# Servicing Heavy-Duty Air Filter Elements

## When to Service?

The element in any heavy duty air cleaner should be serviced when the maximum allowable restriction, established by the engine manufacturer, has been reached. The element should not be serviced on the basis of visual observation because this will generally lead to over-servicing.

Over-servicing will cause increased service cost, both time and material, and may cause dust contamination of the engine due to:

1. Element damage from excessive handling during inspection
2. Increased chance of improper element installation
3. Increased initial inefficiencies

*Achieving Maximum Air Filter Efficiency*
The efficiency of an air filter increases as it is used. As soon as the air filter is put into operation, it begins to remove harmful dust particles. As these particles accumulate throughout the filter medium, the microscopic openings in the medium become obstructed. This on-going reduction in the size of the openings helps the filter stop increasingly finer dust particles, thus resulting in a more efficient filter. As the filter continues to plug with contamination, the restriction to air flow will increase. Most engine manufacturers establish a maximum degree of vacuum in the air induction system that the engine can tolerate and still operate efficiently.

## What is Restriction?
Restriction is the resistance to airflow through the air cleaner system into the engine.

## What Instruments Do We Use to Measure Restriction?
Restriction is best recorded by a water manometer, an air cleaner service indicator or a dial gauge calibrated in inches of water or kPa (kilopascal) (other units may also be used). Since some users will not have a water manometer or dial gauge available, the use of permanently mounted service indicators should be considered. The indicator can be mounted in an area where the operator can monitor the condition of the element constantly.

## How is Restriction Measured?
Accurate restriction can only be measured at maximum airflow. On naturally aspirated or supercharged (not turbocharged) diesels, the maximum airflow

occurs at maximum RPM (high idle) without regard for engine power. On gasoline, LP, or turbocharged diesel engines, the maximum airflow occurs only at maximum engine horsepower at governed RPM. Most engine manufacturers suggest a maximum allowable restriction between 15 and 20 inches of water (3.75 – 5.00 kPa) for gas and LP engines, and from 20 to 30 inches of water (5.00 – 7.50 kPa) for diesels. Exceeding these maximums will affect engine performance.

The operator should not be alarmed when the signal on the restriction indicator begins to appear. The air filter manufacturer furnished your service element to withstand several times these recommended maximums without collapsing or leaking dirt into the engine.

**Where is Restriction Measured?**
Restriction is measured in the air cleaner outlet tap (if provided), at a tap in the air transfer tube, or within the engine intake manifold.

**Measuring Restriction in Dry Air Cleaners**
As a dry air cleaner element becomes loaded with dust, the vacuum on the "engine side" of the air cleaner (at the air cleaner outlet) increases. This vacuum is generally measured as restriction in inches of water or kPa.

The engine manufacturer often places a maximum allowable limit on the amount of restriction the engine can withstand without loss of performance before the element must be serviced.

Mechanical gauges, warning devices, indicators, and water manometers are available to inform the operator when the air cleaner restriction reaches this recommendation limit. These gauges and devices are generally reliable, but the water manometer is the most accurate and dependable.

To use the manometer, hold vertically and fill both legs approximately half full with water. One of the upper ends is connected to the restriction tap on the outlet side of the air cleaner by means of a flexible hose. The other end is left open to atmosphere. With the manometer held vertically and the engine drawing maximum air, the difference in the height of the water columns in the two legs, measured in inches, is the air cleaner restriction.

A restriction indicator’s "lock-up" restriction level is generally marked on the indicator itself. A quick method to check a visual indicator is to remove it, wipe the base clean, then suck on the indicator with your mouth. If the indicator locks up, it is operational, if not, replace indicator.  A more accurate method is to check the calibration against a water manometer.

**Why Service?**
Proper air cleaner servicing will result in maximum engine protection against the ravages of dust. Proper servicing can also save you time and money by increasing filter life and efficiency. Two of the most common servicing problems are: 1) Over-servicing - new filter elements increase in efficiency as dust builds up on the media. DON´T BE FOOLED by filter appearance, it should look dirty.

By using proper filter restriction measurement tools you will use the full life of the filter at maximum efficiency. 2) Improper servicing - your engine is highly vulnerable to abrasive dust contaminants during the servicing process. The most common cause of engine damage is due to careless servicing procedures. By following the steps shown, you can avoid unnecessary dust contamination to the engine.

**How to Service: The Do´s**

*Remove the filter element as gently as possible* - Be extremely careful with the dirty element, until you get it completely out of the housing. Accidentally bumping it while still inside means dropped dirt and dust may contaminate the clean side of your filter housing, before the new filter element has a chance to do its job.

*Always clean the inside of the filter housing carefully* - Dirt left in the air cleaner housing may be harmful to your engine. Use a clean, water-dampened cloth to wipe every surface clean. Check it visually to make sure it's clean and dry before putting in a new element.

*Always clean the gasket sealing surfaces of the filter housing* - An improper gasket seal is one of the most common causes of engine contamination. Make sure that all hardened dirt ridges are completely removed wherever filter gaskets contact the cleaner housing.

*Check for uneven dirt patterns on your old element* - Your old element is a valuable clue to potential dust leakage or gasket sealing problems. A pattern on the element clean side is a sign that the old element was not firmly sealed or that a dust leak exists. Make certain the cause of that leak is identified and rectified before replacing the element.

*Press your fresh gasket to see if it springs back* - Make sure your new element is made with a highly compressible gasket that springs right back when your finger pressure is released. A quality gasket is one of the most important parts of the element. On a radial seal element the gasket surface is the inside diameter of the open end cap.

*Make sure the gasket is seating evenly* - If you don't feel the gasket is seating evenly for a perfect seal, you may not have protection. Re-check to see if the sealing surface in the housing is clean, or if the element is the correct model number. It may be too short for the housing.

*Check connections and ducts for air tight fit* - Check that all clamps and flange joints are tight, as well as air cleaner mounting bolts. Seal any leaks immediately - they mean dirt is directly entering your engine. All duct joints, from air cleaners to engine, must be tight.

*Safety element service* - The safety element should never be cleaned. For maximum engine protection and air cleaner service life, replace the safety element with a new safety element every third primary element change.

**How Not to Service: The Do Not's**

*Don't remove element for inspection* - Such a check will always do more harm to your engine than the good your inspection can do. Ridges of dirt on the gasket sealing surface can drop on the clean filter side when the gasket is released. If you utilize scheduled maintenance, stick with your maintenance schedule. If you're on restriction maintenance, follow your indicator reading; replace the indicator with a new one if you don't trust it.

*Never strike or tap an element to clean it* - only to destroy – Striking or tapping hard enough to knock off dust often damages the element and jeopardizes your engine protection. Deeply embedded dirt is never released by striking or tapping. It is always safer to keep operating until you can change to a new filter.

*Never judge your element's life by looking at it* - A dirty-looking element may still have plenty of life left, while a restricted element may appear clean. Your best bet for lowest filter maintenance costs and best engine performance is to follow a restriction indicator. It's a smart, low cost investment.

*Never leave an air filter housing open longer than necessary* - Your open air filter housing is a direct entry to your engine. If the filter is not going to be changed immediately, you are better off leaving the dirty filter in place. At a minimum, cover the opening. *Don't overlook a worn or damaged gasket in the filter housing* - If your air cleaner has a cover gasket, inspect it and replace it with a new one if necessary. Always ensure that any traces of the old gasket are removed. If your filter model calls for a new gasket with each use, never reuse the old one.

*Don't use a dented filter element* - Never install a dented or punctured element, because it cannot protect properly against contamination. A dent can make a firm seal impossible or can indicate damaged media.

*Never use a warped cover on an air filter housing* - Replace with a new cover as soon as possible. A warped or damaged air filter cover cannot make a proper seal. Also check to make sure there is no damage to the air cleaner housing that could cause a leak.

*Never substitute an incorrect element part number* - Elements may look almost identical but can differ by a fraction of an inch in length – a difference that may make a positive seal impossible. You're always better off using the dirty element until you can get the correct model.

For additional information, contact:

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