

POWER TRANSFER VITAL RELAY PN-150P

(Second Generation)

ASTS USA Part Numbers						
N322508	702	703	704	705	803	806

THIS MANUAL SUPERSEDES SM 4596F DATED JULY, 1984

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1. GENERAL INFORMATION

1.1. INTRODUCTION

This manual provides service information for the PN-150P plug-in relay. The PN-150P relay is a biased relay with a built-in, or external, rectifier for use on AC. This relay is used to detect the presence of AC power and to switch equipment over to standby power when AC is not present.

The design of the PN-150P relay conforms to all applicable AAR specifications.

1.2. DESCRIPTION

1.2.1. General

The PN-150P power transfer relays are basically DC relays with a, built-in or external, rectifier which enables them to be operated on AC voltage.

The relay is factory-calibrated to operate across a wide environmental range. All moving parts are enclosed in a sturdy, transparent, dust and moisture resistant cover. To ensure the relay is inserted in its proper mounting base, all relays have indexing pins. Relays lock securely in the plug-in position.

1.2.2. Coils

Coil resistances of PN-150P relay are (depending on part number) 240 or 400 ohms. Refer to paragraph 1.3.1 to correlate part numbers to coil resistance values. The resistance selected depends on system voltage and circuitry.

1.2.3. Contacts

Contacts of the PN-150P relay are heavy duty low voltage (L.V.) silver to silver-impregnated carbon front and back. The 'S' (Stick) #2 contact of this relay is a standard duty contact designed to open slightly in advance of the other contacts. The purpose of this advance opening is to eliminate intermittent opening and closing of the power contacts due to high resistance or poor power supply regulation.

CAUTION

Equipment damage may result if the "S" #2 contact is employed for any purpose other than its intended use.
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1.3. SPECIFICATIONS

The following subsections provide the electrical and mechanical specifications of the power transfer relays covered in this manual.

2. INSTALLATION

2.1. GENERAL

Relays plug directly into a mounting base that is secured to a rack. The only installation instructions required are for the mounting base and the rectifier assembly for those relays designed or modified for external rectifiers.

2.2. MOUNTING BASE

Secure the mounting base directly to the rack using the hardware furnished. All wiring terminates at the rear of the mounting base to solderless terminals (receptacle contact springs).

Mounting base details are shown in Figure A-2 (Old-Style Base) and Figure A-3 (Improved Base) of the Appendix.

2.3. RELAY INDEXING

Relays are factory equipped with indexing pins to prevent insertion of an incorrect relay into a mounting base. Each relay is accompanied by an indexing plate that is applied to the mounting base at the time of initial installation. A typical plug-in relay with indexing pins and base with indexing plate is shown in Figure 2-1.

The following data defines the indexing that has been established for relays covered by this manual.

- a. The index code always consists of four figures (such as 0001, 0002, or 0101) and is used for both the relay and the indexing plate on the mounting base.
- b. The index code for each relay can be determined from the relay part number and its suffix which is marked on the name plate attached to the front of the relay. The first two digits of the index code are the last two digits of the part number, and the second two digits of the index code are the last two digits of the suffix. The index number thus obtained should agree with the placement of the indexing pins in the numbered vertical rows on the back of the relay starting with the top pin and reading down.
- c. The index code for each mounting base is determined by the placement of the holes in the numbered vertical rows of the large white nylon indexing plate that is affixed to the front of the mounting base. This indexing plate should not be removed from the mounting base unless it is damaged or the indexing is to be purposely changed to accommodate a relay of a different part number. Discard the indexing plate that comes in a bag tied to the handle of all new relays, unless it is needed for replacement of damaged indexing plate or for application to a new mounting base.

WARNING

Never drill new holes in a base indexing plate which will permit application of relays with different part numbers, or change indexing pins on the back of a relay unless it is being converted to a new part number. Otherwise, a hazard will be created which may compromise safety circuit functions.

2.4. RECEPTACLE CONTACT SPRINGS**2.4.1. Old-Style Base Only**

The mounting base will normally be equipped with the required quantity of J680165 solderless receptacle contact springs, and will accommodate one or two #14 or #16 wires. It can, however, be equipped with receptacle contact springs for one or two #10 or #12 wires (J680181), or for one or two #18 or #20 wires (J680179). Make certain which type of solderless receptacle contact springs accompany the mounting base before proceeding with their installation.

2.4.2. Improved One-Piece Base Only

The one piece mounting base with hardware (N451376-0302) includes a full complement of receptacle contact springs (M451142-2702) to accommodate one or two #14-#16 wires, mounting fasteners, and tags. It can, however, be equipped with receptacle contact springs for one or two #10-#12 wires (M451142-2703), or for one or two #18-#20 (M451142-2701). Make certain which type of solderless receptacle contact springs accompany the mounting base before proceeding with their installation..

Each solderless receptacle contact spring should be inspected for physical damage and straightness before proceeding with installation.

The following is recommended when installing solderless receptacle contact springs:

- a. Receptacle contact springs must be inserted into the base with the lock side down (See Figure 2-2).
- b. Make certain that the lanced tab is slightly compressed when the receptacle contact spring is inserted along the top of the cavity. The lanced tab could have been bent during handling, and therefore would not provide the required contact pressure after the relay is inserted. If the lanced tab does not touch, pull it up slightly using fingers or a suitable tool.
- c. After insertion, pull firmly on the wire to make certain the receptacle contact spring is locked in the receptacle.

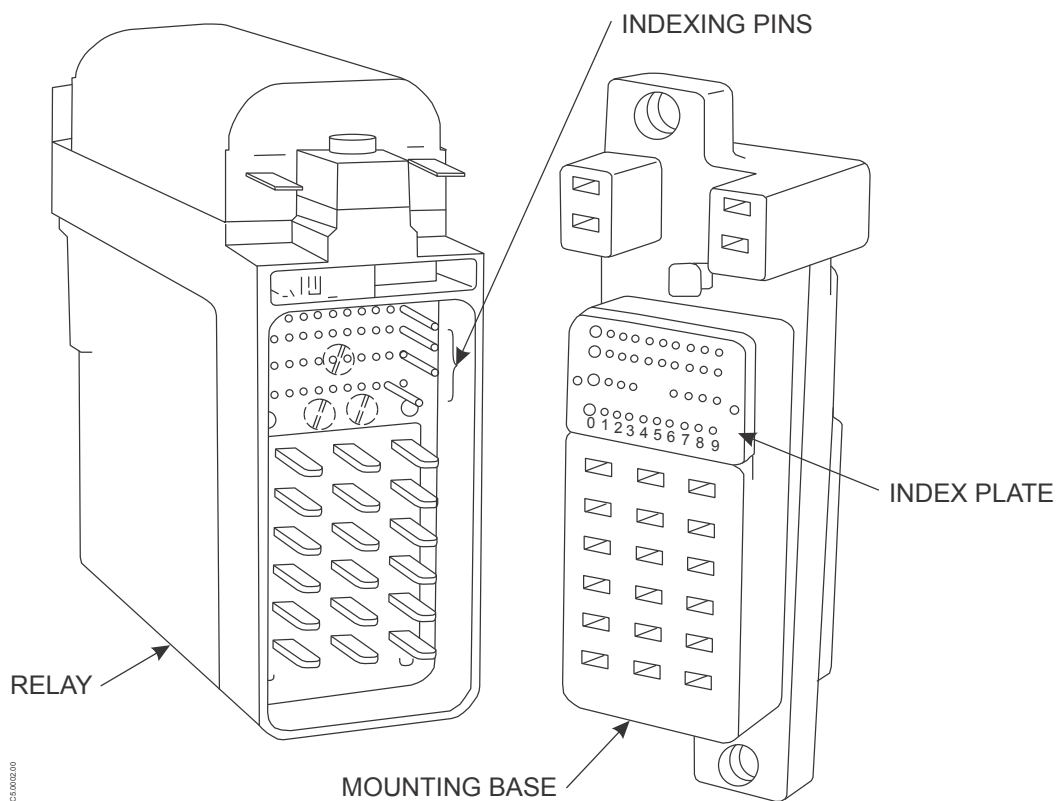


Figure 2-1. Typical Plug-In Relay and Mounting Base

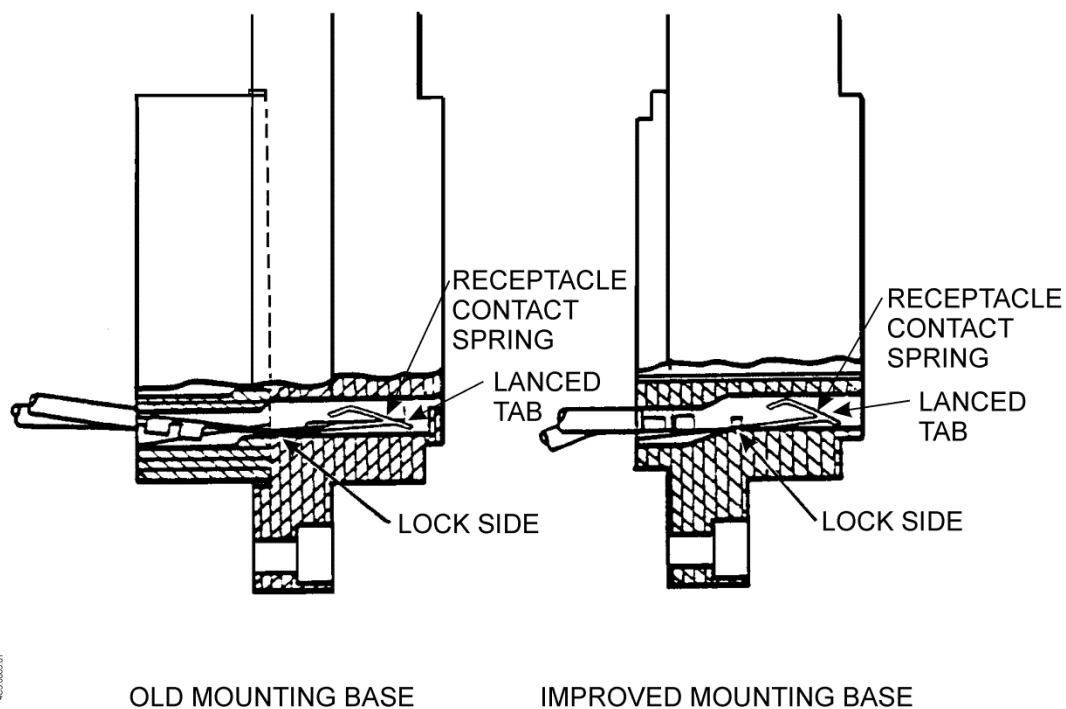


Figure 2-2. Receptacle Spring Installed

2.4.3. Installing Wires in Receptacle Contact Springs

Use the following procedure to ensure a good electrical and mechanical connection between the conductor wire and the receptacle contact spring. The following table identifies the correct crimping tool to be used when installing wires in receptacle contact springs.

Crimping Tool	Wire Size	Old Style Receptacle Contact Spring	Improved Base Receptacle Contact Spring
J397138	#10/#12 AWG	J680181	M451142-2703
J397139	#14/#16 AWG	J680165 (Standard)	M451142-2702
J397188	#18/#20 AWG	J680179	M451142-2701

- Strip 3/16 in. (0.187 in. or 0.47 cm.) of insulation from the end of the wire.
- Place the receptacle contact spring into the jaws of the proper crimping tool. When using only one terminal, of any wire size, use the shortest terminal.
- Partially close the crimping tool jaws against the receptacle contact spring to hold it in place. (Do not crush the receptacle contact spring barrel at this time.)
- Insert the stripped end of wire all the way into the receptacle contact spring barrel. Squeeze the tool handles until crimping is completed and the jaws release. When using both terminals, it is more convenient to attach the first wire to the longest terminal.
- Remove the crimped receptacle contact spring from the tool and inspect the connection. Make certain that the wire is flush with the crimped barrel and that there are no loose strands of wire.

2.5. Rectifier Assembly Installation

See Figure 2-3.

NOTE

This Rectifier Assembly installation is only necessary for relays N322508-704, -705, -806 or relays that are to be modified to have external electronic parts.

- Remove the relay from the mounting base.
- Place the Rectifier Assembly into position on the rear of the mounting base and attach, using the appropriate (#6 or #8) hardware furnished in the kit.
- Select the proper size receptacle contact springs and crimp onto the red and black leads.
- Insert the red lead into the contact space +A (A1) and the black lead into -A (C1). Press the Faston connectors onto the bridge rectifier; red to (+), black to (-).

- e. Crimp the external AC leads and the white leads onto the proper receptacle contact springs. Insert the springs into spaces +B (A2) and -B (C2).
- f. Perform a calibration check (Section 4.6) and then press the Faston connectors onto the lower PC board terminals.

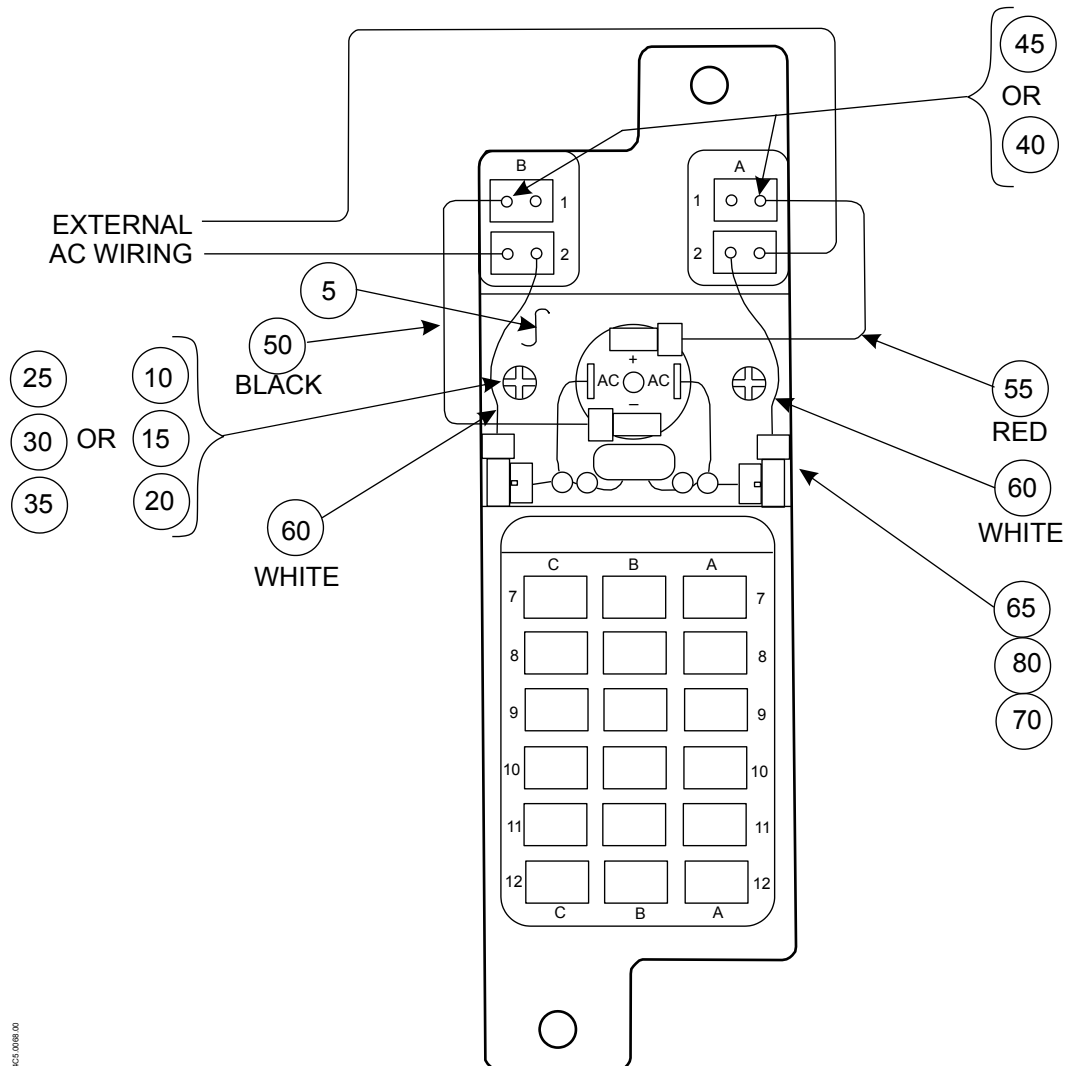


Figure 2-3. Rectifier Installation/Wiring Diagram

2.6. Relay Insertion

Orient the relay to the mounting base with the push rod to the left-hand side; then plug the relay into the base. The relay should be pushed firmly against the mounting base while depressing the latch rod. After the relay is completely seated in the base, release the latch rod and pull on the handle to ensure that the relay has locked in place.

2.7. Stick Contact

A standard low voltage contact has been added at 2F, 2H (B7, B8) base terminals of this relay for stick circuit use only. It is recommended to be used in service. The stick contact of this relay is designed to open slightly in advance of the other contacts. The purpose of this advance opening is described below under typical circuit application.

CAUTION

Equipment damage may result if the stick contact is employed for any purpose other than its intended use.

2.7.1. Typical Circuit Application

The PN-150P relay is made with one contact adjusted to open slightly in advance of the others. This contact is marked "S" in the circuit diagram of Figure 2-4 (marked 2F-2H in Figure 2-4), and is for the purpose of making the relay adaptable to a special stick circuit designed to eliminate one type of difficulty that is common to all power transfer units. This difficulty occurs under certain conditions, such as high resistance in the AC system, in fuse or wire connections, or poor regulation of the transformer supplying the AC load, which might permit the AC voltage to rise sharply as soon as the load is removed by the opening of the front contacts of the PN-150P relay. This would cause an intermittent opening and closing of the contacts which would be unsatisfactory both as to indication of the signals and service of the contacts.

The special stick circuit as shown in Figure 2-4 is so arranged that when the contact marked "S" opens, the circuit of the relay is opened so that it drops regardless of any changes which may occur in the AC voltage thereafter. After the relay has dropped, the load will be supplied by the standby source of power until the crossing relay or track relay which applied the voltage to the load, has picked-up to stop the display of the highway crossing indication. The picking up of the control relay provides a pick-up circuit for the PN-150P relay.

2.7.2. Contact Block

Wiring the contact block is shown in Figure 2-5. Refer to paragraph 4.4.4.1 in this service manual when replacing the contact block. The present relay, -702, -703, and -803 is not a direct replacement of earlier design relays, -002 and -003. The stick contact has been changed from #6 to the #2 location and the mounting base wiring must be changed according to Figure 2-5.

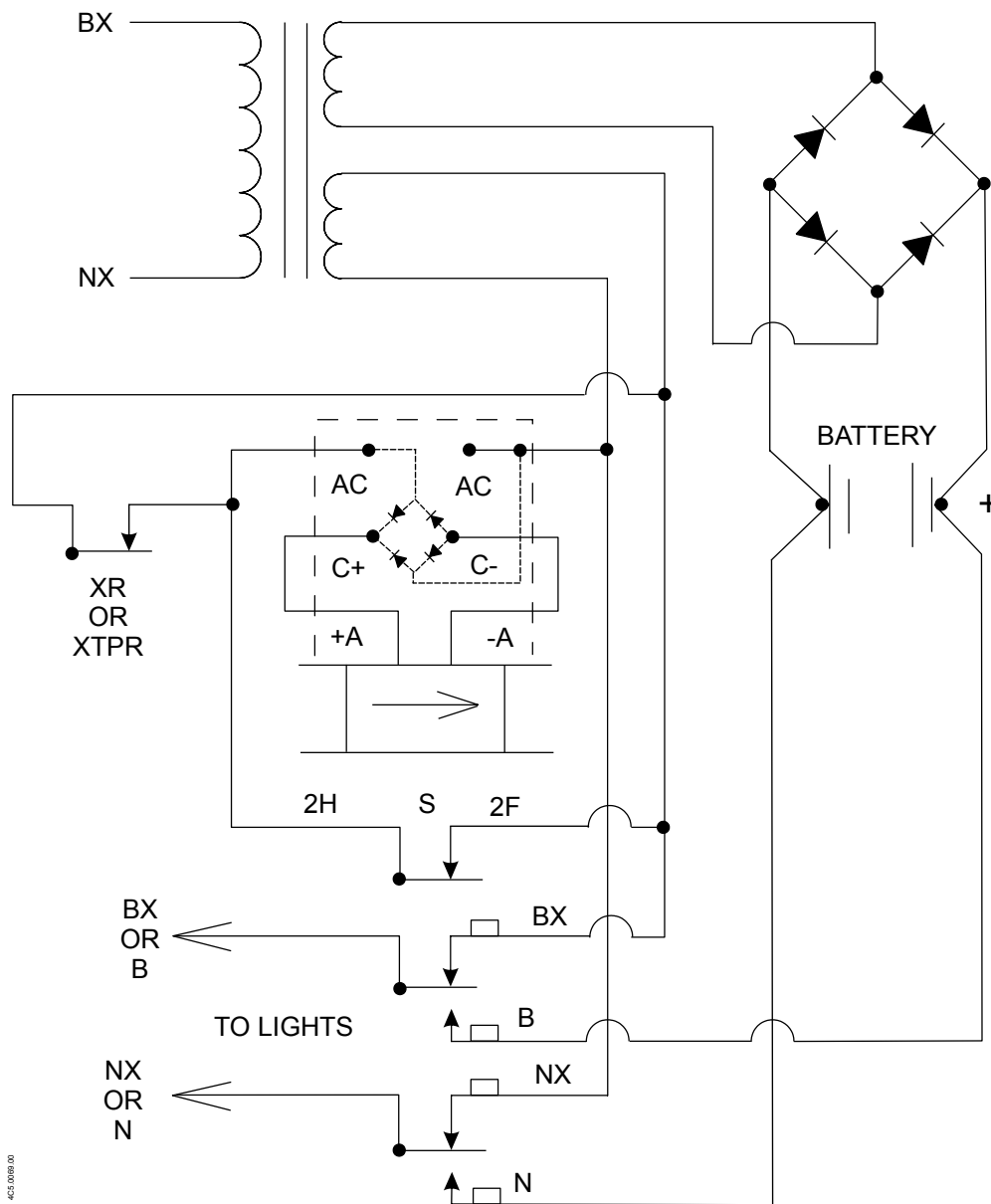


Figure 2-4. Typical Circuit Application of PN-150P Power Transfer Relay in Highway Crossing Scheme Utilizing Special Stick Circuit

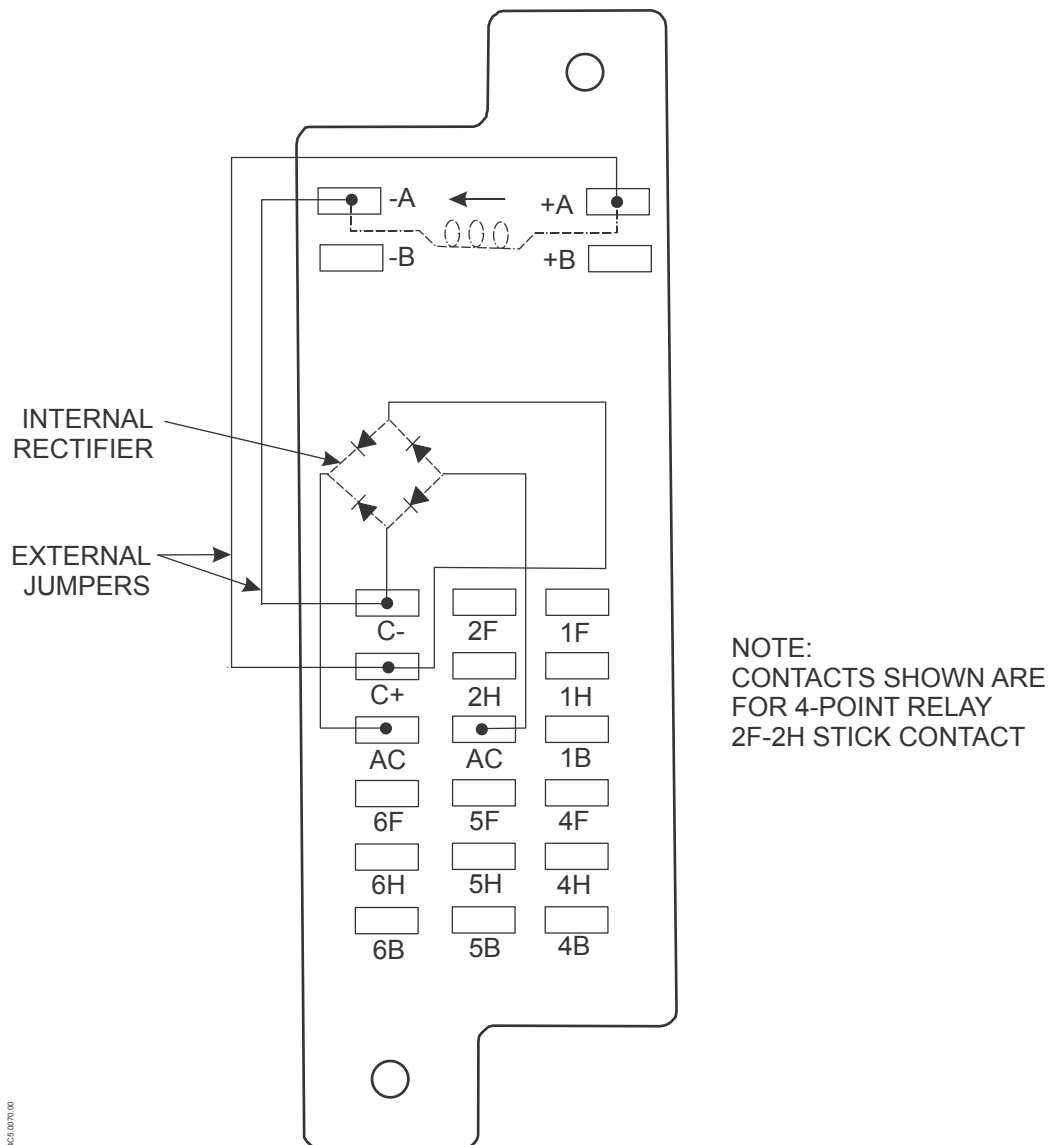


Figure 2-5. Wiring of Contact Block

3. FIELD MAINTENANCE

3.1. INTRODUCTION

This section provides the necessary periodic preventive maintenance procedures which must be performed to ensure continuous, proper, and efficient operation of the PN-150P relays covered in this manual. Field maintenance covers periodic inspections and performance tests.

3.2. PERIODIC PERFORMANCE TEST

3.2.1. Cleaning

Before inspecting and testing the relay, if necessary use a soft cloth to clean the exterior to remove any dirt or dust that may have collected. A safe cleaning solution of alcohol and water may be used for removal of accumulated dirt, grease, etc.

3.2.2. Service Requirements

3.2.2.1. General

All vital relays must be inspected and tested at least once every four (4) years. The tests and inspections are to include: pick-up current, drop-away current, timing of slow operating and timing relays; and visual inspection of contacts for damage or misalignment, corrosion or other contamination of parts, loose parts inside of the cover, broken seal, and cracked or broken cover.

All vital relays installed in locomotive or car-carried equipment are to be removed from service and adjusted, repaired and tested at least once every six (6) years.

Relays not passing the above stated tests and inspections must be replaced and not returned to service until the operating characteristics and conditions are in accordance with ASTS USA specifications.

3.2.2.2. In-Service Test

It is recommended that line relays in service be removed from service for shop repairs when one or more of the following conditions occur: (Use as a reference the calibration values given in Table 4-2.)

- a. If the Drop-Away value (D. A.) falls below 90% of the new relay value.
- b. If the Pick-Up value increases to more than 110% of the new relay value.

3.2.2.3. Test Procedures

Test the operating characteristics of the PN-150P relays as given in Section 4.6 Calibration.

3.3. REPAIR

3.3.1. Relays with Defective Internal Rectifiers

If it is found that a PN-150P relay failure is due to a defective internal rectifier, a relay retro-fit kit (X451131-3601) can be used to disconnect the internal defective rectifier and mount its replacement externally on the mounting base. This will convert relays with part numbers N322508-702, -703, and 803 to relay part numbers N322508-704, -705, and -806 respectively.

This repair causes the internal rectifier to be no longer functional and can be done in an emergency, however, it is recommended that the relay part number be changed along with the indexing and index plate so that the relay cannot be placed into a base that has not been modified.

- Remove the external wire jumpers from (+A) to (C+), and from (-A) to (C-), and discard. See Figure 3-1.
- Remove the external AC wiring from the (AC) spaces and then complete the Rectifier Assembly Installation procedure found in Section 2.5.

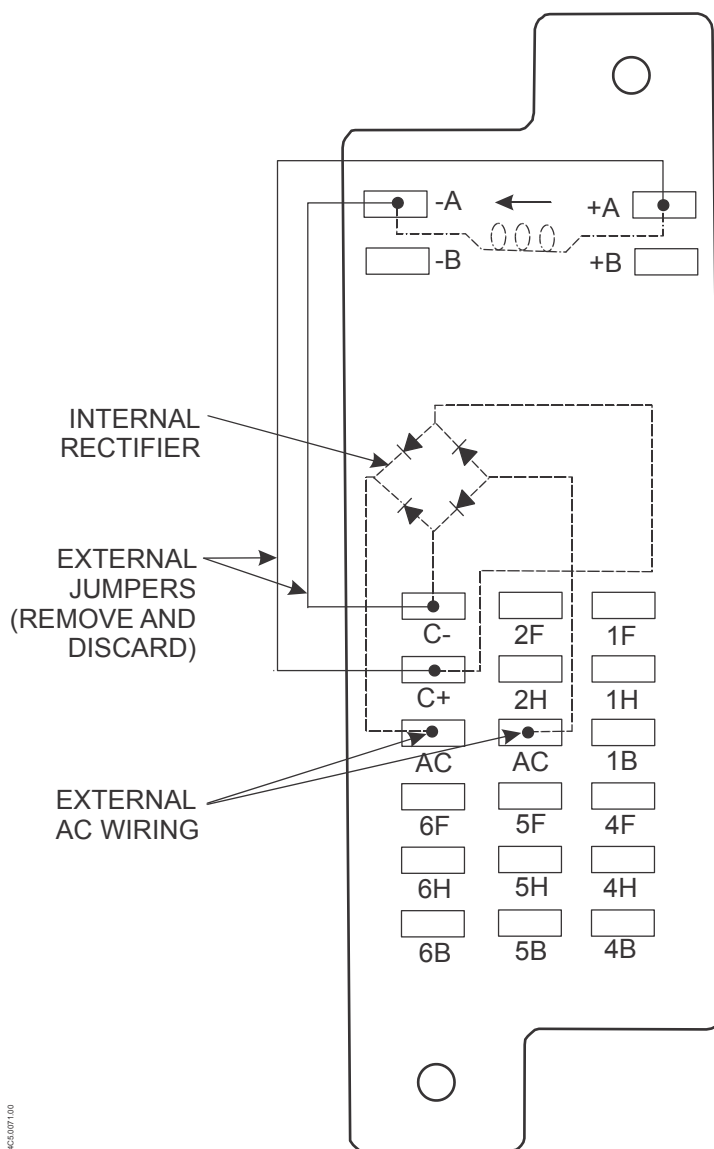


Figure 3-1. Relay Base Before Wiring

3.3.2. Relays with Defective External Rectifiers

After it has been determined that the failure of the relay is due to a defective rectifier assembly:

- a. Disconnect the two leads (Figure 2-3, Item 60) and the two leads (Figure 2-3, Items 50 and 55) from the rectifier assembly.
- b. Remove the two mounting screws and hardware. Replace the defective assembly with a new one and attach with the hardware.
- c. Reconnect the red and black leads (50 and 55).
- d. Perform a calibration check (Section 4.6), and if the relay meets the calibration values, press the remaining two Faston connectors onto the lower two terminals of the rectifier assembly thereby connecting the relay into service.



4. SHOP MAINTENANCE

4.1. INTRODUCTION

This section provides the information necessary to perform shop level repairs of the PN-150P relays covered in this manual. In general, relays arriving at the shop for repair have been checked in the field and have been found to perform unacceptably or have been physically damaged.

4.2. CLEANING AND INSPECTION

Before inspecting the relay and initiating repairs, use a soft cloth to clean the exterior carefully to remove any dirt or dust that may have collected. A safe cleaning solution of alcohol and water or common laundry detergent may be used for removal of accumulated dirt, grease, etc.

Inspect the relay exterior for signs of physical damage, such as cracked or broken cover, cracked or damaged housing, and damaged and or missing contact block terminals and indexing pins. If severe damage is found, a careful inspection of the interior components should be made for physical damage.

Remove the cover and clean the surface between the armature and the pole faces, especially the stop pin area, using a lint-free cloth and alcohol.

Proceed with stop pin and relay contact cleaning, using the following recommended cleaning materials:

Recommended Cleaning Materials

Order Reference

A relay contact cleaning kit, part number X451646-0901, is available that consists of the following three items, or which may be ordered individually:

Burnishing Tool, P. K. Neuses Co. No. 3-316

J397187 (pkg. of 5)

Burnishing Tool, P. K. Neuses Co. No. N318 (Heavy Duty)

J397187-001 (pkg. of 5)

Paper Strip, strips cut from 67 pound white
Springhill Vellum Bristol Paper

J793094 (pkg. of 50)

Also recommended (commercially available):

Emery Paper, Wet or Dry, 600 Grit, cut in strips

(commercially available)

Freon TF, Miller Stephenson MS180

(commercially available)

Stop Pin Conditioning Graphite Stick

(N4521151-3203)

4.2.1. Armature Stop Pin Conditioning

The following instructions are for cleaning the armature stop pin (See Figure 4-1). This procedure should be followed wherever a relay is shopped for failure to meet its calibration specifications during scheduled field inspection and tests.

Shop Maintenance

- a. After removing the cover, clean the stop pin and adjacent surface by saturating a paper strip (contained in J793094) with Freon TF and then placing it between the armature and pole face. Apply moderate pressure on the armature and draw the paper out. Continue until no residue is removed from the surfaces. Dry the surfaces using a clean strip of paper.
- b. The next step is to apply a dry lubricant such as graphite to the relay stop pin and its point of contact on the pole face.

(1) Insert the Stop Pin Conditioning Graphite Stick (N451151-3203) between the armature stop pin and its point of contact on the pole face with graphite against stop pin. While applying moderate pressure on the stick, pull the stick back and forth in a circular motion over the stop pin, continuing several seconds to ensure a sufficient amount of graphite transfer.

It is not necessary to observe a significant deposit of graphite since most of what is required can only be determined by means of a microscope.

- c. Recheck relay calibration and prepare relay for return to service.

4.2.2. Cleaning Relay Contacts

This section covers recommended methods for the preparation and cleaning of relay contacts.

After contacts have been dressed and/or after adjustments have been made to meet calibration requirements, the contacts should be cleaned in accordance with the following procedures.

CAUTION

The following Caution statement is only mandatory for clear Lexan molded drivers. Deviation from this may result in damage to the equipment.

If it is desired to use an aerosol spray for cleaning relay contacts, only virgin Freon TF (available from Miller Stephenson Chemical Co. as MS-180 or MS-230 contact RE-NU FREON TF) is approved by ASTS USA for cleaning contacts with the driver attached to the contact springs.

NOTE

When using the paper strip, clean the back contacts first, then the front contacts last. Discard the paper strips when dirty.

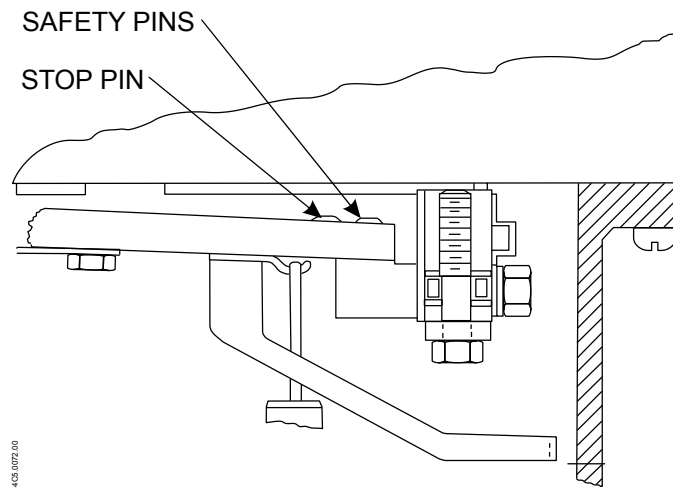


Figure 4-1. Armature Stop Pin Location

4.2.2.1. Contacts That Are Severely Burned

- a. Using a 600 grit emery paper strip folded with the grit side out so that both contacts can be burnished simultaneously, stroke the contacts in the direction of contact wipe.
- b. Using the burnishing tool, stroke the contacts several times in the direction of contact wipe.
- c. Place the paper strip between the open contacts, then close the contacts and withdraw the paper strip.
- d. Repeat step "c" several times, if necessary.
- e. Using the Freon TF spray, give the contacts a degreasing/wash.
- f. Place the paper strip between the open contacts, then close the contacts and withdraw the paper strip.
- g. Repeat step "f" several times if necessary.

4.2.2.2. Contacts with Heavy Tarnish, Slightly Rough or Pitted

Perform the procedure in Subsection 4.2.2.1, Steps "b" to "g".

4.2.2.3. Contacts with Surface Film or Oxidation (Not Pitted)

Perform the procedure in Subsection 4.2.2.1, Steps "f" and "g".

4.3. CHECK-OUT PROCEDURE (Performance Test)

Perform calibration in accordance with Section 4.6.

4.4. REPAIRS AND REPLACEMENT

Since the contacts are the only wearing parts in this relay, in most cases the relay can be restored to proper operation by dressing (Section 4.2.2.1) and readjusting (Section 4.5.5) them.

4.4.1. Recommended Tools

Twist Drill - #42

Screw Driver - Torque Measuring

4.4.2. Disassembly

Dismantle the relay only to the degree necessary to complete repairs. Refer to the parts list appendix for part information and location of parts. In general, to dismantle the plug-in relay, proceed with the following sequence:

- a. Remove relay cover seal.
- b. Carefully remove plastic cover.
- c. Remove/disassemble relay components as required.
- d. Remove contacts/contact block as required.
- e. Remove permanent magnet as required.

NOTE

These magnets are of a special alloy that permits retention of proper strength indefinitely if not abused. When not in place on relays, magnet assemblies should be kept separated from other magnetic objects and the screws, which hold the extension to the magnet, be kept tight. Should a magnet become weakened, it should be returned to the factory for recharging where there is special equipment to fully charge the magnet. It will then be aged it to its best working strength.

4.4.3. Reassembly

Reassembly is accomplished generally in the reverse order of disassembly. Do not overtighten or force parts when reassembling a relay. The following paragraphs provide additional instructions to be followed during reassembly of this relay.

Upon completion of reassembly, calibrate the relay as directed in paragraph 4.6.

4.4.4. General Parts Replacement

4.4.4.1. Replacing Contact Block

If the contact block is to be replaced by another, remove the old block, then use a small punch to remove the small dowel pins. Attach the new block with the four screws. Run a #42 drill (0.0935 Dia.) thru the dowel pin holes into the epoxy contact block for a total depth of 9/16" + 1/32 - 0.

NOTE

Replacement contact blocks **MUST** be of the same general design.

Carefully install the dowel pins, tapping in until they are flush with the surface.

If it is necessary to install a used contact block from another relay, remove only one of the dowel pins from the frame. Carefully press the block on the remaining pin and fasten in place with the screws. One dowel pin will adequately hold the block in place. Install the contact block mounting screws and torque them to 10 ± 2 inch pounds

Do not overtighten or force parts when reassembling a relay. Upon completion of reassembly, calibrate the relay as directed in Section 4.6.

4.4.4.2. Permanent Magnet

The polarity of the magnet should be such that the top end farthest from the two notched holes will attract the end of a compass needle which points toward geographic south.

NOTE

The magnetic shunt is not used in this relay.

The permanent magnet assembly should be applied to the relay as shown in Figure 4-2. Tighten the two long screws holding the magnet assembly to the pole piece sufficiently to straighten the curved strap against the magnet. Bend the nut locks securely up against the sides of the screw heads.

4.5. ADJUSTMENTS

All adjusting and testing must be done with the relay in its normal operating position.

4.5.1. Recommended Tools and Test Equipment

<u>Item</u>	<u>Part Number</u>
Gap Gauge - 0.001 in. to 0.200 in.	
Gram Gauge – 40 - 350 Grams	
Driver Removal Tool	N451151-2801
Bending Tool	J397164-0039

4.5.2. Armature Air Gap

The armature air gap is the distance from armature to pole face, with the stop pin against the pole face. It should not at any point be less than 0.038', minus 0.002'. At the stop pin, light must not be visible across more than 25% of the diameter of the pin. Light must be visible between the hinge plate on the armature and the forward pole face. Safety stop pins should have minimum of 0.001 inch clearance when the armature is at full stroke.

4.5.3. Armature Stroke

Armature stroke is the distance from stop pin to pole face, with the armature resting against the permanent magnet assembly. Assemble the magnet to the relay frame with the magnet held against the small step in the pole face, using a steel screw on the left side and a brass screw on the right side. With a spacer between stop pin and pole face equal to the value for Test #1 called for in Table No 1, adjust and tighten the magnet extension, to be just touching the two stop pins on the bottom of the armature. Magnet hold down screws to be torqued to 15 ± 2 inch pounds.

With the stop pin spacer removed and the armature released, both back stop pins should make contact with the permanent magnet extension over at least 50% of the diameters and neither should project over the edge of the permanent magnet extension. In this position, the air gap at the permanent magnet extension face should average 0.004 inch parallel and must not be less than 0.003 inch at any point. This is the physical air gap from plated magnet extension to plated armature.

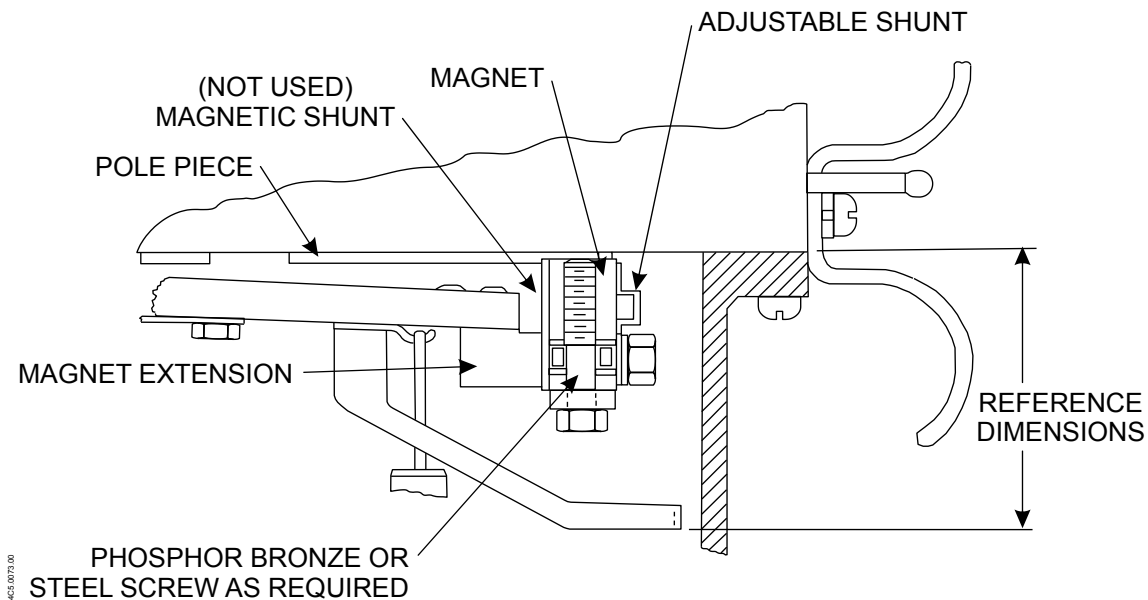


Figure 4-2. Assembly of Permanent Magnet

4.5.4. Indicator

Adjustment of the armature position indicator after calibration should be made so that the bottom of the red painted surface is 1-13/16-inch from the main body of the relay frame. Viewed from the front of the relay with cover applied, the indicator should be in full view with the armature in the deenergized position, and should be hidden with the armature in the energized position.

4.5.5. Contact Adjustment

4.5.5.1. General

The fingers supporting the contact springs should be straight and approximately at right angles to the relay base. All adjustments of contacts should be made using contact adjusting tool J397164-0039. The contact driver can be removed by using the molded contact driver removal tool N451151-2801. Because of the effect of the weight of the contact tips, all checks of contact adjustment should be made with the relay in the normal upright position. Best contact stability is obtained by slightly overbending the spring and returning it to the desired position.

4.5.5.2. Heel Contact Springs

Before adjusting these heel springs it should be determined that the dimensions exist as shown in Figure 4-3 and that the bifurcated parts have a slight trapped pressure against the main member.

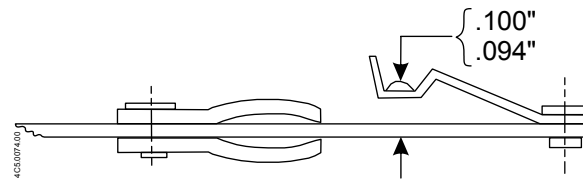


Figure 4-3. Heel Contact Spring

4.5.5.3. Relays with Molded Drivers

The contacts are to be adjusted to just touch when using "closed" spacer. As a guide, there should be no more than 2 grams spring pressure between the contact tips. For any contact adjusted closed (using nominal spacers per Table 4-1), a 0.005" thicker spacer for the fronts and a 0.005" thinner spacer for the backs must allow the contacts to be open.

If the heel springs show free play in the driver slots when the armature is held mid-stroke (neither fronts nor backs touching), the driver must be removed and the heel spring driver clip must be adjusted to 0.094 to 0.100 between the top of the dimple and the bottom of the heel springs.

Adjustment Procedure

- a. Plug relay into appropriate mounting base on test stand.
- b. Check heel springs for bow and adjust as required.
- c. Place contact driver in position on relay.
- d. Insert front contact closed spacer per Table No. I over main stop pin.

NOTE

The value for the stick contact spacer is also given in Table 4-1.

- e. Adjust front contacts to touch.
- f. Insert back closed contact spacer marked per Table 4-1 over main stop pin.
- g. Adjust back contacts to touch.
- h. Pull contact driver from relay. (Tool #N451151-2801)
- i. Bend heel springs to approximately 0.005 min. from front contact (light perceptible). Check that heel springs are approximately in line.
- j. Place driver on relay.
- k. Use front closed spacer per Table 4-1 and adjust front contacts to just close (0.048 typically).
- l. Remove spacer and replace with front open spacer (per Table 4-1) and adjust front contacts to just open (0.043 typically). Note the value for the stick contact also.
- m. Remove spacer and replace with back close spacer (per Table 4-1) and adjust back contacts to just closed (0.086 typically).

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- n. Remove spacer and replace with back open spacer (per Table 4-1) and adjust back contacts to just open (0.081 typically).
- o. Check to see if heels are floating. Adjust heel clip as required.

4.5.5.4. Contact Openings

In obtaining proper calibration it is permissible to vary the adjustments given in the foregoing paragraphs, however:

- a. With the armature in its fully released position, the front contacts must be open at least 0.050 inch.
- b. When a front contact is just making, the corresponding back contact must be open more than 0.020 inch.

4.6. Calibration

4.6.1. Recommended Test Equipment

<u>Nomenclature</u>	<u>Part/Model/Type Number</u>
Filament Transformer	120 VAC Primary, 12.6 VAC Secondary
Variable Transformer (Variac)	120 VAC, 60Hz input
Digital Multimeter	HP3435A

4.6.2. General

The calibration shall be obtained by adjusting the coil spring to meet the approximate requirements outlined in the tables. The adjustable shunt should then be bent out if necessary to obtain approximately 280 grams hold down force measured at the bottom of the operating arm.

Reset the coil spring to give a pick-up very close to, but no higher than the value given in Table 4-2. If the relay does not meet the calibration value, readjust the shunt to give a hold down force in Table 4-1 and change the contact spacers.

All relay adjustments normally can be made by adjusting the coil spring and/or contacts within the allowable limits.

4.6.3. Procedure

Connect power transfer relay test circuit, as shown in Figure 4-4, and proceed as follows, using the referenced values for the specific relay given in Table 4-2.

- a. Set switch S1 to the OFF position.
- b. Set voltmeter M1 to appropriate AC voltage range (Refer to Table 4-2).
- c. Set Variac output control to minimum output setting.
- d. Connect circuit to 120 VAC, 60Hz line.
- e. Set switch S1 to the ON position.
- f. Adjust Variac output control up to, but no higher than the Normal/Charge voltage level as given in Table 4-2 where relay energizes and armature picks up through full stroke.

- g. Slowly decrease the Variac output until the armature just causes the front contacts to open and back contacts to close. Voltmeter M1 should indicate between the dropaway voltage limits given in Table 4-2.

NOTE

Drop-away and Hesitation. When measuring the drop-away, it shall be considered acceptable to have the armature stop pin move away from its pole piece by 0.005 inches and not go to full release. However, after once the armature begins to move, after further reduction in voltage, it must without any hesitation transfer from the front to the back contacts. A hesitation or "hang" is defined as the front contacts being closed with little or no contact pressure.

- h. Further decrease the Variac output until the full back contact compression is achieved. The voltmeter M1 should indicate no less than the dropaway with full back contact compression voltage given in Table 4-2.
- i. Immediately after drop-away value has been measured, reduce the current to zero. Open the circuit for one second, and again apply current, gradually increasing it until the armature moves away from the permanent magnet with a definite sudden motion. The voltage at which this occurs should not be more than 95% of the actual pick-up value measured on the tested relay. If it is, reduce the magnet hold down force by moving the adjustable shunt closer to the magnet within allowable limits and/or increase the spacer for adjusting the back contacts.

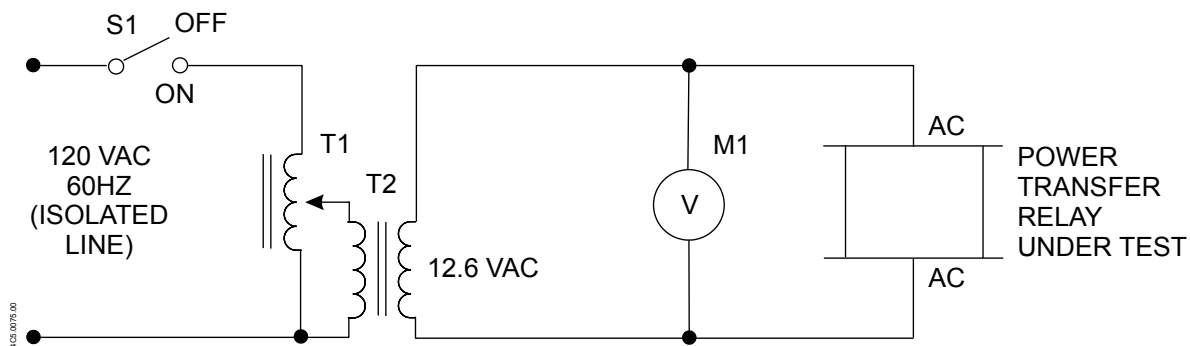


Figure 4-4. PN-150P Relay Test Circuit

- j. Continue increasing current until the armature picks up to close the front contacts, moving to the stop pin at the same energization value. The voltage at which this occurs should not be more than that specified in the calibration tables for Pick-Up and Working.

4.6.4. Hold Down Torque

After the relay has been adjusted to meet calibration requirements, the force required to move the armature away from the permanent magnet extension should be approximately 250 grams for the

Shop Maintenance

4 point relays. This value should be measured at the bottom and center of the molded driver and is the upward force in grams required to move the armature away from the permanent magnet. When measured, the value must not be less than the value given in Table 4-1.

4.6.5. Contact Resistance

Resistance of front contacts should be measured with the armature in its full-stroke position, and resistance of back contacts should be measured with the armature fully released. Cleaned contact resistance should not exceed the following values.

<u>Type of Contacts</u>	<u>Ohms Front Contacts</u>	<u>Ohms Back Contacts</u>
Silver to Silver-Impregnated Carbon	0.09	---
Heavy Duty Silver to Silver-Impregnated Carbon	0.09	0.05

4.7. MODIFICATIONS

4.7.1. External Rectifier (Relay Retrofit Kit X451131-3601)

Existing PN-150P relays with internal rectifiers can be modified to have an external rectifier attached to the mounting base. Relays with part numbers N322508-702, -703, and -803 can be converted to N322508-704, -705, and -806 respectively. This is accomplished by rewiring the base and mounting the external rectifier. The procedure used is given in Section 3.3.1.

This rewiring causes the internal rectifier to be no longer functional and the relay part number, indexing and index plate must be changed so that the relay cannot be installed in a base that has not been modified. In the Relay Retro-Fit Kit (X451131-3601) is a new name plate, index plate and index pin. Stamp the new part number on the name plate. Remove the index pin in the number 2 or 3 location (depending on the relay to be revised). Using the new index plate as a guide, drill a #42 hole $\frac{1}{4}$ " deep at the appropriate new pin location and insert the pin.

After modifying the relay, a calibration check (Section 4.6) must be made using an externally mounted rectifier. It is recommended that a rectifier board, N451131-3501, be available in the shop for calibration purposes.

4.7.2. Parts List (X451131-360)

See Figure 2-3.

Item	Description	Part Number
5	Rectifier Assembly	N451131-3501
10	Screw, 6-32 x 3/8, Rd. Hd. Stl.	J525031
15	Washer, #6 Flt. Stl.	J047996
20	Washer, #6 Lock, Bz.	J047708
25	Screw, 8-32 x 3/8, Rd. Hd. Stl.	J525128
30	Washer, #8 Flt. Stl.	J047745
35	Washer, #8 Lock	J047709
40	Receptacle Contact Spring	M451142-2702
45	Receptacle Contact Spring	J680165
50	Lead, Black, 6-1/2"	N397832-005
55	Lead, Red, 6-1/2"	N397832-004
60	Lead, White, 4"	N395673
65	Index Plate	J078457
70	Name Plate	M451496-6401
75	Print, Drawing	D451131-36
80	Index Pin	J487090

Table 4-1. Adjustment and Calibration Summary for PN-150P Power Transfer Relays

Test Number	4 Point Relay			Stick Cont.	2F 2P	Remarks
	Nominal	Minimum	Maximum			
1. Permanent Magnet Assembly	0.145"	0.135"	0.155"	Nom	Min	Main Stop-Pin Spacer For Adjustment. Back Stop Pins Touching.
2.a Front Contact Adjustment	0.053"	0.048"	0.058"	0.035	0.030	Main Stop-Pin Spacer. Contact Just Open.
2.b Front Contact Adjustment	0.048"	0.043"	0.053"	0.030	0.025	Main Stop-Pin Spacer. Contact Must Close.
3. Back Contact Adjustment	0.081"	0.086"	---			Main Stop-Pin Spacer. Contact Just Open.
4. Back Contact Adjustment	0.086"	0.091"	---			Main Stop-Pin Spacer. Contact Just Close.
5.a Front Contact Openings	---	0.020"	---			With Back Contacts Just Closed.
5.b Front Contact Openings	---	0.050"	---			Armature Released Against Permanent Magnet.
5.c Front and Back Contact Openings	---	0.005"	---			With Operating Arms Removed.
6. Drop-Away	---	Table 4-2	---			After Charge. To Close Back Contacts.
7. Drop-Away To Full Back Contact Pressure	---	Table 4-2	---			After Drop-Away, Reduce Current Until Armature Rests on Permanent Magnet.
8. Break-Away from Permanent Magnet	---	---	95%			Of Actual Pick-Up for Break-Away from the Permanent Magnet.
9. Pick-Up and Working	---	---	Table 4-2			Mark Actual Value on Left Side of Armature
10. Hold-Down Torque		250 Gms				Force on Bottom Contact Engaging Pin of Operating Arm to Pull Armature from Permanent Magnet After Charge.
11. Final Electrical Inspection						Recheck Tests No. 6 and 9 with Cover Applied.

Table 4-2. PN-150P (4-Point) Calibration Values

Coil Resistance Ohms	Normal/ Charge Volts (AC)	Drop-Away Volts (AC)		Full Back Contact Pressure Drop-Away Volts (AC)
		Min.	Max.	
240	10	7.0	7.3	3.5
400	12	8.4	8.75	4.2

APPENDIX-A. PARTS LIST

A.1 Parts List for PN-150P Relays with Molded Drivers

See Figure A-1.

ITEM	DESCRIPTION	PART NUMBER
1	Frame, Relay	N438410-001
2	Rod, Latch	M388888
3	Washer	M437208
4	Spring, Coil	M263919
5	Latch	M321728
6	Dowel Pin	J048716
7	Spring	M321861
8	Armature	N344118-001
9	Washer	M291657
10	Screw, #6-32 x 7/16 Fil. Hd.	J052243
11	Block, Contact (-702, -703, -803)	N428420
11	Block, Contact (-704, -705, -806)	N438966
12	Screw, #6-32 x 3/4 Phillips Fil. Hd. Mach. TP	J522168
13	Arm Molded Operating	M373632-001
14	Indicator	M321894-002
15	Lock Nut	M438415
16	Screw, Spring Guide	M310328-001
17	Magnet, Permanent	M344418
18	Strap	M321853
19	Lock Bolt	J792919
20	Screw	J463078
21	Handle	J561111
22	Washer, Lock #10 Int. Tooth Ph. B2. NP	J047710
23	Screw, #10-32 x 3/8 Phillips Pan Rd. Stl. Cad. P.	J525277
24	Coil (Relay N322508-702, -704)	N333975
24	Coil (Relay N322508-703, -705)	N321647
24	Coil (Relay N322508-803, -806)	N433498
25	Deleted	--
26	Tubing, (-702, -703, -803)	A578438
27	Screw, 1/4-20 x 3/4 Hex. Cap. Stl. TP	J050016
28	Screw, #4-40 x 3/16 Rd. Stl. F	J525024
29	Plate, Name	M451496-6401
30	Pin, Indexing	J487090
31	Gasket	J047081
32	Cover	J776596
33	Washer, 0.170 ID P1. Stl.	J475199
34	Deleted	--
35	Screw	J522042-001
36	Wire, Seal	N330681-0802
37	Seal	N330681-0803
38	Deleted	--
39	Tag, Calibration	S003665
40	Nut, 6-32 Stl. Hex (-702, -703, -803)	J048148
41	Parts Bag (Relay N322508-702)	N330681-0802
41	Parts Bag (Relay N322508-703)	N330681-0803
41	Parts Bag (Relay N322508-803)	N330681-0803
41	Parts Bag (Relay N322508-704)	N330681-0806
41	Parts Bag (Relay N322508-705)	M399568
41	Parts Bag (Relay N322508-806)	M349785-001
42	Insulation, Tubing (-702, -703, -803)	M399568

Appendix-A. Parts List

ITEM	DESCRIPTION	PART NUMBER
43	Spring, Operating Arm	M349785-001
44	Washer,	J047713
45	Spacer Magnet (as required)	M347526
46	Counterweight	M451176-0401
47	Seal Vent	J790257
48	Nut Lock	M451574-0101
49	Tag	M451496-6201
50	spacer	M451446-1801
51	Plate Adjustment	M451446-1701
52	Screw, 6-32 x 13/16 Hex. Cap. Stl.	M341634
53	Pin Roll	J487087
54	Deleted	--
55	Screw, 6-32 x 5/8 Rd. Ed.	J525601
56	Rectifier, (-702, -703, -803)	J726510-0123
57	Washer, Int. Lock #6 (-702, -703, -803)	J047713

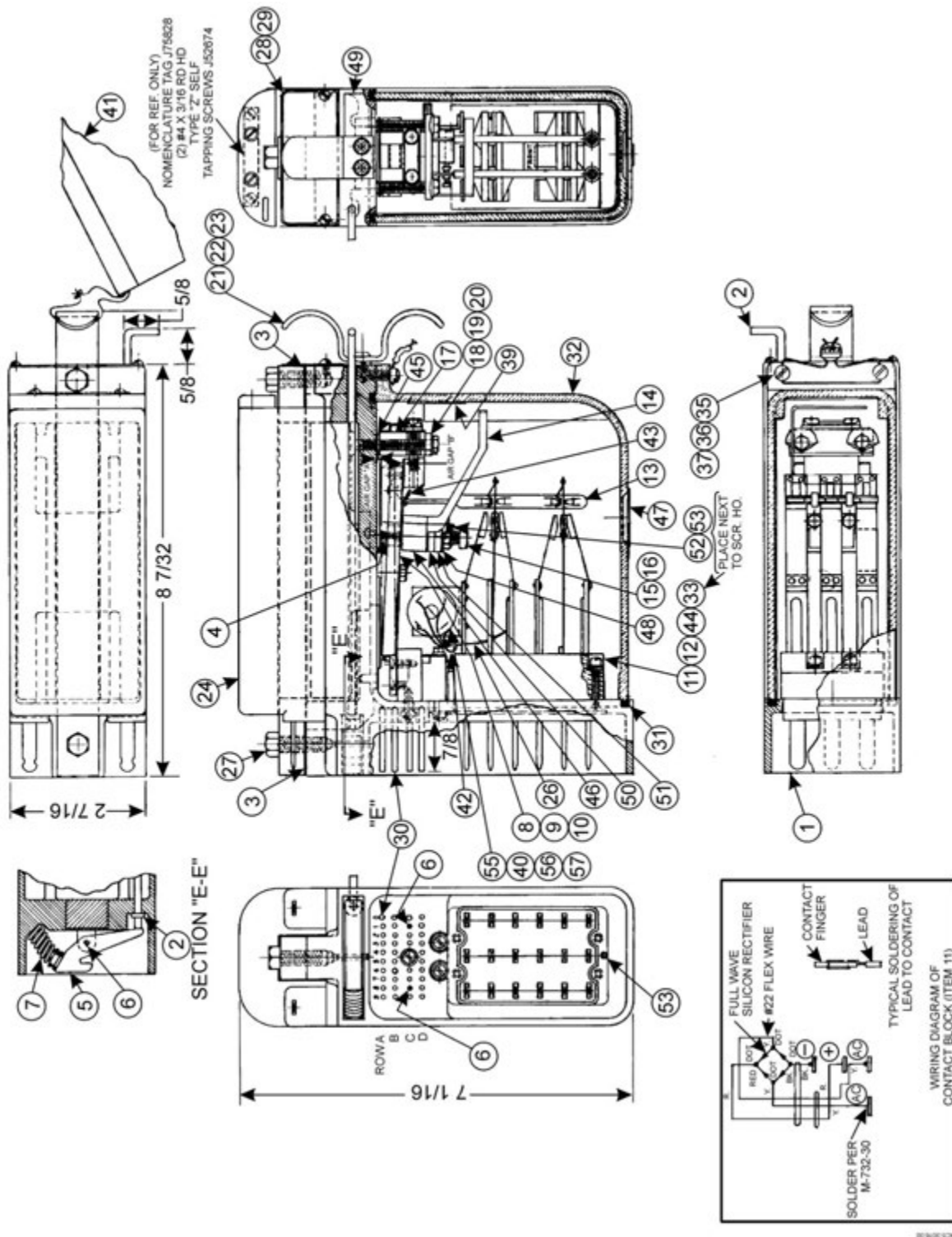


Figure A-1. PN-150P Relay with Molded Driver

Appendix-A. Parts List

A.2 Parts List for Old-Style Mounting Base

See Figure A-2.

ITEM	DESCRIPTION	PART NUMBER
	Base Complete	N438562
	Base Only	N38562-099
1a	Receptacle Contact Springs, Solderless Type, for #18 to #20 Wire	J680179
1b	Receptacle Contact Springs, Solderless Type, for #14 to #16 Wire	J680165
1c	Receptacle Contact Springs, Solderless Type, for #10 to #12 Wire	J680181
2	Base, Basic Mounting	J078455
3	Plate, Contact Clamping (Order should specify part number of mounting base for which contact clamping plate is desired.)	J078458
4	Plate, Coil Clamping (Order should specify part number of mounting base for which coil clamping plate is desired.)	J078459
5	Strike	M321745
6	Tag	J075828
7	Screw, #4 x 3/16 Rd. Hd.	J052674
8	Screws, 1/4-20 x 1-1/4 Rd. Hd. (Not Shown)	J052667
9	Washer, Lock (Not Shown)	J047775
10	Washers, Plate 1/4 Stl.	J047501
11	Nut, 1/4 (Not Shown)	J048002
12	Deleted	---
13	Screw, #6-32 x 1-1/4 Fil. Hd. S. Mach.	J052246
14	Nut	M267499
15	Screw, #6-32 x 5/8 Fil. Hd. S. Mach.	J522090
16	Indexing Plate (Relay N322501-702)	M322078-0101
16	Indexing Plate (Relay N322501-703)	M322078-0102
16	Indexing Plate (Relay N322501-803)	M322078-0104
17	Meter Test Plug	N322965
18	Insulated Test Plug (For opening any coil or contact circuit and for removing receptacle springs)	J077931
NOTE "A: When mounting base complete is ordered, a bag of parts is included in the inner carton with the mounting base and instruction prints. Bag Contains: Tags (Item 6), Screws (Item 7), and Items 8, 9, 10, and 12 which are used for attaching the mounting base to the rack. Included Also are: (Required Quantity) Receptacle contact springs (solderless) J680165 for #14 to #16 wire. If other wire size is used, request the proper part number as shown in Item 1 when ordering base complete. (i.e., N438562 except using receptacle contact springs, solderless J680181).		

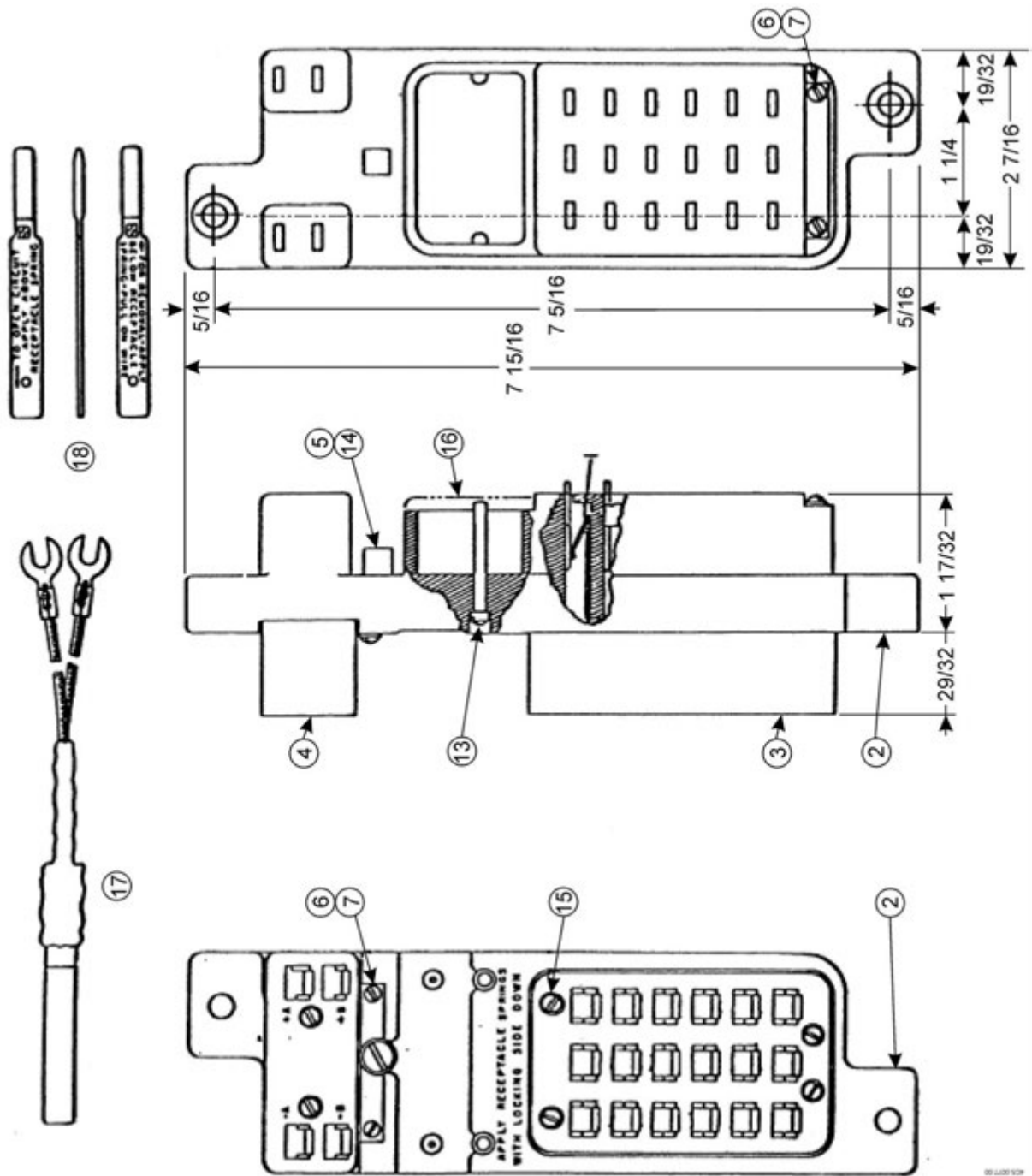


Figure A-2. Old Style Mounting Base

Appendix-A. Parts List

4.8. Parts List for Improved Mounting Base for PN-150P Relays

See Figure A-3.

ITEM	DESCRIPTION	PART NUMBER
1a	Base, Complete for Wayside Relays (Note "A")	N451376-0302
1b	Base Only	N451376-0301
1c	Base, Complete for Car Carrying Relays (Note "A")	N451376-0303
2	Base, Mounting Molded	J780055
3	Strike-Relay	J792848
4	Nut-Speed Push-On	J480280
5	Receptacle Contact Spring	M451142-2702
6	Screw, 1/4-20 x 1-1/4 Rd.	J052667
7	Washer, 1/4 Stl. Lk. Med	J047775
8	Washer, 1/4 Stl. Plate	J047501
9	Nut, 1/4-20 UNC 2B Hvy.	J048002
10	Tag, Relay Indent.	J075951
11	Sheet, Instr. Form #8	S000008
12	Bag, Plastic	J078399
NOTE "A": When mounting base complete is ordered, a plastic bag of parts is included in the inner carton with the mounting base and instruction prints. Bag Contains: Tags (Item 10), Screws (Item 6) Items 6, 7, 8, and 9 which are used for attaching the mounting base to the rack. Included receptacle contact springs are normally (M451142-2702) for #14 and #16 wire, unless otherwise specified. If other wire size is used, the proper part number (M451142-2701 for #18-20; M451142-2703 for #10-12) should be specified when ordering the complete base (N451376-0302 except using receptacle contact springs, solderless M451142-2703).		

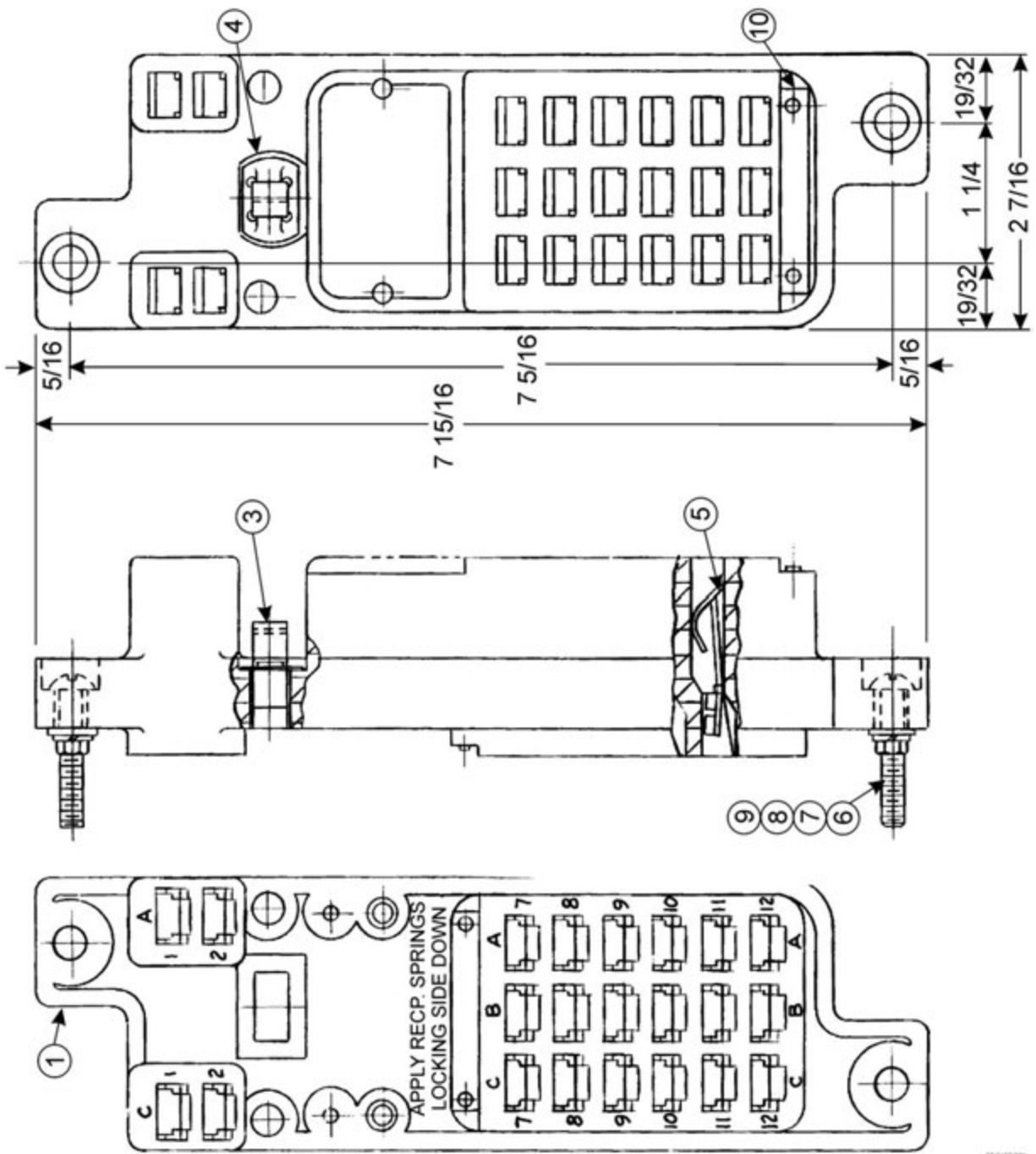


Figure A-3. Improved Mounting Base for PN-150P Relays

Appendix-A. Parts List
Table 4-3. Parts List for External Rectifier Kit (X438967)

ITEM	DESCRIPTION	PART NUMBER
5	Rectifier Assembly	N451131-3501
10	Screw, 6-32 x 3/8, Rd. Hd. Stl.	J525031
15	Washer, #6 Flt. Stl.	J047996
20	Washer, #6 Lock, Bz.	J047708
25	Screw, 8-32 x 3/8, Rd. Rd. Stl.	J525128
30	Washer, #8 Flt. Stl.	J047745
35	Washer, #8 Lock	J047709
40	Receptacle Contact Spring	M451142-2702
45	Receptacle Contact Spring	J680165
50	Lead, Black, 6-1/2"	N397832-005
55	Lead, Red, 6-1/2"	N397832-004
60	Lead, White, 4"	N395673
75	Print, Drawing	D451131-36

Table 4-4. Parts List for Rectifier Assembly (N451131-3501)

ITEM	DESCRIPTION	PART NUMBER
5	PC Mounting Board	M451451-3601
10	Lead	M436836
15	Bridge Rectifier, Sil.	J726150-0123
20	Screw, 4-40 x 5/8, Fl. Hd. Stl.	J521089
25	Washer, #4 Fl. Stl.	J047640
30	Washer, #4 Lock	J047829
35	Varistor, 82 VDC, V82ZZA12	J735528
40	Terminal, Cambion	J730940
45	Rivet, 1/8", Pop	J490037-0014
50	Terminal, Dual Connector	J731399-0015
60	Wire, Bare Tinned #14	A043241
65	Nut, 4-40, Hex. Stl.	J480006

MAINTENANCE NOTICE

PLUG-IN RELAY ARMATURE STOP PIN CLEANING

THIS NOTICE APPLIES TO THE FOLLOWING LIST OF RELAYS

Relay	Manual
PN-150B	SM4551
PN-150B	SM4551-A
PN-150B	SM4551-H
PN-150B	SM4551-N
PN-150BC	SM4551-K
PN-150BC	SM4596-C
PN-150BD	SM4551-D
PN-150BE	SM4551L
PN-150BE	SM4551-P
PN-150BE	SM4551-Q
PN-150BH	SM4551-R
PN-150BH	SM4551-T
PN-150BH	SM4551-V
PN-150BL	SM4551-J
PN-150BL	SM6144
PN-150BM	SM4551-M
PN-150BSR	SM4551-C

Relay	Manual
PN-150BTR	SM4596-A
PN-150HD	SM4551-E
PN-150HD	SM4596-E
PN-150N	SM4551-B
PN-150N	SM4596-X
PN-150NE	SM4551-S
PN-150P	SM4551-F
PN-150P	SM4596-F
PN-150T	SM4587
PN-156	SM4593
PN-250B	SM4563-E
PN-250BE	SM4563
PN-258B	SM4563-C
PN-258BSR	SM4563-B
PN-259BSR	SM4563-D
PN-259SRA	SM4563-H

Maintenance Notice

Should a relay fail to meet its calibration specifications during field inspection and test periods as required by FRA Rules Standards and Instructions, the relay must be shopped.

In this event, the following supplemental stop pin cleaning instructions should be followed (Ref. Figure A).

1. After removing the cover, clean the Stop Pin and adjacent surface by saturating a Paper Strip (contained in J793094) with Freon TF and then placing it between the armature and pole face. Apply moderate pressure on the armature and draw the paper out. Continue until no residue is removed from the surfaces. Dry the surfaces using a clean strip of paper.
2. The next step is to apply a dry lubricant such as graphite to the relay stop pin and its point of contact on the frame.
 - a. Insert the Stop Pin conditioning Graphite Stick, N451151-3203, between the armature stop pin and its point of contact on the pole face with graphite against stop pin. While applying moderate pressure on the stick, pull the stick back and forth in a circular motion over the stop pin, continuing several seconds to ensure a sufficient amount of graphite transfer.

It is not necessary to observe significant deposits of graphite since most of what is required can only be determined by means of a microscope.

3. Recheck the relay calibration and prepare the relay for return to service.

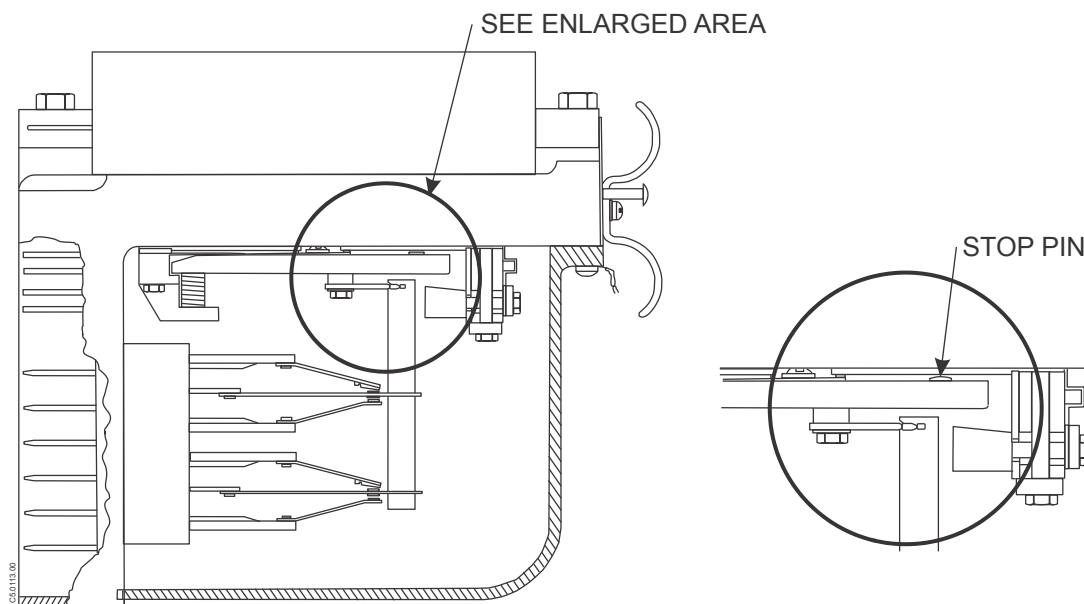


Figure A





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