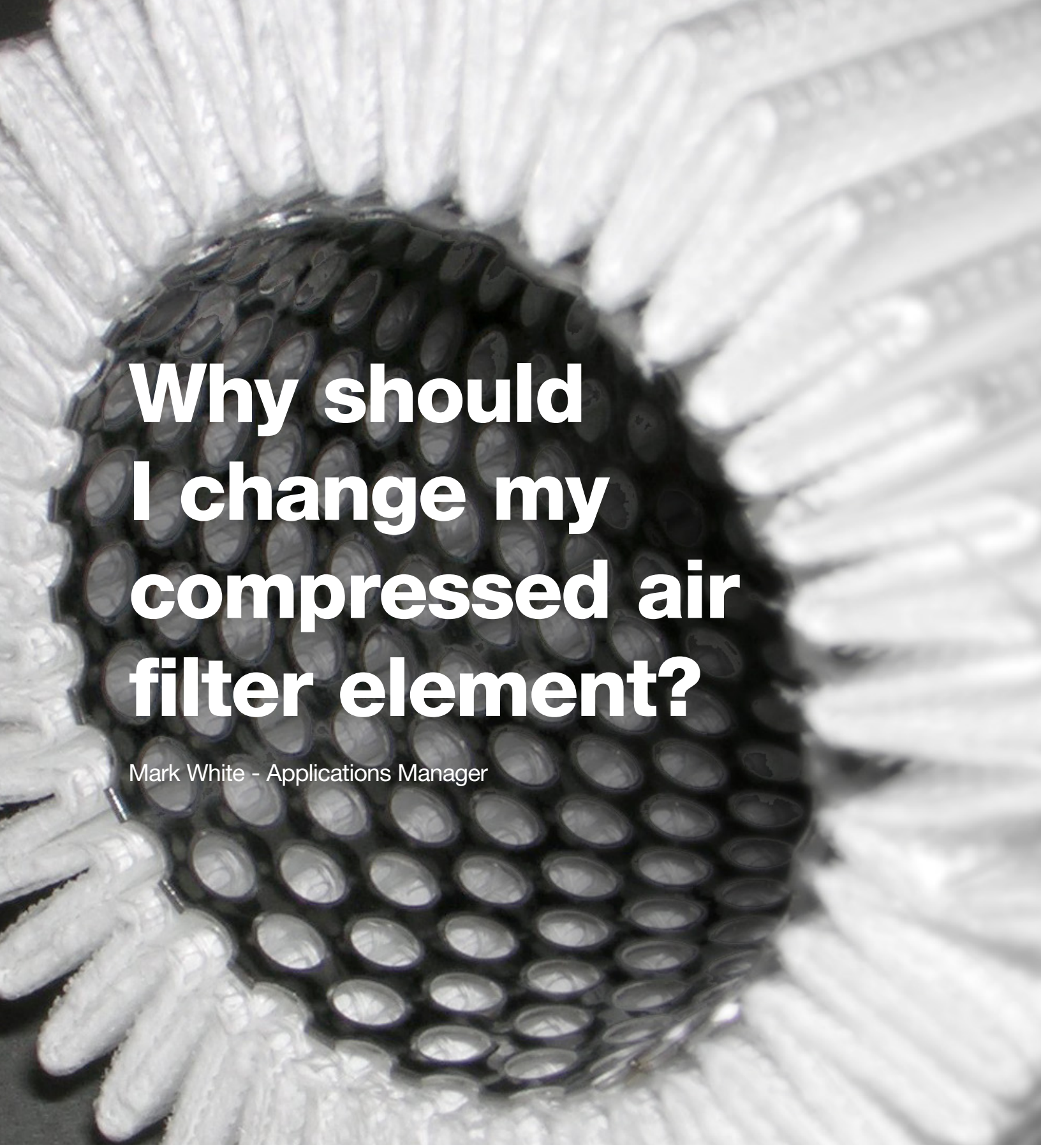


Why should I change my compressed air filter element?

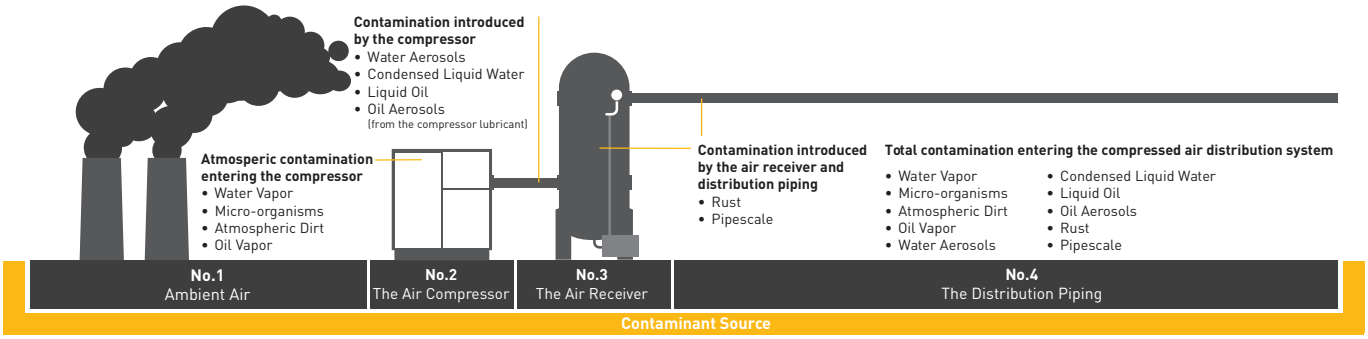
Mark White - Applications Manager

Parker domnick hunter

www.parker.com/igfg

Over 90% of manufacturing facilities world-wide use compressed air as part of their manufacturing process.

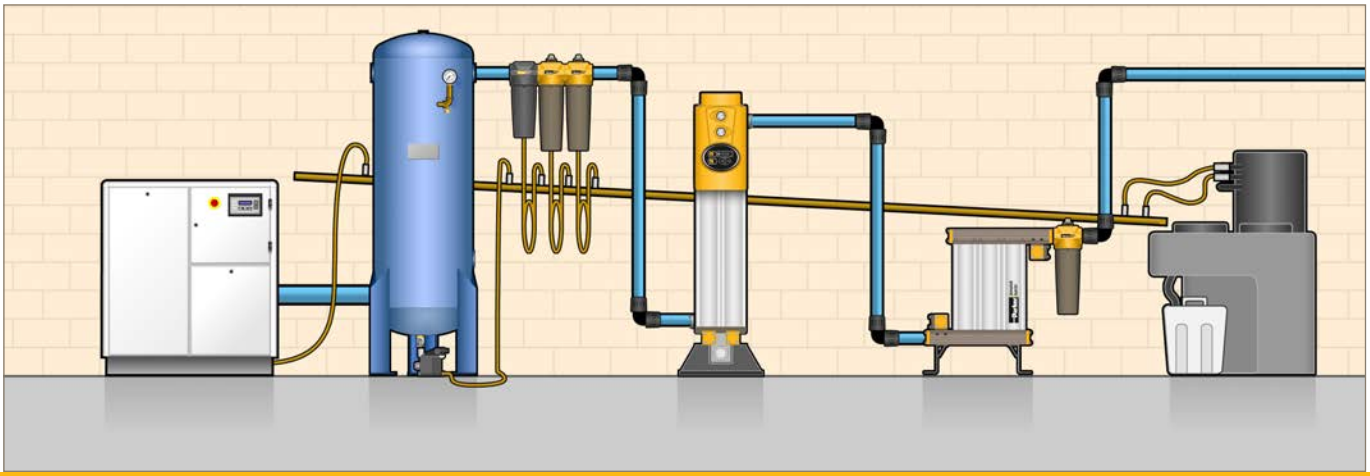
However, this powerful utility is not without its problems, in the form of compressed air contamination. It is therefore common practice to install compressed air filters as part of a "purification system" to ensure contaminants are reduced and the system operates in a safe, efficient and cost effective manner.



Contaminant Removal

The foundation of any purification system is its filtration and of the ten main contaminants found in a compressed air system, filtration is responsible for the treatment of nine of them. Coalescing filters are the most important piece of purification equipment as they reduce six of the ten contaminants and a look in any compressor room will find a pair of coalescing filters (backed up with dry particulate and oil vapour removal filters).

All of these purification technologies utilize replaceable filter elements or cartridges.



To ensure a continuous supply of high quality compressed air is always available (and to help keep energy costs low) filter elements must be replaced periodically (filter elements do not last forever). However, there are a lot of myths regarding the best time filter elements or adsorption cartridges should be changed, and the purpose of this document is to dispel those myths.

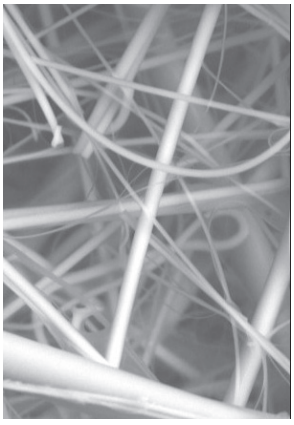
Coalescing & Dry Particulate Filters

The components of coalescing and dry particulate filters are almost identical. They typically consist of a pressure envelope or housing (filter head & bowl), a filter element and a drain (the only major difference being a float drain on the coalescing variants and a manual drain on the dry particulate variants). Many filters are also supplied with differential pressure monitoring devices as standard or as optional extras.

The heart of the filter is the filter element. Filtration media is typically wrapped or pleated between support cylinders to form the element (elements are available in differing filtration grades). Endcaps are secured to the cylinders to form an “integral” seal and an outer drainage layer is added to prevent “re-entrainment” of coalesced liquids. These filter elements do not last forever and require periodic change, however there is often confusion surrounding why the filter element needs to be replaced (and when).

Cross Section of a Coalescing Filter

Cross Section of a Filter Element



Scanning Electron Microscope (SEM) image of clean filtration media

So why should I change my compressed air filter element?

Compressed air filters function under extremely arduous conditions.

- Pressure variations
- Pulsing air demand
- Temperature variations – Day / Night & Summer to Winter
- High / Low Humidity – From 100% saturated air to extremely low dewpoint's
- Chemical attack – from oily acidic condensate and lubricant additives

Coalescing filters are constantly soaked in oily, acidic condensate, whilst at the other end of the spectrum, dry particulate filters operate in very low humidity which over time, weakens and degrades the strength of the filter media.

When the filter is operating, the filtration media in the filter element is bombarded by high velocity dirt particles. This constant bombardment will eventually lead to weakening and failure of the filter media. Once the filtration media becomes damaged, the required air quality can no longer be maintained or guaranteed.
Filter elements therefore have a finite operating life.

What happens to the filtration media in a filter element if it gets damaged?

Even a tiny hole the size of a pin-point can have disastrous consequences. Compressed air will always take the path of least resistance and once the filter media is damaged the compressed air will force through the media, tearing and rupturing the length of the element. This will result in all of the contamination being carried downstream.

Pressure Spikes

Large pressure differentials or "pressure spikes" can also rupture filter elements in an instant, again, allowing contamination to be carried past the filter and into the compressed air system. When pressurizing systems (or the filter after servicing), always ensure isolation valves are opened slowly to prevent damage.

So when should filter elements be replaced?

The recommended replacement times are for the following Parker filter ranges

- Parker domnick hunter OIL-X / OIL-X EVOLUTION / OIL-Xplus
- Parker Zander G Series / GL Series / GL Plus Series
- Parker Hiross HyperFilter

Filter Types	Replacement Times
Coalescing Filters	12 months
Coalescing Filter Float Drains	12 months
Dry Particulate Filters	12 months
OVR & AK Oil Vapor Removal	When odor is detected

Parker domnick hunter Air Quality Guarantee

Parker domnick hunter OIL-X Coalescing & Dry Particulate filter elements come with an air quality guarantee. Changing the filter elements annually with genuine parts renews the guarantee.

The manual states change the element every 12 months, is this continuous operation?

The Parker domnick hunter 12 month lifetime is based upon continuous operation (8736 hours).

My facility only operates 2000 hours over a 12 month period, does this mean my elements will last over 4 years?

Unfortunately, not. As previously stated, filter elements operate in very arduous conditions. Once filter elements have been put into operation, filtration media will weaken and degrade to a point of failure, resulting in contamination carryover. Parker guarantee element performance and air quality for a period of 12 months from installation.

“Why Should I Change My Filter Element?”

Filtration is installed to clean compressed air and achieve a specific air purity (quality). To ensure the desired air purity is maintained, compressed air filter elements should be changed in accordance with the manufacturers recommended maintenance periods. Differential pressure should only become the reason for change if the filter element becomes prematurely blocked and downstream pressure cannot be maintained.

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OIL-X Filter Range Compressed Air Purity Guarantee & Die-Cast Filter Housing Guarantee

Parker domnick hunter OIL-X filter range has been designed to provide compressed air quality that meets or exceeds levels shown in all revisions of ISO8573-1, international air quality standard

Water Separators – Grade WS

OIL-X Water Separators, provide reduction of bulk condensed water and liquid oil and their performance has been tested in accordance with ISO 12500-4:2009 & ISO8573-9. Separation performance has been independently verified by Lloyds Register. When operated between 25 & 100% of rated flow, OIL-X Water Separators will provide liquid separation efficiency between 92 & 100%, equivalent to ISO 8573-1 Class 8 for water. When liquids are present in the compressed air stream, OIL-X Water Separators must be used to protect coalescing filters from bulk liquid contamination.

Coalescing Filters – Grades A0 & AA / Dry Particulate Filters – Grades AO (with manual drain) & AA (with manual drain)

OIL-X coalescing grade reduction of oil and water aerosols, and solid particulates. Dry particulate filters provide reduction of solid particulates only. Their performance has been tested in accordance with ISO 12500-1:2007 & ISO 8573-4:2001. Filtration performance has been independently verified by Lloyds Register. Coalescing and dry particulate filter performance is guaranteed for 12 months when sized, installed and operated in accordance with Parker domnick hunter recommendations. The filter-element guarantee can be extended by replacing the filter element and consumable parts annually.

Oil Vapour Removal Filter – Grades OVR & ACS

OIL-X OVR & ACS oil vapour removal filters provide reduction of oil vapour and their performance has been tested in accordance with ISO 8573-5:2001 and independently verified by Lloyds Register. The lifetime of ACS oil vapour removal filter elements is affected by the inlet oil vapour concentration, bulk oil, temperature, relative humidity or dewpoint of the compressed air and cross-over oil changes and will vary from system to system. For plant scale protection, critical applications or systems where frequent element changes are not possible, Parker domnick hunter OVR oil vapour removal systems should be installed.

OIL-X Filtration ISO8573-1 Air Purity Classifications

Filter Combination	ISO8573-1:2010 Classification	Filter Combination	ISO8573-1:2010 Classification
A0	Class 2...2	A0 (M)	Class 2-...
A0 + AA	Class 1...1	A0 (M) + AA (M)	Class 1-...
A0 + AA + ACS	Class 1...1		
A0 + AA + OVR	Class 1...1		
A0 + AA + OVR + A0 (M)	Class 2...0		
A0 + AA + OVR + A0 (M) + AA (M)	Class 1...0		

Die-Cast Aluminium Filter Housings

OIL-X filter housings are protected by an anti corrosion coating and a tough external epoxy coating. All housings are guaranteed for 10 years under normal recommended use.

Conditions

1. OIL-X Filters are depth filters and are not absolute rated.
   A0 Grade Efficiency is 99.925%
   AA Grade Efficiency is 99.9999+ (= the limit of accurate measurement).
2. Filtration performance has been tested and independently validated in accordance with the requirements shown in the standards for oil aerosol (ISO 12500-1:2007), particulate (ISO 8573-4:2001) and oil vapour (ISO 8573-5:2001) and at a temperature of 21°C.
3. The system pressure and operating temperature of the compressed air system will affect the oil carryover performance of a coalescing filter, and site conditions / load mindset must be accounted for during on site air quality testing.
4. The lifetime of ACS oil vapour removal filter elements is affected by the pressure, oil concentration, relative humidity and temperature of the compressed air and will vary from system to system.
5. Combinations of filters will be required to achieve the highest quality classifications required by ISO 8573-1:2001.
6. A0 filters should be protected from bulk liquid contamination using a grade WS water separator (installation dependant)
7. AA filters must be preceded by an A0 filter.
8. ACS / OVR filters must be preceded by coalescing pre-filtration for oil / water aerosol removal.
9. A0 Performance based upon a maximum inlet concentration of 40mg/m³ of oil aerosol at 21°C.
10. AA Performance based upon a maximum inlet concentration of 10mg/m³ of oil aerosol at 21°C.
11. ACS Performance based upon a maximum inlet concentration of 0.018mg/m³ of oil vapour at 21°C.
12. OVR Performance based upon a maximum inlet concentration of 0.05mg/m³ of oil vapour at 21°C
13. Installation and operation must be in accordance with Parker domnick hunter recommendations.
14. Only genuine Parker domnick hunter replacement parts may be used in any servicekit/repair or all guarantees will be deemed invalid.
15. Installation & service date must be supplied with any guarantee claim.
16. Housing guarantee does not cover consumable parts, normal wear and tear, for any deterioration or defect due to improper use, negligence, accidental or malicious damage. Performance guarantee restricted to replacement of filter elements only and does not cover consequential losses.

The Myths Surrounding Differential Pressure (DP) Gauges, Indicators & Monitors

Many filter housings are supplied fitted with 'Differential Pressure Gauges' or 'Differential Pressure Indicators'. They indicate differential pressure by means of a moving needle, pop up indicator or digital display. Although common in the industry, the accuracy & purpose of these devices is often misunderstood.

Accuracy

Generally, all of these devices, no matter how they display the change in differential pressure are only 'indicators' and are not precise 'gauges'. They typically have an accuracy of around +/-25%. Calibration certificates will not be available for these devices.

Display

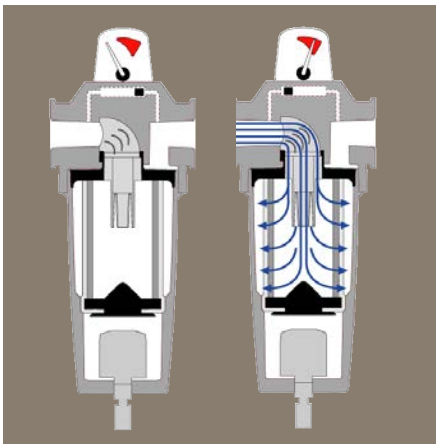
Many of these devices mimic a real gauge, having graduated scales in mbar or psi, others simplify their display, dividing it either into two segments to indicate "Working within Parameters or Service Required" or three segments to include a "Needs Attention" warning. Segments can also be colour coded "Green / Red" or "Green / Amber / Red". The default for these devices is always "Green" or "Good" doesn't indicate a problem with the filter element should the filtration media tear or rupture.






Important Note: All gauges above were purchased with filters & photographed by Parker

Why should I change my compressed air filter element?



Operation

Differential pressure monitoring devices show the difference in pressure created by the filter element as it blocks. While in principle, this is a straight forward measurement, there are a number of parameters that can affect the measurement.

Flow

Compressed air filters are sized to match the compressed air flow rate of the system. More often than not, they are slightly “oversized.” In addition to this, the system will very rarely operate at 100% maximum flow all of the time, therefore the compressed air flowing through the filter is constantly varying. Differential pressure is proportional to flow rate, therefore as the flow rate constantly varies, the differential pressure will also vary constantly. If a user looks at the differential pressure monitoring device at any time other than at maximum flow rate, they will not get a true indication from the device.

Element Condition

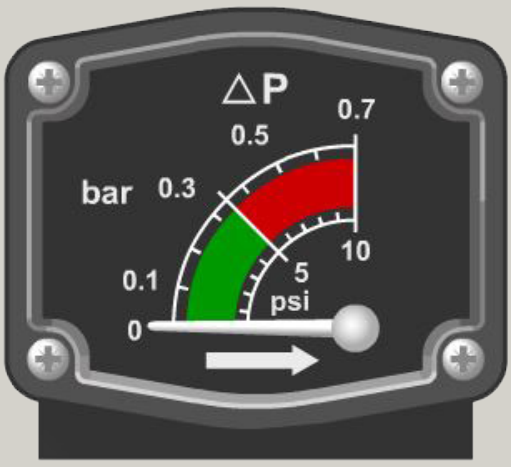
If there is a hole, tear or rupture of the filter media, the indicator would not move as the compressed air will take the path of least resistance and pressure drop across the element would be almost nonexistent.

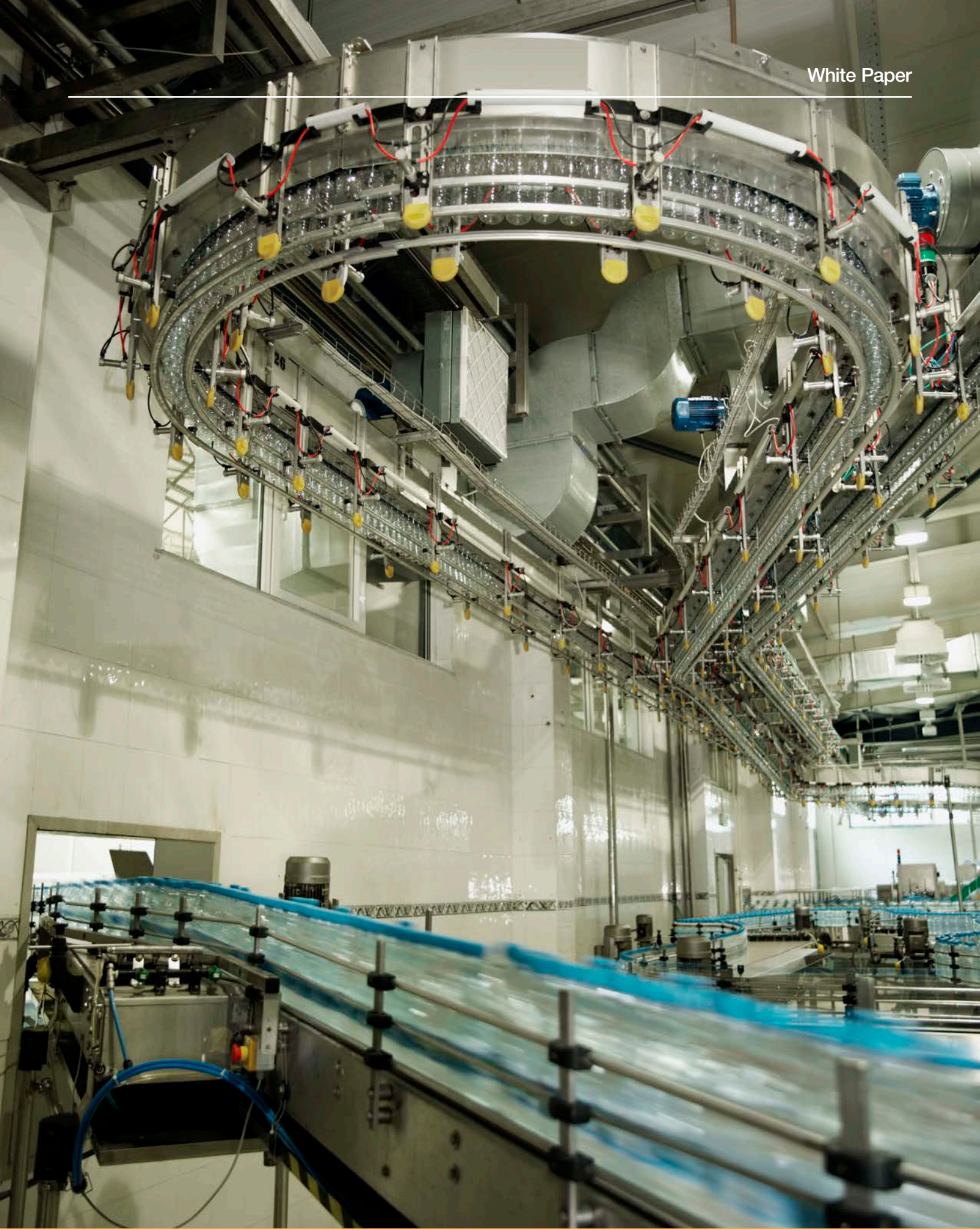
If the differential pressure monitoring device was being used as a “Service Indicator,” the needle on the device (or pop up indicator) would always indicate in the green area and the element would never be serviced until the user eventually detected contamination downstream.

By this time, it is too late and once contamination is introduced into the storage and distribution system, it is very difficult to remove and may often require specialist cleaning of piping and pneumatic equipment before the compressed air system can be operated again.

The true purpose of the differential pressure monitoring device

- The differential pressure monitoring device fitted to a filter is seen by many as a Service Indicator. This is not helped by service manuals stating “Change element when dp = xx mbar” or “Change Element when needle is in the red.”
- Additionally, it is often thought that differential pressure is an indicator of air quality or total energy consumption, again this is not the case.
- In reality, the true purpose of a differential pressure monitoring device is to indicate premature blockage of a filter element and should not be used as a filter service indicator.





Myth – DP is an indication of air quality therefore the “DP Gauge” is an air quality indicator.

Facts

Dry particulate filters are used to reduce atmospheric particulate, rust, pipescale and micro-organisms found in compressed air.

In addition to these contaminants, coalescing filters also reduce oil aerosols & water aerosols to acceptable levels.

Differential pressure is the result of a filter element collecting contamination but in no way has a direct correlation to the delivered air purity.

For example, high differential pressure and / or failure to change elements when advised can result in a tear / rupture of the filter media.

This would allow all of the contamination to pass downstream, while the DP indicator would indicate low dp of be in the “green segment”.

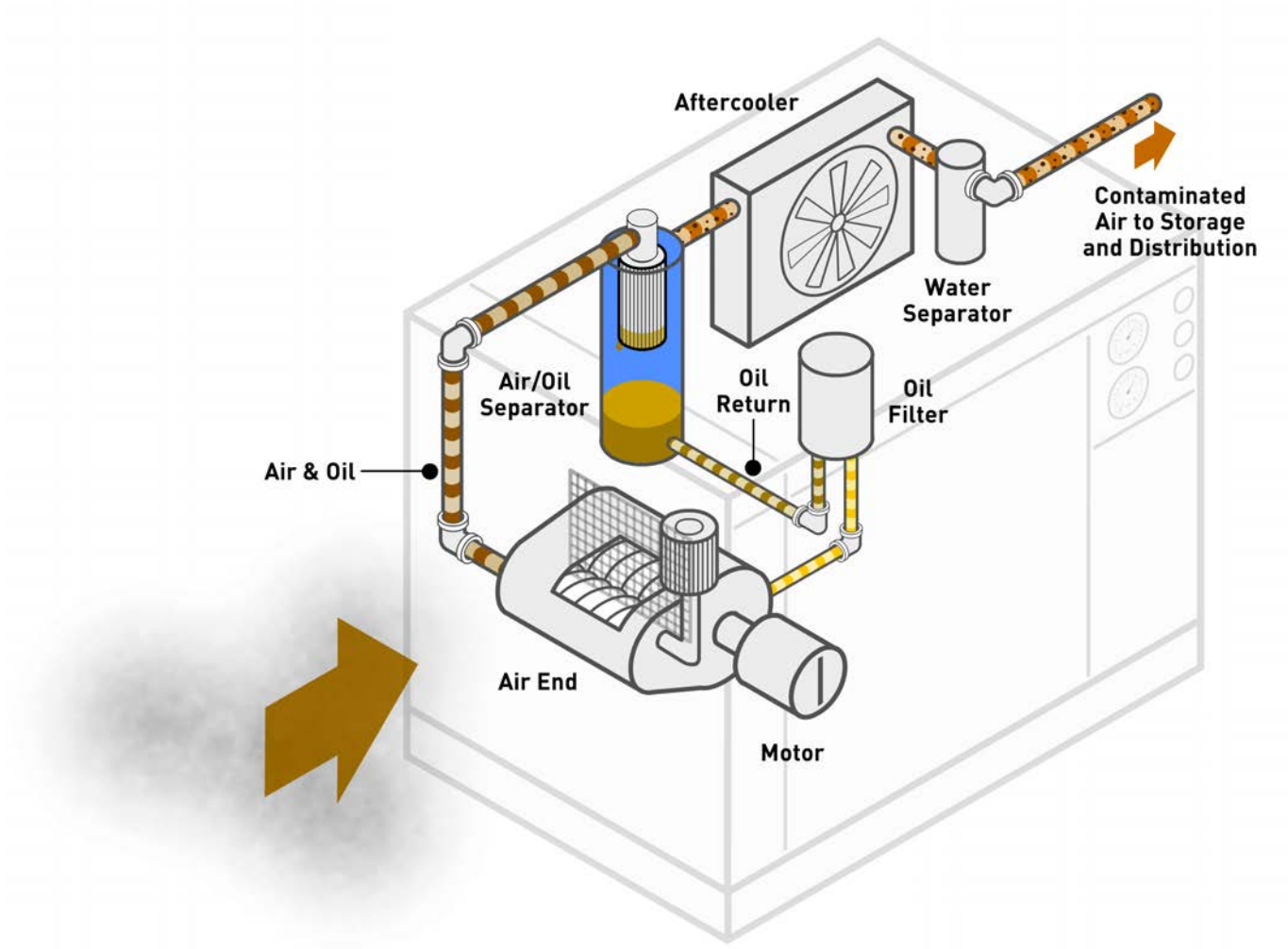
Myth – My filter is fitted with a “DP Gauge” to indicate when to change my filter element.

Facts

The devices fitted to the top of many compressed air filters are not gauges, they are a monitor or indicator. These devices are not as accurate as a true differential pressure gauge would be. They typically have an accuracy of around +/-25%. They are not calibrated nor are they available with a calibrated certificate.

Indicators, monitors or “DP gauges” should never be used as a service indicator, only as a premature blockage indicator. Always follow the manufacturers recommended instructions for element change.

Myth – Compressed Air Filter elements should only be changed when the differential pressure rises.



Facts

Differential pressure is a measurement of pressure loss in a compressed air system. To achieve a constant downstream pressure required to operate equipment and processes, an air compressor must often operate at a higher operating pressure and / or for longer periods to overcome the pressure losses.

Every 1 bar of differential pressure an air compressor must overcome is equal to approximately 7% increase in electrical consumption.

So while keeping differential pressure losses low is good practice, it is not the main reason for changing a filter element.

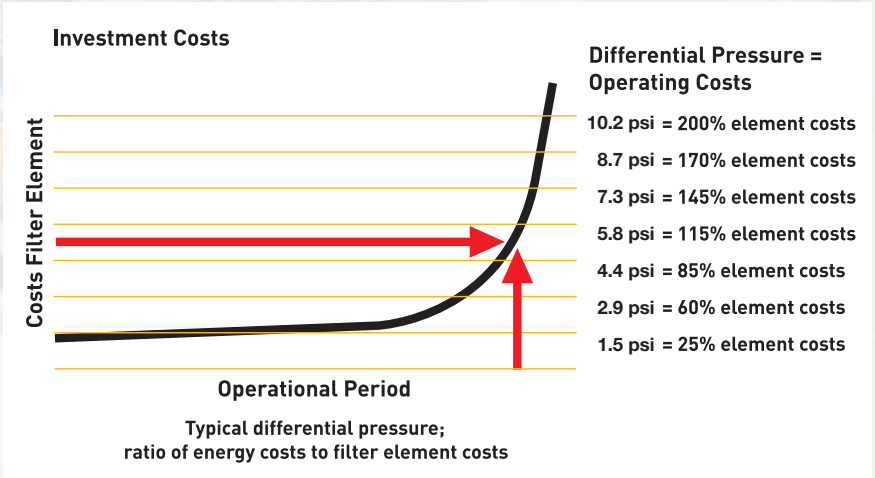
What are the benefits of regularly changing filter elements?

- **High quality compressed air - Guaranteed**
- **Protection of adsorption dryer beds**
- **Protection of downstream equipment, personnel and processes**
- **Reduced operational costs**
- **Increased productivity & profitability**
- **Continued peace of mind**

A balance between risk and cost

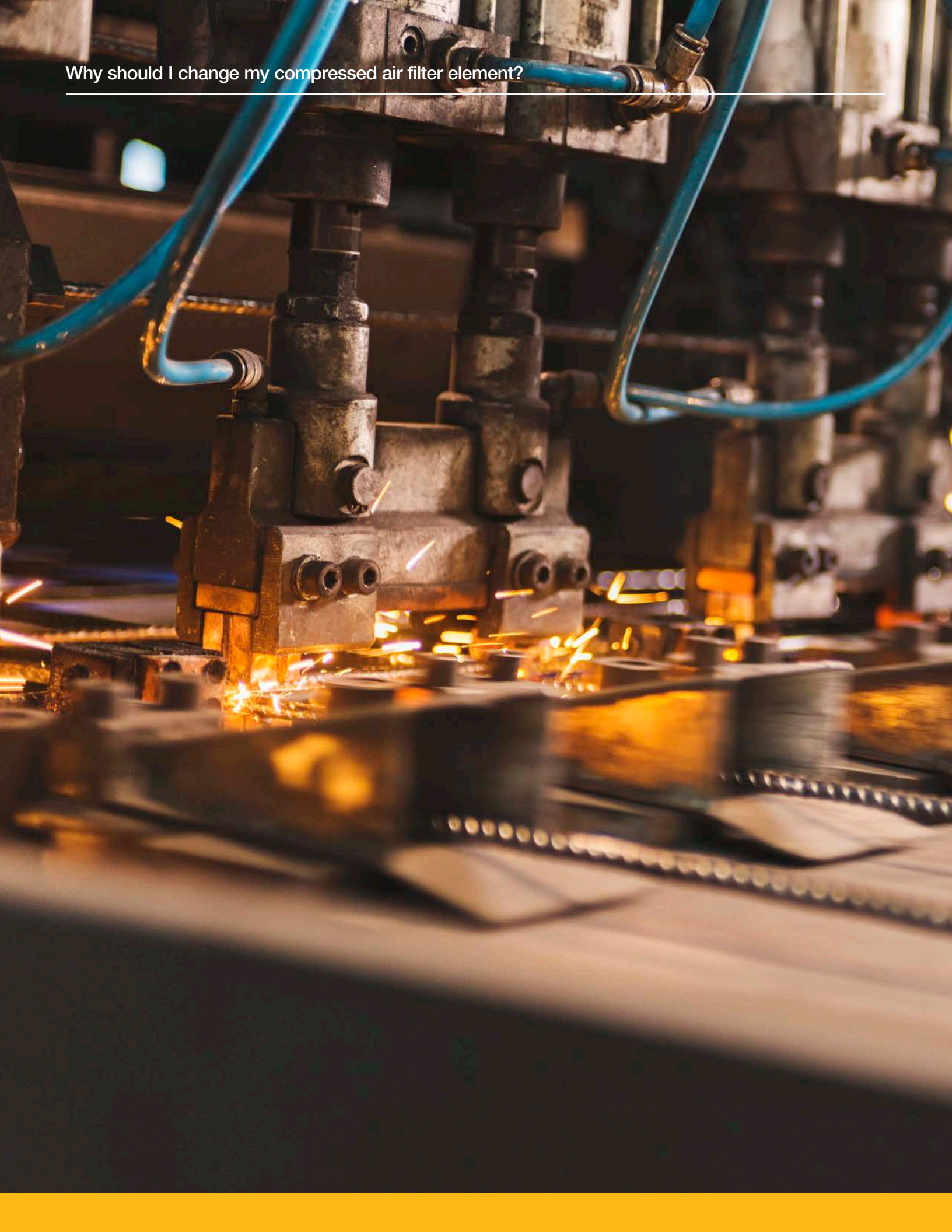
Ultimately the filter element should be replaced as previously stated based upon maintaining air quality. Consideration must also be given to system pressure losses (and therefore operating costs) as the cost of a replacement element is often significantly lower than the energy cost associated with operating with higher differential pressures.

Often the users emphasis is on the cost of maintenance and replacement parts when in reality these cost are insignificant to those associated with product spoilage should a filter element fail. What seems like a cost saving in the short term can turn out to be a costly mistake.



Typical differential pressure;
ratio of energy costs to filter element costs

Why should I change my compressed air filter element?



Frequently Asked Questions

Can I wash filter elements?

No, it is not possible to wash contamination out of the filter media. Subjecting the filter media to hot soapy water or solvent will result in damage.

My filter element doesn't look too dirty, surely I don't need to change it?

Firstly, the part of the filter element you can see is the drainage layer (responsible for preventing coalesced liquids from being carried downstream. The main filtration media is below this and is not visible without dismantling the filter element. Secondly, coalescing & dry particulate filters capture aerosols and particles down to sub-micron sizes (1 micron = 1 millionth of a metre). The best a human eye can see is around 40-50 micron, therefore, it is not possible to see if a filter element is blocked or damaged.

In the past, I've kept these filters in for years before the filter looked damaged enough to need changing – what's the problem?

The main filtration media is held within two support cylinders and although the drainage material on the outside looks intact, you can't see the filtration media. So even though the filter element looks intact from the outside, the filter media beneath can be damaged, passing contamination downstream.

Do I need to change the float drain when I change the element?

Yes. The float drain is a consumable part and should be changed annually along with the filter element. Failure to replace the float drain can result in a blocked drain and contamination passing downstream.

Can I replace the float drain with a 3rd party energy efficient "Zero Loss Drain"?

The float drain factory fitted to Parker coalescing filters is already an energy efficient zero air loss drain, there is no benefit in changing to an electronic level sensing drain.

The float drain should be changed annually with the element to ensure the air quality guarantee is maintained.

Important Note: Changing to a 3rd party (non Parker approved) level sensing drain will invalidate the air quality guarantee as the drain's performance cannot be validated and failure of the drain will result in contamination passing downstream. Additionally, the annual service costs of many electronic zero air loss drains is often significantly higher than the cost of replacing the float drain.

Are in-line adsorption filters affected in the same way as coalescing and dry particulate filers?

In-line adsorption (activated carbon) filters often use the same housings as coalescing and dry particulate filters, looking identical externally.

These activated carbon filters however work differently to coalescing and dry particulate filters. They utilize a bed of activated carbon to remove oil vapors (gaseous oil) from the compressed air. Activated carbon has a fixed capacity to adsorb oil vapor and once this is used up, their elements or cartridges must be replaced.

Smaller, in-line style activated carbon filters are typically matched to the system flow rate and pipe connections. The inlet concentration of oil vapor, the presence of liquid oil as well as the temperature, pressure and dewpoint of the air all affect the life of these elements and in-line AC elements require frequent changes throughout the year to provide technically oil free compressed air.

Worldwide Filtration Manufacturing Locations

North America

Compressed Air Treatment

Industrial Gas Filtration and Generation Division
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716 686 6400
www.parker.com/igfg

Haverhill, MA
978 858 0505
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