

TRS 3064

# Installation, Operation and Maintenance of the **Airflex®** Timing Rotorseal and Cam Limit Switch



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# EAT•N

**Authorized Distributor**



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**Eaton® Airflex® Clutches & Brakes**

# 1.0 Operation

Throughout this manual, there are a number of **Hazard Warnings** that must be read and understood in order to prevent possible personal injury and/or damage to the equipment. Carefully read these warnings. They are included to protect you!

## 1.1 Description:

This manual describes two Airflex® timing control devices, namely, the Airflex® Cam Limit Switch and the Airflex® Timing Rotorseal. The cam limit switch is a rotary cam timing switch device. The timing rotorseal combines the features of a rotary cam timing switch with those of a rotary air seal in one compact unit. Both of these devices are primarily designed to control the operating functions of mechanical power presses. Both devices are also referred to as timers in this manual, since the timing operation for both devices is the same.

When these devices are properly wired into the appropriate Airflex® press control system (refer to Manual CP 3080), these devices can provide the following functions:

- Inch
- Single stroke
- Continuous
- Semicontinuous
- Monitor the stopping effectiveness of the braking system

The Airflex® press control system requires two of the timers, in any combination, to control the above functions and to monitor each other for failure and shaft breakage.

These devices can be furnished for either clockwise or counterclockwise rotation. The direction of rotation of the device is identified by a decal on the cap and is determined by viewing the device from the cap end. Timing rotorseals supplied with Airflex® FSPA clutch and brake packages are assembled for counterclockwise rotation unless otherwise specified on the order.

The cam limit switch can be furnished for either shaft mounting or for foot mounting with a chain drive (see the illustrated Parts List in Section 4.0). The timing rotorseal is designed to be assembled to the flywheel or

bullgear of an Airflex® standard press application clutch and brake package (see Figure 2).

## 1.2 How It Works:

The operation of the timing section of the timing rotorseal is the same as that of the cam limit switch. In this respect, both devices are referred to as timers in this manual. There are five shaft mounted cams which, when rotated, open and close four automotive type breaker points (see Figure 1) as LS1, LS2, LS3 and LS4.

LS1 and LS2 are controlled by cams No. 1 (24) and No. 2 (26) respectively (see Section 4.0 for item numbers in brackets). LS3, when used for brake monitoring, is controlled by a two piece cam No. 3 consisting of an insert (28) and an outer cam (28A). An optional one piece cam No. 3 is supplied with both devices that replaces the two piece cam for applications that do not require brake monitoring. LS4 is controlled by split cams No. 4 (33) and No. 5 (33A). Cam functions are discussed in Section 1.2.1.

The timing rotorseal, besides providing the same timing functions as does the cam limit switch, also provides a means of air delivery from a stationary source to operate a rotating component such as the Airflex® clutch. The seal between the stationary center section (11) and the rotating adapter (1) is provided by the inner and outer carbon seals (16 and 19). The lapped surfaces of these seals are held against the rotating adapter (1) by inner and outer springs (12 and 13). Air enters the stationary center section (11) and passes through the seals into the rotating adapter (1).

### 1.2.1. Cam Functions:

The Airflex® press control system requires two timing devices. To differentiate between the timers both the cam limit switch and the timing rotorseal have a decal, affixed to the end cap, with tabs labeled "A" and "B". Therefore, one timer should be labeled "A" and the other "B"; the unused tabs are removed. To be consistent with the Airflex® press control wiring diagram the timer that monitors the brake should be labeled "A".

The control functions of the cams are:

| Cam No. | "A" Timer                | "B" Timer                                        |
|---------|--------------------------|--------------------------------------------------|
| 1       | Nonrepeat                | Nonrepeat                                        |
| 2       | Top Stop (Continuous)    | Nonrepeat                                        |
| 3       | Brake Monitor            | Semicontinuous Brake Monitor or Special Function |
| 4 & 5   | Top Stop (Single Stroke) | Top Stop (Single Stroke)                         |

Figure 1 illustrates the cams assembled in the timing section of both devices and their relationships.

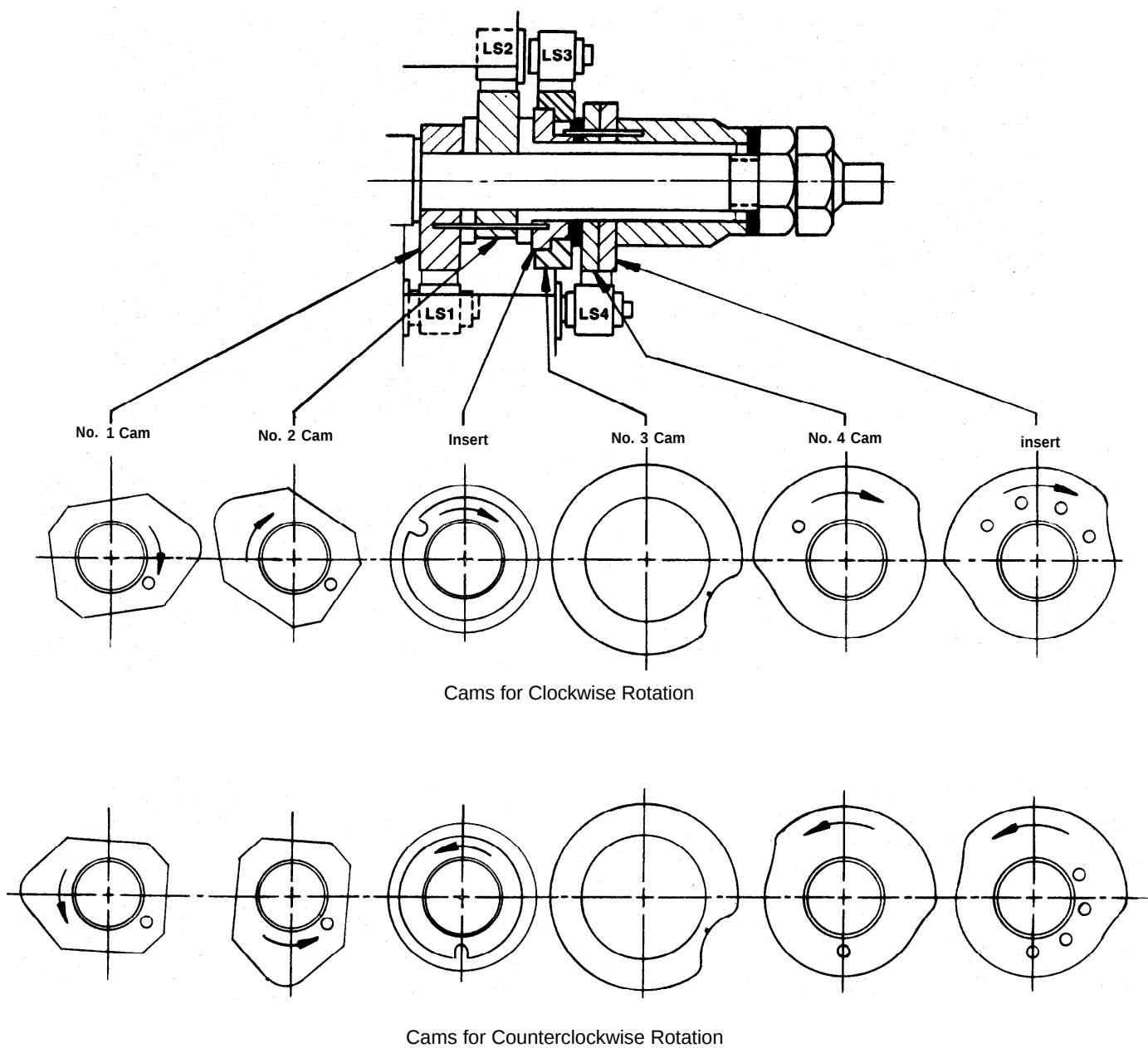
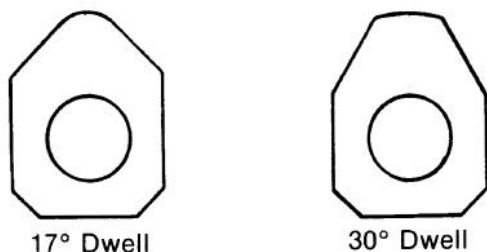


Figure 1. Cam profiles and their relationships

Two cam profiles are available for cams 1 (24) and 2 (26). The standard profile provides a 17° dwell. For applications where timers operate in excess of 300 RPM, a cam profile which provides a 30° dwell should be used for cams 1 and 2. These cam profiles are shown below.



Cam No. 3 (28 and 28A) monitors the effectiveness of the press braking system at the top of the stroke. When cam No. 3 is positioned according to Paragraph 2.3, deviations in stopping position greater than  $\pm 15^\circ$  from top dead center will be detected.

All control systems, except those capable of inch and continuous functions only, require two timers. When two timers are used, except on control panels with semicontinuous function, only the two piece cam No. 3 of the "A" timer is required for brake monitoring. The cam No. 3 of the "B" timer, is available for a user's special function such as a counter. The optional one piece cam No. 3 profile is the same as cam No. 4 shown in Figure 1.

LS4 is controlled by split cams 4 (33) and 5 (33A). This set of cams determines the top stop setting and the amount of time the run buttons must be depressed before the operator can remove his hands from them. If the run buttons are released before this predetermined setting, the press will stop.

The minimum dwell setting of these cams is 135°, and they are fannable up to 255° in increments of 40°. For the proper setting of these cams, refer to Paragraph 2.3.

## 2.0 Installation



### Danger:

Prior to installation of the **Airflex®** Timing Rotorseal and Cam Limit Switch, make sure that the machinery is secured in a safe manner. Failure to do so could result in serious injury or possibly death.



### Warning:

Only qualified maintenance personnel should install, adjust or repair these devices. Faulty workmanship will result in unreasonable exposure to hazardous conditions, injury or severe damage to the equipment.



### Caution:

Before you begin any work, study this manual so that you completely understand what is required. Do not risk injury. Follow the instructions.

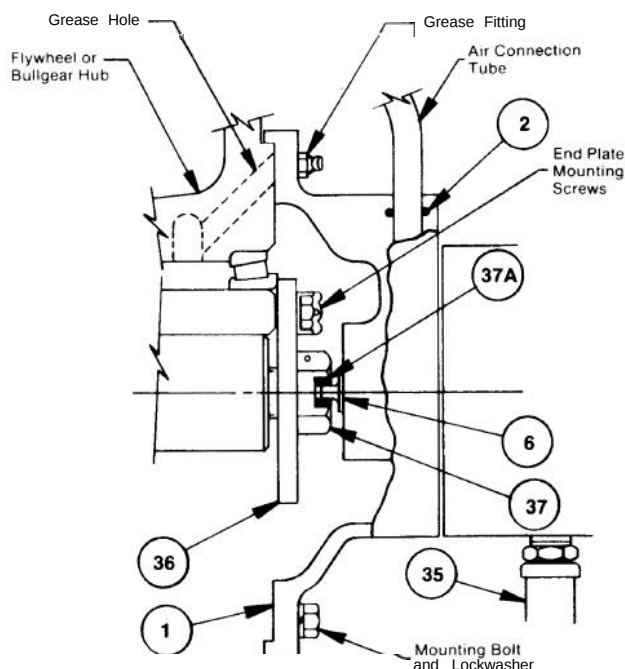
### 2.1 Mounting

Instructions for mounting the **Airflex®** timing rotorseal, foot and shaft mounted cam limit switches are given below. Any combination of these times may be used in the control system. Follow those instructions that pertain to the timers being used.

#### 2.1 .1 Timing Rotorseal:

The **Airflex®** timing rotorseal is custom designed to fit the flywheel or bullgear of an **Airflex®** FSPA clutch and brake package as shown in Figure 2. The flywheel or bullgear

hub has been machined to accept the mounting register and bolt circle of the timer rotorseal adapter (1).



**Figure 2. Timing rotorseal mounting configuration**

The timing rotorseal end plate (36) is used to assemble the device to the crankshaft. The end plate also provides the necessary bearing running clearance and must be properly shimmed. Follow instructions given in Form PP3000.

Before mounting the timing rotorseal, check to be sure its direction of rotation corresponds with that of the flywheel or bullgear.

To mount the timing rotor seal:

- a) Make sure that the air tube "O" rings (2) are in place.
- b) Install the plastic insert (37A) in the head of the drive screw (37).
- c) Install drive screw. Tighten the screw, being careful not to distort the end plate (36).
- d) Tie-wire the drive screw to the end plate mounting screws.
- e) Align the tang of shaft (6) with the slot in the drive screw insert, and align the grease holes in the adapter (1) with those in the hub of the flywheel or bullgear.
- f) Install the lockwashers and mounting bolts. Tighten the mounting bolts uniformly so the adapter flange fits squarely against the register face.
- g) Inspect all air connection tubes and remove all burrs.
- h) Lightly grease or oil the ends of the air tubes and insert them into the mating adapter holes.
- i) Attach the opposite ends of the tubes to their connections.
- j) Connect flexible air hose (35) to the center section and air supply line.



#### Caution:

**Do not use a rigid pipe air line in place of the flexible air hose (35). Rigid pipe does not allow compensation for any eccentricity between the device and the shaft and will cause a preload condition that will shorten the bearing life of the device.**

- k) Apply air pressure and check for air leaks. Repair as required.
- l) Remove air pressure.
- m) Refer to appropriate paragraph and mount second timer.

Wiring instructions are given in Paragraph 2.2.

### 2.1.2. Foot Mounted Cam Limit Switch:

The foot mounted cam limit switch must be chain driven by the crankshaft. The sprocket ratio between the shaft and switch must be 1:1. Sprockets furnished by Airflex® are 3/8 in. pitch. Chain of proper length, determined by the placement of the timer, and the chain guard must be furnished by customer.

Mount the timer as follows:

- a) Select a convenient mounting area for the timer so that there is no interference with the chain drive. Locate the timer as close as possible to the driving shaft so that the chain length is held to a minimum.

- b) Rigidly attach a sprocket to the driving shaft.
- c) Key the other sprocket to the cam limit switch shaft and lock it in position with set screws and jam screws. The cam limit switch shaft diameter is .6250/.6245 inches, has a 3/16 inch square keyway and has a one inch long mounting length.
- d) Fabricate a sturdy bracket or prepare the machine surface for mounting. Bear in mind that the bracket design or positioning of the switch will be influenced by the direction of rotation of the switch.
- e) Position the switch so that the driving and driven sprockets are in alignment. Fasten the switch to its support with four 3/8 inch cap screws and lockwashers.
- f) Attach and tension the drive chain following chain manufacturer's recommendations.
- g) Fabricate a guard to cover sprockets and chain.
- h) Refer to appropriate paragraph and mount second timer.

Wiring instructions are given in Paragraph 2.2.

### 2.1.3 Shaft Mounted Cam Limit Switch:

The shaft mounted cam limit switch is designed for attaching directly to a shaft end. The shaft end must be machined as shown in Figure 3 to accept the shaft pilot and bolt circle.

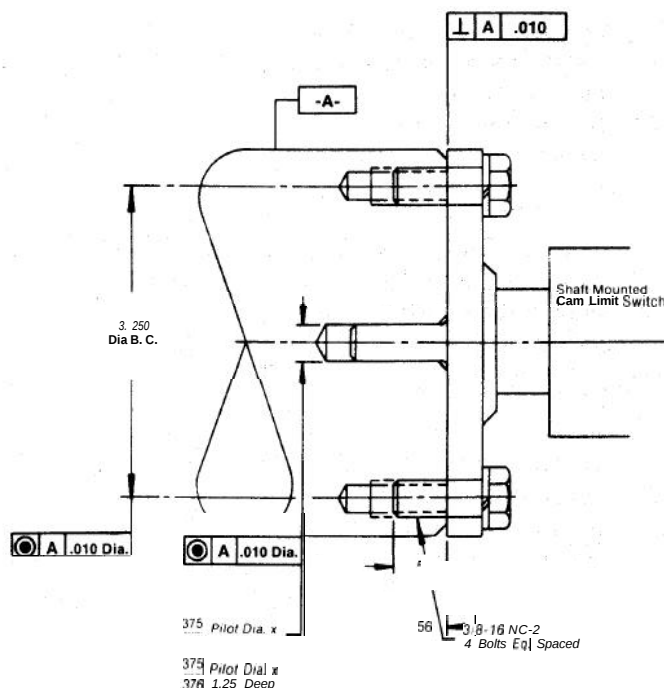


Figure 3. Shaft machining details

Before mounting the timer, check to be sure its direction of rotation corresponds to that of the shaft. Fasten the flange to the shaft with lockwashers and cap screws.

Refer to appropriate paragraph and mount second timer.

Wiring instructions are given in Paragraph 2.2.

## 2.2 Wiring:

Two rotary timers are required in the Airflex® press control system. The timers must be appropriately labeled to identify them and the functions they control. The timer that monitors the brake should be labeled "A" to agree with the Airflex® wiring diagrams. Label the other timer "B". "A" and "B" decals are furnished on each timer end cap. Remove the letter that is not used.

The timer is internally wired at the factory. All leads have the breaker point number to which they are wired printed on the insulation. Label each lead with the corresponding schematic wire number and "A" or "B" to identify the timer to which the lead is connected.

An insulated straight connector fitting for 3/4 inch flexible conduit is furnished with the timer.



### Caution:

**A length of flexible conduit must be used between the timer and rigid conduit. This flexible connection allows compensation for any eccentricity between shafts for shaft mounted timers and will permit chain tension adjustments for the foot mounted timers.**

**Use 16 gauge stranded machine tool wire, U.L. listed, 105°C temperature rating, voltage rating 600 volts, minimum insulation thickness 0.031", oil resistant, for wiring the timers to the control panel.**



### Caution:

**No strain relief is provided internal to the timer. Therefore, when wiring the timer into the application, provide enough slack wire to prevent wire breakage at the contact points.**

## 2.3 Timer Adjustment:

Reread and follow the Hazard Warnings stated under Paragraph 2.0.

Cams No. 1, 2, 3 insert, 4 and 5 (24, 26, 28, 33 and 33A, respectively) are dowelled together and are adjusted as a unit. The outer part of cam No. 3 (28A) in timer "A" is adjusted separately. All the cams, once adjusted, are clamped together by tightening of the two jam nuts (30). See the illustrated parts list in Section 4.0 for the relationship of these parts and when making adjustments.

### 2.3.1. Top Stop and Brake Monitoring

For existing installations: proceed to Step "g".

- Position the crankshaft at top dead center. Make sure, it will remain in a safe position.
- Turn electrical power off to main control panel.
- Remove end cap (31) from timer by removing the two socket head cap screws.
- Loosen jam nuts (30). Hold adjusting knob (29) and align indicator groove on cam No. 3 (28A) in timer "A" with fiber cam follower of LS3 as shown in Figure 4.

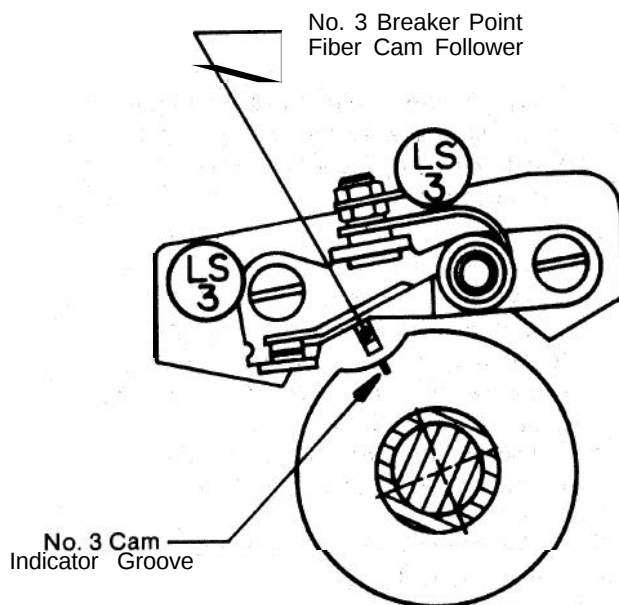


Figure 4. Brake monitoring cam alignment

- Retighten the jam nuts (30).
- Position felt seal (34), replace end cap (31), install and tighten the two socket head cap screws. Turn electrical power on.
- Stroke press to check the stopping position.
- Note the relationship between the desired stopping position and the actual stopping position.
- If the stop is unsatisfactory, inch to the top of the stroke. **Secure** the machine in a safe manner to avoid possible injury.
- Turn electrical power off and remove end cap (31).
- Loosen jam nuts (30) and rotate adjusting knob (29) in opposite direction of cam arrow to advance the stopping position, or in same direction of cam arrow to retard the stopping position.
- Hold adjusting knob (29) from rotating and align indicator groove on brake monitoring cam No. 3 with fiber cam follower of LS3 as shown in Figure 4.

- m) Retighten the jam nuts (30) and repeat Steps "f", "g" and "h".
- n) Repeat this procedure as necessary to obtain the desired stopping position.

### 2.3.2 Long Operation:

This feature is provided so an adjustment can be made to extend the LS4 open time and accommodate presses with long strokes and/or slow crankshaft speeds.

- a) Turn electrical power off to main control panel.
- b) Remove end cap (31) from timer by removing the two socket head cap screws.
- c) Remove jam nuts (30) and washer (40).
- d) Remove adjusting knob (29).
- e) Note that cam No. 5 (33A) has four dowel holes for adjustment. Cams are factory adjusted to a minimum setting of **135°**. Rotate cam No. 5 (33A) to increase or decrease cam dwell.
- f) Insert the dowel of the adjusting knob through cam No. 5 (33A), cam No. 4 (33) and spacer (41) to engage cam No. 3 insert (28). Proper engagement can be determined by rotating the cam adjusting knob. All cams, except cam No. 3 (28A), will turn as a unit when the knob is rotated.
- g) Adjust top stop position and brake monitoring cam as outlined in Paragraph 2.3.1.

### 2.3.3 Timer Synchronizing Instructions:

- a) First, refer to Paragraph 2.3, Timer Adjustments. Where two **Airflex®** timers exist, this section applies to both units.
- b) Set stroking selector on control panel to "inch", turn power "ON", and inch press

to top of stroke. With electrical power "OFF", remove both timer end caps. **Make sure** the machinery is secured in a safe manner.

- c) On each timer, loosen the locknuts (30) and rotate the cam assemblies,, so that the leading edge of the lobe on both cam No. 4 and 5 (33 and 33A) just start to open the LS4 breaker points. Tighten locknuts (30). Also, refer to brake monitoring cam adjustment at this point, when applicable (see Paragraph 2.3.1 and Figure 4).
- d) Set the control panel stroking selector to 'Single Stroke', operate the press, and observe the stopping position. Retard or advance both cam assemblies, as required, to establish desired top stop position. Tighten locknuts.
- e) With "top stop" established, it is likely at this stage of adjustment that one cam' No. 4 of one timer may slightly lead the cam No. 4 of the second timer.
- f) Inch the press through the stroke just far enough for the lobe of the **leading cam** to barely contact the fiber cam follower on the breaker point.
- g) **With power "OFF"**, adjust the second cam assembly to an identical setting. Tighten locknuts.
- h) Run the press again on "Single Stroke" a few times to verify proper operation and stopping position.
- i) **With power "OFF"**, replace the felt seal (34), the timer end caps and socket screws.
- j) The two timers should now be properly synchronized, and the press ready for operation.

## 3.0 Maintenance



#### Danger:

Prior to performing any maintenance, repair or adjustment on the **Airflex®** Timing Rotorseal and Cam Limit Switch, make sure that the machinery will remain secured in a safe manner. Failure to do so could result in serious injury or possibly death.



#### Warning:

Only qualified maintenance personnel should install, adjust or repair these devices. Faulty workmanship will result in unreasonable exposure to hazardous conditions, injury or severe damage to the equipment.



#### Caution:

Before you begin any work, study this manual so that you completely understand what is required. Do not risk injury. Follow the instructions.

### 3.1

#### Breaker Point Assemblies:

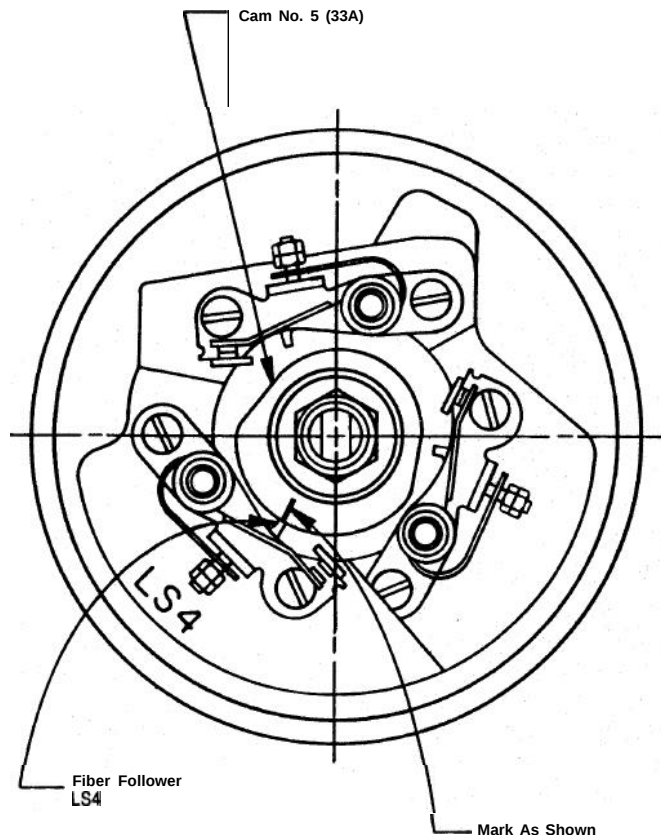
The breaker points furnished with the **Airflex®** timers have silver alloy contacts. Standard automotive breaker points have tungsten contacts and **must not** be used as a substitute. The breaker points should be checked periodically for wear.

Refer to Figure 6 when making any adjustments.

### 3.1.1 Breaker Point Opening Gap:

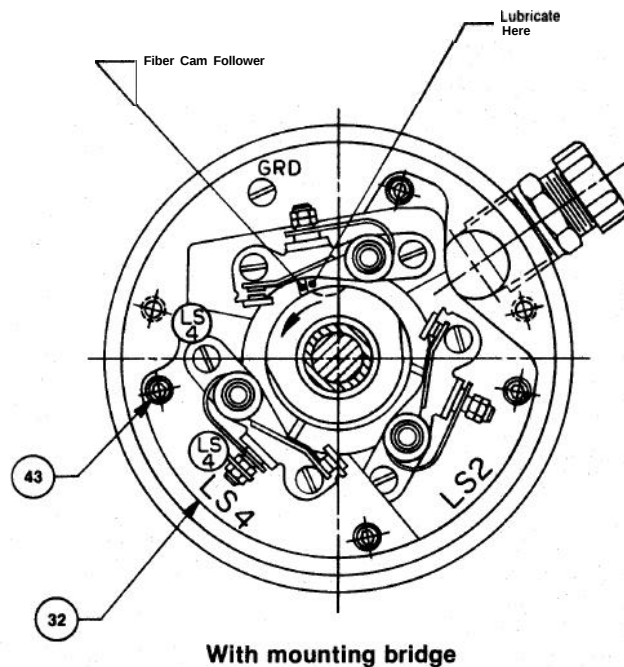
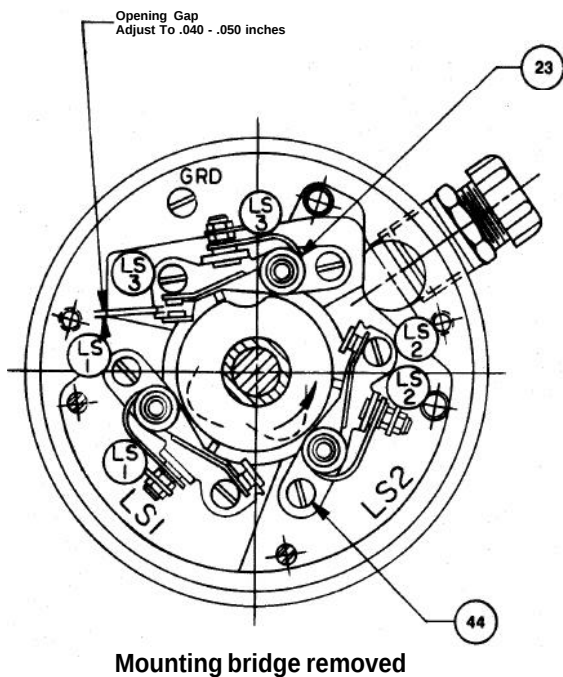
This gap is preset at the factory on new units at time of assembly. A gap setting of .040" to .050" must be maintained at all times. The opening gap must be checked regularly and reset when required. To inspect for proper opening gap:

- Position the crankshaft at top dead center. Use die safety blocks or otherwise secure to hold the ram in this position.
- Turn electrical power **off** to main control panel.
- Remove end cap (31) from timer by removing the two socket head cap screws.
- Mark the location of the fiber follower of the LS4 (42) breaker point with respect to the cam No. 5 (33A). This will prevent the need for several timer adjustments to locate the top stop position. See Figure 5.
- To inspect LS1, refer to Figure 6 and remove the two socket head cap screws (43) and mounting bridge sub-assembly (32).
- Loosen jam nuts (30).
- Rotate cam adjusting knob (29) so that breaker point gap being measured is at its maximum opening.
- Measure gap as indicated in Figure 6.
- If gap must be adjusted, follow instructions given in Paragraph 3.1.2.
- Lubricate the cam follower with a multi-purpose lithium soap grease.
- Measure gap of LS2 by repeating Steps "g" to "j".



**Figure 5**  
**Marking top stop position**

- Rotate No. 3 cam (28A) so that breaker point gap of LS3 is at its maximum opening.
- Repeat Steps "h" through "j".
- Replace mounting bridge sub-assembly (32) and cap screws (43).



**Figure 6**  
**Breaker point maintenance**

- o) Measure gap of LS4 by repeating. Steps "g" through "j".
- p) Align No. 5 cam with previously established top stop mark by rotating cam adjusting knob.
- q) Maintain No. 5 cam alignment by holding adjusting knob. Rotate No. 3 cam so that indicator groove lines up with the fiber cam follower on LS3 breaker point. Refer to Figure 4. This alignment must be done with the crankshaft at top dead center.
- r) Tighten inner jam nut and lock in place with outer jam nut. Do not back inner jam nut off to meet outer jam nut.
- s) Reinspect cam positions.
- t) Make sure that the ground connection is tight, (see Figure 6).
- u) Position felt seal (34) and replace end cap (31).
- v) Turn electrical power on when press is ready to run.
- w) If top stop position must be readjusted, follow instructions given in Paragraph 2.3.

### 3.1.2 Breaker Point Adjustment:

When making the following adjustment, exercise caution with the wire leads to make sure they are secure and not shorted out.



#### **Caution:**

**Make sure the electrical power is turned off before proceeding to avoid possible injury.**

- a) Refer to Figure 6 and loosen the two breaker point mounting screws (44).
- b) Shift the breaker point assembly (23) to establish the correct gap.
- c) With the opening gap properly set, retighten the mounting screws (44).

- d) Make sure that the ground connection is tight (see Figure 6)
- e) If points cannot be adjusted to proper gap or are pitted, they must be replaced. Follow instructions given in Paragraph 3.1.3.
- f) After all breaker point adjustments have been made, refer to Paragraph 3.1.1 and complete Steps "p" through "v".

### 3.1.3 Breaker Point Replacement:

- a) Identify all wire leads before detaching them from breaker point terminals.
- b) Disconnect the wire leads from the breaker point being replaced.
- c) Remove the two breaker point mounting screws (44) and discard the old breaker point.
- d) Coat the fiber cam follower with the grease lubricant furnished with the new breaker point.
- e) Install the new breaker point.
- f) Attach the wire leads to the breaker point.
- g) Adjust the breaker point gap as outlined in Paragraph 3.1.2.

### 3.2 Bearings and Seals Replacement:

- 3.2.1 The bearings in both types of timers and the rotating seals (16 and 19) in the timing rotor seal are not considered to be field replaceable items and it is recommended that the units be returned to the factory.

For dimensional information, request Form PP3000.

For additional information, contact Eaton Corporation, **Industrial** Drives Operations, Airflex Division, 9919 Clinton Road, Cleveland, Ohio 44144, telephone (216) 281-2211.

# 4.0 PARTS LIST

| Item No. | Part No.    | Description          | No. Req. |
|----------|-------------|----------------------|----------|
| 1.       | See table A | Adapter "O" ring     | 1        |
| 2.       | See table A | Relief fitting       | 1        |
| 3.       | 145 x 30    | Grease fitting       | 1        |
| 4.       | 145 x 2     | Shaft                | 1        |
| 6.       | 304123      | Snap ring            | 2        |
| 7.       | 139 x 12    | Bearing              | 1        |
| 8.       | 159 x 57    | Snap ring            | 1        |
| 9.       | 138 x 10    | Bearing              | 1        |
| 10.      | 159 x 40    | Center section       | 1        |
| 11.      | 403957      | Inner spring         | 1        |
| 12.      | 201695      | Outer spring         | 1        |
| 13.      | 201677      | Inner washer         | 1        |
| 14.      | 201693      | Outer washer         | 1        |
| 15.      | 201694      | Outer seal           | 1        |
| 16.      | 301965      | Inner "O" ring       | 1        |
| 17.      | 73 x 133    | Outer "O" ring       | 1        |
| 18.      | 73 x 134    | Inner seal           | 1        |
| 19.      | 201686      | Bearing              | 1        |
| 20.      | 159 x 57    | Shim set             | 1        |
| 21.      | 144 x 46*   |                      | 1        |
| 22.      | 139 x 12    | Snap ring            | 1        |
| 23.      | See table B | Breaker points       | 1        |
| 24.      | See table B | No. 1 cam            | 4        |
| 25.      | 201854      | Washer               | 1        |
| 26.      | See table B | No. 2 cam            | 1        |
| 27.      | 201869      | Cam adjusting sleeve | 1        |
| 28.      | See table B | No. 3 cam insert     | 1        |
| 28A.     | 306030      | No. 3 cam            | 1        |
| 29.      | 203003      | Cam adjusting knob   | 1        |
| 30.      | 61 x 22     | Jam nut              | 2        |
| 31.      | 412230      | End cap              | 1        |
| 32.      | 409346      | Bridge               | 1        |
| 33.      | See table B | No. 4 cam            | 1        |
| 33A.     | 119 x 23    | No. 5 cam            | 1        |
| 34.      | See table A | Felt seal            | 1        |
| 35.      | See table A | Air hose             | 1        |
| 36.      | See table A | End plate            | 1        |
| 37.      | 305468      | Drive screw          | 1        |
| 37A.     | 203333      | Drive screw insert   | 1        |
| 38.      | 507137      | Mounting plate       | 1        |
| 39.      | 303 x 1**   | Flush pipe bushing   | 1        |
| 40.      | 153 x 530   | Flat washer          | 1        |
| 41.      | 203107      | Spacer               | 1        |

\*Use as necessary.

\*\*Used on Timing Rotorseals for FSPA's 01 thru 114.

The part no. for the complete assembly is stamped on the timer decal. Identify the timer with this number when specifying component parts.

TABLE A

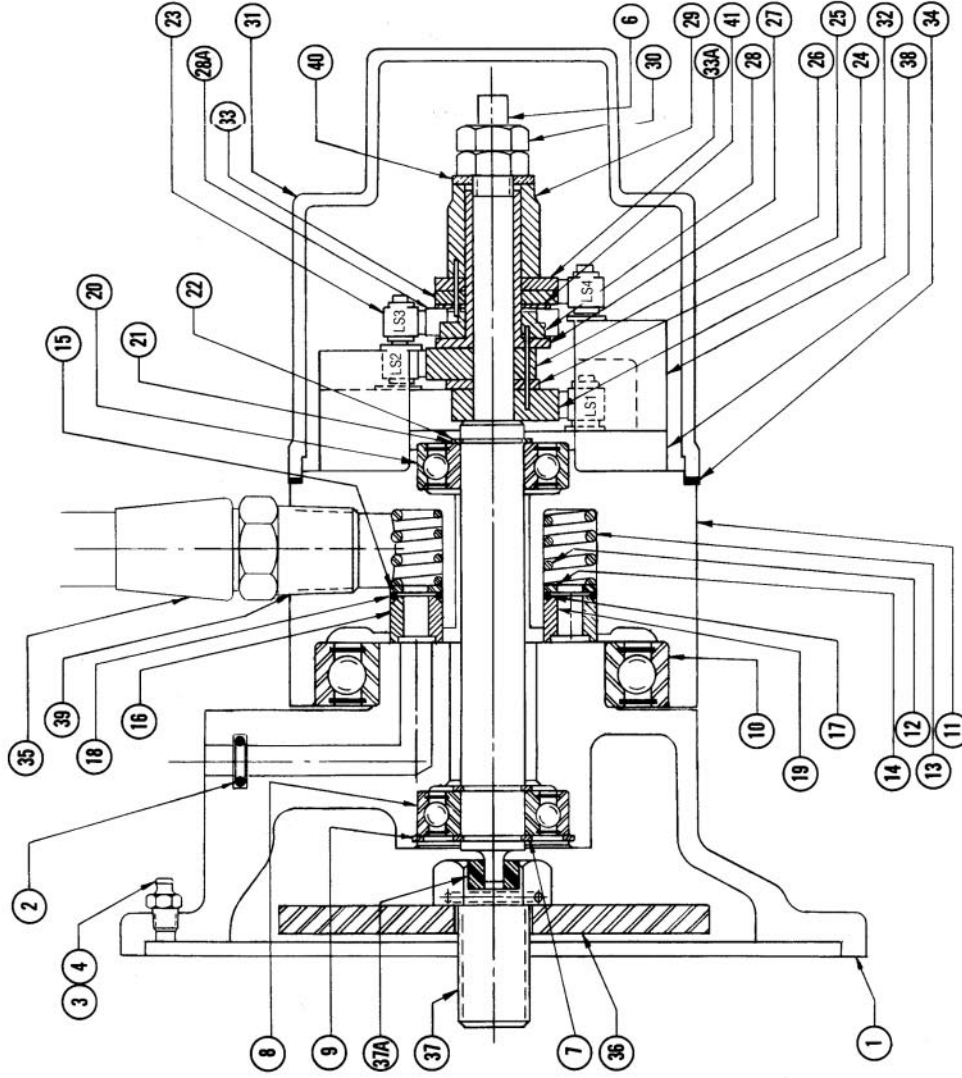
| FSPA No.                | Part No.   |            |             |             |
|-------------------------|------------|------------|-------------|-------------|
|                         | Item No. 1 | Item No. 2 | Item No. 35 | Item No. 36 |
| 01                      | Adapter    | "O" Ring   | Air Hose    | End Plate   |
|                         | 408441     | 73 x 89    | 2           | 410743-30   |
| 1.2, 103, 104, 105      | 408441     | 73 x 89    | 2           | 410743-1    |
| 6, 7, 8                 | 412842     | 73 x 89    | 4           | 410743-60   |
| 109, 110, 111           | 412842     | 73 x 89    | 4           | 410743-2    |
| 112, 113, 114           | 509852     | 73 x 89    | 4           | 410743-3    |
| 115, 116, 117           | 509853     | 73 x 15    | 4           | 410743-3    |
| 118, 119, 120, 121, 122 | 505382     | 73 x 15    | 4           | 410743-11   |

TABLE B

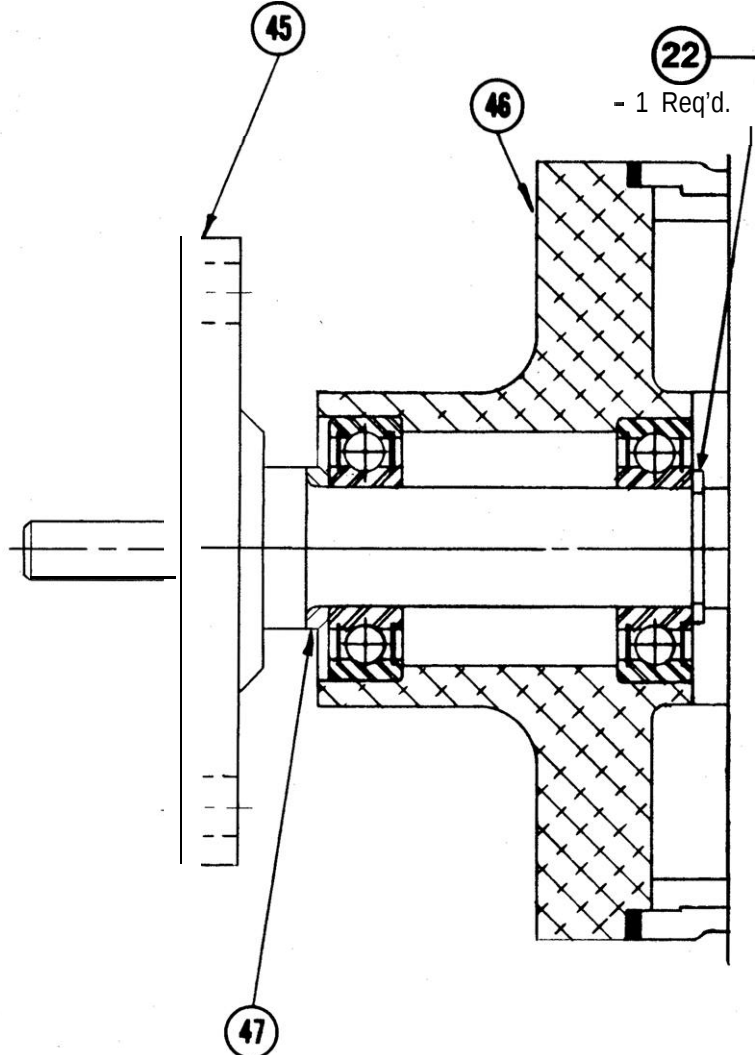
| Complete Assembly Part No. Used On: |           |           |           |           | Direction of Rotation | Part Number*                    |                          |                          |                          |
|-------------------------------------|-----------|-----------|-----------|-----------|-----------------------|---------------------------------|--------------------------|--------------------------|--------------------------|
| FSPA                                | FSPA      | FSPA      | FSPA      | FSPA      |                       | Item No. 23<br>- Breaker Points | Item No. 24<br>No. 1 Cam | Item No. 26<br>No. 2 Cam | Item No. 28<br>No. 3 Cam |
| 145744 GX                           | 145744 GL | 145744 GL | 145744 GL | 145744 GP | Clockwise             | 133 x 201                       | 201856                   | 201857                   | 306029                   |
| 145744 GY                           | 145744 GL | 145744 GL | 145744 GL | 145744 GP | Clockwise             | 133 x 200                       | 201858                   | 201859                   | 306028                   |
| 145744 GZ                           | 145744 GM | 145744 HD | 145744 HD | 145744 GR | Clockwise 30° dwell   | 133 x 201                       | 201861                   | 201862                   | 306029                   |
| 145744 HA                           | 145744 GN | 145744 HE | 145744 HE | 145744 GS | Clockwise 30° dwell   | 133 x 200                       | 201863                   | 201864                   | 306028                   |

## TIMING ROTORSEAL

Part No. for Optional Cam No. 3 (Item No. 28A), is as follows:  
 203002 (For clockwise and clockwise 30° dwell)  
 203087 (for clockwise and clockwise 30° dwell)



| Item No. | Part No.    | Description          | No. Req. |
|----------|-------------|----------------------|----------|
| 6.       | 302276      | Shaft                | 1        |
| 20.      | 159 x 41    | Bearing              | 2        |
| 22.      | 139 x 12    | Snap ring            | 1        |
| 23.      | See table C | Breaker points       | 4        |
| 24.      | See table C | No. 1 cam            | 1        |
| 25.      | 201854      | Washer               | 1        |
| 26.      | See table C | No. 2 cam            | 1        |
| 27.      | 201869      | Cam adjusting sleeve | 1        |
| 28.      | See table C | No. 3 cam insert     | 1        |
| 28A      | 306030      | No. 3 cam            | 1        |
| 29.      | 203003      | Cam adjusting knob   | 1        |
| 30.      | 61 x 22     | Jam nut              | 2        |
| 31.      | 412230      | End cap              | 1        |
| 32.      | 409346      | Bridge               | 1        |
| 33.      | See table C | No. 4 cam            | 1        |
| 33A      | See table C | No. 5 cam            | 1        |
| 34       | 119 x 23    | Felt seal            | 1        |
| 38.      | 507137      | Mounting plate       | 1        |
| 40.      | 153 x 530   | Flat washer          | 1        |
| 41.      | 203107      | Spacer               | 1        |
| 42.      | 404583      | Housing              | 1        |
| 45.      | 411367      | Shaft                | 1        |
| 46.      | 405330      | Housing              | 1        |
| 47.      | 203351      | Spacer               | 1        |

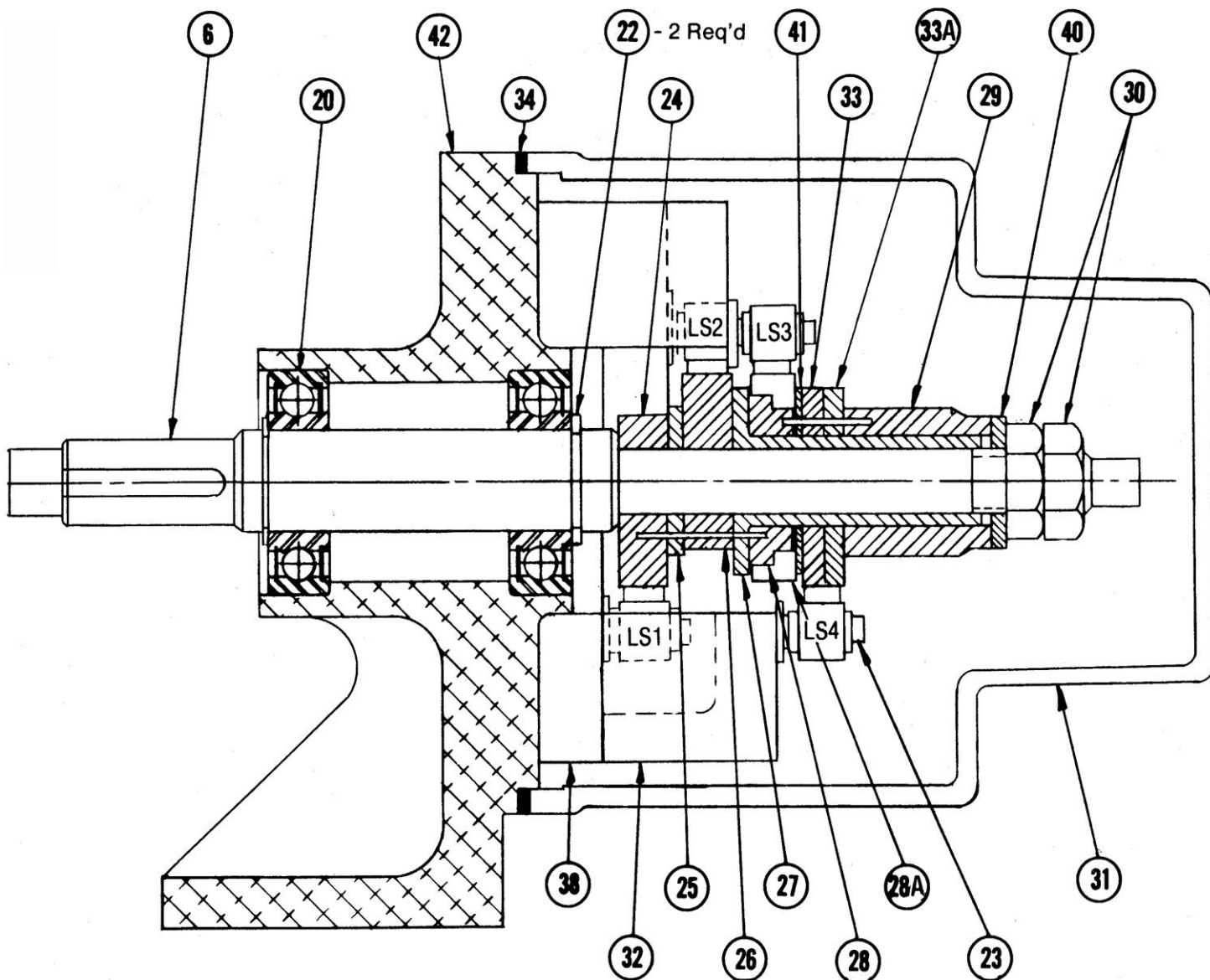


The part no. for the complete assembly is stamped on the timer decal. Identify the timer with this number when specifying component parts.

## SHAFT MOUNTED CAM LIMIT SWITCH

TABLE C

| Complete Assembly Part Number For: |                  | Direction of Rotation        | Part No.                      |                          |                          |                                 |                          |                           |
|------------------------------------|------------------|------------------------------|-------------------------------|--------------------------|--------------------------|---------------------------------|--------------------------|---------------------------|
| Shaft Mounted                      | Foot Mounted     |                              | Item No. 23<br>Breaker Points | Item No. 24<br>No. 1 Cam | Item No. 26<br>No. 2 Cam | Item No. 28<br>No. 3 Cam Insert | Item No. 33<br>No. 4 Cam | Item No. 33A<br>No. 5 Cam |
| 145748 AL                          | 145748 AQ        | Clockwise                    | 133 x 201                     | 201856                   | 201857                   | 306029                          | 203256                   | 203257                    |
| 145748 AM                          | 145748 AR        | C'Clockwise                  | 133 x 200                     | 201858                   | 201859                   | 306028                          | 203254                   | 203255                    |
| 145748 AN                          | 145748 AS        | Clockwise                    | 133 x 201                     | 201861                   | 201862                   | 306029                          | 203256                   | 203257                    |
| <b>145748 AP</b>                   | <b>145748 AT</b> | <b>C'Clockwise 30° Dwell</b> | 133 x 200                     | 201863                   | 201864                   | 306028                          | 203254                   | 203255                    |



FOOT MOUNTED  
CAM LIMIT SWITCH

Part No. for Optional Cam No. 3 (Item No. 28A), is as follows:  
 203002 (For clockwise and clockwise 30" dwell)  
 203087 (for c'lockwise and c'lockwise 30" dwell)

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