Genuine

KIMRAY INC.®

Quality Since 1948

Repair Manual

MECHANICAL OIL VALVE

This Manual for Mechanical Oil Valves purchased before December 2017

INDEX

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SCOPE

This repair manual contains information concerning the Mechanical Oil Valve. Included are detailed instructions regarding disassembly, repair, assembly and testing.

DESCRIPTION

The Mechanical Oil Valve is most commonly used in Separators and Free-Water Knockouts to dump oil and water via a Trunnion Assembly.

MAINTENANCE

Maintenance should be performed on a regular basis. Initial interval of 12 months is recommended. The maintenance interval may increase or decrease depending on changing application environments.

WARNING

Before performing any service to valve or trunnion assembly verify the vessel is not under pressure and drained of all fluids.

GENERAL SPECIFICATIONS

Working Pressures	125-500 Hydrostatic Test: ANSI B16.37		
Body materials	Grey Iron	ASTM A48-94a	Class 20
	Ductile Iron	ASTM A395	Class 65-45-12
	Steel	ASTM A 216	WCB
Bonnet materials	Grey Iron	ASTM A48-94a	Class 20
	Ductile Iron	ASTM A395	Class 65-45-12
	Steel	ASTM A216	WCB
Body types	Angle, Thru		
Connection types	Screw, Flange		
Elastomers	Buna-n (Nitrile)		

To get the long service you have come to expect from Kimray products, always use **GENUINE KIMRAY PARTS** when doing repairs. Remember, parts made to less than Kimray specifications don't save you money!!!

ELASTOMER MATERIALS

AFLAS ® is a trade mark of Asahi Glass Co

TEMPERATURE:
-25° to +500° F
-30° to +260° C

APPLICATION:
Crude Oil & Gas Production (High heat), Steam Flood Production Chemicals (corrosion inhibitors) Amine Sweetener Systems, Gasoline, Diesel, Fuel Oil Systems

FLUID / GAS:
Crude Oil & Gas Production, H2S, Steam, Petroleum fluids, Sea Water

HSN (Highly Saturated Nitrile)

TEMPERATURE:
-15° to +300° F
-26° to +149° C

APPLICATION:
Crude Oil & Gas Production w/ H2S C02

FLUID / GAS:
Crude Oil & Gas H2S, C02, Sea Water

NITRILE

TEMPERATURE:
Buna-N:
-40° to +220° F
-40° to +105° C
Low-Temp:
-85° to +120° F
-65° to +49° C

APPLICATION:
Crude Oil & Gas Production Glycol Dehydrators, Gasoline, Jet Fuel & Diesel Fuel Pumping, Water Disposal, Methanol Injection Pumps, Water pump seals, hydraulic pump seals

FLUID / GAS:
Crude Oil & Gas, Good to Poor in Sour Production (See HSN), Water, Glycols, Hydraulic Oils, Resistance to crude oil in the presence of hydrogen sulfide and amines, Diesel fuel, fuel oils

DO NOT USE WITH:
Aromatic hydrocarbons, chlorinated hydrocarbons, phosphate esters (hydraulic fluids)

GYLON

TEMPERATURE:
-350° to +500° F

APPLICATION:
High heat, high chemical resistance, highly resistance to gas permeation

VITON ® is a trade mark of Dupont

TEMPERATURE:
-10° to +350° F
-23° to +177° C

APPLICATION:
Crude Oil & Gas Production, Glycol Dehydrators, Gasoline, Jet Fuel & Diesel Fuel Pumping, Water Disposal, Methanol Injection Pumps. (Also Vacuum Service) (Gas permeability is very low)

FLUID / GAS:
Crude Oil & Gas, Sour Gas (C02), Propane, Gasoline, Diesel, Fuel Oil Systems

DO NOT USE WITH:
Hot Water, Not preferred for wet H2S, Methyl Alcohol, Amines, Sodium hydroxide solutions

ETHYLENE PROPYLENE

TEMPERATURE:
-65° to +300° F
-54° to +148° C

APPLICATION:
Steam Flood

FLUID / GAS:
Steam, Water, Alcohol

DO NOT USE WITH:
Crude Oil & Gas, Diester Lubricants (Lube Oils)

POLYURETHANE

TEMPERATURE:
-40° to +220° F
-40° to +104° C

APPLICATION:
High abrasion resistance Seats, Diaphragms

FLUID / GAS:
Crude Oil gas and Water, Sour Gas (C02), propane, butane, fuel, mineral oil and grease

POLYACRYLATE

TEMPERATURE:
±0° to +300° F
-17° to +149° C

APPLICATION:
Production Heaters, Thermostats

FLUID / GAS:
Crude Oil & Gas at High Temperature

DO NOT USE WITH:
Alcohol, Glycols

DIAPHRAGM BALANCED REPAIR KIT:

PISTON BALANCED REPAIR KIT:

DISASSEMBLY

STEP 1
REMOVE LEVER BAR
Loosen nuts from bolts (Fig. 1.1) and remove (Fig. 1.2).

Figure 1.1

Figure 1.2

Remove bolts attaching lever bar to hub (Fig. 1.3).
Remove lever from hub (Fig. 1.4).

Figure 1.3

Figure 1.4

STEP 2
REMOVE LEVER HUB
Loosen and remove set screw (Fig. 2.1). Tap trunnion hub off shaft. Take caution not to bend shaft (Fig 2.2).
If hub will not remove easily refer to *APPENDIX A for alternate removal process.*

Figure 2.1

Figure 2.2

STEP 3
REMOVE TRUNNION SHAFT
Wrench loose brass plug (fig. 3.1).

Remove from bonnet casting (Fig. 3.2).

Figure 3.1

Figure 3.2

Wrench loose brass compression nut and remove (Fig. 3.3). Remove by sliding off trunnion shaft (Fig. 3.4).

Figure 3.3

Figure 3.4

Wrench stuffing box loose but do not remove as it will serve as a guide for shaft removal (Fig. 3.5).

Figure 3.5

Figure 3.6

Gently tap trunnion shaft out of bonnet/ trunnion hub using stuffing box as a guide, taking care not to bend shaft or crack the bonnet casting (Fig. 3.6, 3.7).

If shaft will not remove easily refer to *APPENDIX B* for alternate removal process.

Remove thrust washer and discard (Fig. 3.8).

Figure 3.7

Figure 3.8

STEP 4
REMOVE STUFFING BOX

Stuffing box is hand tight at this point, manually remove from bonnet (Fig. 4.1).

Remove packing from the stuffing box (Fig. 4.2).

Figure 4.1

Figure 4.2

STEP 5
REMOVE GASKETS

Gaskets will need to be removed from both sides of the bonnet. They will either be found on the stuffing box (Fig. 5.1) or attached to the bonnet (Fig. 5.2).

Figure 5.1

Figure 5.2

STEP 6
REMOVE BONNET

Wrench loose and remove (4) bolts (Fig. 6.1)

Lift bonnet off the body (Fig. 6.2)

Figure 6.1

Figure 6.2

DISASSEMBLY

STEP 7
REMOVE CAGE ASSEMBLY
Tap out cage assembly from the bottom through the top (Fig. 7.1, 7.2).


Figure 7.1


Figure 7.2

Step 8
DISASSEMBLE CAGE ASSEMBLY
Place the cage assembly in a vise (Fig. 8.1).


Figure 8.1

Using an open-ended wrench as a back-up, un-screw hub from cage using a punch or screwdriver through hub eyelet (Fig. 8.2).


Figure 8.2

Separate stem nut from the diaphragm (Fig. 8.3).


Figure 8.3

Remove snap rings from the linkage (Fig. 8.4).


Figure 8.4

Separate the links from the pins (Fig. 8.5).


Figure 8.5

Separate the stem nut from the trunnion hub (Fig. 8.6).


Figure 8.6

Remove the O-ring from the cage (Fig. 8.7)


Figure 8.7

Place stem in vise and wrench loose the jam nut (Fig. 8.8).


Figure 8.8

Remove seat disk (Fig. 8.9).

Remove soft seat (Fig. 8.10).

Figure 8.9

Figure 8.10

Remove ratio guide (Fig. 8.11)

Figure 8.11

APPENDIX A

ALTERNATE REMOVAL OF LEVER HUB

Sometimes parts will be too difficult to remove mechanical means alone. Heating of the metal may be required to DISASSEMBLE the more stubborn pieces.

Place bonnet with the lever hub/trunnion assembly in a vise (Fig. 1). Apply heat to hub casting (Fig. 2).

CAUTION: THE BRASS COMPRESSION NUT MUST BE WRENCHED OFF THE STUFFING BOX BEFORE HEAT IS APPLIED.

Heat the hub until glowing red (Fig. 3).

Immediately place hot lever hub into a metal container of water (Fig. 4, 5).

Place bonnet/hub assembly back onto the vise and lightly tap lever plate with a hammer till lever hub is completely removed from trunnion shaft (Fig. 6).

Figure 1

Figure 2

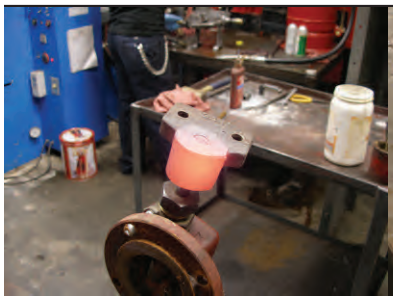


Figure 3

Figure 4

Figure 5

Figure 6

ALTERNATE REMOVAL OF TRUNNION HUB

Sometimes parts will be too difficult to remove by mechanical means alone. Heating of the metal may be required to DISASSEMBLE the more stubborn pieces Heat the trunnion inside the bonnet (Fig. 1) till the hub is glowing red (Fig. 2).

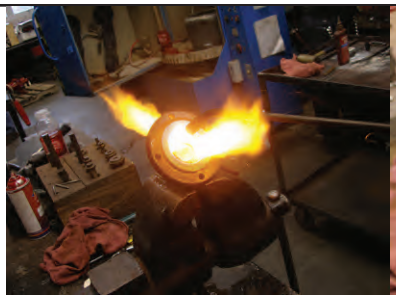


Figure 1

Figure 2

Cool the parts in a metal container of water (Fig. 3, 4).

Figure 3

Figure 4

Place bonnet back in vise and gently tap the trunnion shaft (Fig. 5) until completely free from trunnion hub (Fig. 6).

Figure 5

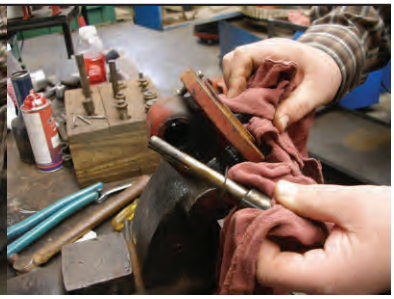


Figure 6

CLEANING AND INSPECTION

RATIO PLUG

Inspect the ratio plug. These parts serve to correctly position the seat and seat disk. If an excessive amount of erosion/ corrosion has occurred discard and replace. Example of a good plug (Fig. 1.1), bad plug (Fig. 1.2).

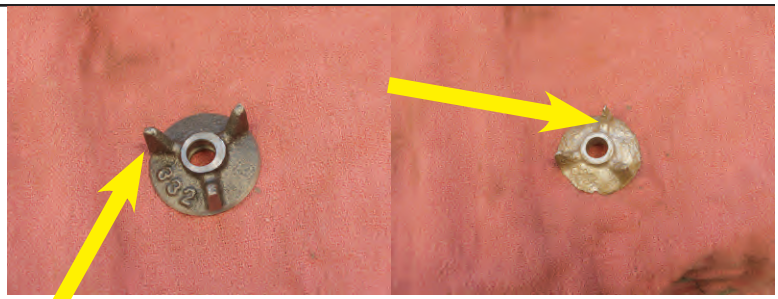


Figure 1.1 Figure 1.2

CAGE

Inspect the bottom surface of the cage that the seat/seat disk contact. Severe pits and burrs could allow one of two things to occur: 1. Damage to the soft seat caused by a ragged edge. 2. Improper seal causing the valve to “bleed” or fail. Example of a bad cage (Fig. 1.3), good cage (Fig 1.4).

Figure 1.3 Figure 1.4

TRUNNION SHAFT

Inspect the key-ways, condition of the shaft surface and verify the shaft is not bent (Fig. 1.5).

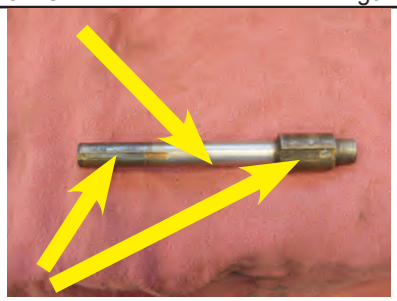


Figure 1.5

THREAD SURFACES

Inspect all thread surfaces for pits, debris and flat spots.

Bonnet - Fig. 1.6
Stem - Fig. 1.7
Stem nut/Piston - Fig. 1.8
Body - Fig. 1.9, 1.10

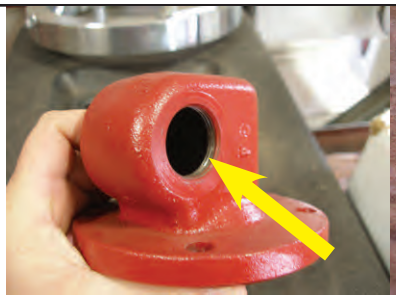


Figure 1.6

Figure 1.7

Figure 1.8

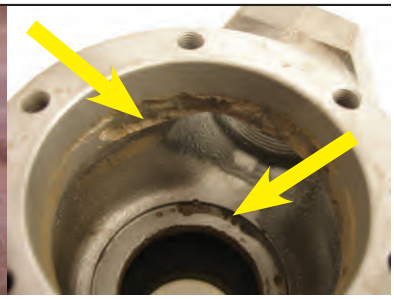


Figure 1.9

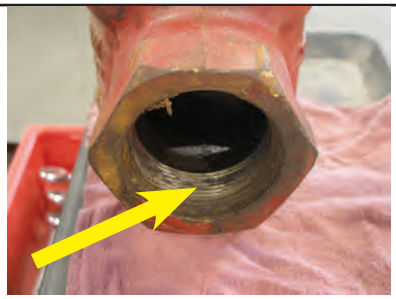


Figure 1.10

CLEANING

In the process of cleaning the valve there are a few essential areas that must be addressed:
1. All thread surfaces.
2. Insure all gasket material is removed.
3. Exterior free of all solvents, debris and fluids if the body is to be re-painted.
4. Interior free of all solvent, debris and fluids that may damage elastomers and affect 0-ring / gasket seals.
5. Remove dead rodents.

ASSEMBLY DIAPHRAGM BALANCED

STEP 1
CAGE ASSEMBLY

Place new O-ring onto cage (Fig. 1.1).

Place soft seat onto seat disk (Fig. 1.2).

Figure 1.1

Figure 1.2

Place ratio plug on the stem (Fig. 1.3, 1.4).

Figure 1.3

Figure 1.4

Place seat assembly on the stem (Fig. 1.5, 1.6).

Figure 1.5

Figure 1.6

Thread jam nut onto seat-end of stem (Fig 1.7).

With a 1/2” open-end wrench on the flats of the stem as back-up, wrench the jam nut tight (Fig. 1.8).

Caution: Do not over-tighten the jam nut. This will “roll” the seat up, preventing a good seal.

Figure 1.7

Figure 1.8

Insert seat/stem assembly into cage (Fig. 1.9).

Place stem plate on stem (Fig. 1.10).

Figure 1.9

Figure 1.10

Place diaphragm onto the stem and cage (Fig. 1.11).

Attach a link with both pins to the trunnion hub (Fig. 1.12).

Figure 1.11

Figure 1.12

Attach retaining clips to both ends of the first link (Fig. 1.13)

Attach stem nut to link by sliding over pin (Fig. 1.14).

Figure 1.13

Figure 1.14

Slide second and final link over the pins (Fig. 1.15)

Attach the remaining two retaining clips to the pins (Fig. 1.16).

Figure 1.15

Figure 1.16

Thread on trunnion/nut linkage to the cage stem using Loctite® on threads. (Fig. 1.17).

Using a 1/2 “ wrench on the stem flats and a shaft through the eye of the hub tighten stem nut to stem (Fig. 1.18).

Figure 1.17

Figure 1.18

STEP 2
CAGE ASSY. INSERTION
Place lubricant around the diameter of the O-ring. This will assure a good O-ring seal, protect the O-ring and ease the insertion of the cage assy. (Fig. 2.1). Lubricate shoulder upon which the gasket sits (Fig. 2.2).

Figure 2.1

Figure 2.2

Apply the gasket (Fig. 2.3) and lubricate (Fig. 2.4).

Figure 2.3

Insert stuffing box with hole facing the same direction as valve connection, as shown in (Fig. 2.5).

Figure 2.4

Figure 2.5

Using a rubber or wooden mallet tap the cage until it seats (Fig. 2.6).
Diaphragm will be flush with machined surface when properly seated and trunnion hub should be centered evenly between bolt-holes. This will insure hub will align with bonnet (Fig. 2.7).

Figure 2.6

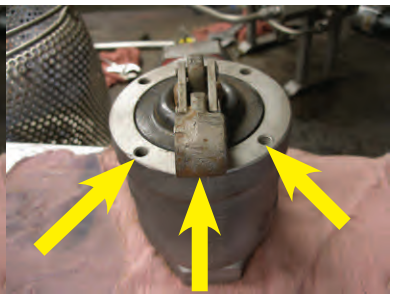


Figure 2.7

STEP 3
BONNET ASSEMBLY
Holding up on the hub assembly place the bonnet cast on the body (Fig. 3.1, 3.2).

Figure 3.1

Figure 3.2

Install trunnion shaft into trunnion hub. Align the keyway in shaft with key in hub (Fig. 3.3).
Install bolts that attach bonnet to body (Fig. 3.4).


Figure 3.3


Figure 3.4

Place gasket on the brass cap (Fig. 3.5).

Thread the brass cap onto bonnet (Fig. 3.6).


Figure 3.5


Figure 3.6

Slide thrust washer on trunnion shaft (Fig. 3.7).
Place first packing onto packing ring (Fig. 3.8).


Figure 3.7


Figure 3.8

Place second and final packing on the packing ring (Fig. 3.9).
Insert the packing into the stuffing box (Fig. 3.10).


Figure 3.9


Figure 3.10

Place the gasket on the stuffing box and grease (Fig. 3.11).
Slide stuffing box onto trunnion shaft. Be careful to keep the packing in place during this (Fig. 3.12).


Figure 3.11


Figure 3.12

Wrench tight. Keep in mind the stuffing box is brass, careful not to over-tighten (Fig. 3.13).
Slide the brass follower onto trunnion shaft and press to packing (Fig. 3.14).

Figure 3.13

Figure 3.14

Slide compression nut onto stuffing box (Fig 3.15) and wrench tight. Again careful to not overtighten (Fig 3.16).

Figure 3.15

Figure 3.16

STEP 4
LEVER ASSEMBLY
Insert key into keyway machined into the lever hub (Fig. 4.1).

Align key in lever hub with keyway in trunnion and slide hub onto shaft till flush (Fig 4.2).

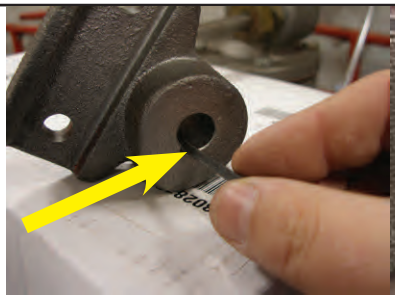


Figure 4.1

Figure 4.2

Thread set screw into lever hub (Fig. 4.3) and wrench tight (Fig 4.4).

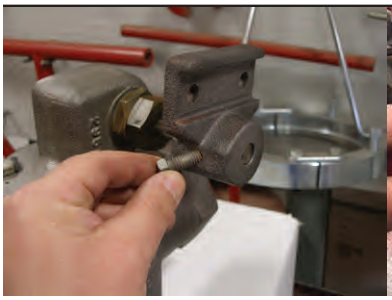


Figure 4.3

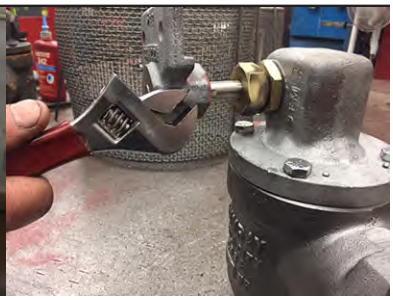


Figure 4.4

As shown in (Fig. 4.5) the adjustable lever arm is placed in the lever hub facing ***towards*** the valve body.

Insert first bolt attaching the lever to the hub (Fig. 4.6).

Figure 4.5

Figure 4.6

Attach final bolt, screw on nuts and wrench both tight (Fig. 4.7, 4.8).

Figure 4.7

Figure 4.8

ASSEMBLY PISTON BALANCED

There are only four parts that Separate a diaphragm balanced from a piston balanced valve.

1 . . . . . Piston

2 . . . . . .Cylinder

3 . . . . . .Ratio Plug

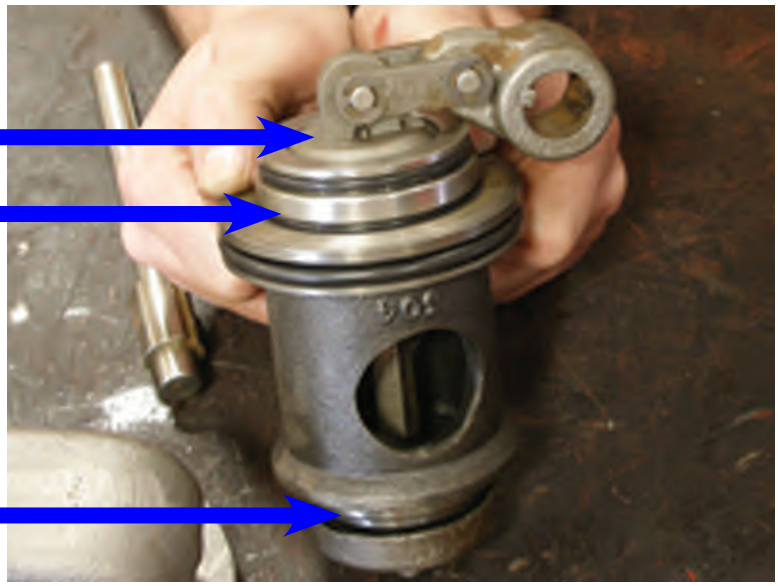


Figure A

4 . Piston Seal Retainer

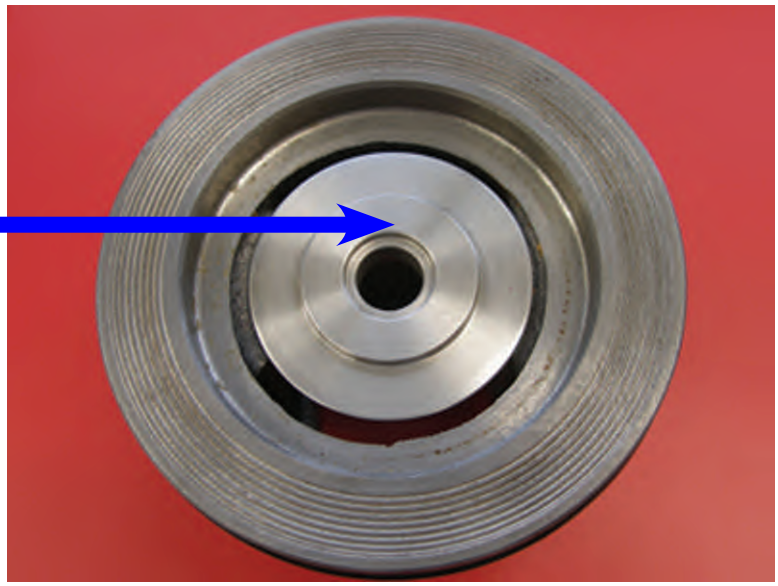


Figure B

STEP 1
PISTON SEAL RETAINER

Retainer sets in the cage, resting on the stem shoulder (Fig. 1.1, 1.2).

Figure 1.1

Figure 1.2

STEP 2
PISTON

Requires (2) back-up and (1) O-ring (Fig. 2.1, 2.2, 2.3).

Figure 2.1

Figure 2.2

Cylinder threads onto cage and rests on the piston seal retainer (Fig. 2.4).

Figure 2.3

Figure 2.4

STEP 3
RATIO PLUG

Unlike the the ratio plug for the diaphragm balanced valve, the ratio plug for piston balanced valves require an O-ring placed in it (Fig. 3.1).

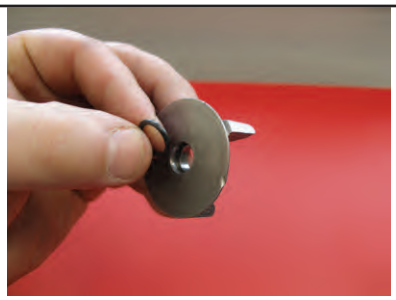


Figure 3.1

STEP 3
CYLINDER

Cylinder uses (2) O-rings
(Fig. 4.1, 4.2, 4.3).

Figure 4.1

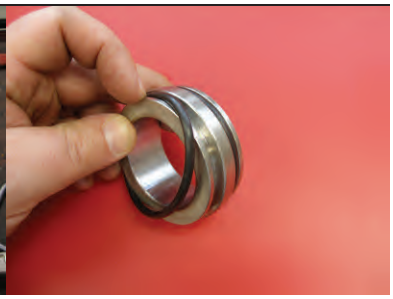


Figure 4.2

Figure 4.3

STEP 4
CYLINDER INSTALL
Cylinder is placed over the piston and firmly seats in cage (Fig. 5.1).
All cage, piston and cylinder 0-rings should be treated with a lubricant (Fig. 5.2).
Note: All gaskets and O-Rings should be lubricated for ease of assembly and future disassembly.

Figure 5.1

Figure 5.2

Shop air is sufficient to test the mechanical oil valve with. Typical shop pressure is 90-100psi.

An adapter will be needed to connect from inlet thread size to air chuck. It will look similar to this (Fig. A).

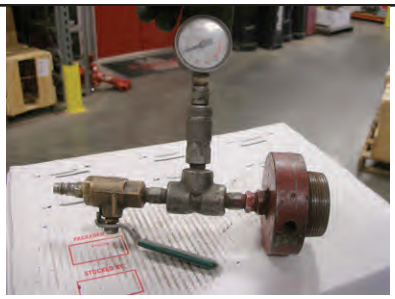


Figure A

Screw ***npt*** end of adapter into inlet side of valve (Fig. B).

Attach shop air to air chuck on adapter and open valve on adapter (Fig. C).

Figure B

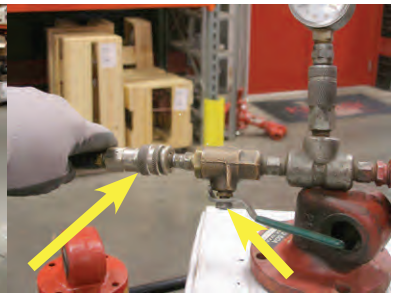


Figure C

Actuate the valve open/closed a few times while checking for leaks at the discharge (Fig. D, E).

Figure D

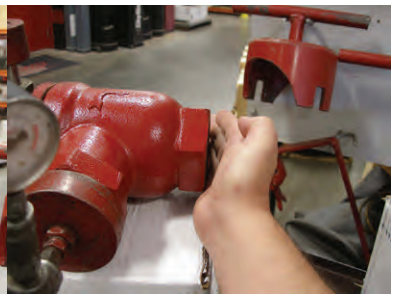


Figure E

After verifying a good seat seal the discharge orifice should be sealed with a plug (Fig. F).

Again pressure up the valve and spray a soapy solution at hub threads and bonnet cap (Fig. G, H). Any leaks will cause bubbles to form.

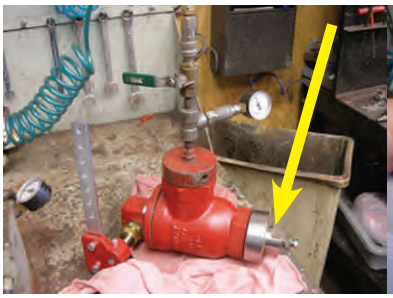


Figure F

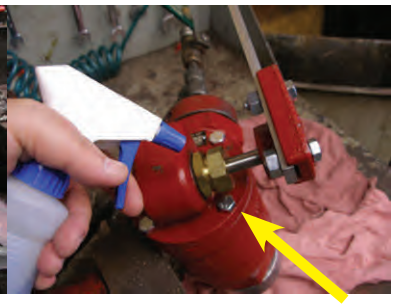


Figure G

Actuate the lever arm and inspect the body for any pin-hole leaks (Fig. I)

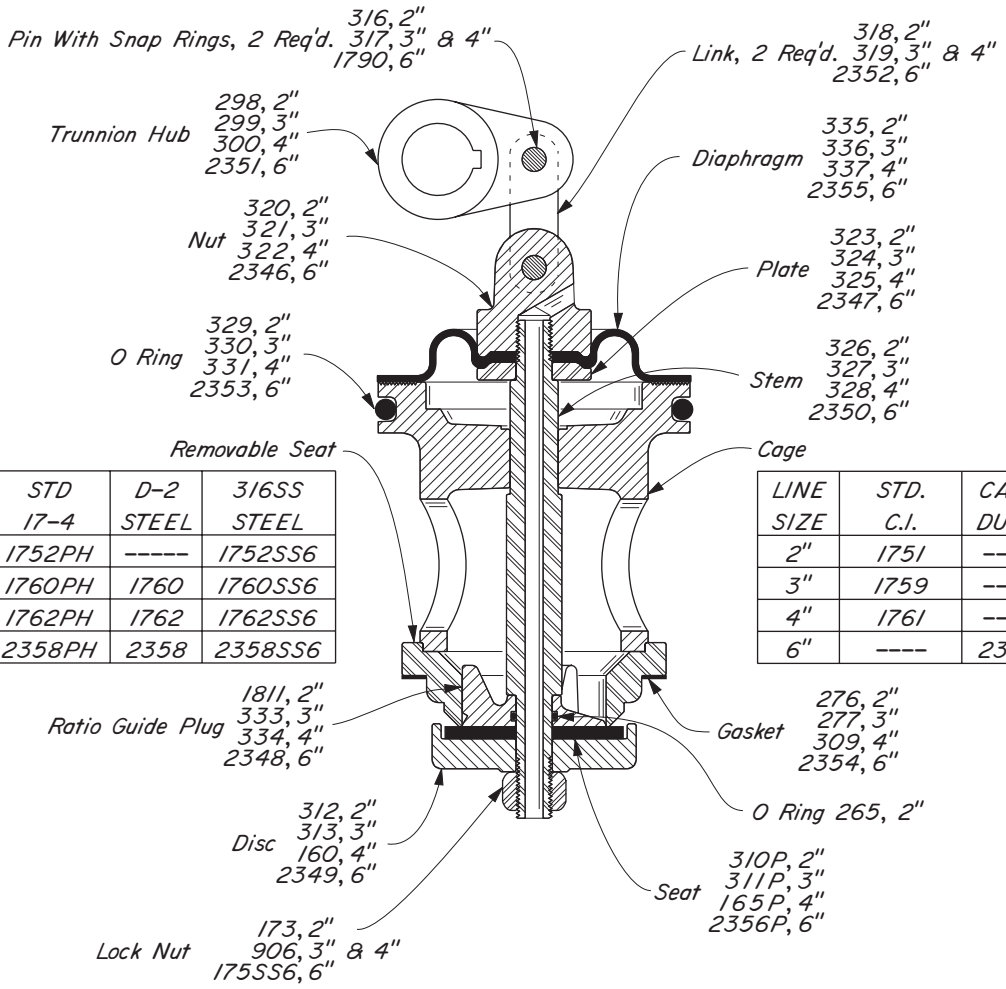
Figure H

Figure I

ALTERNATE SOLUTIONS

Although there are several options in mechanical oil valves for your application (i.e. grade of steel, size, style etc...) when rebuilding and/or repairing a mechanical oil valve sometimes the best solution is simply swapping out the entire cage assembly. This can make for speedy and simple repair jobs in the field, limiting the out-of-service time for the mechanical oil valve to a minimum.

NOTE: SEAT ASSEMBLY SHOWN BELOW IS A CAGE WITH A REMOVABLE SEAT. A FULL CAGE SOFT SEAT ASSEMBLY AVAILABLE.



LINE SIZE	STD 17-4	D-2 STEEL	316SS STEEL
2"	1752PH	-----	1752SS6
3"	1760PH	1760	1760SS6
4"	1762PH	1762	1762SS6
6"	2358PH	2358	2358SS6

LINE SIZE	STD. C.I.	CAST DUCT.	CAST STEEL
2"	1751	----	3097
3"	1759	----	3098
4"	1761	----	3099
6"	----	2357	----

ASSEMBLIES AVAILABLE:

CAT. NO.	TYPE	VALVE	OPER. PRESS.	MAX W.P.
CBS1	2"	212 S/FOA	125	175
CBT1	3"	312 S/FOA	125	175
CBU1	4"	412 S/FOA	125	175
CBV1	6"	612 FOA	125	175

NOTES:

NOTE: To order valve with removable seat, specify valve model, then add "with removable seat."

NOTES

KIMRAY
MECHANICAL OIL VALVE

Repair Manual

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