

## Filter Pair Replacement Procedures for Pulsed (GDX) and Non-Pulsed (GDS) Filters

In the Donaldson GDX Air Inlet Self-Cleaning (pulsed) Filtration Systems and the GDS Air Inlet Static (Non-Pulsed) Filtration Systems, 2 filters (one conical + one cylindrical, or two conicals) are paired and mounted horizontally to provide superior turbine protection.

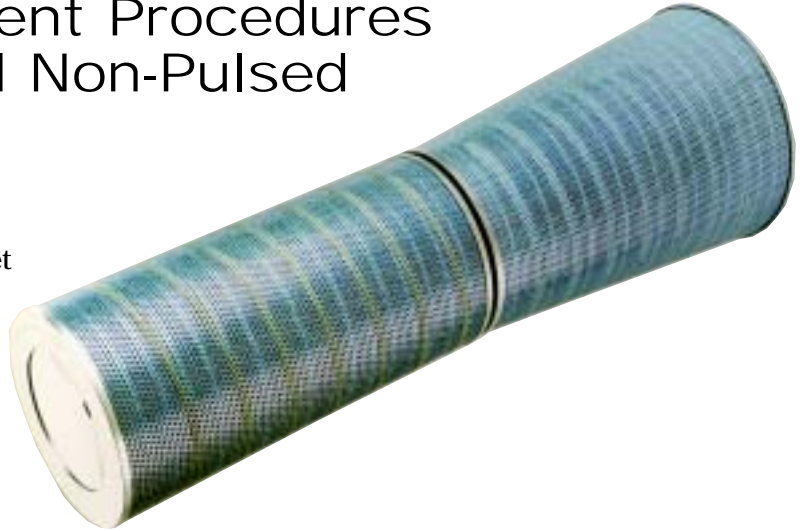
### When to Service Donaldson Filter Element Pairs

The filter elements should be removed if the dirty filter  $\Delta P$  (differential pressure) is higher than the operational guidelines. For instance, if dirty filter  $\Delta P$  is at 5.2 in. w.g. and the recommendations are for maximum dirty filters at 5.0 in. w.g., then it's time for changeout. It is important to note that the dirty filter element can safely accommodate higher  $\Delta P$  levels (i.e. >30 in w.g.), and that gas turbine operational limits on filter differential pressure will be met long before element safety issues are met. The power company policy or gas turbine manufacturer's operational policy sets limits on maximum dirty air filter  $\Delta P$  levels.

Filter elements should also be removed & replaced when filter media characteristics have deteriorated due to time, weather, or other circumstances.

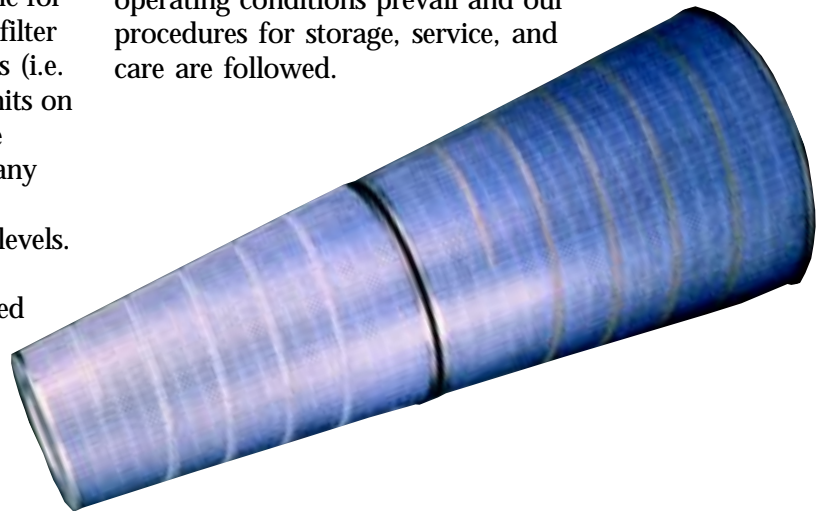
### Specific problems?

Donaldson's lab analysis can help you discover exactly what kind of particulate your filters encounter in your environment. Just send us one filter element after it's been installed under operation for at least 2 years, and we'll send back filter media change recommendations that will enable you to increase turbine output, as well as improve protection against contamination problems specific to your site. Call us for details.



### Filter Product Warranty

Donaldson warrants all the filters we manufacture against defects in materials and workmanship for 2 years from time of manufacture, provided normal operating conditions prevail and our procedures for storage, service, and care are followed.



**Note that washing of our filters is never recommended.** See why on page 5 of this document. (Also, refer to our detailed warranty statement on our website: [www.donaldson.com](http://www.donaldson.com))

Use only genuine Donaldson replacement filter elements in your Donaldson Air Filter System. For information about Donaldson replacement elements, call us at one of the offices listed on the last page of this document.

## Eye and Ear Safety

Shut off the pulse-cleaning mechanism during servicing of the filter elements. Pulses of air are potentially dangerous if the pulse occurs too close to the operator's eardrums or eyes.

We recommend that eye protection be worn at all times, in the filter system during turbine and/or air filter operation. The filter retention bolts that protrude from the elements pose possible danger to the eyes of maintenance personnel.

**WARNING!** Wear eye and ear protectors when you are near elements being pulsed-cleaned. Eye damage may result from the pulse jet hitting the eyes and ear damage from the noise emitted during the pulsing of the elements.

## Off-Gassing Hazard

**WARNING!** The filter media installed in your Donaldson air filter system contains formaldehyde. Formaldehyde is known to be a potential carcinogen, and can act as an irritant and sensitizer of the skin, eyes, and respiratory tract.

## Media Fire Hazard

**WARNING!** All media used in this filtration system are combustible. Use all cautions necessary to make sure that media is kept clear of all heat sources.

Do not smoke or weld near the air filtration system. All welding must be done prior to installation of the inlet hood treatment, air conditioning media or filtration media.

## Filter Element Storage

**CAUTION!** Damage to replacement filter elements can occur if they are not properly protected from exposure to weather. They should be kept inside a building and NOT left in pallets outside. If storing elements inside a building is not possible, store them so that they are protected from exposure to weather. The crates in which the elements are shipped are not sufficient protection from weather.

## Use of Substitute Replacement Filters

Performance (filtration efficiency and pressure drop) of the Donaldson Air Filter System is directly related to the use of high quality, high performance Donaldson filter elements. Donaldson Company does not warrant the performance of our filter system that is not equipped with genuine Donaldson filter elements.

## Visual Inspection of Elements

Visually inspect filter elements on a regular basis, at least every 3 months. Look for any evidence of:

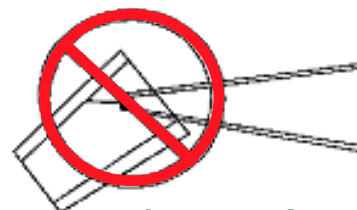
- dust leakage through the media,
- holes or damage to the media,
- damage to the gasket seal.

If any damage is detected, elements should be immediately replaced.

Always handle new elements with care. They look sturdy, but dropping them or denting them can result in holes in the media, improper sealing and/or fit, or other potentially damaging situations. **If an element has been damaged in shipping, do not use it!**

For maximum handling protection, when it's time for filter changeout, keep elements in their original cartons and lift them into the filter house.

Take care when installing new filter elements so that the yoke bolt doesn't inadvertently poke through the inner liner and damage the media.



**Incorrect!**



**Correct!**

## Filter Element Replacement

Air filter element replacement must be done during turbine downtime. Although the elements are replaceable while the turbine is running, for maximum turbine protection, Donaldson recommends replacing only while the rotating equipment is at standstill. As filter handling can be awkward, we recommend that filter changeout be done by two people.

1. Shut off compressed air supply.
2. Remove dirty elements.
3. Inspect support yokes and replace any damaged legs.
4. Install new elements.

### 1) Shut Off Compressed Air Supply

If a GDX (pulsed) filtration system, shut down the compressed air supply and ensure that the line pressure is at zero before proceeding. If a GDS (non-pulsed) system, proceed to next step.

### 2) Remove Dirty Elements

- Brush or vacuum clean the dust that has accumulated over the elements at the tube sheet and any other location, or it might fall into the clean air side during changeout.

- Remove the nut and gasket washer from the yoke assembly that secures the elements to the yoke assembly. Retain nut and washer for replacement.

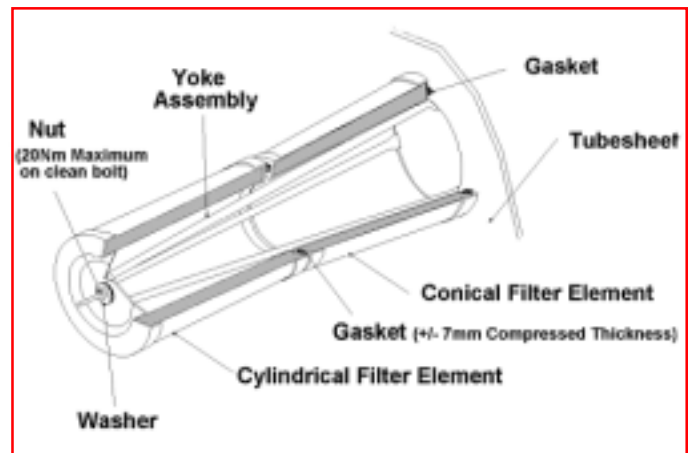
- Carefully slide the elements off one at a time from support yoke. Take care not to damage the yoke.

- Dispose of dirty elements in an environmentally-friendly manner.

### 3) Inspect Support Yokes

- Inspect elements support yokes for damage. Note that the yokes are not made to bear any more weight than the element pair (about 75 lbs/ 33 Kg.) Any excessive load will damage the yoke, create bad alignment of the filter element and result in a poor seal between the tubesheet and the element. If a person inadvertently steps on one and breaks it, Donaldson has replacement yoke kits available from our aftermarket dept. Call for part numbers.

- Make sure that the element retention yokes are centered on the tube sheet hole to ensure proper element sealing between the element and the tube sheet.



Donaldson filter element pairs are mounted together on a yoke assembly that extends from the tubesheet through the inside of the filters. The yoke legs are held together at the far end with a nut & gasket washer on the threaded end protruding from the end of the element. Yoke assemblies are usually retained for use with the new elements.

(If a yoke assembly is damaged, it must be replaced.)

### 4) Install New Elements

- Slide the rear-most element (the conical or the largest conical) on first, taking care not to knock the inner liner against the retention bolt. If damage occurs, such as a hole, do not use the element.

- Slide the 2nd element (either the cylindrical or the smaller conical) onto the yoke, again taking care to avoid internal damage, and making sure the yoke bolt protrudes from the hole in the endcap of the element. Gently push the 2nd element toward the rear element so that the seal snugs up to it.

- Place gasket washer & nut over threaded yoke stud. Tighten element retention nut between 6 ft/lbs (8 nm) and 10 ft/lbs (13 nm) to assure airtight seal between element gasket and tube sheet.

- If the correct torque has been done, but filters can still be rotated around axis, further tighten the nut, not exceeding 15 ft/lbs (20.3 nm.) **CAUTION:** Torque exceeding 15 ft/lbs (20.3 nm) can cause the end cap to compress the inner and outer liners, damaging the filter elements.

- Note that air filter system requires the installation of both conical and cylindrical filter elements.

# Donaldson Offers a Wide Choice of Media so That You Can Choose the Best Filter for Your Particular Environment!

## Premium Protection: Synthetic Media

Our man-made fibers, with their controlled fiber diameter and pore size, result in superior dust-holding capacity and low impedance to airflow. It helps keep  $\Delta P$  low throughout the entire life of the filter, which is typically 2 to 4 years, depending on the harshness of the environment. Synthetic media is sturdy and durable, even under normal-filter-killing conditions such as consistent or prolonged moisture, sticky/wet hydrocarbons, salt, or very dusty/sandy.

Synthetic media is the basis for the best filtration performance in most cases.

## Outstanding Protection: Duratek™ Media

Our special blend of synthetic and natural fibers, which we call Duratek™, is designed to resist the intermittent moisture that power plants and oil/gas field operations so often deal with, such as morning fog and coastal storms. Because of the synthetic fibers and the addition of certain resins, Duratek™ withstands harsh conditions, including high humidity and wet tropical environments. This cost-effective blend offers low  $\Delta P$ , little or no media swelling/bunching, and high dust holding capacity.

## Increase Media Power by Adding Spider-Web®

Spider-Web® is Donaldson's proprietary fine-fiber technology that catches very fine (even sub-micron!) particulate before it reaches the media substrate. Spider-Web® is a treatment that is bonded to a substrate -- either synthetic or Duratek™ filter media.

As you can see in the photos of media (magnified 100's of times) on the previous page, the Spider-Web® layer is made of fibers so fine that they don't impede airflow, yet are strong enough to capture very small particles. This is important for most turbine installations because the particles smaller than  $5\mu$  are the ones that cause fouling of the turbine & compressor blades. Spider-Web® protects your turbine from excessive and premature fouling.

Authentic Donaldson Spider-Web® is blue.

## Matching Filter Media to Your Environment

*If you're in:*

*Choose one of these*

Desert: Arid; heavy dust concentration; sandy; mostly quite fine particulate	Synthetic/Spider-Web® XP, Synthetic/Spider-Web or Duratek®/Spider-Web®
Arctic: very cold, dry air; any moisture turns to frost and builds up on filter elements; heavy insects in warm seasons	Synthetic/Spider-Web® or Duratek®/Spider-Web®
Urban/industrial areas; heavy hydrocarbons in the air; variety of particulates, both large & very small	Synthetic (on sticky/wet hydrocarbons) or Synthetic/Spider-Web® (dry hydrocarbons)
Industrial, high concentrations of a variety of particulate, both large and very fine	Synthetic/Spider-Web® XP, Synthetic, Synthetic/Spider-Web®, Duratek®, or Duratek®/Spider-Web®
Marine, coastal, humid, moisture-laden air	Synthetic/Spider-Web® or Synthetic
Light particulate concentration, dry operating conditions	Synthetic/Spider-Web® or Duratek®/Spider-Web®
Rain forest, very wet, high concentration of insects	Synthetic/Spider-Web®, Duratek®, or Duratek®/Spider-Web®
Seasonal problems with insects, seeds, leaves, or other debris	Add a Pre-Filter Wrap. Can be removed during other seasons; can be installed & removed while system is running.



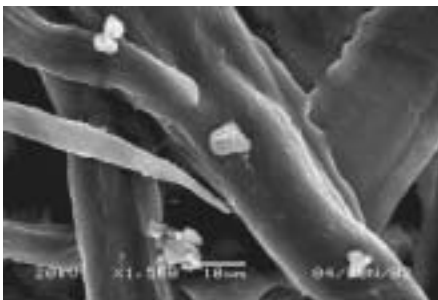
*Webster says: "Be sure to choose filter media that is engineered to conquer your environment*

*and protect your turbine from the ravages of dust and moisture."*

## Donaldson does NOT recommend cleaning and re-using old filters for these reasons:

■ Generally, by the time a filter has reached the point where cleaning is considered, it has actually reached its full operational life. Most filter elements, depending on environment, will last 3 to 4 years and at this point, media degradation has already begun. By washing, no gain in performance or life happens because the filter has already achieved its useful life.

■ When a dirty element is washed, the cleaning solution and water will actually pull dirt through to the clean side of the element, as shown in the photo below. Not good! This defeats the purpose of the filter element.



This photo from our Scanning Electron Microscope (magnified 1500 times) shows the downstream side (the "clean air side") of the filter media! Large particles of dirt -- these about 12mm in size -- are clearly visible! Particles this large are capable of removing metal from turbine compressor blades.

This means that washing actually pushed particles through the media, making them available to damage the turbine! **Washing had the exact opposite effect from what was intended -- it actually negated the protection the filter normally offers!**

■ When cellulose (paper) media is wet, it expands -- which can cause pleat tip damage. Pleat tips comprise a portion of the surface that actually traps the dust particles. When they're damaged, dust can pass through and result in potentially expensive hardware repairs.

■ The more a filter is handled, the greater the risk of physical damage -- which leads to improper fit and sealing, and, eventually, to dust leakage.

Although you may have experienced what seems like a high price for replacement filters, the risks of washing are much more costly. If you have further questions about washing, require assistance in resolving any filter issues, or need a current price quote for replacement filters, please feel free to contact us via the email address and/or telephone numbers listed at right.

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