PNEUMATIC CONTROL DRIVE
TYPE AC0608
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FIGURE 1  Mounting Dimensions, Type AC0608PDA Model 100 Control Drive
FIGURE 2 - Mounting Dimensions, Type AC0608P®A Model 200 Control Drive
FIGURE 3 - Tubing Connections for Air Failure Brake

INSTALLATION

Location

1. Locate Drive in accordance with desired linkage arrangement (see "Connecting Linkage" page 8).

CAUTION. Standard Drive is designed for ambient temperature of 120°F (a special design Drive is available for high temperature service to 250°F). If Drive is subjected to extreme cold, protect compressed air lines and cylinder (trapped moisture in compressed air may freeze and make Drive inoperative). Drives equipped with a heater (Figure 17) are available for this purpose.

Mounting

2. Figures 1 thru 5 give Control Drive mounting dimensions and details. For Drives with casings (Figure 2) see "Removing Casing Access Panels", page 20, for access to mounting base.

3. Mount Control Drive in any desired position

CAUTION: Before tightening mounting bolts and Drive connecting linkage, shim mounting base if necessary so it will not warp when bolts are tightened. Warping of the base will interfere with the freedom of motion of the Drive lever (see Figure 1 and 2)

Tubing Connections

4. Make supply and loading pressure connections as shown in Figure 1, 2, and 3. Use copper or aluminum tubing and suitable fittings

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<th>SUPPLY PRESSURE</th>
<th>MAXIMUM TORQUE</th>
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<tr>
<td>PSIG</td>
<td>FT LBS (NO LOAD)</td>
</tr>
<tr>
<td>40</td>
<td>280</td>
</tr>
<tr>
<td>50</td>
<td>400</td>
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5. If Drive is equipped with an Air Failure Brake with a remote release pushbutton (Figure 4), run a line from an air supply header thru the pushbutton to the connection shown in Figure 3. Use 1/4-inch copper or aluminum tubing and suitable fittings. Mount the remote release pushbutton on a panel near the operator
Positioner Control Loading Arrangements

6. The Positioner is normally furnished mounted on the Control Drive stand with all tubing connections made between the cylinder and Positioner for direct loading operation. Depending upon the specific application, however, the Positioner may be adjusted for reverse loading operation as described below.

Direct loading (Figure 16) is that arrangement whereby the piston rod moves out of the cylinder as control pressure to the Positioner bellows increases. Control air pressure from the upper port of the Positioner pilot valve is supplied to the underside of the piston. The positioning cam is assembled (black concentric and radial lines visible) so when the cam turns in a counterclockwise direction, tension on the positioning spring increases.

Reverse loading is that arrangement whereby the piston rod moves into the cylinder as control loading pressure to the Positioner bellows increases. For applications requiring reverse loading, it is necessary to switch air line connections to the cylinder and reverse the positioning cam (red concentric and radial lines visible) so when the cam turns in a clockwise direction, tension on the positioning spring increases.

a. To reverse air lines.

(1) Move air line connection C2 at top of cylinder to tapped hole on opposite side of cylinder. Plug original C2 connection hole

(2) Move air line connection C1 at bottom of cylinder to tapped hole on opposite side of cylinder. Plug original C1 connection hole

(3) Then exchange connections of the air lines running to the cylinder at manifold.

b. To reverse positioning cam

(1) Remove cam (Figure 8)

(2) Remove locating set screw

(3) Reassemble set screw in tapped hole in other side of cam hub.

(4) Reassemble positioning cam so opposite side of cam faces outward.

Lever Assembly

7. Locate the Hand lever (Figure 1) on the side of the Drive that is most convenient for operation. Then assemble the Drive linkage lever on the opposite side. Assemble both hand lever and Drive linkage lever at any desired angle on the splined ends of the Drive shaft. Locate the hand lock lever on either side of the Drive.

To change the location of the hand lock lever

a. Disassemble the hand lock and shaft

b. Reassemble lever and shaft in the identical holes and bracket in the opposite side of stand or casing.

c. Disassemble the slotted bar and reassemble it on the other side of the Drive lever.

Position Indicator

8. The Control Drive is provided with a position indicator (Figure 1) on which the position of the piston in the cylinder may be noted. Any position of the driven device may also be determined. The position indicator scale is divided into 10 equal parts, each division representing 10% travel of the Drive piston. Install position indicator as follows:

FIGURE 4 - Mounting Dimensions, Remote Pushbutton, Part No. 53151292
See steps 5 and 11 for these additional installation requirements.

For Control Drives with an Air Failure Brake, set the spring adjustment nut (Figure 18) which determines the air pressure at which the Brake will trip. Turning the adjustment nut to decrease the spring compression decreases the pressure at which the Brake will trip. It is suggested that for a normal supply pressure of 40 psig to the Drive, the Brake should be set to trip at 25 psig. For a 50 psig supply pressure, the Brake should trip at 30 psig.

11 If Drive is equipped with an Air Failure Brake with a remote signal lamp, make wiring connections as shown in Figure 5 to the terminals designated in Figure 3. Use No. 14 or larger building wire for protection against damage. Run the wiring in conduit with at least the last two or three feet at the Drive end in flexible conduit so that the wire may be disconnected easily. Mount remote signal lamp on a panel near the operator.

Travel Limit Stops

12 The design of the travel limit stops furnished depends upon whether or not the Drive is equipped with an air failure brake.

For Drives not equipped with an air failure brake, a slotted bar with an adjustable stop is provided (see Figure 1). To set the stop, loosen the nut and slide the stop to the desired position then tighten nut. To secure the stop, drill a hole in the stop washer and slotted bar and insert a dowel pin in the hole.

For Drives equipped with an air failure brake, either a fixed or releasable travel limit stop is provided in place of the slotted bar. The fixed stop consists of one or two steel sleeves which fit over the brake rod (see Figure 26) and mechanically limit travel in either or both directions. The releasable stop is essentially a spring loaded pin which butts against the clevis to limit piston travel. These stops can be released pneumatically to permit additional travel under manual control. Various combinations are possible using pins cut to varying lengths to limit piston travel in either or both directions.

Connecting Linkage

9 Install connecting linkage in accordance with Product Specification P81-5, "Bailey Control Linkage" or in accordance with the special linkage arrangement drawing provided for the control system.

Air Failure Brake

10 For Control Drives equipped with an Air Failure Brake (Figure 3), no additional installation is required unless a remote release pushbutton or remote signal lamp is used.
this Instruction Book to illustrate factory installation details (see Drive Specification Sheet for drawing number). Make external wiring connections as required.

**Pneumatic Position Transmitter**

14. If the Control Drive includes a Pneumatic Position Transmitter, a drawing is included in this Instruction Book to illustrate factory installation details (see Drive Specification Sheet for drawing number). Also refer to Instruction Section P99 35

**Pre-Service Adjustment Checks**

15. Make applicable adjustments as described under "Service Adjustments", page 12, before placing Drive in operation.

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**OPERATION WITHOUT AIR FAILURE BRAKE**

**Positioner Supply and By-pass Valves**

The operation of the Positioner supply and by-pass valves is shown in Figure 6. The arrangement shown is for use with either direct or reverse loading connections to the piston cylinder.

A safety latch is provided to lock the supply and by-pass valves in position when they are set for automatic operation. The latch sets itself and prevents the valves from being bumped or jarred out of position.

**Manual Operation**

1. Supply valve in HAND-CLOSED position.

2. By-pass valve in OPEN HAND position.

3. Hand lock lever pulled up tight when hand lever is not being operated.

4. With the hand lock lever released, position the Drive by manual operation of the hand lever. Pull the hand lock lever up tight to hold the Drive in any position. (Note position of piston in cylinder on position indicator.) To position the Drive in accordance with demand from the control system, remove Positioner access panel (see 'Corrective Maintenance'), remove Positioner cover, and operate Drive so Positioner balance beam is centered between stops (see Figure 8).

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**FIGURE 6 - Positioner Supply and By-pass Valve Operation**
Transfer from Manual to Automatic

1. Remove Positioner access panel (see "Corrective Maintenance") and Positioner cover

2. Adjust loading pressure to Positioner so that balance beam is centered between upper and lower stops

3. Turn by pass valve to CLOSED AUTO
4. Release hand lock lever

5. Slowly turn Positioner supply valve to AUTO OPEN

The Drive is set for automatic operation in accordance with the loading pressure applied to the Positioner from the preceding controller in the system.

NOTE: The above procedure is awkward for routine transfers since the removal of covers and operation at the Drive and controller locations are involved. If transfers are made frequently, determine Drive positions for various loading pressure values, and, then in place of steps 1 and 2 above, note Drive position on position indicator and set the corresponding loading pressure without referring to Positioner balance beam. Install a small pressure gage in loading pressure line at Drive for reference.

Automatic Operation

1. Supply valve in AUTO OPEN position
2. By pass valve in CLOSED position
3. Hand lock lever released

4. The Drive piston is positioned automatically as described under "Description of Operation". Note piston position on position indicator.

Transfer from Automatic to Manual

1. Pull the hand lock lever up tight.
2. Press IN on safety latch assembled with supply and by pass valve.
3. Turn by pass valve to OPEN HAND
4. Turn supply valve to HAND CLOSED.

The Drive is set for manual operation.

OPERATION WITH AIR FAILURE BRAKE

Positioner Supply and By pass Valves

The operation of the Positioner supply and by pass valves is shown in Figure 6. The arrangement shown is for use with either direct or reverse loading connections to the piston cylinder.

A safety latch is provided to lock the supply and by pass valves in position when they are set for automatic operation. The latch sets itself and prevents the valves from being bumped or jarred out of position.

Manual Operation

1. Positioner supply valve in HAND CLOSED position
2. Positioner by pass valve in OPEN HAND position if desired
3. Brake operating lever (Figure 7) in MANUAL position

4. Position the Drive by manual operation of the hand operating lever. Turn Air Failure Brake operating lever to LOCK position to hold Drive in any position. Piston position may be noted on the Drive position indicator. To position the Drive in accordance with demand from the control system, remove Positioner access panel (see "Corrective Maintenance"), remove Positioner cover and operate Drive so Positioner balance beam is centered between stops (see Figure 8).

Transfer from Manual to Automatic

1. Make certain that full air supply is available
2. Turn Positioner supply valve to AUTO OPEN
3. Turn Positioner by pass valve to CLOSED AUTO
4. Turn Brake operating lever to MANUAL

5. Whether or not Hand Auto Station for Control Drive is on HAND, slowly position Drive (by operation of hand lever) to approximately that point which will be held by the Positioner. This will keep the Drive from suddenly jumping to position when placed on automatic. If Drive position is control loading pressure is known, position Drive in accordance with control pressure noted on Hand Auto Station in loading line to Drive if not desired position.
may be determined by observation of Positioner balance beam (Drive will be positioned correctly when balance beam is balanced approximately midway between its upper and lower stops.)

6. Turn Brake operating lever to RESET, hold this position momentarily, then turn lever to AUTO.

7. If Hand/Auto Station for Control Drive is on HAND, adjust Hand/Auto Station manually until its loading and control gages are matched, then, turn Hand/Auto Station to AUTOMATIC.

Automatic Operation


2. By-pass valve in CLOSED-AUTO position

3. Brake operating lever in AUTO position.

4. Drive is now operated automatically by the control system.

NOTE Although every control system is different with regard to equipment and, or operating characteristics, the following generally is the recommended procedure when the control air supply has failed

Drive Operate Necessary During Failure Period:

1. Immediately turn all Hand/Auto Stations in control system to HAND.

2. Transfer Drive to manual mode as outlined below under 'Transfer from Automatic to Manual

3. Upon resumption of full supply air pressure, transfer Drive to automatic mode as outlined above under 'Transfer from Manual to Automatic

Drive Operate on Unnecessary During Failure Period

1. Immediately turn all Hand/Auto Stations in control system to HAND.

2. Leave Drive Positioner valves and Brake operating lever as noted above for automatic operation.

3. Upon resumption of full supply pressure

   a. Make certain that Drive Positioner valves are set for automatic operation.

   b. Reset Air Failure Brake as outlined below (Control Drives should be reactivated

FIGURE 7 - Air Failure Brake Operation

in order of their effect on control system least effective first, most effective last)

c. With Hand/Auto Station to DRIVE on HAND, manually set Hand/Auto Station at approximately the control loading pressure which would normally be applied to the Drive at existing load.

d. Turn Brake operating lever to RESET, hold in this position momentarily, then turn lever to AUTO.

OR

If a remote reset mechanism is in with Brake, with Brake operating lever in AUTO position, press remote reset push button. Hold pushbutton IN until manipulation of Hand/Auto Station causes Drive to show a response and then release pushbutton.

e. Position Control Drive by manual operation of its Hand/Auto Station until normal operation has been resumed.

f. Switch Hand/Auto Station back to Automatic in manner required for specific control system.

Transfer from Automatic to Manual

1. Turn Positioner supply valve to HAND CLOSED.

2. Turn Positioner by pass valve to OPEN HAND

3. Turn Brake operating lever to MANUAL or LOCK as desired.
FIGURE 8 Positioner Adjustments

SERVICE ADJUSTMENTS

The Control Drive is shipped from the factory adjusted for a linear relationship, that is full piston travel for full range input signal. If this is the desired service, the Control Drive may be placed directly in operation (see page 9 or 10). If it is necessary to adapt the Drive to another application, the Positioner adjustments described below may be used to provide almost any desired combination of piston travel versus input signal pressure.

Zero or Suppression Adjustment

By means of the zero adjustment (Figure 8) an initial tension may be imposed upon the positioning spring so that the piston will not start to move from its minimum position until the control loading pressure has increased from 3 psig to any value up to one half of the loading pressure range (9 or 15 psig). This adjustment is of value when two or more Drives are to be operated in sequence, where the Drive is equipped with a minimum stop, or where the characteristic of the device which the Drive is moving must be matched with that of another regulated device.

Range Adjustment

The range adjustment (Figure 8) affords a variation of Drive motion for a given range of control loading pressure. For a 3 to 27 psig loading pressure range, the amount of variation extends, roughly from full piston travel for a 3 to 15 psig change in control loading pressure to one half piston travel for a 3 to 27 psig control loading pressure change. In

*It is recommended that the Control Drive be stroked thru full travel to assure that factory calibration has not been disturbed in transit. If calibration is non-linear, refer to 'Recalibration of Drive and Positioner', page 21.
combination with the zero adjustment described above, full piston travel may be obtained for as small a pressure change as 10 psi -- e.g., a range of 10 to 20 psig.) Range adjustments available with each of the three Positioner cams furnished are shown in Figures 9, 10 and 11. This adjustment is of value when the device being regulated by the Drive is oversized, since the adjustment allows operation of the Drive thru its useful motion for the desired full change in control loading pressure. It is also useful in matching the loading vs. position characteristic of the Drive with those of related power devices in the same control system.

Speed Adjustment

When the system involves only a single Drive, a high positioning speed is usually an advantage. In a complex control system involving more than one drive, it is generally desirable to operate all power devices at the same speed in order to avoid interaction between usual or undesirable process conditions during load changes. However, the speed of operation of the Drive may be decreased if necessary (see Table 3 for normal and minimum decreased speeds of the Control Drive).

If it is necessary to reduce the speed of operation, speed control orifices are available for insertion in the control lines from the pilot valve to the cylinder. As noted in Table 3, the orifice (No. 60 drill, .040" diameter) will increase the time required for full piston travel of the Control Drive with 1/8" pilot (40 psig supply pressure) to 25 seconds. This operating time may be decreased, up to the normal value indicated, by drilling the orifice to a larger diameter. To insert a speed control orifice, proceed as follows:

1. Remove pilot valve stem by springing open pilot stem retaining spring (Figure 8) and allowing stem to drop out (do not scratch stem lands during this process).

2. Remove pilot valve by removing at taching screws (Figure 21).

3. Remove O-ring gaskets from both upper and lower holes on pilot valve block.

4. Insert speed control orifice in each of the upper and lower holes.

5. Replace O-ring gaskets.
6. Reassemble pilot valve to valve block

7. Reassemble pilot valve stem in pilot valve and replace pilot stem retaining spring

Cam Characteristic Adjustment

This adjustment involves selecting or shaping the proper positioning cam in order to obtain that characteristic of piston position vs. control loading pressure which will afford the desired characteristic of controlled medium vs. control loading pressure. Positioning cams A, B, and C are furnished with each Positioner (the B cam is shipped assembled in place and the A and C cams are attached inside Positioner case). The characteristics for which the cams are shaped are listed in Table 1 and are shown in Figures 9, 10, and 11. The figures show a family of curves for each cam, each curve representing a Range Adjustment when used with that specific cam. Table 2 shows pressure values of the various control loading ranges equivalent to the control loading percent value in Figures 9, 10, and 11.

If the system involves a single Drive, it is probable that the B, straight line, cam will be satisfactory. However, one of the other cams may be used to provide a more uniform controlled medium vs. loading pressure characteristics, providing stable control over a wide range of operation with a given gain or proportional band adjustment on the controller. The definition of "controlled medium used here is the rate of action of that medium (water, air, etc.) being controlled.

For a Control Drive which is an integral part of a complex control system, the cams provide a selection of characteristics which, together with the range adjustment, should afford close paralleling of the controlled medium vs. loading pressure characteristic. In order to match the inherent characteristics of the regulated device to that of a similar

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<th>Piston Position (P) vs Control Loading, (L)</th>
<th>Fig. No</th>
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<tr>
<td>A</td>
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</tr>
<tr>
<td>B</td>
<td>Straight Line (L P)</td>
<td>10</td>
</tr>
<tr>
<td>C</td>
<td>Square (L P^2)</td>
<td>11</td>
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TABLE 1 Positioning Cam Characteristics
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<th>PRESSURE VALUE (PSIG)</th>
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<tr>
<td>100</td>
<td>27.0 15.0</td>
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**TABLE 2 - Conversion Table for Control System Ranges**

auxiliary, valve, variable speed control, etc., it may be practical to reduce the controlled medium vs. piston position characteristic of each device in the system to a straight line relationship with regard to control loading pressure. This straight line relationship is established by calibrating the Positioner with respect to the correct positioning cam by the following method.

1. Use straight line cam, B, to determine the actual controlled medium vs. power operator piston position characteristic (see Figure 12). (Determine piston position by observing the position indicator.)

2. Decide upon the exact controlled medium vs. control loading pressure characteristic desired (see Figure 13).

3. From steps 1 and 2 above, determine the exact control loading pressure vs. piston position characteristic (see Figure 14).

4. Select the positioning cam whose characteristic curve, shown in Figures 9, 10 and 11, most closely matches the loading vs. position characteristic determined in step 3.

5. If necessary, set the range and zero adjustments to match the loading vs. position characteristic more accurately.

6. If the required characteristic cannot be matched by the above procedure, or if a more exact characteristic is required, alter the shape of the cam as described below.

**Cam Shaping Method:** To assist in the alternation process, cams are marked with radial lines spaced for equal Drive piston position increments and concentric lines spaced for equal control loading pressure increments. The ten concentric lines on the cam correspond to the actual control loading pressure increments shown in Table 2 for the specific control system range being used. Alter the cam shape as follows:

a. On the cam selected in step 4 above, locate, for each increment of control loading pressure (concentric lines) that Drive piston position (radial lines) required for the specific loading pressure, as determined in step 4. Refer to Figure 15 for the method of locating these points.

b. A curve drawn thru the points located on the cam in step 6a above is the desired cam shape. Either alter cam or cut a new cam to this shape. Caution! There is danger of the cam follower becoming locked in case the cam rise is too steep. When a cam shape is required that includes such a rise, it is necessary to introduce sufficient angularity in the regulating device linkage to allow a less radical cam shape.

**FIGURE 15 - Locating Points for Shaping Cam**
FIGURE 16  Schematic of Positioner

DESCRIPTION OF OPERATION

The power unit of the Control drive is a double acting air cylinder and piston assembly (Figure 16) A differential applied across the piston from the Positioner produces movement of the piston. This movement is transmitted thru the piston rod to the Drive Lever which rotates the drive output shaft.

The Positioner consists essentially of two opposing forces balanced against each other. When the Positioner is balanced, the force exerted upward on the balance beam by the loading bellows is equal to the downward force exerted by the positioning spring. The force exerted by the bellows depends upon the loading pressure established by the system in relation to the demand for the controlled medium. The force exerted by the positioning spring depends upon the position of the piston in the cylinder and the shape of the positioning cam. The Positioner drive arm is connected to the drive lever by means of the Positioner drive rod. Thus, for every position of the Drive, the Positioner drive arm assumes a corresponding position. The drive arm is geared to the positioning cam which is shaped to give the desired characteristic of piston position vs. control loading pressure.
When the forces exerted by the loading bellows and positioning spring (Figure 16) are balanced against each other, the balance beam holds the pilot valve stem in its "neutral" position (that is, the pilot valve stem lands are centered at the pilot ports), creating equal pressures (under no load condition only) on either side of the piston. Thus, the position of the Control Drive is maintained.

When the loading pressure increases or decreases, the force exerted on the balance beam by the loading bellows increases or decreases. Movement of the beam raises or lowers the pilot valve stem, increasing or decreasing the air pressure applied to either side of the piston. As the piston is moved by the differential in pressure thus created, positioning spring tension increases or decreases until: (1) the forces exerted by the bellows and spring are again at balance, (2) the pilot valve stem returns to its "neutral" position, and (3) the piston assumes a new position.

Manual Operation

By proper setting of the supply and by-pass valves (see Figure 6) the Control Drive can be positioned manually with the hand lever. When the Drive is in manual operation, the hand lock lever can be set to lock the Drive in the desired position.

Electric Position Transmitter

The Electric Position Transmitter output is applied to a remote-mounted, voltmeter-type indicator for position indication. A drawing of the Electric Position Transmitter assembly, if provided, is included elsewhere in this Instruction Book.

Solenoid Valves

If Solenoid Valves are provided with the Control Drives, the valves are used to position the Drives at either or both extreme positions.

FIGURE 17 - Control Drive with Strip Heater
of the Drive, that is, full open or full closed. A drawing of the Solenoid Valve Assembly is included elsewhere in this Instruction Book if the Valves are furnished with the Drive.

Heating Elements

Refer to Figure 17. For operating in outdoor applications, heating elements are available for installation within the Drive enclosure. Heating elements are recommended for ambient temperatures remaining below 32°F for extended periods. A thermostat automatically maintains the temperature at approximately 45°F.

Alarm Contacts

Electrical contacts are available to actuate alarm devices or to indicate the piston position for control purposes. A description of electrical contacts for the specific Control Drive is given on the applicable Specification Sheet in front of this Instruction Book. A drawing of the applicable switch assembly, if provided, is included elsewhere in this Instruction Book.

Air Failure Brake

Figure 18 shows the Air Failure Brake in automatic position (operating lever at AUTO) and full air supply pressure available to Control Drive.

In this position, the air supply bellows is expanded causing the trigger lever to engage with the brake set lever. The tripping lever holds the two brake levers apart so they cannot clamp onto the brake rod, thus the Control Drive is free to operate automatically.

In case of a supply air pressure failure with the operating lever in AUTO, the air supply bellows contracts and pulls the trigger lever out of engagement with the brake set lever.

FIGURE 18 - Schematic of Air Failure Brake
brake set lever spring pulls the brake set lever and shaft counterclockwise, causing the tripping lever to release the brake levers so that they clamp onto the brake rod. The Control Drive is locked in position. Also, the brake set lever has opened the by-pass valve so that the pressure on both sides of the Control Drive piston cylinder is equal.

If a remote signal contact is furnished, air failure will cause the remote reset lever to close the contact. This lights a remote signal lamp to denote that the Brake is locked or that the Control Drive is on HAND.

After an air failure, the Control Drive may not be operated automatically again until the Brake has been reset, even though full supply air pressure is restored. The Brake may be reset manually with the operating lever with the pneumatic remote reset mechanism, if furnished.

When the operating lever is in the RESET position, the operating lever shaft gear has moved the reset shaft gear so that the manual reset cam has contacted the lower end of the brake set lever. This moves the brake set lever and shaft clockwise and raises the brake so that it may engage with the trigger lever. At the same time, the reset shaft gear has turned so that the manual brake cam has spread the brake levers apart, and the tripping lever falls between the brake levers. Also, the brake set lever releases the by-pass valve so that the valve closes, and the remote reset lever allows the remote contact to open turning off the remote signal lamp.

If full air supply pressure has been resumed so that the air supply bellows is extended when the operating lever is in the RESET position, the trigger lever will engage with the brake set lever. Then when the operating lever has been turned to AUTO, the Brake is reset and the Control Drive may be operated automatically. However, if full supply air pressure has not been resumed, the trigger and brake reset levers will not engage and the brake levers will clamp onto the brake rod again when the operating lever is turned to AUTO.

The Brake may be reset from a remote point if a remote release mechanism is furnished. With the operating lever in AUTO position, air supply is applied under the remote reset piston when the remote release push button is open (held in). This causes the piston, piston rod cylinder and piston rod to move up. The piston rod turns the remote reset shaft so that the remote reset cam has contracted the lower end of the remote reset lever. This moves the brake set lever and shaft clockwise and raises the brake set lever so that it may engage with the trigger lever. Further action of the various levers and cams is the same as noted above for the RESET position of the operating brake cam. When the release push button has been closed (released), the air pressure under the remote reset piston will bleed off so that the piston will resume its normal position at the bottom of the cylinder.

The Control Drive may be operated manually only if the Brake operating lever is in the MANUAL position and the Control Drive Positioner supply valve has been turned to HAND CLOSED (for the air supply has failed) so that the air supply is cut off and the air supply bellows has contracted. The Positioner by-pass valve, also, may be in its OPEN-HAND position at this time if desired.

When the Brake operating lever is in its MANUAL position, the lever shaft gear has turned the reset shaft gear so that the manual brake cam has spread the brake levers apart to free the brake rod. The brake set and remote reset levers remain in such a position, however, as to hold the by-pass valve open and the remote contact closed.

When the operating lever is in LOCK position, the brake levers are clamped onto the brake rod, the trigger lever is disengaged from the brake set lever, and the brake set and remote reset levers hold the by-pass valve open and the remote contact closed.
ROUTINE MAINTENANCE

1. Periodically check all air connections (while under pressure) for leakage with a soap-suds solution.

2. Maintain an air supply free of dirt, oil, or moisture.

3. Lubricate Drive shaft bearings (thru lubricating fittings) with a light grease at least once a year. To lubricate Drives with casings, remove top cover for access to fittings.

4. Apply penetrating oil to clevis pin and Drive stand pin areas to prevent the pins from freezing in the assembly. Frequency of this lubrication depends upon the operating conditions of each Drive.

5. For Control Drives equipped with an Air Failure Brake, whenever Drive is out of service, or at least once a year, test Air Failure Brake to make sure that it is working properly.

6. At least once a year, clean Positioner pilot valve stem and inner liners with a common solvent as follows

   a. Lock Drive in position using hand lock lever.

   b. Turn supply valve on Positioner to HAND-CLOSED position.

   c. Remove pilot stem retaining spring from bottom of fixed pilot cap carefully to avoid bending spring (Figure 8). Remove pilot stem.

   d. Remove fixed pilot cap and catch valve liners and spring. If valve liners stick in valve body, tap side of body to jar loose. If liners still stick in valve body, remove adjustable pilot cap and lock nut as a unit to avoid disturbing their positions relative to each other. Then push liners out with a pencil. Never use a metal rod.

   e. Clean liners and stem with solvent. Do not use files, reamers, or abrasives on stems or liners.

   f. If adjustable pilot cap and locknut were removed, replace and turn assembly by hand until locknut is tight against pilot body. Replace two upper liners, spring, and two lower liners in valve block.

   g. Replace fixed pilot cap and tighten hand tight against valve body. Replace pilot stem spring.

7. If Positioner supply and by pass valves begin to stick, remove valve as noted below and lubricate with Bailey Petcock Lubricant (Part No. 19987-1). Lubricate the valve at least once a year. To remove valve, turn nut (Figure 8) out of pilot valve body without changing the position of the handle.

NOTE The valves are not interchangeable, either with each other or other Positioner valves. The valves and valve bodies are marked "1" and "2" to prevent mixup in reassembly.

8. Annually check filters in pilot valve body (Figure 21). replace if necessary.

9. Check Positioner and Control Drive adjustment annually.

10. Completely disassemble and clean Control Drive every year or two. Refer to "Corrective Maintenance", below.

11. Change grease in Positioner gear case once every two or three years. Remove Positioner from Drive (as noted in Figure 1) and fill case half full with Vulcanlube, Grade No. 1, supplied by C. H. Clark Oil Company of Cleveland, Ohio. Rotate gears to work grease into teeth.

CORRECTIVE MAINTENANCE

Removing Casing Access Panels

1. For Control Drives with casings, only the end access panels (Figure 2) are removable. To remove either of the panels.

   a. Remove casing cover.

   b. With one hand on each casing latch spring and with thumbs on outside of panel to hold it firm, push down on both springs until panel gives way easily.

   c. Lift unlatched panel away from bottom of stand.
Type AC0608□□A Control Drive

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*No Load

Table 3 - Control Drive Torque and Speed Control Data for Type AC0608□□A Control Drive

2. To replace panel, insert panel in bottom of stand and snap top of panel in place.

Removing Piston and Cylinder Assembly

1. Refer to Figure 1. Remove access panels from Drive casings outlined above (It is not necessary to remove side panels)

2. Disconnect air lines from top and bottom of cylinder.

3. Remove pin assembled thru piston clevis and Drive lever

4. Remove pin attaching cylinder to Drive stand and lnt assembly out of stand.

Servicing Cylinder Assembly

1. Thoroughly clean piston and inside of cylinder. Then apply a coating of Molykote powder mixed to a thin paste with mineral oil to cylinder walls. Apply Vulcanlube Grade No 1 around outside surface of piston cup leathers. After assembly, apply 2 ounces of clear mineral oil to cylinder walls.

NOTE The purpose of the lubricant is to protect the inside wall of the cylinder from rusting. The piston cup leathers are impregnated with a high temperature wax. This wax seals pores in the leather making them air tight and sealing the leather against oil and other liquids which do not act as solvents for the wax. Therefore, do not attempt to make cup leathers soft and more pliable. Replace leathers if they become hard and brittle and begin to crack.

2. If, between overhaul periods, there is reason to believe that piston leathers are sticking to the cylinder wall causing jerky operation, or air is escaping from either side of the piston, remove 1/8 inch pipe plug from top flange and spray a light mineral oil around inside of cylinder wall. Use a white mineral oil or liquid petrolatum. To perform this operation, transfer the Drive to manual operation and lock the Drive in position with piston at bottom of cylinder.

Removing Air Failure Brake Assembly

1. Refer to Figure 18. Set Brake operating lever in MANUAL position.

2. Remove all tubing connections at Brake and disconnect any wiring.

3. Remove nut from bottom of brake rod.

4. Whichever is easier, either remove clevis pin inserted thru brake rod clevis and drive lever (so that brake rod is disassembled from Drive), or position Drive with piston all the way to bottom of cylinder so that brake rod may be swung out when Brake has been dismounted from stand.

5. Remove Brake operating lever handle. Disassemble bearing at each end of operating lever shaft. Remove right-hand bearing and slide left-hand bearing out along shaft. Lift Brake thru slots in mounting brackets and slide Brake off brake rod.

6. To reassemble, perform the above disassembly steps in reverse order.

Recalibration of Drive and Positioner

If the Control Drive has undergone complete maintenance and disassembly, it will be necessary to readjust the Drive in relation to the Positioner as outlined in steps 1 thru 13 below. This procedure will restore the Drive and Positioner to their original factory calibration. It may then be necessary to retrim the Drive to its particular application as described under Service Adjustments.

Page 12.
Refer to Figure 8. The adjustments below are based on the direct loading arrangement shown in Figure 16. (If the Drive is arranged for reverse loading, its movements and positions are opposite from those for direct loading applications.) For direct loading application, the position indicator normally SHUT when the piston is at the bottom of the cylinder and OPEN when the piston is at the top. The words OPEN and SHUT used below refer to these positions. Check these adjustments with linkage to the driven device disconnected from the Drive.

1. Use B. straight line, positioning cam, shipped in place in the Positioner.

2. Make supply air and control loading pressure connections to Drive at bottom of Drive stand (see Figures 1, 2, and 3). Refer to Table 3 for correct supply air pressure for the specific Drive.

3. Make certain that fixed pilot cap (Figure 8) is tightened securely and that the adjustable pilot cap and lock nut are screwed up tight, with one finger of the locknut engaged in a groove in the cap. If adjustable cap becomes unlocked or if pilot valve stem or pilot valve has been disassembled, refer to step 13 before proceeding with adjustment checks.

4. Turn supply valve (Figure 6) to AUTO OPEN and by pass valve to CLOSED AUTO. Set the control loading pressure at zero psig. Piston should move to SHUT position.

5. If cam follower roller does not contact positioning cam at zero mark on cam with piston in SHUT position, disconnect Positioner drive rod and turn rod into or out of ball joint at either end of rod until Positioner drive arm assumes the position which places the follower exactly on zero mark. Reconnect drive rod.

6. Set input loading pressure at 3 psig. Piston should remain in its SHUT position. If piston begins to move away from its SHUT position, turn zero adjustment nut (Figure 8) clockwise (in half turn increments) to increase tension of positioning spring until piston just remains in SHUT position.

7. Increase loading pressure to 3.5 psig. Piston should begin to move away from shut position within 10 to 15 seconds. If not, turn zero adjustment nut counterclockwise (in half turn increments) to decrease tension of positioning spring. Repeat steps 6 and 7 until correct results are obtained.

NOTE for best operating results, when cam follower is at zero on cam, distance between top of spring beam, both at marks 1 and 5, and center of spring pivot on balance beam should be 4 1/2 inches, ±1/16 inch. Although this dimension is not critical, it is suggested that steps 5, 6, and 7 be repeated until dimension has been obtained. However, if any material has been removed from cam at zero point, it will be impossible to obtain this dimension.

8. With Drive zero adjustment set properly (steps 5, 6, and 7) and 3 psig applied to loading bellows, balance beam should be midway between balance beam stop. If not, reset the stop to correct position.

9. Set input loading pressure at maximum range value (15 or 27 psig). If piston does not move to its full OPEN position, loosen clamp screw of range adjuster and move adjustment along spring beam until piston reaches OPEN position. Lock adjustment in place.

10. Decrease loading pressure to 14.5 or 26.5 psig. Piston should move away from its OPEN position within 10–15 seconds. If not, readjust range adjustment (step 7) to obtain correct result.

11. Set loading pressure at midrange value (9 or 15 psig). Piston should move to its mid travel position. If not, adjust pilot stem adjustment until piston position is correct.

12. Repeat steps 6 thru 11 until piston positions at minimum, maximum, and midrange loading pressures are correct.

13. If adjustable pilot cap becomes unlocked or if pilot valve stem or liners are changed, valve ports on liners must be realigned with lands on pilot stem as outlined below (the following assumes that B cam is installed in Positioners).

   a. Turn off supply air to Positioner. Remove pipe plug at top of piston cylinder (Figure 19). and mount an accurate pressure gage in pipe plug hole.

   b. Set Positioner by bypass valve to CLOSED-AUTO position and set the supply valve for OPEN-AUTO position with hand lock lever in AUTO position.

   c. Make certain fixed pilot cap is tightened securely.
d. Apply midrange loading pressure (9 or 15 psig) to loading bellows. Pressure gage in cylinder should read within ±2 psig of one half supply pressure (25 psig if supply pressure is 50 psig). If gage reading is in correct, disengage the finger of the locknut that is in place in the groove of the adjustable pilot cap (Figure 8). Adjust the pilot cap until gage reads on half supply pressure. Turn lock nut down on adjustable cap until it is tight against the pilot valve body then engage one of the locknut fingers in line with a corresponding groove in the adjustable pilot cap.

e. Remove pressure gage and place plug in tapped hole in cylinder.

f. Repeat steps 1 thru 12 to check Positioner adjustments.

REPLACEMENT PARTS

Spare Parts Kits

The Spare Parts Kits shown in Figures 19 thru 26 should be carried in stock. Specify the Spare Parts Kit part number to order a complete kit.

Ordering Individual Parts

Figures 19 thru 26 are Parts Drawings of the Control Drive, Type AC0608□□□A. Normally, these Drawings apply to the Drive furnished. However, there may be individual differences in specific Drives because of

a. Design changes made since the printing of this Instruction Section, or

b. Special design of the Drive to make it suitable for a special application.

Therefore, when ordering parts, assure receipt of correct replacements by specifying the complete nomenclature and Serial Number (stamped on instrument nameplate) of the Drive for which parts are desired.
EXPLANATION OF NOMENCLATURE

TYPE  A  C  0  6  0  8  A  MODEL

N  None
P  Bailey Positioner
S  Solenoid Valve, On Off

0  None
A  3  27  Psig
B  3  15  Psig

1  Stand Only
2  Stand With Casing
3  Stand And Casing With Heating Element

0  No AF Brake
1  AF Brake With Local Release
2  AF Brake With Remote Release
3  AF Brake With Local Release & Contact
4  AF Brake With Remote Release & Contact

M  Mechanical
P  Pneumatic

*See Specification Sheet covering Control Drive for data on Accessories

C1  1 Cam Actuated Micro Switch
C2  2 Cam Actuated Micro Switches
C3  3 Cam Actuated Micro Switches
C4  4 Cam Actuated Micro Switches
S1  1 Cam Actuated National Acme Switch
S2  2 Cam Actuated National Acme Switches

N  None
E  Electric Position Transmitter
T  Pneumatic Position Transmitter

0  No Stops
1  Min Stop
2  Max Stop
3  Min & Max Stops
4  Min Stop
5  Max Stop
6  Min & Max Stops
7  Min Stop
8  Max Stop
9  Min & Max Stops

*Contact for each Stop

An "X" in any Nomenclature position indicates that the feature is special. An "X" as a suffix to the Type or Model indicates that the unit includes some special feature not covered by Nomenclature.
FIGURE 19 Parts Drawing P81-29, Piston and Cylinder Assembly

FIGURE 20 - Parts Drawing P81-26, Type AC0608QA Control Drive Casing Assembly
FIGURE 21  Parts Drawing P92 11, Positioner  Part No  5311450
**TABLE OF VARIABLE PARTS**

|----------|----------|-------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|

**SPARE PARTS KITS**

**KIT NO 25600 2**

- **FOR POSITIONER PART NO 3511450 3 \& 10 1 & PILOT SIZE**

**QUANT IT**

- **Item No.**
- **Serie Note**
- **Quantity**

*FOR HYDRAULIC CYLINDERS SUBSTITUTE STEM 3511747 1 FOR STEM 3511401 1 F HUNTING CYCLE OCCURS*
FIGURE 23 - Parts Drawing P81-39, Strip Heater
FIGURE 24  Parts Drawing P99 116, Pushbutton. Part No 5315129
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**Figure 25 - Parts Drawing P81-65, Air Failure Brake, Part No 5312600**
FIGURE 26 Parts Drawing P81 43, Accessories