

POWER CONTACTOR TYPE PS7 AND 372

APPLICATION: Type PS7 - F2, F3, BL2 and SW1.
Type 372 - F7, GP7, SD7, E8, Switchers and Replacement for Type PS7 Contactor.

GENERAL DESCRIPTION:

The Type PS7 and 372 power contactors are used to connect the traction motors in various electrical circuits with the main generator.

The contactors are located in the high voltage electrical cabinets of the respective locomotives.

The Type PS7, Fig. 1, and 372, Figs. 2 and 3, power contactors are

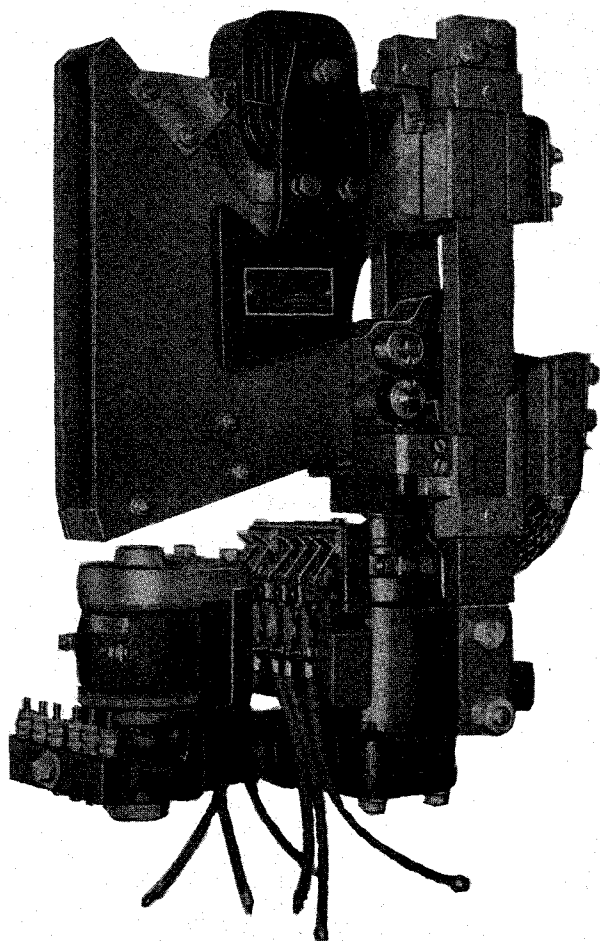


Fig. 1 - Type PS7 Power Contactor

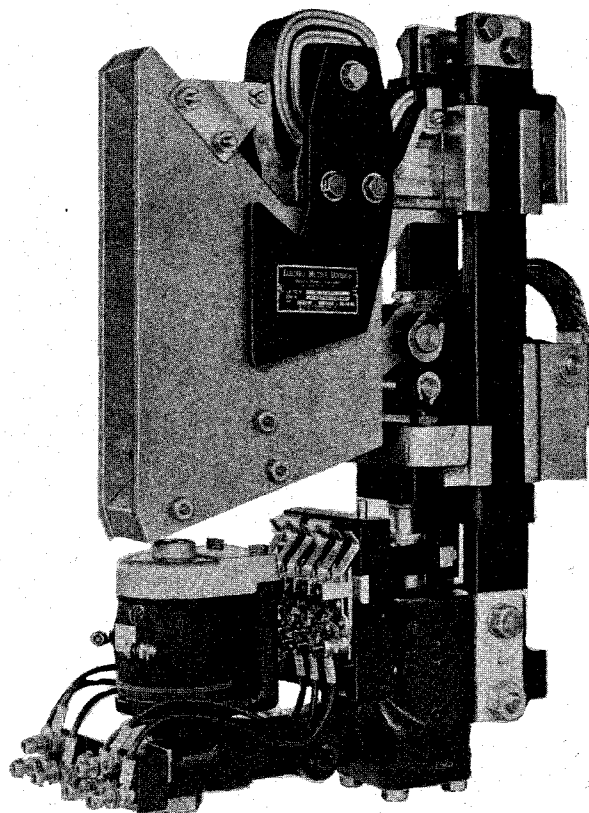


Fig. 2 - Type 372 Power Contactor

pneumatically operated, heavy duty, single pole switches for direct current service. The Type PS7 power contactor has a 1200 volt - 700 ampere rating while the Type 372 is rated slightly higher at 1200 volts - 800 amperes.

The operation of the contactors is identical. In regard to construction, the contactors are similar. The Type 372 power contactor is an improved type, both physically and electrically, and has

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PREVIOUS ISSUES.

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replaced the Type PS7 power contactor. Currently, the Type 372 contactor is basic on all production locomotives.

OPERATION

Energizing the low voltage B46 magnet valve coil lowers the magnet valve stem allowing air under pressure to be applied to the bottom of the air cylinder, Fig. 4. A portion of the incoming air follows an air passage through

the cylinder wall to the upper section of the cylinder above the piston to set up an air cushion; while the main air stream forces the piston up against the tension of the piston spring. As the piston is forced up, the air passage (two air passages on PS7 type contactor air cylinder) to the upper section of the cylinder is sealed shutting off the air above the piston. The upward action of the piston causes the push (connecting) rod assembly to move upward actuating the contact arm which in turn actuates the contact

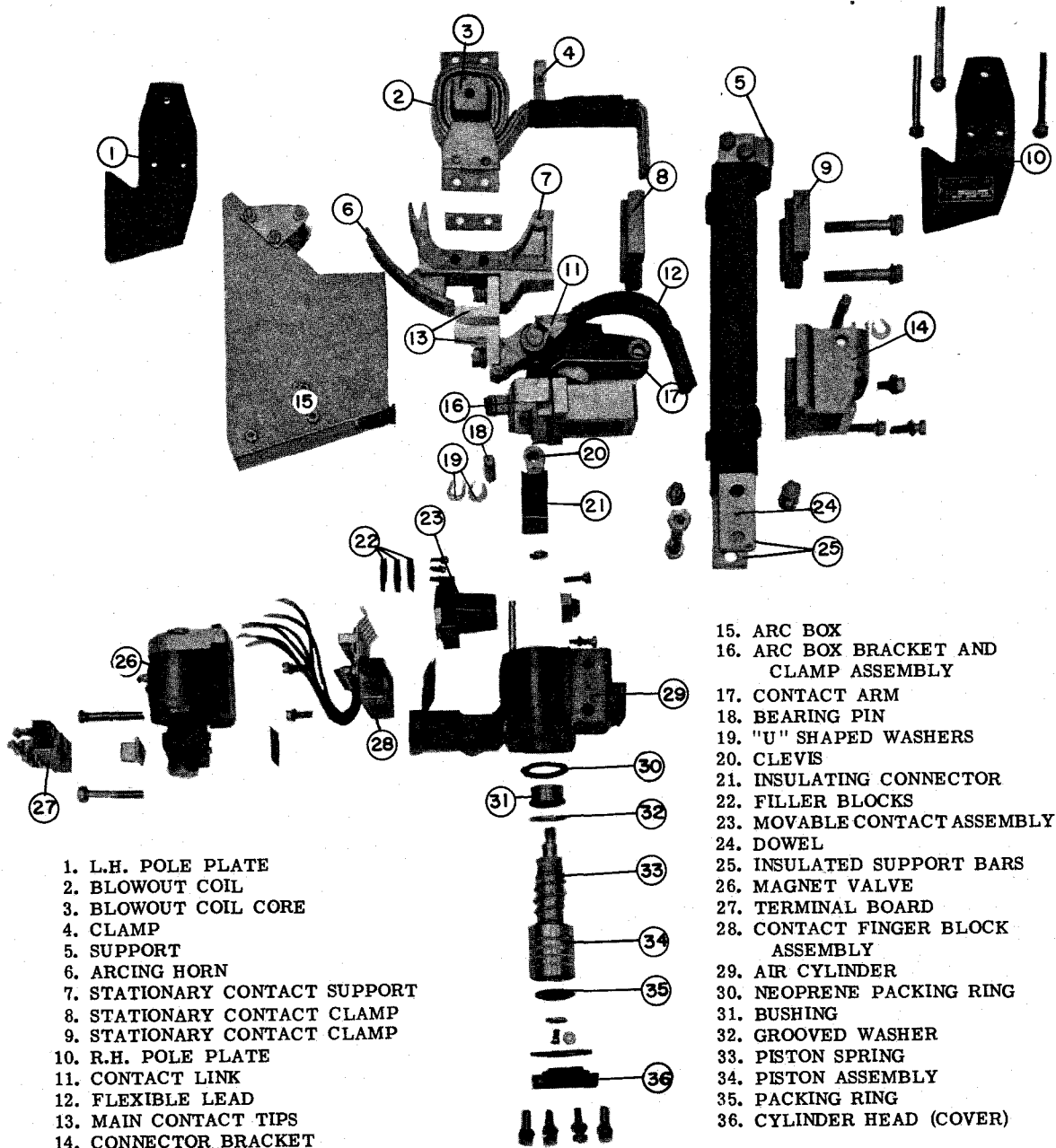


Fig. 3 - Exploded View — Type 372 Power Contactor

link through an upper bearing pin and a spring; thus closing the main contact. The air cushion above the piston in the air cylinder prevents the contact tips from bouncing when the main contact closes and the spring located between the contact link and arm gives the contact tips a wiping action. After the main contact tips close, the air cylinder piston continues to move compressing the connecting rod spring until the piston reaches the stroke limit where it seals off against a neoprene packing ring. The connecting rod spring serves to cushion the piston at the end of the stroke.

The electrical current flow is from the lower main terminal in the rear, through the flexible lead to the contact link, lower and upper contact tips, upper contact support, blowout coil, and out through the blowout coil lead to the upper main terminal in the rear.

When the B46 magnet valve coil is de-energized, the valve spring forces the valve stem up to close off the air supply, thus allowing the air from the air cylinder to bleed off through the air ports in the magnet valve housing to atmosphere. The piston spring in the air cylinder returns the piston to the normal position which in turn opens the main contact. When the main contact opens, the magnetic field set up by the blowout coil acts to blow the arc out of the main contact preventing damage to the contact tips. The arc horns act to lengthen the arc gap and to dissipate the arc temperature; while the arc box channels the arc.

MAINTENANCE

The contactor should be inspected according to the Scheduled Maintenance Program, Maintenance Instruction 1704.

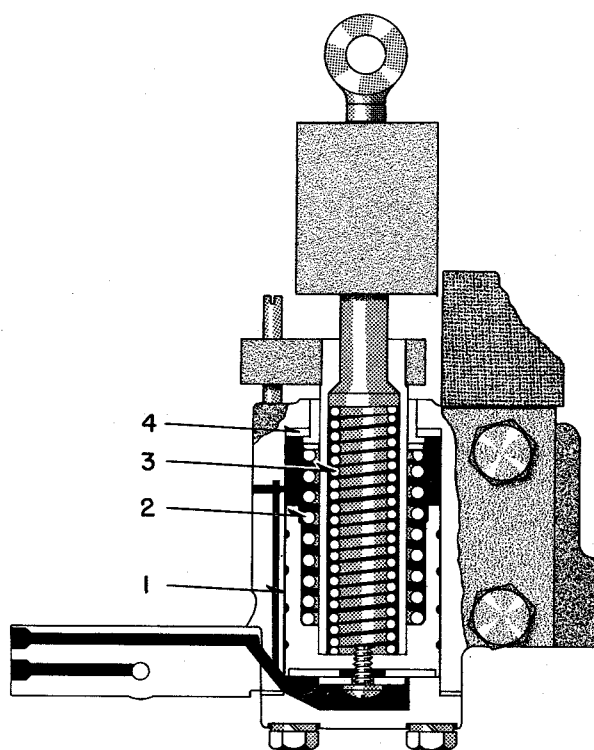
General

1. Inspect for free movement of all moving parts and check for undesirable play or clearance. Replace any movable parts worn sufficiently to cause undesirable play.

- a. The 1/2" bearing pin clearance (contact arm to clevis) must be held so that a minimum of 9/16" gap (using new contact tips) exists between contact tips.
- b. The 3/4" bearing pin clearance (upper bearing pin on contact arm) must be held so that no interference exists between the contact link and clevis.

NOTE: On PS7 power contactors, this will be the 1/2" bearing pin clearance (upper bearing pin on contact arm).

2. Inspect for burning or pitting of contact tips.
3. Inspect for correct alignment, wiping action wear, and pressure of all contacts. When the main contact is properly closed, the contact tips are heeled.



- | | |
|------------------|--------------------------|
| 1. Piston | 3. Connecting Rod Spring |
| 2. Piston Spring | 4. Neoprene Packing Ring |

Fig. 4 - Air Cylinder Type 372
Power Contactor

4. Inspect for tightness of all electrical connections and contactor mounting.

Main Contacts

1. Copper contact tips.

When copper contact tips become badly pitted or burned, they should be dressed with a clean medium or fine mill file. When filing contact tips, a contact tip contour similar to the original contour must be maintained, also the current carrying surface between the contact tips must be similar to the original contact tip surface (use new contact tip as pattern).

2. Silver plated copper contact tips.

Slight discolorations on the silver contact tip surface should not be removed. These discolorations are silver oxide and do not impair the contact tip operation. The removal of the discolorations materially reduces the coating of silver and the life of the contact tips. Unless severe burning or pitting is observed in the contact area, the surfaces should not be touched. If the contact tips are badly pitted or burned, clean with a medium or fine mill file per instructions given for copper contact tips.

NOTE: Any filing of contact tips should be done outside of the electrical cabinet to prevent copper particles from accumulating or gathering on other electrical equipment.

3. Lubrication

Do not lubricate the main contact tips. Grease or oil of any type around the contactor will collect dirt; consequently resulting in the deterioration of insulation.

4. Contact pressure.

Test for checking contact pressure should be made with new contact tips,

all locomotive circuits de-energized, and control (electric) air set at 90 ± 3 p.s.i.

To perform test, proceed as follows:

- a. Pass a loop of fine wire around the movable contact tip. Place a spring balance in such a direction that the pull on the wire will be perpendicular to the contact tip surface.
- b. Close the contact by energizing the magnet valve.
- c. Keep the contact closed and pull with the spring balance until the movable contact tip leaves the stationary contact tip. Refer to maintenance data for proper contact pressure.
- d. No adjustment is provided to vary the contact pressure. In the event of incorrect contact pressure, check for air leakage at the magnet valve and the air cylinder.

Auxiliary Contacts (Interlocks)

1. Finger and bar type interlocks - copper fingers and bars.

- a. Inspect the interlock fingers and bars for wear, sharp edges, burrs, alignment, and burned and pitted areas.
- b. Any bars having grooves deeper than 1/32" should be replaced. Remove all sharp edges, burrs, etc. with a fine file and smooth bars with sandpaper in the direction of the bar motion. All filing should be done outside of the electrical cabinet.
- c. Any interlock finger which has worn down to a thickness of 1/32" at the contact surface must be replaced. New finger is 1/16" thick. Replace any burned or pitted interlock finger which cannot be dressed up like a new finger. The interlock finger should be dressed with

sandpaper by moving the sandpaper in the direction of contactor motion.

- d. Interlock fingers should be parallel to each other and perpendicular to the interlock bars.
- e. Check the interlock finger contact pressure (see Maintenance Data) and lift (contact lift is checked only when the movable contact block assembly is not equipped with filler blocks), see Fig. 5. If the lift of the interlock finger does not fall within limits, adjustment should be made by bending the finger. The finger should not be bent more than $3/32$ " to obtain the proper amount of lift. If further adjustment is necessary, fishpaper shims should be inserted behind interlock block.
- f. Copper interlock finger and bar assemblies having a movable contact block assembly, Fig. 6, that is equipped with **FILLER BLOCKS SHOULD NOT HAVE THE FINGERS AND BARS LUBRICATED**. When the movable contact block assembly of a copper finger and bar interlock assembly is not equipped with filler blocks, lubrication should be used. The fingers and bars should have a thin coat of contact surface grease (8196885 - 1 lb. can) applied to their surfaces. The method of application is to work some grease in a clean bound rag wiping the rag over the copper surfaces (petroleum jelly should not be used). The grease should not be apparent by visual inspection. Too much

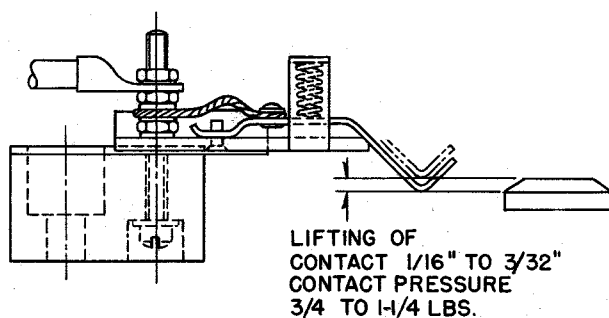


Fig. 5 - Interlock Contact Finger Lift

grease will collect dirt which is detrimental to the life of the interlock assembly.

- g. When movable contact block assembly is equipped with filler blocks, interlock finger support should not prevent finger from contacting bar. Movable block assembly should be wiped clean when necessary.

NOTE: Filler blocks are used on movable contact block assemblies to increase interlock finger and bar life. For application of filler blocks to the movable contact block assembly, refer to Modification Instruction 5053.

2. Finger and bar type interlocks - silver-copper alloy fingers with silver plated copper bars.

Slight discolorations on interlock finger and bar surfaces should not be removed. These discolorations are silver oxide and do not impair interlock operation. Removal of the discolorations materially reduces the coating of silver and in turn the life of the interlock. Unless severe burning and pitting is observed in contact area, the surfaces should not be touched. If interlock fingers and bars are badly burned, pitted, out of alignment, etc; maintain as per instructions given for copper interlock fingers and bars with following exceptions:

- a. Do not use abrasives such as sandpaper in dressing silver contacts, use a fine mill file.
- b. **DO NOT LUBRICATE** silver interlock fingers and bars regardless of whether the movable contact block assembly is or is not equipped with filler blocks.

3. Enclosed type interlocks - stationary contact stud with $1/32$ " coin silver sleeve and button type silver movable contacts.

Slight discoloration on the silver enclosed type interlocks, Fig. 7, should

not be removed. These discolorations are silver oxide and do not impair interlock operation. Removal of the discolorations materially reduces the coating of silver and the life of the interlock. Do not touch the contacts unless severely burned or pitted. If contacts need to be dressed, use a fine millfile. When dressing the contacts, maintain the original contour of the stationary contact stud. Refer to Maintenance Data for wear limits, etc.

Aluminum Contact Link

The aluminum contact link on early Type 372 power contactors, Fig. 8, should not be cleaned with abrasive material unless badly pitted. Cleaning the contact link surface with an abrasive material will result in the removal of the silver plating which results in the contactor over-heating.

NOTE: To change the rope type shunt and aluminum contact link to new type contact link and flat braided

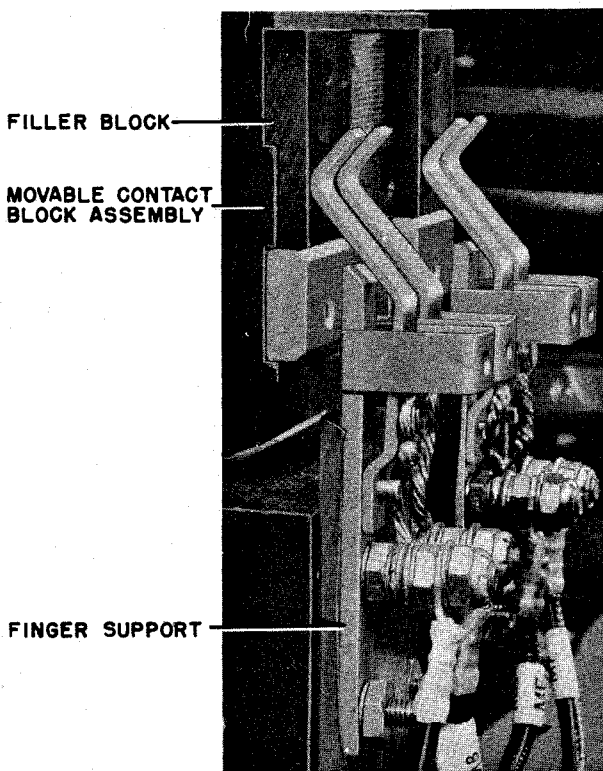


Fig. 6 - Interlock Assembly

shunt assembly see Modification Instruction 5034.

Magnet Valve

Maintenance of the magnet valve consists essentially of cleaning the parts to prevent sticking. Refer to the Scheduled Maintenance Program, Maintenance Instruction 1704, for period of cleaning and to Maintenance Instruction 636 for method of cleaning.

Air Cylinder

For periods of cleaning and lubrication refer to the Scheduled Maintenance Program 1704.

Following is the procedure for removing the air cylinder for cleaning and inspection.

1. Remove the four screws at the base of the air cylinder. Remove the cylinder head.
2. Loosen the two hexagonal head screws that hold the movable contact block (interlock bar) assembly to the connecting rod sleeve. Remove assembly.
3. Unscrew insulating connector on the push rod assembly with an open end wrench, at the same time bearing up on the piston so that it will not fly out.
4. Remove the piston and clean all surfaces with a clean dry rag. Inspect for scratches on the piston and cylinder walls. The presence of scratches,

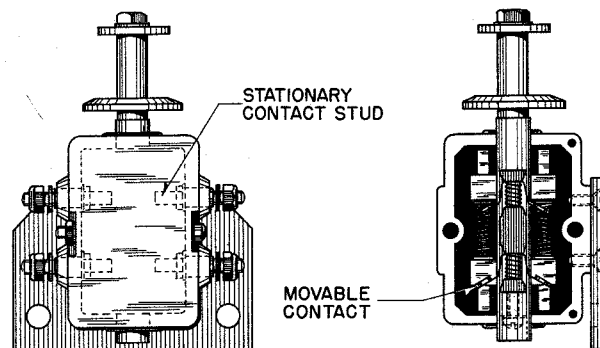


Fig. 7 - Enclosed Type Interlocks

except those of the hair line variety, will require the application of a new air cylinder assembly.

5. Replace damaged upper connecting rod packing ring and other worn or damaged parts.

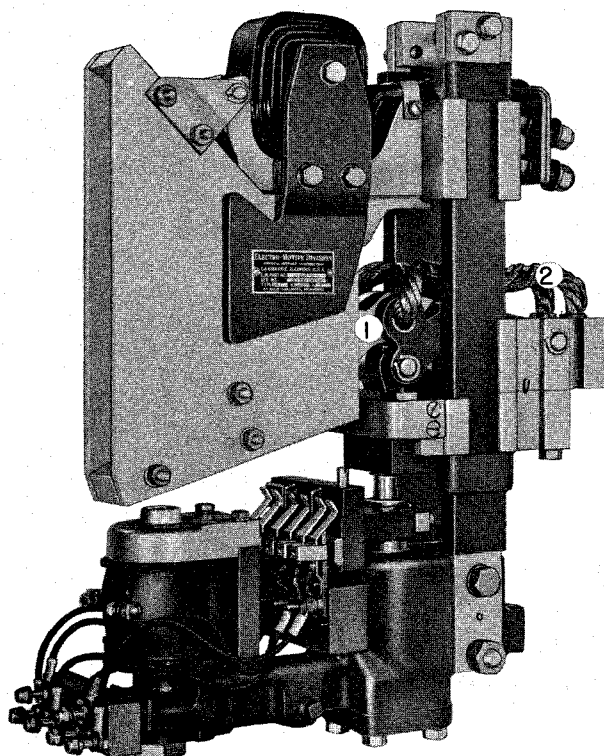
NOTE: When installing neoprene packing ring, wash bushing and air cylinder with a perchlorethylene cleaner. Allow to dry. Use **CAUTION** as cleaner is slightly toxic. Apply packing ring to bushing and coat surface of the packing ring which bears against the cylinder with cement (8122390 - 1 qt.). Allow cement to dry for 24 hours before assembling. Prior to as-

sembling the packing ring to the air cylinder, coat the surface of cylinder which bears against the packing ring with cement. Press the packing ring and the bushing in place. The brass bushing should be pressed against the packing ring, but care should be exercised so as not to compress packing ring. **MAKE CERTAIN** all cement is removed from air cylinder walls.

6. Apply a thick coating of clean cup grease to the piston and cylinder walls. Remove any excess grease that may enter the air passages. Lubricate the encased connecting rod spring by applying a few drops of oil (SAE #30 or equivalent) around the base of the connecting rod. The large return spring does not require lubrication.

NOTE: When handling the parts, never drop the piston or cylinder cover for these parts require accurate tolerances and a mar would ruin the machined surfaces.

7. Reassemble and test as per bench test on power contactors.



1. Aluminum Contact Link
2. Rope Type Shunt

Fig. 8 - Early Type 372 Power Contactor

Bench Test Of Type PS7 And 372 Contactors

1. Mount the contactor in the upright position on the test stand. Connect the contactor to an air test set up as shown in Fig. 9.
2. Measure the magnet valve coil resistance. The resistance must be $383 \text{ ohms} \pm 10\% @ 20^\circ\text{C}$.
3. Set the air pressure to 90 p.s.i. and check the pickup and dropout voltage of the coil. Pickup is 48 volts maximum and dropout is 5 to 28 volts.

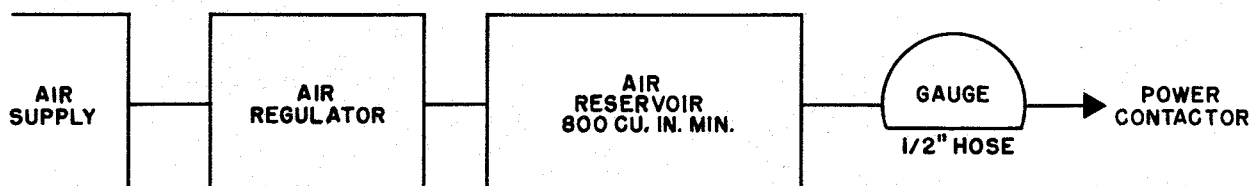


Fig. 9 - Schematic Power Contactor Air Test

NOTE: The pickup and dropout action must be sudden with no pause or hesitation on either stroke with 74 volts DC applied across the coil.

4. With the air pressure set at 90 p.s.i., there must be no air leakage when the coil is energized at 5 and 48 volts.
5. Contactor should pick up and seal off (no air leaks) at a maximum of 70 p.s.i.
6. The Type PS7 contactor must fully and positively close at 55 to 59 p.s.i. measured at the contactor.
7. The Type 372 contactor must fully and positively close at 55 to 65 p.s.i. measured at the contactor.

By-Pass Adjustment On A New Air Cylinder — Type PS7 Power Contactor

An improper setting of the air cylinder by-pass, Fig. 10, may result in the contactor not closing, or possible bouncing action of the main contact tips on closing.

NOTE: The air by-pass has already been set in air cylinders which are assembled to a power contactor.

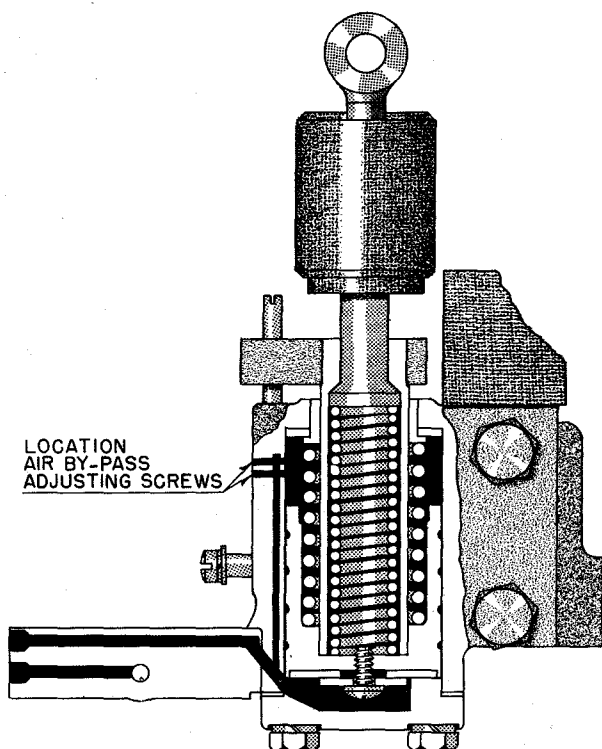


Fig. 10 - Location Of By-Pass Adjusting Screws Type PS7 Contactor Air Cylinder

The air by-pass setting in most cases should not change on these cylinders as the adjusting screw has been cut off, peened over, and filed smooth with the outer surface of the cylinder.

Following is the procedure for setting the air cylinder by-pass:

1. A contactor air test set up, as shown in Fig. 9, must be used to provide a regulated air supply which will give sufficient air pressure (50 to 70 p.s.i. measured at the contactor) and capacity for contactor operation. The air gauge must be located as close to the contactor as is practicable. Connect the contactor to the air supply.
2. Make certain the contactor is in good mechanical shape and free of binding.
3. Run a 8-32 tap into the by-pass holes in the air cylinder wall to clean the thread. Apply the two brass 8-32 adjusting screws. Next, turn both screws in until they are bottomed on the shoulders of the cylinder orifices. Then back off both screws six full turns.

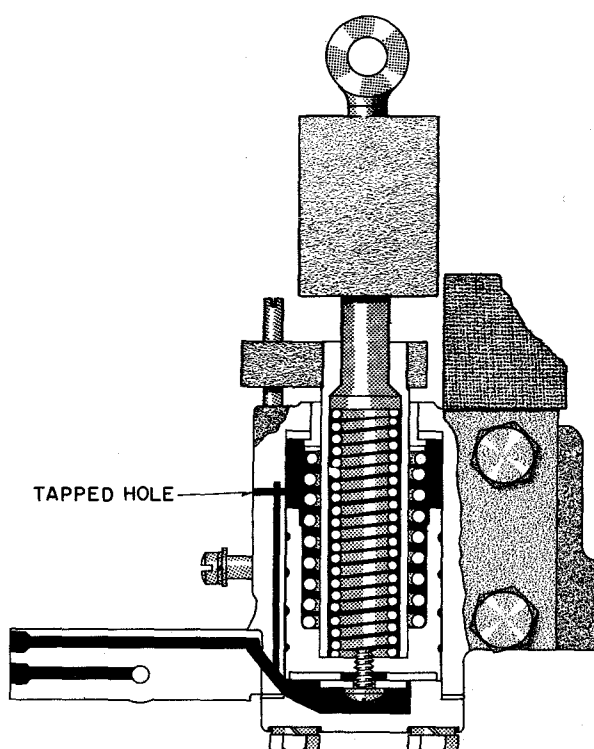


Fig. 11 - Location Of Tapped Hole Type 372 Contactor Air Cylinder

4. Set the air pressure at 58 p.s.i. and energize the magnet valve. The contactor will not pick up if in good order.
5. Turn in on the TOP by-pass adjusting screw until the contactor closes with the contact tips heeled. In the event that the top screw seals off its orifice before closure, use the lower screw to complete the adjustment.
6. To check the setting, allow the contactor to open. Then reduce the air pressure to about 50 p.s.i., energize the magnet valve and slowly increase the air pressure until the contactor closes. The gauge should read from 57 to 59 p.s.i. just before the closing jump.
7. Cut off the by-pass adjusting screws about one thread from the cylinder casting (be careful not to rotate screws during cut-off), peen tight, and file smooth.
8. Recheck the closing pressure as the peening operation will usually reduce the pressure from 1 to 2 p.s.i. An air pressure range of 55 to 59 p.s.i. is satisfactory.

Establishing The By-Pass Cut Off Point On A Type 372 Power Contactor Air Cylinder

There is no by-pass adjustment on the Type 372 power contactor air cylinder. On the Type 372 air cylinder, the 8-32 brass screw is used only to plug the tapped hole in the air cylinder, Fig. 11. On a new air cylinder, the screw should be turned in 5 to 6 full turns cut off, peened over and filed smooth with the outer surface of the cylinder.

In the event that the air cylinder, piston assembly, or insulated bars are replaced, it will be necessary to re-establish the by-pass cut off point. This is accomplished by moving the air cylinder up or down on the insulated bars (bolt hole clearance allows movement of 1/32" in each direction) until the contac-

tor closes at 60 (57-63 measured at the contactor) p.s.i. with the contact tips heeled. Then tighten the mounting bolts and drill for the dowel. Apply the dowel.

NOTE: New contact tips must be used when making this setting; also air test set up as shown in Fig. 9 must be used.

MAINTENANCE DATA

Main Contact

Contact pressure
(new contacts) - - - - 40 to 45 lbs.
Contact opening
(new contacts) - - - 9/16" to 11/16"
Contact wear (each) - - - 3/16" max.

Auxiliary Contacts (Interlocks)

Finger and Bar Type Interlocks

Contact pressure
(with filler blocks) - - - 3/4 to 1 lb.
Contact pressure
(without filler blocks) 3/4 to 1-1/4 lb.
Contact lift - - - - - 1/16" to 3/32"
Contact finger
wear - - - - - 1/32" max. off new
contact finger
Contact bar wear - 1/32" max. off new
bar

Enclosed Type Interlocks

Contact spring
pressure - - - - - 1/4 lb. at 3/32"
spring deflection
Contact opening - - - - - 3/16"
Contact lift - - - - - 3/32"
Contact wear - - - - 1/32" max. each

Magnet Valve - Type B46

Resistance @ 20°C. - 383 ohms \pm 10%
Working voltage - - - - - 74 volts DC

Pickup @ 90 p.s.i. - - - 48 volts max.

Dropout @ 90 p.s.i. - - - 5 to 28 volts

Reference

M.I. 636 - Types B46 And UB-19
Magnet Valves

M.I. 1704 - Scheduled Maintenance
Program

M.I. 5034 - Power Contactor Improved
Operation

M.I. 5053 - Reduced Wear Of Interlock
Bars On Power, Motor
Shunting And Braking Con-
tactors