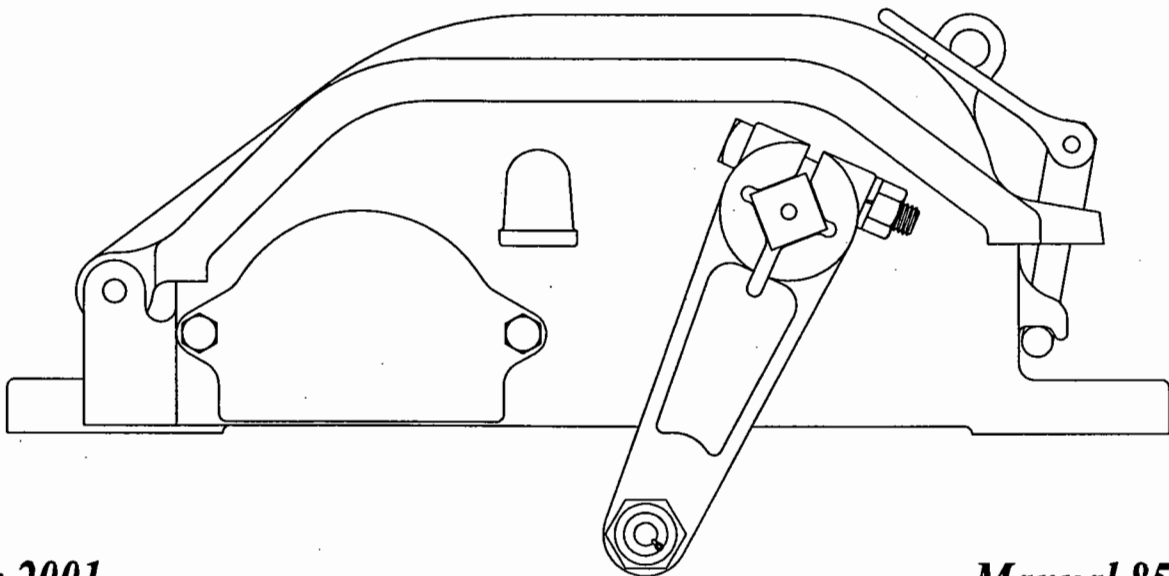




G & B Specialties, Inc.

856 Series Switch Circuit Controller



May 2001

Manual 8561

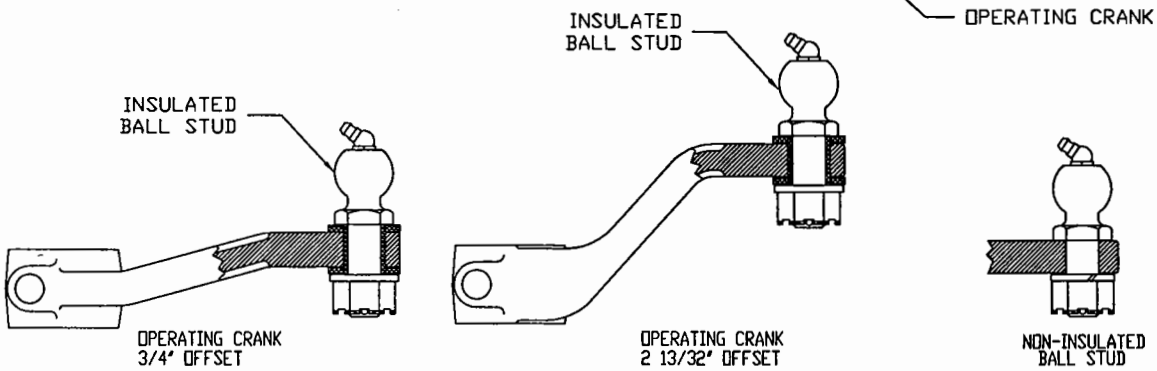
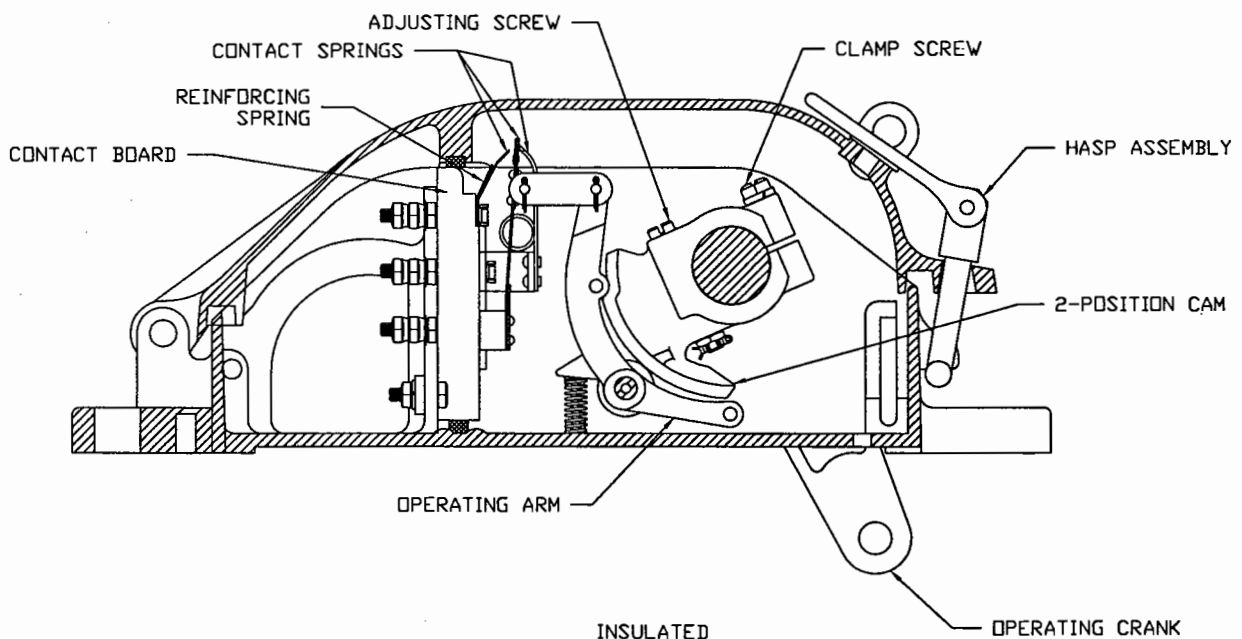
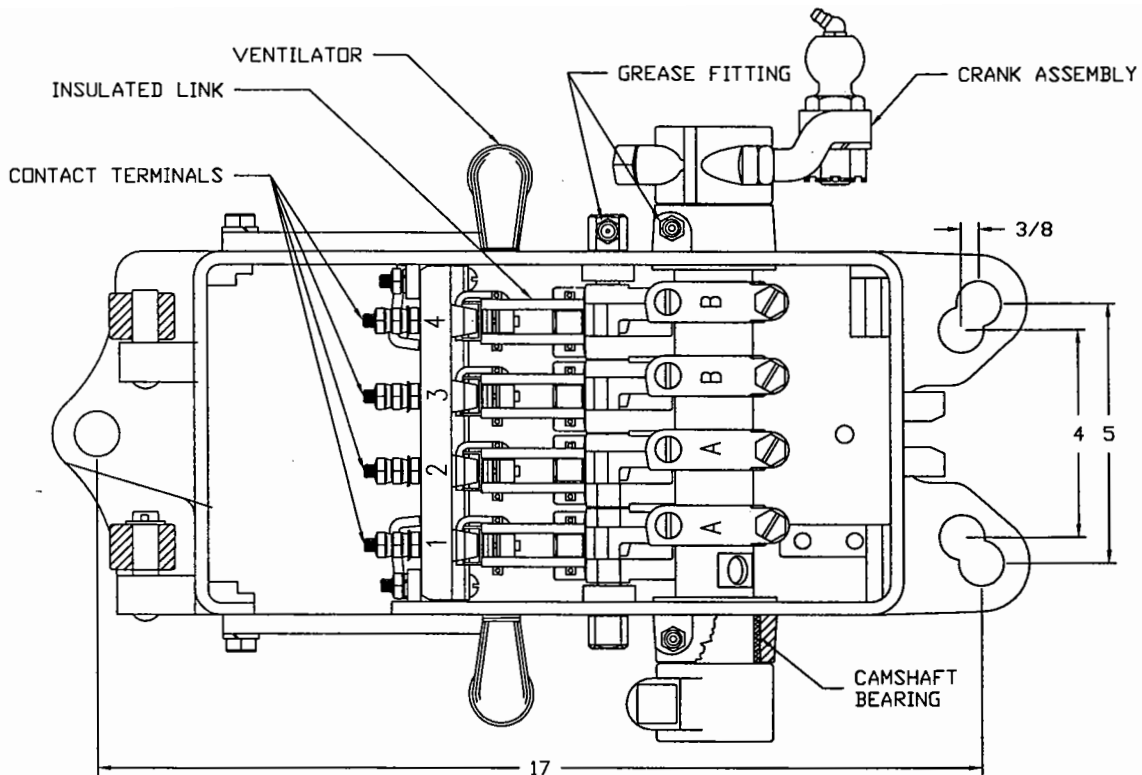


FIGURE 1-1
856 SERIES CIRCUIT CONTROLLER
4-WAY, 2-POSITION

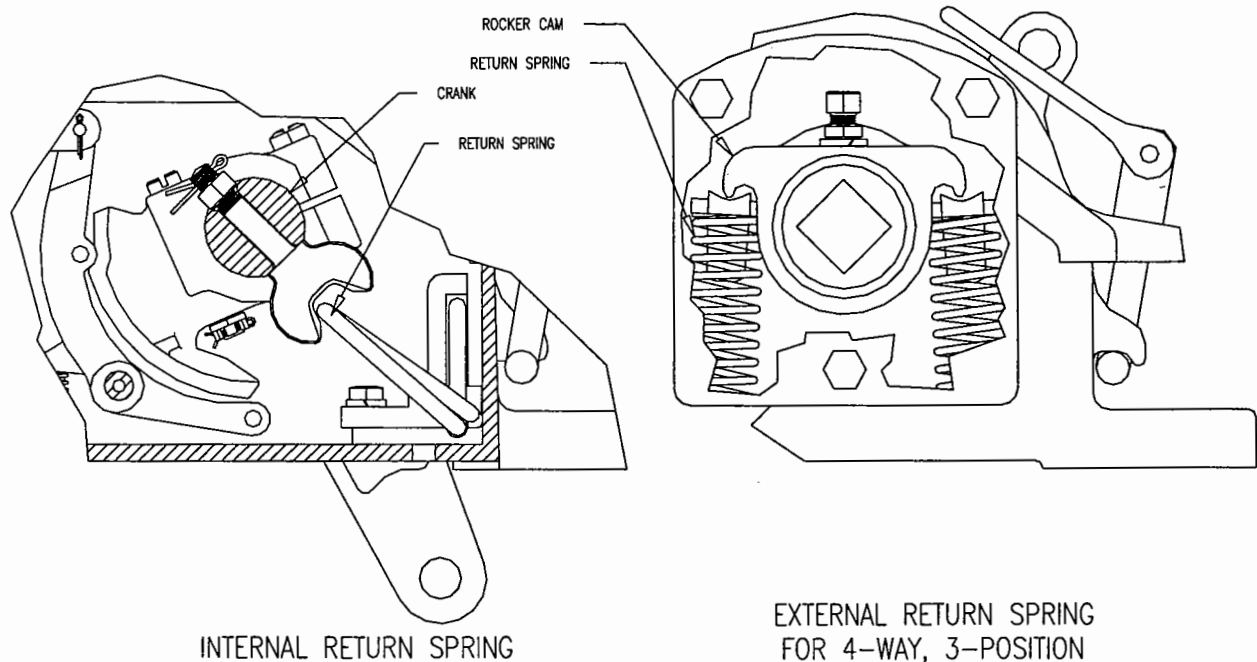


FIGURE 1-2 RETURN SPRING CONFIGURATIONS

All components are easily accessible in a cast iron weather-tight housing. The hinged, removable cover facilitates ease of inspection, adjustment, and maintenance of internal parts.

Brass 90-degree ventilators on each side of the switch circuit controller provide circulation of air within the housing to keep condensation to a minimum. The camshaft provides for a large bearing surface to reduce bushing wear and the 1 1/2" diameter allows for ample engagement of the micrometer adjusting screws. The camshaft bearings are long wearing bronze, backed with steel. Pressure grease fittings are provided for each bearing.

1.4 Equipment and materials recommended for maintenance

The following items (Table 1) are recommended to maintain the 856-switch circuit controller.

Description	Part No.
Hand Grease Gun	Commercially Available
Paddle, Wooden	Commercially Available
Oil Can	Commercially Available
Grease, Lubemaster CCL500 High-Temp Moly	857500-CCL
Oil, SAE 30	Commercially Available
Household Degreaser	Commercially Available
Lint-Free Cloths	Commercially Available
¼" Obstruction Gauge	
¼" and 17/64" Feeler Gauges	Commercially Available
Contact Spring Bender	857077-CT1
Thin White Lead	Commercially Available
Arbor Press	Commercially Available
Drill Press	Commercially Available
Tag Wire, 0.018"	Commercially Available

TABLE 1
Recommended Materials and Equipment

PART 2

INSTALLATION AND ADJUSTMENT

2.1 General

Detailed mounting plans of the layout, which the 856 switch circuit controller is a component of, that have been approved by the railroad should be followed when installing a circuit controller.

856 switch circuit controllers may be installed in either right-hand or left-hand layouts. They may be connected to the far point or the near point. The specific application in which the circuit controller is used determines the following:

- A) Circuit controller camshaft and cam configuration required.
- B) Crank offset required.
- C) Insulated or non-insulated ball stud assembly
- D) Point detector rod and point detector lugs for near or far point installation.
- E) Return spring configuration.

2.2 Mounting

The following procedures apply to typical layouts containing 856 switch circuit controllers. The procedures take into consideration that all components of the layout have been installed, with the exception of the switch circuit controller.

- A) Manually crank the switch points to the normal position.
- B) Using the hardware called for in the layout bill of materials secure the 856 switch circuit controller without the crank, to the number tie specified in the layout.
- C) Install the operating crank on the circuit controller in the normal position for right-hand or left-hand operation, as required by the layout. Position the crank so that in the normal position of the switch, the point at which the circuit controller crank will connect to the circuit controller operating rod, stands at approximately 2 3/8" from the centerline of the camshaft. Secure the crank to the camshaft with clamp collar making sure that end motion is at a minimum, but still maintaining free operation.
- D) Attach the circuit controller operating rod to the 856 switch circuit controller crank.

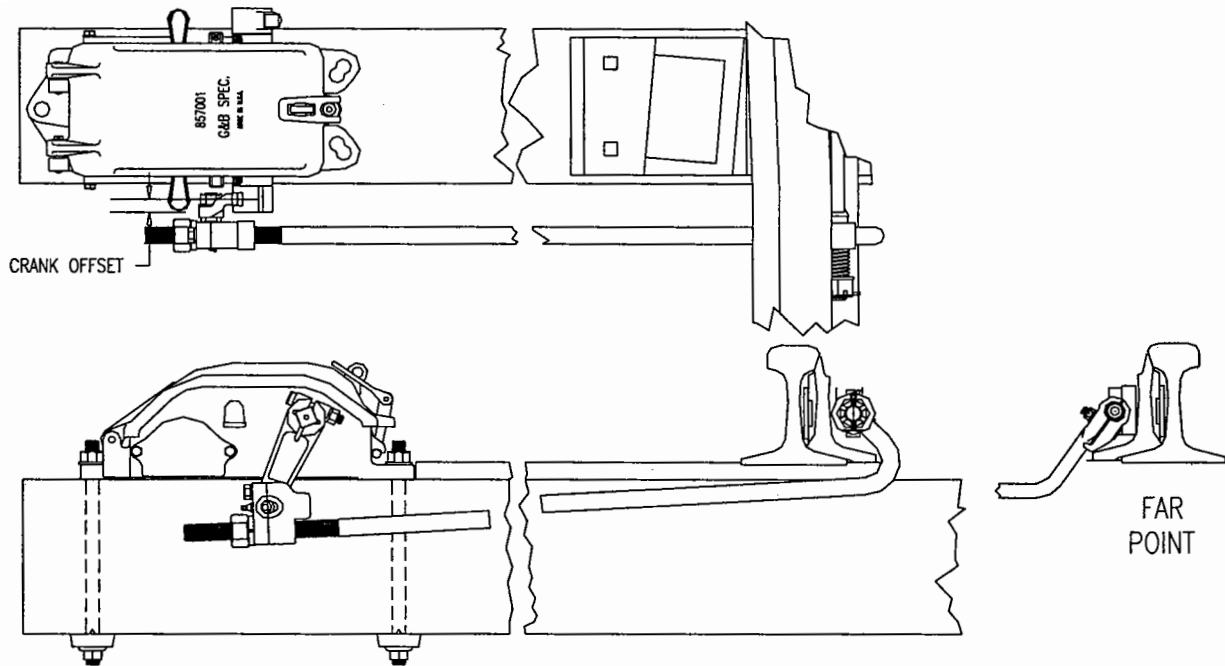


FIGURE 2-1
TYPICAL NEAR POINT INSTALLATION

- E) Open 856 switch circuit controller cover and attach conduit to controller.
- F) Refer to the appropriate circuit drawing and wire the circuit controller board accordingly.

2.3 Cam Adjustments

The following procedure describes the cam adjustment for a 4-way, 2-position 856 switch circuit controller used in a right-hand layout to provide a polarized indication.

- A) If not already in the normal position, manually crank the switch points to the normal position.
- B) Open the 856 circuit controller cover.
- C) Make an initial (rough) adjustment of the two pairs of cams (figure 3-1, polarized two-position cams) for a normal to the right, right-hand layout by performing steps (1) and (2), or for a normal to the left, right-hand layout by performing

for normal to the left, right-hand layout by performing following steps (3) and (4):

NOTE

Contact sets are numbered 1 through 4 from left to right, facing the terminal block. The cams controlling contact sets 1 and 2 are "A" cams and those controlling sets 3 and 4 are "B" cams. The positions of the A and B cam contact sets when the switch point is in the normal position for a normal-to-the-right and a normal-to-the-left installation for the polarized two-position cam application is shown in Figure 3-1.

- 1) Loosen the clamp screws of the two A cams and rotate adjusting screws so that the operating arms are just activated and the wiper arms just make with the outer contacts (nearest to the terminal block).
 - 2) Loosen the clamp screws of the two B cams. Rotate the adjusting screws so that the two B cams are offset from the two A cams approximately 30 degrees, with operating arms activated and wipers arms making with the outer contacts.
 - 3) Loosen the clamp screws of the two A cams and rotate adjusting screws so that operating arms are just released and wiper arms just make with the inner contacts (furthest from the terminal block).
 - 4) Loosen the clamp screws of the two B cams. Rotate the adjusting screws so that the two B cams are offset from the two A cams by approximately 30 degrees, with the operating arms released and wiper arms making with the inner contacts.
-
- D) Place a ¼" obstruction between the stock rail and open (reverse) point, 6" from the tip of the point.
 - E) Manually crank the switch points toward the reverse position up against the obstruction.
 - F) Check that the 856 switch circuit controller contacts are in the following positions:

NOTE

Reverse position of each contact set is opposite to the normal position defined in the preceding NOTE and shown in Figure 3-1.

- 1) Wiper arms of contact sets 1 and 2 are made with their reverse position contacts.
 - 2) Wiper arms of contact sets 3 and 4 are separated from their reverse position contacts by the thickness of a wire tag only. They make contact when the obstruction is removed from between the point and the stock rail.
 - 3) If necessary, make fine adjustments of the cams which operate contact sets 3 and 4 as follows:
 - a) Loosen the cam clamp screws.
 - b) Rotate adjusting screws of cams until their associated wiper arms are separated from their reverse position contacts by the thickness of a wire tag.
 - c) Tighten the cam clamp screws.
- G) Manually crank points away from reverse position far enough to remove obstruction, then manually crank points back to reverse position.
- H) Insert ¼" obstruction between stock rail and open point, 6 inches from tip of the point.
- I) Manually crank the switch points toward the normal position against the obstruction.
- J) Check that the contacts of the 856 switch circuit controller are in the following positions:
 - 1) Wiper arms of contact sets 3 and 4 are made with their normal position contacts.
 - 2) Wiper arms of contact sets 1 and 2 are separated from their normal position contacts by the thickness of a wire tag only. They make contact when the obstruction is removed from between the point and the stock rail.
 - 3) If necessary, make a fine adjustment of the cams that control contact sets 1 and 2 as described in step F) 3) for the cams that control contact sets 3 and 4.
- K) Verify that all clamp screws are tight. If not, tighten them to 13-15 ft.lbs.
- L) Manually crank the points away from their normal position far enough to remove the obstruction, then manually crank the points back to their normal position.

2.4 Initial Lubrication

After the 856 switch circuit controller has been installed and adjusted, it must be

lubricated to ensure optimum operation. Figure 2-2 illustrates the 856 switch circuit controller lubrication points, and the following steps outline the lubrication procedures.

2.4.1 Equipment/Materials Required

The following lubricants and application equipment are recommended to lubricate the 856 switch circuit controller:

- A. Hand grease gun, for grease fittings.
- B. Wooden paddle for spreading oil.
- C. Part No.857500-CCL Moly grease or equivalent.
- D. SAE-30 oil.

2.4.2 Lubrication Procedure

Perform lubrication on the 856 switch circuit controller as follows:

- A. Using a hand grease gun, apply grease, Part No. 857500-CCL or equivalent, to the alemite fittings for the camshaft bushings and rocker shaft shown in Figure 2-2.
- B. Using an oil can and a wooden paddle, apply SAE-30 oil to the rollers on the operating arms and the link connections.
- C. Using an oil can, apply a few drops of SAE-30 oil to the cover hinges, hasp pin, and hasp Tee bolt threads.
- D. Apply a thin coat of grease to the cover gaskets.

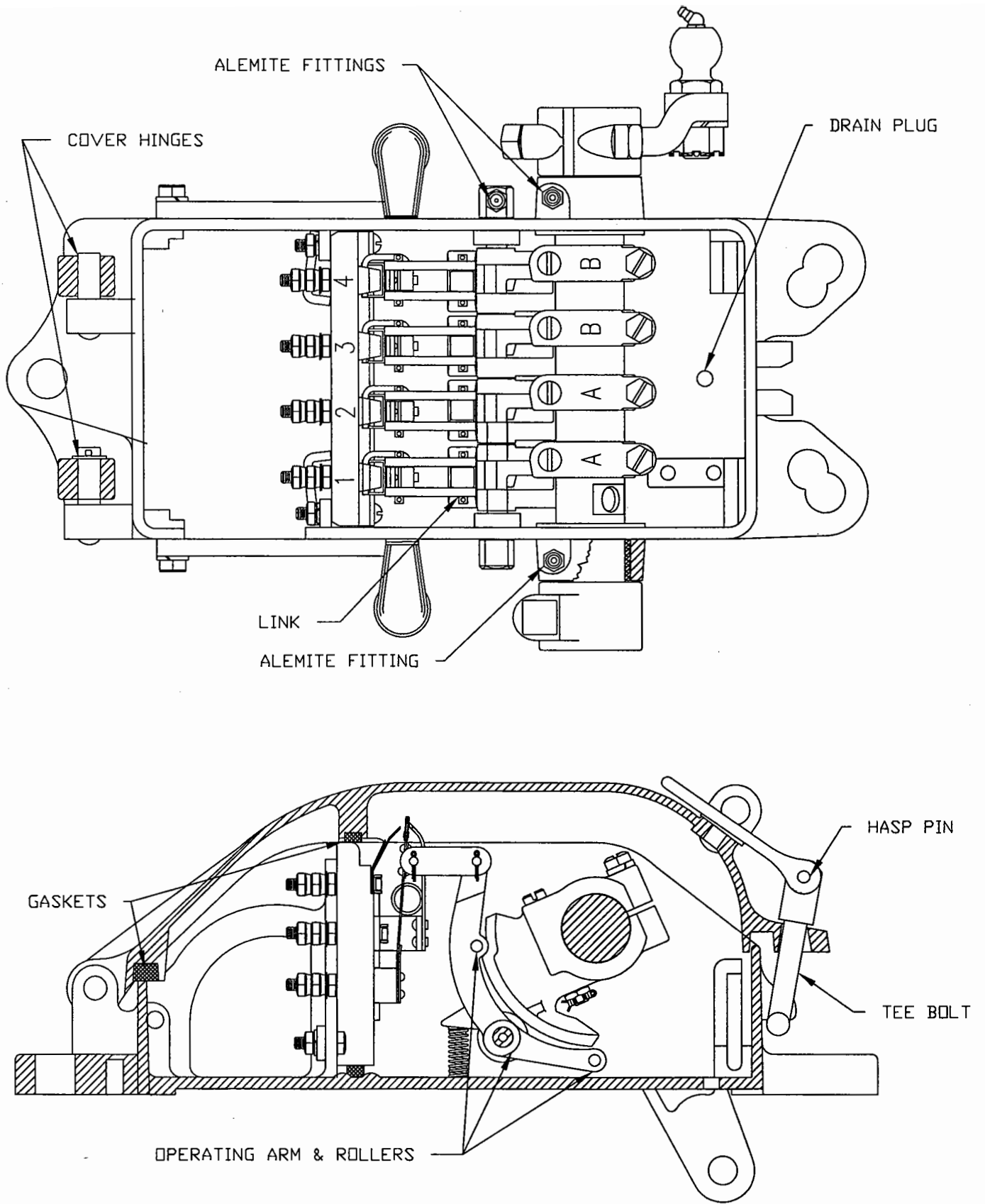


FIGURE 2-2
 856 SERIES CIRCUIT CONTROLLER
 LUBRICATION POINTS

PART 3

OPERATING PRINCIPLES

3.1 Introduction

Operating principles of the 856 switch circuit controller are outlined in this section with a discussion of the controller's mechanical operating mechanism.

3.2 Operating Mechanism

In a typical application, the 856 switch circuit controller is used to monitor the two positions of the switch points (normal and reverse). The switch points drive the operating crank (shown in figure 1-1) via a circuit controller operating rod. The operating crank in turn drives the camshaft, which has four individually adjustable cams mounted to it. Each cam is used to drive or release a spring loaded operating arm around a pivot. Force is transferred through an insulating link to the movable spring contact (wiper arm). When the operating arm is released as illustrated in figure 1-1, the wiper arm is contacting the inner contact spring. After the cam has driven the operating arm, the wiper arm is contacting the outer contact spring. Figure 3-1 shows the orientation of the operating crank, operating arms, cams, and contacts for both normal to the left and normal to the right conditions using 2-position or three position configurations. Note that in the typical application described in this manual, the four 2-position cams are arranged in two pairs with each pair oriented at a different position on the camshaft (polarized). In this arrangement presume that the switch points are driven from normal (position shown in figure 3-1) to reverse. When the switch points go past $\frac{1}{4}$ " away from the normal position, the pair of A contacts transfer; when the switch points are $\frac{1}{4}$ " away from the reverse position the pair of B contacts transfer. For a reverse to normal move, the B contacts transfer just beyond $\frac{1}{4}$ " from reverse and A contacts transfer at $\frac{1}{4}$ " from normal.

The 3-position cams are used for applications that require an intermediate position from the two contact closures, one where the wiper arm is open.

As illustrated in Figure 1-2, there are two return spring configurations (when used). One is used when a return spring is required for a 4-way, 3-position application, and the other is used for all other applications. The external return spring configuration may be substituted in place of the internal return spring for most applications. The return springs are designed to bring the operating crank

to the center position in the event of a broken or disconnected circuit controller operating rod. When this occurs, the circuits will act as if the points are in transit and will not show an incorrect normal or reverse indication. The constant pressure of the return spring also serves to reduce vibration and associated wear on the camshaft bearings.

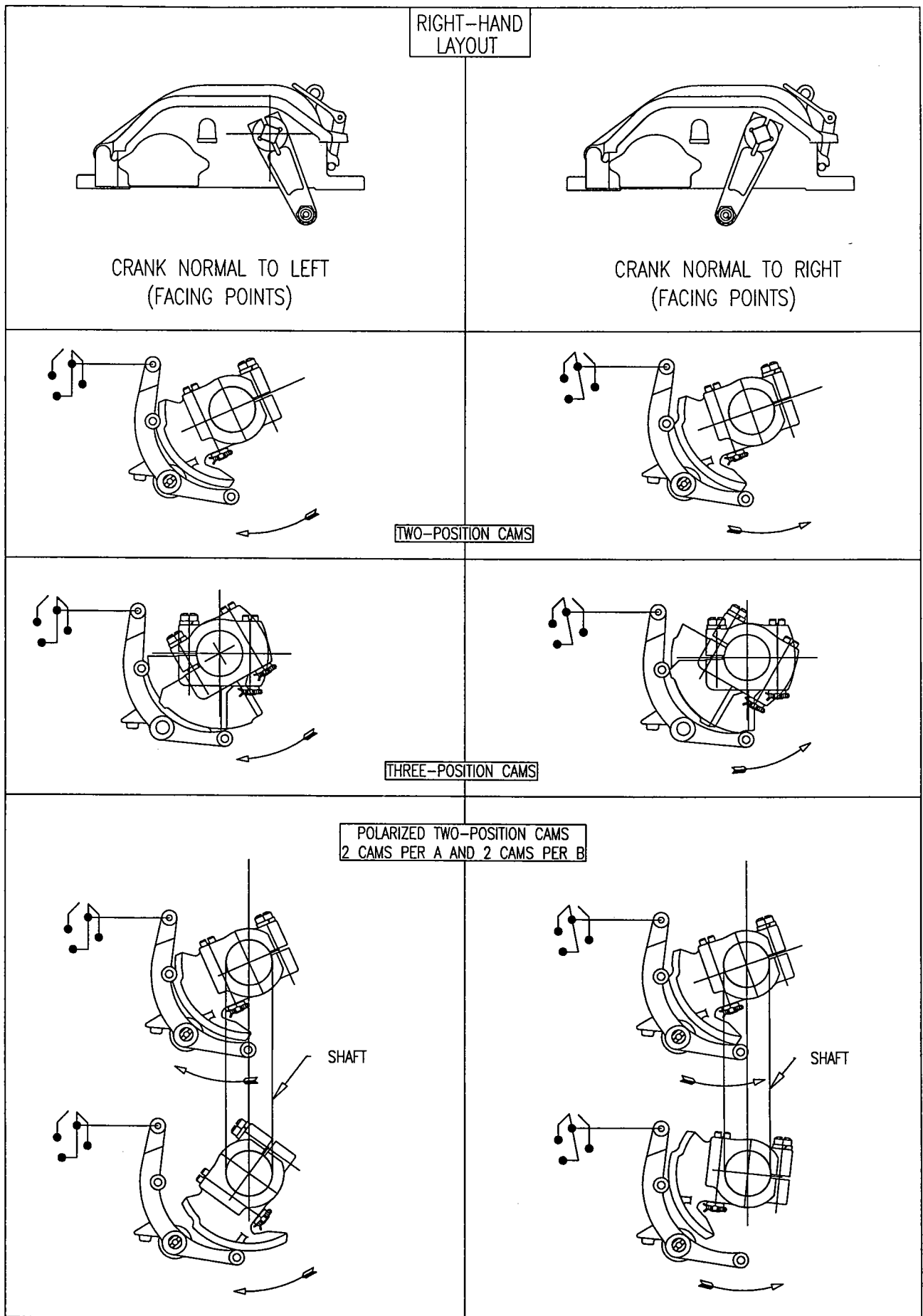


FIGURE 3-1
856 SWITCH CIRCUIT CONTROLLER CAM AND CONTACT SETTINGS

PART 4

FIELD MAINTENANCE

4.1 Introduction

This section contains or references procedures for preventative maintenance, troubleshooting, and corrective maintenance for the 856 switch circuit controller at the field level.

4.2 Preventative Maintenance

The following paragraphs outline procedures for periodic cleaning and inspection, and lubrication of the 856 switch circuit controller. These procedures must be performed at least once every six months to ensure continued fault free operation.

4.2.1 Cleaning

Extensive cleaning is not required on the 856 switch circuit controller. It is imperative that the 856 switch circuit controller is cleaned at the time of each inspection (every six months minimum) to prevent excessive wear and corrosion, ensure that electrical components are not pitted or possibly shorted because of excessive filtration of sand and/or dust, and to prepare the surfaces of the cams, operating arm rollers, and linkages for lubrication. Clean the 856 switch circuit controller as outlined in clauses 4.2.1.1 and 4.2.1.2.

4.2.1.1 Equipment/Materials Suggested

- A) Household degreasing cleaner
- B) Soft lint-free cloths

4.2.1.2 Procedure

- A) Dampen a lint-free cloth with household degreaser and wipe circuit controller components free of any accumulated dust and dirt. Pay particular attention to the ventilators, electrical contacts, terminals, and all moving parts (cams, rollers, contacts, contact springs, return springs and linkages).
- B) Dry the 856 switch circuit controller parts with a clean lint-free cloth.

NOTE

If a component shows any sign of pitting, corrosion, or general deterioration, it must be replaced.

4.2.2 Inspection

Inspection consists of observing the overall appearance and integrity of the 856 switch circuit controller, associated electrical conduit, and the circuit controller operating rod. A determination is then made whether the controller is in good condition or if an obvious or potential faulty condition exists. When any faulty condition is observed, it must be corrected immediately. Inspection shall be completed as follows on a six-month basis following cleaning of the 856 switch circuit controller:

- A. Check for loose or damaged electrical connections.
- B. Check for burned, frayed, or broken insulation.
- C. Check for accumulation of dust, dirt, and foreign materials.

CAUTION

The following (step D) should be performed, prior to anticipated freezing weather, in addition to each six-month interval.

- D. Check that there are no signs of moisture accumulation within the 856 switch circuit controller compartment. If moisture is present, check to see if the drain plug (Figure 2-2) is installed in the drain hole. If so, remove the drain plug to allow moisture to drain out of the compartment. The plug may be removed by grasping it with a pair of pliers and pulling it out of the drain hole. Replace plug by pushing it back into the drain hole.

NOTE

The drain plug should have been installed initially if the 856 switch circuit controller is installed at a location where blowing dust and sand could be troublesome, otherwise it should be left out.

- E. After compartment has drained, reinstall the drain plug.
- F. Check that the 856 switch circuit controller cover gaskets are resilient and have not reached a state where they may cause looseness in the cover's hinge. If so, replace worn gaskets.

NOTE

Low points in the gaskets may be built up by placing thin pieces of felt or similar material in the groove under the gasket.

- G. Check that the conduit connected to the 856 switch circuit controller is not crimped, nicked, cut, or otherwise damaged
- H. Operate the 856 switch circuit controller crank back and forth as often as necessary and check for:
 - 1) Proper movement of the 856 switch circuit controller operating crank and return spring mechanism (when used).
 - 2) Excessive or unusual vibration and noise.
 - 3) Excessive wear and lost motion.
 - 4) Positive and firm contact between wiper arms and stationary contacts.
 - 5) Check that the 856 switch circuit controller cover hinge pins, ventilators, cams, contacts, and linkages do not show excessive wear and are clean.
- I. With the circuit controller operating rod disconnected from the crank, check that the return spring mechanism (where used) brings the operating crank to the center position. In this position "A" pair of contacts (paragraph 3.2) will be transferred, but "B" pair of contacts will not have transferred. When the controller is in this position, it indicates neither a normal or reverse position. Reconnect the circuit controller operating rod.

4.2.3 Lubrication

After the 856 switch circuit controller has been inspected and cleaned, refer to paragraph 2.4, and perform lubrication procedures. Lubrication procedures should be performed at each inspection and cleaning (every six months).

4.3 Troubleshooting

Troubleshooting of the 856 switch circuit controller is performed in its environment as part of the system in which it is operating.

4.4 Corrective Maintenance

Corrective maintenance in the field is limited to the adjustment of cams and contact springs, and replacement of those components (such as gaskets) which are easily replaced in the field. It is recommended that more difficult component removal and replacement is done in the shop. Procedures for removing the 856 switch circuit controller as an entire assembly are considered to be obvious and are not included in this manual.

4.4.1 Cam Adjustments (see Figure 3-1)

4.4.1.1 Test Equipment Required

- A. ¼" obstruction

4.4.1.2 Procedure

In general the cam adjustment procedures are similar to those outlined in Part 2, Installation and Adjustments. Part 2 describes cam adjustment just after installation, which requires rough and fine adjustment. The following describes cam adjustment procedures for a 4-way 2-position 856 switch circuit controller in a right-hand layout of a switch machine control and indication circuit.

- A. Manually crank the points to the normal position.
- B. Open circuit controller cover.
- C. Check that wiper arms make with proper normal position contacts.

NOTE

For right-hand layouts where right position of the 856 switch circuit controller crank corresponds with the normal position of the points, circuit controller wiper arms make with contacts closest to the terminal strip. For right-hand layouts where left position of the circuit controller crank corresponds with the normal position of the points, the circuit controller wiper arms make with the contacts furthest from the terminal strip.

- D. Place a ¼" obstruction between the stock rail and open point, 6 inches from the tip of the point
- E. Manually crank the switch points toward the reverse position against the obstruction.

- F. Check that the 856 switch circuit controller contacts are in the following positions:

NOTE

For reference purposes, 856 switch circuit controller contacts are numbered 1 through 4 from left to right, facing the terminals of the contact board. Reverse position contact of each set, is the contact opposite of the normal position contact defined in the previous note.

- 1) Wiper arms of contact sets 1 and 2 are made with their reverse position contacts.
 - 2) Wiper arms of contact sets 3 and 4 are separated from their reverse position contacts by the thickness of a wire tag only. They make contact when obstruction is removed from between the point and the stock rail.
 - 3) If necessary, adjust the cams for contact sets 3 and 4 as follows:
 - a) Loosen the cam clamp screws.
 - b) Rotate the adjusting screws of the cams until their associated wiper arms are separated from their reverse position contacts by the thickness of a wire tag.
 - c) Tighten the clamp screws of the cams.
- G. Manually crank the points away from the reverse position far enough to remove the obstruction, then manually crank the points back to reverse position.
- H. Insert a 1/4" obstruction between the rail and the open point, 6" from the tip of the point.
- I. Manually crank the points toward the normal position, up against the obstruction.
- J. Check that the 856 switch circuit controller contacts are in the following positions:
- 1) Wiper arms of contact sets 3 and 4 are made with their normal position contacts.
 - 2) Wiper arms of contact sets 1 and 2 are separated from their normal position contacts by the thickness of a wire tag only. They make contact when the obstruction is removed from between the stock

rail and the points.

- 3) If necessary, adjust the cams for contact sets 1 and 2, the same way as described in F. 3) for the no. 3 and 4 contact sets.

- K. Manually crank the points away from the normal position far enough to remove the obstruction, then manually crank the points back to the normal position.
- L. Close the cover of the 856 switch circuit controller

4.4.2 Contact Spring Adjustments (See Figure 4-1)

4.2.2.1 Test Equipment and Special Tools Required

1/4" and 17/64" Feeler gauges
857077-CT1 Contact spring bender

4.4.2.2 Procedure

For all contact sets, proceed as follows:

- A. Open the 856 switch circuit controller cover.
- B. Remove the insulated links.
- C. Using the contact spring bender, set the center contact springs (wiper arms) to stand approximately midway between the long and short contacts.
- D. Reinstall the insulated links.
- E. Manually crank the switch points so that the center contacts make with the shorter stationary contacts.
- F. With the heel contact compressing the short contact spring, set the long contact spring using a 1/4" feeler gauge.
- G. Adjust the long contact spring until the gap between the long contact and the heel contact equals 1/4". The 1/4" feeler gauge should just pass through this gap. When the long contacts are compressed by the heel contacts, the compression may not be less than 1/16".

NOTE

When bending the springs to increase compression, always bend slightly beyond the desired point then carefully bend back until the proper compression is achieved.

- H. Manually crank the switch points so that the center contacts make

- contact with the longer stationary contacts.
- I. With the heel contact compressing the long contact spring, set the short contact spring using a $17/64$ " feeler gauge.
 - J. Adjust the short contact spring using the same method as for the long contact, except using a $17/64$ " feeler gauge rather than a $1/4$ " gauge. When the short contacts are compressed by the heel contacts, their compression may not be less than $1/32$ ".
 - K. Close the cover of the 856 switch circuit controller.

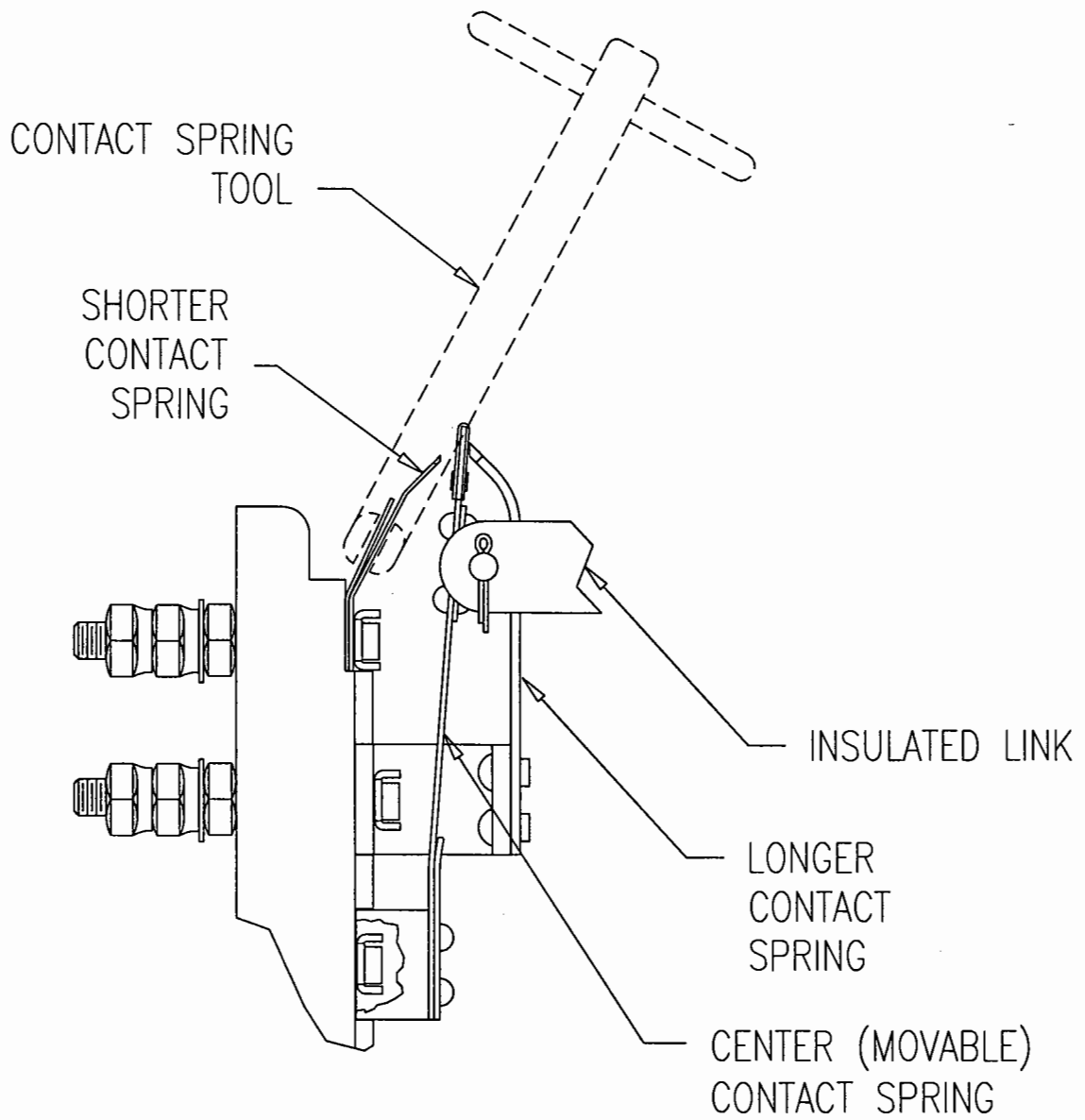


FIGURE 4-1. CONTACT ADJUSTMENT

PART 5

SHOP MAINTENANCE

5.1 Introduction

Shop maintenance of the 856 switch circuit controller consists of restoring a damaged, worn, or otherwise defective switch circuit controller to operating condition. Thoroughly cleaning, inspecting, and disassembling the circuit controller to the extent necessary to repair it accomplish this. Repair consists of replacing worn, defective or damaged parts, then reassembling, lubricating the controller, and adjusting the contact springs. The parts list and accompanying illustration show the relationship of the components and their attaching parts. The parts list illustration provides information to assist in disassembly and assembly of the 856 switch circuit controller. With the exception of the camshaft bushings, disassembly of the controller is obvious. Procedures are as follows:

- A. Clean and inspect the circuit controller as outlined in paragraphs 4.2.1 and 4.2.2.
- B. Disassemble the circuit controller to the extent necessary to replace worn/damaged parts, using the illustration as a guide.
- C. If the camshaft bushings require replacement, follow the procedures outlined in paragraph 5.2.
- D. Reassemble the 856 switch circuit controller, using the illustration as a guideline.
- E. Lubricate the circuit controller as outlined in paragraph 2.4.
- F. Perform contact spring adjustment procedures as outlined in paragraph 4.2.2.

5.2 Camshaft Bushing Replacement

To remove the camshaft bushings (857562) proceed as follows:

- A. Remove the bolts (66), nuts (67), and lock washers (68) from the collar and crank. Remove the collar and crank.
- B. Loosen the clamp screws (38) on all of the cams.
- C. Remove the adjusting screws (36), nuts (37), and cotter pin (32) from cams.
- D. Slide the camshaft out of the 856 circuit controller housing. Remove the cams from the interior of the housing.

- E. Coat the outside of a new bushing (Part No.857562) with thin white lead.
- F. Place the 856 switch circuit controller on an arbor press bed as illustrated in Figure 5-1.
- G. Place the new bushing over the worn bushing being replaced as illustrated in Figure 5-1.
- H. Place a cold rolled steel bushing tool (857000-BT2) on the new bushing as illustrated in Figure 5-1. Tool dimensions are 2 ½" x 1.498 I.D. x 2" O.D.
- I. Bring the arbor press down until the worn bushing falls out into the circuit controller interior, and the new bushing is pressed into place. The new bushing I.D. will close to approximately 1.5 inches.
- J. Perform steps E through I to replace the bushing in the opposite side of the case. (Bushings must be replaced in pairs.)
- K. As illustrated in Figure 5-2, clamp a plate with a 1.5-inch diameter shouldered cone to a drill press table.
- L. Insert a 1.502- to 1.504- inch diameter reamer into the drill press. (The reamer should have a minimum flute length of 10 inches.)
- M. Center the reamer on the shouldered cone, then lock the drill press column.
- N. Raise the reamer and place the 856 switch circuit controller on the drill press with the bottom bushing centered on the shouldered cone.
- O. Ream the top bushing only.
- P. Raise the reamer and invert the controller. Center the new bottom bushing and ream the second bushing.
- Q. Extend the reamer until it goes through both bushings and is centered on the shouldered cone.
- R. Lift the 856 switch circuit controller and ream both bushings simultaneously.
- S. Reassemble items removed in steps A, B, C, and D.

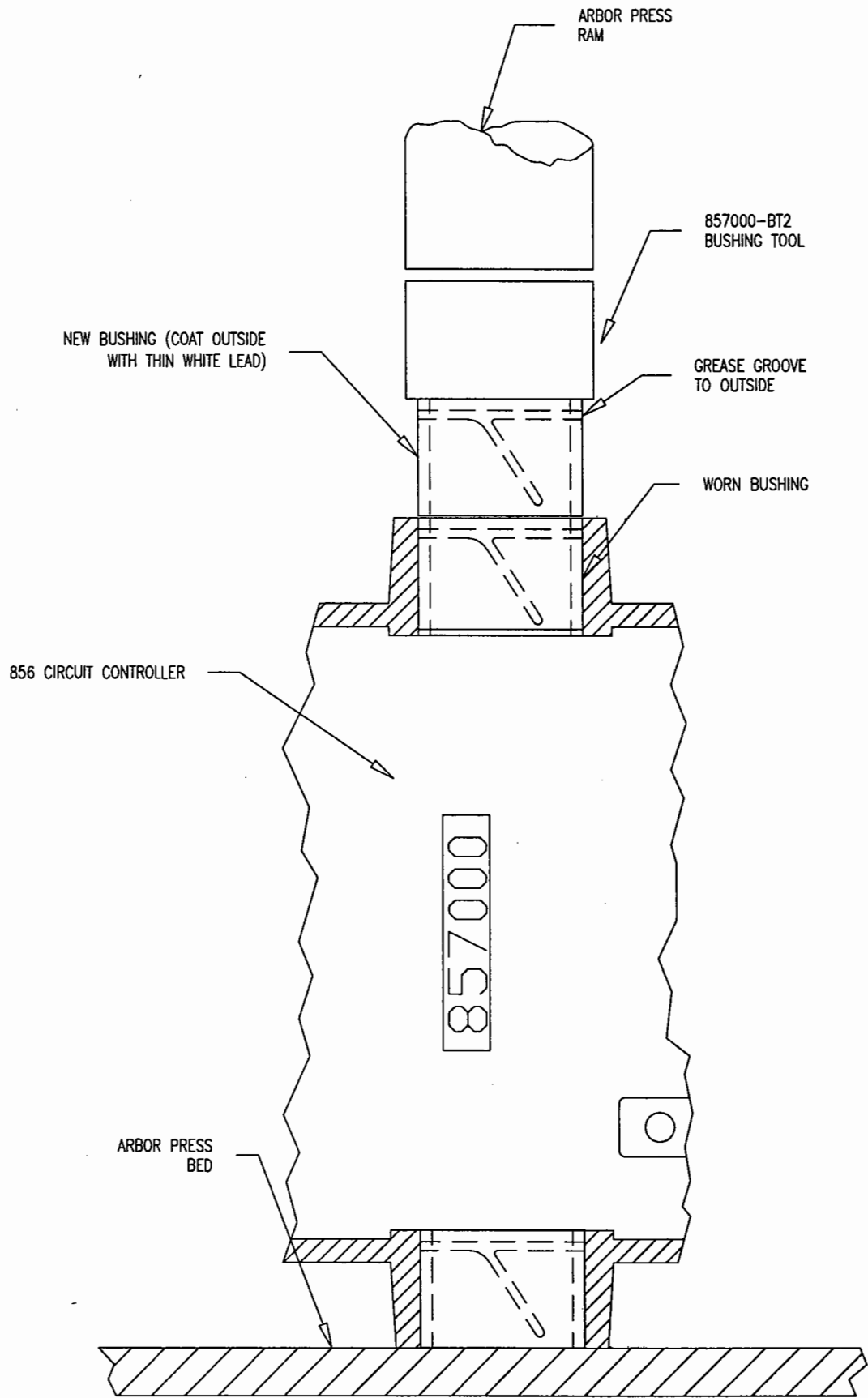


FIGURE 5-1
CAMSHAFT BUSHING REPLACEMENT

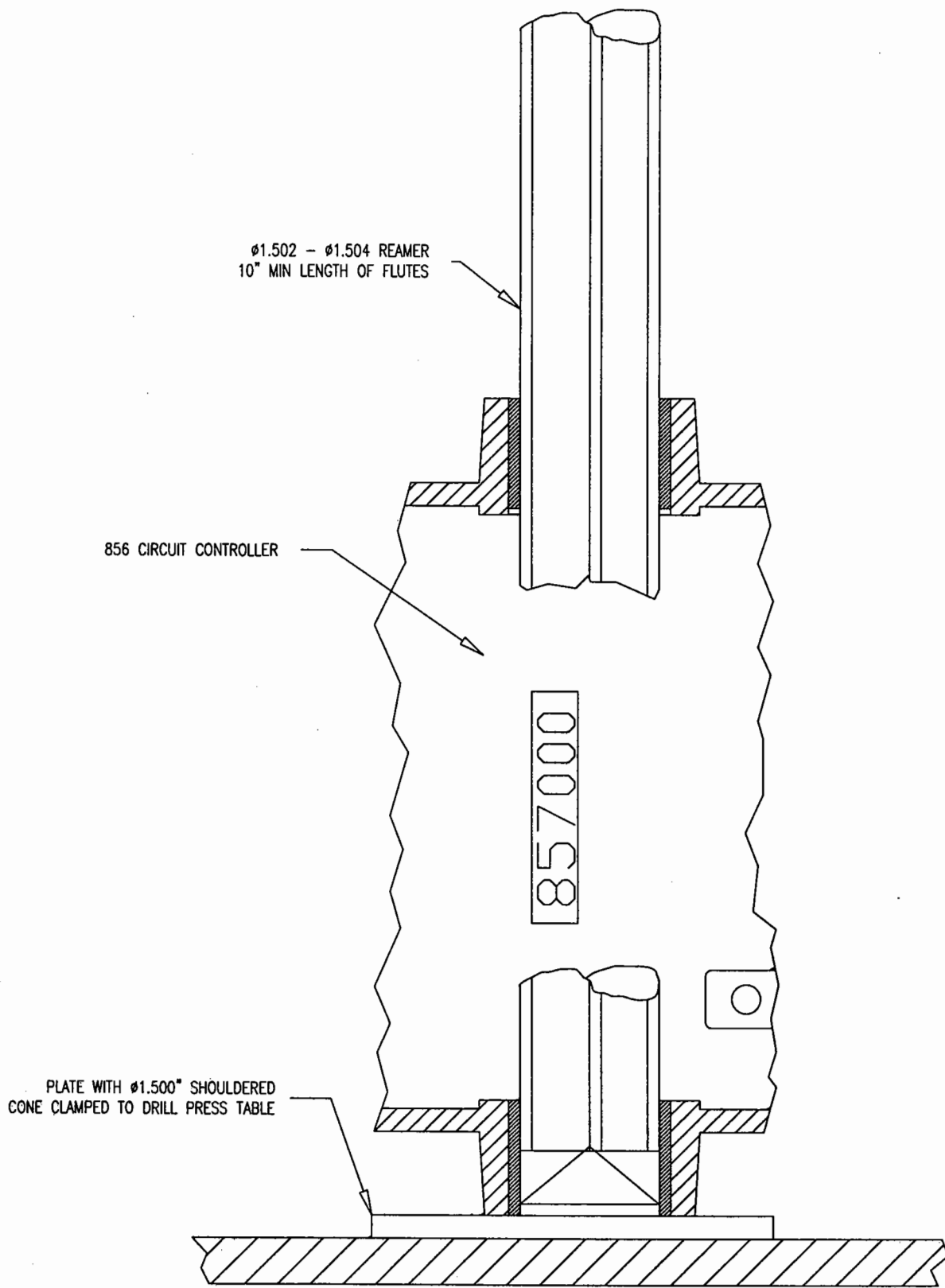
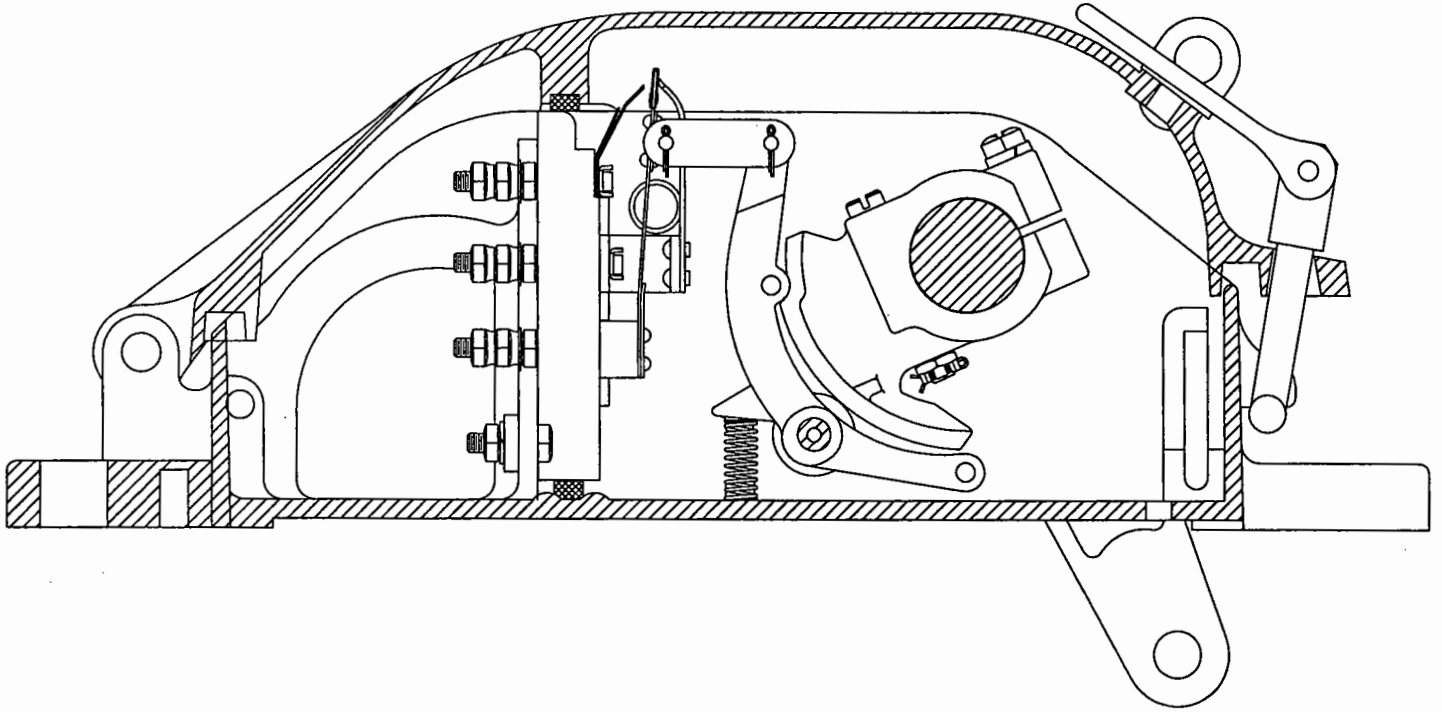


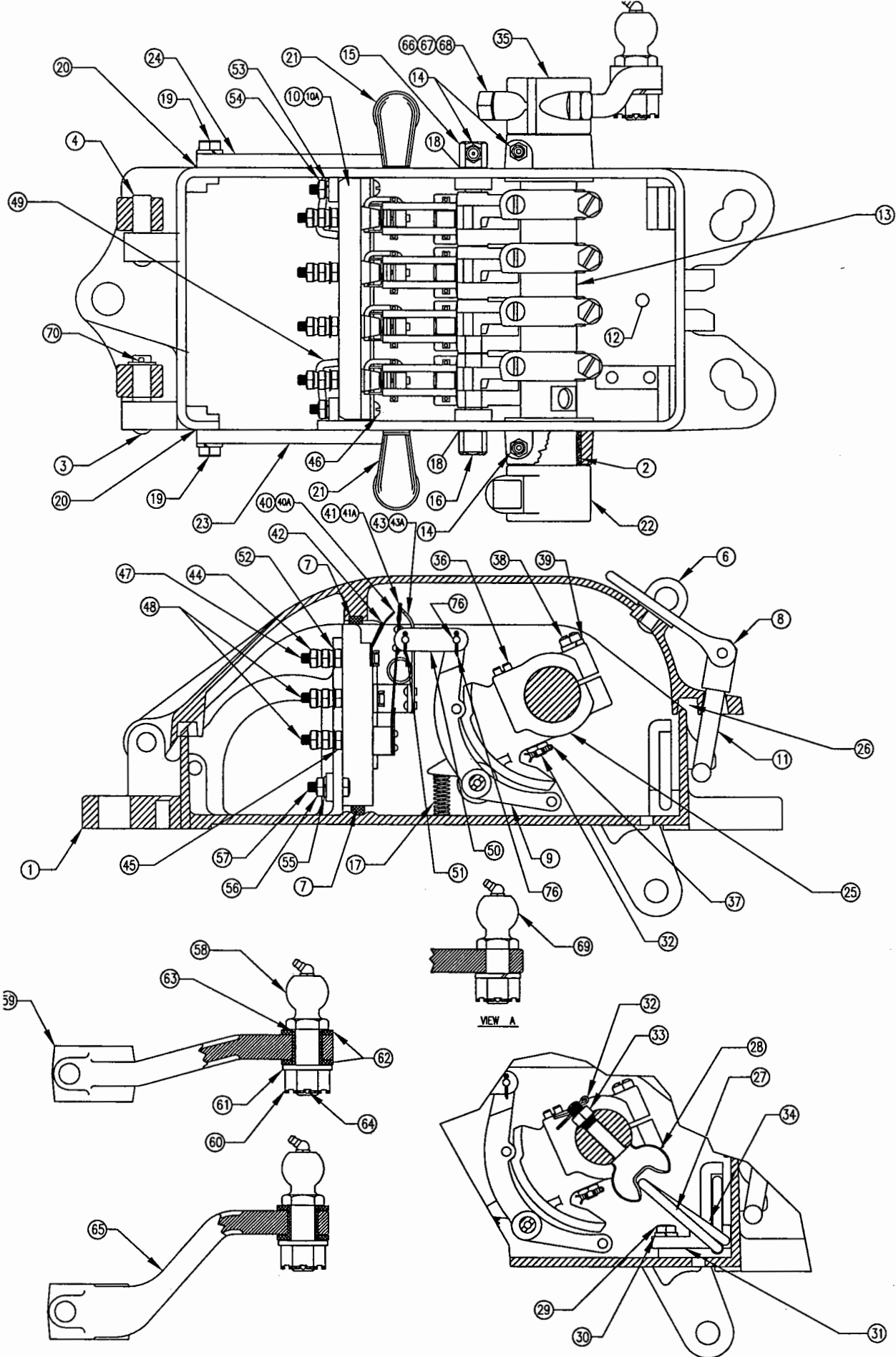
FIGURE 5-2
REAMING CAMSHAFT BUSHINGS



*Part 6
Parts List*

*856 Series Switch
Circuit Controller*

May 2001



856 SERIES CIRCUIT CONTROLLER

**856 Series Circuit Controller
Parts List for 2 Position, 4-Way**

Item	Part Number	Description
1	857000X	Base, Circuit Controller, w/Bushings
2	857562	Bushing
3	857819-001	Stud
4	857820-002	Stud
5	857001X	Cover Complete, 4-Way
6	857161-001	Hasp Lug
7	857077-123	Gasket, Contact Board
8	857002X	Hasp, Complete
9	857004X	Operating Arm Assy.
10	857077-614X	Board, Contact Spring
10A	857077-615	Board, Contact Spring, Heavy Duty
11	857344	Tee Bolt
12	857404	Protector Plug, Tapered, Non-Threaded, .299"
13	857531-005	Camshaft, 4-Way, 2 Position
14	990900-009	Fitting, Alemite Hydraulic, 1610
15	857081-410X	Shaft, Complete, Operating arm
16	857081-409	Nut, Operating Arm Shaft
17	857004-832	Spring, Operating Arm
18	990600-050-030	Washer, Adjusting, 7/16, (When Required)
19	990725-100-30	Bolt, 3/8-16 x 1" Hx Hd Stainless
20	857147-675	Gasket, Wire Outlet Cover
21	857109-001X	Ventilator, Complete
22	857015	Collar
23	860125	Plate, Wire Outlet, Blank
24	860125-001	Plate, Wire Guide, 1 1/2" Tapped Hole
25	857005X	Cam, 2 Position, Complete
26	857001-043	Gasket, Cover
27	857022-146	Return Spring
28	857044	Operating Crank
29	990723-125-12	Tap Bolt, 5/16 x 1 1/4 Hx. Hd.
30	990403-031-02	Lock Washer, 5/16, Std. Z/Y
31	857144-001	Return Spring Clamp
32	990504-062-02	Cotter pin, 3/32 x 5/8 Std, Z/Y
33	990311-037-02	Hex Nut, 3/8-16 Z/Y
34	990723-100-12	Cap Screw, 5/16 x 1 Hx. Hd., Z/Y
35		Crank, Complete (Contact Engineering)
36	857005-637	Adjusting Screw
37	857005-096	Castelated Nut
38	991141-175-12	3/8-16 x 1 3/4 Slotted Hx Hd Gr5 Z/Y
39	990401-037-02	Washer, Lock, Med. 3/8" Z/Y
40	857077-201	Contact
40A	857077-301-01	Contact, Front, Heavy Duty
41	857077-102X	Contact Assembly
41A	857077-302-01	Contact Assembly, Heel, Heavy Duty
42	857077-158	Reinforcing Spring
43	857077-200X	Contact Assembly
43A	857077-300-02	Contact Assembly, Back, Heavy Duty
44	990101-006-E55	Nut, AAR Binding
45	990101-007-E55	Nut, AAR Clasp
46	857077-509	Rd. Hd. Mach. Screw, 1/4-20 x 1 1/2
47	990102-187-55	Binding Post, #14 x 1 7/8
48	990102-250-55	Binding Post, #14 x 2 1/4

**856 Series Circuit Controller
Parts List for 2 Position, 4-Way**

49	857077-386	Clamp, Contact Board
50	857077-665	Insulated Link
51	990502-037-00	Cotter Pin, 1/16 x 3/8"
52	990601-025-055	Washer, 1/4"
53	990402-025-02	Lock Washer, 1/4", Z/Y
54	990330-025-02	Hex Jam Nut, 1/4-20
55	990403-025-02	1/4 Lock Washer
56	990331-025-02	Hex Nut, 1/4-20 Heavy, Z/Y
57	857077-508	1/4-20 x 2 Hex Tap Bolt
58	857866-001	Ball Stud, Lubricated
59	857013-001	Crank, 3/4" Offset, w/13/16 Drilled Hole
60	990332-062-02	Nut, Slotted, 5/8 Hex
61	857866-375	Washer, 21/32 I.D. X 1 1/4 O.D. X .062, 1010 STL
62	973502-2	Insulation Washer, 53/64 I.D. X 1 3/8 O.D. X 3/32
63	973099-1	Insulation Bushing, 5/8 X 13/16 X 25/32
64	990506-125-02	Cotter Pin, 1/8 x 1 1/4
65	857014-001	Crank, 2 13/32" Offset, w/13/16 Drilled Hole
66	990027-300-02	Bolt, 1/2-13 x 3 Sq. Hd. Z/Y
67	990331-050-02	Nut, 1/2-13 Std. Z/Y
68	990403-050-02	Lock Washer, 1/2" Std Z/Y
69	081193X	Ball Stud Assembly Per "View A"
70	990506-075-02	Cotter Pin, 1/8 x 3/4
71	990401-037-30	Lock Washer, Med., 3/8" Stainless Steel
72	857109-003	Protector Plug, Tapered, Non-Threaded, .683"
73	998917-010X	Hardware Kit, Contact Board
74	589002-786	Adjustment Warning Tag
75	857077-001X	Contact Board Heater Kit (Optional)
76	857077-765	Link pin
77	860126	Outlet cover, Blank (not shown, contact G&B Engineering)
78	860126-001	Outlet cover, 1 1/2 Pipe Thread (not shown, contact G&B Engineering)
79	857008X	Centering Attachment, External (Contact Engineering)
80	857008-002-01	Centering Attachment, External for 1 1/8 sq. camshaft (Contact Engineering)
81	857000TX	Case, Opposite Hinged From Illustrated (Contact G&B Engineering)
82	857001TX	Cover Complete, 4-Way, For Item 81
83		Contact Board Complete (Contact G&B Engineering)