



M AINTENANCE I NSTRUCTION

MICHIANA LUBE OIL FILTERS

GENERAL DESCRIPTION

The Michiana lubricating oil filter assemblies used on EMD equipment can be broadly grouped into four categories. Each can be identified according to its appearance. There are circular tank models containing several elements, such as the models shown in Fig. 1, and multiple single element containers mounted on a common base; rectangular tank filters containing several elements; and a single element filter. The round tank and multiple element containers are used on current equipment. The rectangular and single element filters are used on early railroad equipment.

Regardless of the model of filter used with the engine, it serves the prime function of removing oxidation and contamination products from the oil that may have been taken up by the oil as it circulated through the engine. Oil is taken from the engine sump by the scavenging oil pump and is forced through the oil filter. Cleaned oil leaving the filter is returned to the engine.

Filter elements, Fig. 2, are used to clean the oil. The element used in the filter may consist of a perforated metal container which encloses a replaceable filter, or an integral element consisting of an outer perforated shell of hard paper board enclosing a pleated paper filter material and having a perforated center tube. A filter element may also consist of an inner perforated metal tube which is completely covered by a specially packed cotton wastex filled woven cloth sock. The sock is securely fastened to the inner center-tube. Cotton waste elements are classed as cageless and non-cageless.

They are similar in construction but the cageless type has an extra sock covering. Non-cageless elements must be used inside a perforated filter shell. A cageless element can be used as is, without a shell, in filter assemblies constructed or modified to accommodate the cageless element.

Circular Tank Filters

The circular tank model filters can be divided into two designs; the seven-element and the four-element types.

SEVEN-ELEMENT FILTER

Representative views of the seven-element filter are shown in Fig. 1. A hinged cover closes the open end of the tank and is held tightly by the cover hold down bolts. A gasket is used between the cover and the top of the tank to prevent oil leakage during operation. Flanged openings are provided for the oil inlet and outlet connections and for filter housing vent and drain lines. When the filter is installed, a separate drain line (not shown) extends from the filter to a valve in the engine mounted strainer housing. The valve is opened to provide quick draining of the filter during maintenance by permitting oil to return to the engine oil pan.

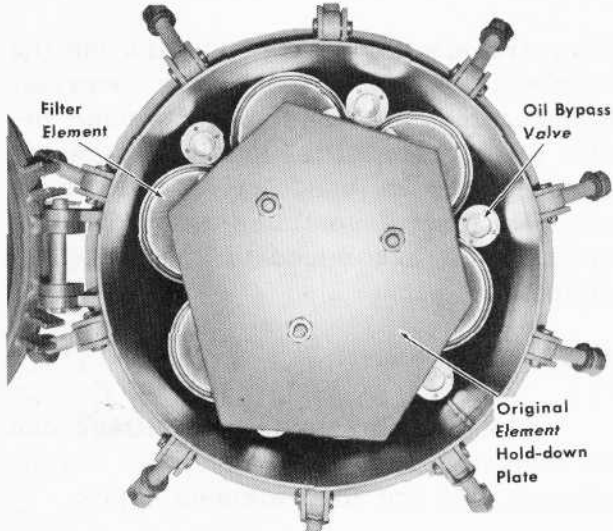
Internally, the filter is divided into two compartments by a false bottom or separator plate about five inches above the true bottom, the portion above the false bottom being the element compartment which receives the unfiltered oil. The lower portion is the discharge compartment which receives the oil after it has passed through the filters.

* This bulletin is completely revised and supersedes M.I. 1604.

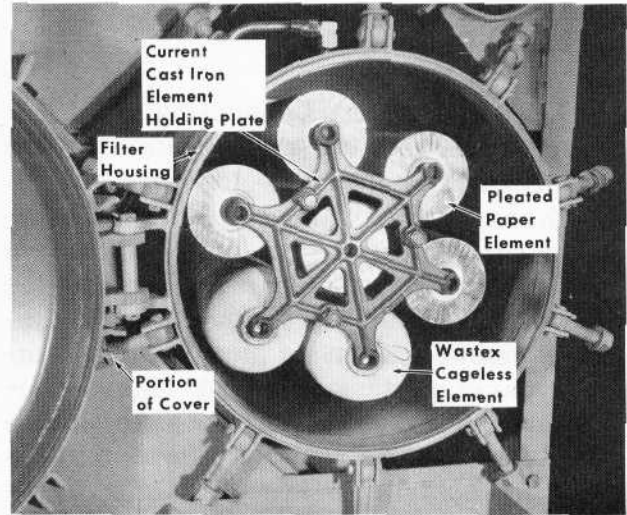
Seven center tubes are provided in the element compartment to support the elements. The center tubes are permanently fixed in the false bottom of the filter. Drilled holes in the center tubes allow the filtered oil to enter the hollow center of the tubes and flow into the dis-

charge compartment. Provision is made at the bottom of the center tubes to support and seal the bottom of the elements.

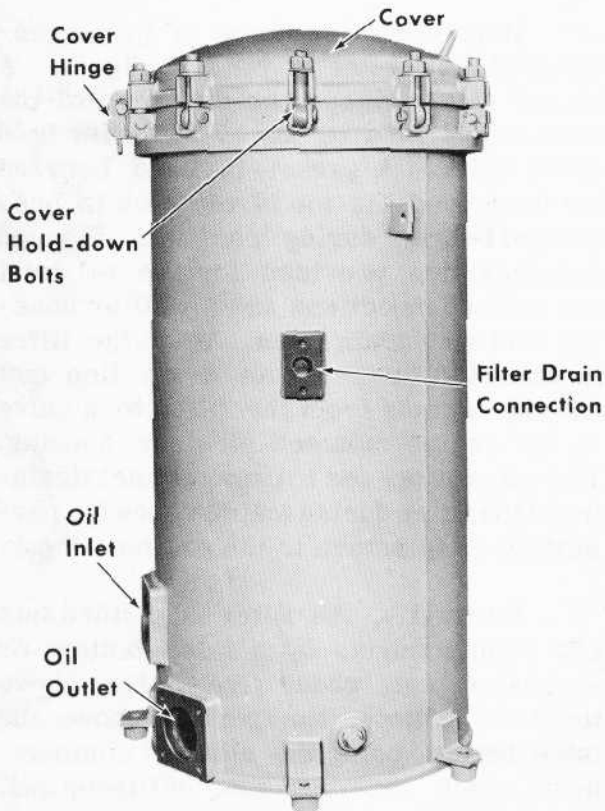
The filter elements are placed over the center tubes and held at the top by a hold down plate, shown in Fig. 1. (See



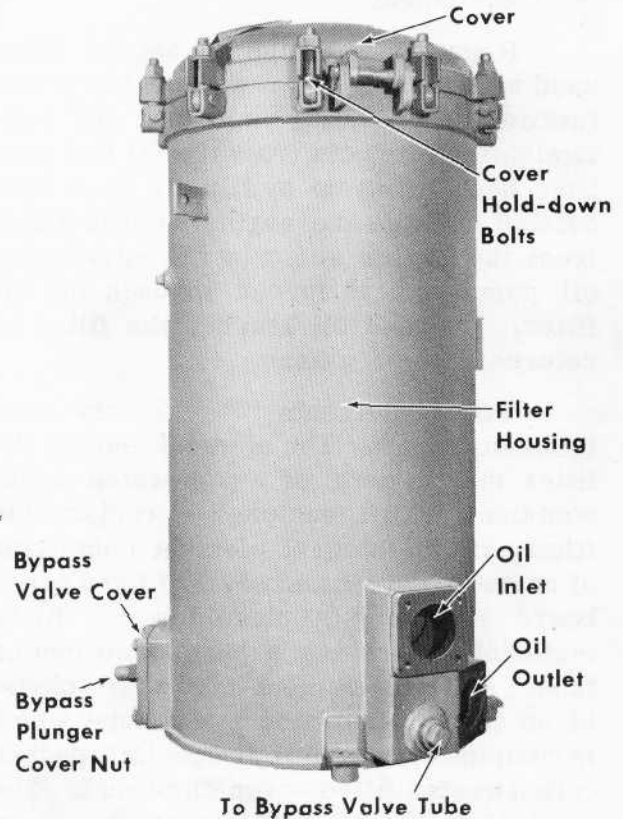
Cover Open



Cover Open



Filter 8272268



Filter 8291381

Fig. 1 - Representative Views Of Seven-Element Filters

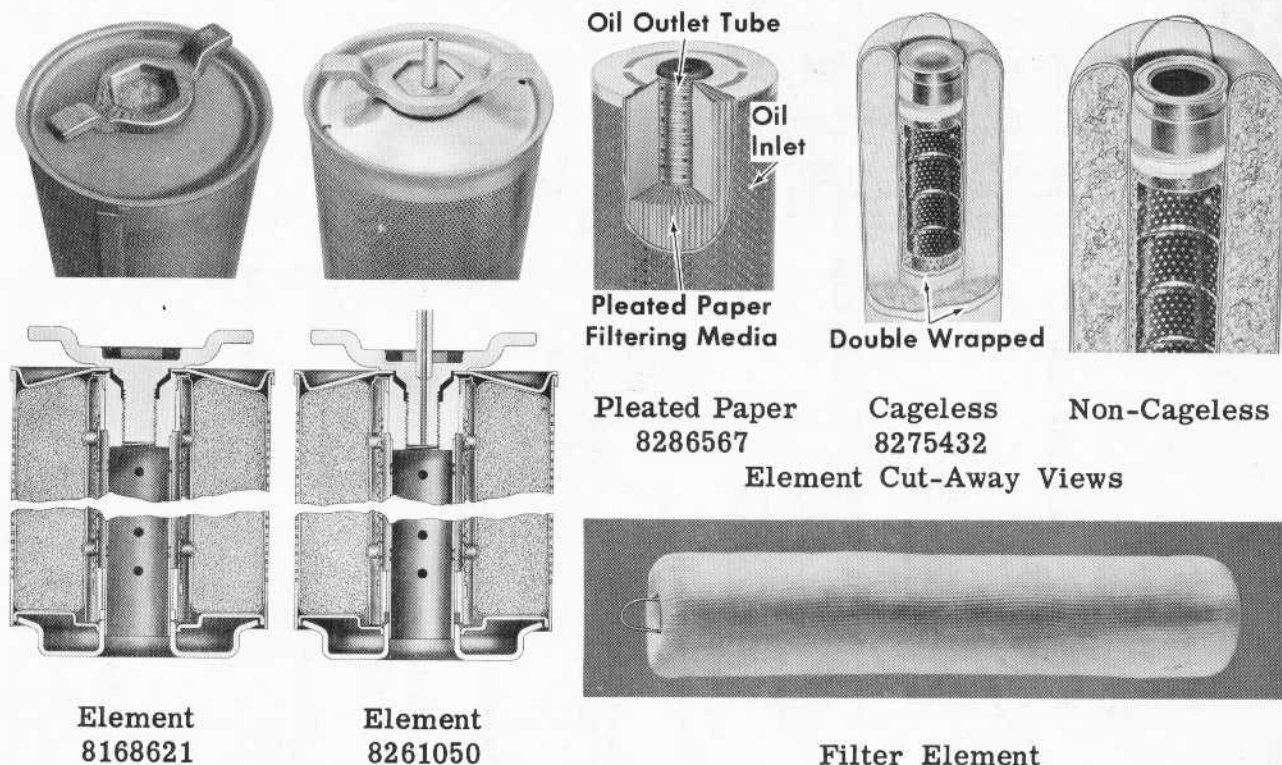


Fig. 2 - Filter Elements

Maintenance for modification of original filter plates.) The plate is in turn held by nuts on three threaded rods extending through the plate and attached to the false bottom of the filter. A baffle at the oil inlet of the housing prevents direct impingement of the incoming oil against the filter elements.

Provision is made in the filter to permit oil circulation in the event of cold oil or dirty filters. The oil begins to by-pass the filter at differential pressures greater than 17 psi. The original model seven-element filter 8272268 is equipped with five separate by-pass valves as shown in Fig. 1. The current model seven-element filter 8291381, Fig. 1, has a single by-pass valve, having a relieving capacity equal to the five by-pass valves on the previous filter.

The by-pass valve arrangements on the filters are shown in Fig. 3. The single spring loaded by-pass valve closes the end of a tube extending into the discharge oil compartment of filter 8291381. The opposite end of the tube is open to

the oil inlet to the filter. If oil under pressure opens the valve, a portion of the oil is by-passed directly into the discharge oil compartment. The by-pass valve is held in place in the tube by three springs which are between the inside of the valve cover and the valve cage. A tell tale plunger is pushed outward when the valve opens and must be manually pushed in again to reset it. To check whether the valve has opened, the plunger cover nut is removed and the position of the plunger observed. The individual by-pass valves in filter 8272268 are located inside the filter at cartridge height. Each valve consists of a valve body, piston spring and headless plug. The valves are threaded at the bottom to screw on the extended pipe. Oil passing through the by-pass valve continues through the extended pipe into the discharge compartment.

Filter Elements For Seven Element Filters

The type of filter elements used in the seven-element filter depends upon the application of the filter.

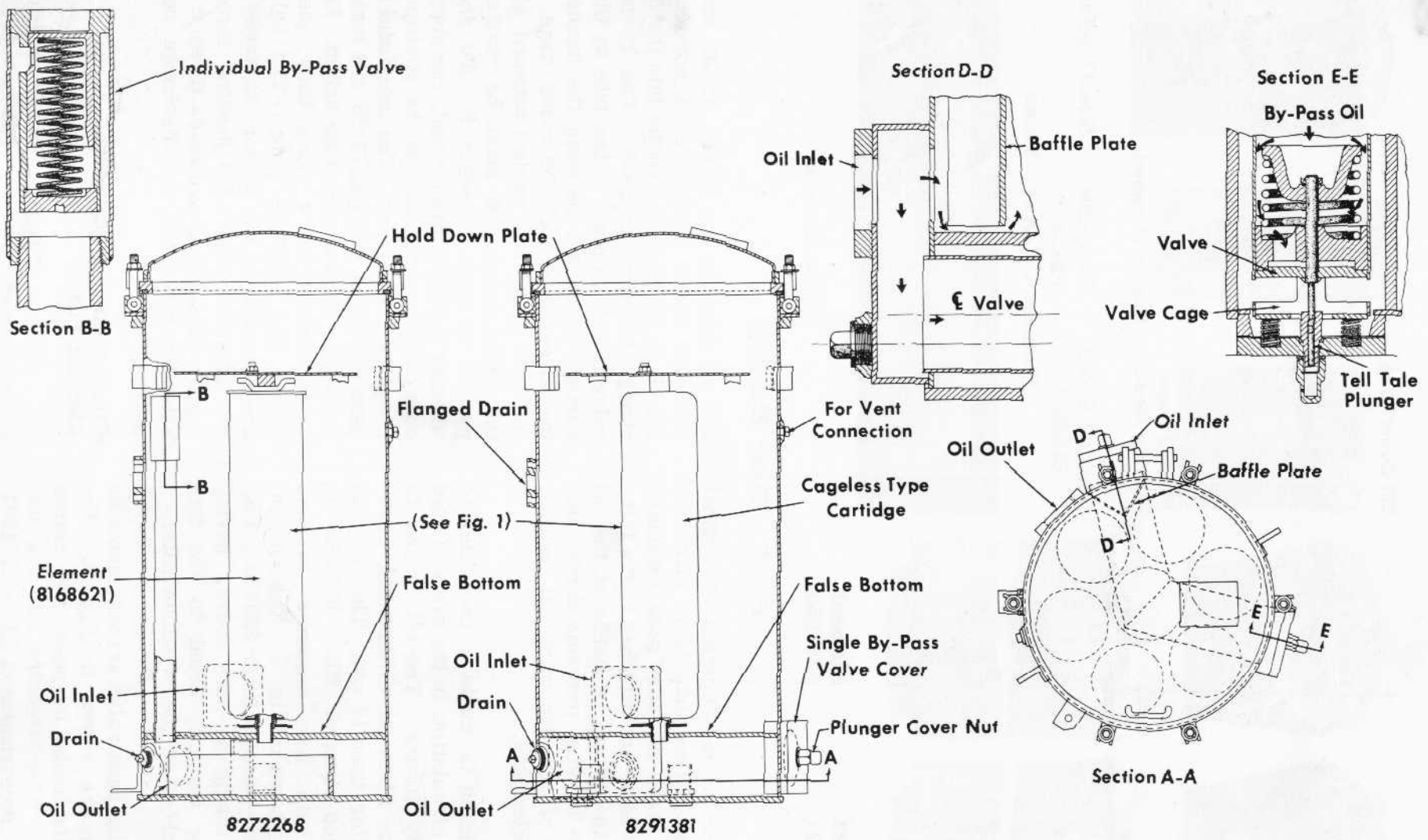


Fig. 3 - Seven-Element Michiana Filter Details

The seven-element filter in locomotives equipped with turbocharged engines uses two (2) cageless design cotton waste elements 8275432 and five (5) pleated paper elements 8286567. In this installation full flow filtration of the oil, essential with turbocharged engines, is provided.

The seven-element filter installed in nonturbocharged engine equipped locomotives, Models SD18 and GP18, used seven cotton waste elements 8262493, installed

in perforated metal shells. However, the seven-element filter in current production SD18 and GP18 locomotives is equipped with cageless element 8275432, and this element may be used in the original filter with or without an element container.

FOUR-ELEMENT FILTER

Circular tanks having four elements, similar to Fig. 4, are used on locomotives,

Caged element assembly, 8168656 shown. Cageless element 8275432, can be used.

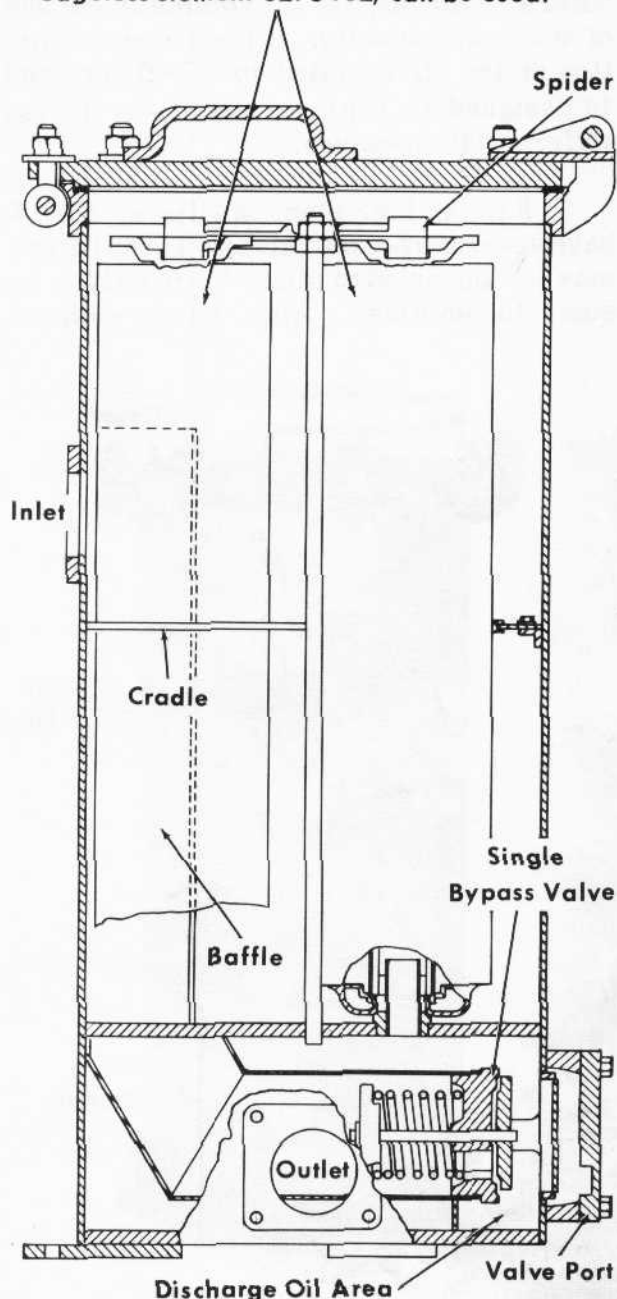
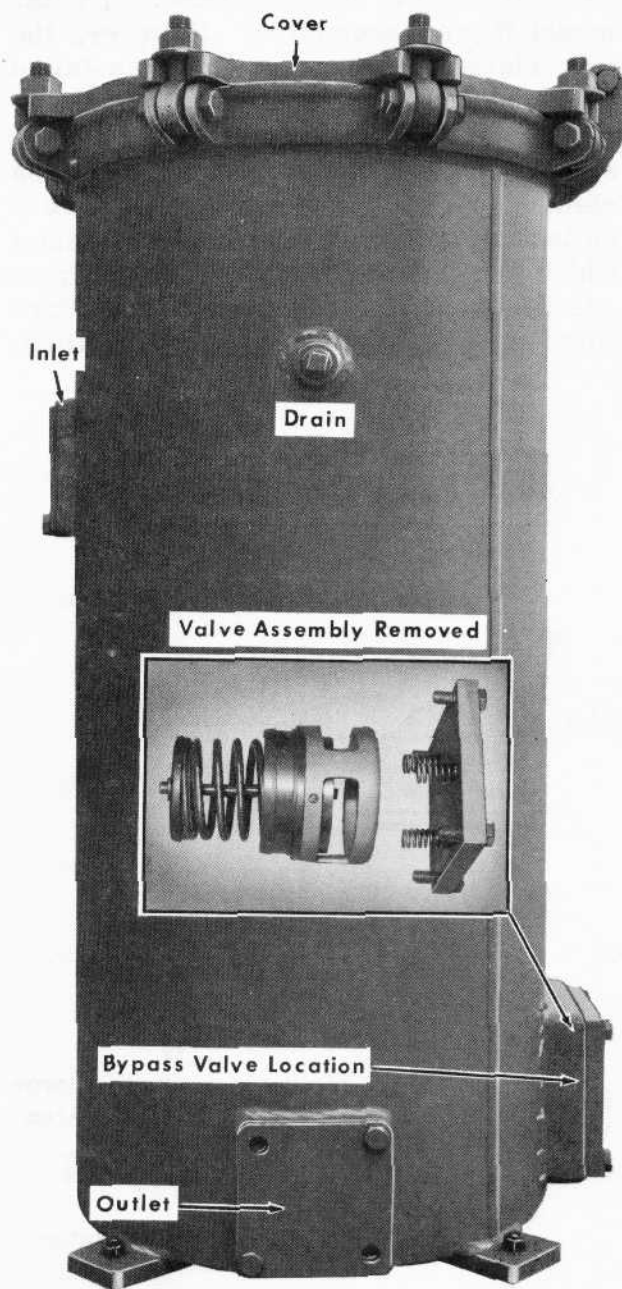


Fig. 4 - Four Element Single By-Pass Filter Assembly

mounted either horizontally or vertically. As shown, the four elements are held against the false bottom by a spider plate which is secured by a threaded rod and nut. The filter elements used in the circular tank are closed at the top and discharge the filtered oil out the bottom center opening into the space between the false and true bottoms of the tank. The nonadjustable spring loaded by-pass valve located in a passage between the element compartment and the discharge oil space, permits oil circulation in the event of dirty filters, cold oil, or oil volume in excess of element capacity. It by-passes a portion of the oil supplied to the filter, and is designed to begin to relieve at 17 psi differential pressure.

Earlier four element filters, Fig. 5 have several by-pass valves. These filters may be converted to single by-pass type on some locomotives. Also, seven element

filters can replace four element type on some locomotives. Replacement on "F" type locomotives is outlined in Modification Instruction 9524. Information on other replacements can be obtained on request.

Filter Elements For Four Element Filters

Cotton waste element 8262493, installed in a perforated metal shell, is basically used in all four-element circular model filter assemblies. However, the four-element filter assemblies installed in domestic model locomotives such as GP9, SD9, F9, E9, SW900 and SW1200, since February, 1959, can use cageless element 8275432. These filters have a deflecting baffle installed at the oil inlet which protects the cageless element from possible erosion of the outer cover. Earlier four-element filters can be modified,

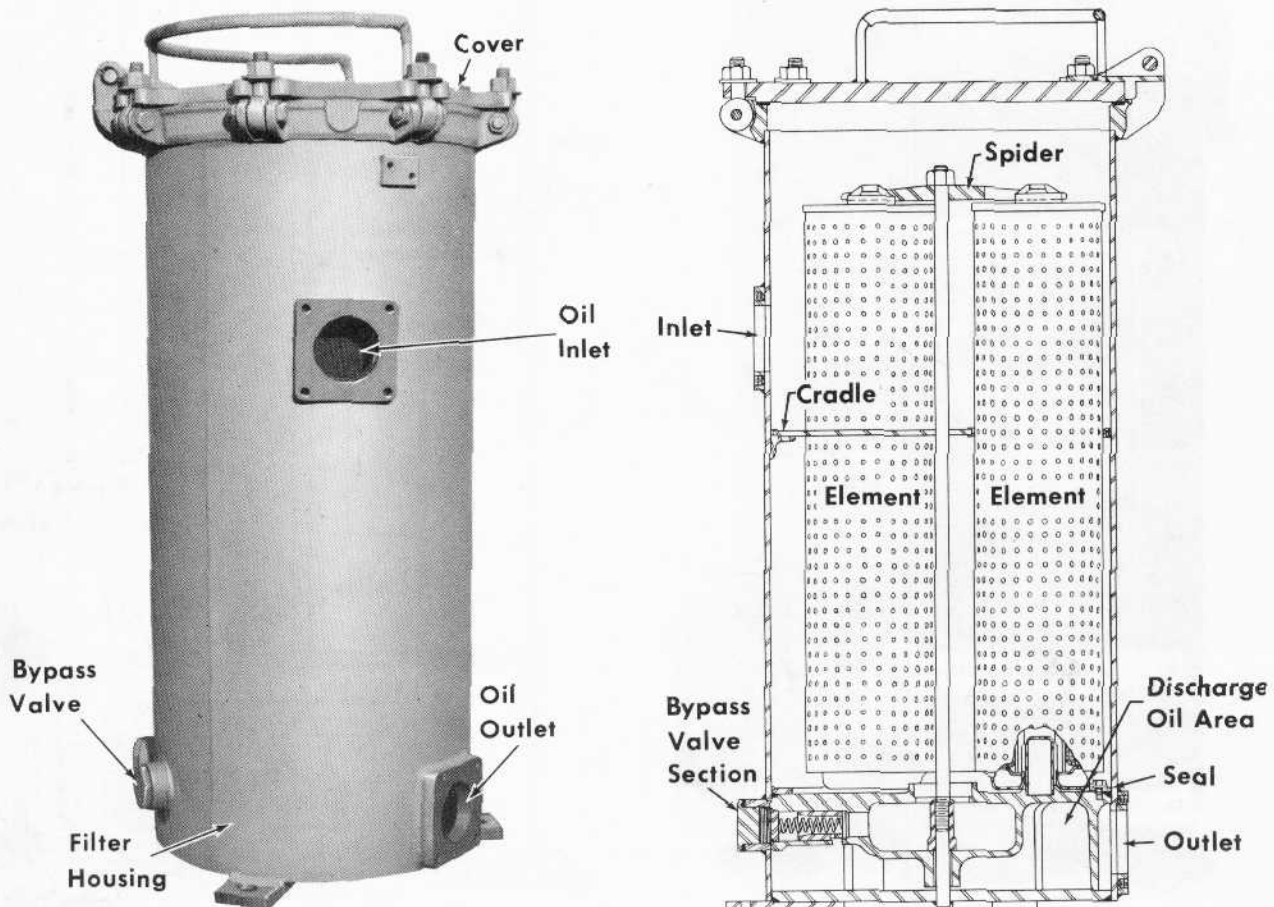


Fig. 5 - Four-Element Filter

as shown in Fig. 6, to accept the cageless element 8275432.

Caged elements 8168656 are basically used in single by-pass filter assemblies applied to export locomotives, however, cageless elements 8275432 can be used in these filters if desired. Cageless type elements should not be used in multiple by-pass valve type circular four element filter assemblies installed in export locomotives, because the position of the filter and location of the oil inlet precludes their use.

Multiple Tank Filter Assembly

A ten-element, multiple tank filter assembly is shown in Fig. 7. Ten individual filter housings are mounted on a common base. Filters similar to that

shown in Fig. 7, having two or six individual housings mounted on a common base, are also used. Each housing accommodates one filter element.

The base is divided into inlet and outlet oil manifolds, as shown in Fig. 8. The filter housings are located above openings to these manifolds so that the outside of the filter element is connected to the inlet manifold and the center or discharge portion of the element is connected to the oil outlet manifold. A number of by-pass valves are located between the manifolds so as to by-pass oil around the filter elements in the event of high pressure caused by cold oil or dirty elements, or oil volume in excess of the element capacity. Flanged pipes to each manifold are provided for external oil line connections.

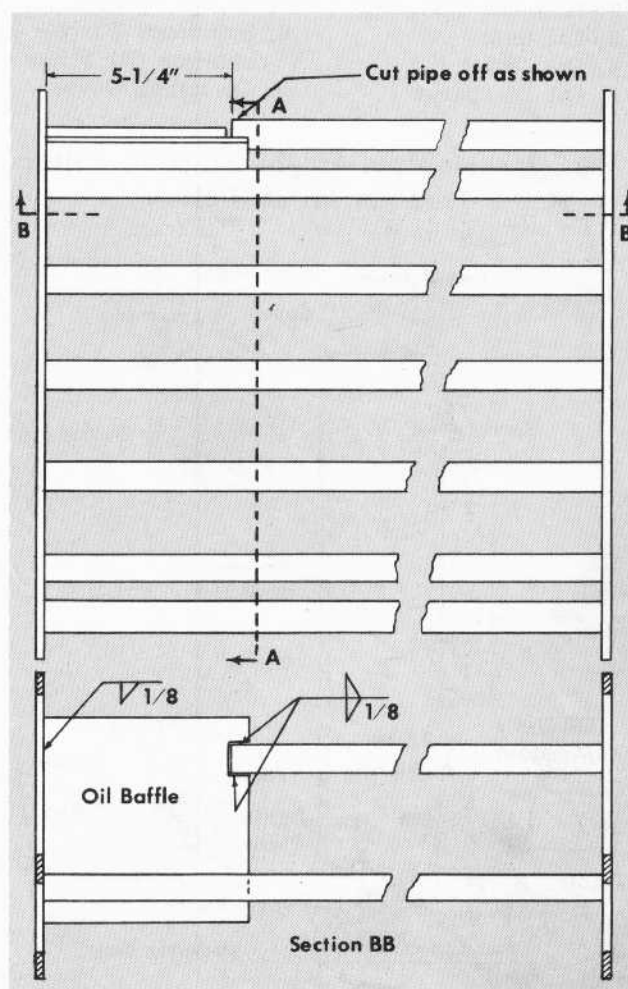
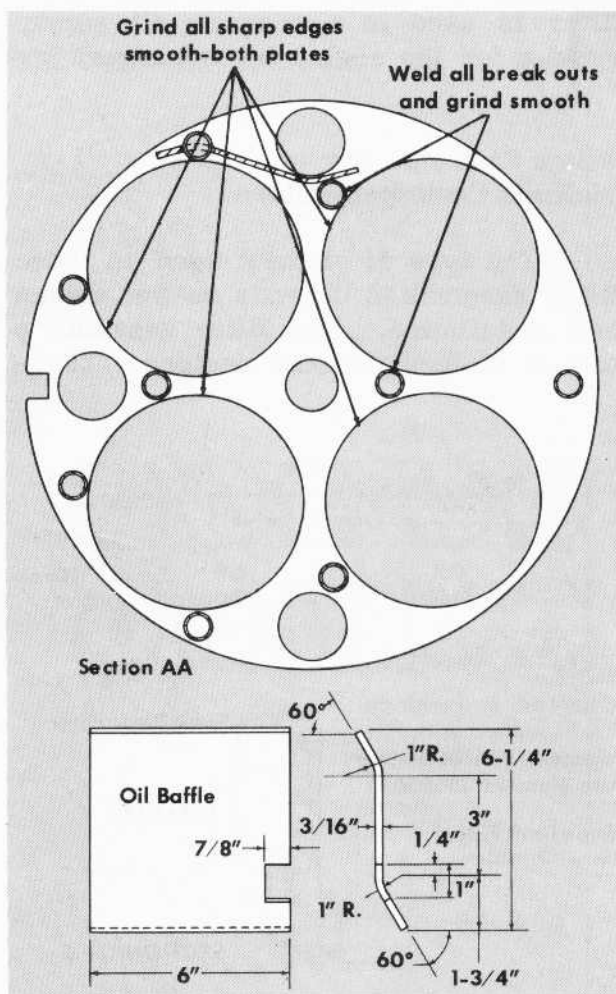
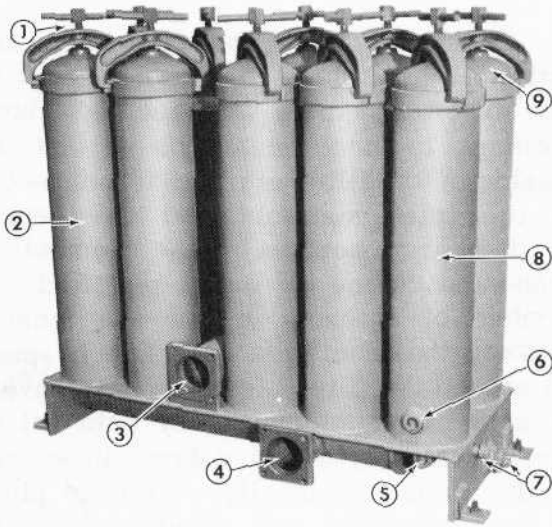


Fig. 6 - Modification Of Four Element Filter Cradle

Each individual housing is provided with a removable cover to permit application and removal of the filter elements. A spring at the underside of the cover



- | | |
|------------------------|----------------------------------------|
| 1. "T" Handle And Yoke | 6. Oil Inlet |
| 2. Element Container | 7. Filter Drains |
| 3. Oil Inlet | 8. Individual Turbo-charger Oil Filter |
| 4. Oil Outlet | 9. Container Cover |
| 5. Oil Discharge | |

Fig. 7 - Multiple-Single Element Filter Used On MP36 Units

contacts the top of the element and holds it down when the cover is applied. A tee handled screw, at the center of a yoke bridging the shell, is used to hold the cover against a gasket at the top of the housing.

Later filter assemblies have a baffle plate, Fig. 8, between the element and the oil inlet, to prevent direct impingement of oil on the element. Filter assemblies having the baffle may use the cageless type filter element, unless specified otherwise.

The multiple tank filter assembly installed on MP units has one housing, Fig. 9, separated from the others which does not connect to the oil inlet and outlet manifolds common to the other nine housings. It has its own one-inch oil inlet and outlet pipe connections and an individual one-half inch drain pipe. This filter is used in a separate oil supply system for the engine turbocharger.

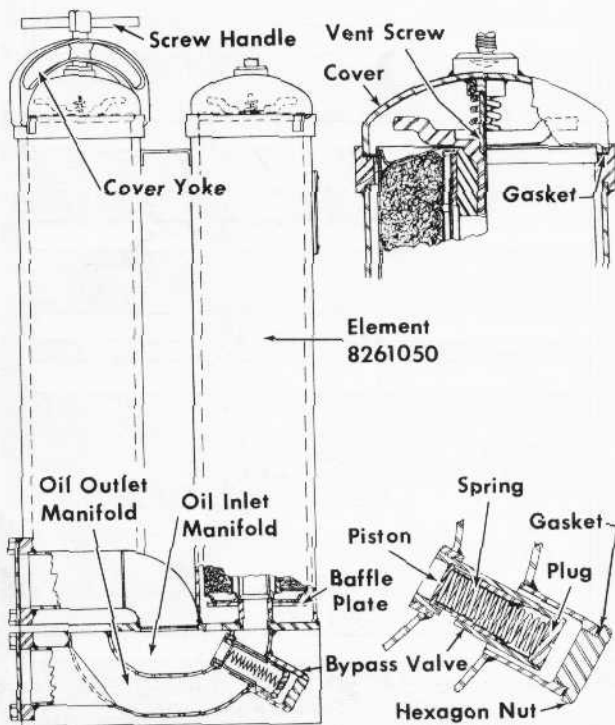
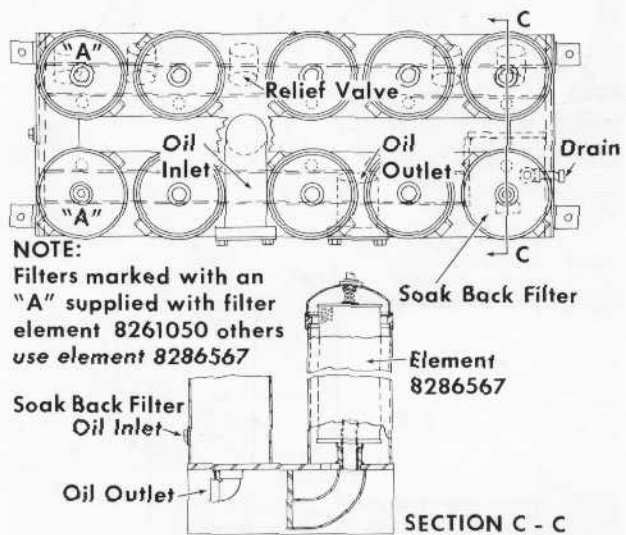


Fig. 8 - Cross-Section Drawing Of Multiple-Single Element Filter

Filter Elements For Multiple Container Filters

The type of element used in these filter assemblies depends on the design and installation. The filter assemblies can be divided into two designs. These



NOTE:
Filters marked with an "A" supplied with filter element 8261050 others use element 8286567

Fig. 9 - Power Unit Filter Details

are the current designs having an integral vent arrangement, and the earlier filters which were originally equipped with external vent lines from each housing. The filter assembly installation on the MP unit differs from the others inasmuch as it is equipped with different cartridges.

The internal vent design filter assemblies are 8249387, 8253177, and 8248239. These filters replace prior external vent filters 8207645, 8214050, and 8212458, respectively. Internal vent filters use a flat design cover gasket 8253898 and the external vent filters use a square cross section gasket 8213372, and these gaskets should not be interchanged. External vent filters may be changed to internal vent design as outlined later.

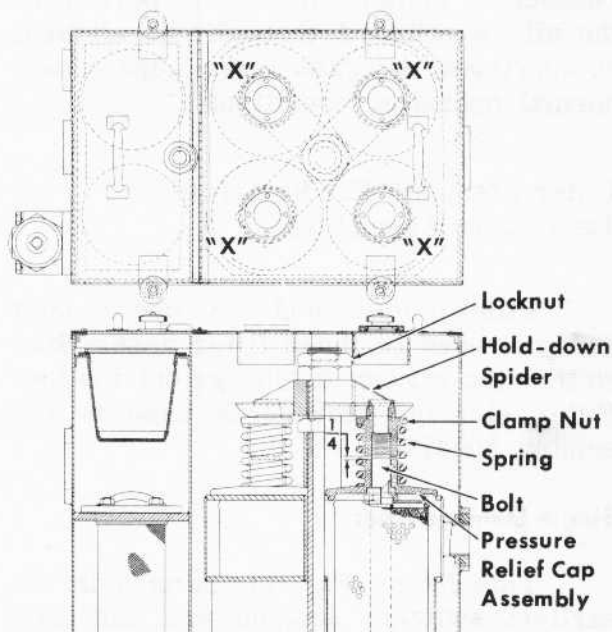
Filter element assembly 8261050, Fig. 2, is used in all internal vented filters except the MP unit installation as subsequently outlined. This assembly consists of element 8262493 installed in a perforated metal shell having center tube 8052879, and a vented design cover screw, 8252176.

The turbocharged 567D4 engine used on the MP unit installation requires full flow oil filtration. To provide this, two filter element assemblies 8261050 and eight pleated paper elements 8266567, shown in Fig. 2, are used. The cotton waste elements are used in the two end filter housings, marked "A" in Fig. 9. All the remaining housings contain the pleated paper element 8286567.

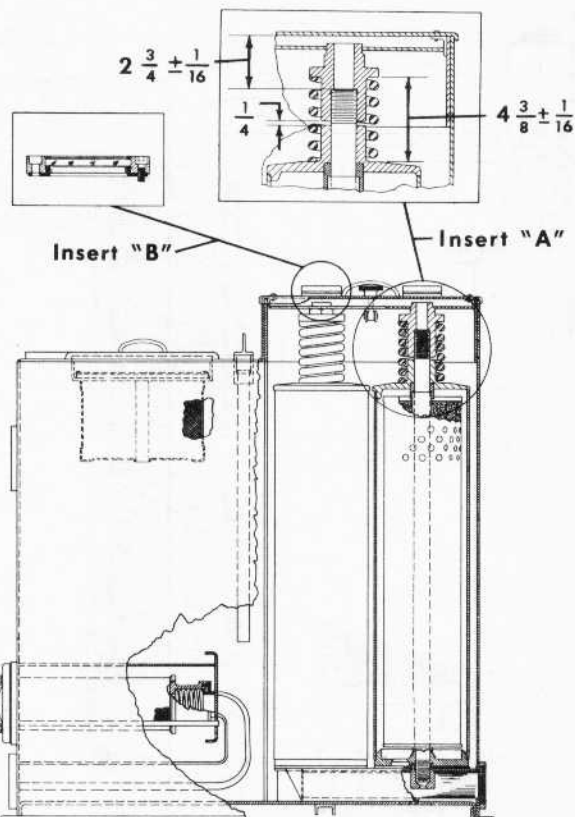
Rectangular Tank Filter Assembly

The rectangular design filter assembly is used on early model locomotives. Representative drawings of these filter assemblies are shown in Fig. 10. Inlet oil to the filters either enters the element compartments from the bottom or the side and after passing through the filter, discharges out the top. Four sight glasses, in the tank cover, each directly above an element discharge, allows visual observation of the oil flowing from

each element. Spring loaded caps on each filter element serve as by-pass valves



E7 Locomotive Filter Assembly



E6 And Early Switcher Locomotive Filter Assembly

Fig. 10 - Rectangular Tank Filter Assemblies

relieving at about 20 psi and as a means of securing the filter elements in their respective compartments. A portion of the oil is relieved through the element compartment by-pass valve caps under normal operating conditions.

Filter Elements For Rectangular Tank Filter Assemblies

Filter element 8054713, open at both ends, is used in these filter assemblies so that the oil can discharge out the top. Filter element 8262493 is used in assembly 8054713.

Single Element Filter

This filter, Fig. 11, is used in the earliest switcher locomotives and uses element 8262493 in element assembly 8168621.

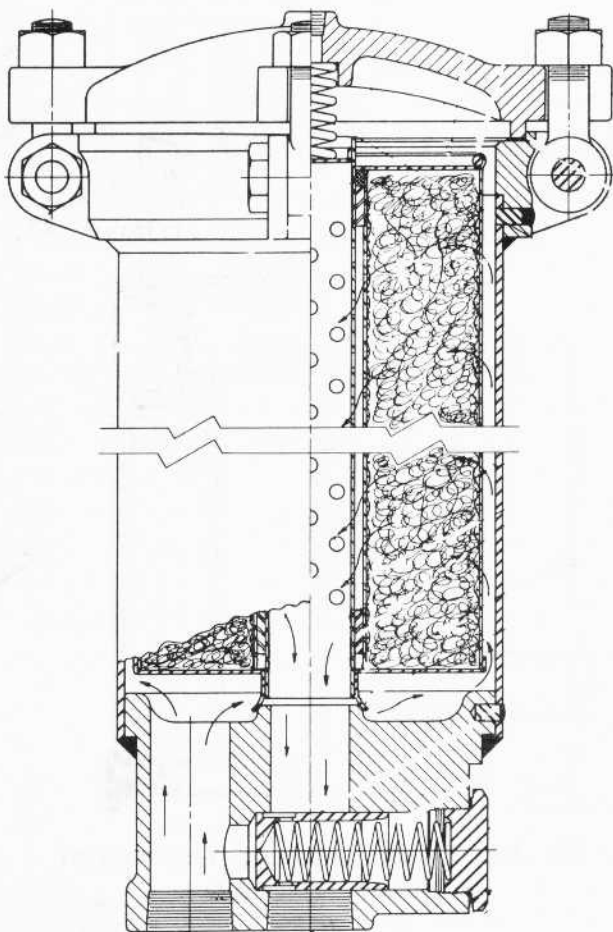


Fig. 11 - Single Element Filter

Filter Elements

There are nine different filter elements for use in lube oil filters as listed below. Elements having a small tube diameter are to be used in perforated shells that do not have center screens. Those with a large tube diameter are to be used with shells having center screens.

| Part No. | Tube Diameter | Remarks |
|----------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8275432 | Small | Cageless type having colored waste. Used in 7 and 4 element filter tank having inlet baffles. |
| 8286567 | Small | Pleated paper element type cartridge. Used in turbocharged engine filter assemblies and rebuilt engine filters to give full flow protection on initial oil charge |
| 8262493 | Large | 100% white wastex. |
| 8281232 | Large | 50% white and colored wastex. |
| 8262493 | Small | 100% white wastex. |
| 8281231 | Small | 50% white and colored wastex. |
| 8168621 | | Consists of a perforated shell, wastex element 8262493, screened center tube, element cover and cover wing bolt assembly 8168656. |
| 8261050 | | Same as element 8168621 except has vented design cover wing bolt assembly 8252176. |
| 8054713 | | Consists of a perforated shell, wastex element 8262493, screened center tube, element cover, cover snap ring and element handle. This element has a center opening at each end. |

Full Flow Oil Filtration On Rebuilt Engines

When engines are operated for the first time after being rebuilt, there is a possibility of foreign material finding its way into the lube oil system. To protect against this possibility, it is recommended that the system be given full flow filtration during initial operation.

A percentage of the oil is always being by-passed when conventional wastex cartridges are used in the filter. To provide full flow filtration the pleated paper filter element 8286567 is used in place of the wastex elements. The paper element should be used during the break-in and load test period, which normally does not exceed eight (8) hours running time. (It should be noted, however, that paper elements in conjunction with two wastex cartridges are used in all turbocharged engine filter assemblies.) Paper elements remove all the foreign material larger than fifteen microns, but do not control the carbonaceous contaminants in the oil as effectively as the wastex cartridges over a sustained period of operation.

When operating at full engine speed with maximum oil flow, the pressure drop across clean filters in a seven-element housing will be about 5 psi. The drop will be about 8 psi in a four-element installation due to the increased flow of oil each element must handle. In either case, the pressure differential between the inlet and outlet is less than the amount required to open the by-pass valves, so full flow filtration is assured. It is important to make sure that the by-pass valves are not stuck open and their opening pressure is not less than 17 psi.

Care should be taken not to over-torque the nuts on the cartridge hold down spider since this will cause crushing and cracking of the paper pleats in the cartridge. Approximately 25 lbs. torque applied to the hold down nuts is sufficient to hold the elements, yet not crush their center tubes.

It is also recommended that a 0-30 psi gauge be installed in the vent line at the top of the filter to note any excessive pressure rise during operation, which would indicate increased restriction to flow caused by a clogged filter.

After the break-in run, the paper filters should be removed and replaced by the basic filter elements used. The paper filter elements may be retained for reuse provided that the inlet oil pressure in the housing did not exceed 12 psi during operation at full speed with hot oil and that inspection of the cartridges does not reveal any cracks or holes in the paper pleats. If they qualify for reuse, they should be carefully stored to protect them from dirt and damage, otherwise the paper cartridges should be discarded.

Since the pleated paper elements are closed at the top they cannot be used in rectangular filter tanks.

MAINTENANCE

Changing Cartridges

Cartridges should be changed at intervals given in the Scheduled Maintenance Program for the type of equipment used. However, unusual operating conditions will require filter changes other than on a scheduled basis. In the event of lube oil contamination, engine breakdown because of parts failure, or in some cases when changing types of oil, it will be necessary to change filter cartridges. See preceding item covering full flow filtration of rebuilt engines. Also refer to the latest revision of the instruction covering flushing of the oil system.

Installing Elements

Care should be taken to install the filter element which is correct for the type of tank in which it is to be used. Closed center tube elements are used in round tanks and open center tube elements are used in rectangular tanks. Vented type elements should be used in multiple

single container shells without vent piping and conventional elements in those with external vent piping. It is suggested that sufficient spare perforated shells be kept on hand so that immediate reconditioning is not necessary.

Check the center tube seats when installing the elements to determine that there is no foreign material on the surface which will prevent proper seating of the element or cartridge. Check the element covers to make certain that the screw, snap ring or handle holding it are tight and properly applied.

Be sure that the plugs at the upper end of the elements are properly aligned with the centering bosses on the hold down plate. Approximately 25 ft-lbs. torque should be applied to the hold down nuts when using cageless cartridges or pleated paper elements.

Handles should be removed from open tube assemblies 8054713 after installation in the rectangular tanks. The handles interfere with the by-pass valve assembly bushing used in this application. The elements should be aligned properly so that the by-pass valve assemblies and internal tube (where used) are tight and that the spider will hold them during operation.

Cleaning Filter Assembly Tanks

At intervals listed in the Scheduled Maintenance Program corresponding to lube oil change periods, lube oil filter tanks should be cleaned thoroughly. Wash and flush tank interior, using petroleum solvent. Drain and wipe out using only bound edge towels. Be sure discharge area between true and false bottoms of the tanks does not contain trapped cleaning solution.

By-Pass Valves

It is recommended that the filter by-pass valves be removed, cleaned, and inspected, at intervals specified in the Scheduled Maintenance Program.

A weak or broken by-pass valve spring or one held open will allow more than the normal amount of oil to by-pass the filter and permit undesirable oil by-passing on filters used with turbocharged engines.

The by-pass valves are located toward the bottom, or discharge end of the filter, on other than seven-element or rectangular tank filters, and may be identified by their hexagon head plugs. The separate spring type by-pass valves are located inside the oil discharge compartment of the four and seven element filter assemblies. No regular maintenance is required on single relief valve assemblies.

After draining the tank, remove the hexagon plug, slotted head screw plug, spring and piston.

Clean and inspect the parts and check the springs for proper tension. Minimum length of springs should not be less than 2-7/8" under a load of 30 lbs.

Reassemble the valves by inserting the piston, closed end first, and insert the spring. Apply the spring screw plug all the way to its stop. Apply a new gasket on the hexagon plug and tighten the plug in place in the filter.

On seven element filters the by-pass valves are screwed into stand pipes inside the filter. To remove these valve assemblies, use special spanner wrench 8277270, which has four pins to fit the relief valve, and a hexagon stem to accommodate a wrench. The valve spring specification for this valve is the same as that for the preceding valve. There is no adjustment provided on either of the valves.

By-pass valves on rectangular tanks, Fig. 10, are similar in function but different in construction when compared to other by-pass valves. The bolt, cap, spring and clamp nut make up an individual assembly on E7 locomotive tanks, one of which covers each element container

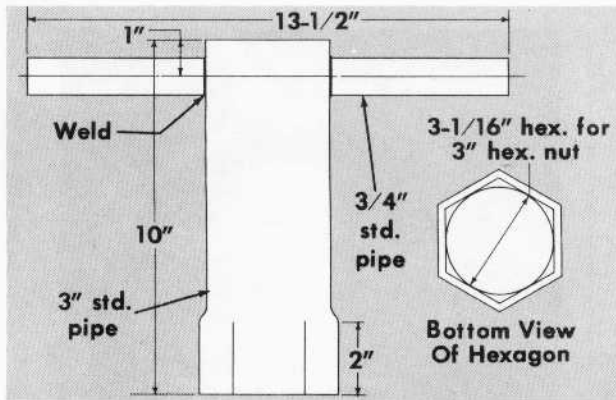


Fig. 12 - Filter Nut Wrench Construction

and is held by a spider as shown. It is not necessary to disassemble this valve when changing elements. On assembly, maintain $1/4$ " space between clamp nut and cap to allow for spring compression. When applying the spider do not tighten it excessively. Construction details of a filter nut wrench is shown in Fig. 12.

It is necessary to take apart the by-pass valve assembly, Fig. 10, on rectangular tanks used on E6 and early switcher locomotives, to change filter elements. In this assembly a perforated hollow tube extends upward to serve as the bolt for the relief valve assembly. Insert "A," Fig. 10, shows dimensions to be held at assembly of this valve. The tube or bolt top should be $2-3/4" \pm 1/16"$ and the space between cap and clamp nut should be $1/4$ ".

Repacking Hand Packed Filter Elements

Replaceable prepacked wastex cartridges are recommended in place of manually hand packed filter elements. However, wastex is available for hand packed elements which are still in use.

On elements using loose hand packed wastex the center screen tube must be in good condition. Also, early element cans such as 8035047 and 8054713 with the large perforated outer shell must have the screen around the inside of the outer shell intact and in good condition. Cartridges must be used if either of these conditions cannot be satisfied.

After the element is removed, carefully take out the used wastex. A drawing, 8102979, is available upon request, which provides the information necessary to construct a filter unpacking rack which also has a provision for used wastex disposal. Thoroughly clean the element container after the used wastex is removed.

A full package of wastex 8032230 (7 lbs.) should be used to repack each element. A drawing, 8062925, is available upon request, which shows construction of an element packing rack that will hold the element and aid hand packing. Apply the wastex to the element and push it down evenly around the center tube using a blunt ended stick. Use the element cover occasionally to check center tube alignment.

When the element is properly packed, replace the element cover and screw or snapping. Replace cover handle, if used. If the element is not to be installed soon after packing, it should be protected by being covered during storage. A drawing, 8070917, showing construction of an element storage box is available upon request.

Conversion Of External Vent Design Filters To Internal Vent Filters

External vent filters 8207645, 8212458, and 8214050 can be converted to the internal vent design as follows:

1. Shut down the engine and drain the filter.
2. Remove all the external vent piping from the filter housings and from the lube oil system piping.
3. Plug the vent holes in the filter housings using $1/4$ " NPT bronze plugs 112578. Solder the plugs in place to prevent oil leakage.
4. Plug the vent connection at the oil system pipe with $1/2$ " NPT plug 103868.

5. Replace the nonvent design wing bolt 8168656 in each element with vented type assembly 8252176.
6. Retain the square cross section cover gasket 8213372 in the converted filters. (Flat cover gasket 8253898 can only be used in filter assemblies originally built with internal vent, as mentioned in the preceding item covering filter elements and cartridges.)

Modification Of Seven-Element Filter Original Hold Down Plate

When applying the original filter hold down plate in the seven-element lube oil filter, Fig. 13, it is difficult to determine whether or not the pipe stubs on the hold down plate are centered on each filter. To make the application of this plate more convenient we suggest the plate be modified as shown in Fig. 13.

This modification can be done in the following manner:

1. Locate the bottom of the plate and label it by stamping the word **BOTTOM** on the outer face.
2. Drill a one inch hole through the plate at the center of each of the seven pipe stubs. These holes will make it possible to observe the center of each element when installing the plate.
3. Drill or machine three holes 3-1/2 inches in diameter as shown in Fig. 13 to permit observation and any repositioning of the center element that may be necessary.

Identifying the bottom of the plate will assist in properly positioning the plate during installation.

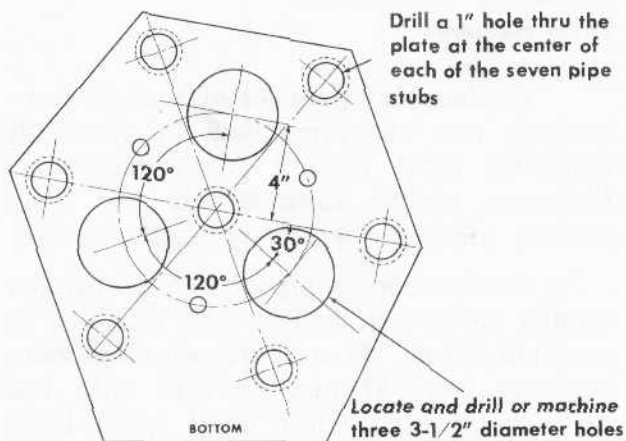
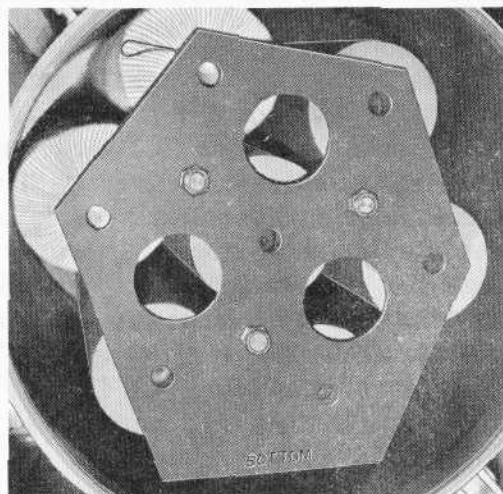
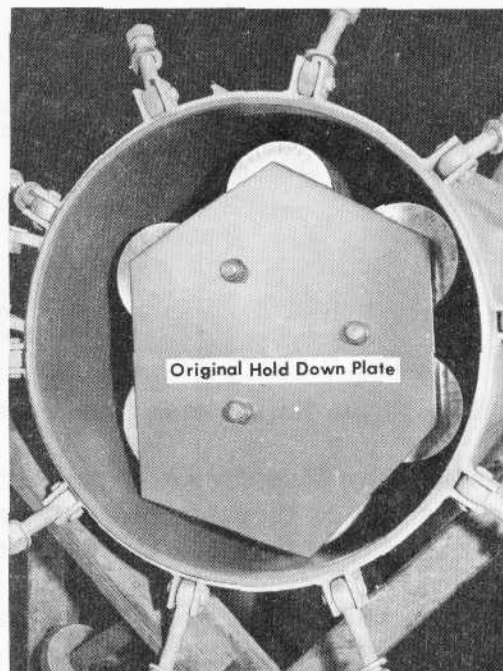


Fig. 13 - Modification of Seven-Element Filter Original Hold Down Plate

EQUIPMENT LIST

| | Drawing |
|-----------------------------------------------------------------------------------------------------|----------|
| Michiana filter element packing rack - - - - - | 8062925 |
| Michiana filter element storage box - - - - - | 8070917 |
| Michiana filter unpacking rack (with waste cart) - - - - - | 8102979 |
| Filter nut wrench - - - - - | 8107833 |
| Filter element storage can - - - - - | File 112 |
| Wrench (spanner - to move relief valves inside housing on early seven-element filters) - - - - - | 8277270 |

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