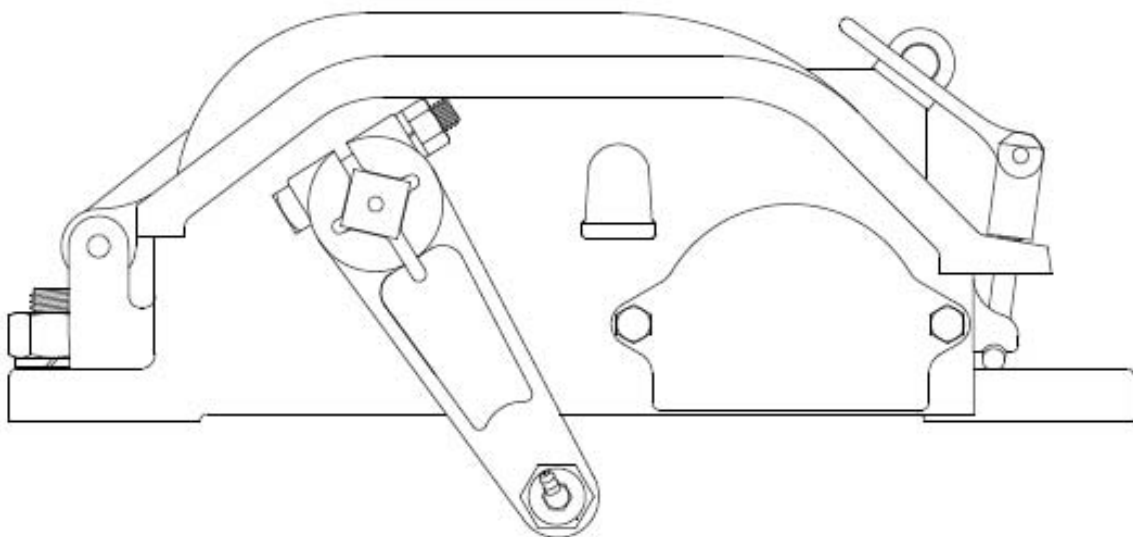




G&B Specialties
A *Wabtec* subsidiary

856500 Series Switch Circuit Controller



August 2015

Manual 8565

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MANUAL SPECIAL NOTATIONS

In the G&B Specialties manuals, there are three methods used to convey special informational notations to the reader. These notations are warnings, cautions and notes. Both warnings and cautions are readily noticeable by boldface type one line beneath the caption.

Warning

A warning is the most important notation to heed. A warning is used to tell the reader that special attention needs to be paid to the message because if the instructions or advice is not followed when working on the equipment then the result could be either serious, harmful or deadly. This sudden, unexpected operation of a switch machine, for example, or the technician contacting the third rail could lead to personal injury or death. An example of a typical warning notice follows:

WARNING

DISCONNECT THE MOTOR ENERGY WHENEVER THE GEAR COVER IS REMOVED. OTHERWISE, THE SWITCH MACHINE MAY OPERATE UNEXPECTEDLY AND POSSIBLY CAUSE PERSONAL INJURY.

Caution

A caution statement is used when an operating or maintenance procedure, practice, condition, or statement, which if not strictly adhered to, could result in damage to or destruction of equipment. A caution statement is also used when personnel could be surprised if shocked by a circuit operating at a low current. A typical caution found in a manual is as follows:

CAUTION

Turn power off before attempting to remove or insert circuit boards into a module. Boards can be damaged if power is not turned off.

Note

A note is normally used to provide minor additional information to the reader to explain the reason for a given step in a test procedure or to just provide a background detail. An example of the use of a note follows:

NOTE

A capacitor may be mounted on the circuit board with a RTV adhesive. Use the same color RTV.

PART 1

CIRCUIT CONTROLLER OVERVIEW

1.1 Introduction

This section contains general information on the 856- circuit controller. Covered in this section is a description of its physical and operating characteristics, its purpose, and materials/equipment suggested for maintenance.

1.2 Purpose

856 switch circuit controllers are constructed to meet or exceed AAR specifications and are used to electrically detect the position of rail switch-points.

1.3 Description

The 856-switch circuit controller, (figure 1-1) is made in polarized configurations.

The 856-switch circuit controller meets the following stated AAR requirements:

- 1) Quick individual contact adjustment
- 2) Contacts are positively driven in both directions
- 3) Ruggedly constructed for long service life with minimal maintenance
- 4) All parts are easily accessible for inspection and replacement
- 5) Rapid response of contacts to point movement, guaranteeing complete contact spring operation well within AAR requirements.

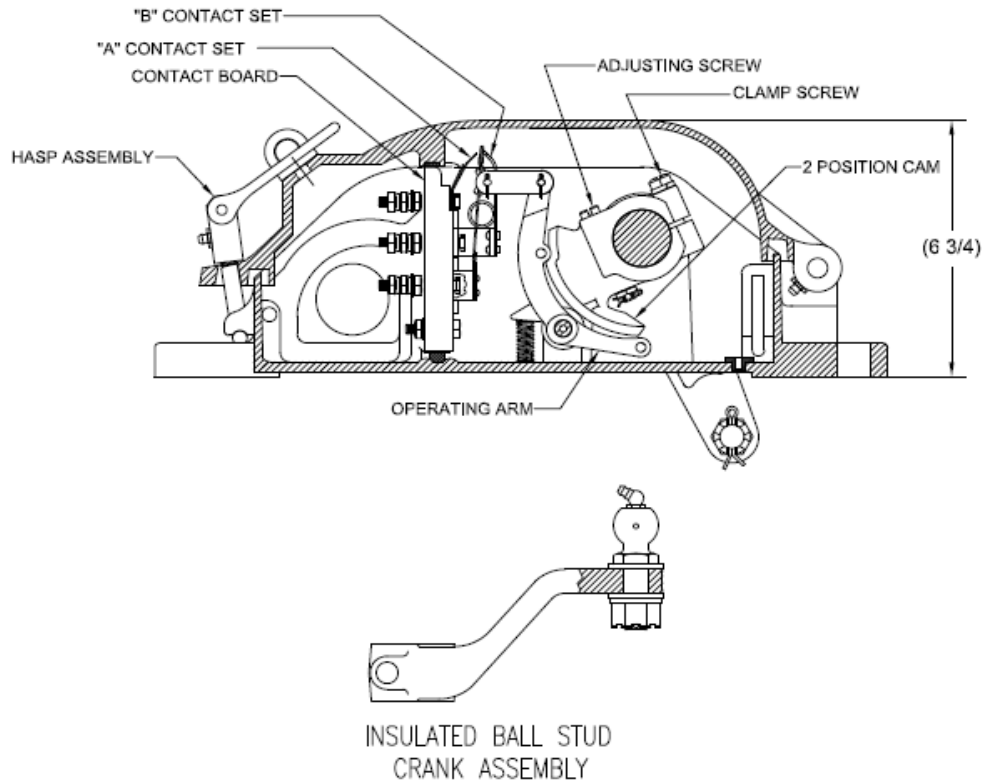
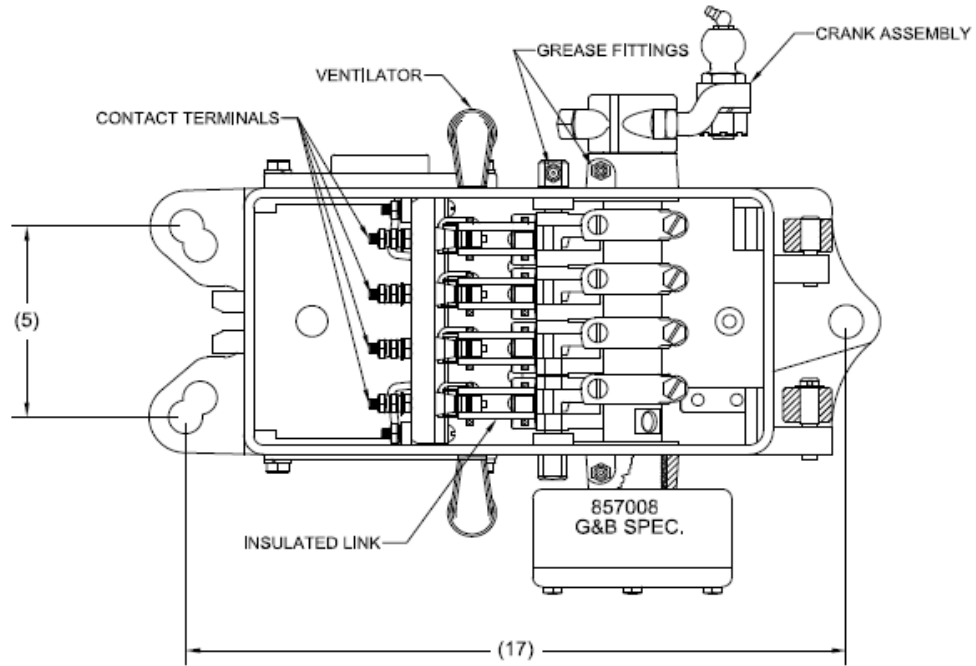


FIGURE 1-1
856500 SERIES CIRCUIT CONTROLLER
4-WAY, 2-POSITION

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.

Material and Equipment

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
1/4" Obstruction Gauge	
1/4" 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

PART 2

INSTALLATION AND ADJUSTMENT

2.1 General

Detailed mounting plans of the layout which the 856- switch circuit controller is a component that has been approved by the railroad and 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 out for in the layout bill of materials, secure the 856 switch circuit controller without the crank, to the number of ties 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.

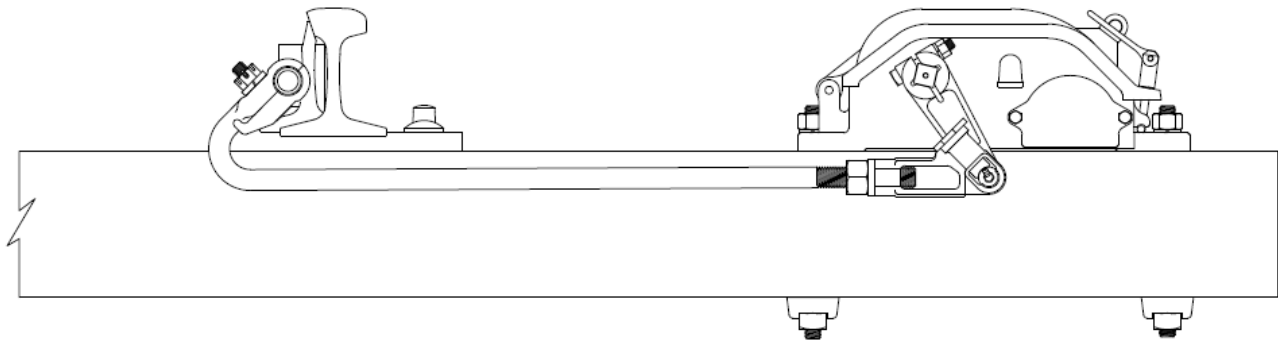


FIGURE 2-1
TYPICAL NEAR POINT INSTALLATION

- 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

Face the Switch Points. Determine your Normal Point. Determine which contacts are being used for your WP circuit.

NOTE

Only two cams are used for a WP circuit. Example: Normal point closed near machine will be 1B and 2B. Normal point closed away from machine will be 1A and 2A.

Cut-out the switch machine to prevent the switch motor from operating while performing the adjustments. Insert the standard one-fourth inch obstruction gauge in the switch point six inches back from the point. Hand crank the switch so the point is firmly up against the obstruction gauge.

Using an adjustable wrench loosen the jam nut on the cam to be adjusted. Insert a screw driver in the adjusting screw and move the center moveable contact until there is an opening of .020 of an inch between the fixed contact and center contact. While holding the screw driver tighten the jam nut to set the adjustment. Repeat this procedure for the rest of the cams.

After the contacts have been adjusted, remove the one-fourth inch obstruction gauge and hand crank the point closed. When the fixed contacts are compressed by the moveable center contact, the compression may not be less than 1/16" on the short contacts (A) and not less than 1/32" on the long contacts (B).

NOTE

Reverse position of each contact set is opposite to the normal position defined in the preceding NOTE and shown in Figure 2-2.

- A) Manually crank points away from the normal position far enough to remove obstruction, and then manually crank points to reverse position.
- B) Insert 1/4" obstruction between stock rail and open point, 6 inches from tip of the point.
- C) Manually crank the switch points toward the reverse position against the obstruction.
- D) 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 a minimum of .020". (They make 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.
- E) Verify that all clamp screws are tight. If not, tighten them to 13-15 ft-lb.
- F) Manually crank the points away from their normal position far enough to remove the obstruction gauge then manually crank the points back to their normal position.

Before placing the switch machine in service, hand crank the switch machine to the full normal and full reverse position and inspect the circuit controller to verify the contacts have the correct wipe/compression. The point detector test **MUST** be performed by using the one-fourth inch obstruction gauge and verifying the contacts are open no less than .020 of an inch.

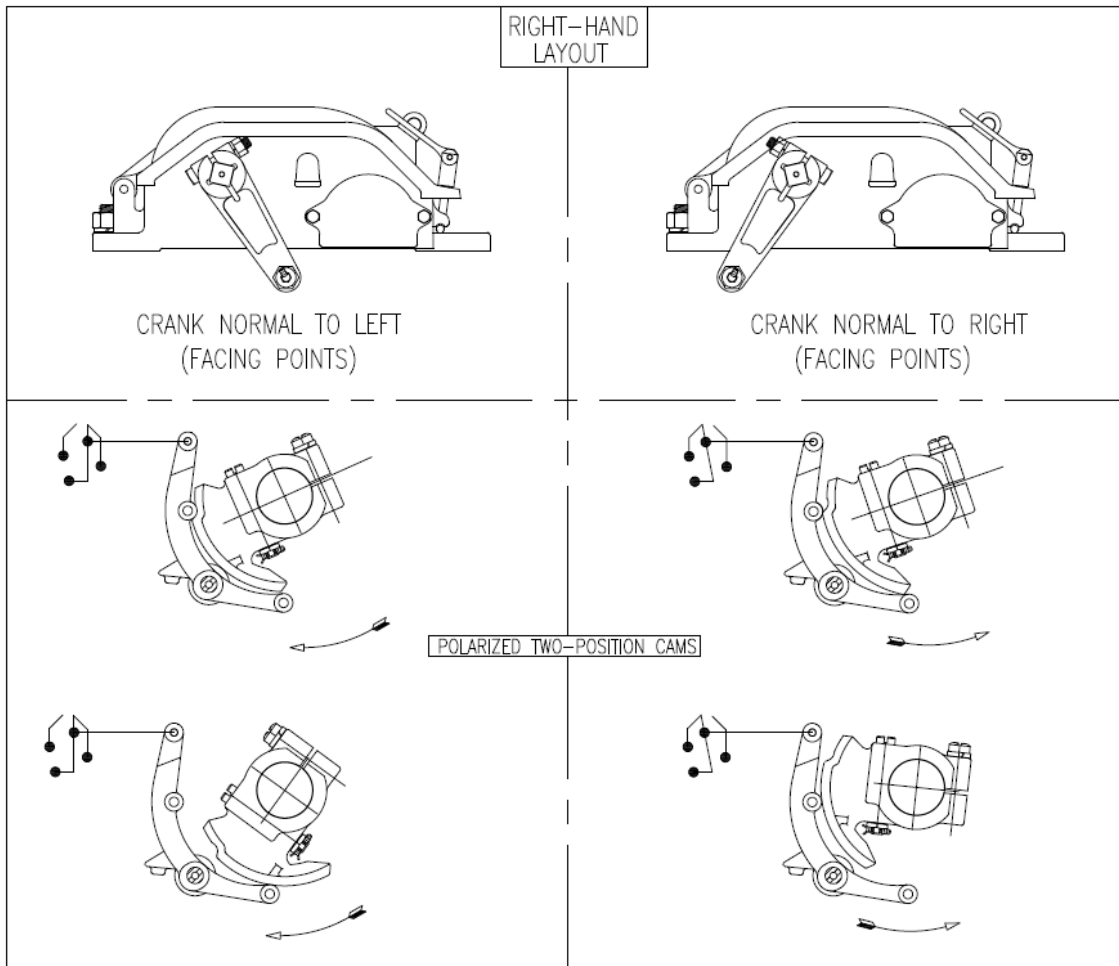


FIGURE 2-2
856500 SERIES CIRCUIT CONTROLLER
CAM AND CONTACT SETTINGS

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.

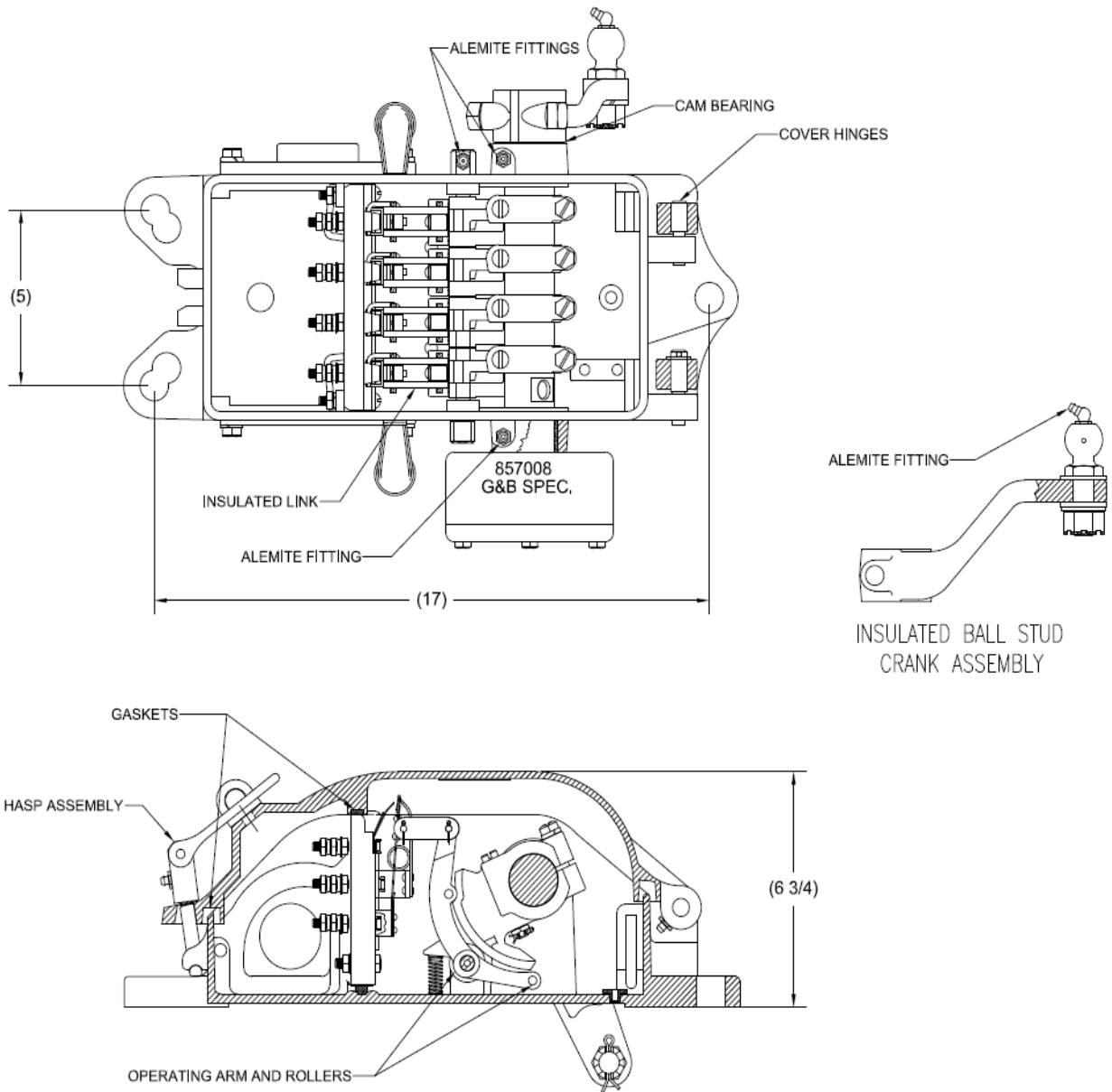


FIGURE 2-3
856500 SERIES CIRCUIT CONTROLLER
LUBRICATION POINTS

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. 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.

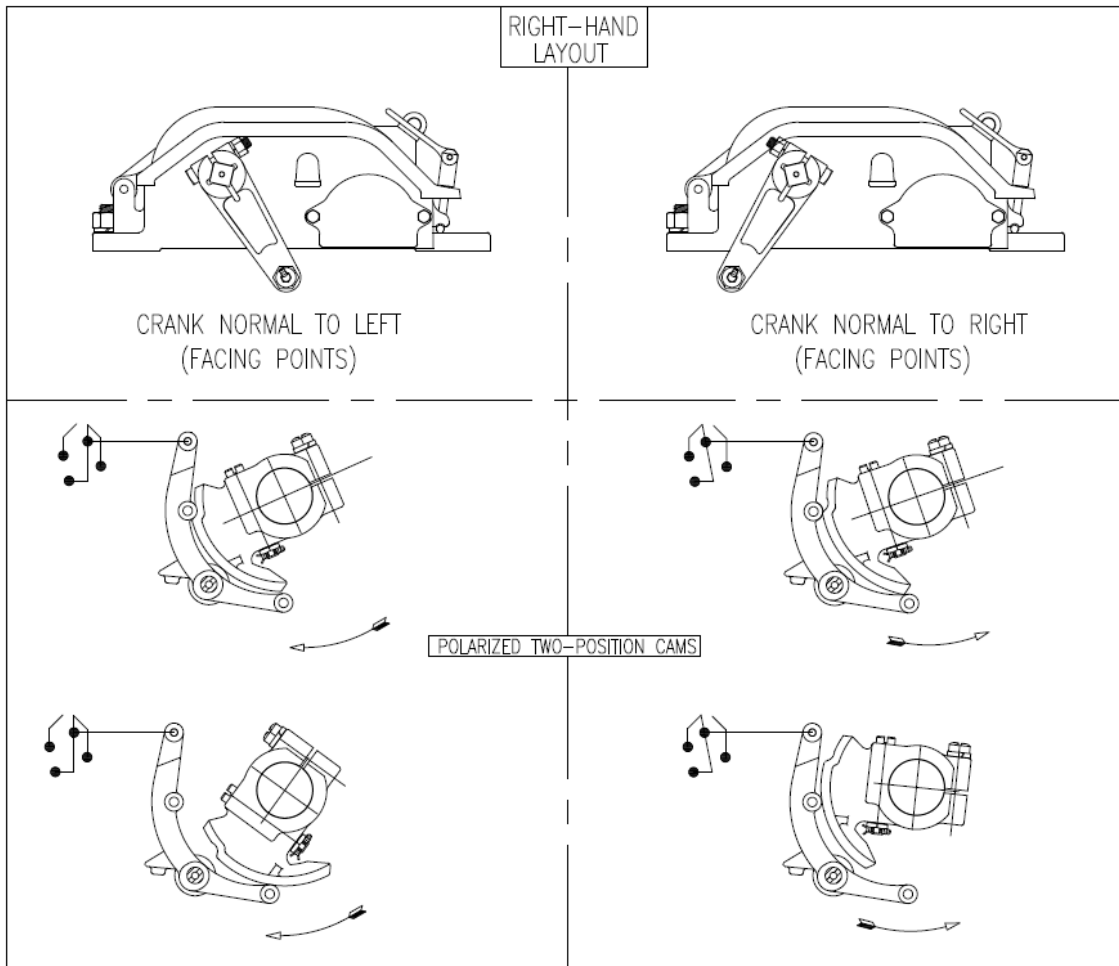


FIGURE 3-1
856500 SERIES CIRCUIT CONTROLLER
CAM AND CONTACT SETTINGS

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 according to the customer's maintenance schedule 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 according to the customer's maintenance schedule 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 required by the customer's maintenance schedule:

- 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
In the 856 switch circuit controller and 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.
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.
 - 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.

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 schedule.

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.

4.3 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.

WARNING

DISCONNECT MOTOR ENERGY WHENEVER MAKING ADJUSTMENTS TO THE SWITCH LAYOUT OR SWITCH MACHINE. UNEXPECTED OPERATION OF THE MACHINE COULD CAUSE INJURY FROM OPEN GEARS, ELECTRICAL SHOCK, OR MOVING PARTS.

4.3.1 Cam Adjustments (see Figure 3-1)

4.3.1.1 Test Equipment Required

- A. ¼" obstruction gauge

4.3.1.2 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. Refer to part 2 to adjust cams and contacts.

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 Contact Spring Adjustments (See Figure 5-1)

5.2.1 Test Equipment and Special Tools Required

¼", 17/64" and 1/32" Feeler gauges
857077-CT1 Contact spring bender

5.2.2 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 ¼" feeler gauge.
- G. Adjust the long contact spring until the gap between the long contact and the heel contact equals ¼". The ¼" feeler gauge should just pass through this gap.

Page 5-1

- H. 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.

- I. Manually crank the switch points so that the center contacts make contact with longer stationary contacts.
- J. 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.

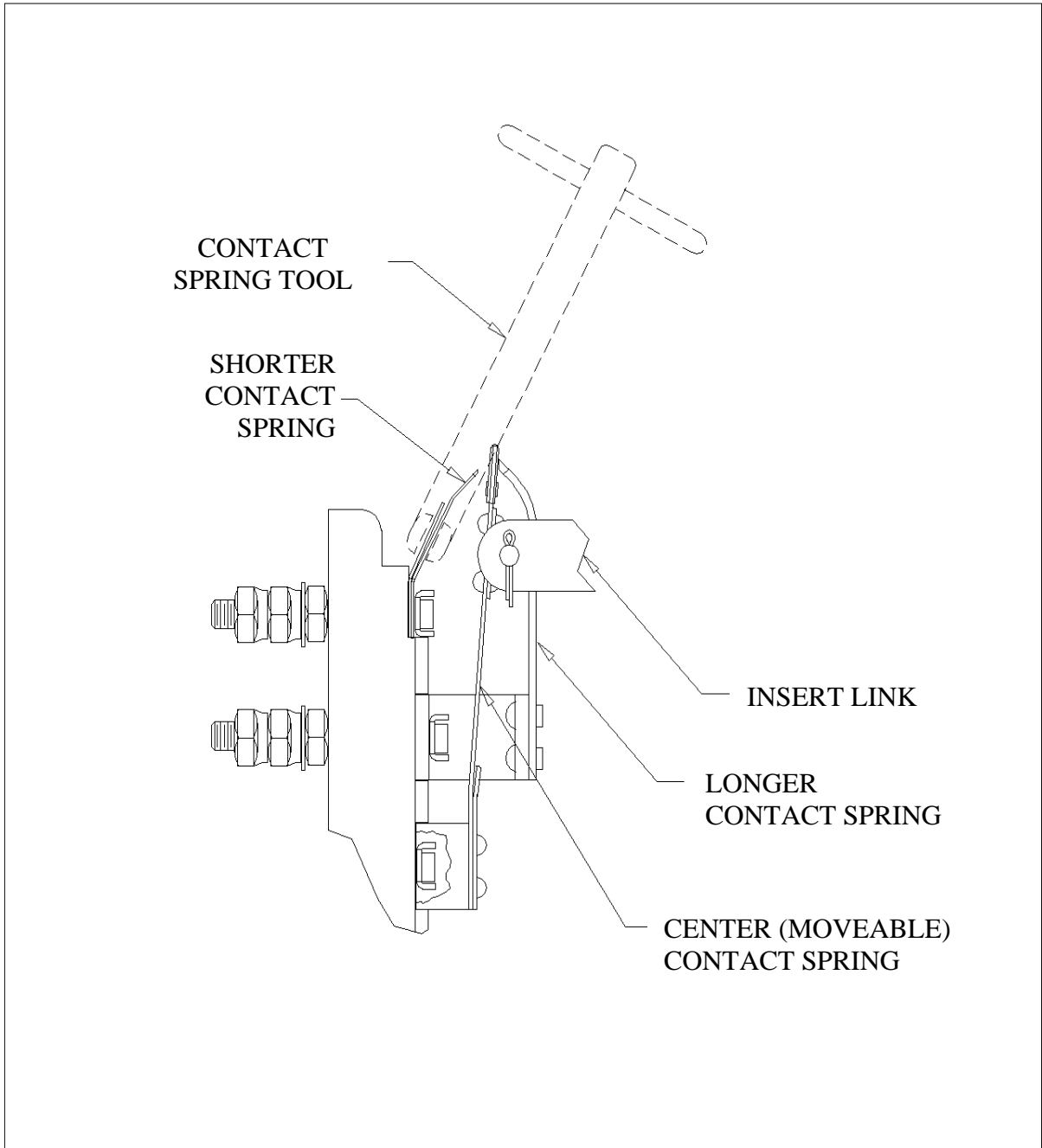


FIGURE 5-1 CONTACT ADJUSTMENT

5.3 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) of all 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 5-2. 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 5-3, 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.

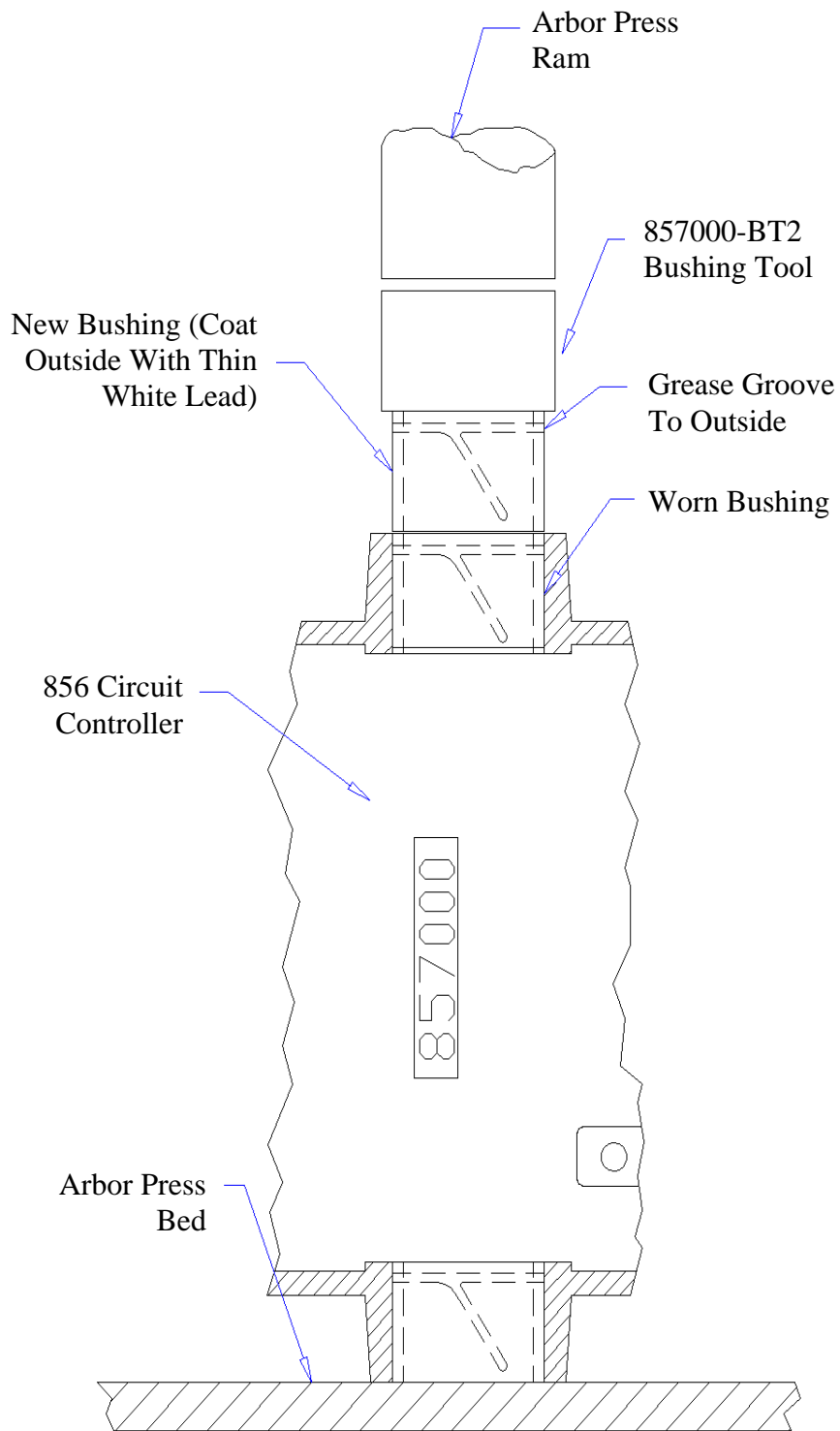


FIGURE 5-2
CAMSHAFT BEARING REPLACEMENT

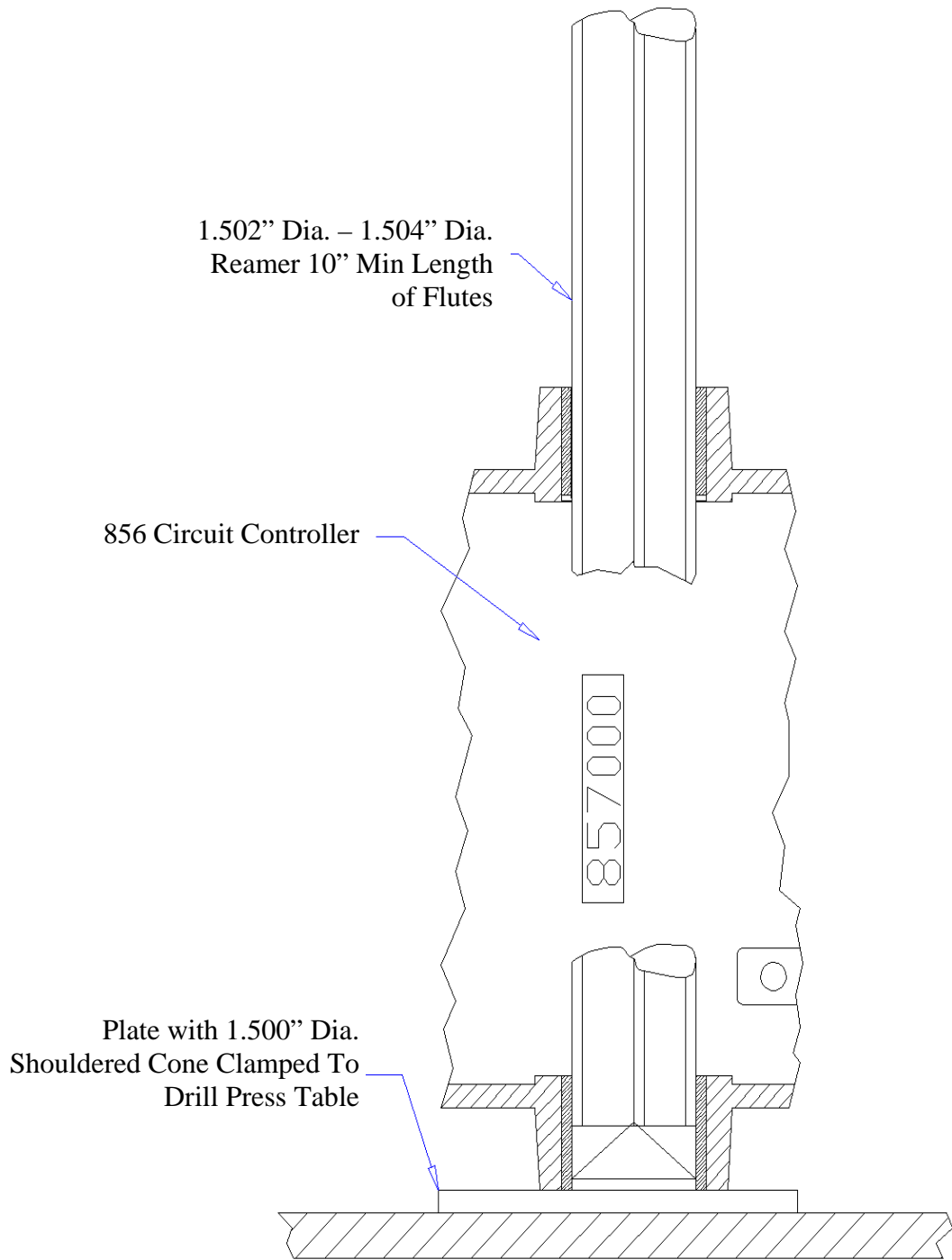
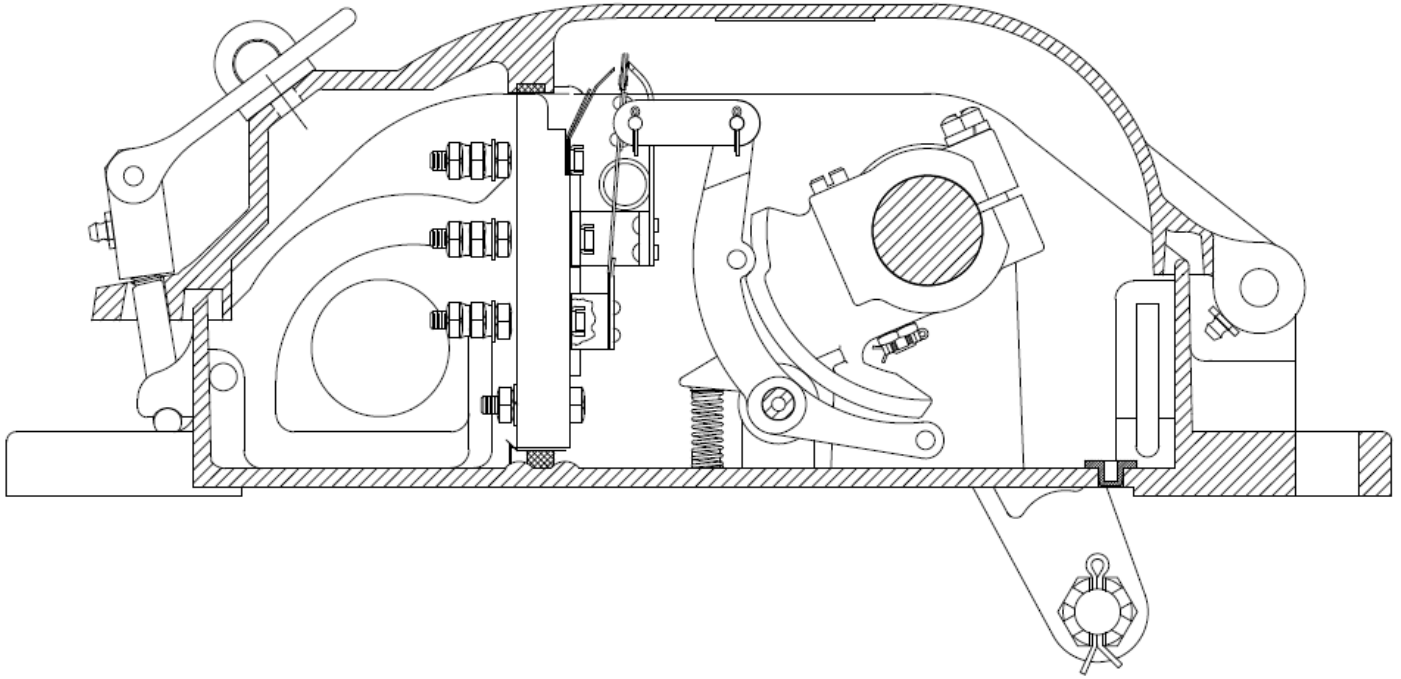


FIGURE 5-3
REAMING CAMSHAFT BUSHINGS



Part 6
Parts List

**856 Series Switch
Circuit Controller**

August 2015

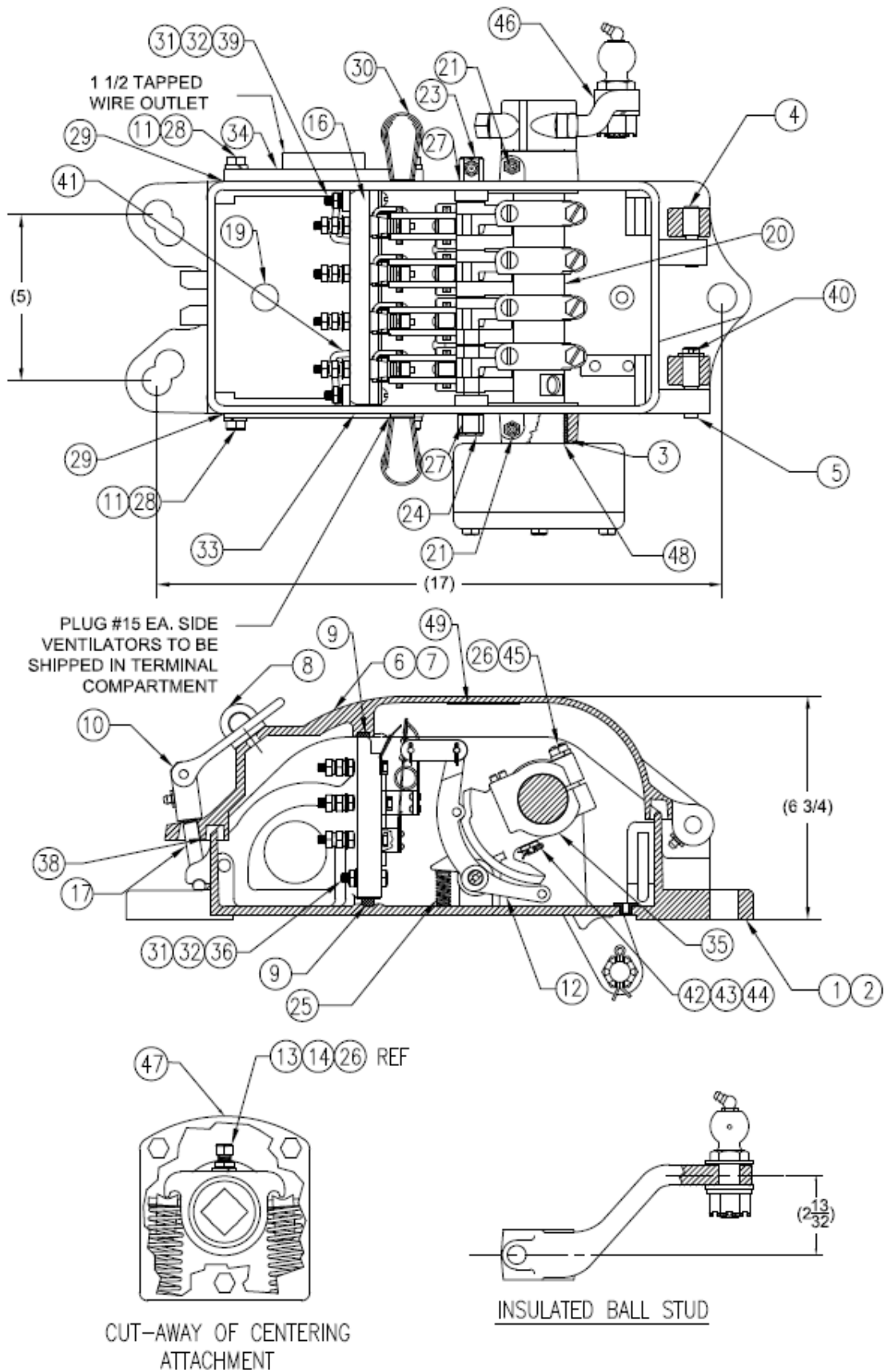
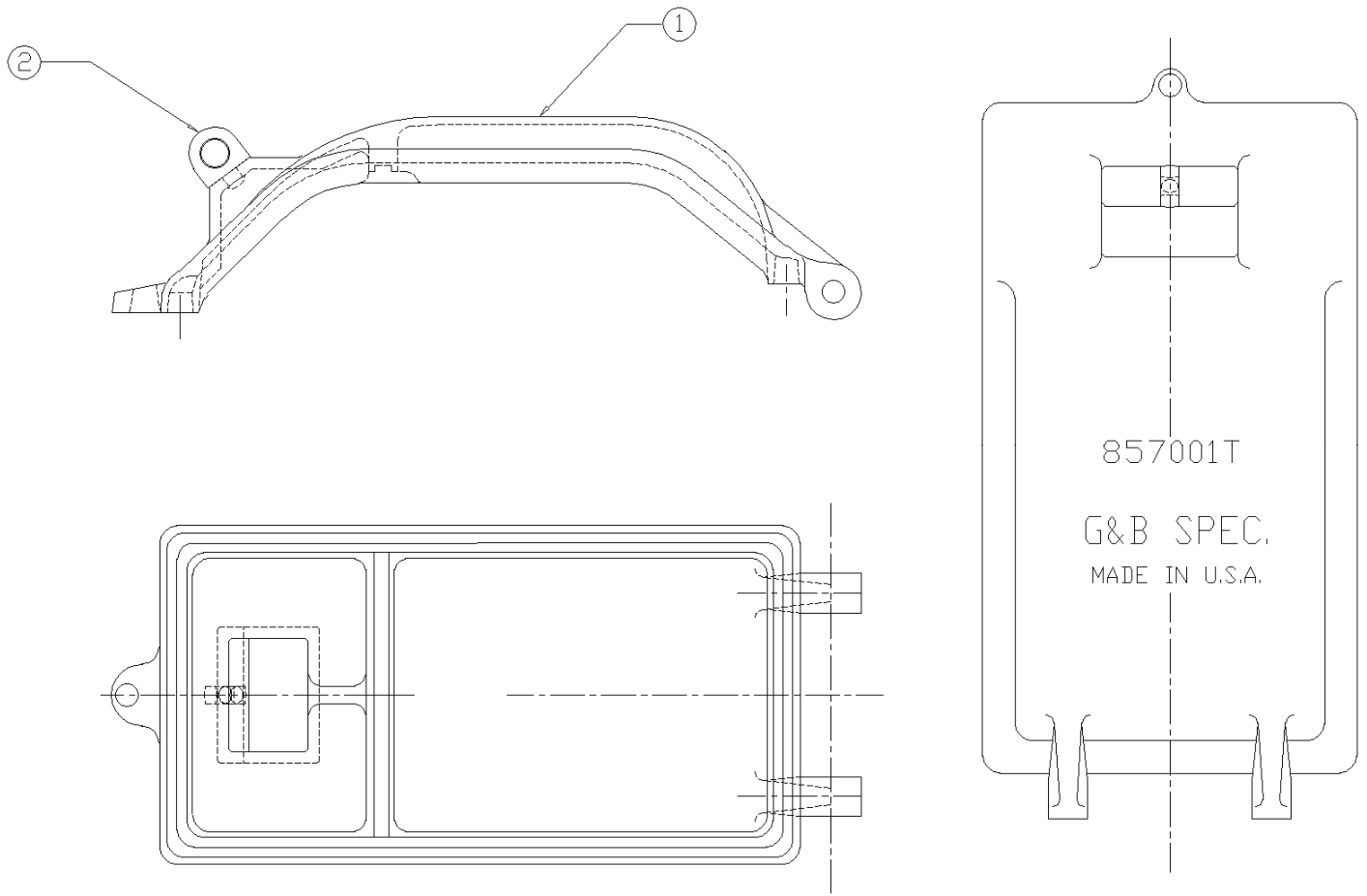


FIGURE 6-2
856500-030-03 SERIES CIRCUIT CONTROLLER

ITEM	REQ'D	PART NO.	DESCRIPTION
1	1	857000TX	Case, Circuit Controller w/Bushings
2	REF	857000T	Case, Controller
3	REF	857562	Bushing(2 per Case)
4	1	857819-003	Hinge Pin, Phos. Bz.
5	1	857820-003	Hinge Pin, Phos. Bz.
6	1	857001-100TX	Cover Complete w/Grease Fittings
7	REF	857001-100T	Cover
8	REF	857161-001	Hasp Lug
9	2	857077-123	Gasket, Contact Board
10	1	857002-101X	Hasp Assembly w/Fitting
11	4	990401-037-30	Washer, 3/8 Stainless Medium Lock
12	4	857004X	Operating Arm Assembly
13	REF	991314-125-22	Screw, 3/8-24 X 1 1/4 Set
14	REF	990310037-02	Nut, 3/8 Hex Jam
15	2	857109-003	Protector Plug, .683 tapered
16	1	857077-614X	Board Assy., Contact
17	REF	857344	Tee Bolt
18	1	998917-010X	Hardware Kit
19	1	857404	Plug, .299 Tapered
20	1	857434-005	Camshaft
21	2	990900-003	Fitting, Alemite #1610
22	1	589002-786	Tag, EP Point Warning
23	1	857081-410X	Operating Arm Shaft
24	1	857081-409	Nut, Operating Arm Shaft
25	4	857004-832	Spring, Operating Arm
26	4	990401-037-02	Washer, 3/8 Lock
27		990699-043-30	Washer, Adjusting(when required)
28	4	990725-100-30	Bolt, 3/8-16 X 1 Hex Hd Stainless
29	2	860126G	Gasket, Wire Outlet Cover
30	2	857109-001X	Ventilator Complete
31	4	990316-025-02	Nut, 1/4-20 Elastic Stop
32	4	990401-025-02	Washer, 1/4 Lock
33	1	860126	Outlet Cover, Blank
34	1	860126-001	Outlet cover, 1 1/2 Tapped Hole
35	4	857005	Cam, 2 Position
36	2	857077-508	Bolt, 1/4-20 x 2 Hex Head
37	1	589399-006	Tag, Final Inspection
38	1	857001-043	Gasket, Case Cover
39	2	857077-509	Screw, 1/4-20 X 1 1/2 Rd Head Machine
40	1	990506-075-02	Pin, 1/8 X 3/4 Cotter
41	2	857077-386	Clamp, Contact Board
42	4	857005-637	Bolt, Cam Adjusting
43	4	857005-096	Nut, 3/8-24 Slotted
44	4	990504-062-02	Pin, 3/32 X 5/8 Cotter
45	4	991141-175-12	Screw, 3/8-16 X 1 3/4 Slotted Hex Head
46	1	857014-001-01	Crank, 2 13/32 Offset w/ Insulated Ball Stud
47	1	857008X	External Centering Attachment
48	1	857008-005	Seal, Camshaft
49	1	Z-STICKER005	Warning Sticker

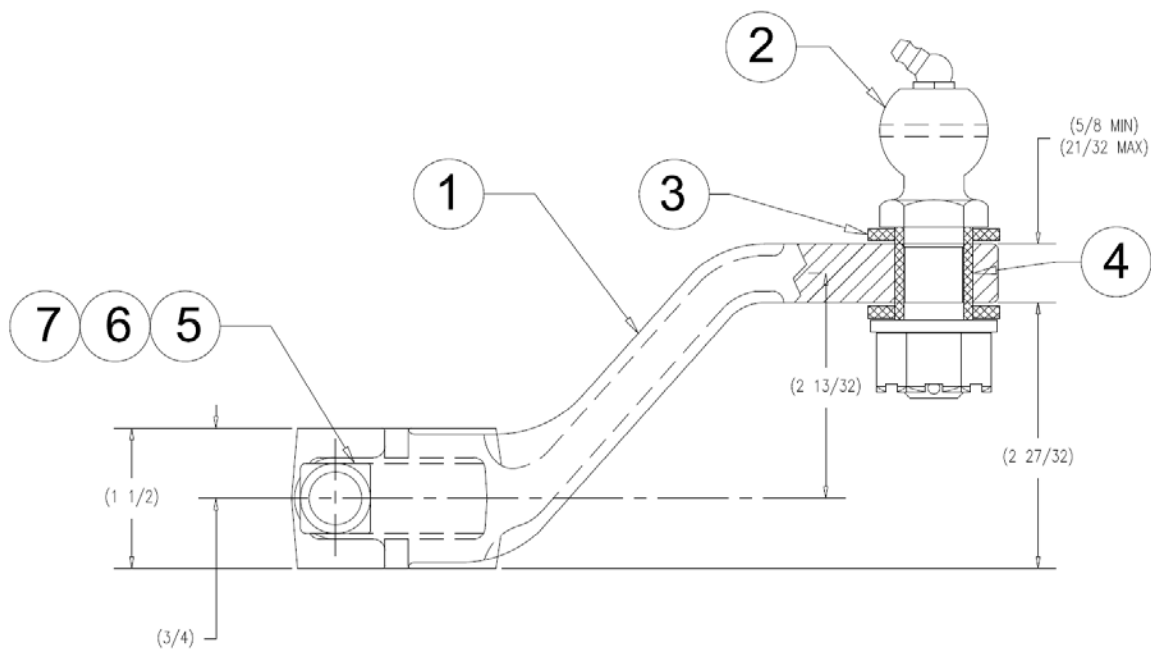
FIGURE 6-2 PARTS LIST



**FIGURE 6-3
COVER ASSEMBLY**

ITEM NUMBER	PART NUMBER	DRAWING NUMBER	DESCRIPTION	QUANTITY
1	857001T	857001T	CIRCUIT CONTROLLER MACHINED COVER	1
2	857161-001	857161001	HASP LUG	1

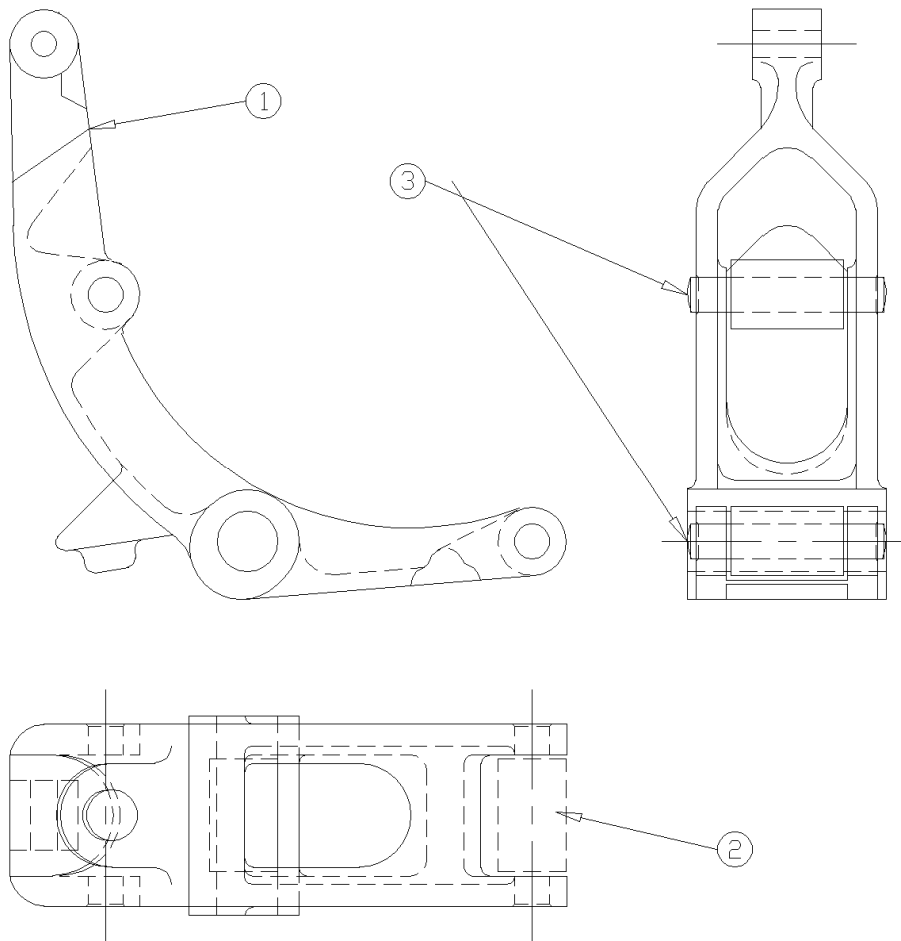
FIGURE 6-3 PARTS LIST



**FIGURE 6-4
CRANK ASSEMBLY**

ITEM NUMBER	PART NUMBER	DESCRIPTION	QUANTITY
1	857014-001	OPER. CRANK, W/ 13/16" HOLE	1
2	081193X	BALL STUD ASSEMBLY	1
3	973502-2	INSUL. WASHER, .8281 ID X 1.375 OD	2
4	973099-1	INS. BUSHING, 5/8 X 13/16 X 25/32	1
5	990027-300-02	BOLT, 1/2-13 X 3 SQ. HD. Z/Y	1
6	990403-050-02	WASHER, 1/2 X-DUTY LOCK	1
7	990331-050-02	NUT, 1/2 HEAVY HEX	1

FIGURE 6-4 PARTS LIST

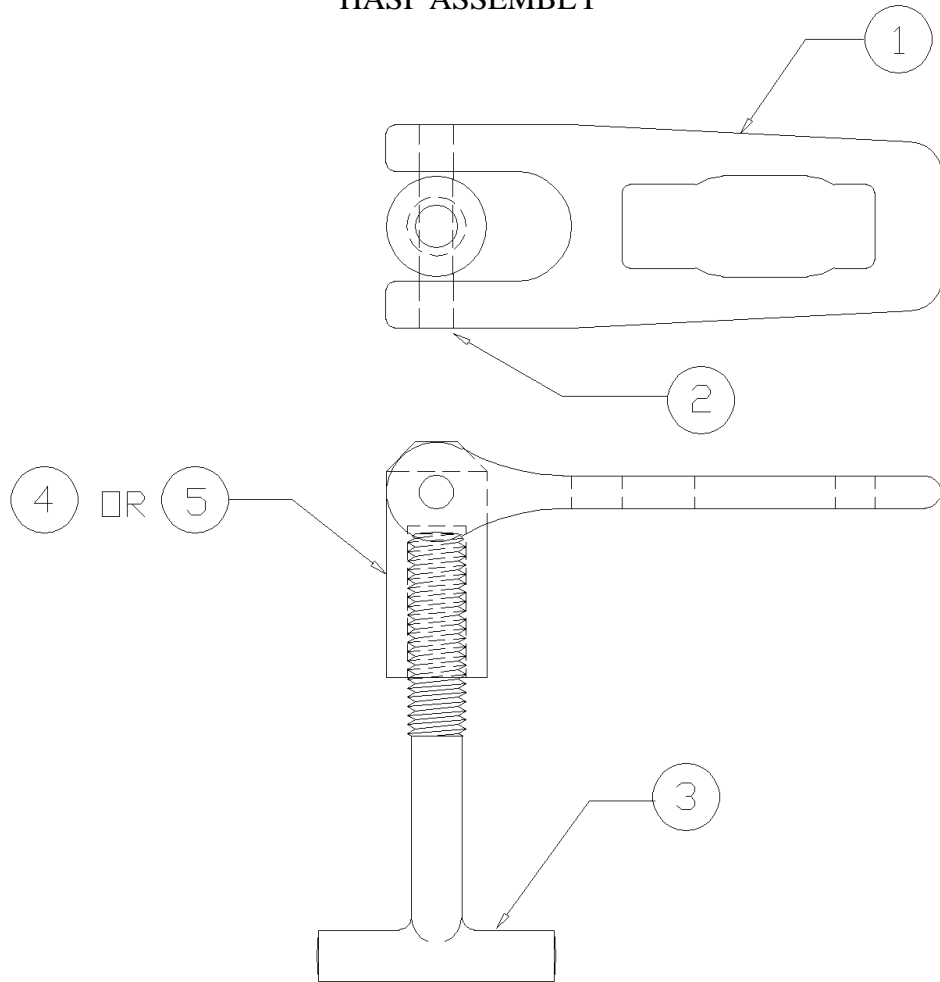


**FIGURE 6-5
OPERATING ARM**

ITEM NUMBER	PART NUMBER	DRAWING NUMBER	DESCRIPTION	QUANTITY
1	857004	857004	OPERATING ARM	1
2	857081-173	857081-173	ROLLER	2
3	857081-451	857081-451	PIN	2

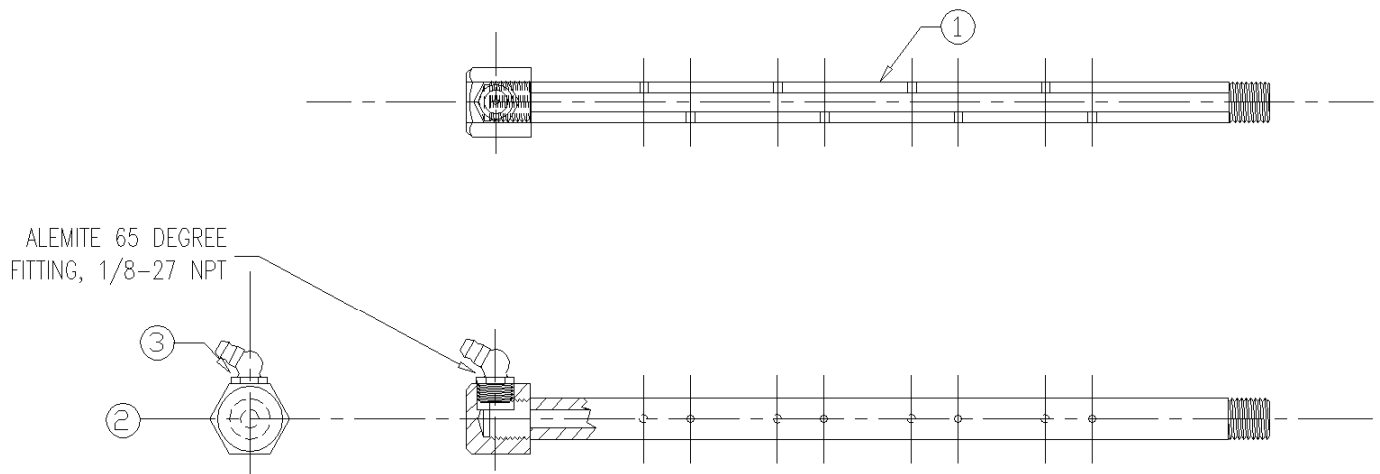
FIGURE 6-5 PARTS LIST

**FIGURE 6-6
HASP ASSEMBLY**



ITEM NUMBER	PART NUMBER	DESCRIPTION	QUANTITY
1	857002	HASP	1
2	990568-150-00	ROLL PIN, 1/4" X 1 1/2"	1
3	857344	TEE BOLT, W/ 7/16"-14 THREADS	1
4	857002-443-21	HASP NUT, 7/16"-14 THREADS	1
5	990900-004	FITTING, 3/16 STR DRIVE	1

FIGURE 6-6 PARTS LIST



**FIGURE 6-7
ROCKER SHAFT ASSEMBLY**

ITEM NUMBER	PART NUMBER	DRAWING NUMBER	DESCRIPTION	QUANTITY
1	857081-410	857081410	.4375 O.D. TUBING, .120 WALL X 8 3/8	1
2	857081-409	857081409	7/16-20 NUT, ROCKER SHAFT	1
3	990900-007	—	FITTING, 65 DEG.	1

FIGURE 6-7 PARTS LIST

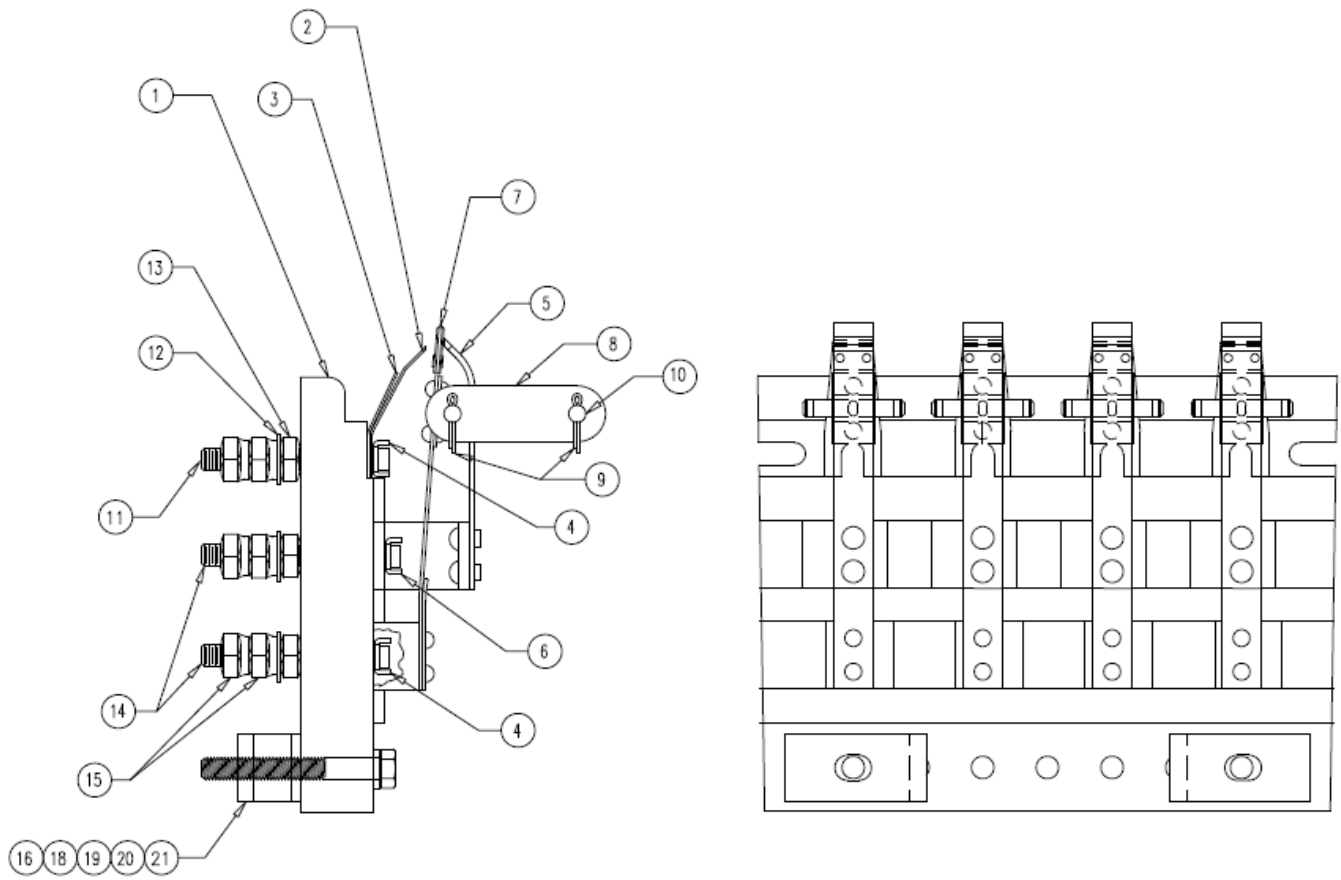


FIGURE 6-8
CONTACT BOARD ASSEMBLY

ITEM NUMBER	PART NUMBER	DESCRIPTION	QUANTITY
1	857077-613	BOARD, PHENOLIC CONTACT SPRING	1
2	857077-201	CONTACT SPRING	4
3	857077-158	REINFORCING SPRING	4
4	857077-259	LOCK WASHER	8
5	857077-206-01	CONTACT SPRING ASSEMBLY	4
6	857077-468	BOLT LOCK	4
7	857077-102X	CONTACT SPRING ASSEMBLY	4
8	857077-665	INSULATED LINK	8
9	990502-037-02	1/16" X 3/8" STEEL PLATED COTTER PIN	16
10	857077-765	LINK PIN	4
11	990102-187-55	BINDING POST, #14-24 X 1 7/8"	4
12	990601-025-055	WASHER, 1/4" NICKEL	12
13	990101-007-E55	NUT, BINDING POST, #14-24 NICKEL	12
14	990102-225-55	BINDING POST, #14-24 X 2 1/4	8
15	998917-010X	HARDWARE KIT, CONTACT TERMINAL	1
16	857077-386	CLAMP, TERMINAL BOARD	2
THE FOLLOWING ITEMS TO BE PACKAGED IN POLY BAG			
17	857077-509	SCREW, 1/4-20 X 1 1/2 RD HD	2
18	990600-025-002	WASHER, 1/4 NARROW FLAT	2
19	990401-025-02	WASHER, 1/4 REGULAR LOCK	4
20	857077-508	BOLT, 1/4-20 X 2 HX HD TAP	2
21	990316-025-01	NUT, 1/4-20 REG HEX ELASTIC STOP	4

FIGURE 6-8 PARTS LIST

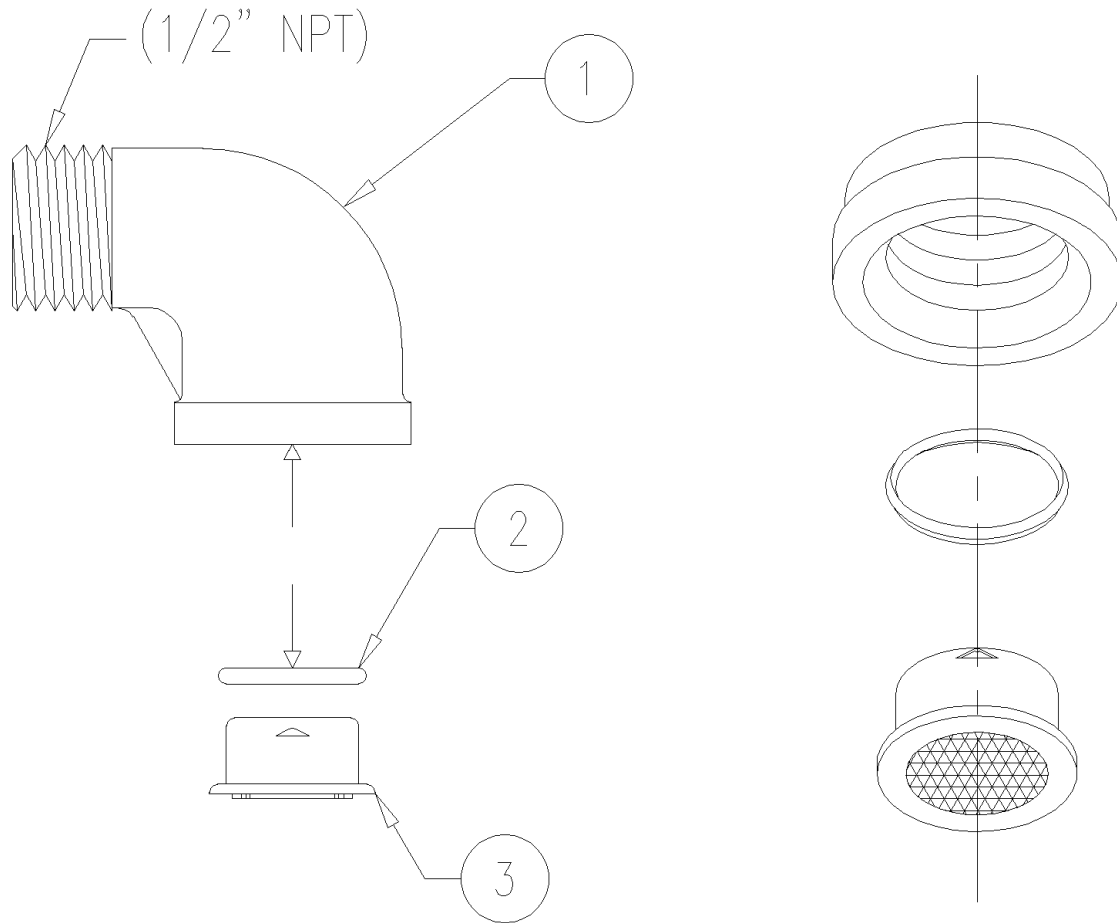


FIGURE 6-9
VENTILATOR ASSEMBLY

ITEM NUMBER	PART NUMBER	DESCRIPTION	QUANTITY
1	998530-002	STREET ELBOW, 0.500 GALV	1
2	857097-097	O-RING, #112	1
3	D2421B	VENT, SCREEN	1

FIGURE 6-9 PARTS LIST