



**MODULAR COMPRESSED AIR
PURIFICATION.
DONALDSON FRL MEMBRANE AIR DRYERS.**

Donaldson®
Ultrafilter™

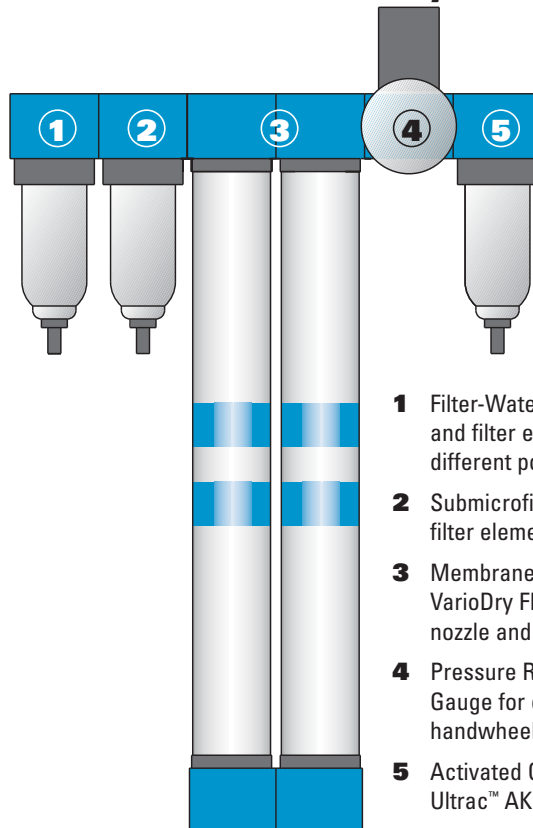
DONALDSON® FRL-UNITS. THE INTELLIGENT AND COMPLETE PURIFICATION SOLUTION.

The introduction of Quality Air (Filter, Regulator, Lubricator) program establishes a quality standard for compressed air purification in industrial pneumatic applications only Donaldson can offer. An important fact for all users of compressed air since it now allows to make use of the Donaldson quality and performance in the FRL sector as well – not only reducing the number of suppliers but also guaranteeing a constant high quality level of this important power source from generating to the point of use, typically Donaldson. The almost unlimited possibilities in combining and varying the single Donaldson FRL components are pointed out best by having a close look at the single steps of the compressed air purification process.

A Contribution to Energy Saving

No matter what quantity of compressed air needs to be treated only the quality demands determine the components of your purification equipment. With a centralized purification device the entire compressed air generated has to be purified to meet the quality demands of the most sensitive application – regardless of the fact that this only consumes 1% or even less of the air. Local compressed air treatment with Donaldson FRL-units supplies each individual application exactly with the air quality required and therefore avoids costly super qualification of compressed air for low demand purposes.

Modular Compressed Air Purification with integrated dryer: VarioDry FRL



- 1** Filter-Water-Separator with cyclone system and filter element, filter element available in different pore sizes
- 2** Submicrofilter equipped with Ultrair™ SMF filter element
- 3** Membrane Compressed Air Dryer Ultratroc VarioDry FRL with integrated purge air nozzle and internal regeneration air duct
- 4** Pressure Regulating Valve and Pressure Gauge for outlet pressure visualization, handwheel lockable
- 5** Activated Carbon Filter equipped with Ultrac™ AK filter element

Ultrair Depth
filter element



Packages

The single Donaldson FRL components are designed to match perfectly with the VarioDry FRL membrane dryer in terms of airflow and connection size.

No matter what purification solution is required – Donaldson always offers the optimized combination for the individual application.

A Look Inside: High Efficiency Filter Element

The next important step on your way to a compressed air purified exactly to the individual requirements is filtration. Depending on inlet as well as outlet parameters filtration can be designed purely as a one-stage FRL component but also up to a several-stage maximum retention device.

Donaldson supplies an optimally tailored solution for every application: from coarse dust filters up to submicro filters. They all do an extremely reliable and economical job in cleaning your air from oil, water and particles by their

- high capacity
- constant high efficiency
- superior dirt retention capacity
- minimized differential pressure
- optimized economy
- highest reliability

Particularly the high efficiency Ultrair micro-fiber fleece guarantees an optimal three-dimensional depth filtration ensuring highest load as well as dirt-hold capacity.

Step by Step – the Purification Process

The Donaldson FRL purification chain starts with a Filter-Water-Separator. It retains bulk particle contamination by a sieve effect and contains a cyclone separator to remove water and oil droplets from the compressed air.

The Filter-Water-Separator prevents the following high efficiency filter from bulk contaminants, and therefore avoids pollution related problems like short overall lifetime or high differential pressure.



Filter-Water-Separators are available in different pore sizes



Three stage filter combination to ensure the optimum filtration result

Superior Concept: Integrated Membrane Dryer

The integration of a dryer in the FRL-unit itself offers some major advantages like:

- tuned to form a complete package
- no additional fittings required
- identical housing design guarantees lowest differential pressure
- no danger of leakage since external adapters or interconnecting devices are not used

Air coming from the prefilters enters the integrated dryer and is fed through the center of a bundle of hollow fibers with semi-permeable membranes. Moisture diffuses across the semi-permeable membrane as air moves through the centre of the hollow fiber bundle. The dry air produced leaves the system in order to drive the application or to enter the next purification step respectively with a portion of it fed back over the outside of the fiber bundle and vented to atmosphere via outlets. A throttle nozzle controls the continuous volume of sweep or purge air. No condensate is generated during the drying process since dehumidification takes place in the gas phase completely.

Performance of the integrated membrane dryer for a given application will be a function of inlet conditions to the system. Varying inlet conditions will produce varying outlet conditions, although a discrete Pressure Dew Point (PDP) reduction within the dryer takes place.



FRL SUPERPLUS. DRY COMPRESSED AIR.

Leaving the last filtration stage the compressed air is free of dirt particles oil and water but far away from being dry. A temperature drop of only 3°F will result in water vapor condensing again – a fact which cannot be prevented by any filtration technology. The reason behind is the natural process that air at a relative humidity of 100% condenses and water is set free with falling temperatures of the air. A fact that illustrates best the necessity of a FRL integrated dryer because only drying the air reliably prevents condensate from forming downstream of the filters. All FRL-units benefit from Donaldson's long-standing experience in manufacturing air dryers.

Bundled Advantages

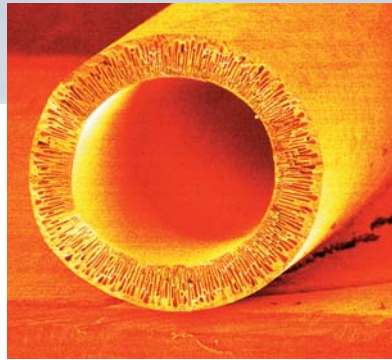
The use of a membrane compressed air dryer integrated in the Donaldson FRL-unit combines several unique advantages in a single device:

- almost silent operation allows direct workshop installation
- no power supply required
- inherently safe device, applicable in hazardous areas
- no oxygen depletion, suitable for breathing air applications

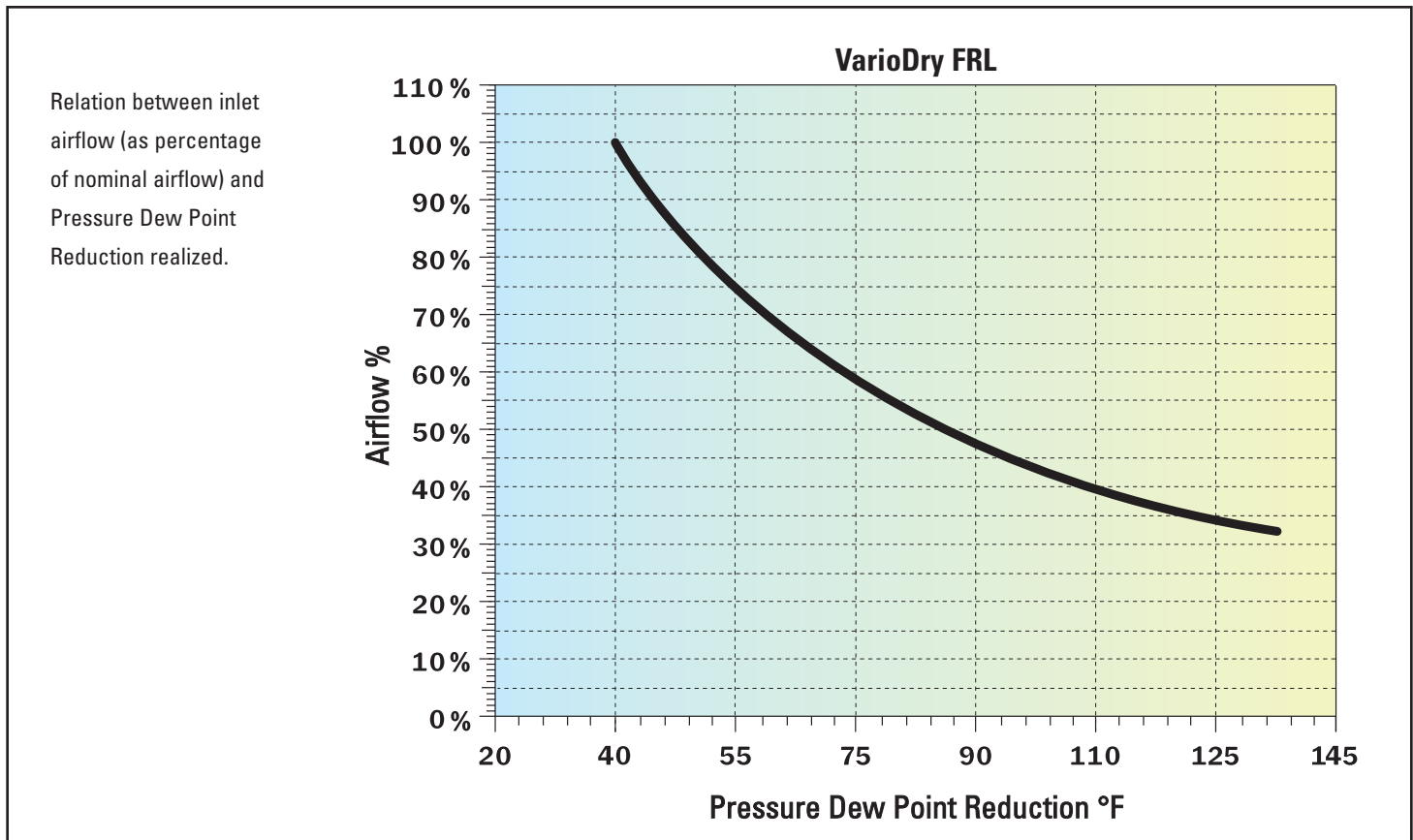
Membrane Dryer VarioDry FRL



Heart of the Dryer:
Module with the hollow fiber bundle.



Cross section of hollow membrane fibers:
Cross section of the hollow membrane fibers. Taken with extreme magnification by means of a scanning electron microscope. The membrane wall thickness is approx. 150 micrometer.



PURIFICATION DOES NOT END WITH DRYING ...

Always the Right Pressure

The previous phases described in the purification process with FRL-units allow to supply each application with the required compressed air in terms of purity and dryness. But all this does happen on a working pressure level supplied by the compressor station to the complete compressed air system.



Pressure Regulating Valve (Diaphragm type) fitted with pressure gauge

The use of a pressure regulator contributes to the ideal purification solution by:

- enable the optimal tuning to the requirement of the pneumatic device
- eliminates the transmission of pressure shock waves
- guarantees the exact observation of a maximum pressure limit
- optimal use of larger flow capacity for prefilters and dryer with higher operating pressure
- ensures that pressure related processes can run at constant conditions

The compressed air leaving the dryer is treated to a quality level high enough to ensure a smooth production process without downtime. This statement describes the situation of most applications correctly, however there is a high number of situations where experience and practice proves that clean and dry air alone simply is not sufficient.

In addition to application related individual circumstances the reasons behind can usually be divided into two classes. At first not each individual application can operate on the working pressure generated in the central compressor station and secondly there is a wide range in the demands regarding the residual oil content of the dried air.

No Bitter Aftertaste

Of course the results of compressed air still containing oil vapor and aerosols are not in all branches as dramatic as in the food and beverage industry where not only taste but health is a major concern as well.

But for many other applications the fact applies as well that oil components in the air which were not removed completely can cause trouble. Even with non-oil lubricated air compressors you will find oil in the compressed air – a consequence of polluted ambient air used for compression. This leaves the purification equipment with the job to ensure that oil vapor is removed and the danger to health is minimized reliably. The guarantee for oilfree compressed air is the Ultrac AK activated carbon filter capturing all gaseous hydrocarbons in an exceptionally intensive two-stage adsorption process patented by Donaldson. Only an Donaldson activated carbon filter ensures that purification as well as protection requirements are met and only a FRL-unit comprising an AK filter is to be regarded as complete purification station for oilfree air in the true sense of the word.



Activated carbon filters guarantee comprehensive product protection and customer care

Donaldson Oil Mist Lubricator – and everything will work out fine

Usually pneumatic cylinders and actuators depend on a constant amount of lubricated compressed air in order to do their job with the required precision and repeating accuracy. Therefore these components used in a number of industrial applications have to be supplied with a defined quantity of oil only the Donaldson oil mist lubricator can offer. By adding a lubricator to the FRL-unit the reliable and accurate function of the components is ensured as well as it contributes to prolong the life span of the pneumatic devices.



Different bowl materials allow adaptation to distinct applications and environments

Accessories and Options

Although the removal of oil vapor and aerosols symbolizes the highest purification level it does not simultaneously represent the end of opportunities. There nearly is no limit to the variability and possibility of combining the single components of the FRL program. Additionally the accessories or the combinations respectively really complete the individual unit. Besides the tuning to the individual requirements these components virtually enhance functionality, user-friendliness as well as easy operation to perfectly match with the single application. This ensures the optimal solution to meet each request perfectly – there is no reason to accept anything less any longer.



Ball-valve operated Shut-Off Device

Purification unlimited

Purification brought to the top – that simply is the essence of the FRL program. This does not only refer to the fact that air which has been treated completely fulfills even highest quality demands but also points out that decentral air treatment represents the state of the art technology offering the purification optimum for each individual application. The Donaldson philosophy expressed in the FRL series is best described simply: compressed air as clean as necessary and at a highly cost-effective pricing.

Intelligent Combinations

The modular FRL system of Donaldson simply offers the user more – more flexibility and more individuality hence the system guarantees one component to fit with the next.

Nevertheless Donaldson has adapted customer needs and developed several components which already combine more than one feature in a single housing.

A filter-regulator does not only minimize space requirements compared to two separate units. It also reduces investment costs and additionally ensures that the filtration downstream always operates at a constant pressure and therefore with a defined performance. This illustrates that individual requirements are met best by individual solutions which might well result in a combination with all the advantages and benefits described above. FRL units offer maximum advantages at minimum investment costs.



Filter-Regulator including pressure gauge

FRL-unit comprising a combination and two single FRL-components



TECHNICAL DATA. FRL MEMBRANE DRYERS.

Explanations:

Airflow related to intake state of the air compressor (68°F, 14.5 psi); working pressure 100 psi gauge, inlet temperature 100°F, inlet Pressure Dew Point 100°F according to CAGI ADF 700 reference conditions. Performance data given refer to a PDP reduction of 40°F and a regeneration airflow of 10%.

Operating parameters:

Ambient temperature min. 35°F, max. 140°F; operating pressure min. 75 psi, max. 150 psi, permissible pressure and/or temperatures may vary in combination with distinct FRL accessories.

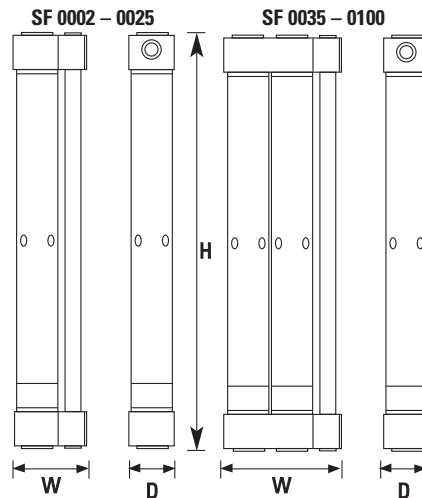
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Quality guaranteed

A company grows according to the challenges that are set. And according to the quality standard which it sets itself. We were the first to be awarded the DQS certificate in accordance with DIN ISO 9001. For a constant quality standard in every single department of the company. Donaldson customers always receive intelligent products and systems representing state of the art technology. Premier quality goals combined with innovative technology enable system solutions of highest economic efficiency and reliability. All components are tuned to match with each other. In addition to a functional guarantee, all Donaldson customers can rely on the compressed air quality process security.

Model	Inlet – Airflow scfm	Connection (inches FNPT)	Weight lb.
SF 0002-US	1.5	1/4	4.5
SF 0003-US	3	1/4	5.5
SF 0006-US	6	1/2	7
SF 0008-US	8	1/2	7.5
SF 0010-US	10	1/2	8
SF 0015-US	15	1/2	8
SF 0020-US	20	1/2	14
SF 0030-US	30	1/2	15
SF 0040-US	40	1	27
SF 0050-US	50	1	35
SF 0060-US	60	1	43
SF 0070-US	70	1	48
SF 0085-US	85	1	48

Model	Height inches	Width inches	Depth inches
SF 0002-US	15 -1/2	11	4-7/16
SF 0003-US	22-3/16	11	4-7/16
SF 0006-US	24-3/4	15	5
SF 0008-US	24-3/4	15	5
SF 0010-US	24-3/4	15	5
SF 0015-US	24-3/4	15	5
SF 0020-US	24-3/4	15	5
SF 0030-US	24-3/4	15	5
SF 0040-US	24-3/4	30	5-1/2
SF 0050-US	24-3/4	33	5-1/2
SF 0060-US	24-3/4	37	5-1/2
SF 0070-US	24-3/4	40	5-1/2
SF 0085-US	24-3/4	40	5-1/2



Product range

Adsorption dryers:

– Ultrapac 2000 (3 – 60 cfm)

High-capacity-filters:

– Standard (3 – 11,500 cfm)

– Superplus

Compressed air membrane dryers:

– VarioDry Classic (1 – 19 cfm)

Condensate drain:

– Ultramat

– Ultrasep (75 – 4,000 cfm)



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