	111131066	4 WKS	\$177.00		162
R978878241	4WE6D6X/EG24N9DA/62	S	111131066	2 WKS	\$181.00		162
R978017732	4WE6D6X/EG24N9DAL/62	P	111131066	4 WKS	\$197.00		162
R978017862	4WE6D6X/EG24N9DAL/62=CSA	S	111131066	2 WKS	\$197.00		162
R978890387	4WE6D6X/EG24N9DK23/62	P	111131066	4 WKS	\$214.00		162
R978890969	4WE6D6X/EG24N9DK23L/62	P	111131066	4 WKS	\$226.00		162
R978017806	4WE6D6X/EG24N9DK24L/62	P	111131066	4 WKS	\$244.00		162
R978896201	4WE6D6X/EG24N9DK24L2/62	P	111131066	4 WKS	\$244.00		162
R978017769	4WE6D6X/EG24N9DK25L/62	P	111131066	4 WKS	\$254.00		162
R978017922	4WE6D6X/EG24N9K4/62	S	111131066	2 WKS	\$177.00		162
R978017825	4WE6D6X/EG24N9K4/62=CSA	S	111131066	2 WKS	\$177.00		162
R900931341	4WE6D6X/EG24N9K4=CSA	S	111131066	2 WKS	\$177.00		162
R978874053	4WE6D6X/EW110N9DA/62	S	111131066	2 WKS	\$181.00		162
R978017739	4WE6D6X/EW110N9DAL/62	S	111131066	2 WKS	\$197.00		162
R978017775	4WE6D6X/EW110N9DAL/62=CSA	S	111131066	2 WKS	\$197.00		162
R978879237	4WE6D6X/EW110N9DK23/62	P	111131066	4 WKS	\$214.00		162
R978879456	4WE6D6X/EW110N9DK23L/62	P	111131066	4 WKS	\$226.00		162
R978017792	4WE6D6X/EW110N9DK25L/62	P	111131066	4 WKS	\$254.00		162
R978017734	4WE6D6X/EW110N9K4/62	S	111131066	2 WKS	\$177.00		162
R978017841	4WE6D6X/EW110N9K4/62=CSA	S	111131066	2 WKS	\$177.00		162
R978017095	4WE6D6X/EW230N9DA/62	P	111131066	4 WKS	\$213.00		162
R978017839	4WE6D6X/EW230N9DAL/62	P	111131066	4 WKS	\$197.00		162
R978017766	4WE6D6X/OEG24N9K4/62	P	111131066	4 WKS	\$212.00		162
R978874049	4WE6D6X/OEW110N9DA/62	P	111131066	4 WKS	\$222.00		162
R978017838	4WE6D6X/OEW110N9K4/62	P	111131066	4 WKS	\$212.00		162
R978890292	4WE6D6X/OFEG12N9DA/62	P	111131066	4 WKS	\$246.00		162

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978017819	4WE6D6X/OFEG12N9K4/62	P	111131066	4 WKS	\$237.00		162
R978892546	4WE6D6X/OFEG24N9DA/62	S	111131066	2 WKS	\$246.00		162
R978017871	4WE6D6X/OFEG24N9DAL/62	P	111131066	4 WKS	\$279.00		162
R978017861	4WE6D6X/OFEG24N9DAL/62=CSA	S	111131066	2 WKS	\$279.00		162
R978017770	4WE6D6X/OFEG24N9DK24L/62	P	111131066	4 WKS	\$306.00		162
R978896205	4WE6D6X/OFEG24N9DK24L2/62	P	111131066	4 WKS	\$306.00		162
R978017763	4WE6D6X/OFEG24N9K4/62	S	111131066	2 WKS	\$237.00		162
R978017826	4WE6D6X/OFEG24N9K4/62=CSA	S	111131066	2 WKS	\$237.00		162
R978017788	4WE6D6X/OFEG96N9K4/62	P	111131066	4 WKS	\$260.00		162
R978873230	4WE6D6X/OFEW110N9DA/62	S	111131066	2 WKS	\$246.00		162
R978017810	4WE6D6X/OFEW110N9DAL/62	S	111131066	2 WKS	\$279.00		162
R978017778	4WE6D6X/OFEW110N9DAL/62=CSA	S	111131066	2 WKS	\$279.00		162
R978017850	4WE6D6X/OFEW110N9DK25L/62	P	111131066	4 WKS	\$314.00		162
R978017735	4WE6D6X/OFEW110N9K4/62	P	111131066	4 WKS	\$237.00		162
R978017845	4WE6D6X/OFEW110N9K4/62=CSA	S	111131066	2 WKS	\$237.00		162
R978913038	4WE6D73-6X/EG12N9DA/A12/62	P	111131066	4 WKS	\$235.00		168
R978017827	4WE6D73-6X/EG12N9K4/A12/62	P	111131066	4 WKS	\$229.00		162
R978017844	4WE6D73-6X/EG96N9K4/A12/62	P	111131066	4 WKS	\$242.00		162
R978017759	4WE6D73-6X/OFEG24N9K4/A12/62	P	111131066	4 WKS	\$318.00		162
R978878249	4WE6E6X/EG12N9DA/62	S	111131066	2 WKS	\$222.00		162
R978878250	4WE6E6X/EG12N9DAL/62	S	111131066	2 WKS	\$253.00		162
R978017783	4WE6E6X/EG12N9K4/62	S	111131066	2 WKS	\$212.00		162
R978905130	4WE6E6X/EG12N9K4/62CSA	S	111131066	2 WKS	\$212.00		162
R978878253	4WE6E6X/EG24N9DA/62	S	111131066	2 WKS	\$222.00		162
R978017870	4WE6E6X/EG24N9DAL/62	P	111131066	4 WKS	\$253.00		162
R978017809	4WE6E6X/EG24N9DK24L/62	P	111131066	4 WKS	\$280.00		162
R978896208	4WE6E6X/EG24N9DK24L2/62	P	111131066	4 WKS	\$280.00		162
R978017772	4WE6E6X/EG24N9DK25L/62	P	111131066	4 WKS	\$288.00		162
R978017750	4WE6E6X/EG24N9K4/62	S	111131066	2 WKS	\$212.00		162
R978017860	4WE6E6X/EG24N9K4/62=CSA	S	111131066	2 WKS	\$212.00		162
R978017789	4WE6E6X/EG96N9K4/62	P	111131066	4 WKS	\$234.00		162
R978875049	4WE6E6X/EW110N9DA/62	S	111131066	2 WKS	\$222.00		162
R978873115	4WE6E6X/EW110N9DAL/62	S	111131066	2 WKS	\$253.00		162
R978017851	4WE6E6X/EW110N9DAL/62=CSA	S	111131066	2 WKS	\$253.00		162
R978878115	4WE6E6X/EW110N9DK25/62	P	111131066	4 WKS	\$258.00		162
R978017821	4WE6E6X/EW110N9DK25L/62	P	111131066	4 WKS	\$288.00		162
R978017737	4WE6E6X/EW110N9K4/62	S	111131066	2 WKS	\$212.00		162
R978017842	4WE6E6X/EW110N9K4/62=CSA	S	111131066	2 WKS	\$212.00		162
R978017100	4WE6E6X/EW230N9DA/62	P	111131066	4 WKS	\$233.00		162
R978017866	4WE6E6X/EW230N9DAL/62	P	111131066	4 WKS	\$253.00		162
R978017751	4WE6E6X/EW230N9K4/62	P	111131066	4 WKS	\$212.00		162
R900922472	4WE6E73-6X/EG12N9K4/A12	P	111131066	4 WKS	\$286.00		168
R978017818	4WE6E73-6X/EG12N9K4/A12/62	P	111131066	4 WKS	\$286.00		162
R978895476	4WE6E73-6X/EG24N9DA/A12/62	P	111131066	4 WKS	\$297.00		168
R978017760	4WE6E73-6X/EG24N9K4/A12/62	P	111131066	4 WKS	\$286.00		162
R978017832	4WE6E73-6X/EG96N9K4/A12/62	P	111131066	4 WKS	\$314.00		162
R978017752	4WE6EA6X/EG24N9K4/62	P	111131066	4 WKS	\$177.00		162
R978017796	4WE6EA6X/EW110N9K4/62	P	111131066	4 WKS	\$177.00		162
R978878257	4WE6G6X/EG12N9DA/62	S	111131066	2 WKS	\$222.00		162
R978017779	4WE6G6X/EG12N9DAL/62	S	111131066	2 WKS	\$253.00		162
R978017762	4WE6G6X/EG12N9K4/62	S	111131066	2 WKS	\$212.00		162
R978908129	4WE6G6X/EG12N9K4/62CSA	P	111131066	4 WKS	\$212.00		162
R978878261	4WE6G6X/EG24N9DA/62	S	111131066	2 WKS	\$222.00		162
R978017731	4WE6G6X/EG24N9DAL/62	S	111131066	2 WKS	\$253.00		162

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978017869	4WE6G6X/EG24N9DK25L/62	P	111131066	4 WKS	\$288.00		162
R978017753	4WE6G6X/EG24N9K4/62	S	111131066	2 WKS	\$212.00		162
R978906689	4WE6G6X/EG24N9K4/62CSA	S	111131066	2 WKS	\$212.00		162
R978017840	4WE6G6X/EG96N9K4/62	P	111131066	4 WKS	\$234.00		162
R978872815	4WE6G6X/EW110N9DA/62	S	111131066	2 WKS	\$222.00		162
R978875060	4WE6G6X/EW110N9DAL/62	S	111131066	2 WKS	\$253.00		162
R900558642	4WE6G6X/EW110N9K4	S	111131066	2 WKS	\$202.00		162
R978017738	4WE6G6X/EW110N9K4/62	S	111131066	2 WKS	\$212.00		162
R978017852	4WE6G6X/EW110N9K4/62=CSA	S	111131066	2 WKS	\$212.00		162
R978017099	4WE6G6X/EW230N9DA/62	P	111131066	4 WKS	\$213.00		162
R978900337	4WE6G73-6X/EG12N9DA/A12/62	P	111131066	4 WKS	\$297.00		168
R978017867	4WE6G73-6X/EG12N9K4/A12/62	P	111131066	4 WKS	\$286.00		162
R978017765	4WE6G73-6X/EG24N9K4/A12/62	P	111131066	4 WKS	\$286.00		162
R978911412	4WE6G73-6X/EG96N9K4/62	P	111131066	4 WKS	\$287.00		168
R978914146	4WE6G73-6X/EW110RN9DAL/A12/62	P	111131066	4 WKS	\$428.00		168
R978878265	4WE6H6X/EG12N9DA/62	S	111131066	2 WKS	\$222.00		162
R978878266	4WE6H6X/EG12N9DAL/62	P	111131066	4 WKS	\$253.00		162
R978017782	4WE6H6X/EG12N9K4/62	S	111131066	2 WKS	\$212.00		162
R978907962	4WE6H6X/EG12N9K4/62CSA	S	111131066	2 WKS	\$212.00		162
R978017803	4WE6H6X/EG24N9DAL/62	P	111131066	4 WKS	\$253.00		162
R978017786	4WE6H6X/EG24N9DK25L/62	P	111131066	4 WKS	\$288.00		162
R978017754	4WE6H6X/EG24N9K4/62	P	111131066	4 WKS	\$212.00		162
R978017828	4WE6H6X/EG24N9K4/62=CSA	S	111131066	2 WKS	\$212.00		162
R978017801	4WE6H6X/EG96N9K4/62	P	111131066	4 WKS	\$234.00		162
R978875071	4WE6H6X/EW110N9DA/62	S	111131066	2 WKS	\$222.00		162
R978875072	4WE6H6X/EW110N9DAL/62	S	111131066	2 WKS	\$253.00		162
R978017730	4WE6H6X/EW110N9DK25L/62	P	111131066	4 WKS	\$288.00		162
R978017797	4WE6H6X/EW110N9K4/62	P	111131066	4 WKS	\$212.00		162
R978905734	4WE6H6X/EW110N9K4/62CSA	S	111131066	2 WKS	\$212.00		162
R978017793	4WE6H73-6X/EG24N9K4/A12/62	P	111131066	4 WKS	\$286.00		162
R978017817	4WE6H73-6X/EG96N9K4/A12/62	P	111131066	4 WKS	\$314.00		162
R978878274	4WE6J6X/EG12N9DA/62	S	111131066	2 WKS	\$222.00		162
R978878275	4WE6J6X/EG12N9DAL/62	S	111131066	2 WKS	\$253.00		162
R978017784	4WE6J6X/EG12N9DK25L/62	P	111131066	4 WKS	\$288.00		162
R978017761	4WE6J6X/EG12N9K4/62	S	111131066	2 WKS	\$212.00		162
R978905419	4WE6J6X/EG12N9K4/62CSA	S	111131066	2 WKS	\$212.00		162
R978878278	4WE6J6X/EG24N9DA/62	S	111131066	2 WKS	\$222.00		162
R978017815	4WE6J6X/EG24N9DAL/62	P	111131066	4 WKS	\$253.00		162
R978017863	4WE6J6X/EG24N9DAL/62=CSA	S	111131066	2 WKS	\$253.00		162
R978017807	4WE6J6X/EG24N9DK24L/62	P	111131066	4 WKS	\$280.00		162
R978896206	4WE6J6X/EG24N9DK24L2/62	P	111131066	4 WKS	\$280.00		162
R978890882	4WE6J6X/EG24N9DK25/62	P	111131066	4 WKS	\$258.00		162
R978017767	4WE6J6X/EG24N9DK25L/62	P	111131066	4 WKS	\$288.00		162
R978017776	4WE6J6X/EG24N9DK25L/62=CSA	P	111131066	4 WKS	\$288.00		162
R978017756	4WE6J6X/EG24N9K4/62	S	111131066	2 WKS	\$212.00		162
R978017824	4WE6J6X/EG24N9K4/62=CSA	S	111131066	2 WKS	\$212.00		162
R978017802	4WE6J6X/EG96N9K4/62	P	111131066	4 WKS	\$234.00		162
R978874065	4WE6J6X/EW110N9DA/62	S	111131066	2 WKS	\$222.00		162
R978017736	4WE6J6X/EW110N9DAL/62	S	111131066	2 WKS	\$253.00		162
R978017820	4WE6J6X/EW110N9DAL/62=CSA	S	111131066	2 WKS	\$253.00		162
R978017785	4WE6J6X/EW110N9DK25L/62	P	111131066	4 WKS	\$288.00		162
R978017733	4WE6J6X/EW110N9K4/62	S	111131066	2 WKS	\$212.00		162
R978017813	4WE6J6X/EW110N9K4/62=CSA	S	111131066	2 WKS	\$212.00		162
R978017096	4WE6J6X/EW230N9DA/62	P	111131066	4 WKS	\$213.00		162



**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978917541	4WE6J73-6X/EG12N9DA/A12/62	P	111131066	4 WKS	\$297.00		168
R978017847	4WE6J73-6X/EG12N9K4/A12/62	P	111131066	4 WKS	\$286.00		162
R978901536	4WE6J73-6X/EG24N9DA/A12/62	P	111131066	4 WKS	\$297.00		168
R978901050	4WE6J73-6X/EG24N9DAL/A12/62	P	111131066	4 WKS	\$336.00		168
R978017814	4WE6J73-6X/EG96N9K4/A12/62	P	111131066	4 WKS	\$314.00		162
R978017757	4WE6JA6X/EG24N9K4/62	P	111131066	4 WKS	\$177.00		162
R978017822	4WE6M6X/EG12N9K4/62	P	111131066	4 WKS	\$212.00		162
R978017777	4WE6M6X/EG24N9DAL/62	P	111131066	4 WKS	\$253.00		162
R978017808	4WE6M6X/EG24N9DK24L/62	P	111131066	4 WKS	\$280.00		162
R978017837	4WE6M6X/EG24N9DK25L/62	P	111131066	4 WKS	\$288.00		162
R978017771	4WE6M6X/EG24N9K4/62	P	111131066	4 WKS	\$212.00		162
R978017843	4WE6M6X/EW110N9K4/62=CSA	P	111131066	4 WKS	\$212.00		162
R978898240	4WE6W6X/EG12N9K4/62	P	111131066	4 WKS	\$212.00		162
R978896207	4WE6W6X/EG24N9DK24L2/62	P	111131066	4 WKS	\$280.00		162
R978017764	4WE6W6X/EG24N9K4/62	P	111131066	4 WKS	\$212.00		162
R978017868	4WE6W6X/EG24N9K4/62=CSA	P	111131066	4 WKS	\$212.00		162
R978878286	4WE6Y6X/EG24N9DA/62	P	111131066	4 WKS	\$181.00		162
R978017833	4WE6Y6X/EG24N9DAL/62	P	111131066	4 WKS	\$197.00		162
R978891625	4WE6Y6X/EG24N9DK24L/62	P	111131066	4 WKS	\$244.00		162
R978896202	4WE6Y6X/EG24N9DK24L2/62	P	111131066	4 WKS	\$244.00		162
R978017799	4WE6Y6X/EG24N9DK25L/62	P	111131066	4 WKS	\$254.00		162
R978017748	4WE6Y6X/EG24N9K4/62	P	111131066	4 WKS	\$177.00		162
R978017823	4WE6Y6X/EG24N9K4/62=CSA	P	111131066	4 WKS	\$177.00		162
R978874546	4WE6Y6X/EW110N9DA/62	P	111131066	4 WKS	\$181.00		162
R978017864	4WE6Y6X/EW110N9DAL/62	P	111131066	4 WKS	\$197.00		162
R978017831	4WE6Y6X/EW110N9DAL/62=CSA	P	111131066	4 WKS	\$197.00		162
R978877586	4WE6Y6X/EW110N9DK23L/62	P	111131066	4 WKS	\$226.00		162
R978017791	4WE6Y6X/EW110N9K4/62	P	111131066	4 WKS	\$177.00		162
R900926575	4WEH10D4X/6EG24N9ETK4	P	111152104	4 WKS	\$633.00		170
R978878485	4WEH10E4X/6EG24N9ETDA	S	111152104	2 WKS	\$615.00		170
R978895600	4WEH10E4X/6EG24N9ETDK24L	P	111152104	4 WKS	\$673.00		170
R900928594	4WEH10E4X/6EG24N9ETK4	P	111152104	4 WKS	\$605.00		170
R900952630	4WEH10E4X/6EG24N9ETK4/B10	P	111152104	4 WKS	\$616.00		170
R978909326	4WEH10E4X/6EG24N9ETS2DK24L	P	111152104	4 WKS	\$859.00		170
R900918714	4WEH10E4X/6EG24N9TK4	P	111152104	4 WKS	\$605.00		170
R978891142	4WEH10E4X/6EW110N9EDA	P	111152104	4 WKS	\$615.00		170
R978874283	4WEH10E4X/6EW110N9ETDA	P	111152104	4 WKS	\$615.00		170
R900924136	4WEH10E4X/6EW110N9ETDAL=CSA	P	111152104	4 WKS	\$647.00		170
R900906463	4WEH10E4X/6EW110N9ETK4	P	111152104	4 WKS	\$605.00		170
R978901423	4WEH10E4X/6EW110NETS2DK25L	P	111152104	4 WKS	\$913.00		170
R978897011	4WEH10EA4X/6EG12N9ETDA	P	111152104	4 WKS	\$554.00		170
R978899118	4WEH10EA4X/6EW110N9EDA	P	111152104	4 WKS	\$554.00		170
R978900206	4WEH10EB4X/6EG12N9K4	P	111152104	4 WKS	\$549.00		170
R978899880	4WEH10EB4X/6EW110N9ETSDA	P	111152104	4 WKS	\$742.00		170
R978900469	4WEH10G4X/6EG12N9ETSDA	P	111152104	4 WKS	\$828.00		170
R978893231	4WEH10G4X/6EG24N9DA	P	111152104	4 WKS	\$641.00		170
R978901259	4WEH10G4X/6EG24N9DAL	P	111152104	4 WKS	\$672.00		170
R978901912	4WEH10G4X/6EG24N9ESDA	P	111152104	4 WKS	\$828.00		170
R978900132	4WEH10G4X/6EG24N9S2DK25L	P	111152104	4 WKS	\$895.00		170
R978901821	4WEH10G4X/6EG24N9SDA	P	111152104	4 WKS	\$828.00		170
R978898988	4WEH10G4X/6EW110N9DA	P	111152104	4 WKS	\$641.00		170
R978903050	4WEH10G4X/6EW110N9DK25	P	111152104	4 WKS	\$677.00		170
R978898232	4WEH10G4X/6EW110N9ETDACSA	P	111152104	4 WKS	\$641.00		170
R978908383	4WEH10G4X/6EW110N9SDA	P	111152104	4 WKS	\$828.00		170

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978874359	4WEH10G4X/6EW110N9TDA	P	111152104	4 WKS	\$641.00		170
R978903909	4WEH10H4X/6EG24NETSDAL	P	111152104	4 WKS	\$876.00		170
R978903051	4WEH10H4X/6EW110N9DK25	P	111152104	4 WKS	\$651.00		170
R978909015	4WEH10H4X/6EW110N9ETSDA	P	111152104	4 WKS	\$802.00		170
R978909741	4WEH10H4X/6EW110N9K4CSA	P	111152104	4 WKS	\$605.00		170
R978874431	4WEH10H4X/6EW110N9TDA	P	111152104	4 WKS	\$615.00		170
R900929184	4WEH10H4X/6EW110N9TK4	P	111152104	4 WKS	\$605.00		170
R978898666	4WEH10HA4X/6EW110N9S2DAL	P	111152104	4 WKS	\$757.00		170
R978906313	4WEH10HD4X/6EG24N9DAL	P	111152104	4 WKS	\$572.00		170
R978909809	4WEH10HD4X/6EG24N9ETK4	S	111152104	2 WKS	\$552.00		170
R978900470	4WEH10J4X/6EG12N9ETDAL	P	111152104	4 WKS	\$647.00		170
R978878521	4WEH10J4X/6EG24N9ETDA	S	111152104	2 WKS	\$615.00		170
R978895598	4WEH10J4X/6EG24N9ETDK24L	P	111152104	4 WKS	\$673.00		170
R900926574	4WEH10J4X/6EG24N9ETK4	S	111152104	2 WKS	\$605.00		170
R900556904	4WEH10J4X/6EG24N9ETS2K4	P	111152104	4 WKS	\$792.00		170
R978899854	4WEH10J4X/6EW110N9DAL	P	111152104	4 WKS	\$647.00		170
R978874496	4WEH10J4X/6EW110N9ETDA	P	111152104	4 WKS	\$615.00		170
R978903510	4WEH10J4X/6EW110N9ETDK25LCSA	P	111152104	4 WKS	\$682.00		170
R900906464	4WEH10J4X/6EW110N9ETK4	S	111152104	2 WKS	\$605.00		170
R900922278	4WEH10J4X/6EW110N9ETK4/B08	P	111152104	4 WKS	\$616.00		170
R978909563	4WEH10J4X/6EW110N9ETK4/B12	P	111152104	4 WKS	\$616.00		170
R978900597	4WEH10J4X/6EW110N9ETS2DALCSA	P	111152104	4 WKS	\$833.00		170
R978901424	4WEH10J4X/6EW110N9ETS2DK25LCSA	P	111152104	4 WKS	\$870.00		170
R900922909	4WEH10J4X/6EW110N9ETS2K4	P	111152104	4 WKS	\$792.00		170
R978879663	4WEH10J4X/6EW110N9ETSDK25L	P	111152104	4 WKS	\$870.00		170
R900949914	4WEH10JA4X/6EG24N9ETK4	P	111152104	4 WKS	\$549.00		170
R900925790	4WEH10JA4X/6EW110N9ETK4	P	111152104	4 WKS	\$549.00		170
R978905713	4WEH10JA4X/6EW110N9ETS2DA	P	111152104	4 WKS	\$742.00		170
R978900123	4WEH10Q4X/6EW110N9ETDALCSA	P	111152104	4 WKS	\$647.00		170
R900569040	4WEH10W4X/6EG24N9EK4	P	111152104	4 WKS	\$605.00		170
R978894368	4WEH10W4X/6EG24N9ETS2DK24L	P	111152104	4 WKS	\$859.00		170
R978900119	4WEH10W4X/6EW110N9DK25L	P	111152104	4 WKS	\$682.00		170
R978897415	4WEH10Y4X/6EG24N9ETDK23L	P	111152104	4 WKS	\$682.00		170
R978874524	4WEH10Y4X/6EW110N9TDA	P	111152104	4 WKS	\$638.00		170
R978895261	4WEH10Y4X/6EW110NETDA	P	111152104	4 WKS	\$670.00		170
R900922083	4WEH16D7X/6EG24N9ETK4	P	111152167	4 WKS	\$641.00		170
R900923989	4WEH16D7X/6EG24N9K4	P	111152167	4 WKS	\$641.00		170
R900939842	4WEH16D7X/6EG96N9K4	P	111152167	4 WKS	\$651.00		170
R978902504	4WEH16D7X/6EW110N9ETDK23L	P	111152167	4 WKS	\$690.00		170
R978911016	4WEH16D7X/OF6EG12N9ETK4	P	111152167	4 WKS	\$805.00		170
R978902906	4WEH16E7X/6EG12N9ETDA	P	111152167	4 WKS	\$617.00		170
R900923992	4WEH16E7X/6EG24N9EK4	P	111152167	4 WKS	\$607.00		170
R978907904	4WEH16E7X/6EG24N9EK4CSA	P	111152167	4 WKS	\$607.00		170
R978901832	4WEH16E7X/6EG24N9ETDALCSA	P	111152167	4 WKS	\$649.00		170
R978908049	4WEH16E7X/6EG24N9ETDK25L	P	111152167	4 WKS	\$684.00		170
R900922084	4WEH16E7X/6EG24N9ETK4	S	111152167	2 WKS	\$607.00		170
R978902666	4WEH16E7X/6EG24N9ETS2DAL	S	111152167	2 WKS	\$835.00		170
R900923990	4WEH16E7X/6EG24N9TK4	P	111152167	4 WKS	\$607.00		170
R978903589	4WEH16E7X/6EW110N9EDAL	P	111152167	4 WKS	\$649.00		170
R978901354	4WEH16E7X/6EW110N9EDK25LCSA	P	111152167	4 WKS	\$684.00		170
R978900796	4WEH16E7X/6EW110N9ETDA	S	111152167	2 WKS	\$617.00		170
R978905802	4WEH16E7X/6EW110N9ETDAL	P	111152167	4 WKS	\$649.00		170
R978906935	4WEH16E7X/6EW110N9ETDK25	P	111152167	4 WKS	\$653.00		170
R978906652	4WEH16E7X/6EW110N9TDAL	P	111152167	4 WKS	\$649.00		170

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978901175	4WEH16E7X/6EW110N9TS2DK25L	P	111152167	4 WKS	\$873.00		170
R978909361	4WEH16E7X/6EW110N9TSK4/B08CSA	P	111152167	4 WKS	\$805.00		170
R978903928	4WEH16EA7X/6EW110N9ETDAL	P	111152167	4 WKS	\$574.00		170
R978901807	4WEH16EA7X/6EW110N9S2DK23L	P	111152167	4 WKS	\$791.00		170
R978901370	4WEH16G7X/6EG12N9EDA	P	111152167	4 WKS	\$646.00		170
R978901371	4WEH16G7X/6EG12N9ETDA	P	111152167	4 WKS	\$646.00		170
R978900832	4WEH16G7X/6EG12NETDA/P4.5	P	111152167	4 WKS	\$801.00		170
R978907979	4WEH16G7X/6EG24N9EK4/P4.5CSA	P	111152167	4 WKS	\$753.00		170
R978907224	4WEH16G7X/6EG24N9EK4CSA	P	111152167	4 WKS	\$635.00		170
R978904675	4WEH16G7X/6EG24N9ETDA/B08	P	111152167	4 WKS	\$655.00		170
R978907417	4WEH16G7X/6EG24N9TDA	P	111152167	4 WKS	\$646.00		170
R978901499	4WEH16G7X/6EG24NEDA	P	111152167	4 WKS	\$678.00		170
R978908309	4WEH16G7X/6EW110N9EDACSA	P	111152167	4 WKS	\$646.00		170
R978901297	4WEH16G7X/6EW110N9EDK25L	P	111152167	4 WKS	\$712.00		170
R978901497	4WEH16GA7X/6EG12NDA	P	111152167	4 WKS	\$616.00		170
R978901498	4WEH16GA7X/6EG24NDA	P	111152167	4 WKS	\$616.00		170
R978906994	4WEH16GA7X/6EW110N9ETDA/P4.5	P	111152167	4 WKS	\$704.00		170
R978908792	4WEH16GA7X/6EW110N9ETDK23/P4.5	P	111152167	4 WKS	\$736.00		170
R978906933	4WEH16GA7X/6EW110N9ETDK25/P4.5	P	111152167	4 WKS	\$745.00		170
R978903421	4WEH16H7X/6EG12N9ETDA	P	111152167	4 WKS	\$617.00		170
R978901661	4WEH16H7X/6EG12N9TDA	P	111152167	4 WKS	\$617.00		170
R978906586	4WEH16H7X/6EG24N9K4/P4.5CSA	P	111152167	4 WKS	\$726.00		170
R978904339	4WEH16H7X/6EW110N9DA	P	111152167	4 WKS	\$617.00		170
R978909697	4WEH16H7X/6EW110N9ES2DA	P	111152167	4 WKS	\$804.00		170
R978908761	4WEH16HC7X/6EW110N9DA	P	111152167	4 WKS	\$558.00		170
R978905839	4WEH16HD7X/6EW110N9EDAL	P	111152167	4 WKS	\$572.00		170
R978907906	4WEH16HD7X/6EW110N9ETDALCSA	P	111152167	4 WKS	\$572.00		170
R900933005	4WEH16HD7X/OF6EW110N9K4	P	111152167	4 WKS	\$645.00		170
R978909933	4WEH16J7X/6EG110N9ETDAL	S	111152167	2 WKS	\$671.00		170
R978901157	4WEH16J7X/6EG24N9DA	P	111152167	4 WKS	\$617.00		170
R978904877	4WEH16J7X/6EG24N9EDK25L	P	111152167	4 WKS	\$684.00		170
R900927456	4WEH16J7X/6EG24N9EK4	P	111152167	4 WKS	\$607.00		170
R978905927	4WEH16J7X/6EG24N9ES2DK25L	P	111152167	4 WKS	\$873.00		170
R978901910	4WEH16J7X/6EG24N9ETDALCSA	P	111152167	4 WKS	\$649.00		170
R900944737	4WEH16J7X/6EG24N9ETDK25L	P	111152167	4 WKS	\$684.00		170
R900922085	4WEH16J7X/6EG24N9ETK4	P	111152167	4 WKS	\$607.00		170
R900924819	4WEH16J7X/6EG24N9ETS2K4	P	111152167	4 WKS	\$795.00		170
R978904283	4WEH16J7X/6EG24N9ETSDK25L	P	111152167	4 WKS	\$873.00		170
R900925580	4WEH16J7X/6EG24N9K4	P	111152167	4 WKS	\$607.00		170
R900927255	4WEH16J7X/6EG24N9TK4	P	111152167	4 WKS	\$607.00		170
R978901743	4WEH16J7X/6EG24N9TK4CSA	P	111152167	4 WKS	\$607.00		170
R978907595	4WEH16J7X/6EW110N9DALCSA	P	111152167	4 WKS	\$649.00		170
R978905194	4WEH16J7X/6EW110N9EDK25L/B10	P	111152167	4 WKS	\$695.00		170
R900926682	4WEH16J7X/6EW110N9ES2K4	P	111152167	4 WKS	\$795.00		170
R978900844	4WEH16J7X/6EW110N9ETDA	P	111152167	4 WKS	\$617.00		170
R978900784	4WEH16J7X/6EW110N9ETDK25LCSA	P	111152167	4 WKS	\$684.00		170
R900923867	4WEH16J7X/6EW110N9ETK4	P	111152167	4 WKS	\$607.00		170
R900934936	4WEH16J7X/6EW110N9ETS2K4	P	111152167	4 WKS	\$795.00		170
R978908811	4WEH16JA7X/6EW110N9TK4	P	111152167	4 WKS	\$555.00		170
R900943380	4WEH16JB7X/6EW110N9ES2K4=CSA	P	111152167	4 WKS	\$743.00		170
R978908632	4WEH16JB7X/6EW110N9K4	P	111152167	4 WKS	\$555.00		170
R978907328	4WEH16W7X/6EW110N9ETDA	P	111152167	4 WKS	\$617.00		170
R978908122	4WEH16W7X/6EW110NETDAL/B08	P	111152167	4 WKS	\$692.00		170
R978900695	4WEH16WA7X/6EW110N9ETDK23L	P	111152167	4 WKS	\$604.00		170



## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R900925548	4WEH16Y7X/6EG24N9ETSK4	P	111152167	4 WKS	\$828.00		170
R978906948	4WEH16Y7X/6EW110N9ESDK23L	P	111152167	4 WKS	\$877.00		170
R978900785	4WEH16Y7X/6EW110N9ETDK23LCSA	P	111152167	4 WKS	\$690.00		170
R900942061	4WEH16Y7X/6EW110N9ETK4	P	111152167	4 WKS	\$641.00		170
R978900748	4WEH16Y7X/6EW110N9ETS2DK23L	P	111152167	4 WKS	\$877.00		170
R978903058	4WEH16Y7X/6EW110N9TDA	P	111152167	4 WKS	\$646.00		170
R978892350	4WEH22D7X/6EW110N9EDA	P	111152227	4 WKS	\$649.00		170
R900578025	4WEH22D7X/6EW110N9EDAL	P	111152227	4 WKS	\$662.00		170
R978876820	4WEH22D7X/6EW110N9ETDA	P	111152227	4 WKS	\$649.00		170
R900973561	4WEH22D7X/6EW110N9ETK4/B10	P	111152227	4 WKS	\$654.00		170
R900950360	4WEH22D7X/6EW110N9TK4	P	111152227	4 WKS	\$645.00		170
R978901053	4WEH22E7X/6EG12N9EDA	P	111152227	4 WKS	\$624.00		170
R978899292	4WEH22E7X/6EG12N9EDAL	P	111152227	4 WKS	\$655.00		170
R978892617	4WEH22E7X/6EG24N9EDA	P	111152227	4 WKS	\$624.00		170
R978908795	4WEH22E7X/6EG24N9EDAL	P	111152227	4 WKS	\$655.00		170
R978901712	4WEH22E7X/6EG24N9EDK24L2	P	111152227	4 WKS	\$682.00		170
R900979846	4WEH22E7X/6EG24N9ETS2DAL/B10	P	111152227	4 WKS	\$853.00		170
R978909862	4WEH22E7X/6EG24N9ETS2DK24L2	P	111152227	4 WKS	\$870.00		170
R900918655	4WEH22E7X/6EG24N9K4	P	111152227	4 WKS	\$615.00		170
R978900348	4WEH22E7X/6EG24N9S2DK25L	P	111152227	4 WKS	\$879.00		170
R978903520	4WEH22E7X/6EG24N9TK4/B08	P	111152227	4 WKS	\$625.00		170
R978892640	4WEH22E7X/6EW110N9DA	P	111152227	4 WKS	\$624.00		170
R978902827	4WEH22E7X/6EW110N9DK25L	P	111152227	4 WKS	\$692.00		170
R978891447	4WEH22E7X/6EW110N9EDA	P	111152227	4 WKS	\$624.00		170
R978893674	4WEH22E7X/6EW110N9EDAL	P	111152227	4 WKS	\$655.00		170
R978897591	4WEH22E7X/6EW110N9EDALCSA	P	111152227	4 WKS	\$655.00		170
R978876824	4WEH22E7X/6EW110N9ETDA	P	111152227	4 WKS	\$624.00		170
R978892586	4WEH22E7X/6EW110N9ETDAL	P	111152227	4 WKS	\$655.00		170
R978909447	4WEH22E7X/6EW110N9ETDK25	P	111152227	4 WKS	\$659.00		170
R900906469	4WEH22E7X/6EW110N9ETK4	P	111152227	4 WKS	\$615.00		170
R978901299	4WEH22E7X/6EW110N9ETS2DALCSA	P	111152227	4 WKS	\$843.00		170
R978898110	4WEH22E7X/6EW110N9ETSDAL	P	111152227	4 WKS	\$843.00		170
R978907992	4WEH22E7X/6EW110N9TDA	P	111152227	4 WKS	\$624.00		170
R978891176	4WEH22E7X/6EW110NEDK25L	P	111152227	4 WKS	\$727.00		170
R978898464	4WEH22E7X/6EW110NTDA/B08	P	111152227	4 WKS	\$665.00		170
R978891196	4WEH22EB7X/6EW110N9DA	P	111152227	4 WKS	\$565.00		170
R978902985	4WEH22EB7X/6EW110N9EDK23L	P	111152227	4 WKS	\$608.00		170
R978901593	4WEH22G7X/6EG12N9EDA	P	111152227	4 WKS	\$649.00		170
R978894173	4WEH22G7X/6EG12N9ETDK25L/P4.5	P	111152227	4 WKS	\$833.00		170
R978899806	4WEH22G7X/6EG12N9TDA	P	111152227	4 WKS	\$649.00		170
R978906858	4WEH22G7X/6EG24N9ETS2DA	P	111152227	4 WKS	\$835.00		170
R978892609	4WEH22G7X/6EW110N9DA	P	111152227	4 WKS	\$649.00		170
R978901317	4WEH22G7X/6EW110N9DA/B12	P	111152227	4 WKS	\$658.00		170
R978890458	4WEH22G7X/6EW110N9DAL	P	111152227	4 WKS	\$680.00		170
R978905845	4WEH22G7X/6EW110N9DAL/B10	P	111152227	4 WKS	\$691.00		170
R978890046	4WEH22G7X/6EW110N9EDA	P	111152227	4 WKS	\$649.00		170
R978891670	4WEH22G7X/6EW110N9EDA/P4.5	P	111152227	4 WKS	\$765.00		170
R978898712	4WEH22G7X/6EW110N9ETDA/P4.5CSA	P	111152227	4 WKS	\$765.00		170
R978898126	4WEH22G7X/6EW110N9ETDAL/P4.5CSA	P	111152227	4 WKS	\$797.00		170
R978907696	4WEH22G7X/6EW110N9ETDK25L/P4.5	P	111152227	4 WKS	\$833.00		170
R978909425	4WEH22G7X/6EW110N9ETS2DA	P	111152227	4 WKS	\$835.00		170
R978897964	4WEH22G7X/6EW110N9ETSDA/P4.5	P	111152227	4 WKS	\$954.00		170
R978892314	4WEH22G7X/6EW110N9S2DA	P	111152227	4 WKS	\$835.00		170
R978900535	4WEH22G7X/6EW110N9SDA	P	111152227	4 WKS	\$835.00		170

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978901194	4WEH22G7X/6EW110N9TDALCSA	P	111152227	4 WKS	\$680.00		170
R978905522	4WEH22GA7X/6EW110N9DA	P	111152227	4 WKS	\$593.00		170
R978900511	4WEH22GB7X/6EG12N9ETDA/P4.5	P	111152227	4 WKS	\$709.00		170
R978903540	4WEH22H7X/6EG12N9DACSA	P	111152227	4 WKS	\$624.00		170
R978903734	4WEH22H7X/6EG12N9ETS2DA	P	111152227	4 WKS	\$811.00		170
R978910815	4WEH22H7X/6EG12N9TK4	P	111152227	4 WKS	\$661.00		170
R978907991	4WEH22H7X/6EG24N9DA	P	111152227	4 WKS	\$624.00		170
R978896447	4WEH22H7X/6EW110N9DA/P4.5	P	111152227	4 WKS	\$742.00		170
R978900461	4WEH22H7X/6EW110N9EDA	P	111152227	4 WKS	\$624.00		170
R978896848	4WEH22H7X/6EW110N9EDA/P4.5	P	111152227	4 WKS	\$742.00		170
R978893145	4WEH22H7X/6EW110N9ETDA	P	111152227	4 WKS	\$624.00		170
R978899945	4WEH22H7X/6EW110N9ETDA/P4.5	P	111152227	4 WKS	\$742.00		170
R900928017	4WEH22H7X/6EW110N9ETS2K4/P4,5	P	111152227	4 WKS	\$919.00		170
R978904921	4WEH22H7X/6EW110N9TDA	P	111152227	4 WKS	\$624.00		170
R900959214	4WEH22HD7X/6EG24N9ETK4/B10	P	111152227	4 WKS	\$569.00		170
R978899883	4WEH22J7X/6EG12N9ETDA	P	111152227	4 WKS	\$624.00		170
R978909948	4WEH22J7X/6EG12N9ETDA/B08	P	111152227	4 WKS	\$634.00		170
R978903729	4WEH22J7X/6EG12N9ETS2DA	P	111152227	4 WKS	\$811.00		170
R978900713	4WEH22J7X/6EG24N9DA/B08	P	111152227	4 WKS	\$634.00		170
R978908571	4WEH22J7X/6EG24N9EDK24L	P	111152227	4 WKS	\$682.00		170
R978903359	4WEH22J7X/6EG24N9ES2DK25L	P	111152227	4 WKS	\$879.00		170
R978905899	4WEH22J7X/6EG24N9ES2K4CSA	P	111152227	4 WKS	\$802.00		170
R978898029	4WEH22J7X/6EG24N9ETDALCSA	P	111152227	4 WKS	\$655.00		170
R900926787	4WEH22J7X/6EG24N9ETK4	P	111152227	4 WKS	\$615.00		170
R978907596	4WEH22J7X/6EG24N9ETK4CSA	P	111152227	4 WKS	\$615.00		170
R978896389	4WEH22J7X/6EG24N9ETS2DK24L/B10	P	111152227	4 WKS	\$880.00		170
R978900349	4WEH22J7X/6EG24N9S2DK25L	P	111152227	4 WKS	\$879.00		170
R900923369	4WEH22J7X/6EG24N9S2K4	P	111152227	4 WKS	\$802.00		170
R978900475	4WEH22J7X/6EG24NETK4/B10CSA	P	111152227	4 WKS	\$656.00		170
R978903810	4WEH22J7X/6EG24NETS2DK25L	P	111152227	4 WKS	\$924.00		170
R978900476	4WEH22J7X/6EG24NETSK4/B10CSA	P	111152227	4 WKS	\$853.00		170
R978897593	4WEH22J7X/6EW110N9EDALCSA	P	111152227	4 WKS	\$655.00		170
R978908120	4WEH22J7X/6EW110N9ES2DA	P	111152227	4 WKS	\$811.00		170
R978891981	4WEH22J7X/6EW110N9ES2DK25L	P	111152227	4 WKS	\$879.00		170
R978876825	4WEH22J7X/6EW110N9ETDA	P	111152227	4 WKS	\$624.00		170
R978903034	4WEH22J7X/6EW110N9ETDA/P4.5	P	111152227	4 WKS	\$742.00		170
R978892664	4WEH22J7X/6EW110N9ETDAL	P	111152227	4 WKS	\$655.00		170
R978893429	4WEH22J7X/6EW110N9ETDAL/P4.5	P	111152227	4 WKS	\$773.00		170
R978898030	4WEH22J7X/6EW110N9ETDALCSA	P	111152227	4 WKS	\$655.00		170
R978878332	4WEH22J7X/6EW110N9ETDK25L	P	111152227	4 WKS	\$692.00		170
R900921309	4WEH22J7X/6EW110N9ETK4	P	111152227	4 WKS	\$615.00		170
R900957887	4WEH22J7X/6EW110N9ETS2DAL=CSA	P	111152227	4 WKS	\$843.00		170
R978895535	4WEH22J7X/6EW110N9ETS2DK25L	P	111152227	4 WKS	\$879.00		170
R978891844	4WEH22J7X/6EW110N9ETSDA	P	111152227	4 WKS	\$811.00		170
R978894104	4WEH22J7X/6EW110N9ETSDAL	P	111152227	4 WKS	\$843.00		170
R978893249	4WEH22J7X/6EW110N9S2DAL	P	111152227	4 WKS	\$843.00		170
R978902516	4WEH22J7X/6EW110N9SDACSA	P	111152227	4 WKS	\$811.00		170
R978902029	4WEH22J7X/6EW110N9TDA	P	111152227	4 WKS	\$624.00		170
R978901273	4WEH22J7X/6EW110N9TDA/P4.5	P	111152227	4 WKS	\$742.00		170
R978891175	4WEH22J7X/6EW110NEDK25L	P	111152227	4 WKS	\$727.00		170
R978902128	4WEH22J7X/6EW110NETSDAL/P4.5	P	111152227	4 WKS	\$1,009.00		170
R978891776	4WEH22Q7X/6EW110N9ETDK25L	P	111152227	4 WKS	\$692.00		170
R978895724	4WEH22W7X/6EG24N9ETS2DK24L	P	111152227	4 WKS	\$870.00		170
R978892226	4WEH22W7X/6EW110N9ETDK25L	P	111152227	4 WKS	\$692.00		170

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978908685	4WEH22Y7X/6EG24N9EDK24L	P	111152227	4 WKS	\$711.00		170
R978898108	4WEH22Y7X/6EW110N9DAL	P	111152227	4 WKS	\$662.00		170
R978897633	4WEH22Y7X/6EW110N9EDA	P	111152227	4 WKS	\$649.00		170
R978897427	4WEH32E6X/6EW110N9EDK25	P	111152326	4 WKS	\$1,958.00		170
R978906038	4WEH32E6X/6EW110N9EDK25L	P	111152326	4 WKS	\$1,991.00		170
R978898413	4WEH32E6X/6EW110N9ES2DA	P	111152326	4 WKS	\$2,112.00		170
R978908424	4WEH32E6X/6EW110N9ETS2DAL/B10D3	P	111152326	4 WKS	\$2,445.00		170
R978903391	4WEH32E6X/6EW110N9TDA	P	111152326	4 WKS	\$1,921.00		170
R978891608	4WEH32G6X/6EW110N9EDA	P	111152326	4 WKS	\$2,007.00		170
R900948683	4WEH32G6X/6EW110N9ETDAL	P	111152326	4 WKS	\$2,039.00		170
R900926915	4WEH32G6X/6EW110N9ETK4	P	111152326	4 WKS	\$1,997.00		170
R978897648	4WEH32G6X/6EW110N9S2K4	P	111152326	4 WKS	\$2,189.00		170
R978908333	4WEH32J6X/6EW110N9ETDAL	P	111152326	4 WKS	\$1,953.00		170
R978900259	4WEH32J6X/6EW110N9S2DALCSA	P	111152326	4 WKS	\$2,146.00		170
R978900637	4WEH32J6X/6EW110N9S2DK25L	P	111152326	4 WKS	\$2,183.00		170
R978892363	4WEH32J6X/6EW110N9TS2DAL	P	111152326	4 WKS	\$2,146.00		170
R978905136	4WEH32J6X/6EW110NETSDA	P	111152326	4 WKS	\$2,220.00		170
R900444197	4WH10E4X/	P	111151104	4 WKS	\$409.00		170
R900567688	4WH10HC4X/	P	111151104	4 WKS	\$402.00		170
R900443486	4WH10Y4X/	P	111151104	4 WKS	\$466.00		170
R900923871	4WH16D7X/	P	111151167	4 WKS	\$479.00		170
R900923875	4WH16E7X/	P	111151167	4 WKS	\$415.00		170
R900412527	4WH22G7X/	P	111151227	4 WKS	\$454.00		170
R900409136	4WH22HD7X/	P	111151227	4 WKS	\$422.00		170
R900409848	4WH22J7X/	P	111151227	4 WKS	\$424.00		170
R900477327	4WH6C5X/5	P	111144065	4 WKS	\$275.00		158
R900955873	4WH6D5X/5	P	111144065	4 WKS	\$275.00		158
R900476392	4WH6D5X/OF/5	P	111144065	4 WKS	\$315.00		158
R900412123	4WH6EA5X/5	P	111144065	4 WKS	\$275.00		158
R900370032	4WH6GA5X/5	P	111144065	4 WKS	\$275.00		158
R978900517	4WH6HA5X/5	P	111144065	4 WKS	\$275.00		158
R900487078	4WH6HB5X/5	P	111144065	4 WKS	\$275.00		158
R900413067	4WH6J5X/5	P	111144065	4 WKS	\$315.00		158
R978893925	4WHD10C3X/12	P	111144103	4 WKS	\$446.00		160
R900775978	4WHD10EA3X/12	P	111144103	4 WKS	\$446.00		160
R978900587	4WHD10H3X/12	P	111144103	4 WKS	\$480.00		160
R978908139	4WHD10JA3X/12	P	111144103	4 WKS	\$446.00		160
R978895923	4WHD10M3X/12	P	111144103	4 WKS	\$480.00		160
R900476880	4WMD6D5X/F	P	111143065	4 WKS	\$388.00		156
R900475573	4WMD6E5X/F	P	111143065	4 WKS	\$369.00		156
R900591592	4WMM10D3X/	P	111141103	4 WKS	\$446.00		160
R900587838	4WMM10D3X/F	P	111141103	4 WKS	\$476.00		160
R900589983	4WMM10E3X/	P	111141103	4 WKS	\$480.00		160
R900589975	4WMM10E3X/F	P	111141103	4 WKS	\$511.00		160
R900590222	4WMM10G3X/	P	111141103	4 WKS	\$506.00		160
R900701525	4WMM10GA3X/	P	111141103	4 WKS	\$506.00		160
R900589913	4WMM10H3X/F	P	111141103	4 WKS	\$511.00		160
R900586919	4WMM10J3X/	P	111141103	4 WKS	\$480.00		160
R900589954	4WMM10J3X/F	P	111141103	4 WKS	\$511.00		160
R900589953	4WMM10M3X/	P	111141103	4 WKS	\$480.00		160
R900589994	4WMM10Y3X/	P	111141103	4 WKS	\$446.00		160
R900472158	4WMM6C5X/F	P	111141065	4 WKS	\$390.00		156
R900468328	4WMM6D5X/	P	111141065	4 WKS	\$360.00		156
R900469301	4WMM6D5X/F	P	111141065	4 WKS	\$390.00		156

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R900467936	4WMM6E5X/	P	111141065	4 WKS	\$360.00		156
R900405611	4WMM6E5X/F	P	111141065	4 WKS	\$390.00		156
R900499217	4WMM6EB5X/	P	111141065	4 WKS	\$360.00		156
R900471209	4WMM6G5X/	P	111141065	4 WKS	\$360.00		156
R900469533	4WMM6G5X/F	P	111141065	4 WKS	\$390.00		156
R900467370	4WMM6H5X/	P	111141065	4 WKS	\$360.00		156
R900469302	4WMM6J5X/	P	111141065	4 WKS	\$360.00		156
R900466583	4WMM6J5X/F	P	111141065	4 WKS	\$390.00		156
R900495893	4WMM6Y5X/	P	111141065	4 WKS	\$360.00		156
R978870562	4WN10J3X/12	P	111146103	4 WKS	\$493.00		160
R900710167	4WP10D3X/12	P	111145103	4 WKS	\$458.00		160
R978870124	4WP10G3X/12	P	111145103	4 WKS	\$519.00		160
R900931178	4WP10H3X/12	P	111145103	4 WKS	\$493.00		160
R978917418	4WP6D6X/5	P	111145066	4 WKS	\$275.00		158
R978917419	4WP6E6X/5	P	111145066	4 WKS	\$315.00		158
R978000835	4WP6G6X/5	P	111145066	4 WKS	\$315.00		158
R978917421	4WP6J6X/5	P	111145066	4 WKS	\$315.00		158
R900921739	4WRA10E30-2X/G24N9K4/V	P	112111102	4 WKS	\$971.00		310
R900954061	4WRA10E60-2X/G24K4/V	P	112111102	4 WKS	\$971.00		310
R900947149	4WRA6E03-2X/G24N9K4/V	P	112111062	4 WKS	\$786.00		310
R900910780	4WRA6E07-2X/G24K4/V	P	112111062	4 WKS	\$786.00		310
R900906262	4WRA6E07-2X/G24N9K4/V	P	112111062	4 WKS	\$786.00		310
R900904438	4WRA6E15-2X/G24K4/V	P	112111062	4 WKS	\$786.00		310
R900904439	4WRA6E30-2X/G24K4/V	P	112111062	4 WKS	\$786.00		310
R900902940	4WRA6E30-2X/G24N9K4/V	P	112111062	4 WKS	\$786.00		310
R900923472	4WRA6W07-2X/G24N9K4/V	P	112111062	4 WKS	\$786.00		310
R900913443	4WRA6W15-2X/G24N9K4/V	P	112111062	4 WKS	\$786.00		310
R978879705	4WRAB6E12-1X/G12N9K4/MR	P	112117061	4 WKS	\$420.00		308
R978898190	4WRAB6E25-1X/G12N9K4/MR	S	112117061	2 WKS	\$420.00		308
R978898127	4WRAB6EA25-1X/G12N9K4/MR	P	112117061	4 WKS	\$354.00		308
R978891597	4WRAB6W12-1X/G12N9K4/MR	S	112117061	2 WKS	\$420.00		308
R978877472	4WRAB6W25-1X/G12N9K4/MR	S	112117061	2 WKS	\$420.00		308
R978892368	4WRAB6WA12-1X/G12N9K4/MR	P	112117061	4 WKS	\$354.00		308
R978891053	4WRAB6WA25-1X/G12N9K4/MR	P	112117061	4 WKS	\$354.00		308
R900558356	4WRAE10E60-2X/G24N9K31/A1V	P	112111102	4 WKS	\$1,518.00		310
R900929318	4WRAE10E60-2X/G24N9K31/F1V	P	112111102	4 WKS	\$1,518.00		310
R900900988	4WRAE10W60-2X/G24N9K31/A1V	P	112111102	4 WKS	\$1,518.00		310
R900909389	4WRAE6E15-2X/G24N9K31/A1V	P	112111062	4 WKS	\$1,332.00		310
R900947059	4WRAE6E15-2X/G24N9K31/F1V	P	112111062	4 WKS	\$1,332.00		310
R900558355	4WRAE6E30-2X/G24N9K31/A1V	P	112111062	4 WKS	\$1,332.00		310
R900931485	4WRAE6E30-2X/G24N9K31/F1V	P	112111062	4 WKS	\$1,332.00		310
R900900987	4WRAE6W30-2X/G24N9K31/A1V	P	112111062	4 WKS	\$1,332.00		310
0811403104	4WRBA6EA30-2X/G24N9Z4/M	P	112181	4 WKS	\$746.00		302
0811404852	4WRBAE10E35J-2X/G24N9K31/A1M	P	112181102	4 WKS	\$1,539.00		302
0811404850	4WRBAE10E65J-2X/G24N9K31/A1M	P	112181102	4 WKS	\$1,579.00		302
0811404851	4WRBAE10W65J-2X/G24N9K31/A1M	P	112614102	4 WKS	\$1,539.00		302
0811404151	4WRBAE6E18J-2X/G24N9K31/A1M	P	112181062	4 WKS	\$1,139.00		302
0811404150	4WRBAE6E32J-2X/G24N9K31/A1M	P	112181062	4 WKS	\$1,139.00		302
R900954101	4WRE10E50-2X/G24K4/V	P	112112102	4 WKS	\$1,167.00		313
R900954102	4WRE10E75-2X/G24K4/V	P	112112102	4 WKS	\$1,167.00		313
R900954116	4WRE10V50-2X/G24K4/V	P	112112102	4 WKS	\$1,375.00		313
R900954117	4WRE10V75-2X/G24K4/V	P	112112102	4 WKS	\$1,375.00		313
R900933478	4WRE6E08-2X/G24K4/V	P	112112062	4 WKS	\$947.00		313
R900954092	4WRE6E16-2X/G24K4/V	P	112112062	4 WKS	\$947.00		313

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R900926366	4WRE6E32-2X/G24K4/V	P	112112062	4 WKS	\$947.00		313
R900954097	4WRE6V08-2X/G24K4/V	P	112112062	4 WKS	\$1,122.00		313
R900954098	4WRE6V16-2X/G24K4/V	P	112112062	4 WKS	\$1,122.00		313
R900954099	4WRE6V32-2X/G24K4/V	P	112112062	4 WKS	\$1,122.00		313
R900941264	4WRE6W08-2X/G24K4/V	P	112112062	4 WKS	\$947.00		313
R900944121	4WRE6W16-2X/G24K4/V	P	112112062	4 WKS	\$947.00		313
R900933480	4WRE6W32-2X/G24K4/V	P	112112062	4 WKS	\$947.00		313
R900927231	4WREE10E50-2X/G24K31/A1V	S	112112102	2 WKS	\$1,835.00		313
R900943094	4WREE10E50-2X/G24K31/F1V	P	112112102	4 WKS	\$1,835.00		313
R900927230	4WREE10E75-2X/G24K31/A1V	S	112112102	2 WKS	\$1,835.00		313
R900927356	4WREE10E75-2X/G24K31/F1V	P	112112102	4 WKS	\$1,835.00		313
R900940191	4WREE10EA75-2X/G24K31/A1V	P	112112102	4 WKS	\$1,601.00		313
R900927236	4WREE10Q2-75-2X/G24K31/A1V	P	112112102	4 WKS	\$2,193.00		313
R900927235	4WREE10V50-2X/G24K31/A1V	P	112112102	4 WKS	\$2,043.00		313
R900924975	4WREE10V50-2X/G24K31/F1V	P	112112102	4 WKS	\$2,043.00		313
R900924607	4WREE10V75-2X/G24K31/A1V	S	112112102	2 WKS	\$2,043.00		313
R900927234	4WREE10W1-75-2X/G24K31/A1V	P	112112102	4 WKS	\$1,938.00		313
R900931371	4WREE10W50-2X/G24K31/A1V	P	112112102	4 WKS	\$1,835.00		313
R900927233	4WREE10W75-2X/G24K31/A1V	S	112112102	2 WKS	\$1,835.00		313
R900948360	4WREE10W75-2X/G24K31/F1V	P	112112102	4 WKS	\$1,835.00		313
R900912156	4WREE6E08-2X/G24K31/A1V	P	112112062	4 WKS	\$1,598.00		313
R900920567	4WREE6E16-2X/G24K31/A1V	P	112112062	4 WKS	\$1,598.00		313
R900941623	4WREE6E16-2X/G24K31/F1V	P	112112062	4 WKS	\$1,598.00		313
R900907114	4WREE6E32-2X/G24K31/A1V	P	112112062	4 WKS	\$1,598.00		313
R900912154	4WREE6Q2-32-2X/G24K31/A1V	P	112112062	4 WKS	\$1,855.00		313
R900909367	4WREE6V08-2X/G24K31/A1V	P	112112062	4 WKS	\$1,771.00		313
R900907440	4WREE6V16-2X/G24K31/A1V	P	112112062	4 WKS	\$1,771.00		313
R900911681	4WREE6V32-2X/G24K31/A1V	S	112112062	2 WKS	\$1,771.00		313
R900926747	4WREE6V32-2X/G24K31/F1V	P	112112062	4 WKS	\$1,771.00		313
R900923000	4WREE6W08-2X/G24K31/A1V	P	112112062	4 WKS	\$1,598.00		313
R900924283	4WREE6W08-2X/G24K31/F1V	P	112112062	4 WKS	\$1,598.00		313
R900925657	4WREE6W16-2X/G24K31/A1V	P	112112062	4 WKS	\$1,598.00		313
R900911004	4WREE6W32-2X/G24K31/A1V	P	112112062	4 WKS	\$1,598.00		313
0811404715	4WRLE10E1-80SJ-3X/G24ETK0/A1M	P	112633103	4 WKS	\$3,834.00		316
0811404701	4WRLE10E1-80SJ-3X/G24K0/A1M	P	112633103	4 WKS	\$3,834.00		316
0811404713	4WRLE10E-80SJ-3X/G24ETK0/A1M	P	112633103	4 WKS	\$3,741.00		316
0811404700	4WRLE10E-80SJ-3X/G24K0/A1M	P	112633103	4 WKS	\$3,741.00		316
0811404670	4WRLE10Q4-85M-3X/G24ETK0/A1M	P	112631102	4 WKS	\$6,034.00		323
R978714489	4WRLE10Q4-85M-3X/G24K0/A1M	P	112181102	4 WKS	\$6,034.00		323
0811404668	4WRLE10Q4-85M-3X/G24TK0/A1M	P	112631102	4 WKS	\$6,034.00		323
0811404673	4WRLE10V1-85M-3X/G24ETK0/A1M	P	112631102	4 WKS	\$5,251.00		320
0811404661	4WRLE10V-55M-3X/G24ETK0/A1M	P	112631102	4 WKS	\$5,123.00		320
0811404652	4WRLE10V-55M-3X/G24K0/A1M	P	112631102	4 WKS	\$5,251.00		320
0811404659	4WRLE10V-55M-3X/G24TK0/A1M	P	112631102	4 WKS	\$5,251.00		320
0811404662	4WRLE10V-85M-3X/G24ETK0/A1M	P	112631102	4 WKS	\$5,123.00		320
0811404653	4WRLE10V-85M-3X/G24K0/A1M	P	112631102	4 WKS	\$5,251.00		320
0811404660	4WRLE10V-85M-3X/G24TK0/A1M	P	112631102	4 WKS	\$5,251.00		320
0811404703	4WRLE10W1-80SJ-3X/G24K0/A1M	P	112633103	4 WKS	\$3,834.00		316
R978714407	4WRLE10W1-80SJ-3X/G24TK0/A1M	P	112181102	4 WKS	\$3,871.00		316
0811404711	4WRLE10W4-80SJ-3X/G24K0/A1M	P	112633103	4 WKS	\$3,741.00		316
0811404707	4WRLE10W-80SJ-3X/G24ETK0/A1M	P	112633103	4 WKS	\$3,741.00		316
0811404702	4WRLE10W-80SJ-3X/G24K0/A1M	P	112633103	4 WKS	\$3,741.00		316
0811404306	4WRLE16E1Z-180SJ-3X/G24K0/A1M	P	112633163	4 WKS	\$4,456.00		316
0811404319	4WRLE16EZ-180SJ-3X/G24ETK0/A1M	P	112633163	4 WKS	\$4,347.00		316



## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
0811404305	4WRLE16EZ-180SJ-3X/G24K0/A1M	P	112633163	4 WKS	\$4,347.00		316
R978714476	4WRLE16Q4-200M-3X/G24EK0/A1M	P	112631162	4 WKS	\$6,733.00		323
0811404270	4WRLE16Q4-200M-3X/G24ETK0/A1M	P	112631162	4 WKS	\$6,733.00		323
0811404276	4WRLE16Q4-200M-3X/G24K0/A1M	P	112631162	4 WKS	\$6,733.00		323
0811404275	4WRLE16Q4-200M-3X/G24TK0/A1M	P	112631162	4 WKS	\$6,733.00		323
0811404281	4WRLE16V1-120M-3X/G24ETK0/A1M	P	112631162	4 WKS	\$5,968.00		320
0811404282	4WRLE16V1-200M-3X/G24ETK0/A1M	P	112631162	4 WKS	\$5,968.00		320
R978714486	4WRLE16V120M-3X/G24ETK0/A1M	P	112181102	4 WKS	\$5,968.00		320
0811404250	4WRLE16V120M-3X/G24K0/A1M	P	112631162	4 WKS	\$5,823.00		320
R978714408	4WRLE16V120M-3X/G24TK0/A1M	P	112181102	4 WKS	\$5,793.00		320
R978715719	4WRLE16V200M-3X/G24ETK0/A1M	P	112181102	4 WKS	\$5,684.00		320
0811404251	4WRLE16V-200M-3X/G24K0/A1M	P	112631162	4 WKS	\$5,823.00		320
0811404273	4WRLE16W1-200M-3X/G24EK0/A1WX02M-779	P	112633164	4 WKS	\$6,988.00		316
0811404308	4WRLE16W1Z-180SJ-3X/G24K0/A1M	P	112633163	4 WKS	\$4,456.00		316
0811404328	4WRLE16W4-180SJ-3X/G24ETK0/A1M	P	112633163	4 WKS	\$4,735.00		316
0811404320	4WRLE16W5-180SJ-3X/G24K0/A1M	P	112633163	4 WKS	\$4,347.00		316
0811404307	4WRLE16WZ-180SJ-3X/G24K0/A1M	P	112633163	4 WKS	\$4,347.00		316
0811404454	4WRLE25EZ-350SJ-3X/G24K0/A1M	P	112633253	4 WKS	\$5,246.00		316
R978714393	4WRLE25V370M-3X/G24ETK0/A1M	P	112181102	4 WKS	\$6,764.00		320
0811404430	4WRLE25V-370M-3X/G24K0/A1M	P	112631252	4 WKS	\$6,902.00		320
0811404457	4WRLE25W1Z-350SJ-3X/G24K0/A1M	P	112633253	4 WKS	\$5,376.00		316
0811404471	4WRLE25W4-350SJ-3X/G24ETK0/A1M	P	112633253	4 WKS	\$4,886.00		316
0811404472	4WRLE25W4-350SJ-3X/G24K0/A1M	P	112633253	4 WKS	\$5,246.00		316
0811404456	4WRLE25WZ-350SJ-3X/G24K0/A1M	P	112633253	4 WKS	\$5,246.00		316
0811404435	4WRLE25X-370M-3X/G24EK0/A1M-812	P	112631252	4 WKS	\$7,622.00		323
0811404434	4WRLE25X-370M-3X/G24ETK0/A1M-812	P	112631252	4 WKS	\$7,622.00		323
0811404438	4WRLE27Q4-430M-3X/G24ETK0/A1M	P	112631252	4 WKS	\$7,814.00		323
0811404441	4WRLE27Q4-430M-3X/G24K0/A1M	P	112631252	4 WKS	\$7,814.00		323
0811404442	4WRLE27Q4-430M-3X/G24TK0/A1M	P	112631252	4 WKS	\$7,814.00		323
0811404432	4WRLE27V430M-3X/G24K0/A1M	P	112631252	4 WKS	\$7,802.00		316
0811404001	4WRP10E-63S-1X/G24Z4/M	P	112614100	4 WKS	\$1,631.00		292
0811403001	4WRP10EA63S-1X/G24Z4/M	P	11261510	4 WKS	\$1,222.00		290
0811404770	4WRPE10E-50SJ-2X/G24K0/A1M	P	112614102	4 WKS	\$2,946.00		298
0811404771	4WRPE10E-80SJ-2X/G24K0/A1M	P	112614102	4 WKS	\$2,946.00		298
0811404750	4WRPE10EA80SJ-2X/G24K0/M	P	112615105	4 WKS	\$1,787.00		294
0811404552	4WRPE10V-80M-2X/G24K0/A1M-837	P	112612107	4 WKS	\$4,053.00		288
0811404772	4WRPE10W-50SJ-2X/G24K0/A1M	P	112614102	4 WKS	\$2,946.00		298
0811404778	4WRPE10W-50SJ-2X/G24K0/F1M	P	112614102	4 WKS	\$2,946.00		298
0811404773	4WRPE10W-80SJ-2X/G24K0/A1M	P	112614102	4 WKS	\$2,946.00		298
0811404140	4WRPE6E-18SJ-2X/G24K0/A1M	P	112614062	4 WKS	\$2,407.00		298
0811404141	4WRPE6E-32SJ-2X/G24K0/A1M	P	112614062	4 WKS	\$2,407.00		298
0811403128	4WRPE6EA32SJ-2X/G24K0/A1M	P	112615065	4 WKS	\$1,619.00		294
0811404142	4WRPE6W-18SJ-2X/G24K0/A1M	P	112614062	4 WKS	\$2,407.00		298
0811404143	4WRPE6W-32SJ-2X/G24K0/A1M	P	112614062	4 WKS	\$2,407.00		298
0811404817	4WRPEH10C3B100L-2X/G24K0/F1M	P	112611103	4 WKS	\$4,053.00		279
0811404801	4WRPEH10C3B100L-2X/G24K0/A1M	P	112611103	4 WKS	\$4,053.00		279
0811404800	4WRPEH10C3B50L-2X/G24K0/A1M	P	112611103	4 WKS	\$4,053.00		279
0811404803	4WRPEH10C4B100L-2X/G24K0/A1M	P	112611103	4 WKS	\$4,053.00		279
0811404802	4WRPEH10C4B50L-2X/G24K0/A1M	P	112611103	4 WKS	\$4,053.00		279
0811404600	4WRPEH6C3B04L-2X/G24K0/A1M	P	112611063	4 WKS	\$3,111.00		276
0811404631	4WRPEH6C3B04L-2X/G24K0/F1M	P	112611063	4 WKS	\$3,111.00		276
0811404601	4WRPEH6C3B12L-2X/G24K0/A1M	P	112611063	4 WKS	\$3,111.00		276
0811404632	4WRPEH6C3B12L-2X/G24K0/F1M	P	112611063	4 WKS	\$3,111.00		276
0811404602	4WRPEH6C3B24L-2X/G24K0/A1M	P	112611063	4 WKS	\$3,111.00		276

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
0811404633	4WRPEH6C3B24L-2X/G24K0/F1M	P	112611063	4 WKS	\$3,111.00		276
0811404603	4WRPEH6C3B40L-2X/G24K0/A1M	P	112611063	4 WKS	\$3,111.00		276
0811404634	4WRPEH6C3B40L-2X/G24K0/F1M	P	112611063	4 WKS	\$3,111.00		276
0811404610	4WRPEH6C4B04L-2X/G24K0/A1M	P	112611063	4 WKS	\$3,111.00		276
0811404611	4WRPEH6C4B12L-2X/G24K0/A1M	P	112611063	4 WKS	\$3,111.00		276
0811404612	4WRPEH6C4B24L-2X/G24K0/A1M	P	112611063	4 WKS	\$3,111.00		276
0811404613	4WRPEH6C4B40L-2X/G24K0/A1M	P	112611063	4 WKS	\$3,111.00		276
0811404690	4WRVE10V55M-2X/G24K0/B5M	P	112632100	4 WKS	\$6,027.00		324
0811404691	4WRVE10V85M-2X/G24K0/B5M	P	112632100	4 WKS	\$5,880.00		324
0811404290	4WRVE16V120M-2X/G24K0/B5M	P	112632160	4 WKS	\$6,723.00		324
0811404291	4WRVE16V200M-2X/G24K0/B5M	P	112632160	4 WKS	\$6,558.00		324
0811404445	4WRVE25V370M-2X/G24K0/B5M	P	112632250	4 WKS	\$7,459.00		324
R900943060	4WRZ10E1-85-7X/6EG24N9ETK4/D3V	P	112131107	4 WKS	\$2,138.00		327
R900960129	4WRZ10E85-7X/6EG24N9EK4/D3V	P	112131107	4 WKS	\$1,981.00		327
R900944558	4WRZ10E85-7X/6EG24N9ETK4/D3V	P	112131107	4 WKS	\$1,981.00		327
R900948691	4WRZ10E85-7X/6EG24N9K4/V	P	112131107	4 WKS	\$1,786.00		327
R900946490	4WRZ10W6-50-7X/6EG24N9ETK4/D3V	P	112131107	4 WKS	\$1,981.00		327
R978909359	4WRZ10W6-85-7X/6EG24ETK4/D3V	P	112131107	4 WKS	\$1,925.00		327
R900947002	4WRZ10W6-85-7X/6EG24N9EK4/D3V	P	112131107	4 WKS	\$1,981.00		327
R900949710	4WRZ10W6-85-7X/6EG24N9ETK4/D3V	P	112131107	4 WKS	\$1,981.00		327
R900945218	4WRZ10W8-50-7X/6EG24N9EK4/D3V	P	112131107	4 WKS	\$2,138.00		327
R900943862	4WRZ10W8-50-7X/6EG24N9EK4/V	P	112131107	4 WKS	\$1,942.00		327
R900958780	4WRZ10W8-50-7X/6EG24N9ETK4/D3M	P	112131107	4 WKS	\$2,138.00		327
R900956997	4WRZ10W8-50-7X/6EG24N9ETK4/V	P	112131107	4 WKS	\$1,942.00		327
R900963716	4WRZ10W8-85-7X/6EG24ETK4/V	P	112131107	4 WKS	\$1,887.00		327
R900948535	4WRZ16E100-7X/6EG24N9EK4/D3V	P	112131167	4 WKS	\$2,309.00		327
R900948020	4WRZ16E1-100-7X/6EG24N9EK4/D3V	P	112131167	4 WKS	\$2,482.00		327
R900953855	4WRZ16E1-100-7X/6EG24N9ETK4/D3V	P	112131167	4 WKS	\$2,482.00		327
R900955675	4WRZ16E1-100-7X/6EG24N9K4/D3V	P	112131167	4 WKS	\$2,482.00		327
R900953217	4WRZ16E1-100-7X/6EG24N9K4/V	P	112131167	4 WKS	\$2,288.00		327
R900943498	4WRZ16E1-150-7X/6EG24N9ETK4/D3V	P	112131167	4 WKS	\$2,482.00		327
R900965375	4WRZ16E150-7X/6EG24K4/V	P	112131167	4 WKS	\$2,057.00		327
R900947411	4WRZ16E150-7X/6EG24N9EK4/D3V	P	112131167	4 WKS	\$2,309.00		327
R900944363	4WRZ16E150-7X/6EG24N9ETK4/D3V	P	112131167	4 WKS	\$2,309.00		327
R900961974	4WRZ16E150-7X/6EG24N9ETK4/V	P	112131167	4 WKS	\$2,113.00		327
R900959577	4WRZ16E150-7X/6EG24N9K4/D3V	P	112131167	4 WKS	\$2,309.00		327
R900940843	4WRZ16W6-150-7X/6EG24N9EK4/V	P	112131167	4 WKS	\$2,113.00		327
R900946491	4WRZ16W6-150-7X/6EG24N9ETK4/D3V	P	112131167	4 WKS	\$2,309.00		327
R900964717	4WRZ25E1-220-7X/6EG24N9K4/D3V	P	112131257	4 WKS	\$3,322.00		327
R900957218	4WRZ25E1-220-7X/6EG24N9K4/V	P	112131257	4 WKS	\$3,126.00		327
R900963586	4WRZ25E1-325-7X/6EG24N9ETK4/D3V	P	112131257	4 WKS	\$3,322.00		327
R978908323	4WRZ25W6-220-7X/6EG24ETK4/V	P	112131257	4 WKS	\$2,859.00		327
R900947183	4WRZ25W6-220-7X/6EG24N9ETK4/D3V	P	112131257	4 WKS	\$3,110.00		327
R900957450	4WRZ25W6-220-7X/6EG24N9K4/D3V	P	112131257	4 WKS	\$3,110.00		327
R900947184	4WRZ25W6-325-7X/6EG24N9EK4/D3V	P	112131257	4 WKS	\$3,110.00		327
R900946218	4WRZ25W6-325-7X/6EG24N9EK4/V	P	112131257	4 WKS	\$2,914.00		327
R900949376	4WRZ25W6-325-7X/6EG24N9ETK4/D3V	P	112131257	4 WKS	\$3,110.00		327
R900945912	4WRZ25W8-325-7X/6EG24N9ETK4/D3V	P	112131257	4 WKS	\$3,322.00		327
R900950967	4WRZ25W8-325-7X/6EG24N9K4/D3V	P	112131257	4 WKS	\$3,322.00		327
R900951703	4WRZ25W8-325-7X/6EG24N9K4/V	P	112131257	4 WKS	\$3,126.00		327
R900925705	4WRZE10E25-7X/6EG24N9EK31/A1D3V	P	112131107	4 WKS	\$2,603.00		327
R900942135	4WRZE10E25-7X/6EG24N9ETK31/A1D3V	P	112131107	4 WKS	\$2,603.00		327
R900968830	4WRZE10E50-7X/6EG24N9EK31/A1V	P	112131107	4 WKS	\$2,408.00		327
R900956542	4WRZE10E85-7X/6EG24N9EK31/A1D3V	P	112131107	4 WKS	\$2,603.00		327

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price	Price adder per	Page
					(7/15/06)	100mm (CDT3) 1" (CDT1, 4)	
R900948133	4WRZE10E85-7X/6EG24N9K31/A1D3V	P	112131107	4 WKS	\$2,603.00		327
R900950368	4WRZE10E85-7X/6EG24N9TK31/A1D3V	P	112131107	4 WKS	\$2,603.00		327
R900958568	4WRZE10W6-25-7X/6EG24N9ETK31/F1V	P	112131107	4 WKS	\$2,408.00		327
R900921152	4WRZE10W6-50-7X/6EG24N9ETK31/A1D3V	P	112131107	4 WKS	\$2,603.00		327
R900952143	4WRZE10W6-50-7X/6EG24N9ETK31/F1D3V	P	112131107	4 WKS	\$2,603.00		327
R900939922	4WRZE10W6-50-7X/6EG24N9K31/F1D3V	P	112131107	4 WKS	\$2,603.00		327
R900932993	4WRZE10W6-85-7X/6EG24N9ETK31/A1D3V	P	112131107	4 WKS	\$2,603.00		327
R900949753	4WRZE10W8-85-7X/6EG24N9EK31/F1D3V	P	112131107	4 WKS	\$2,760.00		327
R900964180	4WRZE10W8-85-7X/6EG24N9K31/A1D3V	P	112131107	4 WKS	\$2,760.00		327
R900958045	4WRZE16E100-7X/6EG24N9TK31/A1D3V	P	112131167	4 WKS	\$2,932.00		327
R900963222	4WRZE16E1-100-7X/6EG24N9ETK31/A1D3V	P	112131167	4 WKS	\$3,105.00		327
R900959051	4WRZE16E1-150-7X/6EG24N9ETK31/A1D3V	P	112131167	4 WKS	\$3,105.00		327
R900963720	4WRZE16E150-7X/6EG24N9EK31/F1V	P	112131167	4 WKS	\$2,736.00		327
R900945995	4WRZE16E150-7X/6EG24N9ETK31/A1V	P	112131167	4 WKS	\$2,736.00		327
R900951428	4WRZE16W6-100-7X/6EG24N9ETK31/A1D3V	P	112131167	4 WKS	\$2,932.00		327
R900923501	4WRZE16W6-150-7X/6EG24N9ETK31/A1D3V	P	112131167	4 WKS	\$2,932.00		327
R900954663	4WRZE16W8-150-7X/6EG24ETK31/A1D3M	P	112131167	4 WKS	\$3,050.00		327
R900963242	4WRZE16W8-150-7X/6EG24K31/A1D3M	P	112131167	4 WKS	\$3,050.00		327
R900964591	4WRZE16W8-150-7X/6EG24N9EK31/A1V	P	112131167	4 WKS	\$2,911.00		327
R900949751	4WRZE16W8-150-7X/6EG24N9EK31/F1D3V	P	112131167	4 WKS	\$3,105.00		327
R900934524	4WRZE16W8-150-7X/6EG24N9ETK31/A1D3V	P	112131167	4 WKS	\$3,105.00		327
R900921154	4WRZE16W8-150-7X/6EG24N9ETK31/A1V	P	112131167	4 WKS	\$2,911.00		327
R900925738	4WRZE16W8-150-7X/6EG24N9ETK31/F1D3V	P	112131167	4 WKS	\$3,105.00		327
R900962129	4WRZE16W9-150-7X/6EG24N9ETK31/A1D3V	P	112131167	4 WKS	\$3,280.00		327
R900965034	4WRZE25E1-220-7X/6EG24N9ETK31/A1D3V	P	112131257	4 WKS	\$3,946.00		327
R900953095	4WRZE25E220-7X/6EG24N9ETK31/A1D3V	P	112131257	4 WKS	\$3,733.00		327
R900953675	4WRZE25E3-325-7X/6EG24N9ETK31/F1V	P	112131257	4 WKS	\$3,961.00		327
R900954679	4WRZE25W6-220-7X/6EG24ETK31/A1D3M	P	112131257	4 WKS	\$3,677.00		327
R900959830	4WRZE25W6-220-7X/6EG24N9EK31/A1V	P	112131257	4 WKS	\$3,537.00		327
R900964933	4WRZE25W6-220-7X/6EG24N9EK31/F1V	P	112131257	4 WKS	\$3,537.00		327
R900951208	4WRZE25W6-220-7X/6EG24N9ETK31/A1D3V	P	112131257	4 WKS	\$3,733.00		327
R900963714	4WRZE25W6-220-7X/6EG24N9K31/A1D3V	P	112131257	4 WKS	\$3,733.00		327
R900947361	4WRZE25W6-220-7X/6EG24N9K31/F1V	P	112131257	4 WKS	\$3,537.00		327
R900934542	4WRZE25W6-220-7X/6EG24N9TK31/A1V	P	112131257	4 WKS	\$3,537.00		327
R978909693	4WRZE25W6-325-7X/6EG24N9EK31/F1D3V	P	112131257	4 WKS	\$3,733.00		327
R900940842	4WRZE25W6-325-7X/6EG24N9ETK31/A1V	P	112131257	4 WKS	\$3,537.00		327
R900948609	4WRZE25W6-325-7X/6EG24N9ETK31/F1D3V	P	112131257	4 WKS	\$3,733.00		327
R900949756	4WRZE25W8-325-7X/6EG24N9EK31/F1D3V	P	112131257	4 WKS	\$3,946.00		327
R900949807	4WRZE25W8-325-7X/6EG24N9ETK31/F1D3V	P	112131257	4 WKS	\$3,946.00		327
R900954697	4WRZE32E520-7X/6EG24ETK31/A1D3M	P	112131327	4 WKS	\$5,270.00		327
R900967322	4WRZE32E520-7X/6EG24N9ETK31/F1D3V	P	112131327	4 WKS	\$5,325.00		327
R900957472	4WRZE32E520-7X/6EG24N9K31/A1D3V	P	112131327	4 WKS	\$5,325.00		327
R900938883	4WRZE32E520-7X/6EG24N9TK31/A1D3V	P	112131327	4 WKS	\$5,325.00		327
R900958046	4WRZE32E520-7X/6EG24N9TK31/F1D3V	P	112131327	4 WKS	\$5,325.00		327
R978870849	5-4WE10C3X/CG24N9K4/A12	P	111132103	4 WKS	\$450.00		166
R900592969	5-4WE10D3X/CG24N9K4	P	111132103	4 WKS	\$444.00		166
R900928685	5-4WE10H3X/CG96N9K4/C	P	111132103	4 WKS	\$583.00		166
R900595823	5-4WE10J3X/CG24N9K4	P	111132103	4 WKS	\$472.00		166
0811402107	5WRPE10FB70L-2X/G24K0/A1M	P	112611103	4 WKS	\$4,053.00		285
R902402079	A10FM28/52W-VRC60N000	P	815131213	4 weeks	\$889.00		52
R902403658	A10FM28/52W-VRC66N000	P	815131213	4 weeks	\$889.00		52
R910995633	A10FM45/52W-VRC60N000	P	815131221	4 weeks	\$977.00		52
R902406027	A10FM45/52W-VRC66N000	P	815131221	4 weeks	\$977.00		52
R902420018	A10VM28DG/52W1-VRC60N000	P	815231111	4 weeks	\$898.00		64



## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R902406022	A10VM28DG/52W1-VRC61N000	P	815231111	4 weeks	\$898.00		64
R902411878	A10VM28DG/52W1-VRC64N000	P	815231111	4 weeks	\$898.00		64
R902430413	A10VM28DG/52W1-VRC66N000	P	815231111	4 weeks	\$898.00		64
R902500291	A10VM28HZ/52W1-VRC60N000	P	815231111	4 weeks	\$1,033.00		64
R902400221	A10VM28HZ/52W1-VRC66N000	P	815231111	4 weeks	\$1,033.00		64
R902425897	A10VM45DG/52W1-VRC60N000	P	815231121	4 weeks	\$1,136.00		64
R902427638	A10VM45DG/52W1-VRC61N000	P	815231121	4 weeks	\$1,136.00		64
R902400122	A10VM45DG/52W1-VRC64N000	P	815231121	4 weeks	\$1,136.00		64
R902400121	A10VM45DG/52W1-VRC66N000	P	815231121	4 weeks	\$1,136.00		64
R902400477	A10VM45HZ/52W1-VRC60N000	P	815231121	4 weeks	\$1,357.00		64
R902406026	A10VM45HZ/52W1-VRC61N000	P	815231121	4 weeks	\$1,357.00		64
R902400201	A10VM45HZ/52W1-VRC64N000	P	815231121	4 weeks	\$1,357.00		64
R902400481	A10VM45HZ/52W1-VRC66N000	P	815231121	4 weeks	\$1,357.00		64
R910919708	A10VO100DFR/31L-PSC61N00	P	814232123	4 weeks	\$3,236.00		95
R910921190	A10VO100DFR/31L-PSC62K01	P	814232123	4 weeks	\$3,510.00		95
R910911006	A10VO100DFR/31L-PSC62K02	P	814232123	4 weeks	\$3,510.00		95
R910907323	A10VO100DFR/31L-PSC62N00	P	814232123	4 weeks	\$3,236.00		95
R910920979	A10VO100DFR/31R-PSC61N00	P	814232123	4 weeks	\$3,236.00		95
R910917244	A10VO100DFR/31R-PSC62K01	P	814232123	4 weeks	\$3,510.00		95
R910911970	A10VO100DFR/31R-PSC62K02	P	814232123	4 weeks	\$3,510.00		95
R910906900	A10VO100DFR/31R-PSC62N00	P	814232123	4 weeks	\$3,236.00		95
R910924428	A10VO100DFR1/31L-PSC61N00	P	814232123	4 weeks	\$3,236.00		95
R910968458	A10VO100DFR1/31L-PSC62K01	P	814232123	4 weeks	\$3,510.00		95
R910930665	A10VO100DFR1/31L-PSC62K02	P	814232123	4 weeks	\$3,510.00		95
R910940045	A10VO100DFR1/31L-PSC62N00	P	814232123	4 weeks	\$3,236.00		95
R910940560	A10VO100DFR1/31R-PSC61N00	P	814232123	4 weeks	\$3,236.00		95
R910911023	A10VO100DFR1/31R-PSC62K01	P	814232123	4 weeks	\$3,510.00		95
R910929630	A10VO100DFR1/31R-PSC62K02	P	814232123	4 weeks	\$3,510.00		95
R910910567	A10VO100DFR1/31R-PSC62N00	P	814232123	4 weeks	\$3,236.00		95
R902430848	A10VO100DR/31L-PSC61N00	P	814232123	4 weeks	\$3,236.00		95
R902500502	A10VO100DR/31L-PSC62K01	P	814232123	4 weeks	\$3,510.00		95
R910923450	A10VO100DR/31L-PSC62K02	P	814232123	4 weeks	\$3,510.00		95
R910913633	A10VO100DR/31L-PSC62N00	P	814232123	4 weeks	\$3,236.00		95
R910936662	A10VO100DR/31R-PSC61N00	P	814232123	4 weeks	\$3,236.00		95
R910931051	A10VO100DR/31R-PSC62K01	P	814232123	4 weeks	\$3,510.00		95
R910916623	A10VO100DR/31R-PSC62K02	P	814232123	4 weeks	\$3,510.00		95
R910912430	A10VO100DR/31R-PSC62N00	P	814232123	4 weeks	\$3,236.00		95
R910941500	A10VO100DRG/31L-PSC61N00	P	814232123	4 weeks	\$3,236.00		95
R902500501	A10VO100DRG/31L-PSC62K01	P	814232123	4 weeks	\$3,510.00		95
R910996193	A10VO100DRG/31L-PSC62K02	P	814232123	4 weeks	\$3,510.00		95
R910928371	A10VO100DRG/31L-PSC62N00	P	814232123	4 weeks	\$3,236.00		95
R910992958	A10VO100DRG/31R-PSC61N00	P	814232123	4 weeks	\$3,236.00		95
R902500500	A10VO100DRG/31R-PSC62K01	P	814232123	4 weeks	\$3,510.00		95
R910996652	A10VO100DRG/31R-PSC62K02	P	814232123	4 weeks	\$3,510.00		95
R910932441	A10VO100DRG/31R-PSC62N00	P	814232123	4 weeks	\$3,236.00		95
R910960372	A10VO140DFR/31L-PSD61N00	P	814232141	4 weeks	\$4,610.00		95
R910964089	A10VO140DFR/31L-PSD62K01	P	814232141	4 weeks	\$4,940.00		95
R910984805	A10VO140DFR/31L-PSD62K02	P	814232141	4 weeks	\$4,940.00		95
R910924186	A10VO140DFR/31L-PSD62N00	P	814232141	4 weeks	\$4,610.00		95
R902415491	A10VO140DFR/31R-PSD61N00	P	814232141	4 weeks	\$4,610.00		95
R910925779	A10VO140DFR/31R-PSD62K01	P	814232141	4 weeks	\$4,940.00		95
R910924316	A10VO140DFR/31R-PSD62K02	P	814232141	4 weeks	\$4,940.00		95
R910921425	A10VO140DFR/31R-PSD62N00	P	814232141	4 weeks	\$4,610.00		95
R910932228	A10VO140DFR1/31L-PSD61N00	P	814232141	4 weeks	\$4,610.00		95

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R902500508	A10VO140DFR1/31L-PSD62K01	P	814232141	4 weeks	\$4,940.00		95
R910966882	A10VO140DFR1/31L-PSD62K02	P	814232141	4 weeks	\$4,940.00		95
R910920257	A10VO140DFR1/31L-PSD62N00	P	814232141	4 weeks	\$4,610.00		95
R910936425	A10VO140DFR1/31R-PSD61N00	P	814232141	4 weeks	\$4,610.00		95
R910990953	A10VO140DFR1/31R-PSD62K01	P	814232141	4 weeks	\$4,940.00		95
R910940948	A10VO140DFR1/31R-PSD62K02	P	814232141	4 weeks	\$4,940.00		95
R910920255	A10VO140DFR1/31R-PSD62N00	P	814232141	4 weeks	\$4,610.00		95
R910967481	A10VO140DR/31L-PSD61N00	P	814232141	4 weeks	\$4,236.00		95
R902500507	A10VO140DR/31L-PSD62K01	P	814232141	4 weeks	\$4,566.00		95
R902500506	A10VO140DR/31L-PSD62K02	P	814232141	4 weeks	\$4,566.00		95
R910944605	A10VO140DR/31L-PSD62N00	P	814232141	4 weeks	\$4,236.00		95
R910967484	A10VO140DR/31R-PSD61N00	P	814232141	4 weeks	\$4,236.00		95
R910995070	A10VO140DR/31R-PSD62K01	P	814232141	4 weeks	\$4,566.00		95
R910947689	A10VO140DR/31R-PSD62K02	P	814232141	4 weeks	\$4,566.00		95
R910926346	A10VO140DR/31R-PSD62N00	P	814232141	4 weeks	\$4,236.00		95
R902500111	A10VO140DRG/31L-PSD61N00	P	814232141	4 weeks	\$4,236.00		95
R910932966	A10VO140DRG/31L-PSD62K01	P	814232141	4 weeks	\$4,566.00		95
R902500505	A10VO140DRG/31L-PSD62K02	P	814232141	4 weeks	\$4,566.00		95
R902500159	A10VO140DRG/31L-PSD62N00	P	814232141	4 weeks	\$4,236.00		95
R902500504	A10VO140DRG/31R-PSD61N00	P	814232141	4 weeks	\$4,236.00		95
R902500503	A10VO140DRG/31R-PSD62K01	P	814232141	4 weeks	\$4,566.00		95
R902404174	A10VO140DRG/31R-PSD62K02	P	814232141	4 weeks	\$4,566.00		95
R910945836	A10VO140DRG/31R-PSD62N00	P	814232141	4 weeks	\$4,236.00		95
R910910330	A10VO28DFR/31L-PSC61N00	P	814232111	4 weeks	\$1,193.00		95
R910910039	A10VO28DFR/31L-PSC62K01	P	814232111	4 weeks	\$1,334.00		95
R910908653	A10VO28DFR/31L-PSC62K02	P	814232111	4 weeks	\$1,334.00		95
R910940787	A10VO28DFR/31L-PSC62N00	P	814232111	4 weeks	\$1,193.00		95
R910907114	A10VO28DFR/31R-PSC61N00	P	814232111	4 weeks	\$1,193.00		95
R910908655	A10VO28DFR/31R-PSC62K01	P	814232111	4 weeks	\$1,334.00		95
R910908889	A10VO28DFR/31R-PSC62K02	P	814232111	4 weeks	\$1,334.00		95
R910907402	A10VO28DFR/31R-PSC62N00	P	814232111	4 weeks	\$1,193.00		95
R910991152	A10VO28DFR/52L-PRC62K68	P	814232111	4 weeks	\$1,203.00		99
R910976285	A10VO28DFR/52L-PSC61N00	P	814232111	4 weeks	\$1,062.00		99
R902500457	A10VO28DFR/52L-PSC62N00	P	814232111	4 weeks	\$1,062.00		99
R910976772	A10VO28DFR/52L-PSC64N00	P	814232111	4 weeks	\$1,062.00		99
R902401495	A10VO28DFR/52R-PRC62K68	P	814232111	4 weeks	\$1,203.00		99
R910976487	A10VO28DFR/52R-PSC61N00	P	814232111	4 weeks	\$1,062.00		99
R910992465	A10VO28DFR/52R-PSC62N00	P	814232111	4 weeks	\$1,062.00		99
R910976769	A10VO28DFR/52R-PSC64N00	P	814232111	4 weeks	\$1,062.00		99
R910910556	A10VO28DFR1/31L-PSC61N00	P	814232111	4 weeks	\$1,193.00		95
R910922947	A10VO28DFR1/31L-PSC62K01	P	814232111	4 weeks	\$1,334.00		95
R910910625	A10VO28DFR1/31L-PSC62K02	P	814232111	4 weeks	\$1,334.00		95
R910910568	A10VO28DFR1/31L-PSC62N00	P	814232111	4 weeks	\$1,193.00		95
R910911737	A10VO28DFR1/31R-PSC61N00	P	814232111	4 weeks	\$1,193.00		95
R910923181	A10VO28DFR1/31R-PSC62K01	P	814232111	4 weeks	\$1,334.00		95
R910920960	A10VO28DFR1/31R-PSC62K02	P	814232111	4 weeks	\$1,334.00		95
R910942696	A10VO28DFR1/31R-PSC62N00	P	814232111	4 weeks	\$1,193.00		95
R902401496	A10VO28DFR1/52L-PRC62K68	P	814232111	4 weeks	\$1,203.00		99
R910986799	A10VO28DFR1/52L-PSC61N00	P	814232111	4 weeks	\$1,062.00		99
R910992837	A10VO28DFR1/52L-PSC62N00	P	814232111	4 weeks	\$1,062.00		99
R910987271	A10VO28DFR1/52L-PSC64N00	P	814232111	4 weeks	\$1,062.00		99
R902401497	A10VO28DFR1/52R-PRC62K68	P	814232111	4 weeks	\$1,203.00		99
R910978473	A10VO28DFR1/52R-PSC61N00	P	814232111	4 weeks	\$1,062.00		99
R902400303	A10VO28DFR1/52R-PSC62N00	P	814232111	4 weeks	\$1,062.00		99

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R910979350	A10VO28DFR1/52R-PSC64N00	P	814232111	4 weeks	\$1,062.00		99
R910908605	A10VO28DR/31L-PSC61N00	P	814232111	4 weeks	\$1,193.00		95
R910911830	A10VO28DR/31L-PSC62K01	P	814232111	4 weeks	\$1,334.00		95
R910909460	A10VO28DR/31L-PSC62N00	P	814232111	4 weeks	\$1,193.00		95
R910912013	A10VO28DR/31R-PSC61N00	P	814232111	4 weeks	\$1,193.00		95
R910915421	A10VO28DR/31R-PSC62K01	P	814232111	4 weeks	\$1,334.00		95
R910913825	A10VO28DR/31R-PSC62K02	P	814232111	4 weeks	\$1,334.00		95
R910909159	A10VO28DR/31R-PSC62N00	P	814232111	4 weeks	\$1,193.00		95
R902401498	A10VO28DR/52L-PRC62K68	P	814232111	4 weeks	\$1,203.00		99
R902401499	A10VO28DR/52L-PSC61N00	P	814232111	4 weeks	\$1,062.00		99
R902426043	A10VO28DR/52L-PSC62N00	P	814232111	4 weeks	\$1,062.00		99
R910993045	A10VO28DR/52L-PSC64N00	P	814232111	4 weeks	\$1,062.00		99
R902406028	A10VO28DR/52R-PRC62K68	P	814232111	4 weeks	\$1,203.00		99
R910984372	A10VO28DR/52R-PSC61N00	P	814232111	4 weeks	\$1,062.00		99
R902401461	A10VO28DR/52R-PSC62N00	P	814232111	4 weeks	\$1,062.00		99
R910983084	A10VO28DR/52R-PSC64N00	P	814232111	4 weeks	\$1,062.00		99
R910944080	A10VO28DRG/31L-PSC61N00	P	814232111	4 weeks	\$1,193.00		95
R910929576	A10VO28DRG/31L-PSC62K01	P	814232111	4 weeks	\$1,334.00		95
R910931935	A10VO28DRG/31L-PSC62K02	P	814232111	4 weeks	\$1,334.00		95
R910941110	A10VO28DRG/31L-PSC62N00	P	814232111	4 weeks	\$1,193.00		95
R910966020	A10VO28DRG/31R-PSC61N00	P	814232111	4 weeks	\$1,193.00		95
R910929962	A10VO28DRG/31R-PSC62K01	P	814232111	4 weeks	\$1,334.00		95
R910944997	A10VO28DRG/31R-PSC62K02	P	814232111	4 weeks	\$1,334.00		95
R910928418	A10VO28DRG/31R-PSC62N00	P	814232111	4 weeks	\$1,193.00		95
R902406000	A10VO28DRG/52L-PRC62K68	P	814232111	4 weeks	\$1,203.00		99
R902402509	A10VO28DRG/52L-PSC61N00	P	814232111	4 weeks	\$1,062.00		99
R902406001	A10VO28DRG/52L-PSC62N00	P	814232111	4 weeks	\$1,062.00		99
R902500327	A10VO28DRG/52L-PSC64N00	P	814232111	4 weeks	\$1,062.00		99
R902406002	A10VO28DRG/52R-PRC62K68	P	814232111	4 weeks	\$1,203.00		99
R910976584	A10VO28DRG/52R-PSC61N00	P	814232111	4 weeks	\$1,062.00		99
R902406003	A10VO28DRG/52R-PSC62N00	P	814232111	4 weeks	\$1,062.00		99
R910976766	A10VO28DRG/52R-PSC64N00	P	814232111	4 weeks	\$1,062.00		99
R910940366	A10VO45DFR/31L-PSC61N00	P	814232121	4 weeks	\$1,471.00		95
R910909949	A10VO45DFR/31L-PSC62K01	P	814232121	4 weeks	\$1,636.00		95
R910910030	A10VO45DFR/31L-PSC62K02	P	814232121	4 weeks	\$1,636.00		95
R910908124	A10VO45DFR/31L-PSC62N00	P	814232121	4 weeks	\$1,471.00		95
R910905696	A10VO45DFR/31R-PSC61N00	P	814232121	4 weeks	\$1,471.00		95
R910907404	A10VO45DFR/31R-PSC62K01	P	814232121	4 weeks	\$1,636.00		95
R910908888	A10VO45DFR/31R-PSC62K02	P	814232121	4 weeks	\$1,636.00		95
R910943655	A10VO45DFR/31R-PSC62N00	P	814232121	4 weeks	\$1,471.00		95
R902401053	A10VO45DFR/52L-PRC62K04	P	814232121	4 weeks	\$1,459.00		99
R910975255	A10VO45DFR/52L-PSC61N00	P	814232121	4 weeks	\$1,260.00		99
R902403845	A10VO45DFR/52L-PSC62N00	P	814232121	4 weeks	\$1,260.00		99
R910972815	A10VO45DFR/52L-PSC64N00	P	814232121	4 weeks	\$1,260.00		99
R902406004	A10VO45DFR/52R-PRC62K04	P	814232121	4 weeks	\$1,459.00		99
R910990157	A10VO45DFR/52R-PSC61N00	P	814232121	4 weeks	\$1,260.00		99
R902400300	A10VO45DFR/52R-PSC62N00	P	814232121	4 weeks	\$1,260.00		99
R910970014	A10VO45DFR/52R-PSC64N00	P	814232121	4 weeks	\$1,260.00		99
R910914939	A10VO45DFR1/31L-PSC61N00	P	814232121	4 weeks	\$1,471.00		95
R910916472	A10VO45DFR1/31L-PSC62K01	P	814232121	4 weeks	\$1,636.00		95
R910932495	A10VO45DFR1/31L-PSC62K02	P	814232121	4 weeks	\$1,636.00		95
R910909288	A10VO45DFR1/31L-PSC62N00	P	814232121	4 weeks	\$1,471.00		95
R910943343	A10VO45DFR1/31R-PSC61N00	P	814232121	4 weeks	\$1,471.00		95
R910916931	A10VO45DFR1/31R-PSC62K01	P	814232121	4 weeks	\$1,636.00		95

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R910920557	A10VO45DFR1/31R-PSC62K02	P	814232121	4 weeks	\$1,636.00		95
R910910181	A10VO45DFR1/31R-PSC62N00	P	814232121	4 weeks	\$1,471.00		95
R902400475	A10VO45DFR1/52L-PRC62K04	P	814232121	4 weeks	\$1,459.00		99
R910983571	A10VO45DFR1/52L-PSC61N00	P	814232121	4 weeks	\$1,260.00		99
R902400341	A10VO45DFR1/52L-PSC62N00	P	814232121	4 weeks	\$1,260.00		99
R910966170	A10VO45DFR1/52L-PSC64N00	P	814232121	4 weeks	\$1,260.00		99
R902406005	A10VO45DFR1/52R-PRC62K04	P	814232121	4 weeks	\$1,459.00		99
R910975491	A10VO45DFR1/52R-PSC61N00	P	814232121	4 weeks	\$1,260.00		99
R910985626	A10VO45DFR1/52R-PSC62N00	P	814232121	4 weeks	\$1,260.00		99
R910966718	A10VO45DFR1/52R-PSC64N00	P	814232121	4 weeks	\$1,260.00		99
R910910311	A10VO45DR/31L-PSC61N00	P	814232121	4 weeks	\$1,471.00		95
R910917466	A10VO45DR/31L-PSC62K01	P	814232121	4 weeks	\$1,636.00		95
R910911223	A10VO45DR/31L-PSC62K02	P	814232121	4 weeks	\$1,636.00		95
R910909446	A10VO45DR/31L-PSC62N00	P	814232121	4 weeks	\$1,471.00		95
R910910995	A10VO45DR/31R-PSC61N00	P	814232121	4 weeks	\$1,471.00		95
R910910044	A10VO45DR/31R-PSC62K01	P	814232121	4 weeks	\$1,636.00		95
R910915423	A10VO45DR/31R-PSC62K02	P	814232121	4 weeks	\$1,636.00		95
R910909824	A10VO45DR/31R-PSC62N00	P	814232121	4 weeks	\$1,471.00		95
R902406006	A10VO45DR/52L-PRC62K04	P	814232121	4 weeks	\$1,459.00		99
R902406007	A10VO45DR/52L-PSC61N00	P	814232121	4 weeks	\$1,260.00		99
R902400311	A10VO45DR/52L-PSC62N00	P	814232121	4 weeks	\$1,260.00		99
R910984529	A10VO45DR/52L-PSC64N00	P	814232121	4 weeks	\$1,260.00		99
R902406008	A10VO45DR/52R-PRC62K04	P	814232121	4 weeks	\$1,459.00		99
R902406009	A10VO45DR/52R-PSC61N00	P	814232121	4 weeks	\$1,260.00		99
R902426054	A10VO45DR/52R-PSC62N00	P	814232121	4 weeks	\$1,260.00		99
R902400322	A10VO45DR/52R-PSC64N00	P	814232121	4 weeks	\$1,260.00		99
R910939170	A10VO45DRG/31L-PSC61N00	P	814232121	4 weeks	\$1,471.00		95
R910940745	A10VO45DRG/31L-PSC62K01	P	814232121	4 weeks	\$1,636.00		95
R902401005	A10VO45DRG/31L-PSC62K02	P	814232121	4 weeks	\$1,636.00		95
R910927101	A10VO45DRG/31L-PSC62N00	P	814232121	4 weeks	\$1,471.00		95
R910946866	A10VO45DRG/31R-PSC61N00	P	814232121	4 weeks	\$1,471.00		95
R910940008	A10VO45DRG/31R-PSC62K01	P	814232121	4 weeks	\$1,636.00		95
R910965232	A10VO45DRG/31R-PSC62K02	P	814232121	4 weeks	\$1,636.00		95
R910919978	A10VO45DRG/31R-PSC62N00	P	814232121	4 weeks	\$1,471.00		95
R902406010	A10VO45DRG/52L-PRC62K04	P	814232121	4 weeks	\$1,459.00		99
R910975616	A10VO45DRG/52L-PSC61N00	P	814232121	4 weeks	\$1,260.00		99
R902401404	A10VO45DRG/52L-PSC62N00	P	814232121	4 weeks	\$1,260.00		99
R902406011	A10VO45DRG/52L-PSC64N00	P	814232121	4 weeks	\$1,260.00		99
R902406012	A10VO45DRG/52R-PRC62K04	P	814232121	4 weeks	\$1,459.00		99
R910983637	A10VO45DRG/52R-PSC61N00	P	814232121	4 weeks	\$1,260.00		99
R902406013	A10VO45DRG/52R-PSC62N00	P	814232121	4 weeks	\$1,260.00		99
R902400271	A10VO45DRG/52R-PSC64N00	P	814232121	4 weeks	\$1,260.00		99
R910992210	A10VO60DFR/52L-PSC61N00	P	814232322	4 weeks	\$1,595.00		99
R910990809	A10VO60DFR/52L-PSC62N00	P	814232322	4 weeks	\$1,595.00		99
R910979367	A10VO60DFR/52L-PSD61N00	P	814232322	4 weeks	\$1,595.00		99
R910997186	A10VO60DFR/52L-PSD62N00	P	814232322	4 weeks	\$1,595.00		99
R910988141	A10VO60DFR/52R-PSC61N00	P	814232322	4 weeks	\$1,595.00		99
R910990988	A10VO60DFR/52R-PSC62N00	P	814232322	4 weeks	\$1,595.00		99
R910979368	A10VO60DFR/52R-PSD61N00	P	814232322	4 weeks	\$1,595.00		99
R902400288	A10VO60DFR/52R-PSD62N00	P	814232322	4 weeks	\$1,595.00		99
R910987326	A10VO60DFR1/52L-PSC61N00	P	814232322	4 weeks	\$1,595.00		99
R902426557	A10VO60DFR1/52L-PSC62N00	P	814232322	4 weeks	\$1,595.00		99
R910976294	A10VO60DFR1/52L-PSD61N00	P	814232322	4 weeks	\$1,595.00		99
R910978418	A10VO60DFR1/52L-PSD62N00	P	814232322	4 weeks	\$1,595.00		99



**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R910990159	A10VO60DFR1/52R-PSC61N00	P	814232322	4 weeks	\$1,595.00		99
R902405137	A10VO60DFR1/52R-PSC62N00	P	814232322	4 weeks	\$1,595.00		99
R910974886	A10VO60DFR1/52R-PSD61N00	P	814232322	4 weeks	\$1,595.00		99
R910984482	A10VO60DFR1/52R-PSD62N00	P	814232322	4 weeks	\$1,595.00		99
R910990125	A10VO60DR/52L-PSC61N00	P	814232322	4 weeks	\$1,595.00		99
R902406014	A10VO60DR/52L-PSC62N00	P	814232322	4 weeks	\$1,595.00		99
R910990624	A10VO60DR/52L-PSD61N00	P	814232322	4 weeks	\$1,595.00		99
R902406017	A10VO60DR/52L-PSD62N00	P	814232322	4 weeks	\$1,595.00		99
R902406015	A10VO60DR/52R-PSC61N00	P	814232322	4 weeks	\$1,595.00		99
R902406016	A10VO60DR/52R-PSC62N00	P	814232322	4 weeks	\$1,595.00		99
R902406018	A10VO60DR/52R-PSD61N00	P	814232322	4 weeks	\$1,595.00		99
R902406019	A10VO60DR/52R-PSD62N00	P	814232322	4 weeks	\$1,595.00		99
R902400410	A10VO71DFR/31L-PSC91N00	P	814232122	4 weeks	\$2,124.00		95
R902401171	A10VO71DFR/31L-PSC92K01	P	814232122	4 weeks	\$2,317.00		95
R902400327	A10VO71DFR/31L-PSC92K02	P	814232122	4 weeks	\$2,317.00		95
R902400273	A10VO71DFR/31L-PSC92N00	P	814232122	4 weeks	\$2,124.00		95
R902401010	A10VO71DFR/31R-PSC91N00	P	814232122	4 weeks	\$2,124.00		95
R902401216	A10VO71DFR/31R-PSC92K01	P	814232122	4 weeks	\$2,317.00		95
R902400254	A10VO71DFR/31R-PSC92K02	P	814232122	4 weeks	\$2,317.00		95
R902400307	A10VO71DFR/31R-PSC92N00	P	814232122	4 weeks	\$2,124.00		95
R902400029	A10VO71DFR/31L-PSC91N00	P	814232122	4 weeks	\$2,124.00		95
R902401025	A10VO71DFR/31L-PSC92K01	P	814232122	4 weeks	\$2,317.00		95
R902406040	A10VO71DFR/31L-PSC92K02	P	814232122	4 weeks	\$2,317.00		95
R902400426	A10VO71DFR/31L-PSC92N00	P	814232122	4 weeks	\$2,124.00		95
R910990742	A10VO71DFR/31R-PSC91N00	P	814232122	4 weeks	\$2,124.00		95
R902401176	A10VO71DFR/31R-PSC92K01	P	814232122	4 weeks	\$2,317.00		95
R902400063	A10VO71DFR/31R-PSC92K02	P	814232122	4 weeks	\$2,317.00		95
R902400494	A10VO71DFR/31R-PSC92N00	P	814232122	4 weeks	\$2,124.00		95
R902401066	A10VO71DR/31L-PSC91N00	P	814232122	4 weeks	\$2,124.00		95
R902401008	A10VO71DR/31L-PSC92K01	P	814232122	4 weeks	\$2,317.00		95
R902401181	A10VO71DR/31L-PSC92K02	P	814232122	4 weeks	\$2,317.00		95
R902406039	A10VO71DR/31L-PSC92N00	P	814232122	4 weeks	\$2,124.00		95
R902401160	A10VO71DR/31R-PSC91N00	P	814232122	4 weeks	\$2,124.00		95
R902406038	A10VO71DR/31R-PSC92K01	P	814232122	4 weeks	\$2,317.00		95
R902401092	A10VO71DR/31R-PSC92K02	P	814232122	4 weeks	\$2,317.00		95
R902400350	A10VO71DR/31R-PSC92N00	P	814232122	4 weeks	\$2,124.00		95
R902400293	A10VO71DRG/31L-PSC91N00	P	814232122	4 weeks	\$2,124.00		95
R902401486	A10VO71DRG/31L-PSC92K01	P	814232122	4 weeks	\$2,317.00		95
R902406037	A10VO71DRG/31L-PSC92K02	P	814232122	4 weeks	\$2,317.00		95
R902401155	A10VO71DRG/31L-PSC92N00	P	814232122	4 weeks	\$2,124.00		95
R902401308	A10VO71DRG/31R-PSC91N00	P	814232122	4 weeks	\$2,124.00		95
R902401138	A10VO71DRG/31R-PSC92K01	P	814232122	4 weeks	\$2,317.00		95
R902401249	A10VO71DRG/31R-PSC92K02	P	814232122	4 weeks	\$2,317.00		95
R902401115	A10VO71DRG/31R-PSC92N00	P	814232122	4 weeks	\$2,124.00		95
R902406224	A10VSO10DFR/52R-PKC64N00	P	814232611	4 WKS	\$960.00		99
R902438335	A10VSO10DR/52R-PKC64N00	P	814232611	4 WKS	\$960.00		99
R902433002	A10VSO10DR/52R-VKC64N00-S1768	P	811232611	4 WKS	\$1,063.00		99
R902406235	A10VSO10DRG/52R-PKC64N00	P	814232611	4 WKS	\$960.00		99
R902500157	A10VSO18DFR/31L-PSC62K01	P	814232412	4 weeks	\$1,187.00		95
R910947666	A10VSO18DFR/31L-PSC62N00	P	814232412	4 weeks	\$1,062.00		95
R910947413	A10VSO18DFR/31R-PKC62K01	P	814232412	4 WKS	\$1,159.00		95
R910937515	A10VSO18DFR/31R-PKC62K40	P	814232412	4 WKS	\$1,159.00		95
R910946934	A10VSO18DFR/31R-PKC62N00	P	814232412	4 WKS	\$1,033.00		95
R910974677	A10VSO18DFR/31R-PSC62K01	P	814232412	4 weeks	\$1,187.00		95

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R910946939	A10VSO18DFR/31R-PSC62N00	P	814232412	4 weeks	\$1,062.00		95
R910974032	A10VSO18DFR1/31L-PSC62K01	P	814232412	4 weeks	\$1,187.00		95
R910946936	A10VSO18DFR1/31L-PSC62N00	P	814232412	4 weeks	\$1,062.00		95
R910945527	A10VSO18DFR1/31R-PSC62K01	P	814232412	4 weeks	\$1,187.00		95
R910947182	A10VSO18DFR1/31R-PSC62N00	P	814232412	4 weeks	\$1,062.00		95
R902406033	A10VSO18DR/31L-PSC62K01	P	814232412	4 weeks	\$1,187.00		95
R910961895	A10VSO18DR/31L-PSC62N00	P	814232412	4 weeks	\$1,062.00		95
R910983980	A10VSO18DR/31R-PKC62K01	P	814232412	4 WKS	\$1,159.00		95
R910940516	A10VSO18DR/31R-PKC62N00	P	814232412	4 WKS	\$1,033.00		95
R910960393	A10VSO18DR/31R-PSC62K01	P	814232412	4 weeks	\$1,187.00		95
R910948645	A10VSO18DR/31R-PSC62N00	P	814232412	4 weeks	\$1,062.00		95
R902406030	A10VSO18DRG/31L-PSC62K01	P	814232412	4 weeks	\$1,187.00		95
R902406025	A10VSO18DRG/31L-PSC62N00	P	814232412	4 weeks	\$1,062.00		95
R910987771	A10VSO18DRG/31R-PKC62K01	P	814232412	4 WKS	\$1,159.00		95
R902500108	A10VSO18DRG/31R-PKC62K40	P	814232412	4 WKS	\$1,159.00		95
R910944906	A10VSO18DRG/31R-PSC62N00	P	814232412	4 WKS	\$1,033.00		95
R910969812	A10VSO18DRG/31R-PSC62K01	P	814232412	4 weeks	\$1,159.00		95
R910948142	A10VSO18DRG/31R-PSC62N00	P	814232412	4 weeks	\$1,062.00		95
R902447030	A4 125/180-U01 THRU DRIVE KT	P	819920000	4 Weeks	\$306.00		76
R902447045	A4 125/180-U04 THRU DRIVE KT	P	819920000	4 Weeks	\$306.00		76
R902447050	A4 125/180-U07 THRU DRIVE KT	P	819920000	4 Weeks	\$306.00		76
R902447054	A4 125/180-U15 THRU DRIVE KT	P	819920000	4 Weeks	\$306.00		76
R902447056	A4 125/180-U16 THRU DRIVE KT	P	819920000	4 Weeks	\$306.00		76
R902447062	A4 125/180-U17 THRU DRIVE KT	P	819920000	4 Weeks	\$424.00		76
R902447052	A4 125/180-U24 THRU DRIVE KT	P	819920000	4 Weeks	\$306.00		76
R902447035	A4 125/180-U52 THRU DRIVE KT	P	819920000	4 Weeks	\$306.00		76
R902447040	A4 125/180-U68 THRU DRIVE KT	P	819920000	4 Weeks	\$306.00		76
R902447065	A4 180-U78 THRU DRIVE KT	P	819920000	4 Weeks	\$363.00		76
R902447032	A4 250/355-U01 THRU DRIVE KT	P	819920000	4 Weeks	\$424.00		76
R902447047	A4 250/355-U04 THRU DRIVE KT	P	819920000	4 Weeks	\$424.00		76
R902447051	A4 250/355-U07 THRU DRIVE KT	P	819920000	4 Weeks	\$424.00		76
R902447055	A4 250/355-U15 THRU DRIVE KT	P	819920000	4 Weeks	\$424.00		76
R902447057	A4 250/355-U16 THRU DRIVE KT	P	819920000	4 Weeks	\$424.00		76
R902447063	A4 250/355-U17 THRU DRIVE KT	P	819920000	4 Weeks	\$306.00		76
R902447067	A4 250/355-U18 THRU DRIVE KT	P	819920000	4 Weeks	\$511.00		76
R902447053	A4 250/355-U24 THRU DRIVE KT	P	819920000	4 Weeks	\$424.00		76
R902447037	A4 250/355-U52 THRU DRIVE KT	P	819920000	4 Weeks	\$424.00		76
R902447042	A4 250/355-U68 THRU DRIVE KT	P	819920000	4 Weeks	\$424.00		76
R902447066	A4 250/355-U78 THRU DRIVE KT	P	819920000	4 Weeks	\$511.00		76
not assigned	AA10VG18MD1/10L-NSC66F004S-E	P	811231112	4 WKS	\$1,626.00		114
not assigned	AA10VG18MD1/10L-NSC66F014S-E	P	811231112	4 WKS	\$1,906.00		114
not assigned	AA10VG18MD1/10L-NSC66F024S-E	P	811231112	4 WKS	\$1,922.00		114
not assigned	AA10VG18MD1/10R-NSC66F004S-E	P	811231112	4 WKS	\$1,626.00		114
not assigned	AA10VG18MD1/10R-NSC66F014S-E	P	811231112	4 WKS	\$1,906.00		114
not assigned	AA10VG18MD1/10R-NSC66F024S-E	P	811231112	4 WKS	\$1,922.00		114
not assigned	AA10VG28EP31/10L-NSC60F005DP	P	811231113	4 WKS	\$2,574.00		114
not assigned	AA10VG28EP31/10L-NSC60F005SP	P	811231113	4 WKS	\$2,574.00		114
not assigned	AA10VG28EP31/10L-NSC60F015DP	P	811231113	4 WKS	\$2,855.00		114
not assigned	AA10VG28EP31/10L-NSC60F015SP	P	811231113	4 WKS	\$2,855.00		114
not assigned	AA10VG28EP31/10L-NSC60F025DP	P	811231113	4 WKS	\$2,870.00		114
not assigned	AA10VG28EP31/10L-NSC60F025SP	P	811231113	4 WKS	\$2,870.00		114
not assigned	AA10VG28EP31/10R-NSC60F005DP	P	811231113	4 WKS	\$2,574.00		114
not assigned	AA10VG28EP31/10R-NSC60F005SP	P	811231113	4 WKS	\$2,574.00		114
not assigned	AA10VG28EP31/10R-NSC60F015DP	P	811231113	4 WKS	\$2,855.00		114

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
not assigned	AA10VG28EP31/10R-NSC60F015SP	P	811231113	4 WKS	\$2,855.00		114
not assigned	AA10VG28EP31/10R-NSC60F025DP	P	811231113	4 WKS	\$2,870.00		114
not assigned	AA10VG28EP31/10R-NSC60F025SP	P	811231113	4 WKS	\$2,870.00		114
not assigned	AA10VG28EP41/10L-NSC60F005DP	P	811231113	4 WKS	\$2,574.00		114
not assigned	AA10VG28EP41/10L-NSC60F005SP	P	811231113	4 WKS	\$2,574.00		114
not assigned	AA10VG28EP41/10L-NSC60F015DP	P	811231113	4 WKS	\$2,855.00		114
not assigned	AA10VG28EP41/10L-NSC60F015SP	P	811231113	4 WKS	\$2,855.00		114
not assigned	AA10VG28EP41/10L-NSC60F025DP	P	811231113	4 WKS	\$2,870.00		114
not assigned	AA10VG28EP41/10L-NSC60F025SP	P	811231113	4 WKS	\$2,870.00		114
not assigned	AA10VG28EP41/10R-NSC60F005DP	P	811231113	4 WKS	\$2,574.00		114
not assigned	AA10VG28EP41/10R-NSC60F005SP	P	811231113	4 WKS	\$2,574.00		114
not assigned	AA10VG28EP41/10R-NSC60F015DP	P	811231113	4 WKS	\$2,855.00		114
not assigned	AA10VG28EP41/10R-NSC60F015SP	P	811231113	4 WKS	\$2,855.00		114
not assigned	AA10VG28EP41/10R-NSC60F025DP	P	811231113	4 WKS	\$2,870.00		114
not assigned	AA10VG28EP41/10R-NSC60F025SP	P	811231113	4 WKS	\$2,870.00		114
not assigned	AA10VG28HD1/10L-NSC60F005D	P	811231113	4 WKS	\$2,335.00		114
not assigned	AA10VG28HD1/10L-NSC60F005S	P	811231113	4 WKS	\$2,335.00		114
not assigned	AA10VG28HD1/10L-NSC60F015D	P	811231113	4 WKS	\$2,615.00		114
not assigned	AA10VG28HD1/10L-NSC60F015S	P	811231113	4 WKS	\$2,615.00		114
not assigned	AA10VG28HD1/10L-NSC60F025D	P	811231113	4 WKS	\$2,631.00		114
not assigned	AA10VG28HD1/10L-NSC60F025S	P	811231113	4 WKS	\$2,631.00		114
not assigned	AA10VG28HD1/10R-NSC60F005D	P	811231113	4 WKS	\$2,335.00		114
not assigned	AA10VG28HD1/10R-NSC60F005S	P	811231113	4 WKS	\$2,335.00		114
not assigned	AA10VG28HD1/10R-NSC60F015D	P	811231113	4 WKS	\$2,615.00		114
not assigned	AA10VG28HD1/10R-NSC60F015S	P	811231113	4 WKS	\$2,615.00		114
not assigned	AA10VG28HD1/10R-NSC60F025D	P	811231113	4 WKS	\$2,631.00		114
not assigned	AA10VG28HD1/10R-NSC60F025S	P	811231113	4 WKS	\$2,631.00		114
not assigned	AA10VG28HW1/10L-NSC60F005D	P	811231113	4 WKS	\$2,069.00		114
not assigned	AA10VG28HW1/10L-NSC60F005S	P	811231113	4 WKS	\$2,069.00		114
not assigned	AA10VG28HW1/10L-NSC60F015D	P	811231113	4 WKS	\$2,349.00		114
not assigned	AA10VG28HW1/10L-NSC60F015S	P	811231113	4 WKS	\$2,349.00		114
not assigned	AA10VG28HW1/10L-NSC60F025D	P	811231113	4 WKS	\$2,365.00		114
not assigned	AA10VG28HW1/10L-NSC60F025S	P	811231113	4 WKS	\$2,365.00		114
not assigned	AA10VG28HW1/10R-NSC60F005D	P	811231113	4 WKS	\$2,069.00		114
not assigned	AA10VG28HW1/10R-NSC60F005S	P	811231113	4 WKS	\$2,069.00		114
not assigned	AA10VG28HW1/10R-NSC60F015D	P	811231113	4 WKS	\$2,349.00		114
not assigned	AA10VG28HW1/10R-NSC60F015S	P	811231113	4 WKS	\$2,349.00		114
not assigned	AA10VG28HW1/10R-NSC60F025D	P	811231113	4 WKS	\$2,365.00		114
not assigned	AA10VG28HW1/10R-NSC60F025S	P	811231113	4 WKS	\$2,365.00		114
not assigned	AA10VG45EP31/10L-NSC60F005DP	P	811231121	4 WKS	\$2,927.00		114
not assigned	AA10VG45EP31/10L-NSC60F005SP	P	811231121	4 WKS	\$2,927.00		114
not assigned	AA10VG45EP31/10L-NSC60F015DP	P	811231121	4 WKS	\$3,236.00		114
not assigned	AA10VG45EP31/10L-NSC60F015SP	P	811231121	4 WKS	\$3,236.00		114
not assigned	AA10VG45EP31/10L-NSC60F025DP	P	811231121	4 WKS	\$3,257.00		114
not assigned	AA10VG45EP31/10L-NSC60F025SP	P	811231121	4 WKS	\$3,257.00		114
not assigned	AA10VG45EP31/10R-NSC60F005DP	P	811231121	4 WKS	\$2,927.00		114
not assigned	AA10VG45EP31/10R-NSC60F005SP	P	811231121	4 WKS	\$2,927.00		114
not assigned	AA10VG45EP31/10R-NSC60F015DP	P	811231121	4 WKS	\$3,236.00		114
not assigned	AA10VG45EP31/10R-NSC60F015SP	P	811231121	4 WKS	\$3,236.00		114
not assigned	AA10VG45EP31/10R-NSC60F025DP	P	811231121	4 WKS	\$3,257.00		114
not assigned	AA10VG45EP31/10R-NSC60F025SP	P	811231121	4 WKS	\$3,257.00		114
not assigned	AA10VG45EP41/10L-NSC60F005DP	P	811231121	4 WKS	\$2,927.00		114
not assigned	AA10VG45EP41/10L-NSC60F005SP	P	811231121	4 WKS	\$2,927.00		114
not assigned	AA10VG45EP41/10L-NSC60F015DP	P	811231121	4 WKS	\$3,236.00		114

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
not assigned	AA10VG45EP41/10L-NSC60F015SP	P	811231121	4 WKS	\$3,236.00		114
not assigned	AA10VG45EP41/10L-NSC60F025DP	P	811231121	4 WKS	\$3,257.00		114
not assigned	AA10VG45EP41/10L-NSC60F025SP	P	811231121	4 WKS	\$3,257.00		114
not assigned	AA10VG45EP41/10R-NSC60F005DP	P	811231121	4 WKS	\$2,927.00		114
not assigned	AA10VG45EP41/10R-NSC60F005SP	P	811231121	4 WKS	\$2,927.00		114
not assigned	AA10VG45EP41/10R-NSC60F015DP	P	811231121	4 WKS	\$3,236.00		114
not assigned	AA10VG45EP41/10R-NSC60F015SP	P	811231121	4 WKS	\$3,236.00		114
not assigned	AA10VG45EP41/10R-NSC60F025DP	P	811231121	4 WKS	\$3,257.00		114
not assigned	AA10VG45EP41/10R-NSC60F025SP	P	811231121	4 WKS	\$3,257.00		114
not assigned	AA10VG45HD1/10L-NSC60F005D	P	811231121	4 WKS	\$2,674.00		114
not assigned	AA10VG45HD1/10L-NSC60F005S	P	811231121	4 WKS	\$2,674.00		114
not assigned	AA10VG45HD1/10L-NSC60F015D	P	811231121	4 WKS	\$2,984.00		114
not assigned	AA10VG45HD1/10L-NSC60F015S	P	811231121	4 WKS	\$2,984.00		114
not assigned	AA10VG45HD1/10L-NSC60F025D	P	811231121	4 WKS	\$3,005.00		114
not assigned	AA10VG45HD1/10L-NSC60F025S	P	811231121	4 WKS	\$3,005.00		114
not assigned	AA10VG45HD1/10R-NSC60F005D	P	811231121	4 WKS	\$2,674.00		114
not assigned	AA10VG45HD1/10R-NSC60F005S	P	811231121	4 WKS	\$2,674.00		114
not assigned	AA10VG45HD1/10R-NSC60F015D	P	811231121	4 WKS	\$2,984.00		114
not assigned	AA10VG45HD1/10R-NSC60F015S	P	811231121	4 WKS	\$2,984.00		114
not assigned	AA10VG45HD1/10R-NSC60F025D	P	811231121	4 WKS	\$3,005.00		114
not assigned	AA10VG45HD1/10R-NSC60F025S	P	811231121	4 WKS	\$3,005.00		114
not assigned	AA10VG45HW1/10L-NSC60F005D	P	811231121	4 WKS	\$2,398.00		114
not assigned	AA10VG45HW1/10L-NSC60F005S	P	811231121	4 WKS	\$2,398.00		114
not assigned	AA10VG45HW1/10L-NSC60F015D	P	811231121	4 WKS	\$2,708.00		114
not assigned	AA10VG45HW1/10L-NSC60F015S	P	811231121	4 WKS	\$2,708.00		114
not assigned	AA10VG45HW1/10L-NSC60F025D	P	811231121	4 WKS	\$2,729.00		114
not assigned	AA10VG45HW1/10L-NSC60F025S	P	811231121	4 WKS	\$2,729.00		114
not assigned	AA10VG45HW1/10R-NSC60F005D	P	811231121	4 WKS	\$2,398.00		114
not assigned	AA10VG45HW1/10R-NSC60F005S	P	811231121	4 WKS	\$2,398.00		114
not assigned	AA10VG45HW1/10R-NSC60F015D	P	811231121	4 WKS	\$2,708.00		114
not assigned	AA10VG45HW1/10R-NSC60F015S	P	811231121	4 WKS	\$2,708.00		114
not assigned	AA10VG45HW1/10R-NSC60F025D	P	811231121	4 WKS	\$2,729.00		114
not assigned	AA10VG45HW1/10R-NSC60F025S	P	811231121	4 WKS	\$2,729.00		114
R910913620	AA10VSO100DFR/31R-PKC62K01	P	814232423	4 WKS	\$3,617.00		103
R910913645	AA10VSO100DFR/31R-PKC62K02	P	814232423	4 WKS	\$3,617.00		103
R910911017	AA10VSO100DFR/31R-PKC62K03	P	814232423	4 WKS	\$3,617.00		103
R910961351	AA10VSO100DFR/31R-PKC62K04	P	814232423	4 WKS	\$3,617.00		103
R910913640	AA10VSO100DFR/31R-PKC62K05	P	814232423	4 WKS	\$3,617.00		103
R902408360	AA10VSO100DFR/31R-PKC62K07	P	814232423	4 WKS	\$3,617.00		103
R910912782	AA10VSO100DFR/31R-PKC62K08	P	814232423	4 WKS	\$3,617.00		103
R910911890	AA10VSO100DFR/31R-PKC62K38	P	814232423	4 WKS	\$3,617.00		103
R910908603	AA10VSO100DFR/31R-PKC62N00	P	814232423	4 WKS	\$3,345.00		103
R902500093	AA10VSO100DR/31R-PKC62K01	P	814232423	4 WKS	\$3,617.00		103
R910999832	AA10VSO100DR/31R-PKC62K03	P	814232423	4 WKS	\$3,617.00		103
R910999215	AA10VSO100DR/31R-PKC62K05	P	814232423	4 WKS	\$3,617.00		103
R910975714	AA10VSO100DR/31R-PKC62K08	P	814232423	4 WKS	\$3,617.00		103
R902405624	AA10VSO100DR/31R-PKC62K38	P	814232423	4 WKS	\$3,617.00		103
R902500117	AA10VSO100DR/31R-PKC62K40	P	814232423	4 WKS	\$3,617.00		103
R910943522	AA10VSO100DR/31R-PKC62N00	P	814232423	4 WKS	\$3,345.00		103
R902405352	AA10VSO100DRG/31R-PKC62N00	P	814232423	4 WKS	\$3,345.00		103
R910922747	AA10VSO140DFR/31R-PKD62K03	P	814232441	4 WKS	\$5,457.00		103
R910923144	AA10VSO140DFR/31R-PKD62K05	P	814232441	4 WKS	\$5,457.00		103
R902500130	AA10VSO140DFR/31R-PKD62K07	P	814232441	4 WKS	\$5,457.00		103
R910923215	AA10VSO140DFR/31R-PKD62K08	P	814232441	4 WKS	\$5,457.00		103



**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price	Price adder per	Page
					(7/15/06)	100mm (CDT3) 1" (CDT1, 4)	
R910929109	AA10VSO140DFR/31R-PKD62K21	P	814232441	4 WKS	\$5,457.00		103
R910923223	AA10VSO140DFR/31R-PKD62K38	P	814232441	4 WKS	\$5,457.00		103
R910936493	AA10VSO140DFR/31R-PKD62K40	P	814232441	4 WKS	\$5,457.00		103
R910921680	AA10VSO140DFR/31R-PKD62N00	P	814232441	4 WKS	\$5,128.00		103
R902500259	AA10VSO140DR/31R-PKD62K01	P	814232441	4 WKS	\$5,043.00		103
R902500055	AA10VSO140DR/31R-PKD62K02	P	814232441	4 WKS	\$5,043.00		103
R910993420	AA10VSO140DR/31R-PKD62K03	P	814232441	4 WKS	\$5,043.00		103
R902500232	AA10VSO140DR/31R-PKD62K05	P	814232441	4 WKS	\$5,043.00		103
R902500033	AA10VSO140DR/31R-PKD62K08	P	814232441	4 WKS	\$5,043.00		103
R910986272	AA10VSO140DR/31R-PKD62K17	P	814232441	4 WKS	\$5,043.00		103
R902500056	AA10VSO140DR/31R-PKD62K21	P	814232441	4 WKS	\$5,043.00		103
R902500158	AA10VSO140DR/31R-PKD62K38	P	814232441	4 WKS	\$5,043.00		103
R902500150	AA10VSO140DR/31R-PKD62K40	P	814232441	4 WKS	\$5,043.00		103
R910928863	AA10VSO140DR/31R-PKD62N00	P	814232441	4 WKS	\$4,713.00		103
R902500264	AA10VSO140DRG/31R-PKD62K03	P	814232441	4 WKS	\$5,043.00		103
R902500265	AA10VSO140DRG/31R-PKD62K05	P	814232441	4 WKS	\$5,043.00		103
R902500028	AA10VSO140DRG/31R-PKD62K07	P	814232441	4 WKS	\$5,043.00		103
R902500266	AA10VSO140DRG/31R-PKD62K08	P	814232441	4 WKS	\$5,043.00		103
R902403526	AA10VSO140DRG/31R-PKD62K21	P	814232441	4 WKS	\$5,043.00		103
R902500134	AA10VSO140DRG/31R-PKD62K38	P	814232441	4 WKS	\$5,043.00		103
R910928882	AA10VSO140DRG/31R-PKD62N00	P	814232441	4 WKS	\$4,713.00		103
R910909275	AA10VSO28DFR/31R-PKC62K01	P	814232413	4 WKS	\$1,448.00		103
R910966000	AA10VSO28DFR/31R-PKC62K02	P	814232413	4 WKS	\$1,448.00		103
R910910133	AA10VSO28DFR/31R-PKC62K03	P	814232413	4 WKS	\$1,448.00		103
R910936261	AA10VSO28DFR/31R-PKC62K40	P	814232413	4 WKS	\$1,448.00		103
R910939606	AA10VSO28DFR/31R-PKC62N00	P	814232413	4 WKS	\$1,306.00		103
R910994846	AA10VSO28DFR/31R-PKC62K01	P	814232413	4 WKS	\$1,448.00		103
R902400247	AA10VSO28DR/31R-PKC62K02	P	814232413	4 WKS	\$1,448.00		103
R902400018	AA10VSO28DR/31R-PKC62K03	P	814232413	4 WKS	\$1,448.00		103
R902400358	AA10VSO28DR/31R-PKC62K40	P	814232413	4 WKS	\$1,448.00		103
R910939604	AA10VSO28DR/31R-PKC62N00	P	814232413	4 WKS	\$1,306.00		103
R910966024	AA10VSO28DRG/31R-PKC62K01	P	814232413	4 WKS	\$1,448.00		103
R902401281	AA10VSO28DRG/31R-PKC62K02	P	814232413	4 WKS	\$1,448.00		103
R902401127	AA10VSO28DRG/31R-PKC62K03	P	814232413	4 WKS	\$1,448.00		103
R902401128	AA10VSO28DRG/31R-PKC62K40	P	814232413	4 WKS	\$1,448.00		103
R910940792	AA10VSO28DRG/31R-PKC62N00	P	814232413	4 WKS	\$1,306.00		103
R910909279	AA10VSO45DFR/31R-PKC62K01	P	814232421	4 WKS	\$1,777.00		103
R910986201	AA10VSO45DFR/31R-PKC62K02	P	814232421	4 WKS	\$1,777.00		103
R910907990	AA10VSO45DFR/31R-PKC62K03	P	814232421	4 WKS	\$1,777.00		103
R910911088	AA10VSO45DFR/31R-PKC62K03	P	814232111	4 weeks	\$1,334.00		103
R910907984	AA10VSO45DFR/31R-PKC62K05	P	814232421	4 WKS	\$1,777.00		103
R910936245	AA10VSO45DFR/31R-PKC62K40	P	814232421	4 WKS	\$1,777.00		103
R910939612	AA10VSO45DFR/31R-PKC62N00	P	814232421	4 WKS	\$1,613.00		103
R910964862	AA10VSO45DR/31R-PKC62K02	P	814232421	4 WKS	\$1,777.00		103
R910930737	AA10VSO45DR/31R-PKC62K03	P	814232421	4 WKS	\$1,777.00		103
R910966131	AA10VSO45DR/31R-PKC62K05	P	814232421	4 WKS	\$1,777.00		103
R902400345	AA10VSO45DR/31R-PKC62K40	P	814232421	4 WKS	\$1,777.00		103
R910940544	AA10VSO45DR/31R-PKC62N00	P	814232421	4 WKS	\$1,613.00		103
R902400269	AA10VSO45DRG/31R-PKC62K01	P	814232421	4 WKS	\$1,777.00		103
R902400337	AA10VSO45DRG/31R-PKC62K02	P	814232421	4 WKS	\$1,777.00		103
R902400314	AA10VSO45DRG/31R-PKC62K04	P	814232421	4 WKS	\$1,777.00		103
R902400387	AA10VSO45DRG/31R-PKC62K05	P	814232421	4 WKS	\$1,777.00		103
R902400382	AA10VSO45DRG/31R-PKC62K40	P	814232421	4 WKS	\$1,777.00		103
R910965956	AA10VSO45DRG/31R-PKC62N00	P	814232421	4 WKS	\$1,613.00		103

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R902400480	AA10VSO71DFR/31R-PKC92K01	P	814232422	4 WKS	\$2,527.00		103
R902400118	AA10VSO71DFR/31R-PKC92K02	P	814232422	4 WKS	\$2,527.00		103
R902401009	AA10VSO71DFR/31R-PKC92K03	P	814232422	4 WKS	\$2,527.00		103
R902400357	AA10VSO71DFR/31R-PKC92K04	P	814232422	4 WKS	\$2,527.00		103
R902400129	AA10VSO71DFR/31R-PKC92K05	P	814232422	4 WKS	\$2,527.00		103
R902400154	AA10VSO71DFR/31R-PKC92K08	P	814232422	4 WKS	\$2,527.00		103
R902400458	AA10VSO71DFR/31R-PKC92K40	P	814232422	4 WKS	\$2,527.00		103
R902400347	AA10VSO71DFR/31R-PKC92N00	P	814232422	4 WKS	\$2,334.00		103
R902400202	AA10VSO71DR/31R-PKC92K01	P	814232422	4 WKS	\$2,527.00		103
R902401039	AA10VSO71DR/31R-PKC92K02	P	814232422	4 WKS	\$2,527.00		103
R902400263	AA10VSO71DR/31R-PKC92K03	P	814232422	4 WKS	\$2,527.00		103
R902400333	AA10VSO71DR/31R-PKC92K05	P	814232422	4 WKS	\$2,527.00		103
R902401203	AA10VSO71DR/31R-PKC92K07	P	814232422	4 WKS	\$2,527.00		103
R902400305	AA10VSO71DR/31R-PKC92K08	P	814232422	4 WKS	\$2,527.00		103
R902400425	AA10VSO71DR/31R-PKC92K40	P	814232422	4 WKS	\$2,527.00		103
R902400434	AA10VSO71DR/31R-PKC92N00	P	814232422	4 WKS	\$2,334.00		103
R902400256	AA10VSO71DRG/31R-PKC92K01	P	814232422	4 WKS	\$2,527.00		103
R902401095	AA10VSO71DRG/31R-PKC92K03	P	814232422	4 WKS	\$2,527.00		103
R902401117	AA10VSO71DRG/31R-PKC92K08	P	814232422	4 WKS	\$2,527.00		103
R902400217	AA10VSO71DRG/31R-PKC92K40	P	814232422	4 WKS	\$2,527.00		103
R902401004	AA10VSO71DRG/31R-PKC92N00	P	814232422	4 WKS	\$2,334.00		103
R902017474	AA11VLO130DR/10L-NSD62N00	P	814234231	4 Weeks	\$6,557.00		91
R909606878	AA11VLO130DR/10R-NSD62N00	P	814234231	4 Weeks	\$6,557.00		91
R909613455	AA11VLO130DRG/10L-NSD62N00	P	814234231	4 Weeks	\$6,696.00		91
R902046546	AA11VLO130DRS/10L-NSD62K02	P	814234231	4 Weeks	\$7,077.00		91
R902046954	AA11VLO130DRS/10L-NSD62K04	P	814234231	4 Weeks	\$7,092.00		91
R902018580	AA11VLO130DRS/10L-NSD62K07	P	814234231	4 Weeks	\$7,265.00		91
R909606879	AA11VLO130DRS/10L-NSD62N00	P	814234231	4 Weeks	\$6,696.00		91
R902062566	AA11VLO130DRS/10R-NSD62K02	P	814234231	4 Weeks	\$7,077.00		91
R902070267	AA11VLO130DRS/10R-NSD62K17	P	814234231	4 Weeks	\$7,247.00		91
R909609230	AA11VLO130DRS/10R-NSD62N00	P	814234231	4 Weeks	\$6,696.00		91
R902044992	AA11VLO130LRD/10R-NSD62N00	P	814234231	4 Weeks	\$7,105.00		91
R902046991	AA11VLO130LRDS/10L-NSD62K17	P	814234231	4 Weeks	\$7,795.00		91
R909606919	AA11VLO130LRDS/10L-NSD62N00	P	814234231	4 Weeks	\$7,244.00		91
R902019765	AA11VLO130LRDS/10R-NSD62K01	P	814234231	4 Weeks	\$7,593.00		91
R902003585	AA11VLO130LRDS/10R-NSD62N00	P	814234231	4 Weeks	\$7,244.00		91
R902094347	AA11VLO145DRS/11L-NSD62N00	P	814234241	4 Weeks	\$7,159.00		91
R902112693	AA11VLO145DRS/11R-NSD62K17	P	814234241	4 Weeks	\$7,414.00		91
R902081666	AA11VLO145DRS/11R-NSD62N00	P	814234241	4 Weeks	\$7,159.00		91
R902108358	AA11VLO145LRDS/11R-NSD62K02	P	814234241	4 Weeks	\$8,093.00		91
R902097455	AA11VLO145LRDS/11R-NSD62K07	P	814234241	4 Weeks	\$8,279.00		91
R902089378	AA11VLO145LRDS/11R-NSD62N00	P	814234241	4 Weeks	\$7,710.00		91
R902037423	AA11VLO190DR/11L-NSD62N00	P	814234243	4 Weeks	\$8,897.00		91
R902050287	AA11VLO190DRS/11L-NSD62K04	P	814234243	4 Weeks	\$9,495.00		91
R902032963	AA11VLO190DRS/11L-NSD62N00	P	814234243	4 Weeks	\$9,068.00		91
R902075881	AA11VLO190DRS/11R-NSD62K02	P	814234243	4 Weeks	\$9,481.00		91
R902030119	AA11VLO190DRS/11R-NSD62N00	P	814234243	4 Weeks	\$9,068.00		91
R902096482	AA11VLO190LRD/11R-NSD62K07	P	814234243	4 Weeks	\$9,757.00		91
R902032982	AA11VLO190LRD/11R-NSD62N00	P	814234243	4 Weeks	\$9,163.00		91
R902104773	AA11VLO190LRDH2/11L-NSD62K02	P	814234243	4 Weeks	\$9,986.00		91
R902046918	AA11VLO190LRDH2/11L-NSD62N00	P	814234243	4 Weeks	\$9,574.00		91
R902044229	AA11VLO190LRDS/11L-NSD62K04	P	814234243	4 Weeks	\$9,761.00		91
R902090564	AA11VLO190LRDS/11R-NPD62N00	P	814234243	4 Weeks	\$8,699.00		91
R902042738	AA11VLO190LRDS/11R-NSD62K02	P	814234243	4 Weeks	\$9,747.00		91

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R902062561	AA11VLO190LRDS/11R-NSD62K04	P	814234243	4 Weeks	\$9,761.00		91
R902046207	AA11VLO190LRDS/11R-NSD62K07	P	814234243	4 Weeks	\$9,687.00		91
R902042644	AA11VLO190LRDS/11R-NSD62N00	P	814234243	4 Weeks	\$9,334.00		91
R902088323	AA11VLO190LRS/11R-NSD62K01	P	814234243	4 Weeks	\$9,574.00		91
R902044772	AA11VLO260DR/11R-NSD62N00	P	814234254	4 Weeks	\$11,580.00		91
R902062532	AA11VLO260DRG/11L-NSD62N00	P	814234254	4 Weeks	\$11,174.00		91
R902046509	AA11VLO260DRG/11R-NSD62N00	P	814234254	4 Weeks	\$11,174.00		91
R902064552	AA11VLO260DRS/11L-NSD62N00	P	814234254	4 Weeks	\$11,174.00		91
R902100815	AA11VLO260LRD/11R-NSD62N00	P	814234254	4 Weeks	\$11,844.00		91
R902108017	AA11VLO260LRDH2/11L-NSD62K02	P	814234254	4 Weeks	\$12,697.00		91
R902037201	AA11VLO260LRDH2/11L-NSD62K17	P	814234254	4 Weeks	\$12,517.00		91
R902030152	AA11VLO260LRDH2/11L-NSD62N00	P	814234254	4 Weeks	\$12,255.00		91
R902079116	AA11VO130DRS/10L-NSD62K07	P	814234231	4 Weeks	\$6,958.00		91
R902087743	AA11VO130DRS/10L-NSD62K17	P	814234231	4 Weeks	\$6,939.00		91
R902022005	AA11VO130DRS/10L-NSD62N00	P	814234231	4 Weeks	\$6,387.00		91
R909606343	AA11VO130DRS/10R-NSD62K07	P	814234231	4 Weeks	\$6,958.00		91
R902039268	AA11VO130DRS/10R-NSD62N00	P	814234231	4 Weeks	\$6,387.00		91
R902016292	AA11VO130LRD/10L-NSD62N00	P	814234231	4 Weeks	\$6,796.00		91
R902016317	AA11VO130LRDS/10L-NSD62N00	P	814234231	4 Weeks	\$7,172.00		91
R902053486	AA11VO130LRDS/10R-NSD62K01	P	814234231	4 Weeks	\$7,521.00		91
R902073388	AA11VO40DRG/10L-NSC62N00	P	814234221	4 Weeks	\$3,778.00		91
R902026800	AA11VO40DRS/10L-NSC62N00	P	814234221	4 Weeks	\$3,778.00		91
R902066860	AA11VO40LRD/10L-NSC62N00	P	814234221	4 Weeks	\$4,190.00		91
R909602372	AA11VO40LRDS/10L-NSC62N00	P	814234221	4 Weeks	\$4,084.00		91
R902075519	AA11VO40LRDS/10R-NSC62N00	P	814234221	4 Weeks	\$4,084.00		91
R902050038	AA11VO40LRG/10L-NSC62N00	P	814234221	4 Weeks	\$4,126.00		91
R902102093	AA11VO60DRG/10L-NSC62N00	P	814234223	4 Weeks	\$4,312.00		91
R902087324	AA11VO60DRG/10R-NSC62K07	P	814234223	4 Weeks	\$4,883.00		91
R909601057	AA11VO60DRS/10L-NSC62N00	P	814234223	4 Weeks	\$4,312.00		91
R902042946	AA11VO60DRS/10R-NSC62N00	P	814234223	4 Weeks	\$4,312.00		91
R902048451	AA11VO60LRD/10L-NSC62N00	P	814234223	4 Weeks	\$4,729.00		91
R909601871	AA11VO60LRDS/10L-NSC62N00	P	814234223	4 Weeks	\$4,792.00		91
R902027773	AA11VO60LRDS/10R-NSC62K01	P	814234223	4 Weeks	\$4,957.00		91
R902039012	AA11VO75DR/10L-NSD62K02	P	814234224	4 Weeks	\$5,027.00		91
R902096446	AA11VO75DRS/10L-NSD62K01	P	814234224	4 Weeks	\$5,062.00		91
R902096447	AA11VO75DRS/10L-NSD62K02	P	814234224	4 Weeks	\$5,094.00		91
R909608951	AA11VO75DRS/10L-NSD62K07	P	814234224	4 Weeks	\$5,282.00		91
R902050050	AA11VO75DRS/10L-NSD62N00	P	814234224	4 Weeks	\$4,712.00		91
R902036245	AA11VO75DRS/10R-NSD62N00	P	814234224	4 Weeks	\$4,712.00		91
R902051259	AA11VO75LRDS/10L-NSD62N00	P	814234224	4 Weeks	\$5,192.00		91
R909601730	AA11VO75LRDS/10R-NSD62N00	P	814234224	4 Weeks	\$5,192.00		91
R902032908	AA11VO95DRG/10L-NSD62N00	P	814234225	4 Weeks	\$5,819.00		91
R902046197	AA11VO95DRS/10L-NSD62K02	P	814234225	4 Weeks	\$5,632.00		91
R909602011	AA11VO95DRS/10L-NSD62K04	P	814234225	4 Weeks	\$5,646.00		91
R902046053	AA11VO95DRS/10L-NSD62K07	P	814234225	4 Weeks	\$5,819.00		91
R902010260	AA11VO95DRS/10L-NSD62K17	P	814234225	4 Weeks	\$5,801.00		91
R902002720	AA11VO95DRS/10L-NSD62N00	P	814234225	4 Weeks	\$5,249.00		91
R902039182	AA11VO95DRS/10R-NSD62K02	P	814234225	4 Weeks	\$5,632.00		91
R902044816	AA11VO95DRS/10R-NSD62K04	P	814234225	4 Weeks	\$5,646.00		91
R902042944	AA11VO95DRS/10R-NSD62K07	P	814234225	4 Weeks	\$5,819.00		91
R902064128	AA11VO95DRS/10R-NSD62K17	P	814234225	4 Weeks	\$5,801.00		91
R902064129	AA11VO95DRS/10R-NSD62N00	P	814234225	4 Weeks	\$5,249.00		91
R902087560	AA11VO95LRDH2/10L-NSD62N00	P	814234225	4 Weeks	\$5,980.00		91
R902044850	AA11VO95LRDS/10R-NSD62K01	P	814234225	4 Weeks	\$6,174.00		91

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R909601674	AA11VO95LRDS/10R-NSD62N00	P	814234225	4 Weeks	\$5,800.00		91
R909416550	AA2FM107/61W-VSD510	P	812113131	4 WKS	\$3,387.00		47
R909409681	AA2FM125/61W-VSD520	P	812113132	4 WKS	\$3,926.00		47
R909421614	AA2FM16/61W-VSC530	P	812113115	4 WKS	\$1,387.00		47
R902028609	AA2FM160/61W-VSD510	P	812113141	4 WKS	\$4,633.00		47
R909409203	AA2FM180/61W-VSD510	P	812113142	4 WKS	\$4,865.00		47
R909408999	AA2FM32/61W-VSD520	P	812113121	4 WKS	\$1,793.00		47
R909417126	AA2FM45/61W-VSD520	P	812113122	4 WKS	\$2,136.00		47
R909408971	AA2FM63/61W-VSD520	P	812113124	4 WKS	\$2,586.00		47
R902011966	AA2FM80/61W-VQDN520	P	812113125	4 WKS	\$2,863.00		47
R902011964	AA2FM90/61W-VQDN520	P	812113126	4 WKS	\$3,059.00		47
not assigned	AA4VG125EP3D1/32L-NSF52F001DP	P	811233131	4 WKS	\$8,097.00		68
not assigned	AA4VG125EP3D1/32L-NSF52F001SP	P	811233131	4 WKS	\$8,097.00		68
not assigned	AA4VG125EP3D1/32L-NSF52F011DP	P	811233131	4 WKS	\$8,559.00		68
not assigned	AA4VG125EP3D1/32L-NSF52F011SP	P	811233131	4 WKS	\$8,559.00		68
not assigned	AA4VG125EP3D1/32L-NSF52F021DP	P	811233131	4 WKS	\$8,626.00		68
not assigned	AA4VG125EP3D1/32L-NSF52F021SP	P	811233131	4 WKS	\$8,626.00		68
not assigned	AA4VG125EP3D1/32R-NSF52F001DP	P	811233131	4 WKS	\$8,097.00		68
not assigned	AA4VG125EP3D1/32R-NSF52F001SP	P	811233131	4 WKS	\$8,097.00		68
not assigned	AA4VG125EP3D1/32R-NSF52F011DP	P	811233131	4 WKS	\$8,559.00		68
not assigned	AA4VG125EP3D1/32R-NSF52F011SP	P	811233131	4 WKS	\$8,559.00		68
not assigned	AA4VG125EP3D1/32R-NSF52F021DP	P	811233131	4 WKS	\$8,626.00		68
not assigned	AA4VG125EP3D1/32R-NSF52F021SP	P	811233131	4 WKS	\$8,626.00		68
not assigned	AA4VG125EP4D1/32L-NSF52F001DP	P	811233131	4 WKS	\$8,097.00		68
not assigned	AA4VG125EP4D1/32L-NSF52F001SP	P	811233131	4 WKS	\$8,097.00		68
not assigned	AA4VG125EP4D1/32L-NSF52F011DP	P	811233131	4 WKS	\$8,559.00		68
not assigned	AA4VG125EP4D1/32L-NSF52F011SP	P	811233131	4 WKS	\$8,559.00		68
not assigned	AA4VG125EP4D1/32L-NSF52F021DP	P	811233131	4 WKS	\$8,626.00		68
not assigned	AA4VG125EP4D1/32L-NSF52F021SP	P	811233131	4 WKS	\$8,626.00		68
not assigned	AA4VG125EP4D1/32R-NSF52F001DP	P	811233131	4 WKS	\$8,097.00		68
not assigned	AA4VG125EP4D1/32R-NSF52F001SP	P	811233131	4 WKS	\$8,097.00		68
not assigned	AA4VG125EP4D1/32R-NSF52F011DP	P	811233131	4 WKS	\$8,559.00		68
not assigned	AA4VG125EP4D1/32R-NSF52F011SP	P	811233131	4 WKS	\$8,559.00		68
not assigned	AA4VG125EP4D1/32R-NSF52F021DP	P	811233131	4 WKS	\$8,626.00		68
not assigned	AA4VG125EP4D1/32R-NSF52F021SP	P	811233131	4 WKS	\$8,626.00		68
R902024048	AA4VG125HD1/32L-NSF52F001D	P	811233131	4 WKS	\$7,924.00		68
R902024258	AA4VG125HD1/32L-NSF52F001S	P	811233131	4 WKS	\$7,924.00		68
R902104775	AA4VG125HD1/32L-NSF52F011D	P	811233131	4 WKS	\$8,385.00		68
not assigned	AA4VG125HD1/32L-NSF52F011S	P	811233131	4 WKS	\$8,385.00		68
R902029496	AA4VG125HD1/32L-NSF52F021D	P	811233131	4 WKS	\$8,452.00		68
not assigned	AA4VG125HD1/32L-NSF52F021S	P	811233131	4 WKS	\$8,452.00		68
R902024066	AA4VG125HD1/32R-NSF52F001D	P	811233131	4 WKS	\$7,924.00		68
not assigned	AA4VG125HD1/32R-NSF52F001S	P	811233131	4 WKS	\$7,924.00		68
not assigned	AA4VG125HD1/32R-NSF52F011D	P	811233131	4 WKS	\$8,385.00		68
R902024079	AA4VG125HD1/32R-NSF52F011S	P	811233131	4 WKS	\$8,385.00		68
R902044087	AA4VG125HD1/32R-NSF52F021D	P	811233131	4 WKS	\$8,452.00		68
not assigned	AA4VG125HD1/32R-NSF52F021S	P	811233131	4 WKS	\$8,452.00		68
R902024048	AA4VG125HWD1/32L-NSF52F001D	P	811233131	4 WKS	\$7,530.00		68
R902024258	AA4VG125HWD1/32L-NSF52F001S	P	811233131	4 WKS	\$7,530.00		68
R902104775	AA4VG125HWD1/32L-NSF52F011D	P	811233131	4 WKS	\$7,991.00		68
not assigned	AA4VG125HWD1/32L-NSF52F011S	P	811233131	4 WKS	\$7,991.00		68
R902029496	AA4VG125HWD1/32L-NSF52F021D	P	811233131	4 WKS	\$8,058.00		68
not assigned	AA4VG125HWD1/32L-NSF52F021S	P	811233131	4 WKS	\$8,058.00		68
R902024066	AA4VG125HWD1/32R-NSF52F001D	P	811233131	4 WKS	\$7,530.00		68



## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price	Price adder per	Page
					(7/15/06)	100mm (CDT3) 1" (CDT1, 4)	
not assigned	AA4VG125HWD1/32R-NSF52F001S	P	811233131	4 WKS	\$7,530.00		68
not assigned	AA4VG125HWD1/32R-NSF52F011D	P	811233131	4 WKS	\$7,991.00		68
R902024079	AA4VG125HWD1/32R-NSF52F011S	P	811233131	4 WKS	\$7,991.00		68
R902044087	AA4VG125HWD1/32R-NSF52F021D	P	811233131	4 WKS	\$8,058.00		68
not assigned	AA4VG125HWD1/32R-NSF52F021S	P	811233131	4 WKS	\$8,058.00		68
not assigned	AA4VG56EP3D1/32L-NSC52F005DP	P	811253123	4 WKS	\$4,248.00		68
not assigned	AA4VG56EP3D1/32L-NSC52F005SP	P	811253123	4 WKS	\$4,248.00		68
not assigned	AA4VG56EP3D1/32L-NSC52F015DP	P	811233123	4 WKS	\$4,529.00		68
not assigned	AA4VG56EP3D1/32L-NSC52F015SP	P	811233123	4 WKS	\$4,529.00		68
not assigned	AA4VG56EP3D1/32L-NSC52F025DP	P	811233123	4 WKS	\$4,640.00		68
not assigned	AA4VG56EP3D1/32L-NSC52F025SP	P	811233123	4 WKS	\$4,640.00		68
not assigned	AA4VG56EP3D1/32R-NSC52F005DP	P	811233123	4 WKS	\$4,248.00		68
not assigned	AA4VG56EP3D1/32R-NSC52F005SP	P	811233123	4 WKS	\$4,248.00		68
not assigned	AA4VG56EP3D1/32R-NSC52F015DP	P	811233123	4 WKS	\$4,529.00		68
not assigned	AA4VG56EP3D1/32R-NSC52F015SP	P	811233123	4 WKS	\$4,529.00		68
not assigned	AA4VG56EP3D1/32R-NSC52F025DP	P	811233123	4 WKS	\$4,640.00		68
not assigned	AA4VG56EP3D1/32R-NSC52F025SP	P	811233123	4 WKS	\$4,640.00		68
not assigned	AA4VG56EP4D1/32L-NSC52F005DP	P	811233123	4 WKS	\$4,248.00		68
not assigned	AA4VG56EP4D1/32L-NSC52F015DP	P	811233123	4 WKS	\$4,529.00		68
not assigned	AA4VG56EP4D1/32L-NSC52F015SP	P	811233123	4 WKS	\$4,529.00		68
not assigned	AA4VG56EP4D1/32L-NSC52F025DP	P	811233123	4 WKS	\$4,640.00		68
not assigned	AA4VG56EP4D1/32L-NSC52F025SP	P	811233123	4 WKS	\$4,640.00		68
not assigned	AA4VG56EP4D1/32R-NSC52F005DP	P	811233123	4 WKS	\$4,248.00		68
not assigned	AA4VG56EP4D1/32R-NSC52F005SP	P	811233123	4 WKS	\$4,248.00		68
not assigned	AA4VG56EP4D1/32R-NSC52F015DP	P	811233123	4 WKS	\$4,529.00		68
not assigned	AA4VG56EP4D1/32R-NSC52F015SP	P	811233123	4 WKS	\$4,529.00		68
not assigned	AA4VG56EP4D1/32R-NSC52F025DP	P	811233123	4 WKS	\$4,640.00		68
not assigned	AA4VG56EP4D1/32R-NSC52F025SP	P	811233123	4 WKS	\$4,640.00		68
R902020675	AA4VG56HD1/32L-NSC52F005D	P	811233123	4 WKS	\$4,019.00		68
R902030007	AA4VG56HD1/32L-NSC52F005S	P	811233123	4 WKS	\$4,019.00		68
R902030400	AA4VG56HD1/32L-NSC52F015D	P	811233123	4 WKS	\$4,300.00		68
not assigned	AA4VG56HD1/32L-NSC52F015S	P	811233123	4 WKS	\$4,300.00		68
not assigned	AA4VG56HD1/32L-NSC52F025D	P	811233123	4 WKS	\$4,411.00		68
not assigned	AA4VG56HD1/32L-NSC52F025S	P	811233123	4 WKS	\$4,411.00		68
R902032308	AA4VG56HD1/32R-NSC52F005D	P	811233123	4 WKS	\$4,019.00		68
R902020664	AA4VG56HD1/32R-NSC52F005S	P	811233123	4 WKS	\$4,019.00		68
not assigned	AA4VG56HD1/32R-NSC52F015D	P	811233123	4 WKS	\$4,300.00		68
R902022768	AA4VG56HD1/32R-NSC52F015S	P	811233123	4 WKS	\$4,300.00		68
R902044128	AA4VG56HD1/32R-NSC52F025D	P	811233123	4 WKS	\$4,411.00		68
R902020662	AA4VG56HD1/32R-NSC52F025S	P	811233123	4 WKS	\$4,411.00		68
R902020675	AA4VG56HWD1/32L-NSC52F005D	P	811233123	4 WKS	\$3,742.00		68
R902030007	AA4VG56HWD1/32L-NSC52F005S	P	811233123	4 WKS	\$3,742.00		68
R902030400	AA4VG56HWD1/32L-NSC52F015D	P	811233123	4 WKS	\$4,023.00		68
not assigned	AA4VG56HWD1/32L-NSC52F015S	P	811233123	4 WKS	\$4,023.00		68
not assigned	AA4VG56HWD1/32L-NSC52F025D	P	811233123	4 WKS	\$4,134.00		68
not assigned	AA4VG56HWD1/32L-NSC52F025S	P	811233123	4 WKS	\$4,134.00		68
R902032308	AA4VG56HWD1/32R-NSC52F005D	P	811233123	4 WKS	\$3,742.00		68
R902020664	AA4VG56HWD1/32R-NSC52F005S	P	811233123	4 WKS	\$3,742.00		68
not assigned	AA4VG56HWD1/32R-NSC52F015D	P	811233123	4 WKS	\$4,023.00		68
R902022768	AA4VG56HWD1/32R-NSC52F015S	P	811233123	4 WKS	\$4,023.00		68
R902044128	AA4VG56HWD1/32R-NSC52F025D	P	811233123	4 WKS	\$4,134.00		68
R902020662	AA4VG56HWD1/32R-NSC52F025S	P	811233123	4 WKS	\$4,134.00		68
not assigned	AA4VG71EP3D1/32L-NSF52F001DP	P	811233124	4 WKS	\$4,621.00		68
not assigned	AA4VG71EP3D1/32L-NSF52F001SP	P	811233124	4 WKS	\$4,621.00		68

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price	Price adder per	Page
					(7/15/06)	100mm (CDT3) 1" (CDT1, 4)	
not assigned	AA4VG71EP3D1/32L-NSF52F011DP	P	811233124	4 WKS	\$4,902.00		68
not assigned	AA4VG71EP3D1/32L-NSF52F011SP	P	811233124	4 WKS	\$4,902.00		68
not assigned	AA4VG71EP3D1/32L-NSF52F021DP	P	811233124	4 WKS	\$5,013.00		68
not assigned	AA4VG71EP3D1/32L-NSF52F021SP	P	811233124	4 WKS	\$5,013.00		68
not assigned	AA4VG71EP3D1/32R-NSF52F001DP	P	811233124	4 WKS	\$4,621.00		68
not assigned	AA4VG71EP3D1/32R-NSF52F001SP	P	811233124	4 WKS	\$4,621.00		68
not assigned	AA4VG71EP3D1/32R-NSF52F011DP	P	811233124	4 WKS	\$4,902.00		68
not assigned	AA4VG71EP3D1/32R-NSF52F011SP	P	811233124	4 WKS	\$4,902.00		68
not assigned	AA4VG71EP3D1/32R-NSF52F021DP	P	811233124	4 WKS	\$5,013.00		68
not assigned	AA4VG71EP3D1/32R-NSF52F021SP	P	811233124	4 WKS	\$5,013.00		68
not assigned	AA4VG71EP4D1/32L-NSF52F001DP	P	811233124	4 WKS	\$4,621.00		68
not assigned	AA4VG71EP4D1/32L-NSF52F001SP	P	811233124	4 WKS	\$4,621.00		68
not assigned	AA4VG71EP4D1/32L-NSF52F011DP	P	811233124	4 WKS	\$4,902.00		68
not assigned	AA4VG71EP4D1/32L-NSF52F011SP	P	811233124	4 WKS	\$4,902.00		68
not assigned	AA4VG71EP4D1/32L-NSF52F021DP	P	811233124	4 WKS	\$5,013.00		68
not assigned	AA4VG71EP4D1/32L-NSF52F021SP	P	811233124	4 WKS	\$5,013.00		68
not assigned	AA4VG71EP4D1/32R-NSF52F001DP	P	811233124	4 WKS	\$4,621.00		68
not assigned	AA4VG71EP4D1/32R-NSF52F001SP	P	811233124	4 WKS	\$4,621.00		68
not assigned	AA4VG71EP4D1/32R-NSF52F011DP	P	811233124	4 WKS	\$4,902.00		68
not assigned	AA4VG71EP4D1/32R-NSF52F011SP	P	811233124	4 WKS	\$4,902.00		68
not assigned	AA4VG71EP4D1/32R-NSF52F021DP	P	811233124	4 WKS	\$5,013.00		68
not assigned	AA4VG71EP4D1/32R-NSF52F021SP	P	811233124	4 WKS	\$5,013.00		68
R902022389	AA4VG71HD1/32L-NSF52F001D	P	811233124	4 WKS	\$4,389.00		68
R902022649	AA4VG71HD1/32L-NSF52F001S	P	811233124	4 WKS	\$4,389.00		68
R902032653	AA4VG71HD1/32L-NSF52F011D	P	811233124	4 WKS	\$4,670.00		68
not assigned	AA4VG71HD1/32L-NSF52F011S	P	811233124	4 WKS	\$4,670.00		68
R902007823	AA4VG71HD1/32L-NSF52F021D	P	811233124	4 WKS	\$4,781.00		68
not assigned	AA4VG71HD1/32L-NSF52F021S	P	811233124	4 WKS	\$4,781.00		68
R902022361	AA4VG71HD1/32R-NSF52F001D	P	811233124	4 WKS	\$4,389.00		68
R902022646	AA4VG71HD1/32R-NSF52F001S	P	811233124	4 WKS	\$4,389.00		68
not assigned	AA4VG71HD1/32R-NSF52F011D	P	811233124	4 WKS	\$4,670.00		68
R902022652	AA4VG71HD1/32R-NSF52F011S	P	811233124	4 WKS	\$4,670.00		68
R902022391	AA4VG71HD1/32R-NSF52F021D	P	811233124	4 WKS	\$4,781.00		68
not assigned	AA4VG71HD1/32R-NSF52F021S	P	811233124	4 WKS	\$4,781.00		68
R902022389	AA4VG71HWD1/32L-NSF52F001D	P	811233124	4 WKS	\$4,112.00		68
R902022649	AA4VG71HWD1/32L-NSF52F001S	P	811233124	4 WKS	\$4,112.00		68
R902032653	AA4VG71HWD1/32L-NSF52F011D	P	811233124	4 WKS	\$4,393.00		68
not assigned	AA4VG71HWD1/32L-NSF52F011S	P	811233124	4 WKS	\$4,393.00		68
R902007823	AA4VG71HWD1/32L-NSF52F021D	P	811233124	4 WKS	\$4,504.00		68
not assigned	AA4VG71HWD1/32L-NSF52F021S	P	811233124	4 WKS	\$4,504.00		68
R902022361	AA4VG71HWD1/32R-NSF52F001D	P	811233124	4 WKS	\$4,112.00		68
R902022646	AA4VG71HWD1/32R-NSF52F001S	P	811233124	4 WKS	\$4,112.00		68
not assigned	AA4VG71HWD1/32R-NSF52F011D	P	811233124	4 WKS	\$4,393.00		68
R902022652	AA4VG71HWD1/32R-NSF52F011S	P	811233124	4 WKS	\$4,393.00		68
R902022391	AA4VG71HWD1/32R-NSF52F021D	P	811233124	4 WKS	\$4,504.00		68
not assigned	AA4VG71HWD1/32R-NSF52F021S	P	811233124	4 WKS	\$4,504.00		68
not assigned	AA4VG90EP3D1/32L-NSF52F001DP	P	811233125	4 WKS	\$5,108.00		68
not assigned	AA4VG90EP3D1/32L-NSF52F001SP	P	811233125	4 WKS	\$5,108.00		68
not assigned	AA4VG90EP3D1/32L-NSF52F011DP	P	811233125	4 WKS	\$5,389.00		68
not assigned	AA4VG90EP3D1/32L-NSF52F011SP	P	811233125	4 WKS	\$5,389.00		68
not assigned	AA4VG90EP3D1/32L-NSF52F021DP	P	811233125	4 WKS	\$5,501.00		68
not assigned	AA4VG90EP3D1/32L-NSF52F021SP	P	811233125	4 WKS	\$5,501.00		68
not assigned	AA4VG90EP3D1/32R-NSF52F001DP	P	811233125	4 WKS	\$5,108.00		68
not assigned	AA4VG90EP3D1/32R-NSF52F001SP	P	811233125	4 WKS	\$5,108.00		68

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price	Price adder per	Page
					(7/15/06)	100mm (CDT3) 1" (CDT1, 4)	
not assigned	AA4VG90EP3D1/32R-NSF52F011DP	P	811233125	4 WKS	\$5,389.00		68
not assigned	AA4VG90EP3D1/32R-NSF52F011SP	P	811233125	4 WKS	\$5,389.00		68
not assigned	AA4VG90EP3D1/32R-NSF52F021DP	P	811233125	4 WKS	\$5,501.00		68
not assigned	AA4VG90EP3D1/32R-NSF52F021SP	P	811233125	4 WKS	\$5,501.00		68
not assigned	AA4VG90EP4D1/32L-NSF52F001DP	P	811233125	4 WKS	\$5,108.00		68
not assigned	AA4VG90EP4D1/32L-NSF52F001SP	P	811233125	4 WKS	\$5,108.00		68
not assigned	AA4VG90EP4D1/32L-NSF52F011DP	P	811233125	4 WKS	\$5,389.00		68
not assigned	AA4VG90EP4D1/32L-NSF52F011SP	P	811233125	4 WKS	\$5,389.00		68
not assigned	AA4VG90EP4D1/32L-NSF52F021DP	P	811233125	4 WKS	\$5,501.00		68
not assigned	AA4VG90EP4D1/32L-NSF52F021SP	P	811233125	4 WKS	\$5,501.00		68
not assigned	AA4VG90EP4D1/32R-NSF52F001DP	P	811233125	4 WKS	\$5,108.00		68
not assigned	AA4VG90EP4D1/32R-NSF52F001SP	P	811233125	4 WKS	\$5,108.00		68
not assigned	AA4VG90EP4D1/32R-NSF52F011DP	P	811233125	4 WKS	\$5,389.00		68
not assigned	AA4VG90EP4D1/32R-NSF52F011SP	P	811233125	4 WKS	\$5,389.00		68
not assigned	AA4VG90EP4D1/32R-NSF52F021DP	P	811233125	4 WKS	\$5,501.00		68
not assigned	AA4VG90EP4D1/32R-NSF52F021SP	P	811233125	4 WKS	\$5,501.00		68
R902023304	AA4VG90HD1/32L-NSF52F001D	P	811233125	4 WKS	\$4,996.00		68
R902026548	AA4VG90HD1/32L-NSF52F001S	P	811233125	4 WKS	\$4,996.00		68
R902094352	AA4VG90HD1/32L-NSF52F011D	P	811233125	4 WKS	\$5,277.00		68
not assigned	AA4VG90HD1/32L-NSF52F011S	P	811233125	4 WKS	\$5,277.00		68
not assigned	AA4VG90HD1/32L-NSF52F021D	P	811233125	4 WKS	\$5,388.00		68
not assigned	AA4VG90HD1/32L-NSF52F021S	P	811233125	4 WKS	\$5,388.00		68
R902023303	AA4VG90HD1/32R-NSF52F001D	P	811233125	4 WKS	\$4,996.00		68
R902023558	AA4VG90HD1/32R-NSF52F001S	P	811233125	4 WKS	\$4,996.00		68
not assigned	AA4VG90HD1/32R-NSF52F011D	P	811233125	4 WKS	\$5,277.00		68
R902023560	AA4VG90HD1/32R-NSF52F011S	P	811233125	4 WKS	\$5,277.00		68
not assigned	AA4VG90HD1/32R-NSF52F021D	P	811233125	4 WKS	\$5,388.00		68
R902023562	AA4VG90HD1/32R-NSF52F021S	P	811233125	4 WKS	\$5,388.00		68
R902023304	AA4VG90HWD1/32L-NSF52F001D	P	811233125	4 WKS	\$4,683.00		68
R902026548	AA4VG90HWD1/32L-NSF52F001S	P	811233125	4 WKS	\$4,683.00		68
R902094352	AA4VG90HWD1/32L-NSF52F011D	P	811233125	4 WKS	\$4,964.00		68
not assigned	AA4VG90HWD1/32L-NSF52F011S	P	811233125	4 WKS	\$4,964.00		68
not assigned	AA4VG90HWD1/32L-NSF52F021D	P	811233125	4 WKS	\$5,075.00		68
not assigned	AA4VG90HWD1/32L-NSF52F021S	P	811233125	4 WKS	\$5,075.00		68
R902023303	AA4VG90HWD1/32R-NSF52F001D	P	811233125	4 WKS	\$4,683.00		68
not assigned	AA4VG90HWD1/32R-NSF52F011D	P	811233125	4 WKS	\$4,964.00		68
R902023560	AA4VG90HWD1/32R-NSF52F011S	P	811233125	4 WKS	\$4,964.00		68
not assigned	AA4VG90HWD1/32R-NSF52F021D	P	811233125	4 WKS	\$5,075.00		68
R902023562	AA4VG90HWD1/32R-NSF52F021S	P	811233125	4 WKS	\$5,075.00		68
R902406637	AA4VSO 40 DFR /10R-PKD63N00 E	P	814234321	4 WKS	\$5,467.00		73
R902406306	AA4VSO 40 DR /10R-PKD63N00 E	P	814234321	4 WKS	\$4,672.00		73
R910988315	AA4VSO 40 DRG /10R-PKD63N00	P	814234321	4 WKS	\$4,672.00		73
R902406400	AA4VSO 71 DFR /10R-PKD63N00 E	P	814234322	4 WKS	\$6,319.00		73
R902406401	AA4VSO 71 DR /10R-PKD63N00 E	P	814234322	4 WKS	\$5,527.00		73
R902500472	AA4VSO 71 DRG /10R-PKD63N00 E	P	814234322	4 WKS	\$5,527.00		73
R902446064	AA4VSO 125 DFR /30R-VKD75U99 E	P	814234331	4 WKS	\$7,826.00		73
R902446067	AA4VSO 125 DR /30R-FKD75U99 E	P	814234331	4 WKS	\$8,189.00		73
R902451164	AA4VSO 125 DR /30R-VKD75U99 E	P	814234331	4 WKS	\$7,033.00		73
R902455830	AA4VSO 180 DFR /30R-FKD75U99 E	P	814234341	4 WKS	\$11,625.00		73
R902451165	AA4VSO 180 DFR /30R-VKD75U99 E	P	814234341	4 WKS	\$10,297.00		73
R902446024	AA4VSO 180 DR /30R-VKD75U99 E	P	814234341	4 WKS	\$9,504.00		73
R902453291	AA4VSO 180 DR /30R-VSD75U99 E	P	814234341	4 WKS	\$9,504.00		73
R902446069	AA4VSO 180 DR /30R-FKD75U99 E	P	814234341	4 WKS	\$10,832.00		73
R902449863	AA4VSO 180 DRG /30R-FKD75U99 E	P	814234341	4 WKS	\$10,832.00		73

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R902455522	AA4VSO 180 DRG /30R-VKD75U99 E	P	814234341	4 WKS	\$9,504.00		73
R902453292	AA4VSO 180 DRG /30R-VSD75U99 E	P	814234341	4 WKS	\$9,504.00		73
R902451163	AA4VSO 250 DFR /30R-VKD75U99 E	P	814234351	4 WKS	\$12,515.00		73
R902447831	AA4VSO 250 DR /30R-FSD75U99 E	P	814234351	4 WKS	\$13,333.00		73
R902444798	AA4VSO 250 DR /30R-VKD75U99 E	P	814234351	4 WKS	\$11,722.00		73
R902452613	AA4VSO 250 DR /30R-VSD75U99 E	P	814234351	4 WKS	\$11,722.00		73
R902449865	AA4VSO 250 DRG /30R-FKD75U99 E	P	814234351	4 WKS	\$13,333.00		73
R902454171	AA4VSO 250 DRG /30R-VSD75U99 E	P	814234351	4 WKS	\$11,722.00		73
R902445974	AA4VSO250DR /30R-FKD75U99 E	P	814234351	4 WKS	\$13,333.00		73
not assigned	AA6VM107EP1/63W-VSD520PB-E	P	812213131	4 WKS	\$5,078.00		60
not assigned	AA6VM107EP1/63W-VSD527PB-E	P	812213131	4 WKS	\$5,413.00		60
not assigned	AA6VM107EP2/63W-VSD520PB-E	P	812213131	4 WKS	\$5,078.00		60
not assigned	AA6VM107EP2/63W-VSD527PB-E	P	812213131	4 WKS	\$5,413.00		60
R902092299	AA6VM107EZ1/63W-VSD520PB-E	P	812213131	4 WKS	\$4,991.00		60
R902092719	AA6VM107EZ1/63W-VSD527PB-E	P	812213131	4 WKS	\$5,326.00		60
R902092299	AA6VM107EZ2/63W-VSD520PB-E	P	812213131	4 WKS	\$4,991.00		60
R902092719	AA6VM107EZ2/63W-VSD527PB-E	P	812213131	4 WKS	\$5,326.00		60
R902092098	AA6VM107HA1/63W-VSD520A-E	P	812213131	4 WKS	\$4,764.00		60
R902092101	AA6VM107HA1/63W-VSD527A-E	P	812213131	4 WKS	\$5,099.00		60
not assigned	AA6VM107HA1T/63W-VSD520A-E	P	812213131	4 WKS	\$4,764.00		60
R902092491	AA6VM107HA1T/63W-VSD527A-E	P	812213131	4 WKS	\$5,099.00		60
not assigned	AA6VM107HA2/63W-VSD520A-E	P	812213131	4 WKS	\$4,764.00		60
not assigned	AA6VM107HA2/63W-VSD527A-E	P	812213131	4 WKS	\$5,099.00		60
not assigned	AA6VM107HA2T/63W-VSD520A-E	P	812213131	4 WKS	\$4,764.00		60
not assigned	AA6VM107HA2T/63W-VSD527A-E	P	812213131	4 WKS	\$5,099.00		60
R902092167	AA6VM107HD1/63W-VSD520B-E	P	812213131	4 WKS	\$4,764.00		60
R902092048	AA6VM107HD1/63W-VSD527B-E	P	812213131	4 WKS	\$5,099.00		60
not assigned	AA6VM160EP1/63W-VSD520PB-E	P	812213142	4 WKS	\$6,763.00		60
R902092740	AA6VM160EP1/63W-VSD527PB-E	P	812213142	4 WKS	\$7,098.00		60
not assigned	AA6VM160EP2/63W-VSD520PB-E	P	812213142	4 WKS	\$6,763.00		60
R902092740	AA6VM160EP2/63W-VSD527PB-E	P	812213142	4 WKS	\$7,098.00		60
not assigned	AA6VM160EZ1/63W-VSD520PB-E	P	812213142	4 WKS	\$6,596.00		60
not assigned	AA6VM160EZ1/63W-VSD527PB-E	P	812213142	4 WKS	\$6,931.00		60
not assigned	AA6VM160EZ2/63W-VSD520PB-E	P	812213142	4 WKS	\$6,596.00		60
not assigned	AA6VM160EZ2/63W-VSD527PB-E	P	812213142	4 WKS	\$6,931.00		60
R902092095	AA6VM160HA1/63W-VSD520A-E	P	812213142	4 WKS	\$6,420.00		60
R902092107	AA6VM160HA1/63W-VSD527A-E	P	812213142	4 WKS	\$6,755.00		60
not assigned	AA6VM160HA1T/63W-VSD520A-E	P	812213142	4 WKS	\$6,420.00		60
R902092142	AA6VM160HA1T/63W-VSD527A-E	P	812213142	4 WKS	\$6,755.00		60
R902092093	AA6VM160HA2/63W-VSD520A-E	P	812213142	4 WKS	\$6,420.00		60
not assigned	AA6VM160HA2/63W-VSD527A-E	P	812213142	4 WKS	\$6,755.00		60
not assigned	AA6VM160HA2T/63W-VSD520A-E	P	812213142	4 WKS	\$6,420.00		60
R902092090	AA6VM160HA2T/63W-VSD527A-E	P	812213142	4 WKS	\$6,755.00		60
R902092631	AA6VM160HD1/63W-VSD520B-E	P	812213142	4 WKS	\$6,420.00		60
R902092049	AA6VM160HD1/63W-VSD527B-E	P	812213142	4 WKS	\$6,755.00		60
not assigned	AA6VM55EP1/63W-VSD520PB-E	P	812213121	4 WKS	\$3,628.00		60
not assigned	AA6VM55EP1/63W-VSD527PB-E	P	812213121	4 WKS	\$3,962.00		60
not assigned	AA6VM55EP2/63W-VSD520PB-E	P	812213121	4 WKS	\$3,628.00		60
not assigned	AA6VM55EP2/63W-VSD527PB-E	P	812213121	4 WKS	\$3,962.00		60
not assigned	AA6VM55EZ1/63W-VSD520PB-E	P	812213121	4 WKS	\$3,573.00		60
not assigned	AA6VM55EZ1/63W-VSD527PB-E	P	812213121	4 WKS	\$3,908.00		60
not assigned	AA6VM55EZ2/63W-VSD520PB-E	P	812213121	4 WKS	\$3,573.00		60
not assigned	AA6VM55EZ2/63W-VSD527PB-E	P	812213121	4 WKS	\$3,908.00		60
R902092147	AA6VM55HA1/63W-VSD520A-E	P	812213121	4 WKS	\$3,343.00		60



**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R902092728	AA6VM55HA1/63W-VSD527A-E	P	812213121	4 WKS	\$3,677.00		60
not assigned	AA6VM55HA1T/63W-VSD520A-E	P	812213121	4 WKS	\$3,343.00		60
not assigned	AA6VM55HA1T/63W-VSD527A-E	P	812213121	4 WKS	\$3,677.00		60
not assigned	AA6VM55HA2/63W-VSD520A-E	P	812213121	4 WKS	\$3,343.00		60
R902092054	AA6VM55HA2/63W-VSD527A-E	P	812213121	4 WKS	\$3,677.00		60
not assigned	AA6VM55HA2T/63W-VSD520A-E	P	812213121	4 WKS	\$3,343.00		60
R902092082	AA6VM55HA2T/63W-VSD527A-E	P	812213121	4 WKS	\$3,677.00		60
not assigned	AA6VM55HD1/63W-VSD520B-E	P	812213121	4 WKS	\$3,343.00		60
not assigned	AA6VM55HD1/63W-VSD527B-E	P	812213121	4 WKS	\$3,677.00		60
not assigned	AA6VM80EP1/63W-VSC520PB-E	P	812213122	4 WKS	\$4,348.00		60
not assigned	AA6VM80EP1/63W-VSC527PB-E	P	812213122	4 WKS	\$4,683.00		60
not assigned	AA6VM80EP2/63W-VSC520PB-E	P	812213122	4 WKS	\$4,348.00		60
not assigned	AA6VM80EP2/63W-VSC527PB-E	P	812213122	4 WKS	\$4,683.00		60
R902092633	AA6VM80EZ1/63W-VSC520PB-E	P	812213122	4 WKS	\$4,275.00		60
not assigned	AA6VM80EZ1/63W-VSC527PB-E	P	812213122	4 WKS	\$4,610.00		60
R902092633	AA6VM80EZ2/63W-VSC520PB-E	P	812213122	4 WKS	\$4,275.00		60
not assigned	AA6VM80EZ2/63W-VSC527PB-E	P	812213122	4 WKS	\$4,610.00		60
R902092233	AA6VM80HA1/63W-VSC520A-E	P	812213122	4 WKS	\$4,042.00		60
not assigned	AA6VM80HA1/63W-VSC527A-E	P	812213122	4 WKS	\$4,377.00		60
R902092087	AA6VM80HA1T/63W-VSC520A-E	P	812213122	4 WKS	\$4,042.00		60
R902092129	AA6VM80HA1T/63W-VSC527A-E	P	812213122	4 WKS	\$4,377.00		60
not assigned	AA6VM80HA2/63W-VSC520A-E	P	812213122	4 WKS	\$4,042.00		60
not assigned	AA6VM80HA2/63W-VSC527A-E	P	812213122	4 WKS	\$4,377.00		60
not assigned	AA6VM80HA2T/63W-VSC520A-E	P	812213122	4 WKS	\$4,042.00		60
not assigned	AA6VM80HA2T/63W-VSC527A-E	P	812213122	4 WKS	\$4,377.00		60
R902092070	AA6VM80HD1/63W-VSC520B-E	P	812213122	4 WKS	\$4,042.00		60
R902092047	AA6VM80HD1/63W-VSC527B-E	P	812213122	4 WKS	\$4,377.00		60
R978908744	ABM6PN-1X/01D2-01GM	P	143377060	4 WKS	\$360.00		483
R978908745	ABM6PN-1X/02D2-01GM	P	143377060	4 WKS	\$485.00		483
R978908746	ABM6PN-1X/03D2-01GM	P	143377060	4 WKS	\$630.00		483
R978908747	ABM6PN-1X/04D2-01GM	P	143377060	4 WKS	\$757.00		483
R978908748	ABM6PN-1X/05D2-01GM	P	143377060	4 WKS	\$904.00		483
R978908749	ABM6PN-1X/06D2-01GM	P	143377060	4 WKS	\$1,046.00		483
R978908750	ABM6PN-1X/07D2-01GM	P	143377060	4 WKS	\$1,192.00		483
R978908751	ABM6PN-1X/08D2-01GM	P	143377060	4 WKS	\$1,324.00		483
0538103015	ACCUMCHARGEKITMETRICDIAPHW/ADAPT	P	124832000	4 WKS	\$489.00		466
0538103013	ACCUMCHARGEKITUSTHRDBLADDER&DIAPHRA	P	124832000	4 WKS	\$353.00		466
0811106033	ACCUMCHARGEKITV60-210BAR	P	124831000	4 WKS	\$642.00		466
1531316016	ACCUMCLAMPFORDIA.145-155M8	P	124834000	4 WKS	\$42.00		466
1531316005	ACCUMCLAMPHY/DIA224-230M1 250L	P	124834000	4 WKS	\$105.00		466
1531316022	ACCUMCLAMPHY/VGBKS160-1702L	P	124834000	4 WKS	\$54.00		466
1531316026	ACCUMCLAMPHY/VGBKS218-22810-35L	P	124834000	4 WKS	\$95.00		466
R978715255	ADC354F10	P	124831000	4 WKS	\$735.00		466
R978715258	ADC458F10(REPLS987619)	P	124831000	4 WKS	\$643.00		466
R978715257	ADP151F10	P	124831000	4 WKS	\$245.00		466
R900973925	AF6EA4X/XV/12	S	111921000	2 WKS	\$140.00		478
R978908210	AP10-16-1X/A-12	P	143173100	4 WKS	\$205.00		487
R978908211	AP10-16-1X/D-12	P	143173100	4 WKS	\$279.00		487
R978908209	AP6-10-1X/A-12	S	143173060	2 WKS	\$74.00		487
R978912378	AP6-10-1X/D-01	P	143173060	4 WKS	\$121.00		487
R978908220	AP6-10-1X/D-12	S	143173060	2 WKS	\$121.00		487
R978908217	AP6-16-1X/D-12	P	143173060	4 WKS	\$285.00		487
9511290007	AZ-M-F-12-008-UQR12ML	P	833130001	4 WKS	\$298.00		8
9511290013	AZ-M-F-12-008-UQR12ML-S0022	P	833130001	4 WKS	\$320.00		8

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
9511290008	AZ-M-F-12-011-UQR12ML	P	833130001	4 WKS	\$298.00		8
9511290014	AZ-M-F-12-011-UQR12ML-S0022	P	833130001	4 WKS	\$320.00		8
9511290009	AZ-M-F-12-014-UQR12ML	P	833130001	4 WKS	\$299.00		8
9511290015	AZ-M-F-12-014-UQR12ML-S0022	P	833130001	4 WKS	\$321.00		8
9511290010	AZ-M-F-12-016-UQR12ML	P	833130001	4 WKS	\$300.00		8
9511290016	AZ-M-F-12-016-UQR12ML-S0022	P	833130001	4 WKS	\$322.00		8
9511290011	AZ-M-F-12-019-UQR12ML	P	833130001	4 WKS	\$301.00		8
9511290017	AZ-M-F-12-019-UQR12ML-S0022	P	833130001	4 WKS	\$323.00		8
9511290012	AZ-M-F-12-022-UQR12ML	P	833130001	4 WKS	\$303.00		8
9511290018	AZ-M-F-12-022-UQR12ML-S0022	P	833130001	4 WKS	\$325.00		8
9510290044	AZPF-12-004LQR12MB	S	831130000	2 WKS	\$222.00		2
9510290036	AZPF-12-004LRR12MB	S	831130000	2 WKS	\$222.00		2
9510290021	AZPF-12-004RQR12MB	S	831130000	2 WKS	\$222.00		2
9510290015	AZPF-12-004RRR12MB	S	831130000	2 WKS	\$222.00		2
9510290045	AZPF-12-005LQR12MB	S	831130000	2 WKS	\$223.00		2
9510290037	AZPF-12-005LRR12MB	S	831130000	2 WKS	\$223.00		2
9510290022	AZPF-12-005RQR12MB	S	831130000	2 WKS	\$223.00		2
9510290259	AZPF-12-005RQR12MB-S0022	P	831130000	4 WKS	\$245.00		2
9510290005	AZPF-12-005RRR12MB	S	831130000	2 WKS	\$223.00		2
9510290046	AZPF-12-008LQR12MB	S	831130000	2 WKS	\$224.00		2
9510290214	AZPF-12-008LQR12MB-S0022	P	831130000	4 WKS	\$246.00		2
9510290038	AZPF-12-008LRR12MB	S	831130000	2 WKS	\$224.00		2
9510290023	AZPF-12-008RQR12MB	S	831130000	2 WKS	\$224.00		2
9510290191	AZPF-12-008RQR12MB-S0022	P	831130000	4 WKS	\$246.00		2
9510290017	AZPF-12-008RRR12MB	S	831130000	2 WKS	\$224.00		2
9510290047	AZPF-12-011LQR12MB	S	831130000	2 WKS	\$225.00		2
9510290254	AZPF-12-011LQR12MB-S0022	P	831130000	4 WKS	\$247.00		2
9510290039	AZPF-12-011LRR12MB	S	831130000	2 WKS	\$225.00		2
9510290024	AZPF-12-011RQR12MB	S	831130000	2 WKS	\$225.00		2
9510290209	AZPF-12-011RQR12MB-S0022	P	831130000	4 WKS	\$247.00		2
9510290018	AZPF-12-011RRR12MB	S	831130000	2 WKS	\$225.00		2
9510290048	AZPF-12-014LQR12MB	S	831130000	2 WKS	\$226.00		2
9510290215	AZPF-12-014LQR12MB-S0022	P	831130000	4 WKS	\$248.00		2
9510290040	AZPF-12-014LRR12MB	S	831130000	2 WKS	\$226.00		2
9510290025	AZPF-12-014RQR12MB	S	831130000	2 WKS	\$226.00		2
9510290133	AZPF-12-014RQR12MB-S0022	P	831130000	4 WKS	\$248.00		2
9510290004	AZPF-12-014RRR12MB	S	831130000	2 WKS	\$226.00		2
9510290130	AZPF-12-016LQR12MB	S	831130000	2 WKS	\$227.00		2
9510290255	AZPF-12-016LQR12MB-S0022	P	831130000	4 WKS	\$249.00		2
9510290127	AZPF-12-016LRR12MB	S	831130000	2 WKS	\$227.00		2
9510290122	AZPF-12-016RQR12MB	S	831130000	2 WKS	\$227.00		2
9510290210	AZPF-12-016RQR12MB-S0022	P	831130000	4 WKS	\$249.00		2
9510290056	AZPF-12-016RRR12MB	S	831130000	2 WKS	\$227.00		2
9510290131	AZPF-12-019LQR12MB	S	831130000	2 WKS	\$228.00		2
9510290256	AZPF-12-019LQR12MB-S0022	P	831130000	4 WKS	\$250.00		2
9510290128	AZPF-12-019LRR12MB	S	831130000	2 WKS	\$228.00		2
9510290123	AZPF-12-019RQR12MB	S	831130000	2 WKS	\$228.00		2
9510290211	AZPF-12-019RQR12MB-S0022	P	831130000	4 WKS	\$250.00		2
9510290125	AZPF-12-019RRR12MB	S	831130000	2 WKS	\$228.00		2
9510290132	AZPF-12-022LQR12MB	S	831130000	2 WKS	\$230.00		2
9510290257	AZPF-12-022LQR12MB-S0022	P	831130000	4 WKS	\$252.00		2
9510290129	AZPF-12-022LRR12MB	S	831130000	2 WKS	\$230.00		2
9510290124	AZPF-12-022RQR12MB	S	831130000	2 WKS	\$230.00		2
9510290212	AZPF-12-022RQR12MB-S0022	P	831130000	4 WKS	\$252.00		2

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
9510290126	AZPF-12-022RRR12MB	S	831130000	2 WKS	\$230.00		2
9510290118	AZPF-12-025LQR12MB	S	831130000	2 WKS	\$247.00		2
9510290117	AZPF-12-025LRR12MB	S	831130000	2 WKS	\$247.00		2
9510290112	AZPF-12-025RQR12MB	S	831130000	2 WKS	\$247.00		2
9510290111	AZPF-12-025RRR12MB	S	831130000	2 WKS	\$247.00		2
9510290121	AZPF-12-028LQR12MB	S	831130000	2 WKS	\$250.00		2
9510290120	AZPF-12-028LRR12MB	S	831130000	2 WKS	\$250.00		2
9510290115	AZPF-12-028RQR12MB	S	831130000	2 WKS	\$250.00		2
9510290114	AZPF-12-028RRR12MB	S	831130000	2 WKS	\$250.00		2
9510490014	AZ-P-G-22-032-LDC12MB	S	831160000	2 WKS	\$361.00		2
9510490054	AZ-P-G-22-032-LDC40MB	S	831160000	2 WKS	\$361.00		2
9510490034	AZ-P-G-22-032-LQC12MB	P	831160000	4 WKS	\$361.00		2
9510490094	AZ-P-G-22-032-LQC40MB	P	831160000	4 WKS	\$361.00		2
9510490004	AZ-P-G-22-032-RDC12MB	S	831160000	2 WKS	\$361.00		2
9510490044	AZ-P-G-22-032-RDC40MB	S	831160000	2 WKS	\$361.00		2
9510490024	AZ-P-G-22-032-RQC12MB	P	831160000	4 WKS	\$361.00		2
9510490084	AZ-P-G-22-032-RQC40MB	P	831160000	4 WKS	\$361.00		2
9510490015	AZ-P-G-22-036-LDC12MB	S	831160000	2 WKS	\$367.00		2
9510490055	AZ-P-G-22-036-LDC40MB	S	831160000	2 WKS	\$367.00		2
9510490035	AZ-P-G-22-036-LQC12MB	P	831160000	4 WKS	\$367.00		2
9510490095	AZ-P-G-22-036-LQC40MB	P	831160000	4 WKS	\$367.00		2
9510490005	AZ-P-G-22-036-RDC12MB	S	831160000	2 WKS	\$367.00		2
9510490045	AZ-P-G-22-036-RDC40MB	S	831160000	2 WKS	\$367.00		2
9510490025	AZ-P-G-22-036-RQC12MB	P	831160000	4 WKS	\$367.00		2
9510490085	AZ-P-G-22-036-RQC40MB	P	831160000	4 WKS	\$367.00		2
9510490017	AZ-P-G-22-045-LDC12MB	S	831160000	2 WKS	\$377.00		2
9510490057	AZ-P-G-22-045-LDC40MB	S	831160000	2 WKS	\$377.00		2
9510490037	AZ-P-G-22-045-LQC12MB	P	831160000	4 WKS	\$377.00		2
9510490097	AZ-P-G-22-045-LQC40MB	P	831160000	4 WKS	\$377.00		2
9510490007	AZ-P-G-22-045-RDC12MB	S	831160000	2 WKS	\$377.00		2
9510490047	AZ-P-G-22-045-RDC40MB	S	831160000	2 WKS	\$377.00		2
9510490027	AZ-P-G-22-045-RQC12MB	P	831160000	4 WKS	\$377.00		2
9510490087	AZ-P-G-22-045-RQC40MB	P	831160000	4 WKS	\$377.00		2
9510490019	AZ-P-G-22-056-LDC12MB	S	831160000	2 WKS	\$399.00		2
9510490059	AZ-P-G-22-056-LDC40MB	S	831160000	2 WKS	\$399.00		2
9510490039	AZ-P-G-22-056-LQC12MB	P	831160000	4 WKS	\$399.00		2
9510490099	AZ-P-G-22-056-LQC40MB	P	831160000	4 WKS	\$399.00		2
9510490009	AZ-P-G-22-056-RDC12MB	S	831160000	2 WKS	\$399.00		2
9510490049	AZ-P-G-22-056-RDC40MB	S	831160000	2 WKS	\$399.00		2
9510490029	AZ-P-G-22-056-RQC12MB	P	831160000	4 WKS	\$399.00		2
9510490089	AZ-P-G-22-056-RQC40MB	P	831160000	4 WKS	\$399.00		2
9510490020	AZ-P-G-22-063-LDC12MB	S	831160000	2 WKS	\$437.00		2
9510490060	AZ-P-G-22-063-LDC40MB	S	831160000	2 WKS	\$437.00		2
9510490040	AZ-P-G-22-063-LQC12MB	P	831160000	4 WKS	\$437.00		2
9510490100	AZ-P-G-22-063-LQC40MB	P	831160000	4 WKS	\$437.00		2
9510490010	AZ-P-G-22-063-RDC12MB	S	831160000	2 WKS	\$437.00		2
9510490050	AZ-P-G-22-063-RDC40MB	S	831160000	2 WKS	\$437.00		2
9510490030	AZ-P-G-22-063-RQC12MB	P	831160000	4 WKS	\$437.00		2
9510490090	AZ-P-G-22-063-RQC40MB	P	831160000	4 WKS	\$437.00		2
9510390007	AZ-P-N-12-020-LDC12MB	S	831150000	2 WKS	\$280.00		2
9510390001	AZ-P-N-12-020-RDC12MB	S	831150000	2 WKS	\$280.00		2
9510390049	AZ-P-N-12-020-RQC12MB	S	831150000	2 WKS	\$280.00		2
9510390073	AZ-P-N-12-020-RQR12MB	S	831150000	2 WKS	\$280.00		2
9510390008	AZ-P-N-12-022-LDC12MB	S	831150000	2 WKS	\$282.00		2

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
9510390014	AZ-P-N-12-022-RDC12MA	P	831150000	4 WKS	\$321.00		2
9510390002	AZ-P-N-12-022-RDC12MB	S	831150000	2 WKS	\$282.00		2
9510390087	AZ-P-N-12-022-RPR12MA	P	831150000	4 WKS	\$321.00		2
9510390050	AZ-P-N-12-022-RQC12MB	S	831150000	2 WKS	\$282.00		2
9510390074	AZ-P-N-12-022-RQR12MB	S	831150000	2 WKS	\$282.00		2
9510390135	AZ-P-N-12-022-RXR12MA	P	831150000	4 WKS	\$309.00		2
9510390009	AZ-P-N-12-025-LDC12MB	S	831150000	2 WKS	\$286.00		2
9510390003	AZ-P-N-12-025-RDC12MB	S	831150000	2 WKS	\$286.00		2
9510390051	AZ-P-N-12-025-RQC12MB	S	831150000	2 WKS	\$286.00		2
9510390075	AZ-P-N-12-025-RQR12MB	S	831150000	2 WKS	\$286.00		2
9510390010	AZ-P-N-12-028-LDC12MB	S	831150000	2 WKS	\$291.00		2
9510390095	AZ-P-N-12-028-LPR12MA	P	831150000	4 WKS	\$330.00		2
9510390016	AZ-P-N-12-028-RDC12MA	P	831150000	4 WKS	\$330.00		2
9510390004	AZ-P-N-12-028-RDC12MB	S	831150000	2 WKS	\$291.00		2
9510390052	AZ-P-N-12-028-RQC12MB	S	831150000	2 WKS	\$291.00		2
9510390076	AZ-P-N-12-028-RQR12MB	S	831150000	2 WKS	\$291.00		2
9510390137	AZ-P-N-12-028-RXR12MA	P	831150000	4 WKS	\$318.00		2
9510390113	AZ-P-N-12-028-RXR12MB-S0075	P	831150000	4 WKS	\$318.00		2
9510390011	AZ-P-N-12-032-LDC12MB	S	831150000	2 WKS	\$296.00		2
9510390017	AZ-P-N-12-032-RDC12MA	P	831150000	4 WKS	\$335.00		2
9510390005	AZ-P-N-12-032-RDC12MB	S	831150000	2 WKS	\$296.00		2
9510390090	AZ-P-N-12-032-RPR12MA	P	831150000	4 WKS	\$335.00		2
9510390053	AZ-P-N-12-032-RQC12MB	S	831150000	2 WKS	\$296.00		2
9510390077	AZ-P-N-12-032-RQR12MB	S	831150000	2 WKS	\$296.00		2
9510390138	AZ-P-N-12-032-RXR12MA	P	831150000	4 WKS	\$323.00		2
9510390012	AZ-P-N-12-036-LDC12MB	S	831150000	2 WKS	\$301.00		2
9510390018	AZ-P-N-12-036-RDC12MA	P	831150000	4 WKS	\$340.00		2
9510390006	AZ-P-N-12-036-RDC12MB	S	831150000	2 WKS	\$301.00		2
9510390054	AZ-P-N-12-036-RQC12MB	S	831150000	2 WKS	\$301.00		2
9510390078	AZ-P-N-12-036-RQR12MB	S	831150000	2 WKS	\$301.00		2
9510390139	AZ-P-N-12-036-RXR12MA	P	831150000	4 WKS	\$328.00		2
R978901866	BM10PN-1X/01A3-12	S	143375100	2 WKS	\$102.00		482
R978904359	BM10PN-1X/01A3-12RCS	P	143375100	4 WKS	\$129.00		482
R978901880	BM10PN-1X/01D3-12	P	143375100	4 WKS	\$232.00		482
R978901867	BM10PN-1X/02A3-12	S	143375100	2 WKS	\$166.00		482
R978904360	BM10PN-1X/02A3-12RCS	P	143375100	4 WKS	\$194.00		482
R978901881	BM10PN-1X/02D3-12	P	143375100	4 WKS	\$340.00		482
R978901868	BM10PN-1X/03A3-12	S	143375100	2 WKS	\$225.00		482
R978904361	BM10PN-1X/03A3-12RCS	P	143375100	4 WKS	\$254.00		482
R978901882	BM10PN-1X/03D3-12	P	143375100	4 WKS	\$419.00		482
R978901869	BM10PN-1X/04A3-12	S	143375100	2 WKS	\$287.00		482
R978904362	BM10PN-1X/04A3-12RCS	P	143375100	4 WKS	\$315.00		482
R978901883	BM10PN-1X/04D3-12	P	143375100	4 WKS	\$519.00		482
R978901870	BM10PN-1X/05A3-12	S	143375100	2 WKS	\$346.00		482
R978904363	BM10PN-1X/05A3-12RCS	P	143375100	4 WKS	\$374.00		482
R978901884	BM10PN-1X/05D3-12	P	143375100	4 WKS	\$632.00		482
R978901871	BM10PN-1X/06A3-12	S	143375100	2 WKS	\$410.00		482
R978901885	BM10PN-1X/06D3-12	P	143375100	4 WKS	\$777.00		482
R978901859	BM6PN-1X/01A2-12	S	143375060	2 WKS	\$82.00		482
R978903697	BM6PN-1X/01A2-12RCI	P	143375060	4 WKS	\$109.00		482
R978904351	BM6PN-1X/01A2-12RCS	P	143375060	4 WKS	\$109.00		482
R978901873	BM6PN-1X/01D2-12	P	143375060	4 WKS	\$138.00		482
R978901860	BM6PN-1X/02A2-12	S	143375060	2 WKS	\$107.00		482
R978903698	BM6PN-1X/02A2-12RCI	P	143375060	4 WKS	\$134.00		482

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per		Page No.
						100mm (CDT3)	1" (CDT1, 4)	
R978904352	BM6PN-1X/02A2-12RCS	P	143375060	4 WKS	\$134.00			482
R978901874	BM6PN-1X/02D2-12	P	143375060	4 WKS	\$223.00			482
R978901861	BM6PN-1X/03A2-12	S	143375060	2 WKS	\$139.00			482
R978903699	BM6PN-1X/03A2-12RCI	P	143375060	4 WKS	\$167.00			482
R978904353	BM6PN-1X/03A2-12RCS	P	143375060	4 WKS	\$167.00			482
R978901875	BM6PN-1X/03D2-12	P	143375060	4 WKS	\$305.00			482
R978901862	BM6PN-1X/04A2-12	S	143375060	2 WKS	\$178.00			482
R978903700	BM6PN-1X/04A2-12RCI	P	143375060	4 WKS	\$205.00			482
R978904354	BM6PN-1X/04A2-12RCS	P	143375060	4 WKS	\$205.00			482
R978901876	BM6PN-1X/04D2-12	P	143375060	4 WKS	\$373.00			482
R978901863	BM6PN-1X/05A2-12	S	143375060	2 WKS	\$210.00			482
R978903701	BM6PN-1X/05A2-12RCI	P	143375060	4 WKS	\$237.00			482
R978904355	BM6PN-1X/05A2-12RCS	P	143375060	4 WKS	\$237.00			482
R978901877	BM6PN-1X/05D2-12	P	143375060	4 WKS	\$477.00			482
R978901864	BM6PN-1X/06A2-12	S	143375060	2 WKS	\$245.00			482
R978901878	BM6PN-1X/06D2-12	P	143375060	4 WKS	\$558.00			482
R978901865	BM6PN-1X/07A2-12	P	143375060	4 WKS	\$277.00			482
R978901879	BM6PN-1X/07D2-12	P	143375060	4 WKS	\$634.00			482
R978902784	BM6PN-1X/08A2-12	P	143375060	4 WKS	\$310.00			482
R978902785	BM6PN-1X/08D2-12	P	143375060	4 WKS	\$764.00			482
1834486001	CARD HOLDER R	P	115182008	4 WKS	\$171.00			403
R900217552	CARTASSYPVV1-1X/018R	P	121000920	4 WKS	\$597.00			17
R900212896	CARTASSYPVV1-1X/027R	P	121000920	4 WKS	\$597.00			17
R900212618	CARTASSYPVV1-1X/036R	P	121000920	4 WKS	\$597.00			17
R900216354	CARTASSYPVV1-1X/040R	P	121000920	4 WKS	\$597.00			17
R900212619	CARTASSYPVV1-1X/046R	P	121000920	4 WKS	\$597.00			17
R900216355	CARTASSYPVV2-1X/040R	P	121000920	4 WKS	\$712.00			17
R900212620	CARTASSYPVV2-1X/045R	P	121000920	4 WKS	\$712.00			17
R900219111	CARTASSYPVV2-1X/045RD	P	121000920	4 WKS	\$712.00			17
R900212897	CARTASSYPVV2-1X/055R	P	121000920	4 WKS	\$712.00			17
R900212616	CARTASSYPVV2-1X/055RD	P	121000920	4 WKS	\$712.00			17
R900216594	CARTASSYPVV2-1X/060R	P	121000920	4 WKS	\$712.00			17
R900212617	CARTASSYPVV2-1X/060RD	P	121000920	4 WKS	\$712.00			17
R900222239	CARTASSYPVV2-1X/068LD	P	121000920	4 WKS	\$712.00			17
R900215400	CARTASSYPVV2-1X/068R	P	121000920	4 WKS	\$712.00			17
R900218736	CARTASSYPVV2-1X/068RD	P	121000920	4 WKS	\$712.00			17
R900212621	CARTASSYPVV4-1X/069R	P	121000920	4 WKS	\$833.00			17
R900212882	CARTASSYPVV4-1X/082R	P	121000920	4 WKS	\$833.00			17
R900219113	CARTASSYPVV4-1X/082RD	P	121000920	4 WKS	\$833.00			17
R900214997	CARTASSYPVV4-1X/098R	P	121000920	4 WKS	\$833.00			17
R900219114	CARTASSYPVV4-1X/098RD	P	121000920	4 WKS	\$833.00			17
R900212879	CARTASSYPVV4-1X/113R	P	121000920	4 WKS	\$833.00			17
R900219115	CARTASSYPVV4-1X/113RD	P	121000920	4 WKS	\$833.00			17
R900212622	CARTASSYPVV4-1X/122R	P	121000920	4 WKS	\$833.00			17
R900219116	CARTASSYPVV4-1X/122RD	P	121000920	4 WKS	\$833.00			17
R900212623	CARTASSYPVV5-1X/139R	P	121000920	4 WKS	\$1,125.00			17
R900212624	CARTASSYPVV5-1X/154R	P	121000920	4 WKS	\$1,125.00			17
R900212881	CARTASSYPVV5-1X/162R	P	121000920	4 WKS	\$1,125.00			17
R900217553	CARTASSYPVV5-1X/183R	P	121000920	4 WKS	\$1,125.00			17
R900212130	CARTASSYPVV5-1X/193R	P	121000920	4 WKS	\$1,125.00			17
R978016333	CDT1MF1/1.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$432.00		\$5	490
R978010269	CDT1MF1/1.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$257.00		\$5	490
R978018373	CDT1MF1/1.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$488.00		\$6	490
R978010270	CDT1MF1/1.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$313.00		\$6	490



## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per		Page No.
						100mm (CDT3)	1" (CDT1, 4)	
R978010271	CDT1MF1/2.00/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$454.00	\$6	490	
R978023890	CDT1MF1/2.00/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$280.00	\$6	490	
R978010272	CDT1MF1/2.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$530.00	\$6	490	
R978013140	CDT1MF1/2.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$356.00	\$6	490	
R978010274	CDT1MF1/2.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$468.00	\$6	490	
R978027518	CDT1MF1/2.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$293.00	\$6	490	
R978010275	CDT1MF1/2.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$546.00	\$6	490	
R978013171	CDT1MF1/2.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$371.00	\$6	490	
R978010278	CDT1MF1/3.25/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$596.00	\$10	490	
R978025419	CDT1MF1/3.25/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$386.00	\$10	490	
R978010279	CDT1MF1/3.25/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$704.00	\$12	490	
R978011891	CDT1MF1/3.25/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$494.00	\$12	490	
R978010282	CDT1MF1/4.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$649.00	\$10	490	
R978027519	CDT1MF1/4.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$439.00	\$10	490	
R978010283	CDT1MF1/4.00/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$760.00	\$14	490	
R978021984	CDT1MF1/4.00/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$550.00	\$14	490	
R978027520	CDT1MF2/1.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$432.00	\$5	490	
R978010313	CDT1MF2/1.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$257.00	\$5	490	
R978027702	CDT1MF2/1.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$488.00	\$6	490	
R978010314	CDT1MF2/1.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$313.00	\$6	490	
R978010315	CDT1MF2/2.00/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$454.00	\$6	490	
R978027521	CDT1MF2/2.00/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$280.00	\$6	490	
R978010316	CDT1MF2/2.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$530.00	\$6	490	
R978018073	CDT1MF2/2.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$356.00	\$6	490	
R978010318	CDT1MF2/2.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$468.00	\$6	490	
R978027522	CDT1MF2/2.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$293.00	\$6	490	
R978010319	CDT1MF2/2.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$546.00	\$6	490	
R978024890	CDT1MF2/2.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$371.00	\$6	490	
R978010322	CDT1MF2/3.25/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$596.00	\$10	490	
R978027523	CDT1MF2/3.25/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$386.00	\$10	490	
R978010323	CDT1MF2/3.25/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$704.00	\$12	490	
R978027524	CDT1MF2/3.25/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$494.00	\$12	490	
R978010326	CDT1MF2/4.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$649.00	\$10	490	
R978027525	CDT1MF2/4.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$439.00	\$10	490	
R978010327	CDT1MF2/4.00/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$760.00	\$14	490	
R978027526	CDT1MF2/4.00/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$550.00	\$14	490	
R978027527	CDT1MP1/1.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$461.00	\$5	490	
R978010355	CDT1MP1/1.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$286.00	\$5	490	
R978027528	CDT1MP1/1.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$488.00	\$6	490	
R978010356	CDT1MP1/1.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$313.00	\$6	490	
R978010357	CDT1MP1/2.00/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$479.00	\$6	490	
R978023862	CDT1MP1/2.00/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$305.00	\$6	490	
R978027529	CDT1MP1/2.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$560.00	\$6	490	
R978018105	CDT1MP1/2.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$385.00	\$6	490	
R978010360	CDT1MP1/2.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$496.00	\$6	490	
R978027530	CDT1MP1/2.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$321.00	\$6	490	
R978010361	CDT1MP1/2.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$579.00	\$6	490	
R978017878	CDT1MP1/2.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$405.00	\$6	490	
R978010364	CDT1MP1/3.25/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$621.00	\$10	490	
R978012966	CDT1MP1/3.25/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$411.00	\$10	490	
R978010365	CDT1MP1/3.25/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$726.00	\$12	490	
R978027531	CDT1MP1/3.25/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$516.00	\$12	490	
R978010368	CDT1MP1/4.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$681.00	\$10	490	
R978027532	CDT1MP1/4.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$471.00	\$10	490	

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per		Page No.
						100mm (CDT3)	1" (CDT1, 4)	
R978010369	CDT1MP1/4.00/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$786.00	\$14	490	
R978027533	CDT1MP1/4.00/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$576.00	\$14	490	
R978027534	CDT1MS2/1.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$461.00	\$5	490	
R978010399	CDT1MS2/1.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$286.00	\$5	490	
R978027535	CDT1MS2/1.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$488.00	\$6	490	
R978010400	CDT1MS2/1.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$313.00	\$6	490	
R978010401	CDT1MS2/2.00/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$479.00	\$6	490	
R978027536	CDT1MS2/2.00/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$305.00	\$6	490	
R978010402	CDT1MS2/2.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$560.00	\$6	490	
R978027537	CDT1MS2/2.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$385.00	\$6	490	
R978010404	CDT1MS2/2.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$496.00	\$6	490	
R978027538	CDT1MS2/2.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$321.00	\$6	490	
R978185526	CDT1MS2/2.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$579.00	\$6	490	
R978010406	CDT1MS2/2.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$405.00	\$6	490	
R978010408	CDT1MS2/3.25/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$621.00	\$10	490	
R978027539	CDT1MS2/3.25/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$411.00	\$10	490	
R978010409	CDT1MS2/3.25/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$726.00	\$12	490	
R978027540	CDT1MS2/3.25/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$516.00	\$12	490	
R978010412	CDT1MS2/4.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$681.00	\$10	490	
R978024912	CDT1MS2/4.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$471.00	\$10	490	
R978010413	CDT1MS2/4.00/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$786.00	\$14	490	
R978026121	CDT1MS2/4.00/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$576.00	\$14	490	
R978027541	CDT1MS4/1.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$432.00	\$5	490	
R978025011	CDT1MS4/1.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$257.00	\$5	490	
R978027542	CDT1MS4/1.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$488.00	\$6	490	
R978027543	CDT1MS4/1.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$313.00	\$6	490	
R978027544	CDT1MS4/2.00/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$454.00	\$6	490	
R978027545	CDT1MS4/2.00/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$280.00	\$6	490	
R978027546	CDT1MS4/2.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$530.00	\$6	490	
R978027547	CDT1MS4/2.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$356.00	\$6	490	
R978027548	CDT1MS4/2.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$468.00	\$6	490	
R978027549	CDT1MS4/2.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$293.00	\$6	490	
R978027550	CDT1MS4/2.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$546.00	\$6	490	
R978027551	CDT1MS4/2.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$371.00	\$6	490	
R978027552	CDT1MS4/3.25/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$596.00	\$10	490	
R978027553	CDT1MS4/3.25/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$386.00	\$10	490	
R978027554	CDT1MS4/3.25/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$704.00	\$12	490	
R978027555	CDT1MS4/3.25/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$494.00	\$12	490	
R978027556	CDT1MS4/4.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$649.00	\$10	490	
R978027557	CDT1MS4/4.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$439.00	\$10	490	
R978027558	CDT1MS4/4.00/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$760.00	\$14	490	
R978027559	CDT1MS4/4.00/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$550.00	\$14	490	
R978027560	CDT1MX0/1.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$424.00	\$5	490	
R978024680	CDT1MX0/1.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$249.60	\$5	490	
R978027561	CDT1MX0/1.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$479.00	\$6	490	
R978027562	CDT1MX0/1.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$305.00	\$6	490	
R978027563	CDT1MX0/2.00/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$449.00	\$6	490	
R978027564	CDT1MX0/2.00/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$275.00	\$6	490	
R978027565	CDT1MX0/2.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$522.00	\$6	490	
R978027566	CDT1MX0/2.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$347.00	\$6	490	
R978027567	CDT1MX0/2.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$461.00	\$6	490	
R978027568	CDT1MX0/2.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$286.00	\$6	490	
R978027569	CDT1MX0/2.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$539.00	\$6	490	
R978027570	CDT1MX0/2.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$364.00	\$6	490	



## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per		Page No.
						100mm (CDT3)	1" (CDT1, 4)	
R978027571	CDT1MX0/3.25/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$578.00	\$10	490	
R978027572	CDT1MX0/3.25/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$368.00	\$10	490	
R978027573	CDT1MX0/3.25/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$700.00	\$12	490	
R978027574	CDT1MX0/3.25/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$490.00	\$12	490	
R978027575	CDT1MX0/4.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$643.00	\$10	490	
R978027576	CDT1MX0/4.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$433.00	\$10	490	
R978027577	CDT1MX0/4.00/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$737.00	\$14	490	
R978027578	CDT1MX0/4.00/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$527.00	\$14	490	
R978027579	CDT1MX1/1.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$424.00	\$5	490	
R978027580	CDT1MX1/1.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$250.00	\$5	490	
R978027581	CDT1MX1/1.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$479.00	\$6	490	
R978027582	CDT1MX1/1.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$305.00	\$6	490	
R978027583	CDT1MX1/2.00/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$449.00	\$6	490	
R978027584	CDT1MX1/2.00/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$275.00	\$6	490	
R978027585	CDT1MX1/2.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$522.00	\$6	490	
R978027586	CDT1MX1/2.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$347.00	\$6	490	
R978027587	CDT1MX1/2.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$461.00	\$6	490	
R978027588	CDT1MX1/2.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$286.00	\$6	490	
R978027589	CDT1MX1/2.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$539.00	\$6	490	
R978027590	CDT1MX1/2.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$364.00	\$6	490	
R978027591	CDT1MX1/3.25/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$578.00	\$10	490	
R978027592	CDT1MX1/3.25/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$368.00	\$10	490	
R978027593	CDT1MX1/3.25/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$700.00	\$12	490	
R978027594	CDT1MX1/3.25/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$490.00	\$12	490	
R978027595	CDT1MX1/4.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$643.00	\$10	490	
R978027596	CDT1MX1/4.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$433.00	\$10	490	
R978027597	CDT1MX1/4.00/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$737.00	\$14	490	
R978027598	CDT1MX1/4.00/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$527.00	\$14	490	
R978027599	CDT1MX2/1.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$424.00	\$5	490	
R978027600	CDT1MX2/1.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$250.00	\$5	490	
R978027601	CDT1MX2/1.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$479.00	\$6	490	
R978027602	CDT1MX2/1.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$305.00	\$6	490	
R978027603	CDT1MX2/2.00/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$449.00	\$6	490	
R978027604	CDT1MX2/2.00/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$275.00	\$6	490	
R978027605	CDT1MX2/2.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$522.00	\$6	490	
R978027606	CDT1MX2/2.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$347.00	\$6	490	
R978027607	CDT1MX2/2.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$461.00	\$6	490	
R978027608	CDT1MX2/2.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$286.00	\$6	490	
R978027609	CDT1MX2/2.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$539.00	\$6	490	
R978027610	CDT1MX2/2.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$364.00	\$6	490	
R978027611	CDT1MX2/3.25/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$578.00	\$10	490	
R978027612	CDT1MX2/3.25/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$368.00	\$10	490	
R978027613	CDT1MX2/3.25/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$700.00	\$12	490	
R978027614	CDT1MX2/3.25/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$490.00	\$12	490	
R978027615	CDT1MX2/4.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$643.00	\$10	490	
R978027616	CDT1MX2/4.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$433.00	\$10	490	
R978027617	CDT1MX2/4.00/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$737.00	\$14	490	
R978027618	CDT1MX2/4.00/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$527.00	\$14	490	
R978027619	CDT1MX3/1.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$424.00	\$5	490	
R978027620	CDT1MX3/1.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$250.00	\$5	490	
R978027621	CDT1MX3/1.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$479.00	\$6	490	
R978027622	CDT1MX3/1.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$305.00	\$6	490	
R978027623	CDT1MX3/2.00/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$449.00	\$6	490	
R978027624	CDT1MX3/2.00/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$275.00	\$6	490	

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per		Page No.
						100mm (CDT3)	1" (CDT1, 4)	
R978027625	CDT1MX3/2.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$522.00	\$6	490	
R978027626	CDT1MX3/2.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$347.00	\$6	490	
R978027627	CDT1MX3/2.50/0.63/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$461.00	\$6	490	
R978027628	CDT1MX3/2.50/0.63/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$286.00	\$6	490	
R978027629	CDT1MX3/2.50/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$539.00	\$6	490	
R978027630	CDT1MX3/2.50/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$364.00	\$6	490	
R978027631	CDT1MX3/3.25/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$578.00	\$10	490	
R978027632	CDT1MX3/3.25/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$368.00	\$10	490	
R978027633	CDT1MX3/3.25/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$700.00	\$12	490	
R978027634	CDT1MX3/3.25/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$490.00	\$12	490	
R978027635	CDT1MX3/4.00/1.00/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$643.00	\$10	490	
R978027636	CDT1MX3/4.00/1.00/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$433.00	\$10	490	
R978027637	CDT1MX3/4.00/1.38/.....Z10/S11HHDMMWW	S	13111101*	2 WKS	\$737.00	\$14	490	
R978027638	CDT1MX3/4.00/1.38/.....Z10/S11HHUMWW	S	13111101*	2 WKS	\$527.00	\$14	490	
R900972805	CDT3ME5/100/45/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,280.00	\$68	492	
R900958188	CDT3ME5/100/70/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,506.00	\$94	492	
R900962750	CDT3ME5/25/12/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$545.00	\$24	492	
R900962752	CDT3ME5/25/18/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$560.00	\$26	492	
R900700338	CDT3ME5/32/14/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$569.00	\$25	492	
R900958529	CDT3ME5/32/22/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$595.00	\$28	492	
R900972976	CDT3ME5/40/18/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$632.00	\$26	492	
R900966666	CDT3ME5/40/28/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$676.00	\$33	492	
R900958198	CDT3ME5/50/22/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$714.00	\$34	492	
R900972979	CDT3ME5/50/36/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$783.00	\$41	492	
R900966668	CDT3ME5/63/28/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$862.00	\$40	492	
R900960542	CDT3ME5/63/45/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$966.00	\$50	492	
R900960610	CDT3ME5/80/36/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,029.00	\$57	492	
R900973851	CDT3ME5/80/56/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,179.00	\$70	492	
R900743917	CDT3ME6/100/45/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,280.00	\$68	492	
R900717505	CDT3ME6/100/70/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,506.00	\$94	492	
R900972721	CDT3ME6/25/12/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$545.00	\$24	492	
R900958820	CDT3ME6/25/18/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$560.00	\$26	492	
R900712337	CDT3ME6/32/14/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$569.00	\$25	492	
R900959965	CDT3ME6/32/22/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$595.00	\$28	492	
R900965935	CDT3ME6/40/18/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$632.00	\$26	492	
R900965987	CDT3ME6/40/28/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$676.00	\$33	492	
R900966669	CDT3ME6/50/22/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$714.00	\$34	492	
R900969310	CDT3ME6/50/36/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$783.00	\$41	492	
R900246350	CDT3ME6/63/28/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$862.00	\$40	492	
R900710447	CDT3ME6/80/36/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,029.00	\$57	492	
R900977004	CDT3ME6/80/56/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,179.00	\$70	492	
R978917368	CDT3MP1/100/45/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,334.00	\$68	492	
R978917369	CDT3MP1/100/70/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,570.00	\$94	492	
R978917356	CDT3MP1/25/12/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$569.00	\$24	492	
R978917357	CDT3MP1/25/18/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$581.00	\$26	492	
R978917358	CDT3MP1/32/14/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$591.00	\$25	492	
R978917359	CDT3MP1/32/22/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$620.00	\$28	492	
R978917360	CDT3MP1/40/18/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$656.00	\$26	492	
R978917361	CDT3MP1/40/28/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$705.00	\$33	492	
R978917362	CDT3MP1/50/22/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$744.00	\$34	492	
R978917363	CDT3MP1/50/36/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$815.00	\$41	492	
R978917364	CDT3MP1/63/28/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$898.00	\$40	492	
R978917365	CDT3MP1/63/45/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,008.00	\$50	492	
R978917366	CDT3MP1/80/36/.....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,070.00	\$57	492	

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per		Page No.
						100mm (CDT3)	1" (CDT1, 4)	
R978917367	CDT3MP1/80/56/....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,230.00	\$70	492	
R978917371	CDT3MS2/100/70/....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,596.00	\$94	492	
R900247995	CDT3MS2/25/12/....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$577.00	\$24	492	
R900975149	CDT3MS2/25/18/....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$590.00	\$26	492	
R900246351	CDT3MS2/32/14/....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$602.00	\$25	492	
R900962878	CDT3MS2/32/22/....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$634.00	\$28	492	
R900972820	CDT3MS2/40/18/....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$668.00	\$26	492	
R900965936	CDT3MS2/40/28/....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$714.00	\$33	492	
R900706511	CDT3MS2/50/22/....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$754.00	\$34	492	
R900965082	CDT3MS2/50/36/....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$828.00	\$41	492	
R900732427	CDT3MS2/63/28/....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$911.00	\$40	492	
R900708239	CDT3MS2/63/45/....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,024.00	\$50	492	
R978917370	CDT3MS2/80/36/....Z10/B1HHDMMWW	P	1311130**	4 WKS	\$1,086.00	\$57	492	
R978003329	CDT4ME5/1.50/0.63/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$601.00	\$7	494	
R978003328	CDT4ME5/1.50/0.63/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$408.00	\$7	494	
R978003331	CDT4ME5/1.50/1.00/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$678.00	\$7	494	
R978003330	CDT4ME5/1.50/1.00/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$485.00	\$7	494	
R978003377	CDT4ME5/2.00/1.00/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$692.00	\$9	494	
R978003376	CDT4ME5/2.00/1.00/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$479.00	\$9	494	
R978003379	CDT4ME5/2.00/1.38/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$778.00	\$10	494	
R978003378	CDT4ME5/2.00/1.38/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$566.00	\$10	494	
R978003425	CDT4ME5/2.50/1.00/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$778.00	\$10	494	
R978003424	CDT4ME5/2.50/1.00/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$532.00	\$10	494	
R978003427	CDT4ME5/2.50/1.38/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$879.00	\$11	494	
R978003426	CDT4ME5/2.50/1.38/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$633.00	\$11	494	
R978003473	CDT4ME5/3.25/1.38/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$940.00	\$13	494	
R978003472	CDT4ME5/3.25/1.38/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$659.00	\$13	494	
R978003475	CDT4ME5/3.25/1.75/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,067.00	\$14	494	
R978003474	CDT4ME5/3.25/1.75/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$786.00	\$14	494	
R978003521	CDT4ME5/4.00/1.75/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,149.00	\$16	494	
R978003520	CDT4ME5/4.00/1.75/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$812.00	\$16	494	
R978003523	CDT4ME5/4.00/2.00/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,295.00	\$19	494	
R978003522	CDT4ME5/4.00/2.00/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$958.00	\$19	494	
R978003333	CDT4MF1/1.50/0.63/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$570.00	\$7	494	
R978003332	CDT4MF1/1.50/0.63/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$378.00	\$7	494	
R978003335	CDT4MF1/1.50/1.00/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$645.00	\$7	494	
R978003334	CDT4MF1/1.50/1.00/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$451.00	\$7	494	
R978003381	CDT4MF1/2.00/1.00/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$657.00	\$9	494	
R978003380	CDT4MF1/2.00/1.00/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$445.00	\$9	494	
R978003383	CDT4MF1/2.00/1.38/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$738.00	\$10	494	
R978003382	CDT4MF1/2.00/1.38/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$526.00	\$10	494	
R978003429	CDT4MF1/2.50/1.00/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$740.00	\$10	494	
R978003428	CDT4MF1/2.50/1.00/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$495.00	\$10	494	
R978003431	CDT4MF1/2.50/1.38/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$835.00	\$11	494	
R978003430	CDT4MF1/2.50/1.38/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$590.00	\$11	494	
R978003477	CDT4MF1/3.25/1.38/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$894.00	\$13	494	
R978003476	CDT4MF1/3.25/1.38/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$614.00	\$13	494	
R978003479	CDT4MF1/3.25/1.75/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,011.00	\$14	494	
R978003478	CDT4MF1/3.25/1.75/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$730.00	\$14	494	
R978003525	CDT4MF1/4.00/1.75/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,093.00	\$16	494	
R978003524	CDT4MF1/4.00/1.75/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$756.00	\$16	494	
R978003527	CDT4MF1/4.00/2.00/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,227.00	\$19	494	
R978003526	CDT4MF1/4.00/2.00/....Z10/S11HHUMWW	S	1311140**	2 WKS	\$890.00	\$19	494	
R978003337	CDT4MF2/1.50/0.63/....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$570.00	\$7	494	

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per		Page No.
						100mm (CDT3)	1" (CDT1, 4)	
R978003336	CDT4MF2/1.50/0.63/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$378.00	\$7	494	
R978003339	CDT4MF2/1.50/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$645.00	\$7	494	
R978003338	CDT4MF2/1.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$451.00	\$7	494	
R978003385	CDT4MF2/2.00/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$657.00	\$9	494	
R978003384	CDT4MF2/2.00/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$445.00	\$9	494	
R978003387	CDT4MF2/2.00/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$738.00	\$10	494	
R978003386	CDT4MF2/2.00/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$526.00	\$10	494	
R978003433	CDT4MF2/2.50/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$740.00	\$10	494	
R978003432	CDT4MF2/2.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$495.00	\$10	494	
R978003435	CDT4MF2/2.50/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$835.00	\$11	494	
R978003434	CDT4MF2/2.50/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$590.00	\$11	494	
R978003481	CDT4MF2/3.25/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$894.00	\$13	494	
R978003480	CDT4MF2/3.25/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$614.00	\$13	494	
R978003483	CDT4MF2/3.25/1.75/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$1,011.00	\$14	494	
R978003482	CDT4MF2/3.25/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$730.00	\$14	494	
R978003529	CDT4MF2/4.00/1.75/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$1,093.00	\$16	494	
R978003528	CDT4MF2/4.00/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$756.00	\$16	494	
R978003531	CDT4MF2/4.00/2.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$1,227.00	\$19	494	
R978003530	CDT4MF2/4.00/2.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$890.00	\$19	494	
R978003341	CDT4MP1/1.50/0.63/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$601.00	\$7	494	
R978003340	CDT4MP1/1.50/0.63/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$408.00	\$7	494	
R978003343	CDT4MP1/1.50/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$678.00	\$7	494	
R978003342	CDT4MP1/1.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$485.00	\$7	494	
R978003389	CDT4MP1/2.00/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$692.00	\$9	494	
R978003388	CDT4MP1/2.00/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$479.00	\$9	494	
R978003391	CDT4MP1/2.00/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$778.00	\$10	494	
R978003390	CDT4MP1/2.00/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$566.00	\$10	494	
R978003437	CDT4MP1/2.50/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$778.00	\$10	494	
R978003436	CDT4MP1/2.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$532.00	\$10	494	
R978003439	CDT4MP1/2.50/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$879.00	\$11	494	
R978003438	CDT4MP1/2.50/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$633.00	\$11	494	
R978003485	CDT4MP1/3.25/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$940.00	\$13	494	
R978002455	CDT4MP1/3.25/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$659.00	\$13	494	
R978003487	CDT4MP1/3.25/1.75/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$1,067.00	\$14	494	
R978003486	CDT4MP1/3.25/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$786.00	\$14	494	
R978003533	CDT4MP1/4.00/1.75/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$1,149.00	\$16	494	
R978003532	CDT4MP1/4.00/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$812.00	\$16	494	
R978003535	CDT4MP1/4.00/2.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$1,295.00	\$19	494	
R978003534	CDT4MP1/4.00/2.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$958.00	\$19	494	
R978003345	CDT4MS2/1.50/0.63/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$601.00	\$7	494	
R978003344	CDT4MS2/1.50/0.63/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$408.00	\$7	494	
R978003347	CDT4MS2/1.50/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$678.00	\$7	494	
R978003346	CDT4MS2/1.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$485.00	\$7	494	
R978003393	CDT4MS2/2.00/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$692.00	\$9	494	
R978003392	CDT4MS2/2.00/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$479.00	\$9	494	
R978003395	CDT4MS2/2.00/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$778.00	\$10	494	
R978003394	CDT4MS2/2.00/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$566.00	\$10	494	
R978003441	CDT4MS2/2.50/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$778.00	\$10	494	
R978003440	CDT4MS2/2.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$532.00	\$10	494	
R978003443	CDT4MS2/2.50/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$879.00	\$11	494	
R978003442	CDT4MS2/2.50/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$633.00	\$11	494	
R978003489	CDT4MS2/3.25/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$940.00	\$13	494	
R978003488	CDT4MS2/3.25/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$659.00	\$13	494	
R978003491	CDT4MS2/3.25/1.75/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$1,067.00	\$14	494	



## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per		Page No.
						100mm (CDT3)	1" (CDT1, 4)	
R978003490	CDT4MS2/3.25/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$786.00	\$14	494	
R978003537	CDT4MS2/4.00/1.75/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,149.00	\$16	494	
R978003536	CDT4MS2/4.00/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$812.00	\$16	494	
R978003539	CDT4MS2/4.00/2.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,295.00	\$19	494	
R978003538	CDT4MS2/4.00/2.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$958.00	\$19	494	
R978003349	CDT4MS4/1.50/0.63/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$570.00	\$7	494	
R978003348	CDT4MS4/1.50/0.63/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$378.00	\$7	494	
R978003351	CDT4MS4/1.50/1.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$645.00	\$7	494	
R978003350	CDT4MS4/1.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$451.00	\$7	494	
R978003397	CDT4MS4/2.00/1.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$657.00	\$9	494	
R978003396	CDT4MS4/2.00/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$445.00	\$9	494	
R978003399	CDT4MS4/2.00/1.38/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$738.00	\$10	494	
R978003398	CDT4MS4/2.00/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$526.00	\$10	494	
R978003445	CDT4MS4/2.50/1.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$740.00	\$10	494	
R978003444	CDT4MS4/2.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$495.00	\$10	494	
R978003447	CDT4MS4/2.50/1.38/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$835.00	\$11	494	
R978003446	CDT4MS4/2.50/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$590.00	\$11	494	
R978003493	CDT4MS4/3.25/1.38/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$894.00	\$13	494	
R978003492	CDT4MS4/3.25/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$614.00	\$13	494	
R978003495	CDT4MS4/3.25/1.75/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,011.00	\$14	494	
R978003494	CDT4MS4/3.25/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$730.00	\$14	494	
R978003541	CDT4MS4/4.00/1.75/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,093.00	\$16	494	
R978003540	CDT4MS4/4.00/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$756.00	\$16	494	
R978003543	CDT4MS4/4.00/2.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,227.00	\$19	494	
R978003542	CDT4MS4/4.00/2.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$890.00	\$19	494	
R978003321	CDT4MT1/1.50/0.63/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$601.00	\$7	494	
R978003320	CDT4MT1/1.50/0.63/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$408.00	\$7	494	
R978003323	CDT4MT1/1.50/1.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$678.00	\$7	494	
R978003322	CDT4MT1/1.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$485.00	\$7	494	
R978003369	CDT4MT1/2.00/1.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$692.00	\$9	494	
R978003368	CDT4MT1/2.00/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$479.00	\$9	494	
R978003371	CDT4MT1/2.00/1.38/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$778.00	\$10	494	
R978003370	CDT4MT1/2.00/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$566.00	\$10	494	
R978003417	CDT4MT1/2.50/1.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$778.00	\$10	494	
R978003416	CDT4MT1/2.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$532.00	\$10	494	
R978003419	CDT4MT1/2.50/1.38/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$879.00	\$11	494	
R978003418	CDT4MT1/2.50/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$633.00	\$11	494	
R978003465	CDT4MT1/3.25/1.38/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$940.00	\$13	494	
R978003464	CDT4MT1/3.25/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$659.00	\$13	494	
R978003467	CDT4MT1/3.25/1.75/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,067.00	\$14	494	
R978003466	CDT4MT1/3.25/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$786.00	\$14	494	
R978003513	CDT4MT1/4.00/1.75/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,149.00	\$16	494	
R978003512	CDT4MT1/4.00/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$812.00	\$16	494	
R978003515	CDT4MT1/4.00/2.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,295.00	\$19	494	
R978003514	CDT4MT1/4.00/2.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$958.00	\$19	494	
R978003325	CDT4MT2/1.50/0.63/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$601.00	\$7	494	
R978003324	CDT4MT2/1.50/0.63/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$408.00	\$7	494	
R978003327	CDT4MT2/1.50/1.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$678.00	\$7	494	
R978003326	CDT4MT2/1.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$485.00	\$7	494	
R978003373	CDT4MT2/2.00/1.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$692.00	\$9	494	
R978003372	CDT4MT2/2.00/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$479.00	\$9	494	
R978003375	CDT4MT2/2.00/1.38/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$778.00	\$10	494	
R978003374	CDT4MT2/2.00/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$566.00	\$10	494	
R978003421	CDT4MT2/2.50/1.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$778.00	\$10	494	

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per		Page No.
						100mm (CDT3)	1" (CDT1, 4)	
R978003420	CDT4MT2/2.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$532.00	\$10	494	
R978003423	CDT4MT2/2.50/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$879.00	\$11	494	
R978003422	CDT4MT2/2.50/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$633.00	\$11	494	
R978003469	CDT4MT2/3.25/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$940.00	\$13	494	
R978003468	CDT4MT2/3.25/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$659.00	\$13	494	
R978003471	CDT4MT2/3.25/1.75/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$1,067.00	\$14	494	
R978003470	CDT4MT2/3.25/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$786.00	\$14	494	
R978003517	CDT4MT2/4.00/1.75/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$1,149.00	\$16	494	
R978003516	CDT4MT2/4.00/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$812.00	\$16	494	
R978003519	CDT4MT2/4.00/2.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$1,295.00	\$19	494	
R978003518	CDT4MT2/4.00/2.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$958.00	\$19	494	
R978003305	CDT4MX0/1.50/0.63/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$556.00	\$7	494	
R978003304	CDT4MX0/1.50/0.63/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$363.00	\$7	494	
R978003307	CDT4MX0/1.50/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$625.00	\$7	494	
R978003306	CDT4MX0/1.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$432.00	\$7	494	
R978003353	CDT4MX0/2.00/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$639.00	\$9	494	
R978003352	CDT4MX0/2.00/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$426.00	\$9	494	
R978003355	CDT4MX0/2.00/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$716.00	\$10	494	
R978003354	CDT4MX0/2.00/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$503.00	\$10	494	
R978003401	CDT4MX0/2.50/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$720.00	\$10	494	
R978003400	CDT4MX0/2.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$474.00	\$10	494	
R978003403	CDT4MX0/2.50/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$809.00	\$11	494	
R978003402	CDT4MX0/2.50/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$564.00	\$11	494	
R978003449	CDT4MX0/3.25/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$868.00	\$13	494	
R978003448	CDT4MX0/3.25/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$588.00	\$13	494	
R978003451	CDT4MX0/3.25/1.75/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$980.00	\$14	494	
R978003450	CDT4MX0/3.25/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$699.00	\$14	494	
R978003497	CDT4MX0/4.00/1.75/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$1,059.00	\$16	494	
R978003496	CDT4MX0/4.00/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$722.00	\$16	494	
R978003499	CDT4MX0/4.00/2.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$1,190.00	\$19	494	
R978003498	CDT4MX0/4.00/2.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$853.00	\$19	494	
R978003309	CDT4MX1/1.50/0.63/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$556.00	\$7	494	
R978003308	CDT4MX1/1.50/0.63/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$363.00	\$7	494	
R978003311	CDT4MX1/1.50/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$625.00	\$7	494	
R978003310	CDT4MX1/1.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$432.00	\$7	494	
R978003357	CDT4MX1/2.00/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$639.00	\$9	494	
R978003356	CDT4MX1/2.00/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$426.00	\$9	494	
R978003359	CDT4MX1/2.00/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$716.00	\$10	494	
R978003358	CDT4MX1/2.00/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$503.00	\$10	494	
R978003405	CDT4MX1/2.50/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$720.00	\$10	494	
R978003404	CDT4MX1/2.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$474.00	\$10	494	
R978003407	CDT4MX1/2.50/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$809.00	\$11	494	
R978003406	CDT4MX1/2.50/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$564.00	\$11	494	
R978003453	CDT4MX1/3.25/1.38/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$868.00	\$13	494	
R978003452	CDT4MX1/3.25/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$588.00	\$13	494	
R978003455	CDT4MX1/3.25/1.75/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$980.00	\$14	494	
R978003454	CDT4MX1/3.25/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$699.00	\$14	494	
R978003501	CDT4MX1/4.00/1.75/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$1,059.00	\$16	494	
R978003500	CDT4MX1/4.00/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$722.00	\$16	494	
R978003503	CDT4MX1/4.00/2.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$1,190.00	\$19	494	
R978003502	CDT4MX1/4.00/2.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$853.00	\$19	494	
R978003313	CDT4MX2/1.50/0.63/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$556.00	\$7	494	
R978003312	CDT4MX2/1.50/0.63/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$363.00	\$7	494	
R978003315	CDT4MX2/1.50/1.00/.....Z10/S11HHDMWW	S	1311140**	2 WKS	\$625.00	\$7	494	

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per		Page No.
						100mm (CDT3)	1" (CDT1, 4)	
R978003314	CDT4MX2/1.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$432.00	\$7	494	
R978003361	CDT4MX2/2.00/1.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$639.00	\$9	494	
R978003360	CDT4MX2/2.00/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$426.40	\$9	494	
R978003363	CDT4MX2/2.00/1.38/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$716.00	\$10	494	
R978003362	CDT4MX2/2.00/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$503.00	\$10	494	
R978003409	CDT4MX2/2.50/1.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$720.00	\$10	494	
R978003408	CDT4MX2/2.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$474.00	\$10	494	
R978003411	CDT4MX2/2.50/1.38/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$809.00	\$11	494	
R978003410	CDT4MX2/2.50/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$564.00	\$11	494	
R978003457	CDT4MX2/3.25/1.38/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$868.00	\$13	494	
R978003456	CDT4MX2/3.25/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$588.00	\$13	494	
R978003459	CDT4MX2/3.25/1.75/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$980.00	\$14	494	
R978003458	CDT4MX2/3.25/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$699.00	\$14	494	
R978003505	CDT4MX2/4.00/1.75/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,059.00	\$16	494	
R978003504	CDT4MX2/4.00/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$722.00	\$16	494	
R978003507	CDT4MX2/4.00/2.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,190.00	\$19	494	
R978003506	CDT4MX2/4.00/2.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$853.00	\$19	494	
R978003317	CDT4MX3/1.50/0.63/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$556.00	\$7	494	
R978003316	CDT4MX3/1.50/0.63/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$363.00	\$7	494	
R978003319	CDT4MX3/1.50/1.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$625.00	\$7	494	
R978003318	CDT4MX3/1.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$432.00	\$7	494	
R978003365	CDT4MX3/2.00/1.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$639.00	\$9	494	
R978003364	CDT4MX3/2.00/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$426.00	\$9	494	
R978003367	CDT4MX3/2.00/1.38/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$716.00	\$10	494	
R978003366	CDT4MX3/2.00/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$503.00	\$10	494	
R978003413	CDT4MX3/2.50/1.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$720.00	\$10	494	
R978003412	CDT4MX3/2.50/1.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$474.00	\$10	494	
R978003415	CDT4MX3/2.50/1.38/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$809.00	\$11	494	
R978003414	CDT4MX3/2.50/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$564.00	\$11	494	
R978003461	CDT4MX3/3.25/1.38/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$868.00	\$13	494	
R978003460	CDT4MX3/3.25/1.38/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$588.00	\$13	494	
R978003463	CDT4MX3/3.25/1.75/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$980.00	\$14	494	
R978003462	CDT4MX3/3.25/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$699.00	\$14	494	
R978003509	CDT4MX3/4.00/1.75/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,059.00	\$16	494	
R978003508	CDT4MX3/4.00/1.75/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$722.00	\$16	494	
R978003511	CDT4MX3/4.00/2.00/.....Z10/S11HHDMMWW	S	1311140**	2 WKS	\$1,190.00	\$19	494	
R978003510	CDT4MX3/4.00/2.00/.....Z10/S11HHUMWW	S	1311140**	2 WKS	\$853.00	\$19	494	
R978884988	CH32C1X/636039-WA	S	115139003	2 WKS	\$146.00		401	
R978908266	CH64G-1X/63040-WA	P	115139003	4 WKS	\$363.00		402	
R978007221	CH64G-PH-1X(5604375)CARDHOLDER	P	115139003	4 WKS	\$0.00		402	
1531334008	CONSOLE ONLY10-50L	P	124834000	4 WKS	\$75.00		466	
R978839478	CP10NN-1X/A-01	S	143171100	2 WKS	\$25.00		485	
R978839477	CP10NN-1X/A-12	S	143171100	2 WKS	\$25.00		485	
R978839950	CP10NN-1X/S-12	S	143171100	2 WKS	\$37.00		485	
R978839480	CP6NN-1X/A-01	S	143171060	2 WKS	\$24.00		485	
R978839479	CP6NN-1X/A-12	S	143171060	2 WKS	\$24.00		485	
R978839953	CP6NN-1X/S-01	S	143171060	2 WKS	\$36.00		485	
R978839952	CP6NN-1X/S-12	S	143171060	2 WKS	\$36.00		485	
R900597599	DA10-1-5X/315-17/12	P	111364105	4 WKS	\$909.00		255	
R900598037	DA20-2-5X/200-17/12	P	111364205	4 WKS	\$1,032.00		255	
R900550017	DA20-2-5X/315-17/12	P	111364205	4 WKS	\$1,032.00		255	
R900535030	DB10-2-5X/100/12	P	111334105	4 WKS	\$433.00		233	
R900535929	DB10-2-5X/315/12	P	111334105	4 WKS	\$433.00		233	
R900571768	DB20-1-5X/200/12	P	111334205	4 WKS	\$441.00		233	



## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R900504616	DB20-1-5X/315/12	P	111334205	4 WKS	\$441.00		233
R900500869	DB20-2-5X/100/12	P	111334205	4 WKS	\$441.00		233
R900535931	DB20-2-5X/200/12	P	111334205	4 WKS	\$441.00		233
R900511690	DB20-2-5X/315/12	P	111334205	4 WKS	\$441.00		233
R900535932	DB20-2-5X/350/12	P	111334205	4 WKS	\$441.00		233
R900347593	DB20G2-4X/200/12W65	P	111334204	4 WKS	\$288.00		237
R900481387	DB20G2-4X/315/12W65	P	111334204	4 WKS	\$288.00		237
R900947400	DB20G2-5X/200/12	P	111334205	4 WKS	\$420.00		233
R978864137	DB20G2-5X/315/12	P	111334205	4 WKS	\$420.00		233
R978872339	DB20G2-5X/50/12	P	111334205	4 WKS	\$420.00		233
R900493939	DB20K2-1X/315XY	P	155322201	4 WKS	\$165.00		233
R900558107	DB30-2-5X/315/12	P	111334305	4 WKS	\$427.00		233
R978850999	DBDH10G1X/200/12	P	111331101	4 WKS	\$277.00		220
R900369758	DBDH10G1X/315/12	P	111331101	4 WKS	\$277.00		220
R900423891	DBDH10K1X/100	P	155321101	4 WKS	\$131.00		220
R900424190	DBDH10K1X/200	P	155321101	4 WKS	\$131.00		220
R900424183	DBDH10K1X/315	P	155321101	4 WKS	\$131.00		220
R900424184	DBDH10K1X/400	P	155321101	4 WKS	\$131.00		220
R900366796	DBDH6G1X/100/12	P	111331061	4 WKS	\$220.00		220
R900345310	DBDH6G1X/200/12	S	111331061	2 WKS	\$220.00		220
R900393748	DBDH6G1X/25/12	P	111331061	4 WKS	\$220.00		220
R900458278	DBDH6G1X/315/12	S	111331061	2 WKS	\$220.00		220
R900385305	DBDH6G1X/400/12	P	111331061	4 WKS	\$220.00		220
R900347546	DBDH6G1X/50/12	P	111331061	4 WKS	\$220.00		220
R900424200	DBDH6K1X/200	P	155321061	4 WKS	\$125.00		220
R900424201	DBDH6K1X/315	P	155321061	4 WKS	\$125.00		220
R900341363	DBDS10G1X/100/12	P	111331101	4 WKS	\$277.00		220
R900341591	DBDS10G1X/200/12	P	111331101	4 WKS	\$277.00		220
R900351411	DBDS10G1X/25/12	P	111331101	4 WKS	\$277.00		220
R900377746	DBDS10G1X/315/12	P	111331101	4 WKS	\$277.00		220
R900350129	DBDS10G1X/630/12	P	111331101	4 WKS	\$368.00		220
R900424147	DBDS10K1X/100	S	155321101	2 WKS	\$131.00		220
R900424149	DBDS10K1X/200	S	155321101	2 WKS	\$131.00		220
R900420276	DBDS10K1X/25	P	155321101	4 WKS	\$131.00		220
R900424150	DBDS10K1X/315	S	155321101	2 WKS	\$131.00		220
R900424151	DBDS10K1X/315V	P	155321101	4 WKS	\$144.00		220
R900424152	DBDS10K1X/400	P	155321101	4 WKS	\$131.00		220
R900424153	DBDS10K1X/50	P	155321101	4 WKS	\$131.00		220
R900427601	DBDS10K1X/630	P	155321101	4 WKS	\$223.00		220
R900375503	DBDS15G1X/200/12	P	111331151	4 WKS	\$409.00		220
R900345502	DBDS20G1X/200/12	P	111331201	4 WKS	\$464.00		220
R900356476	DBDS20G1X/315/12	P	111331201	4 WKS	\$464.00		220
R900424267	DBDS20K1X/100	P	155321201	4 WKS	\$233.00		220
R900424269	DBDS20K1X/200	S	155321201	2 WKS	\$233.00		220
R900422542	DBDS20K1X/25	P	155321201	4 WKS	\$233.00		220
R900424271	DBDS20K1X/315	S	155321201	2 WKS	\$233.00		220
R900424203	DBDS20K1X/400	P	155321201	4 WKS	\$233.00		220
R900424205	DBDS20K1X/50	P	155321201	4 WKS	\$233.00		220
R900915548	DBDS25G1X/100/12	P	111331251	4 WKS	\$763.00		220
R900424284	DBDS30K1X/100	P	155321301	4 WKS	\$349.00		220
R900424286	DBDS30K1X/200	P	155321301	4 WKS	\$349.00		220
R900424288	DBDS30K1X/315	S	155321301	2 WKS	\$349.00		220
R900486363	DBDS6G1X/100/12	P	111331061	4 WKS	\$220.00		220
R900341066	DBDS6G1X/200/12	S	111331061	2 WKS	\$220.00		220

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R900352672	DBDS6G1X/315/12	P	111331061	4 WKS	\$220.00		220
R900423723	DBDS6K1X/100	S	155321061	2 WKS	\$125.00		220
R900423724	DBDS6K1X/200	S	155321061	2 WKS	\$125.00		220
R900424321	DBDS6K1X/200V	P	155321061	4 WKS	\$136.00		220
R900420245	DBDS6K1X/25	P	155321061	4 WKS	\$125.00		220
R900423725	DBDS6K1X/315	S	155321061	2 WKS	\$125.00		220
R900428388	DBDS6K1X/315V	P	155321061	4 WKS	\$136.00		220
R900423726	DBDS6K1X/400	P	155321061	4 WKS	\$125.00		220
R900423727	DBDS6K1X/50	P	155321061	4 WKS	\$125.00		220
R900916121	DBE10-5X/100YG24K4M	P	112212105	4 WKS	\$1,052.00		350
R900579169	DBE10-5X/200YG24K4M	P	112212105	4 WKS	\$1,052.00		350
R900916124	DBE10-5X/315YG24K4M	P	112212105	4 WKS	\$1,052.00		350
R900960779	DBE20-5X/100YG24K4M	P	112212205	4 WKS	\$1,088.00		350
R900971449	DBE20-5X/200YG24K4M	P	112212205	4 WKS	\$1,088.00		350
R900975472	DBE20-5X/315YG24K4M	P	112212205	4 WKS	\$1,088.00		350
R900573294	DBE6-1X/315G24NK4M	P	112214061	4 WKS	\$859.00		344
R900916045	DBE6-1X/315YG24NK4M	P	112214061	4 WKS	\$859.00		344
0811402043	DBE6X-1X/315G24-8NZ4M	P	112282060	4 WKS	\$1,097.00		346
0811402079	DBE6X-1X/180G24K31F1M	P	112282062	4 WKS	\$2,398.00		346
0811402076	DBE6X-1X/315G24K31A1M	P	112282062	4 WKS	\$2,398.00		346
R900952490	DBEE6-1X/200G24K31M	P	112214061	4 WKS	\$1,151.00		344
R900961880	DBEE6-1X/200G24NK31M	P	112214061	4 WKS	\$1,151.00		344
R900923238	DBEM10-5X/200YG24K4M	P	112212105	4 WKS	\$1,134.00		350
R900547401	DBEM10-5X/315YG24K4M	P	112212105	4 WKS	\$1,134.00		350
R900954708	DBEME10-5X/200YG24K31M	P	112212105	4 WKS	\$1,450.00		350
R900536812	DBEME10-5X/315YG24K31M	P	112212105	4 WKS	\$1,450.00		350
R900908585	DBEME10-5X/50YG24K31M	P	112212105	4 WKS	\$1,450.00		350
R900937307	DBEME20-5X/100YG24K31M	P	112212205	4 WKS	\$1,486.00		350
R900954709	DBEME20-5X/200YG24K31M	P	112212205	4 WKS	\$1,486.00		350
R900536813	DBEME20-5X/315YG24K31M	P	112212205	4 WKS	\$1,486.00		350
R901000846	DBET-6X/200G24K4V	P	112212006	4 WKS	\$745.00		334
R901000847	DBET-6X/315G24K4V	P	112212006	4 WKS	\$782.00		334
0811402073	DBETBEX-1X/250G24K31A1M	P	112281062	4 WKS	\$2,245.00		340
R901029968	DBETE-6X/200G24K31A1V	P	112212006	4 WKS	\$1,070.00		338
R901029969	DBETE-6X/315G24K31A1V	P	112212006	4 WKS	\$1,070.00		338
0811402021	DBETFX-1X/250G24-27NZ4M	P	112281061	4 WKS	\$1,098.00		336
R900491698	DBETR-1X/180G24K4M	P	112213001	4 WKS	\$1,035.00		338
R900485944	DBETR-1X/315G24K4M	P	112213001	4 WKS	\$1,035.00		338
0811402019	DBETX-1X/250G24-8NZ4M	P	112281060	4 WKS	\$717.00		336
R978873247	DBW10B2-5X/100-6EW110N9DA/12	P	111334105	4 WKS	\$688.00		233
R900944276	DBW10B2-5X/200-6EG24N9K4/12	P	111334105	4 WKS	\$683.00		233
R900955012	DBW10B2-5X/315-6EG24N9K4/12	P	111334105	4 WKS	\$683.00		233
R900925587	DBW20B2-5X/200-6EW110N9K4/12	P	111334205	4 WKS	\$544.00		233
R900920872	DBW20B2-5X/315-6EW110N9K4/12	P	111334205	4 WKS	\$544.00		233
R900941920	DBW30B2-5X/315-6EG24N9K4/12	P	111334305	4 WKS	\$634.00		233
R978029008	DMX-2X/0	P	115117111	4 WKS	\$2,449.00		397
R900936305	DR10-4-5X/200YM/12	P	111344105	4 WKS	\$603.00		252
R978864796	DR10-4-5X/315Y/12	P	111344105	4 WKS	\$603.00		252
R900507099	DR10-5-5X/100Y/12	P	111344105	4 WKS	\$603.00		252
R900618736	DR10-5-5X/200YM/12	P	111344105	4 WKS	\$603.00		252
R900563182	DR10-5-5X/315Y/12	P	111344105	4 WKS	\$603.00		252
R978864072	DR20-4-5X/315Y/12	P	111344205	4 WKS	\$700.00		252
R900519810	DR20-5-5X/100Y/12	P	111344205	4 WKS	\$700.00		252
R900546289	DR20-5-5X/200YM/12	P	111344205	4 WKS	\$700.00		252

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R900574009	DR20-5-5X/315YM/12	P	111344205	4 WKS	\$700.00		252
R900720359	DR20-5-5X/50Y/12	P	111344205	4 WKS	\$700.00		252
R900922541	DR30-5-5X/100Y/12	P	111344305	4 WKS	\$853.00		252
R900554887	DR6DP1-5X/150YM/12	P	111341065	4 WKS	\$339.00		247
R900401214	DR6DP1-5X/210Y/12	P	111341065	4 WKS	\$339.00		247
R900481941	DR6DP2-5X/150Y/12	P	111341065	4 WKS	\$339.00		247
R900479792	DR6DP2-5X/150YM/12	P	111341065	4 WKS	\$339.00		247
R900550783	DR6DP2-5X/210Y/12	P	111341065	4 WKS	\$339.00		247
R900434477	DR6DP2-5X/210YM/12	P	111341065	4 WKS	\$339.00		247
R900430658	DR6DP2-5X/25YM/12	P	111341065	4 WKS	\$339.00		247
R900479788	DR6DP2-5X/75Y/12	P	111341065	4 WKS	\$339.00		247
R900433346	DR6DP2-5X/75YM/12	P	111341065	4 WKS	\$339.00		247
R900917728	DRE10-5X/200YG24K4M	P	112231105	4 WKS	\$1,210.00		356
R900926930	DRE10-5X/200YMG24K4M	P	112231105	4 WKS	\$1,210.00		356
R900916196	DRE10-5X/315YMG24K4M	P	112231105	4 WKS	\$1,210.00		356
R900944899	DRE10-5X/50YG24K4M	P	112231105	4 WKS	\$1,210.00		356
R900948093	DRE10-5X/50YMG24K4M	P	112231105	4 WKS	\$1,210.00		356
R900546913	DRE20-5X/200YMG24K4M	P	112231205	4 WKS	\$1,297.00		356
R900922925	DRE20-5X/315YG24K4M	P	112231205	4 WKS	\$1,297.00		356
0811402080	DREBE6X-1X/175MG24K31A1M	P	112283062	4 WKS	\$2,398.00		348
0811402083	DREBE6X-1X/175MG24K31F1M	P	112283062	4 WKS	\$2,398.00		348
0811402081	DREBE6X-1X/310MG24K31A1M	P	112283062	4 WKS	\$2,398.00		348
R900923432	DREE10-5X/200YMG24NK31M	P	112231105	4 WKS	\$1,566.00		356
R900950007	DREE10-5X/315YMG24NK31M	P	112231105	4 WKS	\$1,566.00		356
R900956336	DREE20-5X/200YMG24NK31M	P	112231205	4 WKS	\$1,641.00		356
R900915969	DREM10-5X/100YG24K4M	P	112231105	4 WKS	\$1,294.00		356
R900915972	DREM10-5X/200YG24K4M	P	112231105	4 WKS	\$1,294.00		356
R900915973	DREM10-5X/200YMG24K4M	P	112231105	4 WKS	\$1,294.00		356
R900907850	DREM10-5X/315YMG24K4M	P	112231105	4 WKS	\$1,294.00		356
R900915981	DREM20-5X/315YMG24K4M	P	112231205	4 WKS	\$1,419.00		356
R900965352	DZ10-2-5X/200Y/12	P	111354105	4 WKS	\$571.00		241
R978865269	DZ20-1-5X/200Y/12	P	111354205	4 WKS	\$665.00		241
R978864353	DZ20-2-5X/200/12	P	111354205	4 WKS	\$665.00		241
R900455873	G154/12	P	113100000	4 WKS	\$402.00		479
R900584166	G155/12	P	113100000	4 WKS	\$459.00		479
R900490017	G156/12	P	113100000	4 WKS	\$490.00		479
R900455126	G174/12	P	113100000	4 WKS	\$300.00		479
R900487923	G279/12	P	113100000	4 WKS	\$135.00		479
R900422656	G341/05	P	113100000	4 WKS	\$98.00		479
R900341065	G341/12	S	113100000	2 WKS	\$98.00		479
R900424450	G342/05	P	113100000	4 WKS	\$108.00		479
R900455128	G342/12	S	113100000	2 WKS	\$108.00		479
R900485504	G409/12	P	113100000	4 WKS	\$170.00		479
R900340082	G411/12	P	113100000	4 WKS	\$339.00		479
R900487396	G413/12	P	113100000	4 WKS	\$322.00		479
R900339598	G415/12	P	113100000	4 WKS	\$337.00		479
R900488054	G461/12	P	113100000	4 WKS	\$137.00		479
R900487397	G502/12	P	113100000	4 WKS	\$179.00		479
R900487398	G534/12	P	113100000	4 WKS	\$203.00		479
R900339599	G546/12	P	113100000	4 WKS	\$202.00		479
R900503115	G646/12	S	113100000	2 WKS	\$111.00		479
R900460656	G67/12	S	113100000	2 WKS	\$93.00		479
R916565821	GFT 7T2.4042, i=43.0, w/ A10VT28	P		4 WKS	\$2,300.00		516
R916570834	GFT 7T2.4055, i=30.9, w/ A10VT28	P		4 WKS	\$2,570.00		516

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R916630806	GFT 7T2.4092, i=43.0, w/ A10VT28	P		4 WKS	\$2,570.00		516
R916574505	GFT 7T2.5064, i=43.0, w/ A10VT28	P		4 WKS	\$2,665.00		516
R916574500	GFT 7T2.5065, i=62.6, w/ A10VT28	P		4 WKS	\$2,665.00		516
R916565818	GFT 7T2.9041, i=62.6, w/o brake	P		4 WKS	\$1,420.00		516
R978890551	H-4WEH25D6X/6EW110N9DAL	P	111152256	4 WKS	\$880.00		170
R978902922	H-4WEH25D6X/6EW110N9EDAL	P	111152256	4 WKS	\$880.00		170
R978897417	H-4WEH25E6X/6EG12N9EDAL	P	111152256	4 WKS	\$840.00		170
R978890354	H-4WEH25E6X/6EG12N9ETDA	P	111152256	4 WKS	\$808.00		170
R978897517	H-4WEH25E6X/6EG24N9EDA	P	111152256	4 WKS	\$808.00		170
R978898946	H-4WEH25E6X/6EG24N9S2DAL	P	111152256	4 WKS	\$1,028.00		170
R978902642	H-4WEH25E6X/6EG24N9SDAL	P	111152256	4 WKS	\$1,028.00		170
R978890052	H-4WEH25E6X/6EW110N9DAL	P	111152256	4 WKS	\$840.00		170
R978877940	H-4WEH25E6X/6EW110N9ETDA	P	111152256	4 WKS	\$808.00		170
R978879696	H-4WEH25E6X/6EW110N9ETDAL	P	111152256	4 WKS	\$840.00		170
R978904865	H-4WEH25G6X/6EW110N9DA	P	111152256	4 WKS	\$868.00		170
R978909606	H-4WEH25G6X/6EW110N9ETDAL	P	111152256	4 WKS	\$899.00		170
R978905829	H-4WEH25G6X/6EW110N9ETSDA/P4.5	P	111152256	4 WKS	\$1,172.00		170
R978901664	H-4WEH25G6X/6EW110N9TS2DA	P	111152256	4 WKS	\$1,055.00		170
R978879697	H-4WEH25GB6X/6EW110N9DAL	P	111152256	4 WKS	\$824.00		170
R978908828	H-4WEH25H6X/6EG24N9ETK4	S	111152256	2 WKS	\$800.00		170
R978897637	H-4WEH25HD6X/6EG24N9EDA	P	111152256	4 WKS	\$751.00		170
R978907174	H-4WEH25HD6X/6EG24N9K4/B10	P	111152256	4 WKS	\$758.00		170
R978899449	H-4WEH25HD6X/6EW110N9ETDA	S	111152256	2 WKS	\$751.00		170
R978895452	H-4WEH25HG6X/6EW110N9DAL/B12	P	111152256	4 WKS	\$1,054.00		170
R978898973	H-4WEH25HH6X/6EG12N9DA	P	111152256	4 WKS	\$958.00		170
R978898480	H-4WEH25J6X/6EG12N9EDA	P	111152256	4 WKS	\$808.00		170
R900914691	H-4WEH25J6X/6EG24N9ETK4	P	111152256	4 WKS	\$800.00		170
R978902923	H-4WEH25J6X/6EW110N9EDAL	P	111152256	4 WKS	\$840.00		170
R978896975	H-4WEH32G6X/6EW110N9DA	P	111152326	4 WKS	\$2,007.00		170
R978892936	H-4WEH32G6X/6EW110N9DAL	P	111152326	4 WKS	\$2,039.00		170
R900953649	H-4WEH32G6X/6EW110N9K4	P	111152326	4 WKS	\$1,997.00		170
R900973884	H-4WEH32J6X/6EG24N9K4	P	111152326	4 WKS	\$1,912.00		170
R978898951	H-4WEH32J6X/6EG24N9S2DAL	P	111152326	4 WKS	\$2,146.00		170
R978897833	H-4WEH32J6X/6EW110N9DA	P	111152326	4 WKS	\$1,921.00		170
R978900334	H-4WEH32J6X/6EW110N9ES2DAL	P	111152326	4 WKS	\$2,146.00		170
R978902003	H-4WEH32J6X/6EW110NTSDA	P	111152326	4 WKS	\$2,220.00		170
R902445975	HAA4VSO 250 DR /30R-VKD75U99 E	P	814234351	4 WKS	\$12,259.00		73
R902453293	HAA4VSO 250 DRG /30R-VSD75U99 E	P	814234351	4 WKS	\$12,259.00		73
R902445975	HAA4VSO250DR/30R-VKD75U99E	P	811234351	4 WKS	\$12,257.00		73
R978700595	HAB10-207-2X/5U09G-2N111-ASME0531114640	P	124110100	4 WKS	\$1,447.00		464
R978700573	HAB1-207-2X/5U12G-2N111-ASME	P	124110010	4 WKS	\$670.00		464
R978700612	HAB20-207-2X/5U09G-2N111-ASME0531115640	P	124110200	4 WKS	\$1,669.00		464
R978700617	HAB35-207-2X/5U09G-2N111-ASME0531115650	P	124110350	4 WKS	\$2,348.00		464
R978700584	HAB4-207-2X/5U08G-2N111-ASME0531113640	P	124110040	4 WKS	\$874.00		464
R978700627	HAB50-207-2X/5U09G-2N111-ASME0531116640	P	124110500	4 WKS	\$3,318.00		464
0531610632	HAD0,075-250-1X/0U12A-2N111-USA	P	124210013	4 WKS	\$83.00		465
0531600600	HAD0,16-250-1X/0F02A-2N111-USA	P	124210023	4 WKS	\$98.00		465
0531600611	HAD0,16-250-1X/0U12C1-2N111-USA	P	124210023	4 WKS	\$98.00		465
0531601533	HAD0,35-160-1X/0F08A-2N111-USA	P	124210032	4 WKS	\$124.00		465
0531601549	HAD0,35-160-1X/0U04A-2N111-USA	P	124210032	4 WKS	\$124.00		465
0531601572	HAD0,35-207-1X/0U04A-2N111-USA	P	124210032	4 WKS	\$124.00		465
0531611527	HAD0,5-160-1X/110U04A-1N111-BA	P	124210052	4 WKS	\$124.00		465
0531611603	HAD0,5-211-1X/110U04A-2N111-USA	P	124210052	4 WKS	\$124.00		465
0531602553	HAD0,7-180-1X/0F08A-2N111-USA	P	124210072	4 WKS	\$176.00		465

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
0531602560	HAD0,7-180-1X/0U04A-2N111-USA	P	124210072	4 WKS	\$176.00		465
0531602581	HAD0,7-207-1X/0F08A-2N111-USA	P	124210073	4 WKS	\$176.00		465
0531602588	HAD0,7-207-1X/0U04C-2N111-USA	P	124210072	4 WKS	\$176.00		465
0531603500	HAD1,4-207-1X/0F08C-2N111-USA	P	124210143	4 WKS	\$301.00		465
0531603501	HAD1,4-207-1X/0U04C-2N111-USA	P	124210143	4 WKS	\$301.00		465
0531613500	HAD2,8-207-1X/0F08C-2N111-USA	P	124210283	4 WKS	\$464.00		465
0531613503	HAD2,8-207-1X/0U04C-2N111-USA	P	124210283	4 WKS	\$464.00		465
0531623500	HAD2-207-1X/0U04C-2N111-USA	P	124210201	4 WKS	\$341.00		465
R978862701	HED1KA4X/350L110/12	P	111910010	4 WKS	\$239.00		470
R900481075	HED1OA4X/100/12	P	111910010	4 WKS	\$210.00		470
R978899220	HED1OA4X/100L24/12	P	111910010	4 WKS	\$239.00		470
R900468190	HED1OA4X/350/12	P	111910010	4 WKS	\$210.00		470
R900407610	HED1OA4X/50/12	P	111910010	4 WKS	\$210.00		470
R900439939	HED2OA2X/200/12	P	111910020	4 WKS	\$373.00		472
R978865027	HED2OA2X/200L24/12	P	111910020	4 WKS	\$402.00		472
R978860728	HED2OA2X/25L110/12	P	111910020	4 WKS	\$402.00		472
R900455372	HED2OA2X/400/12	P	111910020	4 WKS	\$373.00		472
R900590206	HED3OA3X/100/12	P	111910030	4 WKS	\$375.00		474
R900580777	HED3OA3X/200/12	P	111910030	4 WKS	\$375.00		474
R900504056	HED3OA3X/200L110/12	P	111910030	4 WKS	\$408.00		474
R978872092	HED3OA3X/25L110/12	P	111910030	4 WKS	\$369.00		474
R900367896	HED3OA3X/400/12	P	111910030	4 WKS	\$375.00		474
R900591050	HED3OA3X/63/12	P	111910030	4 WKS	\$375.00		474
R901106257	HED8OA-2X/100K14/12	P	111910080	4 WKS	\$214.00		476
R901106512	HED8OA-2X/200K14/12	P	111910080	4 WKS	\$214.00		476
R901102710	HED8OA-2X/350K14	P	111910080	4 WKS	\$218.00		476
R901107091	HED8OA-2X/350K14/12	P	111910080	4 WKS	\$214.00		476
R901107793	HED8OA-2X/50K14/12	P	111910080	4 WKS	\$218.00		476
R901102360	HED8OH-2X/100K14	P	111910080	4 WKS	\$241.00		476
R901099808	HED8OH-2X/200K14	P	111910080	4 WKS	\$241.00		476
R901101640	HED8OH-2X/350K14	P	111910080	4 WKS	\$235.00		476
R901102747	HED8OP-2X/100K14	P	111910080	4 WKS	\$235.00		476
R901106453	HED8OP-2X/350K14	P	111910080	4 WKS	\$241.00		476
R901102365	HED8OP-2X/350K14S	P	111910080	4 WKS	\$253.00		476
R901107083	HED8OP-2X/50K14	P	111910080	4 WKS	\$235.00		476
0811405545	HM18-1X/210-C-B/V0/0	P	115183001	4 WKS	\$397.00		462
0811405531	HM18-1X/210-V-R/V0/0	P	115183001	4 WKS	\$397.00		462
0811405540	HM18-1X/210-V-S/V0/0	P	115183001	4 WKS	\$397.00		462
0811405546	HM18-1X/350-C-B/V0/0	P	115183001	4 WKS	\$397.00		462
0811405532	HM18-1X/350-V-R/V0/0	P	115183001	4 WKS	\$397.00		462
0811405547	HM18-1X/350-V-S/V0/0	P	115183001	4 WKS	\$397.00		462
R978711808	KIT ISO&SAE ADAP VPV130/"G"	P	121000920	4 WKS	\$1,241.00		26
R978711783	KIT ISO&SAE ADAP VPV130TO"F	P	121000920	4 WKS	\$742.00		26
R978711781	KIT ISO&SAE ADAP VPV63TO"F"	P	121000920	4 WKS	\$963.00		26
R978711782	KIT ISO&SAE ADAP VPV63TO"G"	P	121000920	4 WKS	\$1,237.00		26
R978711779	KIT ISO&SAE ADAPTER VPV16/"F"	P	121000920	4 WKS	\$441.00		26
R978711842	KIT P1 VPV80 210BAR PUMP REP.	P	121000920	4 WKS	\$2,392.00		27
R978711849	KIT REPAIR VPV100/130210BAR SAE	P	121000920	4 WKS	\$2,639.00		27
R978711851	KIT REPAIR VPV100/130210BAR SAE/P1	P	121000920	4 WKS	\$2,886.00		27
R978711850	KIT REPAIR VPV164210BAR SAE	P	121000920	4 WKS	\$2,999.00		27
R978711852	KIT REPAIR VPV164210BAR SAE/P1	P	121000920	4 WKS	\$3,434.00		27
R978711838	KIT REPAIR VPV45/63210BAR SAE	P	121000920	4 WKS	\$1,319.00		27
R978711841	KIT REPAIR VPV45/63210BAR SAE/P1	P	121000920	4 WKS	\$1,592.00		27
9511230536	KIT SAE ADAP VPV130TOVPV130	P	111080920	4 WKS	\$1,991.00		26



## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
9511230542	KIT SAE ADAP VPV130TOVPV16	P	111080920	4 WKS	\$679.00		26
9511230540	KIT SAE ADAP VPV130TOVPV32	P	111080920	4 WKS	\$740.00		26
9511230538	KIT SAE ADAP VPV130TOVPV63	P	111080920	4 WKS	\$780.00		26
9511230523	KIT SAE ADAP VPV32/25TO32/25	P	111080920	4 WKS	\$748.00		26
9511230525	KIT SAE ADAP VPV32/25TOVPV16	P	111080920	4 WKS	\$553.00		26
9511230528	KIT SAE ADAP VPV45/63/80TOVPV45/63/80	P	111080920	4 WKS	\$730.00		26
9511230532	KIT SAE ADAP VPV63TOVPV16	P	111080920	4 WKS	\$566.00		26
9511230530	KIT SAE ADAP VPV63TOVPV25/32	P	111080920	4 WKS	\$831.00		26
9511230518	KIT SAE ADAPTER VPV16TOVPV16	P	111080920	4 WKS	\$515.00		26
R901091663	KOL10E-1X/R/M	P	142230000	4 WKS	\$1,520.00		502
R904101920	KOL10N-1X/R/M	S	142850130	2 WKS	\$1,520.00		502
R901091690	KOL120E-1X/A/M	P	142230000	4 WKS	\$5,277.00		502
R904101927	KOL120N-1X/A/M	S	142850130	2 WKS	\$5,277.00		502
R901091669	KOL20E-1X/A/M	P	142230000	4 WKS	\$2,771.00		502
R904101921	KOL20N-1X/A/M	S	142850130	2 WKS	\$2,771.00		502
R901091673	KOL30E-1X/A/M	P	142230000	4 WKS	\$3,334.00		502
R904101922	KOL30N-1X/A/M	S	142850130	2 WKS	\$3,334.00		502
R901091622	KOL3E-1X/R/M	P	142230000	4 WKS	\$1,130.00		502
R904101917	KOL3N-1X/R/M	S	142850130	2 WKS	\$1,130.00		502
R901091674	KOL40E-1X/A/M	P	142230000	4 WKS	\$3,292.00		502
R904101923	KOL40N-1X/A/M	S	142850130	2 WKS	\$3,292.00		502
R901091676	KOL45E-1X/A/M	P	142230000	4 WKS	\$4,120.00		502
R904101924	KOL45N-1X/A/M	S	142850130	2 WKS	\$4,120.00		502
R901091306	KOL5E-1X/R/M	P	142230000	4 WKS	\$1,174.00		502
R904101918	KOL5N-1X/R/M	S	142850130	2 WKS	\$1,174.00		502
R901091679	KOL65E-1X/A/M	P	142230000	4 WKS	\$4,091.00		502
R904101925	KOL65N-1X/A/M	S	142850130	2 WKS	\$4,091.00		502
R901091682	KOL80E-1X/A/M	P	142230000	4 WKS	\$5,225.00		502
R904101926	KOL80N-1X/A/M	S	142850130	2 WKS	\$5,225.00		502
R901091657	KOL8E-1X/R/M	P	142230000	4 WKS	\$1,568.00		502
R900912566	LC16A05E7X/	P	111611167	4 WKS	\$146.00		176
R900912567	LC16A10E7X/	P	111611167	4 WKS	\$146.00		176
R900912572	LC16A20D7X/	P	111611167	4 WKS	\$152.00		176
R900910269	LC16A20E7X/	P	111611167	4 WKS	\$146.00		176
R900912568	LC16A40E7X/	P	111611167	4 WKS	\$146.00		176
R900912593	LC16B05E7X/	P	111611167	4 WKS	\$146.00		176
R900912599	LC16B20D7X/	P	111611167	4 WKS	\$158.00		176
R900912590	LC16B40E7X/	P	111611167	4 WKS	\$146.00		176
R900912546	LC16DB20D7X/	P	111611167	4 WKS	\$181.00		178
R900912531	LC16DB20E7X/	P	111611167	4 WKS	\$158.00		178
R900912532	LC16DB40E7X/	P	111611167	4 WKS	\$158.00		178
R900909251	LC25A05D7X/	P	111611257	4 WKS	\$192.00		176
R900912576	LC25A05E7X/	P	111611257	4 WKS	\$181.00		176
R900912577	LC25A10E7X/	P	111611257	4 WKS	\$181.00		176
R900912580	LC25A20D7X/	P	111611257	4 WKS	\$192.00		176
R900910270	LC25A20E7X/	P	111611257	4 WKS	\$181.00		176
R900912581	LC25A40D7X/	P	111611257	4 WKS	\$192.00		176
R900912574	LC25A40E7X/	P	111611257	4 WKS	\$181.00		176
R900909246	LC25B05E7X/	P	111611257	4 WKS	\$181.00		176
R900912608	LC25B20D7X/	P	111611257	4 WKS	\$200.00		176
R900912604	LC25B20E7X/	P	111611257	4 WKS	\$181.00		176
R900912601	LC25B40E7X/	P	111611257	4 WKS	\$181.00		176
R900912549	LC25DB20E7X/	P	111611257	4 WKS	\$197.00		178
R900912555	LC25DB40D7X/	P	111611257	4 WKS	\$232.00		178

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R900912550	LC25DB40E7X/	P	111611257	4 WKS	\$197.00		178
R900912586	LC32A00E7X/	P	111611327	4 WKS	\$260.00		176
R900912585	LC32A05E7X/	P	111611327	4 WKS	\$260.00		176
R900912583	LC32A10E7X/	P	111611327	4 WKS	\$260.00		176
R900912589	LC32A20D7X/	P	111611327	4 WKS	\$271.00		176
R900906337	LC32A20E7X/	P	111611327	4 WKS	\$260.00		176
R900909662	LC32A40E7X/	P	111611327	4 WKS	\$260.00		176
R900912611	LC32B00E7X/	P	111611327	4 WKS	\$260.00		176
R900909570	LC32B05E7X/	P	111611327	4 WKS	\$260.00		176
R900912612	LC32B10E7X/	P	111611327	4 WKS	\$260.00		176
R900912618	LC32B20D7X/	P	111611327	4 WKS	\$288.00		176
R900912613	LC32B20E7X/	P	111611327	4 WKS	\$260.00		176
R900912610	LC32B40E7X/	P	111611327	4 WKS	\$260.00		176
R900912543	LC32DB20E7X/	P	111611327	4 WKS	\$288.00		178
R900912557	LC32DB40D7X/	P	111611327	4 WKS	\$328.00		178
R900910773	LC32DB40E7X/	P	111611327	4 WKS	\$288.00		178
R900937996	LC40A05E7X/	P	111612407	4 WKS	\$375.00		176
R900937998	LC40A10E7X/	P	111612407	4 WKS	\$375.00		176
R900937999	LC40A20D7X/	P	111612407	4 WKS	\$396.00		176
R900938000	LC40A20E7X/	P	111612407	4 WKS	\$375.00		176
R900935732	LC40A40D7X/	P	111612407	4 WKS	\$396.00		176
R900927973	LC40A40E7X/	P	111612407	4 WKS	\$375.00		176
R900938002	LC40B05E7X/	P	111612407	4 WKS	\$375.00		176
R900938006	LC40B20D7X/	P	111612407	4 WKS	\$426.00		176
R900938007	LC40B20E7X/	P	111612407	4 WKS	\$375.00		176
R900938009	LC40B40E7X/	P	111612407	4 WKS	\$375.00		176
R900928821	LC40DB20D7X/	P	111612407	4 WKS	\$450.00		178
R900938012	LC40DB20E7X/	P	111612407	4 WKS	\$375.00		178
R900938014	LC40DB40D7X/	P	111612407	4 WKS	\$450.00		178
R900927969	LC40DB40E7X/	P	111612407	4 WKS	\$375.00		178
R900938021	LC50A05D7X/	P	111612507	4 WKS	\$502.00		176
R900938022	LC50A05E7X/	P	111612507	4 WKS	\$476.00		176
R900938024	LC50A10E7X/	P	111612507	4 WKS	\$476.00		176
R900938026	LC50A20D7X/	P	111612507	4 WKS	\$502.00		176
R900920273	LC50A20E7X/	P	111612507	4 WKS	\$476.00		176
R900929935	LC50A40E7X/	P	111612507	4 WKS	\$476.00		176
R900938031	LC50B05E7X/	P	111612507	4 WKS	\$476.00		176
R900938032	LC50B10E7X/	P	111612507	4 WKS	\$476.00		176
R900929665	LC50B20E7X/	P	111612507	4 WKS	\$476.00		176
R900938039	LC50DB20E7X/	P	111612507	4 WKS	\$476.00		178
R900938040	LC50DB40D7X/	P	111612507	4 WKS	\$551.00		178
R900938041	LC50DB40E7X/	P	111612507	4 WKS	\$476.00		178
R978907600	LCB16N-1X/D1-07	P	143972160	4 WKS	\$478.00		488
R978907602	LCB25N-1X/D1-07	P	143972250	4 WKS	\$592.00		488
R978907604	LCB32N-1X/D1-07	P	143972320	4 WKS	\$669.00		488
R900932350	LFA16D-7X/F/12	P	111621167	4 WKS	\$105.00		176
R900932410	LFA16DBW2-7X/200/12	P	111621167	4 WKS	\$392.00		178
R900932351	LFA16GWA-7X/12	P	111621167	4 WKS	\$339.00		176
R900932352	LFA16H2-7X/F/12	P	111621167	4 WKS	\$223.00		176
R900932356	LFA16KWA-7X/12	P	111621167	4 WKS	\$394.00		176
R900932358	LFA16WEA-7X/12	P	111621167	4 WKS	\$159.00		176
R900932362	LFA25D-7X/F/12	P	111621257	4 WKS	\$131.00		176
R900932361	LFA25DB2-7X/100/12	P	111621257	4 WKS	\$404.00		178
R900956625	LFA25DB2-7X/315/12	P	111621257	4 WKS	\$404.00		178



**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R900947512	LFA25DBW2-7X/100/12	P	111621257	4 WKS	\$471.00		178
R900932360	LFA25DBW2-7X/200/12	P	111621257	4 WKS	\$471.00		178
R900947015	LFA25DBW2-7X/315/12	P	111621257	4 WKS	\$471.00		178
R900932363	LFA25GWA-7X/12	P	111621257	4 WKS	\$379.00		176
R978909800	LFA25GWB7X/12	P	111621257	4 WKS	\$379.00		176
R900932364	LFA25H2-7X/F/12	P	111621257	4 WKS	\$260.00		176
R900932367	LFA25KWA-7X/12	P	111621257	4 WKS	\$420.00		176
R900932368	LFA25WEA-7X/12	P	111621257	4 WKS	\$181.00		176
R900957441	LFA25WEB-7X/12	P	111621257	4 WKS	\$181.00		176
R900932369	LFA25WEMA-7X/12	P	111621257	4 WKS	\$237.00		176
R900932373	LFA32D-7X/F/12	P	111621327	4 WKS	\$181.00		176
R900932372	LFA32DB2-7X/100/12	P	111621327	4 WKS	\$506.00		178
R900953446	LFA32DB2-7X/315/12	P	111621327	4 WKS	\$506.00		178
R900940858	LFA32DB2-7X/420/12	P	111621327	4 WKS	\$506.00		178
R900932370	LFA32DBW2-7X/200/12	P	111621327	4 WKS	\$569.00		178
R900950274	LFA32DBW2-7X/315/12	P	111621327	4 WKS	\$569.00		178
R900932374	LFA32GWA-7X/12	P	111621327	4 WKS	\$444.00		176
R900916294	LFA32H2-7X/F/12	P	111621327	4 WKS	\$315.00		176
R900932377	LFA32KWA-7X/12	P	111621327	4 WKS	\$521.00		176
R900932379	LFA32WEA-7X/12	P	111621327	4 WKS	\$237.00		176
R900938074	LFA40D-7X/F/12	P	111622407	4 WKS	\$159.00		176
R900968414	LFA40DB2-7X/200/12	P	111622407	4 WKS	\$399.00		178
R900948914	LFA40DBW2-7X/200/12	P	111622407	4 WKS	\$439.00		178
R900961763	LFA40DBW2-7X/315/12	P	111622407	4 WKS	\$439.00		178
R900956116	LFA40GWA-7X/12	P	111622407	4 WKS	\$467.00		176
R900938124	LFA40H2-7X/F/12	P	111622407	4 WKS	\$284.00		176
R900969803	LFA40KWA-7X/12	P	111622407	4 WKS	\$489.00		176
R900968571	LFA40WEA-7X/12	P	111622407	4 WKS	\$260.00		176
R900968634	LFA50D-7X/F/12	P	111622507	4 WKS	\$210.00		176
R900970222	LFA50DBW2-7X/315/12	P	111622507	4 WKS	\$901.00		178
R900951081	LFA50KWA-7X/12	P	111622507	4 WKS	\$872.00		176
R900970722	LFA50WEA-7X/12	P	111622507	4 WKS	\$330.00		176
1834484142	LINE CONN 11P+PE PG16 PLA CRIMPED	P	111080931	4 WKS	\$82.00		324
1834482026	LINE CONN 6P+PE PG11 PLA CRIMPED	P	111080931	4 WKS	\$47.00		
1834482022	LINE CONN 6P+PE PG11 PLA SOLDERED	P	111080931	4 WKS	\$60.00		
R900086685	M-3SED10CK1X/350CG24N9K4	P	111231101	4 WKS	\$435.00		152
R900053910	M-3SED10CK1X/350CG96N9K4	P	111231101	4 WKS	\$484.00		152
R900051053	M-3SED10UK1X/350CG24N9K4	P	111231101	4 WKS	\$435.00		152
R900218884	M-3SED10UK1X/350CG96N9K4	P	111231101	4 WKS	\$484.00		152
R900052392	M-3SED6CK1X/350CG24N9K4	S	111231061	2 WKS	\$328.00		148
R900218734	M-3SED6CK1X/350CG96N9K4	S	111231061	2 WKS	\$375.00		148
R900052621	M-3SED6UK1X/350CG24N9K4	S	111231061	2 WKS	\$328.00		148
R900207848	M-3SED6UK1X/350CG96N9K4	P	111231061	4 WKS	\$375.00		148
R900075565	M-3SEW10C1X/420MG24N9K4	P	111232101	4 WKS	\$502.00		154
R900203834	M-3SEW10C1X/420MG24N9K4/B10	P	111232101	4 WKS	\$529.00		154
R900051908	M-3SEW10C1X/420MG96N9K4/V	P	111232101	4 WKS	\$550.00		154
R900222370	M-3SEW10C1X/630MG24N9K4/V	P	111232101	4 WKS	\$643.00		154
R900051542	M-3SEW10C1X/630MG96N9K4	P	111232101	4 WKS	\$693.00		154
R900075563	M-3SEW10U1X/420MG24N9K4	P	111232101	4 WKS	\$502.00		154
R900051907	M-3SEW10U1X/420MG96N9K4/V	P	111232101	4 WKS	\$550.00		154
R900218367	M-3SEW10U1X/630MG24N9K4/V	P	111232101	4 WKS	\$643.00		154
R900213062	M-3SEW10U1X/630MG96N9K4	P	111232101	4 WKS	\$693.00		154
R900566273	M-3SEW6C3X/420MG24N9K4	S	111232063	2 WKS	\$568.00		150
R900049834	M-3SEW6C3X/420MG24N9K4/V	P	111232063	4 WKS	\$568.00		150

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R900570252	M-3SEW6C3X/420MG96N9K4	S	111232063	2 WKS	\$617.00		150
R900206773	M-3SEW6C3X/420MG96N9K4/V	P	111232063	4 WKS	\$617.00		150
R900204628	M-3SEW6C3X/630MG24N9K4/V	P	111232063	4 WKS	\$708.00		150
R900051045	M-3SEW6C3X/630MG96N9K4	P	111232063	4 WKS	\$758.00		150
R900566283	M-3SEW6U3X/420MG24N9K4	S	111232063	2 WKS	\$568.00		150
R900570744	M-3SEW6U3X/420MG96N9K4	P	111232063	4 WKS	\$617.00		150
R900056442	M-3SEW6U3X/420MG96N9K4/V	P	111232063	4 WKS	\$613.00		150
R900566289	M-3SEW6U3X/630MG24N9K4	P	111232063	4 WKS	\$708.00		150
R900218867	M-3SEW6U3X/630MG24N9K4/V	P	111232063	4 WKS	\$708.00		150
R900054920	M-3SEW6U3X/630MG96N9K4/V	P	111232063	4 WKS	\$758.00		150
R900059471	M-4SED6D1X/350CG24N9K4/P	P	111231061	4 WKS	\$851.00		148
R900223877	M-4SED6YK1X/350CG96N9K4	P	111231101	4 WKS	\$840.00		148
R900087926	M-4SEW10D1X/420MG24N9K4	P	111232101	4 WKS	\$1,152.00		154
R921806850	MCR10F1250F250Z-32/B7M/2W/42/S	P	821110122	4 WKS	\$6,503.00		37
R921806218	MCR10F1340F250Z-32/AOM/42/S	P	821110121	4 WKS	\$4,894.00		37
R921809067	MCR15F1250F280Z-32/AOM/42/S	P	821115111	4 WKS	\$5,214.00		41
R921809118	MCR15F1500F280Z-32/AOM/42/S	P	821115111	4 WKS	\$5,214.00		41
R921808532	MCR20C2100F280Z-32/B19M/2W/42	P	821120114	4 WKS	\$8,802.00		44
R921808023	MCR20C3000F280Z-32/AOM/42	P	821120121	4 WKS	\$7,495.00		44
R921807040	MCR3D400L40Z-32/AOM/12	P	821103121	4 WKS	\$2,465.00		28
R921807106	MCR3F400F180Z-32/AOM/12	P	821103121	4 WKS	\$2,465.00		28
R921807578	MCR3F400F180Z-32/B2M/12	P	821103122	4 WKS	\$3,174.00		28
R921805037	MCR5C565F120Z-32/AOM/12	P	821105111	4 WKS	\$2,883.00		33
R921805100	MCR5D820L50Z-32/AOM/12	P	821105121	4 WKS	\$3,520.00		33
R921805852	MCR5D820L50Z-32/B4M/12	P	821105122	4 WKS	\$4,508.00		33
R921805348	MCR5F680F180Z-32/AOM/12/S	P	821105121	4 WKS	\$3,759.00		33
R978886070	MDSD1-2X/0	S	115111121	2 WKS	\$471.00		375
R978888000	MDSD1-2X/1	P	115111121	4 WKS	\$471.00		375
R978888001	MDSD1-2X/2	P	115111121	4 WKS	\$471.00		375
R978886412	MDSD1K-2X/0	S	115111121	2 WKS	\$510.00		375
R978886413	MDSD1K-2X/1	P	115111121	4 WKS	\$510.00		375
R978839712	MDSD1K-2X/2	P	115111121	4 WKS	\$510.00		375
R978886415	MDSD1K-2X/3	P	115111121	4 WKS	\$510.00		375
R978886416	MDSD1K-2X/4	P	115111121	4 WKS	\$510.00		375
R978886065	MDSD-2X/0	S	115111121	2 WKS	\$471.00		375
R978886066	MDSD-2X/1	P	115111121	4 WKS	\$471.00		375
R978886067	MDSD-2X/2	P	115111121	4 WKS	\$471.00		375
R978886068	MDSD-2X/3	P	115111121	4 WKS	\$471.00		375
R978886069	MDSD-2X/4	P	115111121	4 WKS	\$471.00		375
R978886407	MDSDK-2X/0	S	115111121	2 WKS	\$510.00		375
R978886409	MDSDK-2X/2	P	115111121	4 WKS	\$510.00		375
R978886410	MDSDK-2X/3	P	115111121	4 WKS	\$510.00		375
R978886411	MDSDK-2X/4	P	115111121	4 WKS	\$510.00		375
R900021194	MESAP 43650 TEST ADPT 932818-002	S	111000920	2 WKS	\$137.00		407
R900487395	MG15G1X/V/12	P	111441151	4 WKS	\$239.00		258
R900363511	MK10G1X/V/12	P	111441101	4 WKS	\$233.00		258
R900385474	MK15G1X/V/12	S	111441151	2 WKS	\$272.00		258
R900353821	MK20G1X/V/12	P	111441201	4 WKS	\$343.00		258
R978901615	MPGB002HTYZ4DBFFS1HA10010DFRKN1NN	P	142240000	4 WKS	\$1,472.00		498
R978901613	MPGB002HTYZ4DBFFS1HA10010DRKNN1NN	P	142240000	4 WKS	\$1,472.00		498
R978839418	MPGB002HTYZ4DBFFS1HAA10018DFRKN1NN	P	142240000	4 WKS	\$1,586.00		498
R978839420	MPGB002HTYZ4DBFFS1HAA10018DRKNN1NN	P	142240000	4 WKS	\$1,586.00		498
R978901607	MPGB003HTYZ46EZFS1HA10010DFRKN1NN	P	142240000	4 WKS	\$1,567.00		498
R978901617	MPGB003HTYZ46EZFS1HA10010DRKNN1NN	P	142240000	4 WKS	\$1,567.00		498

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978837581	MPGB003HTYZ46EZFS1HA10018DRKNN1NN	P	142240000	4 WKS	\$1,690.00		498
R978837580	MPGB003HTYZ46EZFS1HA10018DRKNN1NN	P	142240000	4 WKS	\$1,681.00		498
R978901611	MPGB005HTYZ46EZFS1HA10010DRKNN1NN	P	142240000	4 WKS	\$1,654.00		498
R978901609	MPGB005HTYZ46EZFS1HA10010DRKNN1NN	P	142240000	4 WKS	\$1,654.00		498
R978837582	MPGB005HTYZ46EZFS1HA10018DRKNN1NN	P	142240000	4 WKS	\$1,767.00		498
R978837572	MPGB005HTYZ46EZFS1HA10018DRKNN1NN	P	142240000	4 WKS	\$1,767.00		498
R978837589	MPGB005HTYZ46EZFS1HAA10028DRKNN1NN	S	142240000	2 WKS	\$2,251.00		498
R978837587	MPGB005HTYZ46EZFS1HAA10028DRKNN1NN	S	142240000	2 WKS	\$2,251.00		498
R978903607	MPGB010HTYZ46EZFS1HA10010DRKNN1NN	P	142240000	4 WKS	\$1,987.00		498
R978903605	MPGB010HTYZ46EZFS1HA10010DRKNN1NN	P	142240000	4 WKS	\$1,987.00		498
R978837586	MPGB010HTYZ46EZFS1HA10018DRKNN1NN	P	142240000	4 WKS	\$2,101.00		498
R978837585	MPGB010HTYZ46EZFS1HA10018DRKNN1NN	P	142240000	4 WKS	\$2,101.00		498
R978837593	MPGB010HTYZ46EZFS1HAA10028DRKNN1NN	S	142240000	2 WKS	\$2,345.00		498
R978837592	MPGB010HTYZ46EZFS1HAA10028DRKNN1NN	S	142240000	2 WKS	\$2,345.00		498
R978837602	MPGB010HTYZ46EZFS1HAA10045DRKNN1NN	S	142240000	2 WKS	\$2,645.00		498
R978837603	MPGB010HTYZ46EZFS1HAA10045DRKNN1NN	S	142240000	2 WKS	\$2,645.00		498
R978837595	MPGB015HTYZ46EZFS1HAA10028DRKNN1NN	S	142240000	2 WKS	\$3,034.00		498
R978837594	MPGB015HTYZ46EZFS1HAA10028DRKNN1NN	S	142240000	2 WKS	\$3,034.00		498
R978837605	MPGB015HTYZ46EZFS1HAA10045DRKNN1NN	S	142240000	2 WKS	\$3,332.00		498
R978837604	MPGB015HTYZ46EZFS1HAA10045DRKNN1NN	S	142240000	2 WKS	\$3,332.00		498
R978837597	MPGB020HTYZ46EZFS1HAA10028DRKNN1NN	S	142240000	2 WKS	\$3,207.00		498
R978837596	MPGB020HTYZ46EZFS1HAA10028DRKNN1NN	S	142240000	2 WKS	\$3,273.00		498
R978837607	MPGB020HTYZ46EZFS1HAA10045DRKNN1NN	S	142240000	2 WKS	\$3,504.00		498
R978837606	MPGB020HTYZ46EZFS1HAA10045DRKNN1NN	S	142240000	2 WKS	\$3,504.00		498
R978012204	MPGB025HTYM4DOPWS1HA10018DRSNN1NN	P	142240000	4 WKS	\$3,868.00		499
R978012202	MPGB025HTYM4DOPWS1HA10018DRSNN1NN	P	142240000	4 WKS	\$3,897.00		499
R978012208	MPGB025HTYM4DOPWS1HA10028DRSNN1NN	P	142240000	4 WKS	\$4,165.00		499
R978012206	MPGB025HTYM4DOPWS1HA10028DRSNN1NN	P	142240000	4 WKS	\$4,165.00		499
R978012212	MPGB025HTYM4DOPWS1HA10045DRSNN1NN	P	142240000	4 WKS	\$4,468.00		499
R978012210	MPGB025HTYM4DOPWS1HA10045DRSNN1NN	P	142240000	4 WKS	\$4,468.00		499
R978012216	MPGB025HTYM4DOPWS1HA10071DRSNN1NN	P	142240000	4 WKS	\$5,202.00		499
R978012214	MPGB025HTYM4DOPWS1HA10071DRSNN1NN	P	142240000	4 WKS	\$5,202.00		499
R978012224	MPGB030HTYM4DOPWS1HA10028DRSNN1NN	P	142240000	4 WKS	\$4,199.00		499
R978012222	MPGB030HTYM4DOPWS1HA10028DRSNN1NN	P	142240000	4 WKS	\$5,202.00		499
R978012228	MPGB030HTYM4DOPWS1HA10045DRSNN1NN	P	142240000	4 WKS	\$4,501.00		499
R978012226	MPGB030HTYM4DOPWS1HA10045DRSNN1NN	P	142240000	4 WKS	\$4,501.00		499
R978012232	MPGB030HTYM4DOPWS1HA10071DRSNN1NN	P	142240000	4 WKS	\$5,235.00		499
R978012230	MPGB030HTYM4DOPWS1HA10071DRSNN1NN	P	142240000	4 WKS	\$5,235.00		499
R978012236	MPGB040HTYM4DPRWS1HA10028DRSNN1NN	P	142240000	4 WKS	\$5,039.00		499
R978012234	MPGB040HTYM4DPRWS1HA10028DRSNN1NN	P	142240000	4 WKS	\$5,235.00		499
R978012240	MPGB040HTYM4DPRWS1HA10045DRSNN1NN	P	142240000	4 WKS	\$5,341.00		499
R978012238	MPGB040HTYM4DPRWS1HA10045DRSNN1NN	P	142240000	4 WKS	\$5,341.00		499
R978012244	MPGB040HTYM4DPRWS1HA10071DRSNN1NN	P	142240000	4 WKS	\$6,075.00		499
R978012242	MPGB040HTYM4DPRWS1HA10071DRSNN1NN	P	142240000	4 WKS	\$6,075.00		499
R978012248	MPGB040HTYM4DPRWS1HA10100DRSNN1NN	P	142240000	4 WKS	\$7,389.00		499
R978012246	MPGB040HTYM4DPRWS1HA10100DRSNN1NN	P	142240000	4 WKS	\$7,389.00		499
R978012256	MPGB050HTYM4DPRWS1HA10045DRSNN1NN	P	142240000	4 WKS	\$5,476.00		499
R978012254	MPGB050HTYM4DPRWS1HA10045DRSNN1NN	P	142240000	4 WKS	\$5,476.00		499
R978012260	MPGB050HTYM4DPRWS1HA10071DRSNN1NN	P	142240000	4 WKS	\$6,210.00		499
R978012258	MPGB050HTYM4DPRWS1HA10071DRSNN1NN	P	142240000	4 WKS	\$6,210.00		499
R978012264	MPGB050HTYM4DPRWS1HA10100DRSNN1NN	P	142240000	4 WKS	\$7,524.00		499
R978012262	MPGB050HTYM4DPRWS1HA10100DRSNN1NN	P	142240000	4 WKS	\$7,524.00		499
R978012268	MPGB060HTYM4DPRWS1HA10045DRSNN1NN	P	142240000	4 WKS	\$7,105.00		499
R978012266	MPGB060HTYM4DPRWS1HA10045DRSNN1NN	P	142240000	4 WKS	\$7,105.00		499

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978012272	MPGB060HTYM4DPRWS1HA10071DFRSNN1NN	P	142240000	4 WKS	\$7,839.00		499
R978012270	MPGB060HTYM4DPRWS1HA10071DRSNN1NN	P	142240000	4 WKS	\$7,839.00		499
R978012276	MPGB060HTYM4DPRWS1HA10100DFRSNN1NN	P	142240000	4 WKS	\$9,153.00		499
R978012274	MPGB060HTYM4DPRWS1HA10100DRSNN1NN	P	142240000	4 WKS	\$9,153.00		499
R978012288	MPGB075HTYM4DRSWS1HA10071DFRSNN1NN	P	142240000	4 WKS	\$8,882.00		499
R978012286	MPGB075HTYM4DRSWS1HA10071DRSNN1NN	P	142240000	4 WKS	\$8,882.00		499
R978012292	MPGB075HTYM4DRSWS1HA10100DFRSNN1NN	P	142240000	4 WKS	\$10,196.00		499
R978012290	MPGB075HTYM4DRSWS1HA10100DRSNN1NN	P	142240000	4 WKS	\$10,196.00		499
R978012300	MPGB100HTYM4DRSWS3HA10045DFRSNN1NN	P	142240000	4 WKS	\$9,342.00		499
R978012298	MPGB100HTYM4DRSWS3HA10045DRSNN1NN	P	142240000	4 WKS	\$9,342.00		499
R978012304	MPGB100HTYM4DRSWS3HA10071DFRSNN1NN	P	142240000	4 WKS	\$10,076.00		499
R978012302	MPGB100HTYM4DRSWS3HA10071DRSNN1NN	P	142240000	4 WKS	\$10,076.00		499
R978012308	MPGB100HTYM4DRSWS3HA10100DFRSNN1NN	P	142240000	4 WKS	\$11,389.00		499
R978012306	MPGB100HTYM4DRSWS3HA10100DRSNN1NN	P	142240000	4 WKS	\$11,389.00		499
R978012312	MPGB100HTYM4DRSWS3HA10140DFRSNN1NN	P	142240000	4 WKS	\$12,411.00		499
R978012310	MPGB100HTYM4DRSWS3HA10140DRSNN1NN	P	142240000	4 WKS	\$12,411.00		499
R978901621	MPGB7.5HTYZ46EZFS1HA10010DFRKNN1NN	P	142240000	4 WKS	\$1,902.00		498
R978901619	MPGB7.5HTYZ46EZFS1HA10010DRKNN1NN	P	142240000	4 WKS	\$1,902.00		498
R978837584	MPGB7.5HTYZ46EZFS1HA10018DFRKNN1NN	P	142240000	4 WKS	\$2,016.00		498
R978837583	MPGB7.5HTYZ46EZFS1HA10018DRKNN1NN	P	142240000	4 WKS	\$2,016.00		498
R978837591	MPGB7.5HTYZ46EZFS1HAA10028DFRKNN1NN	S	142240000	2 WKS	\$2,261.00		498
R978837590	MPGB7.5HTYZ46EZFS1HAA10028DRKNN1NN	S	142240000	2 WKS	\$2,261.00		498
R978837601	MPGB7.5HTYZ46EZFS1HAA10045DFRKNN1NN	S	142240000	2 WKS	\$2,557.00		498
R978837600	MPGB7.5HTYZ46EZFS1HAA10045DRKNN1NN	S	142240000	2 WKS	\$2,557.00		498
R978713598	MSCONNECTORFOROBEVALVES	P	115139903	4 WKS	\$68.00		323
R900344549	M-SR10KE05-1X/	P	155531101	4 WKS	\$106.00		129
R900345372	M-SR15KE05-1X/	S	155531201	2 WKS	\$125.00		129
R900340979	M-SR20KE05-1X/	S	155531201	2 WKS	\$135.00		129
R900346638	M-SR20KE30-1X/	P	155531201	4 WKS	\$135.00		129
R900344778	M-SR25KE05-1X/	S	155531251	2 WKS	\$170.00		129
R900348453	M-SR25KE15-1X/	P	155531251	4 WKS	\$170.00		129
R900344919	M-SR30KE05-1X/	S	155531301	2 WKS	\$261.00		129
R900348666	M-SR30KE15-1X/	P	155531301	4 WKS	\$261.00		129
R900345961	M-SR30KE30-1X/	P	155531301	4 WKS	\$261.00		129
R900346083	M-SR8KE05-1X/	S	155531081	2 WKS	\$96.00		129
R900356258	M-SR8KE50-1X/	P	155531081	4 WKS	\$96.00		129
R978714397	NG16SERVOSOL200LOBEVIT	P	112631162	4 WKS	\$5,823.00		320
R900021267	PLUGZ31BF6-3PLA07POL	P	111000930	4 WKS	\$48.00		
R978888473	POWERSUPPLYAPS100SU-13(24V,4.2A)	P	115139301	4 WKS	\$759.00		405
R978887102	POWERSUPPLYHC24-2.4-A(24V,2.4A)	P	115139301	4 WKS	\$219.00		405
R978887103	POWERSUPPLYHN24-3.6-A(24V,3.6A)	S	115139301	2 WKS	\$311.00		405
R978931209	PP10/G2005/1BM1	S	142171000	2 WKS	\$2,942.00		500
R978931211	PP10/G2005/1BM1H3	S	142171000	2 WKS	\$2,688.00		500
R978931212	PP10/G2005/1BM2	S	142171000	2 WKS	\$2,976.00		500
R978931214	PP10/G2005/1BM2H3	S	142171000	2 WKS	\$2,724.00		500
R978931215	PP10/G2005/1BM3	P	142171000	4 WKS	\$2,306.00		500
R978931217	PP10/G2005/1BM3H3	P	142171000	4 WKS	\$2,764.00		500
R978931218	PP10/G2005/1BM4	S	142171000	2 WKS	\$2,352.00		500
R978931220	PP10/G2005/1BM4H3	S	142171000	2 WKS	\$2,811.00		500
R978931227	PP10/G2005/1RV	S	142171000	2 WKS	\$2,055.00		500
R978931229	PP10/G2005/1RVH3	S	142171000	2 WKS	\$2,515.00		500
R978931253	PP10/G2005/2BM1	S	142171000	2 WKS	\$2,761.00		500
R978931255	PP10/G2005/2BM1H3	S	142171000	2 WKS	\$2,761.00		500
R978931256	PP10/G2005/2BM2	S	142171000	2 WKS	\$2,338.00		500

### Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978931258	PP10/G2005/2BM2H3	S	142171000	2 WKS	\$2,798.00		500
R978931259	PP10/G2005/2BM3	P	142171000	4 WKS	\$2,380.00		500
R978931261	PP10/G2005/2BM3H3	P	142171000	4 WKS	\$2,838.00		500
R978931262	PP10/G2005/2BM4	S	142171000	2 WKS	\$2,425.00		500
R978931264	PP10/G2005/2BM4H3	S	142171000	2 WKS	\$2,885.00		500
R978931271	PP10/G2005/2RV	S	142171000	2 WKS	\$2,130.00		500
R978931273	PP10/G2005/2RVH3	S	142171000	2 WKS	\$2,588.00		500
R978931274	PP10/G2005/2SBM1	S	142171000	2 WKS	\$2,303.00		500
R978931275	PP10/G2005/2SBM3	P	142171000	4 WKS	\$2,380.00		500
R978931277	PP10/G2005/3BM1	S	142171000	2 WKS	\$2,428.00		500
R978931279	PP10/G2005/3BM1H3	S	142171000	2 WKS	\$2,887.00		500
R978931280	PP10/G2005/3BM2	S	142171000	2 WKS	\$2,464.00		500
R978931282	PP10/G2005/3BM2H3	S	142171000	2 WKS	\$2,922.00		500
R978931283	PP10/G2005/3BM3	P	142171000	4 WKS	\$2,504.00		500
R978931285	PP10/G2005/3BM3H3	P	142171000	4 WKS	\$2,963.00		500
R978931286	PP10/G2005/3BM4	S	142171000	2 WKS	\$2,551.00		500
R978931288	PP10/G2005/3BM4H3	S	142171000	2 WKS	\$3,010.00		500
R978931294	PP10/G2005/3RV	S	142171000	2 WKS	\$2,254.00		500
R978931296	PP10/G2005/3RVH3	S	142171000	2 WKS	\$2,713.00		500
R978931297	PP10/G2005/5BM1	S	142171000	2 WKS	\$2,599.00		500
R978931299	PP10/G2005/5BM1H3	S	142171000	2 WKS	\$3,058.00		500
R978931300	PP10/G2005/5BM2	S	142171000	2 WKS	\$2,634.00		500
R978931302	PP10/G2005/5BM2H3	S	142171000	2 WKS	\$3,093.00		500
R978931303	PP10/G2005/5BM3	P	142171000	4 WKS	\$2,674.00		500
R978931305	PP10/G2005/5BM3H3	P	142171000	4 WKS	\$3,132.00		500
R978931306	PP10/G2005/5BM4	S	142171000	2 WKS	\$2,722.00		500
R978931308	PP10/G2005/5BM4H3	S	142171000	2 WKS	\$3,180.00		500
R978931315	PP10/G2005/5RV	S	142171000	2 WKS	\$2,424.00		500
R978931317	PP10/G2005/5RVH3	S	142171000	2 WKS	\$2,884.00		500
R978931338	PP10/G2005/7.5RV	S	142171000	2 WKS	\$2,731.00		500
R978931405	PP10/G2008/10BM1	S	142171000	2 WKS	\$3,410.00		500
R978931407	PP10/G2008/10BM1H3	S	142171000	2 WKS	\$3,869.00		500
R978931408	PP10/G2008/10BM2	S	142171000	2 WKS	\$3,446.00		500
R978931410	PP10/G2008/10BM2H3	S	142171000	2 WKS	\$3,905.00		500
R978931411	PP10/G2008/10BM3	P	142171000	4 WKS	\$3,487.00		500
R978931413	PP10/G2008/10BM3H3	P	142171000	4 WKS	\$3,946.00		500
R978931414	PP10/G2008/10BM4	S	142171000	2 WKS	\$3,533.00		500
R978931416	PP10/G2008/10BM4H3	S	142171000	2 WKS	\$3,993.00		500
R978931423	PP10/G2008/10RV	S	142171000	2 WKS	\$3,236.00		500
R978931425	PP10/G2008/10RVH3	S	142171000	2 WKS	\$3,695.00		500
R978931384	PP10/G2008/1BM1	S	142171000	2 WKS	\$2,230.00		500
R978931386	PP10/G2008/1BM1H3	S	142171000	2 WKS	\$2,688.00		500
R978931387	PP10/G2008/1BM2	S	142171000	2 WKS	\$2,265.00		500
R978931389	PP10/G2008/1BM2H3	S	142171000	2 WKS	\$2,724.00		500
R978931390	PP10/G2008/1BM3	P	142171000	4 WKS	\$2,306.00		500
R978931392	PP10/G2008/1BM3H3	P	142171000	4 WKS	\$2,764.00		500
R978931393	PP10/G2008/1BM4	S	142171000	2 WKS	\$2,352.00		500
R978931395	PP10/G2008/1BM4H3	S	142171000	2 WKS	\$2,811.00		500
R978931402	PP10/G2008/1RV	S	142171000	2 WKS	\$2,055.00		500
R978931404	PP10/G2008/1RVH3	S	142171000	2 WKS	\$2,515.00		500
R978931426	PP10/G2008/2BM1	S	142171000	2 WKS	\$2,303.00		500
R978931428	PP10/G2008/2BM1H3	S	142171000	2 WKS	\$2,761.00		500
R978931429	PP10/G2008/2BM2	S	142171000	2 WKS	\$2,338.00		500
R978931431	PP10/G2008/2BM2H3	S	142171000	2 WKS	\$2,798.00		500



## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978931432	PP10/G2008/2BM3	P	142171000	4 WKS	\$2,380.00		500
R978931434	PP10/G2008/2BM3H3	P	142171000	4 WKS	\$2,838.00		500
R978931435	PP10/G2008/2BM4	S	142171000	2 WKS	\$2,425.00		500
R978931437	PP10/G2008/2BM4H3	S	142171000	2 WKS	\$2,885.00		500
R978931444	PP10/G2008/2RV	S	142171000	2 WKS	\$2,130.00		500
R978931446	PP10/G2008/2RVH3	S	142171000	2 WKS	\$2,588.00		500
R978931449	PP10/G2008/3/RV	S	142171000	2 WKS	\$2,254.00		500
R978931452	PP10/G2008/3BM1H3	S	142171000	2 WKS	\$2,887.00		500
R978931453	PP10/G2008/3BM2	S	142171000	2 WKS	\$2,464.00		500
R978931455	PP10/G2008/3BM2H3	S	142171000	2 WKS	\$2,922.00		500
R978931456	PP10/G2008/3BM3	P	142171000	4 WKS	\$2,504.00		500
R978931457	PP10/G2008/3BM3H3	P	142171000	4 WKS	\$2,963.00		500
R978931458	PP10/G2008/3BM4	S	142171000	2 WKS	\$2,551.00		500
R978931460	PP10/G2008/3BM4H3	S	142171000	2 WKS	\$3,010.00		500
R978931450	PP10/G2008/3BMR1	S	142171000	2 WKS	\$2,428.00		500
R978931466	PP10/G2008/3RV	S	142171000	2 WKS	\$2,254.00		500
R978931468	PP10/G2008/3RVH3	S	142171000	2 WKS	\$2,713.00		500
R978931470	PP10/G2008/5BM1	S	142171000	2 WKS	\$2,599.00		500
R978931472	PP10/G2008/5BM1H3	S	142171000	2 WKS	\$3,058.00		500
R978931473	PP10/G2008/5BM2	S	142171000	2 WKS	\$2,634.00		500
R978931475	PP10/G2008/5BM2H3	S	142171000	2 WKS	\$3,093.00		500
R978931476	PP10/G2008/5BM3	P	142171000	4 WKS	\$2,674.00		500
R978931477	PP10/G2008/5BM3H3	P	142171000	4 WKS	\$3,132.00		500
R978931478	PP10/G2008/5BM4	S	142171000	2 WKS	\$2,722.00		500
R978931480	PP10/G2008/5BM4H3	S	142171000	2 WKS	\$3,180.00		500
R978931469	PP10/G2008/5BMR5	S	142171000	2 WKS	\$2,755.00		500
R978931487	PP10/G2008/5RV	S	142171000	2 WKS	\$2,424.00		500
R978931489	PP10/G2008/5RVH3	S	142171000	2 WKS	\$2,884.00		500
R978931490	PP10/G2008/7.5BM1	S	142171000	2 WKS	\$2,905.00		500
R978931492	PP10/G2008/7.5BM1H3	S	142171000	2 WKS	\$3,363.00		500
R978931493	PP10/G2008/7.5BM2	S	142171000	2 WKS	\$2,941.00		500
R978931495	PP10/G2008/7.5BM2H3	S	142171000	2 WKS	\$3,400.00		500
R978931496	PP10/G2008/7.5BM3	P	142171000	4 WKS	\$2,981.00		500
R978931498	PP10/G2008/7.5BM3H3	P	142171000	4 WKS	\$3,440.00		500
R978931499	PP10/G2008/7.5BM4	S	142171000	2 WKS	\$3,028.00		500
R978931501	PP10/G2008/7.5BM4H3	S	142171000	2 WKS	\$3,487.00		500
R978931503	PP10/G2008/7.5RV	S	142171000	2 WKS	\$2,731.00		500
R978931505	PP10/G2008/7.5RVH3	S	142171000	2 WKS	\$3,190.00		500
R978931570	PP10/G2011/10BM1	S	142171000	2 WKS	\$3,410.00		500
R978931572	PP10/G2011/10BM1H3	S	142171000	2 WKS	\$3,869.00		500
R978931573	PP10/G2011/10BM2	S	142171000	2 WKS	\$3,446.00		500
R978931575	PP10/G2011/10BM2H3	S	142171000	2 WKS	\$2,770.00		500
R978931576	PP10/G2011/10BM3	P	142171000	4 WKS	\$3,487.00		500
R978931578	PP10/G2011/10BM3H3	P	142171000	4 WKS	\$3,946.00		500
R978931579	PP10/G2011/10BM4	S	142171000	2 WKS	\$3,533.00		500
R978931581	PP10/G2011/10BM4H3	S	142171000	2 WKS	\$3,993.00		500
R978931588	PP10/G2011/10RV	S	142171000	2 WKS	\$3,236.00		500
R978931590	PP10/G2011/10RVH3	S	142171000	2 WKS	\$3,695.00		500
R978931613	PP10/G2011/3BM1	S	142171000	2 WKS	\$2,428.00		500
R978931615	PP10/G2011/3BM1H3	S	142171000	2 WKS	\$2,887.00		500
R978931616	PP10/G2011/3BM2	S	142171000	2 WKS	\$2,464.00		500
R978931618	PP10/G2011/3BM2H3	S	142171000	2 WKS	\$2,922.00		500
R978931619	PP10/G2011/3BM3	P	142171000	4 WKS	\$2,504.00		500
R978931621	PP10/G2011/3BM3H3	P	142171000	4 WKS	\$2,963.00		500

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978931622	PP10/G2011/3BM4	S	142171000	2 WKS	\$2,551.00		500
R978931624	PP10/G2011/3BM4H3	S	142171000	2 WKS	\$3,010.00		500
R978931631	PP10/G2011/3RV	S	142171000	2 WKS	\$2,254.00		500
R978931633	PP10/G2011/3RVH3	S	142171000	2 WKS	\$2,713.00		500
R978931634	PP10/G2011/5BM1	S	142171000	2 WKS	\$2,599.00		500
R978931636	PP10/G2011/5BM1H3	S	142171000	2 WKS	\$3,058.00		500
R978931637	PP10/G2011/5BM2	S	142171000	2 WKS	\$2,634.00		500
R978931639	PP10/G2011/5BM2H3	S	142171000	2 WKS	\$3,093.00		500
R978931640	PP10/G2011/5BM3	P	142171000	4 WKS	\$2,674.00		500
R978931642	PP10/G2011/5BM3H3	P	142171000	4 WKS	\$3,132.00		500
R978931643	PP10/G2011/5BM4	S	142171000	2 WKS	\$2,722.00		500
R978931645	PP10/G2011/5BM4H3	S	142171000	2 WKS	\$3,180.00		500
R978931652	PP10/G2011/5RV	S	142171000	2 WKS	\$2,424.00		500
R978931654	PP10/G2011/5RVH3	S	142171000	2 WKS	\$2,884.00		500
R978931658	PP10/G2011/7.5BM1	S	142171000	2 WKS	\$2,905.00		500
R978931660	PP10/G2011/7.5BM1H3	S	142171000	2 WKS	\$3,363.00		500
R978931661	PP10/G2011/7.5BM2	S	142171000	2 WKS	\$2,941.00		500
R978931663	PP10/G2011/7.5BM2H3	S	142171000	2 WKS	\$3,400.00		500
R978931664	PP10/G2011/7.5BM3	P	142171000	4 WKS	\$2,981.00		500
R978931666	PP10/G2011/7.5BM3H3	P	142171000	4 WKS	\$3,440.00		500
R978931667	PP10/G2011/7.5BM4	S	142171000	2 WKS	\$3,028.00		500
R978931669	PP10/G2011/7.5BM4H3	S	142171000	2 WKS	\$3,487.00		500
R978931676	PP10/G2011/7.5RV	S	142171000	2 WKS	\$2,731.00		500
R978931678	PP10/G2011/7.5RVH3	S	142171000	2 WKS	\$3,190.00		500
R978932366	PP20/G2011/10BM1	S	142171000	2 WKS	\$3,518.00		500
R978932368	PP20/G2011/10BM1H3	S	142171000	2 WKS	\$3,977.00		500
R978932369	PP20/G2011/10BM2	S	142171000	2 WKS	\$3,554.00		500
R978932371	PP20/G2011/10BM2H3	S	142171000	2 WKS	\$4,012.00		500
R978932372	PP20/G2011/10BM3	P	142171000	4 WKS	\$3,595.00		500
R978932374	PP20/G2011/10BM3H3	P	142171000	4 WKS	\$4,054.00		500
R978932375	PP20/G2011/10BM4	S	142171000	2 WKS	\$3,641.00		500
R978932377	PP20/G2011/10BM4H3	S	142171000	2 WKS	\$4,100.00		500
R978932384	PP20/G2011/10RV	S	142171000	2 WKS	\$3,345.00		500
R978932386	PP20/G2011/10RVH3	S	142171000	2 WKS	\$3,803.00		500
R978932408	PP20/G2011/3BM1	S	142171000	2 WKS	\$2,567.00		500
R978932410	PP20/G2011/3BM1H3	S	142171000	2 WKS	\$3,026.00		500
R978932411	PP20/G2011/3BM2	S	142171000	2 WKS	\$2,602.00		500
R978932413	PP20/G2011/3BM2H3	S	142171000	2 WKS	\$3,061.00		500
R978932414	PP20/G2011/3BM3	P	142171000	4 WKS	\$2,643.00		500
R978932416	PP20/G2011/3BM3H3	P	142171000	4 WKS	\$3,101.00		500
R978932417	PP20/G2011/3BM4	S	142171000	2 WKS	\$2,689.00		500
R978932419	PP20/G2011/3BM4H3	S	142171000	2 WKS	\$3,148.00		500
R978932426	PP20/G2011/3RV	S	142171000	2 WKS	\$2,393.00		500
R978932428	PP20/G2011/3RVH3	S	142171000	2 WKS	\$2,852.00		500
R978932429	PP20/G2011/5BM1	S	142171000	2 WKS	\$2,896.00		500
R978932431	PP20/G2011/5BM1H3	S	142171000	2 WKS	\$3,355.00		500
R978932432	PP20/G2011/5BM2	S	142171000	2 WKS	\$2,931.00		500
R978932434	PP20/G2011/5BM2H3	S	142171000	2 WKS	\$3,389.00		500
R978932435	PP20/G2011/5BM3	P	142171000	4 WKS	\$2,972.00		500
R978932437	PP20/G2011/5BM3H3	P	142171000	4 WKS	\$3,431.00		500
R978932438	PP20/G2011/5BM4	S	142171000	2 WKS	\$3,018.00		500
R978932440	PP20/G2011/5BM4H3	S	142171000	2 WKS	\$3,477.00		500
R978932447	PP20/G2011/5RV	S	142171000	2 WKS	\$2,723.00		500
R978932449	PP20/G2011/5RVH3	S	142171000	2 WKS	\$3,181.00		500



## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978932451	PP20/G2011/7.5BM1	S	142171000	2 WKS	\$3,167.00		500
R978932453	PP20/G2011/7.5BM1H3	S	142171000	2 WKS	\$3,625.00		500
R978932454	PP20/G2011/7.5BM2	S	142171000	2 WKS	\$3,202.00		500
R978932456	PP20/G2011/7.5BM2H3	S	142171000	2 WKS	\$3,661.00		500
R978932457	PP20/G2011/7.5BM3	P	142171000	4 WKS	\$3,452.00		500
R978932459	PP20/G2011/7.5BM3H3	P	142171000	4 WKS	\$3,700.00		500
R978932460	PP20/G2011/7.5BM4	S	142171000	2 WKS	\$3,290.00		500
R978932462	PP20/G2011/7.5BM4H3	S	142171000	2 WKS	\$3,748.00		500
R978932469	PP20/G2011/7.5RV	S	142171000	2 WKS	\$2,992.00		500
R978932471	PP20/G2011/7.5RVH3	S	142171000	2 WKS	\$3,452.00		500
R978932508	PP20/G2016/10BM1	S	142171000	2 WKS	\$3,518.00		500
R978932510	PP20/G2016/10BM1H3	S	142171000	2 WKS	\$3,977.00		500
R978932511	PP20/G2016/10BM2	S	142171000	2 WKS	\$3,554.00		500
R978932513	PP20/G2016/10BM2H3	S	142171000	2 WKS	\$4,012.00		500
R978932514	PP20/G2016/10BM3	P	142171000	4 WKS	\$3,595.00		500
R978932516	PP20/G2016/10BM3H3	P	142171000	4 WKS	\$4,054.00		500
R978932517	PP20/G2016/10BM4	S	142171000	2 WKS	\$3,641.00		500
R978932519	PP20/G2016/10BM4H3	S	142171000	2 WKS	\$4,100.00		500
R978932526	PP20/G2016/10RV	S	142171000	2 WKS	\$3,345.00		500
R978932528	PP20/G2016/10RVH3	S	142171000	2 WKS	\$3,803.00		500
R978932530	PP20/G2016/15BM1	S	142171000	2 WKS	\$3,807.00		500
R978932532	PP20/G2016/15BM1H3	S	142171000	2 WKS	\$4,266.00		500
R978932533	PP20/G2016/15BM2	S	142171000	2 WKS	\$3,843.00		500
R978932535	PP20/G2016/15BM2H3	S	142171000	2 WKS	\$4,302.00		500
R978932536	PP20/G2016/15BM3	P	142171000	4 WKS	\$3,884.00		500
R978932538	PP20/G2016/15BM3H3	P	142171000	4 WKS	\$4,343.00		500
R978932539	PP20/G2016/15BM4	S	142171000	2 WKS	\$3,930.00		500
R978932541	PP20/G2016/15BM4H3	S	142171000	2 WKS	\$4,390.00		500
R978932548	PP20/G2016/15RV	S	142171000	2 WKS	\$3,634.00		500
R978932550	PP20/G2016/15RVH3	S	142171000	2 WKS	\$4,092.00		500
R978932572	PP20/G2016/20BM1	S	142171000	2 WKS	\$4,234.00		500
R978932574	PP20/G2016/20BM1H3	S	142171000	2 WKS	\$4,907.00		500
R978932575	PP20/G2016/20BM2	S	142171000	2 WKS	\$4,268.00		500
R978932577	PP20/G2016/20BM2H3	S	142171000	2 WKS	\$4,728.00		500
R978932578	PP20/G2016/20BM3	P	142171000	4 WKS	\$4,310.00		500
R978932580	PP20/G2016/20BM3H3	P	142171000	4 WKS	\$4,768.00		500
R978932581	PP20/G2016/20BM4	S	142171000	2 WKS	\$4,356.00		500
R978932583	PP20/G2016/20BM4H3	S	142171000	2 WKS	\$4,815.00		500
R978932590	PP20/G2016/20RV	S	142171000	2 WKS	\$4,060.00		500
R978932592	PP20/G2016/20RVH3	S	142171000	2 WKS	\$4,519.00		500
R978932614	PP20/G2016/5BM1	S	142171000	2 WKS	\$2,896.00		500
R978932616	PP20/G2016/5BM1H3	S	142171000	2 WKS	\$3,355.00		500
R978932617	PP20/G2016/5BM2	S	142171000	2 WKS	\$2,931.00		500
R978932619	PP20/G2016/5BM2H3	S	142171000	2 WKS	\$3,389.00		500
R978932620	PP20/G2016/5BM3	P	142171000	4 WKS	\$2,972.00		500
R978932622	PP20/G2016/5BM3H3	P	142171000	4 WKS	\$3,270.00		500
R978932623	PP20/G2016/5BM4	S	142171000	2 WKS	\$3,018.00		500
R978932625	PP20/G2016/5BM4H3	S	142171000	2 WKS	\$3,477.00		500
R978932632	PP20/G2016/5RV	S	142171000	2 WKS	\$2,723.00		500
R978932634	PP20/G2016/5RVH3	S	142171000	2 WKS	\$3,181.00		500
R978932635	PP20/G2016/7.5BM1	S	142171000	2 WKS	\$3,167.00		500
R978932637	PP20/G2016/7.5BM1H3	S	142171000	2 WKS	\$3,625.00		500
R978932638	PP20/G2016/7.5BM2	S	142171000	2 WKS	\$3,202.00		500
R978932640	PP20/G2016/7.5BM2H3	S	142171000	2 WKS	\$3,661.00		500

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978932641	PP20/G2016/7.5BM3	P	142171000	4 WKS	\$3,242.00		500
R978932643	PP20/G2016/7.5BM3H3	P	142171000	4 WKS	\$3,700.00		500
R978932644	PP20/G2016/7.5BM4	S	142171000	2 WKS	\$3,290.00		500
R978932646	PP20/G2016/7.5BM4H3	S	142171000	2 WKS	\$3,748.00		500
R978932653	PP20/G2016/7.5RV	S	142171000	2 WKS	\$2,992.00		500
R978932655	PP20/G2016/7.5RVH3	S	142171000	2 WKS	\$3,452.00		500
R978932699	PP20/G2022/10BM1	S	142171000	2 WKS	\$3,518.00		500
R978932701	PP20/G2022/10BM1H3	S	142171000	2 WKS	\$3,977.00		500
R978932702	PP20/G2022/10BM2	S	142171000	2 WKS	\$3,554.00		500
R978932704	PP20/G2022/10BM2H3	S	142171000	2 WKS	\$4,012.00		500
R978932705	PP20/G2022/10BM3	P	142171000	4 WKS	\$3,595.00		500
R978932707	PP20/G2022/10BM3H3	P	142171000	4 WKS	\$4,054.00		500
R978932708	PP20/G2022/10BM4	S	142171000	2 WKS	\$3,641.00		500
R978932710	PP20/G2022/10BM4H3	S	142171000	2 WKS	\$4,100.00		500
R978932717	PP20/G2022/10RV	S	142171000	2 WKS	\$3,345.00		500
R978932719	PP20/G2022/10RVH3	S	142171000	2 WKS	\$3,803.00		500
R978932720	PP20/G2022/15BM1	S	142171000	2 WKS	\$3,807.00		500
R978932722	PP20/G2022/15BM1H3	S	142171000	2 WKS	\$4,266.00		500
R978932723	PP20/G2022/15BM2	S	142171000	2 WKS	\$3,843.00		500
R978932725	PP20/G2022/15BM2H3	S	142171000	2 WKS	\$4,302.00		500
R978932726	PP20/G2022/15BM3	P	142171000	4 WKS	\$3,884.00		500
R978932728	PP20/G2022/15BM3H3	P	142171000	4 WKS	\$4,343.00		500
R978932729	PP20/G2022/15BM4	S	142171000	2 WKS	\$3,930.00		500
R978932731	PP20/G2022/15BM4H3	S	142171000	2 WKS	\$4,390.00		500
R978932738	PP20/G2022/15RV	S	142171000	2 WKS	\$3,634.00		500
R978932740	PP20/G2022/15RVH3	S	142171000	2 WKS	\$4,092.00		500
R978932763	PP20/G2022/20BM1	S	142171000	2 WKS	\$4,234.00		500
R978932765	PP20/G2022/20BM1H3	S	142171000	2 WKS	\$4,692.00		500
R978932766	PP20/G2022/20BM2	S	142171000	2 WKS	\$4,268.00		500
R978932768	PP20/G2022/20BM2H3	S	142171000	2 WKS	\$4,728.00		500
R978932769	PP20/G2022/20BM3	P	142171000	4 WKS	\$4,310.00		500
R978932771	PP20/G2022/20BM3H3	P	142171000	4 WKS	\$4,768.00		500
R978932772	PP20/G2022/20BM4	S	142171000	2 WKS	\$4,356.00		500
R978932774	PP20/G2022/20BM4H3	S	142171000	2 WKS	\$4,815.00		500
R978932781	PP20/G2022/20RV	S	142171000	2 WKS	\$4,060.00		500
R978932783	PP20/G2022/20RVH3	S	142171000	2 WKS	\$4,519.00		500
R978932826	PP20/G2022/7.5BM1	S	142171000	2 WKS	\$3,167.00		500
R978932828	PP20/G2022/7.5BM1H3	S	142171000	2 WKS	\$3,625.00		500
R978932829	PP20/G2022/7.5BM2	S	142171000	2 WKS	\$3,202.00		500
R978932831	PP20/G2022/7.5BM2H3	S	142171000	2 WKS	\$3,661.00		500
R978932832	PP20/G2022/7.5BM3	P	142171000	4 WKS	\$3,242.00		500
R978932834	PP20/G2022/7.5BM3H3	P	142171000	4 WKS	\$3,700.00		500
R978932835	PP20/G2022/7.5BM4	S	142171000	2 WKS	\$3,290.00		500
R978932837	PP20/G2022/7.5BM4H3	S	142171000	2 WKS	\$3,748.00		500
R978932844	PP20/G2022/7.5RV	S	142171000	2 WKS	\$2,992.00		500
R978932846	PP20/G2022/7.5RVH3	S	142171000	2 WKS	\$3,452.00		500
R978932847	PP5/G2004/.5BM1	S	142171000	2 WKS	\$2,161.00		500
R978932849	PP5/G2004/.5BM1H2	S	142171000	2 WKS	\$2,460.00		500
R978932850	PP5/G2004/.5BM2	S	142171000	2 WKS	\$2,196.00		500
R978932852	PP5/G2004/.5BM2H2	S	142171000	2 WKS	\$2,494.00		500
R978932853	PP5/G2004/.5BM3	P	142171000	4 WKS	\$2,237.00		500
R978932855	PP5/G2004/.5BM3H2	P	142171000	4 WKS	\$2,534.00		500
R978932856	PP5/G2004/.5BM4	S	142171000	2 WKS	\$2,284.00		500
R978932858	PP5/G2004/.5BM4H2	S	142171000	2 WKS	\$2,581.00		500

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978932865	PP5/G2004/.5RV	S	142171000	2 WKS	\$1,987.00		500
R978932867	PP5/G2004/.5RVH2	S	142171000	2 WKS	\$2,285.00		500
R978932868	PP5/G2004/.75BM1	S	142171000	2 WKS	\$3,041.00		500
R978932870	PP5/G2004/.75BM1H2	S	142171000	2 WKS	\$2,488.00		500
R978932871	PP5/G2004/.75BM2	S	142171000	2 WKS	\$2,225.00		500
R978932873	PP5/G2004/.75BM2H2	S	142171000	2 WKS	\$2,523.00		500
R978932874	PP5/G2004/.75BM3	P	142171000	4 WKS	\$2,266.00		500
R978932876	PP5/G2004/.75BM3H2	P	142171000	4 WKS	\$2,563.00		500
R978932877	PP5/G2004/.75BM4	S	142171000	2 WKS	\$2,312.00		500
R978932879	PP5/G2004/.75BM4H2	S	142171000	2 WKS	\$2,610.00		500
R978932886	PP5/G2004/.75RV	S	142171000	2 WKS	\$2,016.00		500
R978932888	PP5/G2004/.75RVH2	S	142171000	2 WKS	\$2,313.00		500
R978932889	PP5/G2004/1BM1	S	142171000	2 WKS	\$2,104.00		500
R978932891	PP5/G2004/1BM1H2	S	142171000	2 WKS	\$2,402.00		500
R978932892	PP5/G2004/1BM2	S	142171000	2 WKS	\$2,139.00		500
R978932894	PP5/G2004/1BM2H2	S	142171000	2 WKS	\$2,438.00		500
R978932895	PP5/G2004/1BM3	P	142171000	4 WKS	\$2,181.00		500
R978932897	PP5/G2004/1BM3H2	P	142171000	4 WKS	\$2,477.00		500
R978932898	PP5/G2004/1BM4	S	142171000	2 WKS	\$2,227.00		500
R978932900	PP5/G2004/1BM4H2	S	142171000	2 WKS	\$2,525.00		500
R978932907	PP5/G2004/1RV	S	142171000	2 WKS	\$1,930.00		500
R978932909	PP5/G2004/1RVH2	S	142171000	2 WKS	\$2,228.00		500
R978932910	PP5/G2004/2BM1	S	142171000	2 WKS	\$2,218.00		500
R978932912	PP5/G2004/2BM1H2	S	142171000	2 WKS	\$2,516.00		500
R978932913	PP5/G2004/2BM2	S	142171000	2 WKS	\$2,253.00		500
R978932915	PP5/G2004/2BM2H2	S	142171000	2 WKS	\$2,551.00		500
R978932916	PP5/G2004/2BM3	P	142171000	4 WKS	\$2,294.00		500
R978932918	PP5/G2004/2BM3H2	P	142171000	4 WKS	\$2,592.00		500
R978932919	PP5/G2004/2BM4	S	142171000	2 WKS	\$2,340.00		500
R978932921	PP5/G2004/2BM4H2	S	142171000	2 WKS	\$2,638.00		500
R978932928	PP5/G2004/2RV	S	142171000	2 WKS	\$2,045.00		500
R978932930	PP5/G2004/2RVH2	S	142171000	2 WKS	\$2,341.00		500
R978932932	PP5/G2004/3BM1	S	142171000	2 WKS	\$2,269.00		500
R978932934	PP5/G2004/3BM1H2	S	142171000	2 WKS	\$2,567.00		500
R978932935	PP5/G2004/3BM2	S	142171000	2 WKS	\$2,305.00		500
R978932937	PP5/G2004/3BM2H2	S	142171000	2 WKS	\$2,602.00		500
R978932938	PP5/G2004/3BM3	P	142171000	4 WKS	\$2,345.00		500
R978932940	PP5/G2004/3BM3H2	P	142171000	4 WKS	\$2,643.00		500
R978932941	PP5/G2004/3BM4	S	142171000	2 WKS	\$2,392.00		500
R978932943	PP5/G2004/3BM4H2	S	142171000	2 WKS	\$2,689.00		500
R978898513	PP5/G2-004/3-RV	S	142171000	2 WKS	\$2,112.00		500
R978932951	PP5/G2004/3RVH2	S	142171000	2 WKS	\$2,393.00		500
R978932952	PP5/G2004/5BM1	S	142171000	2 WKS	\$2,400.00		500
R978932954	PP5/G2004/5BM1H2	S	142171000	2 WKS	\$2,698.00		500
R978932955	PP5/G2004/5BM2	S	142171000	2 WKS	\$2,436.00		500
R978932957	PP5/G2004/5BM2H2	S	142171000	2 WKS	\$2,732.00		500
R978932958	PP5/G2004/5BM3	P	142171000	4 WKS	\$2,475.00		500
R978932960	PP5/G2004/5BM3H2	P	142171000	4 WKS	\$2,774.00		500
R978932961	PP5/G2004/5BM4	S	142171000	2 WKS	\$2,523.00		500
R978932963	PP5/G2004/5BM4H2	S	142171000	2 WKS	\$2,819.00		500
R978932970	PP5/G2004/5RV	S	142171000	2 WKS	\$2,226.00		500
R978932972	PP5/G2004/5RVH2	S	142171000	2 WKS	\$2,524.00		500
R978932973	PP5/G2005/.5BM1	S	142171000	2 WKS	\$2,161.00		500
R978932975	PP5/G2005/.5BM1H2	S	142171000	2 WKS	\$2,460.00		500

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978932976	PP5/G2005/.5BM2	S	142171000	2 WKS	\$2,196.00		500
R978932978	PP5/G2005/.5BM2H2	S	142171000	2 WKS	\$2,494.00		500
R978932979	PP5/G2005/.5BM3	P	142171000	4 WKS	\$2,237.00		500
R978932981	PP5/G2005/.5BM3H2	P	142171000	4 WKS	\$2,534.00		500
R978932982	PP5/G2005/.5BM4	S	142171000	2 WKS	\$2,284.00		500
R978932984	PP5/G2005/.5BM4H2	S	142171000	2 WKS	\$2,581.00		500
R978932991	PP5/G2005/.5RV	S	142171000	2 WKS	\$1,987.00		500
R978932993	PP5/G2005/.5RVH2	S	142171000	2 WKS	\$2,285.00		500
R978932994	PP5/G2005/.75BM1	S	142171000	2 WKS	\$2,189.00		500
R978932996	PP5/G2005/.75BM1H2	S	142171000	2 WKS	\$2,488.00		500
R978932997	PP5/G2005/.75BM2	S	142171000	2 WKS	\$2,225.00		500
R978932999	PP5/G2005/.75BM2H2	S	142171000	2 WKS	\$2,523.00		500
R978933000	PP5/G2005/.75BM3	P	142171000	4 WKS	\$2,266.00		500
R978933002	PP5/G2005/.75BM3H2	P	142171000	4 WKS	\$2,563.00		500
R978933003	PP5/G2005/.75BM4	S	142171000	2 WKS	\$2,312.00		500
R978933005	PP5/G2005/.75BM4H2	S	142171000	2 WKS	\$2,610.00		500
R978933012	PP5/G2005/.75RV	S	142171000	2 WKS	\$2,016.00		500
R978933014	PP5/G2005/.75RVH2	S	142171000	2 WKS	\$2,313.00		500
R978933015	PP5/G2005/1BM1	S	142171000	2 WKS	\$2,104.00		500
R978933017	PP5/G2005/1BM1H2	S	142171000	2 WKS	\$2,402.00		500
R978933018	PP5/G2005/1BM2	S	142171000	2 WKS	\$2,139.00		500
R978933020	PP5/G2005/1BM2H2	S	142171000	2 WKS	\$2,438.00		500
R978933021	PP5/G2005/1BM3	P	142171000	4 WKS	\$2,181.00		500
R978933023	PP5/G2005/1BM3H2	P	142171000	4 WKS	\$2,477.00		500
R978933024	PP5/G2005/1BM4	S	142171000	2 WKS	\$2,227.00		500
R978933026	PP5/G2005/1BM4H2	S	142171000	2 WKS	\$2,525.00		500
R978933033	PP5/G2005/1RV	S	142171000	2 WKS	\$1,930.00		500
R978933035	PP5/G2005/1RVH2	S	142171000	2 WKS	\$2,228.00		500
R978933036	PP5/G2005/1SBM1	S	142171000	2 WKS	\$2,246.00		500
R978933037	PP5/G2005/1SBM2H2	S	142171000	2 WKS	\$2,579.00		500
R978933038	PP5/G2005/1SBM3H2	S	142171000	2 WKS	\$2,620.00		500
R978933039	PP5/G2005/1SRV	S	142171000	2 WKS	\$2,073.00		500
R978933040	PP5/G2005/2BM1	S	142171000	2 WKS	\$2,218.00		500
R978933042	PP5/G2005/2BM1H2	S	142171000	2 WKS	\$2,516.00		500
R978933043	PP5/G2005/2BM2	S	142171000	2 WKS	\$2,253.00		500
R978933045	PP5/G2005/2BM2H2	S	142171000	2 WKS	\$2,551.00		500
R978933046	PP5/G2005/2BM3	P	142171000	4 WKS	\$2,294.00		500
R978933048	PP5/G2005/2BM3H2	P	142171000	4 WKS	\$2,592.00		500
R978933049	PP5/G2005/2BM4	S	142171000	2 WKS	\$2,340.00		500
R978933051	PP5/G2005/2BM4H2	S	142171000	2 WKS	\$2,638.00		500
R978933058	PP5/G2005/2RV	S	142171000	2 WKS	\$2,045.00		500
R978933060	PP5/G2005/2RVH2	S	142171000	2 WKS	\$2,341.00		500
R978933061	PP5/G2005/2SRV	S	142171000	2 WKS	\$2,186.00		500
R978933062	PP5/G2005/3BM1	S	142171000	2 WKS	\$2,269.00		500
R978933064	PP5/G2005/3BM1H2	S	142171000	2 WKS	\$2,567.00		500
R978933065	PP5/G2005/3BM2	S	142171000	2 WKS	\$2,305.00		500
R978933066	PP5/G2005/3BM2H1	S	142171000	2 WKS	\$3,016.00		500
R978933067	PP5/G2005/3BM2H2	S	142171000	2 WKS	\$2,602.00		500
R978933068	PP5/G2005/3BM3	P	142171000	4 WKS	\$2,345.00		500
R978933070	PP5/G2005/3BM3H2	P	142171000	4 WKS	\$2,643.00		500
R978933071	PP5/G2005/3BM4	S	142171000	2 WKS	\$2,392.00		500
R978933073	PP5/G2005/3BM4H2	S	142171000	2 WKS	\$2,689.00		500
R978933080	PP5/G2005/3RV	S	142171000	2 WKS	\$2,096.00		500
R978933082	PP5/G2005/3RVH2	S	142171000	2 WKS	\$2,393.00		500

## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R978933083	PP5/G2005/5BM1	S	142171000	2 WKS	\$2,400.00		500
R978933085	PP5/G2005/5BM1H2	S	142171000	2 WKS	\$2,698.00		500
R978933086	PP5/G2005/5BM2	S	142171000	2 WKS	\$2,436.00		500
R978933088	PP5/G2005/5BM2H2	S	142171000	2 WKS	\$2,732.00		500
R978933089	PP5/G2005/5BM3	P	142171000	4 WKS	\$2,475.00		500
R978933091	PP5/G2005/5BM3H2	P	142171000	4 WKS	\$2,774.00		500
R978933092	PP5/G2005/5BM4	S	142171000	2 WKS	\$2,523.00		500
R978933094	PP5/G2005/5BM4H2	S	142171000	2 WKS	\$2,819.00		500
R978933101	PP5/G2005/5RV	S	142171000	2 WKS	\$2,226.00		500
R978933103	PP5/G2005/5RVH2	S	142171000	2 WKS	\$2,524.00		500
R978933104	PP5/G2008/2BM1	S	142171000	2 WKS	\$2,218.00		500
R978933105	PP5/G2008/5S/BM1	S	142171000	2 WKS	\$2,400.00		500
R978898511	PP5/P1-13/1-RV	S	142171000	2 WKS	\$1,897.00		500
R978931061	PPV20110RV	P	142172000	4 WKS	\$4,339.00		500
R978931064	PPV2012RV	P	142172000	4 WKS	\$3,919.00		500
R978931067	PPV2013RV	P	142172000	4 WKS	\$3,948.00		500
R978931070	PPV2015RV	P	142172000	4 WKS	\$4,021.00		500
R978931073	PPV2017.5RV	P	142172000	4 WKS	\$4,314.00		501
R978931076	PPV20210RV	P	142172000	4 WKS	\$4,339.00		501
R978931079	PPV2022RV	P	142172000	4 WKS	\$3,919.00		501
R978931082	PPV2023RV	P	142172000	4 WKS	\$3,948.00		501
R978931085	PPV2025RV	P	142172000	4 WKS	\$4,021.00		501
R978931088	PPV2027.5RV	P	142172000	4 WKS	\$4,314.00		501
R978931027	PPV20A10RV	P	142172000	4 WKS	\$4,213.00		501
R978931030	PPV20A2RV	P	142172000	4 WKS	\$3,839.00		501
R978931033	PPV20A3RV	P	142172000	4 WKS	\$3,850.00		501
R978931040	PPV20A7.5RV	P	142172000	4 WKS	\$4,163.00		501
R978931043	PPV20B10RV	P	142172000	4 WKS	\$4,213.00		501
R978931046	PPV20B2RV	P	142172000	4 WKS	\$3,839.00		501
R978931049	PPV20B3RV	P	142172000	4 WKS	\$3,850.00		501
R978931052	PPV20B5RV	P	142172000	4 WKS	\$3,890.00		501
R978931055	PPV20B7.5RV	P	142172000	4 WKS	\$4,163.00		501
R978931091	PPV40310RV	P	142172000	4 WKS	\$5,010.00		501
R978931095	PPV40315RV	P	142172000	4 WKS	\$5,601.00		501
R978931098	PPV40320RV	P	142172000	4 WKS	\$5,743.00		501
R978931104	PPV4035RV	P	142172000	4 WKS	\$4,931.00		501
R978931108	PPV4037.5RV	P	142172000	4 WKS	\$4,936.00		501
R978931111	PPV40410RV	P	142172000	4 WKS	\$5,010.00		501
R978931114	PPV40415RV	P	142172000	4 WKS	\$5,601.00		501
R978931117	PPV40420RV	P	142172000	4 WKS	\$5,743.00		501
R978931123	PPV4045RV	P	142172000	4 WKS	\$4,931.00		501
R978931126	PPV4047.5RV	P	142172000	4 WKS	\$4,936.00		501
R978931129	PPV60510RV	P	142172000	4 WKS	\$5,788.00		501
R978931132	PPV60515RV	P	142172000	4 WKS	\$6,394.00		501
R978931136	PPV60520RV	P	142172000	4 WKS	\$6,543.00		501
R978931148	PPV60610RV	P	142172000	4 WKS	\$5,788.00		501
R978931151	PPV60615RV	P	142172000	4 WKS	\$6,394.00		501
R978931154	PPV60620RV	P	142172000	4 WKS	\$6,543.00		501
R900485830	PR4-1X/0,40-700WA01M01	P	121314201	4 WKS	\$926.00		23
R900345609	PR4-1X/0,63-700WA01M01	P	121314201	4 WKS	\$926.00		23
R900490630	PR4-1X/1,00-450WA01M01	P	121314201	4 WKS	\$1,000.00		23
R901093640	PR4-3X/1.60-700RA12M01	P	121314101	4 WKS	\$1,250.00		21
R901093641	PR4-3X/10.00-500RA12M01	P	121314101	4 WKS	\$1,915.00		21
R901089758	PR4-3X/2.00-700RA12M01	P	121314101	4 WKS	\$1,250.00		21



**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R901093639	PR4-3X/2.50-700RA12M01	P	121314101	4 WKS	\$1,250.00		21
R901093871	PR4-3X/3.15-500RA12M01	P	121314101	4 WKS	\$1,250.00		21
R901094072	PR4-3X/3.15-700RA12M01	P	121314101	4 WKS	\$1,869.00		21
R901093868	PR4-3X/4.00-700RA12M01	P	121314101	4 WKS	\$1,869.00		21
R901093643	PR4-3X/5.00-500RA12M01	P	121314101	4 WKS	\$1,250.00		21
R901093867	PR4-3X/6.30-500RA12M01	P	121314101	4 WKS	\$1,250.00		21
R901093866	PR4-3X/8.00-500RA12M01	P	121314101	4 WKS	\$1,869.00		21
R901093864	PR4-3X/8.00-700RA12M01	P	121314101	4 WKS	\$3,183.00		21
R900928295	PVV1-1X/018RR15DMB	P	121211011	4 WKS	\$928.00		17
R900928296	PVV1-1X/027RA15DMB	P	121211011	4 WKS	\$928.00		17
R900939075	PVV1-1X/027RJ15DMB	P	121211011	4 WKS	\$974.00		17
R900942112	PVV1-1X/027RR15DMB	P	121211011	4 WKS	\$928.00		17
R900935891	PVV1-1X/036RA15DMB	P	121211011	4 WKS	\$928.00		17
R900965314	PVV1-1X/036RJ15DMB	P	121211011	4 WKS	\$974.00		17
R978909168	PVV1-1X/036RR15DMB	P	121211011	4 WKS	\$928.00		17
R900928297	PVV1-1X/040RA15DMB	P	121211011	4 WKS	\$928.00		17
R900941684	PVV1-1X/040RJ15DMB	P	121211011	4 WKS	\$974.00		17
R900929543	PVV1-1X/046RA15DMB	P	121211011	4 WKS	\$928.00		17
R900942115	PVV2-1X/040RA15DMB	P	121211021	4 WKS	\$1,024.00		17
R978903858	PVV2-1X/045RR15DMB	P	121211021	4 WKS	\$1,024.00		17
R900936290	PVV2-1X/055RA15DMB	P	121211021	4 WKS	\$1,024.00		17
R900936197	PVV2-1X/060RA15DMB	P	121211021	4 WKS	\$1,024.00		17
R900935466	PVV2-1X/068RA15DMB	P	121211021	4 WKS	\$1,024.00		17
R900963515	PVV2-1X/068RR15DMB	P	121211021	4 WKS	\$1,024.00		17
R900936293	PVV4-1X/069RA15DMC	P	121211041	4 WKS	\$1,342.00		17
R900931548	PVV4-1X/082RA15DMC	P	121211041	4 WKS	\$1,342.00		17
R900936294	PVV4-1X/098RA15DMC	P	121211041	4 WKS	\$1,342.00		17
R900936295	PVV4-1X/098RR15DMC	P	121211041	4 WKS	\$1,342.00		17
R900936491	PVV4-1X/113RA15DMC	P	121211041	4 WKS	\$1,342.00		17
R900929542	PVV4-1X/122RA15DMC	P	121211041	4 WKS	\$1,342.00		17
R900932732	PVV5-1X/139RA15DMC	P	121211051	4 WKS	\$1,764.00		17
R900928300	PVV5-1X/139RR15DMC	P	121211051	4 WKS	\$1,764.00		17
R900936296	PVV5-1X/154RA15DMC	P	121211051	4 WKS	\$1,764.00		17
R900936492	PVV5-1X/162RA15DMC	P	121211051	4 WKS	\$1,764.00		17
R900936297	PVV5-1X/183RA15DMC	P	121211051	4 WKS	\$1,764.00		17
R900929349	PVV5-1X/193RA15DMC	P	121211051	4 WKS	\$1,764.00		17
0811403108	QV1NG6Q28L/5BAR4/2WVNOOLR:l=2,5A	P	112182061	4 WKS	\$746.00		
1530221042	RUBBERRINGACCUMBRKT	P	124834000	4 WKS	\$58.00		466
R900348007	S10A0.0/12	P	111532100	4 WKS	\$52.00		128
R900420531	S10A1.0/	P	111532100	4 WKS	\$52.00		128
R900497659	S10A1.0/12	S	111532100	2 WKS	\$52.00		128
R900490600	S15A0.0/12	S	111532150	2 WKS	\$54.00		128
R900420537	S15A1.0/	P	111532150	4 WKS	\$54.00		128
R900455137	S15A1.0/12	S	111532150	2 WKS	\$54.00		128
R900486216	S15A5.0/12	P	111532150	4 WKS	\$54.00		128
R900343034	S20A0.0/12	P	111532200	4 WKS	\$66.00		128
R900470782	S20A1.0/12	S	111532200	2 WKS	\$66.00		128
R900353560	S20A2.0/12	P	111532200	4 WKS	\$66.00		128
R900470822	S20A3.0/12	P	111532200	4 WKS	\$66.00		128
R900347261	S20A5.0/12	P	111532200	4 WKS	\$66.00		128
R900344017	S25A0.0/12	P	111532250	4 WKS	\$124.00		128
R900420511	S25A1.0/	P	111532250	4 WKS	\$124.00		128
R900455138	S25A1.0/12	S	111532250	2 WKS	\$124.00		128
R900354272	S25A5.0/12	P	111532250	4 WKS	\$124.00		128

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R900415457	S30A0.0/12	P	111532300	4 WKS	\$148.00		128
R900420519	S30A1.0/	P	111532300	4 WKS	\$148.00		128
R900492887	S30A1.0/12	S	111532300	2 WKS	\$148.00		128
R900342882	S30A2.0/12	P	111532300	4 WKS	\$148.00		128
R900470823	S30A3.0/12	P	111532300	4 WKS	\$148.00		128
R900488016	S8A1.0/12	P	111532080	4 WKS	\$50.00		128
9511230659	SEAL KIT VPV130/164 SAE/ISO-210	P	111080920	4 WKS	\$231.00		27
9511230658	SEAL KIT VPV45/80 SAE/ISO-210	P	111080920	4 WKS	\$206.00		27
R900448378	SL10GA1-4X/12	P	111533104	4 WKS	\$470.00		130
R978878966	SL10GB2-4X/12	P	111533104	4 WKS	\$470.00		130
R900483371	SL10PA1-4X/	S	111533104	2 WKS	\$498.00		130
R900457388	SL10PA1-4X/V	P	111533104	4 WKS	\$547.00		130
R900443419	SL10PB1-4X/	P	111533104	4 WKS	\$498.00		130
R978893430	SL15GB1-4X/12	P	111533154	4 WKS	\$666.00		130
R900206275	SL15GB1-4X/V/12	P	111533154	4 WKS	\$734.00		130
R900587559	SL20PA1-4X/	S	111533204	2 WKS	\$686.00		130
R900501547	SL20PA1-4X/V	P	111533204	4 WKS	\$757.00		130
R900599586	SL20PB1-4X/	P	111533204	4 WKS	\$686.00		130
R900500208	SL20PB2-4X/	P	111533204	4 WKS	\$686.00		130
R900030795	SL25GB1-4X/V/12	P	111533254	4 WKS	\$820.00		130
R900502331	SL30GA1-4X/12	P	111533304	4 WKS	\$763.00		130
R900587560	SL30PA1-4X/	S	111533304	2 WKS	\$709.00		130
R900500095	SL30PA1-4X/V	P	111533304	4 WKS	\$782.00		130
R900599473	SL30PA2-4X/	P	111533304	4 WKS	\$709.00		130
R900599968	SL30PB1-4X/	P	111533304	4 WKS	\$709.00		130
R900058475	SL30PB2-4X/V	P	111533304	4 WKS	\$782.00		130
R978908200	SP10SN-1X/A-12	S	143174100	2 WKS	\$77.00		484
R978908197	SP10SN-1X/D-12	S	143174100	2 WKS	\$111.00		484
R978910474	SP22SN-1X/D-12	P	143174220	4 WKS	\$240.00		484
R978907503	SP6BN-1X/A-12	P	143174060	4 WKS	\$46.00		484
R978907506	SP6BN-1X/D-12	P	143174060	4 WKS	\$64.00		484
R978908182	SP6SN-1X/A-12	P	143174060	4 WKS	\$50.00		484
R978908179	SP6SN-1X/D-12	P	143174060	4 WKS	\$72.00		484
R900481097	SV10GA1-4X/12	P	111533104	4 WKS	\$392.00		130
R900462117	SV10GA1-4X/V/12	P	111533104	4 WKS	\$432.00		130
R978856677	SV10GB1-4X/V/12	P	111533104	4 WKS	\$432.00		130
R900483369	SV10PA1-4X/	S	111533104	2 WKS	\$392.00		130
R900463364	SV10PA1-4X/V	P	111533104	4 WKS	\$432.00		130
R900467724	SV10PB1-4X/	P	111533104	4 WKS	\$392.00		130
R900403672	SV10PB2-4X/	P	111533104	4 WKS	\$392.00		130
R900503632	SV15GA1-4X/12	P	111533154	4 WKS	\$496.00		130
R900508425	SV20GA1-4X/12	P	111533204	4 WKS	\$549.00		130
R978872250	SV20GB1-4X/V/12	P	111533204	4 WKS	\$604.00		130
R978897606	SV20GB2-4X/12	P	111533204	4 WKS	\$549.00		130
R900587557	SV20PA1-4X/	S	111533204	2 WKS	\$549.00		130
R900500094	SV20PA1-4X/V	P	111533204	4 WKS	\$604.00		130
R900502332	SV25GA1-4X/12	P	111533254	4 WKS	\$625.00		130
R978892121	SV25GB1-4X/12	P	111533254	4 WKS	\$625.00		130
R900517536	SV30GA1-4X/12	P	111533304	4 WKS	\$640.00		130
R900560697	SV30GB1-4X/12	P	111533304	4 WKS	\$640.00		130
R978903236	SV30GB2-4X/V/12	P	111533304	4 WKS	\$704.00		130
R900587558	SV30PA1-4X/	P	111533304	4 WKS	\$640.00		130
R900500892	SV30PA1-4X/V	P	111533304	4 WKS	\$704.00		130
R900599647	SV30PB2-4X/	P	111533304	4 WKS	\$640.00		130



## Preferred & Spotlight Delivery Program

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R987097393	SYDFE1-2X/028R-PKC62N00-0000-A0X0XXX	P	115121102	4 WKS	\$4,559.00		118
R987097394	SYDFE1-2X/045R-PKC62N00-0000-A0X0XXX	P	115121102	4 WKS	\$5,113.00		118
R987096147	SYDFE1-2X/071R-PKC92KC3-0000-A0X0XXX	P	115121102	4 WKS	\$5,928.00		118
R987097397	SYDFE1-2X/071R-PKC92N00-0000-A0X0XXX	P	115121102	4 WKS	\$5,537.00		118
R987097399	SYDFE1-2X/071R-PSC92KC3-0000-A0X0XXX	P	115121102	4 WKS	\$5,928.00		118
R987097403	SYDFE1-2X/100R-PKC62KC3-0000-A0X0XXX	P	115121102	4 WKS	\$6,734.00		118
R987097404	SYDFE1-2X/100R-PKC62N00-0000-A0X0XXX	P	115121102	4 WKS	\$6,257.00		118
R987097406	SYDFE1-2X/100R-PSC62KC3-0000-A0X0XXX	P	115121102	4 WKS	\$6,734.00		118
R987097408	SYDFE1-2X/100R-PSC62N00-0000-A0X0XXX	P	115121102	4 WKS	\$6,257.00		118
R987054392	SYDFEE-2X/028R-PKC62N00-0000-A0A0VXX	P	115121102	4 WKS	\$5,613.00		121
R987097395	SYDFEE-2X/045R-PKC62N00-0000-A0A0VXX	P	115121102	4 WKS	\$6,116.00		121
R987097396	SYDFEE-2X/071R-PKC92KC3-0000-A0A0VXX	P	115121102	4 WKS	\$7,029.00		121
R987097398	SYDFEE-2X/071R-PKC92N00-0000-A0A0VXX	P	115121102	4 WKS	\$6,637.00		121
R987097400	SYDFEE-2X/071R-PSC92KC3-0000-A0A0VXX	P	115121102	4 WKS	\$7,029.00		121
R987097402	SYDFEE-2X/071R-PSC92N00-0000-A0A0VXX	P	115121102	4 WKS	\$6,637.00		121
R987097405	SYDFEE-2X/100R-PKC62N00-0000-A0A0VXX	P	115121102	4 WKS	\$7,263.00		121
R987054609	SYDFEE-2X/100R-PSC62K02-0000-A0A1VXX	P	115121102	4 WKS	\$6,814.00		121
R987054852	SYDFEE-2X/100R-PSC62N00-0000-A0A0VXX	P	115121102	4 WKS	\$6,395.00		121
R978710340	TEST BOX 2 FOR 2STAGE PROP&PL	P	115139903	4 WKS	\$3,888.00		
R978710341	TEST BOX III 7PIN AND 12PIN	P	115139903	4 WKS	\$4,390.00		
R978908992	TP10GAB-1X/A-12	P	143176100	4 WKS	\$54.00		486
R978909644	TP10GAB-1X/D-01	P	143176100	4 WKS	\$88.00		486
R978908993	TP10GAB-1X/D-12	P	143176100	4 WKS	\$88.00		486
R978908994	TP10GPT-1X/A-12	P	143176100	4 WKS	\$54.00		486
R978908995	TP10GPT-1X/D-12	P	143176100	4 WKS	\$88.00		486
R978908998	TP16GAB-1X/A-12	P	143176160	4 WKS	\$108.00		486
R978908999	TP16GAB-1X/D-12	P	143176160	4 WKS	\$145.00		486
R978908990	TP6GAB-1X/A-12	S	143176060	2 WKS	\$40.00		486
R978910334	TP6GAB-1X/D-01	P	143176060	4 WKS	\$54.00		486
R978908991	TP6GAB-1X/D-12	S	143176060	2 WKS	\$54.00		486
R978908988	TP6GPT-1X/A-12	S	143176060	2 WKS	\$40.00		486
R978908989	TP6GPT-1X/D-12	S	143176060	2 WKS	\$54.00		486
9511230605	VPV16PUMPORINGKIT210bar	P	111080920	4 WKS	\$145.00		27
R978711814	VPV16SAECOMBOPUMPKIT210	P	121000920	4 WKS	\$882.00		27
R978711812	VPV16SAEPUMPPAIRKIT210	P	121000920	4 WKS	\$808.00		27
9511230597	VPV25/32ORINGKITISO/SAE	P	111080920	4 WKS	\$168.00		27
R978711809	VPV25/32SAEPUMPPKIT210	P	121000920	4 WKS	\$1,067.00		27
R978711825	VPV25/32SAEREPKITP1210bar	P	121000920	4 WKS	\$1,113.00		27
R978711840	VPV80SAE210BARREPAIRKIT	P	121000920	4 WKS	\$1,979.00		27
R978807708	VT PATCHCORD BLKAK205/410 SIL100CM	S	115139903	2 WKS	\$28.00		406
R978807707	VT PATCHCORD REDAK205/410 SIL100CM	S	115139903	2 WKS	\$28.00		406
R900020153	VT3002-2X/32 CARDHOLDER 32POL	S	115139001	2 WKS	\$191.00		404
R900020154	VT3002-2X/48 CARDHOLDER 48POL	P	115139001	4 WKS	\$297.00		404
R900579497	VT5035-1X/	P	115111311	4 WKS	\$1,009.00		388
R900749982	VT5041-2X/1	P	115111312	4 WKS	\$1,005.00		390
R900749983	VT5041-2X/3	P	115111312	4 WKS	\$1,123.00		390
R900745354	VT-HACD-1-1X/V0/1-0-0	P	115112413	4 WKS	\$2,085.00		394
R978018200	VT-HACD-1-1X/V0/1-0-OKIT	P	115117111	4 WKS	\$2,085.00		394
R978021682	VT-HACD-1-1X/V0/1-D-OKIT	P	115117111	4 WKS	\$2,558.00		394
R978018202	VT-HACD-1-1X/V0/1-P-OKIT	P	115117111	4 WKS	\$3,004.00		394
0811405139	VT-MACAS-500-10/VO	P	115182001	4 WKS	\$1,243.00		392
0811405167	VT-PE-TB2	P	115182004	4 WKS	\$3,888.00		
0811405168	VT-PE-TB3	P	115182004	4 WKS	\$4,390.00		
0811405144	VT-SSPA1-508-20/VO	P	115181006	4 WKS	\$375.00		362

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
0811405145	VT-SSPA1-525-20/VO/I	P	115181006	4 WKS	\$375.00		362
0811405143	VT-SSPA1-525-20/VO	P	115181006	4 WKS	\$375.00		362
R900959635	VT-SSV-1-2X/	P	115111161	4 WKS	\$115.00		400
R900942541	VT-SWMA-1-1X/VO/0	P	115112421	4 WKS	\$660.00		398
0811405108	VT-SWMA3-5-1X/VO/0	P	115182003	4 WKS	\$861.00		387
0811405157	VT-VACAP-500-20/VO	P	115182001	4 WKS	\$707.00		390
0811405152	VT-VARAP1-527-20/VO	P	115182001	4 WKS	\$1,302.00		388
0811405153	VT-VARAP1-537-20/VO	P	115182001	4 WKS	\$1,302.00		388
R978909568	VT-VETNT-1-1X/G24USA	P	115139503	4 WKS	\$389.00		408
R978911933	VT-VETSY-1-1X/1-1-0-A-0	P	115139503	4 WKS	\$2,605.00		408
R900962782	VT-VETSY-1-1X/1-1-1-0-0/(PRUEFG.+KOFFER)	P	115139501	4 WKS	\$2,073.00		408
R978913860	VT-VETSY-1-1X/1-1-1-A-0	P	115139503	4 WKS	\$3,022.00		408
R901009038	VT-VRPA1-100-1X/VO/0	P	115111111	4 WKS	\$803.00		379
0811405095	VT-VRPA1-527-10/VO	P	115182001	4 WKS	\$742.00		363
0811405100	VT-VRPA1-527-10/VO/RTP	P	115181001	4 WKS	\$842.00		363
0811405097	VT-VRPA1-537-10/VO/PV	P	115181001	4 WKS	\$742.00		363
0811405102	VT-VRPA1-537-10/VO/PV-RTP	P	115181001	4 WKS	\$842.00		363
0811405099	VT-VRPA1-537-10/VO/QV	P	115181001	4 WKS	\$742.00		363
R900979887	VT-VRPA2-1-1X/VO/T1	P	115111111	4 WKS	\$916.00		377
R900979885	VT-VRPA2-1-1X/VO/T5	P	115111111	4 WKS	\$1,166.00		377
R900979889	VT-VRPA2-2-1X/VO/T1	P	115111111	4 WKS	\$916.00		377
R900979888	VT-VRPA2-2-1X/VO/T5	P	115111111	4 WKS	\$1,166.00		377
0811405119	VT-VRPA2-527-10/VO/RTP	P	115181001	4 WKS	\$1,118.00		367
0811405120	VT-VRPA2-537-10/VO/RTP	P	115181001	4 WKS	\$1,066.00		367
R900033823	VT-VSPA1-1-1X/	S	115111111	2 WKS	\$392.00		369
R900782310	VT-VSPA1-2-1X/VO/0	P	115111111	4 WKS	\$412.00		371
0811405081	VT-VSPA1-508-10/VO/RTP	P	115181001	4 WKS	\$484.00		362
0811405079	VT-VSPA1-525-10/VO/RTP	P	115181001	4 WKS	\$520.00		361
R900053778	VT-VSPA1K-1-1X/	S	115111131	2 WKS	\$362.00		369
R901002090	VT-VSPA2-1-2X/VO/T1	P	115111111	4 WKS	\$790.00		373
R901002095	VT-VSPA2-1-2X/VO/T5	P	115111111	4 WKS	\$1,049.00		373
R900417595	Z1S10D1-3X/V	P	115111103	4 WKS	\$309.00		140
R900417590	Z1S10P1-3X/V	P	115111103	4 WKS	\$309.00		140
R900417591	Z1S10T1-3X/V	P	115111103	4 WKS	\$309.00		140
R900417571	Z1S6A1-3X/V	P	115111063	4 WKS	\$260.00		138
R901086081	Z1S6C05-4X/V	P	115111064	4 WKS	\$260.00		138
R900417570	Z1S6C1-3X/V	P	115111063	4 WKS	\$260.00		138
R901086051	Z1S6P05-4X/V	S	115111064	2 WKS	\$260.00		138
R900417568	Z1S6P1-3X/V	S	115111063	2 WKS	\$260.00		138
R900335004	Z1S6P2-3X/V	P	115111063	4 WKS	\$260.00		138
R901086058	Z1S6T05-4X/V	P	115111064	4 WKS	\$260.00		138
R900411358	Z2DB10VD2-4X/200V	P	111311104	4 WKS	\$385.00		232
R900411462	Z2DB10VD2-4X/315V	P	111311104	4 WKS	\$385.00		232
R900411314	Z2DB6VD2-4X/200V	P	111311064	4 WKS	\$334.00		231
R900564533	Z2DBK10VC2-1X/210V	P	111312101	4 WKS	\$328.00		230
R900564536	Z2DBK10VD2-1X/210V	P	111312101	4 WKS	\$328.00		230
R900523737	Z2FS10-3-3X/V	P	111412103	4 WKS	\$479.00		262
R900517812	Z2FS10-5-3X/V	S	111412103	2 WKS	\$237.00		262
R900459203	Z2FS16-3X/S	P	111412163	4 WKS	\$532.00		263
R900457256	Z2FS16-3X/S2	P	111412163	4 WKS	\$532.00		263
R900473688	Z2FS16-3X/S2V	P	111412163	4 WKS	\$532.00		263
R900470529	Z2FS16-3X/SV	P	111412163	4 WKS	\$532.00		263
R900456783	Z2FS22-3X/S	P	111412223	4 WKS	\$723.00		264
R900443176	Z2FS22-3X/S2	P	111412223	4 WKS	\$723.00		264

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R900468786	Z2FS22-3X/S2V	P	111412223	4 WKS	\$723.00		264
R900474580	Z2FS22-3X/SV	P	111412223	4 WKS	\$723.00		264
R900481621	Z2FS6-2-4X/1Q	P	111412064	4 WKS	\$191.00		260
R900481623	Z2FS6-2-4X/1QV	P	111412064	4 WKS	\$191.00		260
R900481624	Z2FS6-2-4X/2QV	S	111412064	2 WKS	\$191.00		260
R900581526	Z2FS6A2-4X/1QV	P	111412064	4 WKS	\$191.00		260
R900439389	Z2FS6A2-4X/2QV	P	111412064	4 WKS	\$191.00		260
R900440565	Z2FS6B2-4X/2QV	P	111412064	4 WKS	\$191.00		260
R900564522	Z2FSK10-2-1X/2QV	S	111413101	2 WKS	\$170.00		261
R900564521	Z2FSK6-2-1X/2QV	S	111413061	2 WKS	\$160.00		259
R900407394	Z2S10-1-3X/	P	111513103	4 WKS	\$224.00		142
R900407439	Z2S10-1-3X/V	S	111513103	2 WKS	\$224.00		142
R900421985	Z2S10-2-3X/	P	111513103	4 WKS	\$224.00		142
R900436801	Z2S10-2-3X/V	P	111513103	4 WKS	\$224.00		142
R900440349	Z2S10-3-3X/V	P	111513103	4 WKS	\$224.00		142
R900407424	Z2S10A1-3X/	P	111513103	4 WKS	\$224.00		142
R900407440	Z2S10A1-3X/V	P	111513103	4 WKS	\$224.00		142
R900407434	Z2S10B1-3X/	P	111513103	4 WKS	\$224.00		142
R900407465	Z2S10B1-3X/V	P	111513103	4 WKS	\$224.00		142
R900428795	Z2S10B2-3X/V	P	111513103	4 WKS	\$224.00		142
R900328797	Z2S16-1-5X/	P	111513165	4 WKS	\$572.00		145
R900412459	Z2S16-1-5X/V	P	111513165	4 WKS	\$572.00		145
R900434675	Z2S16-2-5X/V	P	111513165	4 WKS	\$572.00		145
R900328798	Z2S16A1-5X/	P	111513165	4 WKS	\$572.00		145
R900407720	Z2S16A1-5X/V	P	111513165	4 WKS	\$572.00		145
R900328799	Z2S16B1-5X/	P	111513165	4 WKS	\$572.00		145
R900432915	Z2S22-1-5X/	P	111513225	4 WKS	\$654.00		146
R900436495	Z2S22-1-5X/V	P	111513225	4 WKS	\$654.00		146
R900433032	Z2S22A1-5X/	P	111513225	4 WKS	\$654.00		146
R900346704	Z2S22A1-5X/V	P	111513225	4 WKS	\$654.00		146
R900347495	Z2S6-1-6X/	P	111513066	4 WKS	\$181.00		141
R900347504	Z2S6-1-6X/V	S	111513066	2 WKS	\$181.00		141
R900347496	Z2S6-2-6X/	P	111513066	4 WKS	\$181.00		141
R900347505	Z2S6-2-6X/V	S	111513066	2 WKS	\$181.00		141
R900347498	Z2S6A1-6X/	P	111513066	4 WKS	\$181.00		141
R900347507	Z2S6A1-6X/V	P	111513066	4 WKS	\$177.00		141
R900347501	Z2S6B1-6X/	P	111513066	4 WKS	\$181.00		141
R900347510	Z2S6B1-6X/V	P	111513066	4 WKS	\$181.00		141
R900347511	Z2S6B2-6X/V	P	111513066	4 WKS	\$181.00		141
R900564520	Z2SRK10-1-1X/V	S	111514101	2 WKS	\$190.00		144
R900564519	Z2SRK6-1-1X/V	S	111514061	2 WKS	\$153.00		143
R978897935	Z2SRK6A1-1X/V	P	111514061	4 WKS	\$153.00		143
R900937595	Z4WE6E63-3X/EG24N9K4	P	111111063	4 WKS	\$336.00		172
R900954010	Z4WE6E63-3X/EG96NK4	P	111111063	4 WKS	\$346.00		172
R900964347	Z4WE6E63-3X/EW110N9K4	P	111111063	4 WKS	\$336.00		172
R900941212	Z4WE6E68-3X/EG24N9K4	P	111111063	4 WKS	\$336.00		172
R900941777	Z4WE6E68-3X/EW110N9K4	P	111111063	4 WKS	\$336.00		172
R900946435	Z4WEH10E63-4X/6EW110N9ETK4	P	111111104	4 WKS	\$1,106.00		174
R900409937	ZDB10VP2-4X/200V	P	111311104	4 WKS	\$258.00		232
R900409958	ZDB10VP2-4X/315V	S	111311104	2 WKS	\$258.00		232
R900409889	ZDB6VA2-4X/100V	P	111311064	4 WKS	\$211.00		231
R900409886	ZDB6VA2-4X/200V	P	111311064	4 WKS	\$211.00		231
R900409893	ZDB6VA2-4X/315V	P	111311064	4 WKS	\$211.00		231
R900409936	ZDB6VB2-4X/100V	P	111311064	4 WKS	\$211.00		231

**Preferred & Spotlight Delivery Program**

Material	Material description	P/S	Hierarchy	Delivery	Unit Price (7/15/06)	Price adder per	Page No.
						100mm (CDT3) 1" (CDT1, 4)	
R900409854	ZDB6VB2-4X/200V	P	111311064	4 WKS	\$211.00		231
R900409896	ZDB6VB2-4X/315V	P	111311064	4 WKS	\$211.00		231
R900409933	ZDB6VP2-4X/100V	P	111311064	4 WKS	\$211.00		231
R900409844	ZDB6VP2-4X/200V	S	111311064	2 WKS	\$211.00		231
R900409898	ZDB6VP2-4X/315V	S	111311064	2 WKS	\$211.00		231
R900564530	ZDBK10VP2-1X/210V	P	111312101	4 WKS	\$203.00		230
R900564558	ZDBK6VA2-1X/210V	P	111312061	4 WKS	\$181.00		229
R900564561	ZDBK6VB2-1X/210V	P	111312061	4 WKS	\$181.00		229
R900564563	ZDBK6VP2-1X/100V	P	111312061	4 WKS	\$181.00		229
R900564564	ZDBK6VP2-1X/210V	S	111312061	2 WKS	\$181.00		229
R900587492	ZDR10DA2-5X/75Y/12	S	111313105	2 WKS	\$337.00		246
R900961380	ZDR10DA2-5X/75YM/12	S	111313105	2 WKS	\$337.00		246
R900513527	ZDR10DP1-5X/150YM/12	P	111313105	4 WKS	\$337.00		246
R901023629	ZDR10DP1-5X/210YM/12	S	111313105	2 WKS	\$337.00		246
R900582108	ZDR10DP2-5X/150YM/12	P	111313105	4 WKS	\$337.00		246
R900582564	ZDR10DP2-5X/210YM/12	P	111313105	4 WKS	\$337.00		246
R900513528	ZDR10DP2-5X/75YM/12	S	111313105	2 WKS	\$337.00		246
R900515731	ZDR10VP5-3X/100YM/12	P	111313103	4 WKS	\$557.00		249
R900512452	ZDR10VP5-3X/200YM/12	P	111313103	4 WKS	\$557.00		249
R900519414	ZDR10VP5-3X/315YM/12	P	111313103	4 WKS	\$557.00		249
R900481530	ZDR6DA1-4X/25Y/12	P	111313064	4 WKS	\$288.00		245
R900427723	ZDR6DA2-4X/150Y/12	P	111313064	4 WKS	\$288.00		245
R900401222	ZDR6DA2-4X/210Y/12	P	111313064	4 WKS	\$288.00		245
R900411748	ZDR6DA2-4X/25Y/12	P	111313064	4 WKS	\$288.00		245
R900430193	ZDR6DA2-4X/75Y/12	S	111313064	2 WKS	\$288.00		245
R900441081	ZDR6DA2-4X/75YM/12	P	111313064	4 WKS	\$288.00		245
R900509022	ZDR6DB2-4X/150YM/12	P	111313064	4 WKS	\$288.00		245
R900440306	ZDR6DB2-4X/25YM/12	P	111313064	4 WKS	\$288.00		245
R900447403	ZDR6DB2-4X/75YM/12	P	111313064	4 WKS	\$288.00		245
R900424336	ZDR6DP1-4X/150YM/12	P	111313064	4 WKS	\$288.00		245
R900430191	ZDR6DP1-4X/210YM/12	P	111313064	4 WKS	\$288.00		245
R900430189	ZDR6DP1-4X/75YM/12	P	111313064	4 WKS	\$288.00		245
R900483787	ZDR6DP2-4X/150YM	P	111313064	4 WKS	\$288.00		245
R900404754	ZDR6DP2-4X/150YM/12	P	111313064	4 WKS	\$288.00		245
R900433350	ZDR6DP2-4X/210YM/12	S	111313064	2 WKS	\$288.00		245
R900401216	ZDR6DP2-4X/75YM/12	S	111313064	2 WKS	\$288.00		245
R900712080	ZDRK10VA5-1X/100YV/12	P	111314101	4 WKS	\$287.00		248
R900566913	ZDRK10VA5-1X/210YV/12	P	111314101	4 WKS	\$287.00		248
R900721396	ZDRK10VP5-1X/100YMV/12	S	111314101	2 WKS	\$287.00		248
R900566915	ZDRK10VP5-1X/210YMV/12	S	111314101	2 WKS	\$287.00		248
R900721394	ZDRK10VP5-1X/50YMV/12	P	111314101	4 WKS	\$287.00		248
R900700999	ZDRK6VP5-1X/100YMV/12	S	111314061	2 WKS	\$243.00		244
R900566912	ZDRK6VP5-1X/210YMV/12	S	111314061	2 WKS	\$243.00		244
R900700998	ZDRK6VP5-1X/50YMV/12	S	111314061	2 WKS	\$243.00		244
R900921249	ZSF32F1-1-1X/M/12	P	111546321	4 WKS	\$788.00		132
R900539730	ZSF40F1-1-1X/M/12	S	111546401	2 WKS	\$943.00		132
R900539731	ZSF50F1-1-1X/M/12	P	111546501	4 WKS	\$1,155.00		132
R900524565	ZSF80F1-1-1X/M/01	P	111546801	4 WKS	\$1,533.00		132



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