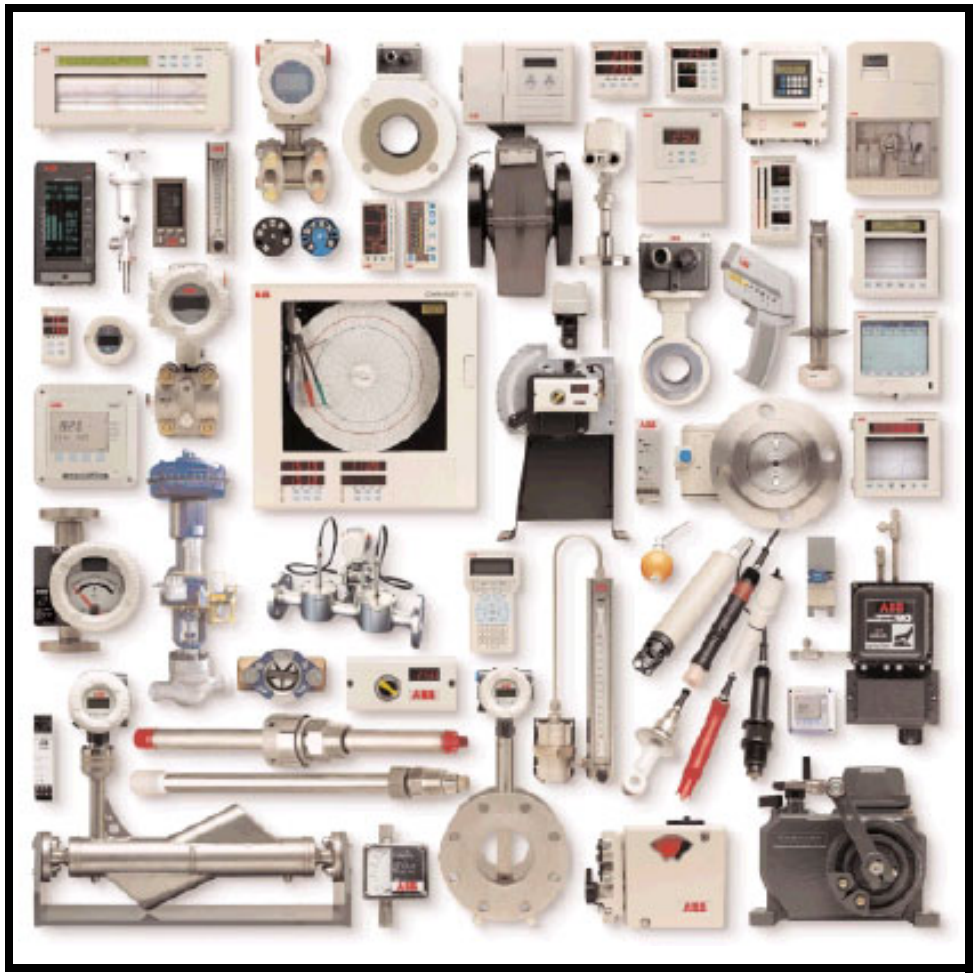
# *INSTRUCTION MANUAL*

## Universal Pneumatic Rotary Actuator
### Type UP



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**WARNING** notices as used in this manual apply to hazards or unsafe practices which could result in personal injury or death.

**CAUTION** notices apply to hazards or unsafe practices which could result in property damage.

**NOTES** highlight procedures and contain information which assist the operator in understanding the information contained in this manual.



**WARNING**

**POSSIBLE PROCESS UPSETS**. Maintenance must be performed only by qualified personnel and only after securing equipment controlled by this product. Adjusting or removing this product while it is in the system may upset the process being controlled. Some process upsets may cause injury or damage.

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# Read First

**WARNING**

**INSTRUCTION MANUALS**
**Do not install, maintain or operate this equipment without reading, understanding and following the proper factory-supplied instructions and manuals, otherwise injury or damage may result.**

**RETURN OF EQUIPMENT**
**All equipment being returned to the factory for repair must be free of any hazardous materials (acids, alkalis, solvents, etc.). A Material Safety Data Sheet (MSDS) for all process liquids must accompany returned equipment. Contact the factory for authorization prior to returning equipment.**

**Read these instructions before starting installation; save these instructions for future reference.**

## Contacting the Factory . . .

Should assistance be required with any of the company's products, contact the following:

**Telephone:**

**24-Hour Call Center**
**1-800-HELP-365**

**E-Mail:**

**ins.techsupport@us.abb.com**

# SECTION 1 - INTRODUCTION

## *OVERVIEW*

This instruction aims to acquaint all users with the Type UP Universal Pneumatic Rotary Actuators. It has explanations of description and operation, installation, calibration, operating procedures, trouble-shooting, maintenance, repair/replacement procedures and support services. There are also appendices that have parts lists, drawings and other reference material. Upon completion of this instruction, you will have a working knowledge of the actuators.

It is important for safety and operating reasons to read and understand this instruction. Do not install or complete any tasks or procedures related to operation, calibration, maintenance or repair until doing so.

## *INTENDED USER*

The information in this instruction is a guide for technical personnel responsible for the installation, operation and upkeep of the Type UP Universal Pneumatic Rotary Actuators.

## *EQUIPMENT DESCRIPTION*

The actuators accept electric or pneumatic control signals. They provide modulating or on/off control power to position devices through mechanical linkage, or by direct coupling.

If the actuator has a positioner (ordered by nomenclature), it offers a selection of input ranges:

- 21 to 103 kilopascals (3 to 15 pounds per square inch gage), Type AV11 Positioner.
- 21 to 186 kilopascals (3 to 27 pounds per square inch gage), Type AV12 Positioner.
- 4 to 20-milliamps, Types AV23 and AV33 Positioners.
- Computer DDC, solid state, or contact input, Type AV44 Positioner.

The positioning function can be characterized for a unique application. Cams for linear, square or square root relationships exist. Custom shaping the cam provides for user specific positioning. A mechanical connection to the actuator shaft serves to feed back the shaft movement.

Actuators fitted with a solenoid valve provide on/off control. In this case, positioning is at either of the extreme positions of travel (zero percent or 100 percent).

## FEATURES

- ***Wide Range of Torque Ratings.*** Six actuator sizes available in ratings from 122 to 6,372 Newton meters (90 to 4,700 foot-pounds).
- ***Easy and Flexible Installation.*** Actuators can be placed in convenient locations and connected to the driven device by standard linkage components (refer to the ***Connecting Linkage for Universal Rotary Actuators*** product specification).
- ***Suitable for High Temperature Environments.*** Actuators can be used in ambient temperatures up to 82°C (180°F).
- ***Adjustable Relationship Between Control Signal and Output Shaft Position.*** Easily adjusted by use of standard positioner cam characteristics (for linear, square and square root relationship) or custom-shaped cam.
- ***Wide Environmental Applications.*** Complete metal enclosures offer superior strength, as well as high immunity to diverse atmospheres and process materials.
- ***Quick and Smooth Transfer.*** Easily shifted from automatic to manual control.
- ***Wide Range of Options Available.*** Factory-installed NEMA 4X enclosure, pneumatic or electric shaft position transmitter, alarm/travel switches, air failure lock, reserve air tank and heated enclosures are available.

## EQUIPMENT APPLICATION

The actuators provide regulation of dampers and fan inlet vanes. They also control lever-operated valves, turbine governors, fluid drives and other final control elements.

## INSTRUCTION CONTENT

**Introduction** — Provides a description of this instruction, its sections and their uses, and a brief description of the actuator. Also included are instructions on how to use this document, reference documents, nomenclature, specifications, options and accessories, shipping weights, and stroke time graphs (Figures 1-1 through 1-17).

**Description and Operation** — Provides an overview of the actuators. A broad description of each type appears in this section.

**Installation** — Contains instructions for unpacking and inspection; location and safety considerations; setup/physical installation including wiring, cabling and tubing connections; connections for optional equipment; and any required adjustments.

**Calibration** — Provides calibration procedures required before placing the actuators into operation and for optional equipment.

**Operating Procedures** — Contains procedures for normal operation of the actuators. Descriptions of the controls are found here.

**Troubleshooting** — Provides procedures for isolating problems. It helps determine if the driving mechanism or the driven device is at fault. A troubleshooting table appears in this section.

**Maintenance** — Contains maintenance information about the actuators and related equipment.

**Repair and Replacement Procedures** — Details the procedures for replacing actuator components.

**Support Services** — Includes information on how to order replacement parts.

**Parts Drawings and Parts Kits** — Contains information on available spare parts and kits.

**Dimension Drawings** — Provides dimension drawings to aid in the installation process.

## *HOW TO USE THIS INSTRUCTION*

This instruction pertains to Types UP1 through UP6 actuators. Information pertains only to the actuators specified.

> **NOTE:** This instruction applies only to the actuators and their related options. All procedures involving positioners appear in the appropriate positioner instruction.

The sections of this instruction are sequentially arranged as they relate to initial start-up; from unpacking to repair and replacement procedures. After initial start-up, refer to this instruction as needed by section.

The word actuator is used throughout this instruction. Actuator refers to ***rotary vane*** when discussing Types UP1 and UP2 actuators. Actuator refers to ***cylinder*** when discussing Types UP3 through UP6 actuators.

## *REFERENCE DOCUMENTS*

Table 1-1 is a list of ABB documents referred to in this instruction.

*Table 1-1. Reference Documents*

| Document | Description |
|---|---|
| C-E88-6 | Type RQ Electronic Position Transmitter specification |
| C-P81-20 | Universal Rotary Actuators Type UP Pneumatic specification |
| C-P88-21 | Characterizable Positioner Type AV1, AV2, AV3, AV4 specification |
| G81-5-1 | Connecting Linkage for Universal Rotary Actuators |
| PN25039 | Characterizable Positioner Type AV1 and AV2 instruction |
| PN25058 | Characterizable Positioner Type AV3 and AV4 instruction |
| P-E88-25-001 | Closed Loop Control Using Type AV Positioner |
| P-P88-001 | Installing a Type AV Positioner in a Hazardous Location |

## *NOMENCLATURE*

The Type UP actuator has nine nomenclature positions. Positions three through nine each have customer selectable options. Use Table 1-2 to select or verify actuator type.

*Table 1-2. Nomenclature*

| Position 1 2 3 4 5 6 7 8 9 | |
|---|---|
| **Type U P □ □ □ □ □ □ □** | **Universal Rotary Actuators Type UP Pneumatic (All Metal Enclosure)** |
| | **Rated Torque at 690 kPa (100 psig) Supply** |
| 1 | 122 Nm(90 ft-lbs) |
| 2 | 610 Nm(450 ft-lbs) |
| 3 | 1,085 Nm(800 ft-lbs) |
| 4 | 1,966 Nm(1,450 ft-lbs) |
| 5 | 3,796 Nm(2,800 ft-lbs) |
| 6 | 6,372 Nm(4,700 ft-lbs) |
| | **Enclosure Rating** |
| 0 | NEMA 3R (standard) |
| 1 | NEMA 4X (all except Type UP1__11__) |
| | **Control Input** |
| 0 | None - slave drive (Type UP6 actuator only) |
| A | 21 to 103 kPa (3 to 15 psig) Type AV1121__ Characterizable Pneumatic Positioner |
| B | 21 to 186 kPa (3 to 27 psig) Type AV1221__ Characterizable Pneumatic Positioner |
| C | 4 to 20-mA Type AV23 Characterizable I/P Positioner (goes to 0% or 100% on loss of input signal) |
| D | 4 to 20-mA Type AV33 Characterizable I/P Positioner (holds position on loss of input signal) |
| E | Type AV44 Characterizable Pulse Input Positioner (holds position on loss of input signal) |
| 5 | On/off solenoid valve, 120 VAC, single coil |
| 6 | On/off solenoid valve, 115/125 VDC, single coil |
| 8 | On/off solenoid valve, 120 VAC, dual coil |
| 9 | On/off solenoid valve, 115/125 VDC, dual coil |

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*Table 1-2. Nomenclature (continued)*

| Position 1 2 3 4 5 6 7 8 9 | |
|---|---|
| **Type U P □ □ □ □ □ □ □** | **Universal Rotary Actuators Type UP Pneumatic (All Metal Enclosure)** |
| Previous Page F | On/off solenoid valve, 220 VAC at 50 Hz/240 VAC at 60 Hz, single coil |
| G | On/off solenoid valve, 220 VAC at 50 Hz/240 VAC at 60 Hz, dual coil |
| | **Shaft Position Transmitter** |
| 0 | None |
| 1 1 | Electric, 4 to 20-mA (linear only)[1] |
| 3 | 4 to 20-mA output, Type RQ10 Position Transmitter (LVDT, non-contacting)[2] |
| 4 1 | 4 to 20-mA output, Type RQ20 Position Transmitter with limit switches (LVDT, non-contacting)[1,2] |
| A | Potentiometric resistive output internal to Type AV positioner (Types AV1, AV2 and AV3) (for actuator Types UP__A through D only)[3] |
| B | 4 to 20-mA output internal to Type AV positioner (Types AV1, AV2 and AV3) (for actuator Types UP__A through D only)[3] |
| C | 21 to 103 kPa (3 to 15 psig) Type AV Pneumatic Position Transmitter output (for Type UP__A only)[4,5] |
| D | 21 to 186 kPa (3 to 27 psig) Type AV Pneumatic Position Transmitter output (for Type UP__B only)[4,5] |
| | **Alarm/Travel Switches** |
| 0 | None |
| 1 | Included (4 SPDT switches) |
| | **Air Control** |
| 0 | None |
| 1 | Air failure lock (for all but Type UP6_0 actuators) |
| 2 | Volume boosters (to increase actuator stroke speed) |
| 3 | Air failure lock and volume boosters |
| 4 | Reserve air tank[4] (goes to 0 or 100% on loss of air supply) |
| | **Heaters** |
| 0 | None |
| 1 | 120 VAC[4] |
| 2 | 240 VAC[4] |

**NOTES**:

1. A 1 or 4 in the sixth position provides limit switches (included with the position transmitter) and requires a 1 in the seventh position.
2. Type RQ Position Transmitters are special orders. Contact an authorized ABB sales/service representative for more information.
3. 4 to 20-mA output position transmitter is built into the Type AV4 positioner as a standard feature.
4. Not available on Type UP1 actuators.
5. The environmental rating on Types UP2, UP3 and UP4 actuators with a Type AV Pneumatic Position Transmitter is a function of the environmental rating of the Type AV Pneumatic Position Transmitter, since it is mounted outside the actuator enclosure. Refer to the ***Refer to the Characterizable Positioner Type AV1, AV2, AV3, AV4 specification for hysteresis, resolution, deadband, repeatability, etc.*** for the environmental ratings.

## *SPECIFICATIONS*

Table 1-3 lists the specifications for the Type UP actuators.

*Table 1-3. Specifications*

| Property | Characteristic/Value |
|---|---|
| Operating torque | Refer to Table 3-2 for maximum values. Refer to Figures 3-5 and 3-7 for operating torque versus air supply pressure. |
| Operating air supply pressure | 276 to 690 kPa (40 to 100 psig) |
| Stroke times | Refer to Figures 1-1 through 1-17. |
| Volume displacement for 90° mechanical output rotation | |
| UP1 | 656 $cm^3$ (40 $in.^3$) rotary vane |
| UP2 | 1,966 $cm^3$ (120 $in.^3$) rotary vane |
| UP3 | 3,687 $cm^3$ (225 $in.^3$) cylinder [15 by 20 cm (6 by 8 in.)] |
| UP4 | 6,555 $cm^3$ (400 $in.^3$) cylinder [20 by 20 cm (8 by 8 in.)] |
| UP5 | 13,110 $cm^3$ (800 $in.^3$) cylinder [20 by 41 cm (8 by 16 in.)] |
| UP6 | 20,566 $cm^3$ (1,255 $in.^3$) cylinder [25 by 41 cm (10 by 16 in.)] |
| Temperature limits | -40° to 82°C (-40° to 180°F)[1]<br>The low temperature operative limit can be extended below 0°C (32°F) without heaters if the dew point of the air supply is maintained at least 10°C (18°F) below the minimum expected ambient temperature. |
| Mechanical rotation | |
| UP1 and UP2 | Rotary vane stroke is nominally set for 90° rotation, but can be adjusted over a range from 80° to 92° via adjustable mechanical stop. |
| UP3, UP4, UP5 and UP6 | Stroke of the cylinder provides a 90° rotation of the output lever. |
| Positioner | Refer to the ***Characterizable Positioner Type AV1, AV2, AV3, AV4 specification*** for details on Type AV positioners available for use with Type UP actuators. |
| Positioner input signal | AV1: 21 to 103 kPa (3 to 15 psig), 21 to 186 kPa (3 to 27 psig), 50% range suppression and/or zero elevation capability.<br>AV2: 4 to 20-mA (goes to 0% (normal acting) or 100% (reverse acting) on loss of input signal).<br>AV3: 4 to 20-mA (holds position on loss of input signal)<br>AV4: Computer DDC, solid state or switch contact (holds position on loss of input signal) |
| Air consumption (nominal) at balance with positioner | Typical 188.8 $cm^3$/sec (0.4 scfm) at 517.1 kPa (75.0 psig) supply, 283.2 $cm^3$/sec (0.6 scfm) maximum at null |
| Positioner action | Direct or reverse is standard |
| Performance specifications | Refer to the ***Characterizable Positioner Type AV1, AV2, AV3, AV4 specification*** for hysteresis, resolution, deadband, repeatability, etc. |
| Solenoid valve type and coil requirements | 4-way, 2-position, 2-wire type (UP__5, UP__6 and UP__F)<br>4-way, 2-position, 4-wire type (UP__8, UP__9 and UP__G) |
| Types UP1 and UP2 | NEMA 4X enclosure rating. CSA certified 120 VAC, 50/60 Hz, 10.5 W; 220 VAC at 50 Hz/240 VAC at 60 Hz, 5.25 W; or 125 VDC, 11.2 W |
| Types UP3, UP4, UP5 and UP6[2] | NEMA 1 enclosure rating. CSA certified 120 VAC, 50/60 Hz, 10.5 W; 220 VAC at 50 Hz/240 VAC at 60 Hz, 5.25 W; or 125 VDC, 11.2 W |

*Table 1-3. Specifications (continued)*

| Property | Characteristic/Value |
|---|---|
| External connections | |
| Air supply | UP1, UP2, UP3 and UP4: ¼-18 NPT female<br>UP5 and UP6: ½-14 NPT female |
| Pneumatic signal | ¼-18 NPT female when using Types AV11 or AV12 positioners as the control input |
| External connections | |
| Air failure reset | ¼-18 NPT female |
| Electrical conduit | Cutouts for ½-in. and ¾-in. female when using Types AV2, AV3 or AV4 positioners, or a solenoid valve for the control input |
| Manual operator | |
| UP1 and UP2 | Lever type with manual locking bolt |
| UP3 and UP4 | Split nut with locking ratchet |
| UP5 and UP6 | Gear type with self-locking ratchet |
| Materials of construction | |
| Frame | Carbon steel |
| Output shaft | Carbon steel |
| Top covers | Sheet metal |
| End covers | Sheet metal |
| Actuators | UP1 and UP2: Die cast aluminum rotary vane housing<br>UP3, UP4, UP5 and UP6: Carbon steel air cylinder housing and ductile iron cylinder end flanges |
| Seals on vane, vane shaft, piston and piston rod | Nitrile rubber |
| Coating on metal parts | Corrosion-resistant polyurethane |
| Storage | Store in a dry, indoor location not subject to rapid temperature changes that would cause condensation to form inside the unit. |
| Storage temperature limits | -40° to 93°C (-40° to 200°F) |
| Enclosure classification | NEMA 3R (standard)<br>NEMA 4X (optional). |
| Agency approvals | Canadian Standards Association (CSA) certified for use in general purpose (nonhazardous) locations. |
| Weight | Refer to Tables 1-5 and 1-6 |

**NOTES:**

1. Some actuator/positioner combinations may have slightly higher minimum, and slightly lower maximum operating temperatures. Refer to the ***Characterizable Positioner Type AV1, AV2, AV3, AV4 specification*** for temperature limitations.

2. The solenoid valve is mounted inside the actuator enclosure on these models; therefore, the environmental rating of the entire unit is a function of the environmental rating of the actuator enclosure.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

## *OPTIONS AND ACCESSORIES*

Table 1-4 lists the options and accessories available for use with the actuators.

*Table 1-4. Options and Accessories*

| Item | Description |
|---|---|
| Shaft Position Transmitter | |
| Electric (external to positioner) | 2-wire unit requiring a 12 to 42 VDC supply and providing a 4 to 20-mA linear output relative to the actuator shaft position. |
| Electric (internal to positioner) | 2-wire unit requiring a 12 to 34 VDC supply and producing a 4 to 20-mA linear output relative to the actuator shaft position. |
| Electric (Type RQ) | Characterizable, LVDT, non-contacting, 2-wire unit requiring a 12 to 42 VDC supply and producing a 4 to 20 mA linear output relative to the actuator shaft position. |
| Pneumatic | Produces a 21 to 103 kPa (3 to 15 psig) or 21 to 186 kPa (3 to 27 psig) linear output relative to the actuator shaft position. Minimum required air supply is 138 kPa (20 psig). The output may be characterized by the user (not available for Type UP1 actuators). |
| Potentiometric Resistive | A potentiometer internal to the Types AV1, AV2 and AV3 positioners. Gears connect the potentiometer to the positioner output shaft. The position of the potentiometer shaft indicates the actuator shaft position. The relationship between the potentiometer and the output shaft dictates that one degree of rotation of the output shaft corresponds to approximately 9.9 ohms of resistive change at the potentiometer. Refer to the appropriate Type AV positioner instruction for more information. |
| Adjustable Alarm/Travel Switches | Consists of four linkage-driven, cam-operated SPDT microswitches, adjustable over the full stroke of the actuator. Used as alarm contacts or for external indications. |
| Contact ratings | C1, C4: 9 A at 125 VAC or VDC at 60°C (140°F)<br>C2, C3: 9 A at 125 VAC or 250 VDC at 60°C (140°F) |
| Air Failure Lock | Locks actuator in its last position when the air supply falls below a preset value. Each actuator includes a pneumatic pushbutton and contains hardware for local or remote reset connection. |
| UP1 and UP2 | Mechanical latch device with a 3-way pneumatic trip valve as the air supply sensor. |
| UP3, UP4, UP5 and UP6 | Uses a 3-way pneumatic trip valve as the air supply sensor, that trips one 4-way (Types UP3 and UP4 actuators) or two 3-way (Types UP5 and UP6 actuators) lock-up valves to lock the actuator in the last position. Includes a pressure switch used to signal an air failure alarm or for a status light. |
| Alarm pressure switch contact ratings | 13.0 A at 115/230 VAC at 60°C (140°F)<br>0.5 A at 110/125 VAC at 60°C (140°F)<br>Switch contacts must be derated 1.5 A for every 10°C (18°F) rise above 60°C (140°F). |

*Table 1-4. Options and Accessories (continued)*

| Item | Description |
|---|---|
| Reserve Air Tank | Available for all except Type UP1 actuators.<br>Drives actuator into the full open or full closed position when the air supply falls below a preset value. Uses a 3-way pneumatic trip valve as the air supply sensor. |
| UP2 | 20.8 l (5.5 gal.) air tank |
| UP3, UP4 and UP5 | 30.3 l (8.0 gal.) air tank |
| UP6 | 64.4 l (17.0 gal.) air tank |
| Strip Heaters (thermostatically controlled) | Available for all except Type UP1 actuators.<br>The low temperature operative limit can be extended below 0°C (32°F) without heaters if the dew point of the air supply is maintained at least 10°C (18°F) below the minimum expected ambient temperature. |
| UP2 | 1 heater element, 500 W at 120 VAC or 240 VAC |
| UP3, UP4, UP5 and UP6 | 2 heater elements, 500 W (1000 W total) at 120 VAC or 240 VAC |
| Volume Boosters and Exhaust Valves | To increase stroke speed. Available only for Type UP6 actuators. Refer to Table 1-2 and Figure 1-16. |
| Accessories | |
| Regulators[1] | Part No. 1951029_5 (standard capacity)<br>Part No. 1951439_1 (high capacity) |
| Supply air filters | In-line coalescing filter for removal of solid and liquid contaminants in compressed air. Filter comes with universal mounting bracket and grade DX filter that is 93% efficient at 0.1 microns.<br>Part No. 5328563_1: 150 psig maximum inlet pressure, 54°C (130°F) maximum temperature, ½ NPT inlet/outlet connection size.<br>Part No. 5328563_2: 250 psig maximum inlet pressure, 121°C (250°F) maximum temperature, ½ NPT inlet/outlet connection size. This filter has an anodized aluminum bowl guard. |
| Pressure switch | Part No. 1941099_2 (Types UP1 and UP2 actuators) to sound an alarm or for status lights to signal loss of air supply. |
| Pressure gages | Part No. 5326605_4: instrument<br>Part No. 5326605_5: supply[2]<br>Part No. 5326605_6: output (two required) |
| Speed control orifices | Regulate time constant of positioner and final control element. Installed directly into positioner output ports.<br>Part No. 5327327_1: 1 mm (0.04 in.)<br>Part No. 5327327_2: blank (drill to suit) |

**NOTES**:

1. A high capacity regulator is suggested for applications using Types UP5 and UP6 actuators where stroke speed is important. Refer to Table 3-1 for regulator capacity information.
2. The manifold on the positioner provides gage ports, one for instrument (internal input signal) and two output gages. A supply gage can be installed in the supply line (piping by customer).

## SHIPPING WEIGHTS

Table 1-2 lists the shipping weights of the actuators including either a positioner or a solenoid valve. Table 1-6 lists the shipping weights of the various options.

*Table 1-5. Type UP Actuator Shipping Weights*

| Actuator Type | Shipping Weight kg (lb) |
|---|---|
| UP1_A/1_B/1_C/1_D/1_E | 25 (55) |
| UP1_5/1_6/1_8/1_9/1_F/1_G | 23 (50) |
| UP2_A/2_B/2_C/2_D/2_E | 45 (100) |
| UP2_5/2_6/2_8/2_9/2_F/2_G | 43 (95) |
| UP3_A/3_B/3_C/3_D/3_E | 145 (320) |
| UP3_5/3_6/3_8/3_9/3_F/3_G | 143 (315) |
| UP4_A/4_B/4_C/4_D/4_E | 163 (360) |
| UP4_5/4_6/4_8/4_9/4_F/4_G | 161 (355) |
| UP5_A/5_B/5_C/5_D/5_E | 336 (741) |
| UP5_5/5_6/5_8/5_9/5_F/5_G | 334 (736) |
| UP6_A/6_B/6_C/6_D/6_E | 369 (814) |
| UP6_5/6_6/6_8/6_9/6_F/6_G | 367 (809) |

*Table 1-6. Option Shipping Weights[1]*

| Option | Shipping Weight kg (lb) |
|---|---|
| Electric Shaft Position Transmitter | 1.8 (4.0) |
| Pneumatic Shaft Position Transmitter | 5.0 (11.0) |
| Alarm/Travel Switches | 1.1 (2.5) |
| Strip Heaters | |
| UP2 | 1.1 (2.5) |
| UP3, UP4, UP5 and UP6 | 2.0 (4.5) |
| Air Failure Lock | |
| UP1 | 3.6 (8.0) |
| UP2 | 5.0 (11.0) |
| UP3 and UP4 | 5.9 (13.0) |
| UP5 and UP6 | 6.8 (15.0) |
| Reserve Air Tank | |
| 20.8 l (5.5 gal.) for UP2 | 10.0 (22.0) |
| 30.3 l (8.0 gal.) for UP3, UP4 and UP5 | 13.6 (30.0) |
| 64.4 l (17.0 gal.) for UP6 | 22.7 (50.0) |
| Volume Boosters (UP6 only) | 4.5 (10.0) |

**NOTE**:
1. Add these values to those listed in Table 1-5 where applicable.

## STROKE TIME GRAPHS

Figures 1-1 through 1-17 show the stroke times for the various types of actuators with positioners and solenoid valves.

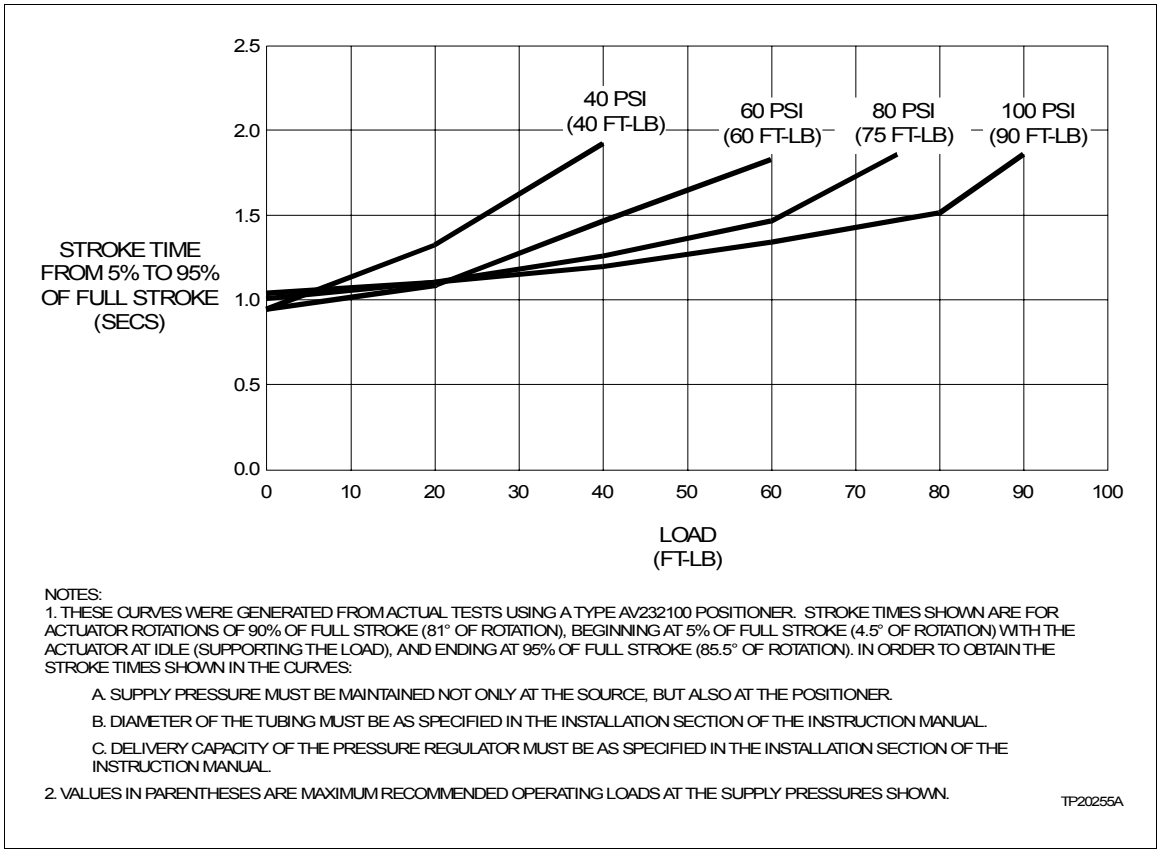
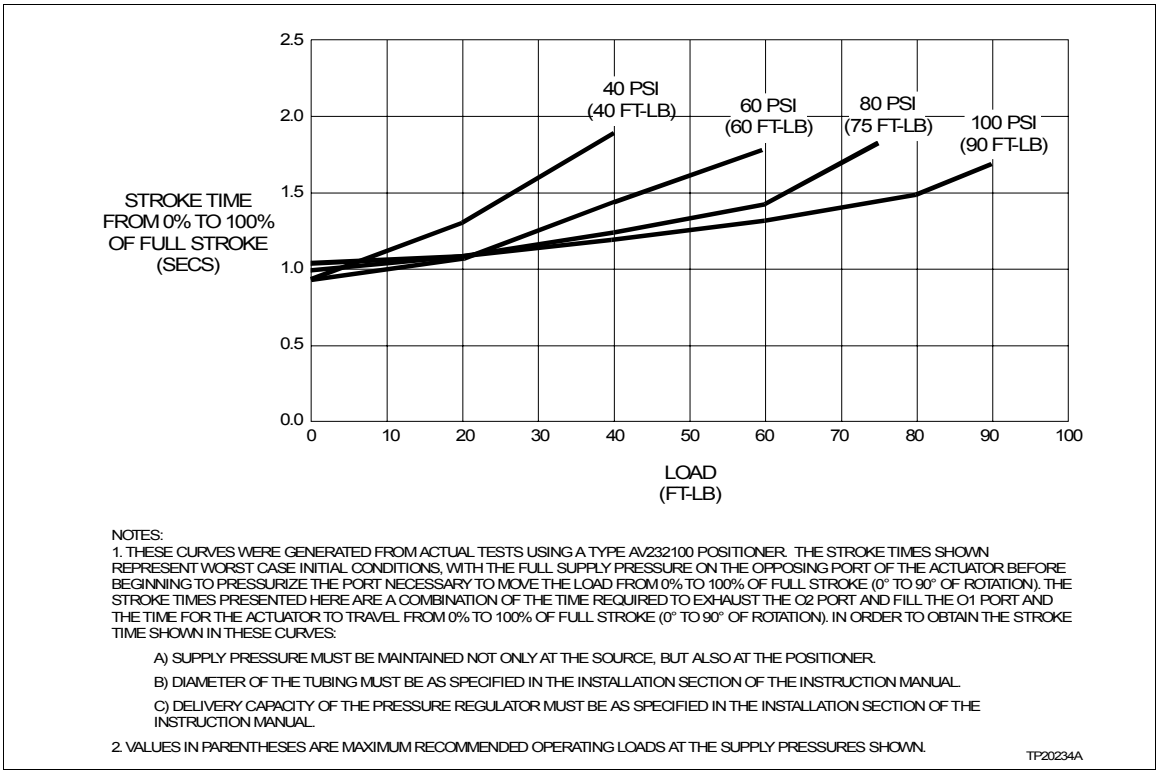



*Figure 1-1. Stroke Times for Type UP1 Actuator with Type AV2 Positioner - 5 to 95% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS USING A TYPE AV232100 POSITIONER. THE STROKE TIMES SHOWN REPRESENT WORST CASE INITIAL CONDITIONS, WITH THE FULL SUPPLY PRESSURE ON THE OPPOSING PORT OF THE ACTUATOR BEFORE BEGINNING TO PRESSURIZE THE PORT NECESSARY TO MOVE THE LOAD FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). THE STROKE TIMES PRESENTED HERE ARE A COMBINATION OF THE TIME REQUIRED TO EXHAUST THE O2 PORT AND FILL THE O1 PORT AND THE TIME FOR THE ACTUATOR TO TRAVEL FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIME SHOWN IN THESE CURVES:

A) SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE POSITIONER.

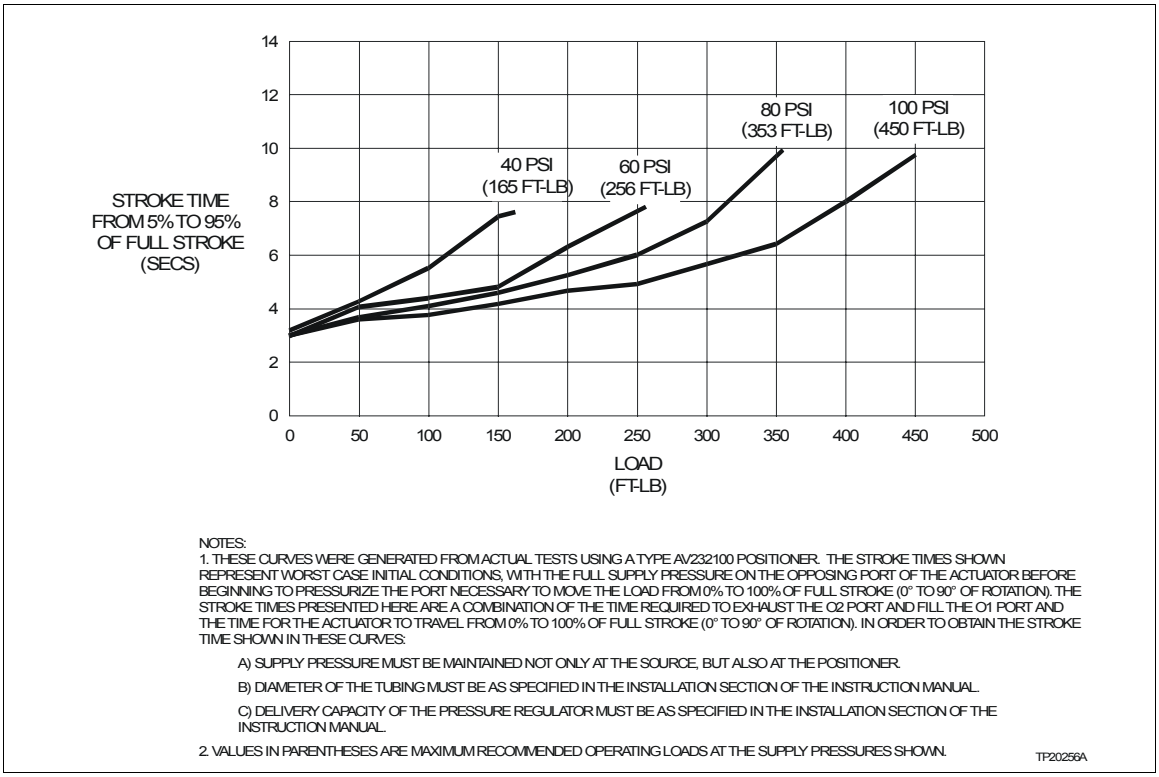
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C) DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20234A

*Figure 1-2. Stroke Times for Type UP1 Actuator with Type AV2 Positioner - 0 to 100% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS USING A TYPE AV232100 POSITIONER. THE STROKE TIMES SHOWN REPRESENT WORST CASE INITIAL CONDITIONS, WITH THE FULL SUPPLY PRESSURE ON THE OPPOSING PORT OF THE ACTUATOR BEFORE BEGINNING TO PRESSURIZE THE PORT NECESSARY TO MOVE THE LOAD FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). THE STROKE TIMES PRESENTED HERE ARE A COMBINATION OF THE TIME REQUIRED TO EXHAUST THE O2 PORT AND FILL THE O1 PORT AND THE TIME FOR THE ACTUATOR TO TRAVEL FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIME SHOWN IN THESE CURVES:

A) SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE POSITIONER.

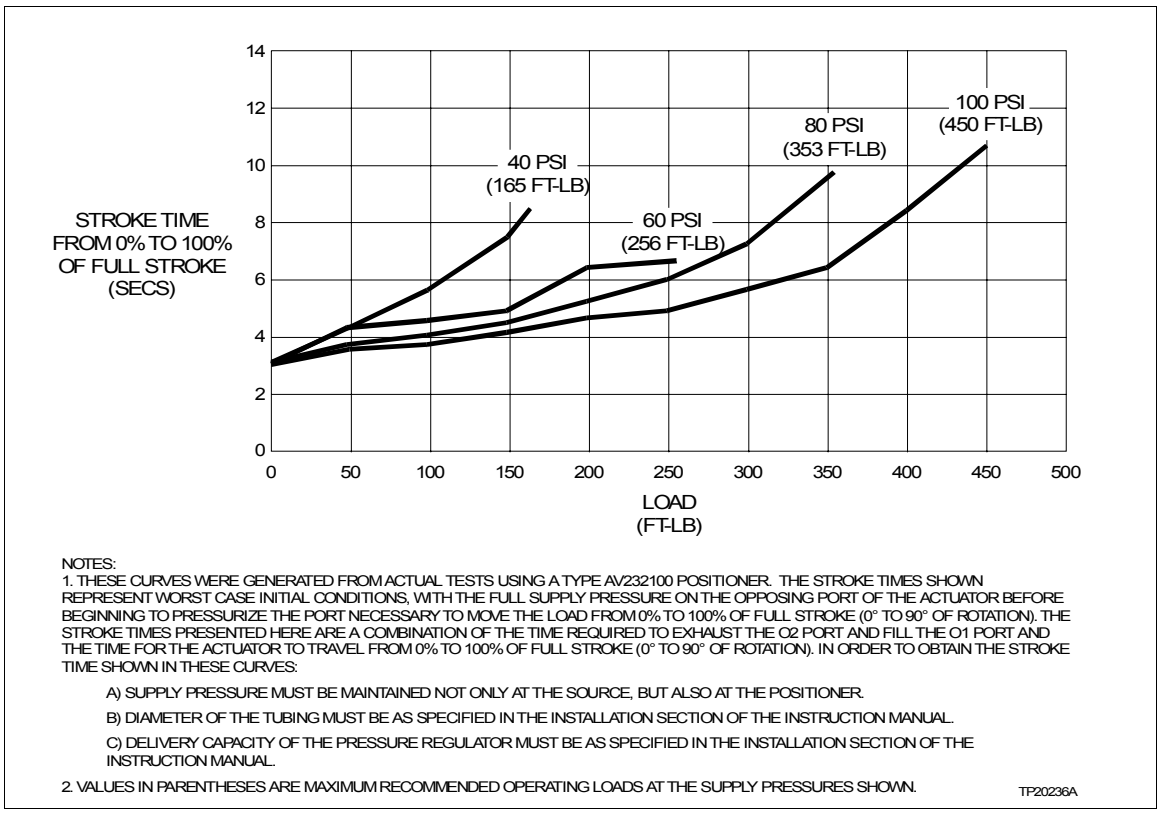
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C) DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20256A

*Figure 1-3. Stroke Times for Type UP2 Actuator with Type AV2 Positioner - 5 to 95% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS USING A TYPE AV232100 POSITIONER. THE STROKE TIMES SHOWN REPRESENT WORST CASE INITIAL CONDITIONS, WITH THE FULL SUPPLY PRESSURE ON THE OPPOSING PORT OF THE ACTUATOR BEFORE BEGINNING TO PRESSURIZE THE PORT NECESSARY TO MOVE THE LOAD FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). THE STROKE TIMES PRESENTED HERE ARE A COMBINATION OF THE TIME REQUIRED TO EXHAUST THE O2 PORT AND FILL THE O1 PORT AND THE TIME FOR THE ACTUATOR TO TRAVEL FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIME SHOWN IN THESE CURVES:

A) SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE POSITIONER.

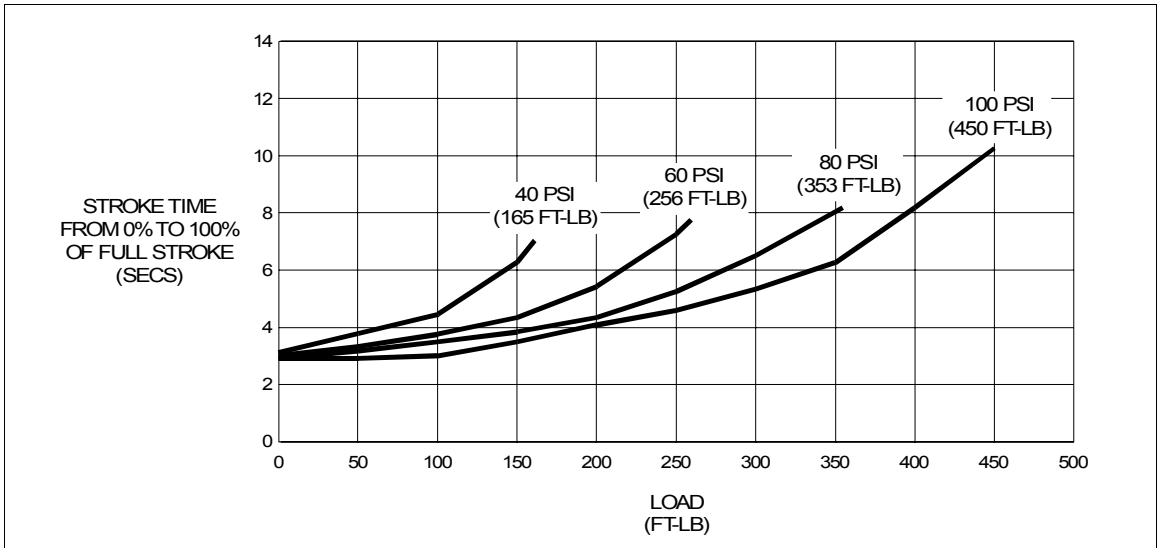
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C) DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20236A

*Figure 1-4. Stroke Times for Type UP2 Actuator with Type AV2 Positioner - 0 to 100% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS. THE STROKE TIMES SHOWN ARE FOR ACTUATOR ROTATIONS FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIME SHOWN IN THESE CURVES:

A) SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE SOLENOID VALVE.

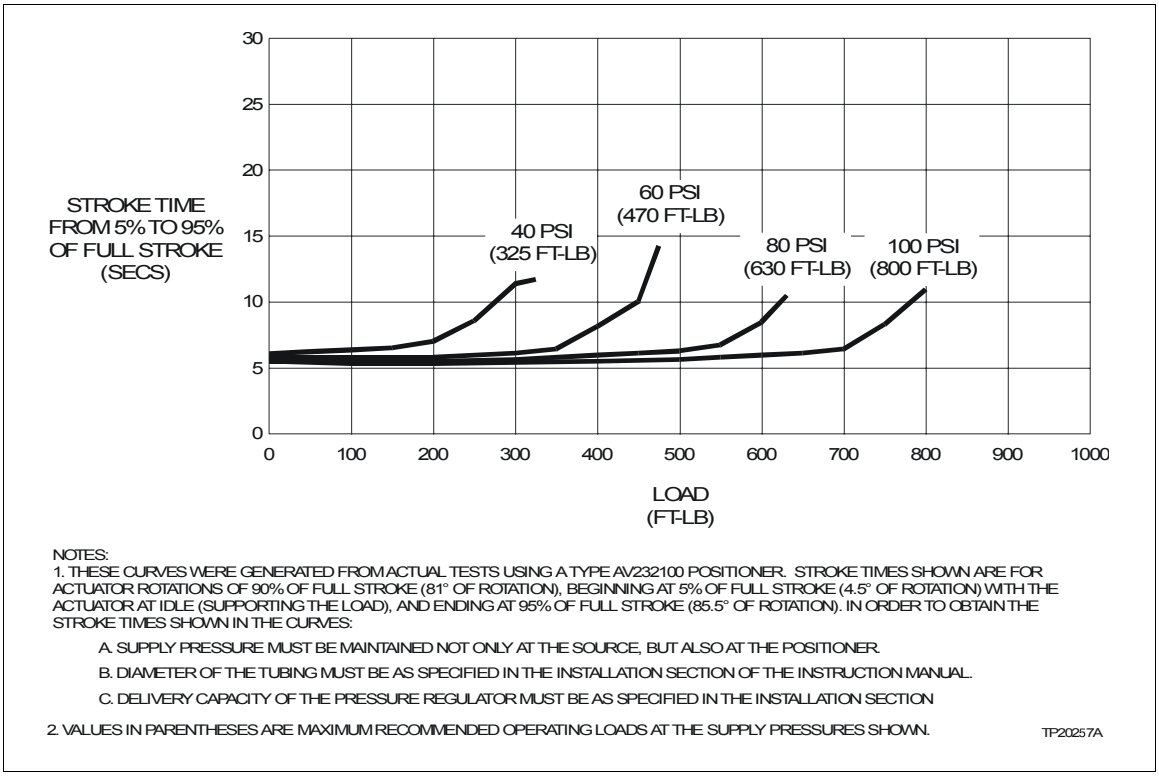
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C) DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20235A

*Figure 1-5. Stroke Times for Type UP2 Actuator with Solenoid Valve - 0 to 100% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS USING A TYPE AV232100 POSITIONER. STROKE TIMES SHOWN ARE FOR ACTUATOR ROTATIONS OF 90% OF FULL STROKE (81° OF ROTATION), BEGINNING AT 5% OF FULL STROKE (4.5° OF ROTATION) WITH THE ACTUATOR AT IDLE (SUPPORTING THE LOAD), AND ENDING AT 95% OF FULL STROKE (85.5° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIMES SHOWN IN THE CURVES:

A. SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE POSITIONER.

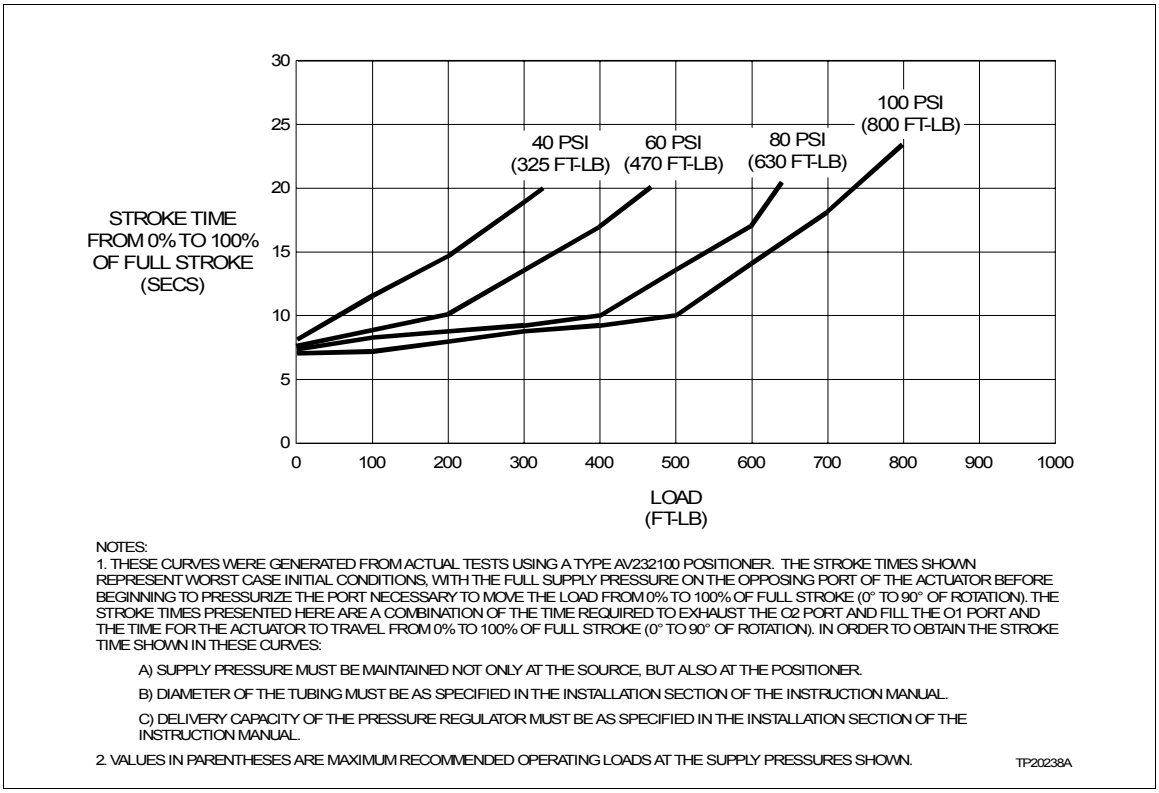
B. DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C. DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20257A

*Figure 1-6. Stroke Times for Type UP3 Actuator with Type AV2 Positioner - 5 to 95% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS USING A TYPE AV232100 POSITIONER. THE STROKE TIMES SHOWN REPRESENT WORST CASE INITIAL CONDITIONS, WITH THE FULL SUPPLY PRESSURE ON THE OPPOSING PORT OF THE ACTUATOR BEFORE BEGINNING TO PRESSURIZE THE PORT NECESSARY TO MOVE THE LOAD FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). THE STROKE TIMES PRESENTED HERE ARE A COMBINATION OF THE TIME REQUIRED TO EXHAUST THE O2 PORT AND FILL THE O1 PORT AND THE TIME FOR THE ACTUATOR TO TRAVEL FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIME SHOWN IN THESE CURVES:

A) SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE POSITIONER.

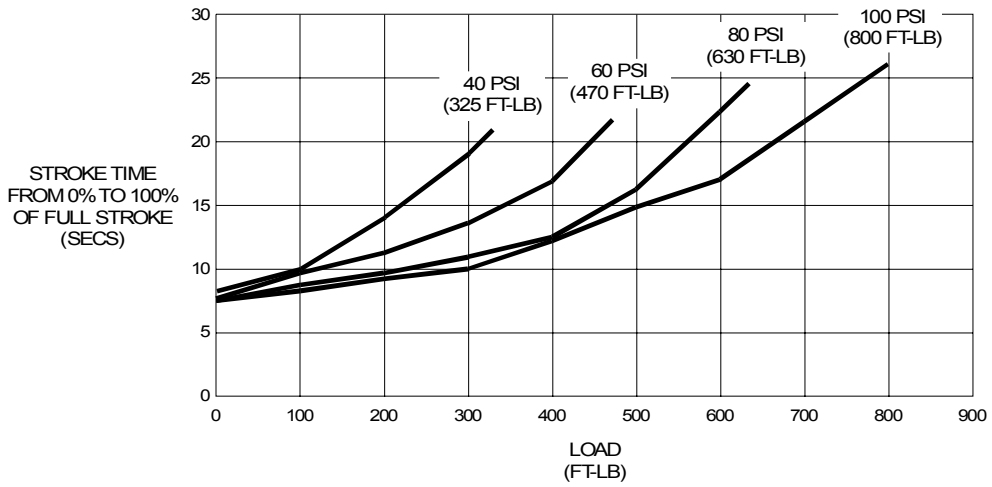
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C) DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20238A

*Figure 1-7. Stroke Times for Type UP3 Actuator with Type AV2 Positioner - 0 to 100% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS. THE STROKE TIMES SHOWN ARE FOR ACTUATOR ROTATIONS FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIME SHOWN IN THESE CURVES:

A) SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE SOLENOID VALVE.

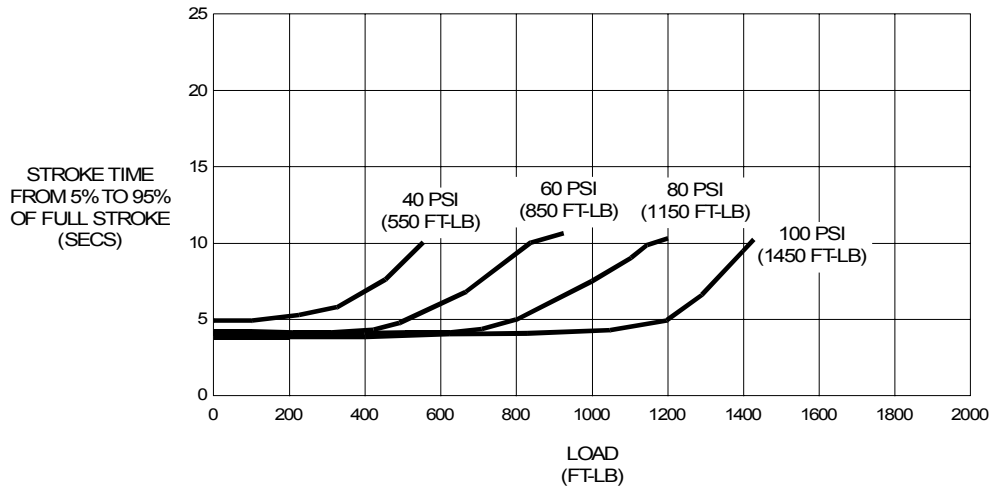
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C) DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20237A

*Figure 1-8. Stroke Times for Type UP3 Actuator with Solenoid Valve - 0 to 100% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS USING A TYPE AV232100 POSITIONER. STROKE TIMES SHOWN ARE FOR ACTUATOR ROTATIONS OF 90% OF FULL STROKE (81° OF ROTATION), BEGINNING AT 5% OF FULL STROKE (4.5° OF ROTATION) WITH THE ACTUATOR AT IDLE (SUPPORTING THE LOAD), AND ENDING AT 95% OF FULL STROKE (85.5° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIMES SHOWN IN THE CURVES:

A. SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE POSITIONER.

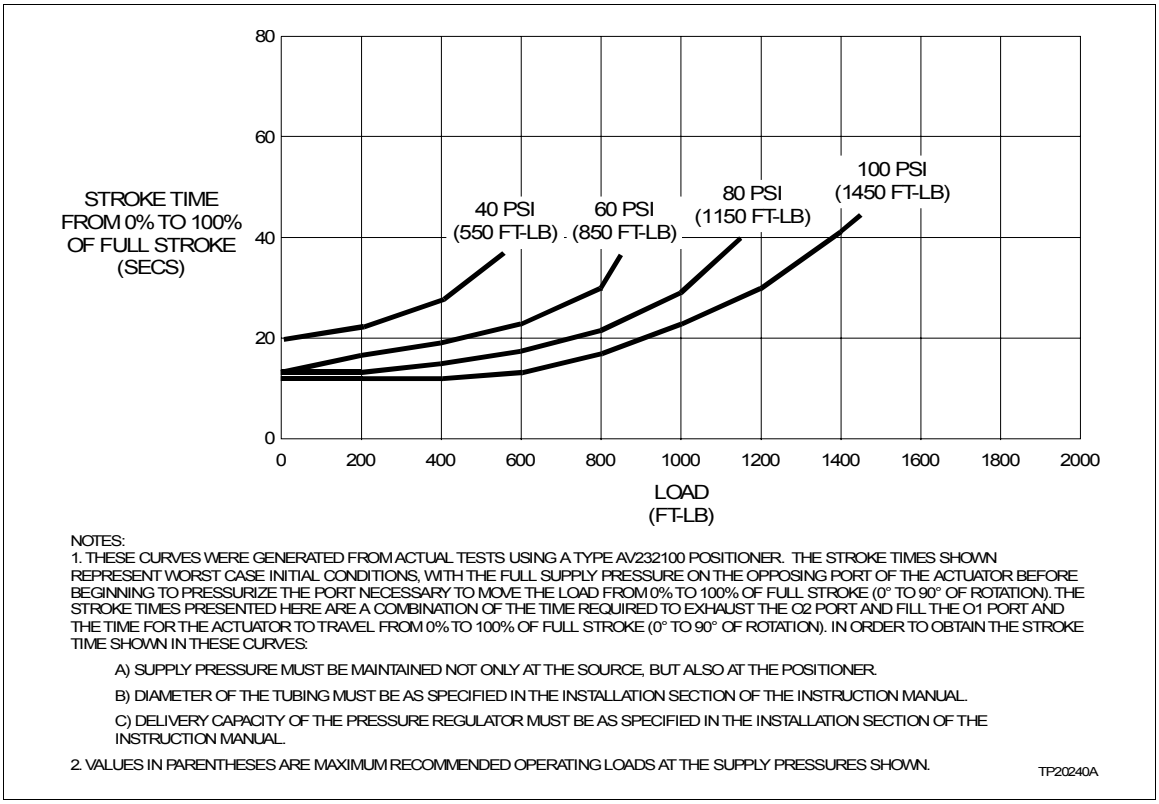
B. DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C. DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20258B

*Figure 1-9. Stroke Times for Type UP4 Actuator with Type AV2 Positioner - 5 to 95% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS USING A TYPE AV232100 POSITIONER. THE STROKE TIMES SHOWN REPRESENT WORST CASE INITIAL CONDITIONS, WITH THE FULL SUPPLY PRESSURE ON THE OPPOSING PORT OF THE ACTUATOR BEFORE BEGINNING TO PRESSURIZE THE PORT NECESSARY TO MOVE THE LOAD FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). THE STROKE TIMES PRESENTED HERE ARE A COMBINATION OF THE TIME REQUIRED TO EXHAUST THE O2 PORT AND FILL THE O1 PORT AND THE TIME FOR THE ACTUATOR TO TRAVEL FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIME SHOWN IN THESE CURVES:

A) SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE POSITIONER.

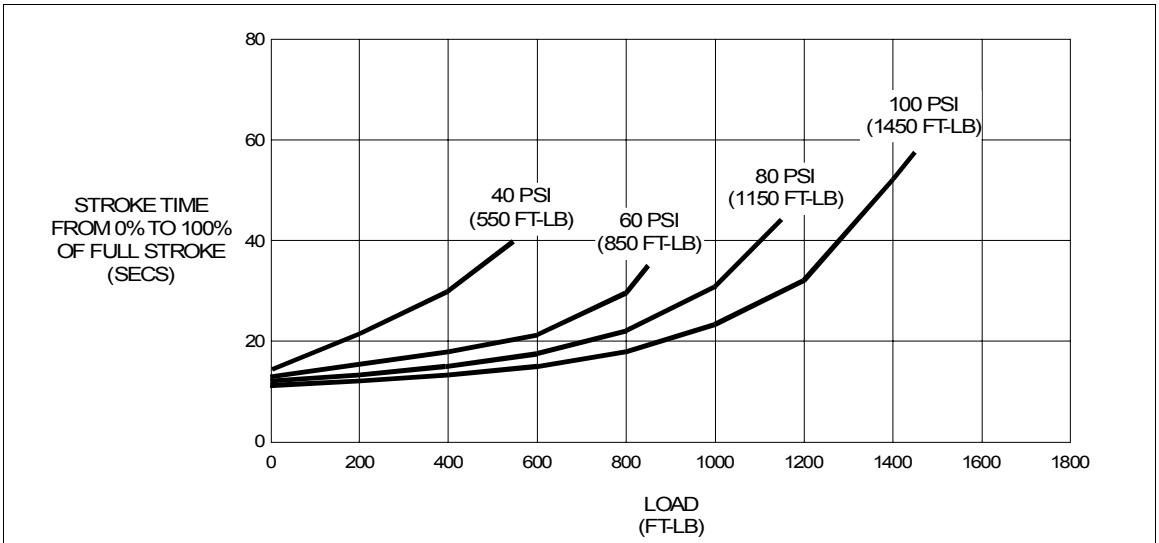
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C) DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20240A

*Figure 1-10. Stroke Times for Type UP4 Actuator with Type AV2 Positioner - 0 to 100% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS. THE STROKE TIMES SHOWN ARE FOR ACTUATOR ROTATIONS FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIME SHOWN IN THESE CURVES:

A) SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE SOLENOID VALVE.

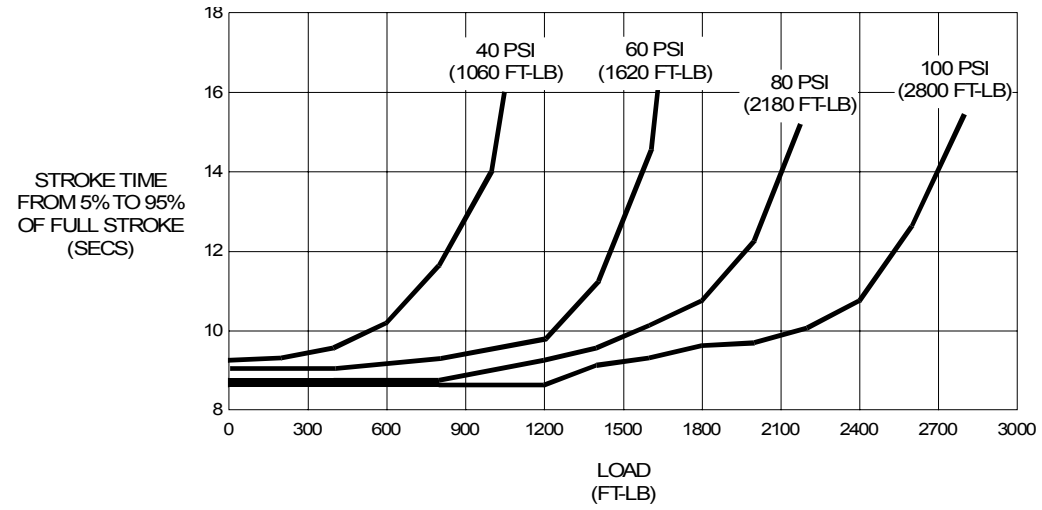
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C) DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20239A

*Figure 1-11. Stroke Times for Type UP4 Actuator with Solenoid Valve - 0 to 100% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS USING A TYPE AV232100 POSITIONER. STROKE TIMES SHOWN ARE FOR ACTUATOR ROTATIONS OF 90% OF FULL STROKE (81° OF ROTATION), BEGINNING AT 5% OF FULL STROKE (4.5° OF ROTATION) WITH THE ACTUATOR AT IDLE (SUPPORTING THE LOAD), AND ENDING AT 95% OF FULL STROKE (85.5° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIMES SHOWN IN THE CURVES:

A. SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE POSITIONER.

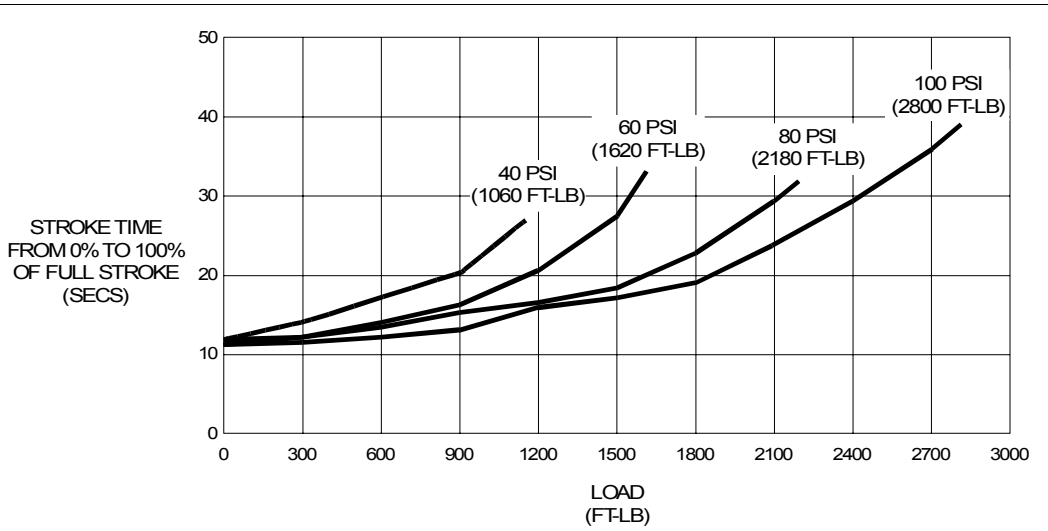
B. DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C. DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20259A

*Figure 1-12. Stroke Times for Type UP5 Actuator with Type AV2 Positioner - 5 to 95% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS USING A TYPE AV232100 POSITIONER. THE STROKE TIMES SHOWN REPRESENT WORST CASE INITIAL CONDITIONS, WITH THE FULL SUPPLY PRESSURE ON THE OPPOSING PORT OF THE ACTUATOR BEFORE BEGINNING TO PRESSURIZE THE PORT NECESSARY TO MOVE THE LOAD FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). THE STROKE TIMES PRESENTED HERE ARE A COMBINATION OF THE TIME REQUIRED TO EXHAUST THE O2 PORT AND FILL THE O1 PORT AND THE TIME FOR THE ACTUATOR TO TRAVEL FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIME SHOWN IN THESE CURVES:

A) SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE POSITIONER.

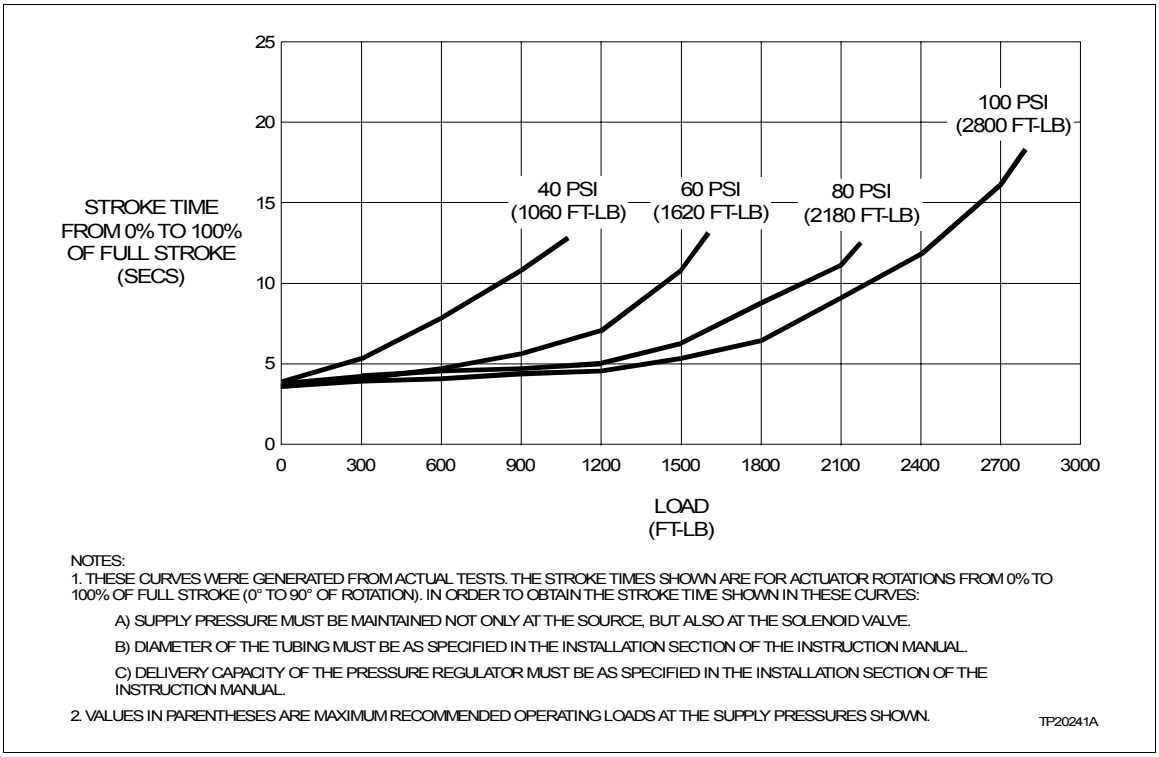
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C) DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20242A

*Figure 1-13. Stroke Times for Type UP5 Actuator with Type AV2 Positioner - 0 to 100% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS. THE STROKE TIMES SHOWN ARE FOR ACTUATOR ROTATIONS FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIME SHOWN IN THESE CURVES:

A) SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE SOLENOID VALVE.

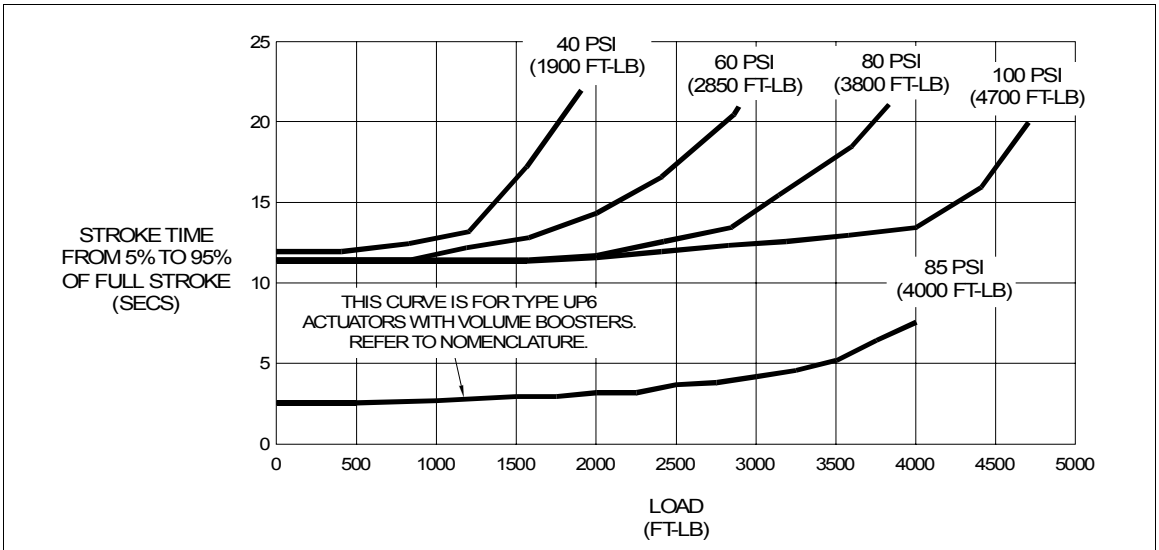
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C) DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20241A

*Figure 1-14. Stroke Times for Type UP5 Actuator with Solenoid Valve - 0 to 100% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS USING A TYPE AV232100 POSITIONER. STROKE TIMES SHOWN ARE FOR ACTUATOR ROTATIONS OF 90% OF FULL STROKE (81° OF ROTATION), BEGINNING AT 5% OF FULL STROKE (4.5° OF ROTATION) WITH THE ACTUATOR AT IDLE (SUPPORTING THE LOAD), AND ENDING AT 95% OF FULL STROKE (85.5° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIMES SHOWN IN THE CURVES:

A. SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE POSITIONER.

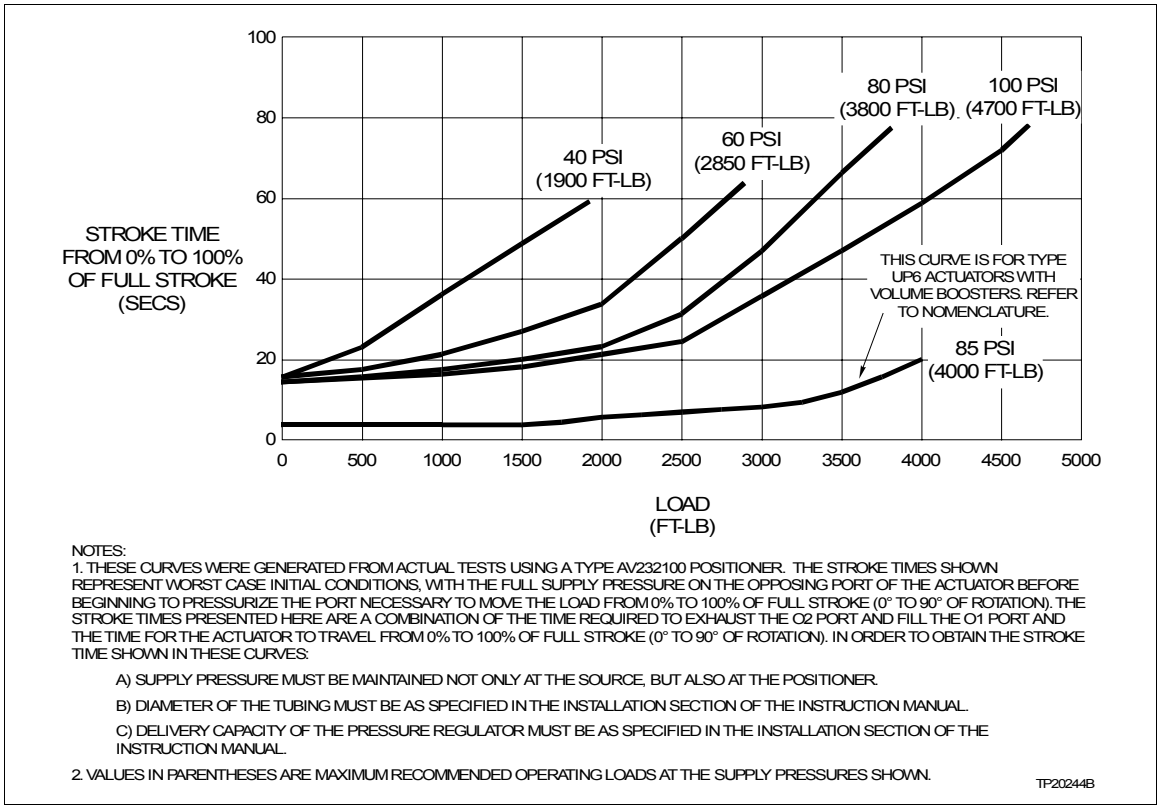
B. DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C. DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20260B

*Figure 1-15. Stroke Times for Type UP6 Actuator with Type AV2 Positioner - 5 to 95% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS USING A TYPE AV232100 POSITIONER. THE STROKE TIMES SHOWN REPRESENT WORST CASE INITIAL CONDITIONS, WITH THE FULL SUPPLY PRESSURE ON THE OPPOSING PORT OF THE ACTUATOR BEFORE BEGINNING TO PRESSURIZE THE PORT NECESSARY TO MOVE THE LOAD FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). THE STROKE TIMES PRESENTED HERE ARE A COMBINATION OF THE TIME REQUIRED TO EXHAUST THE O2 PORT AND FILL THE O1 PORT AND THE TIME FOR THE ACTUATOR TO TRAVEL FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIME SHOWN IN THESE CURVES:

A) SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE POSITIONER.

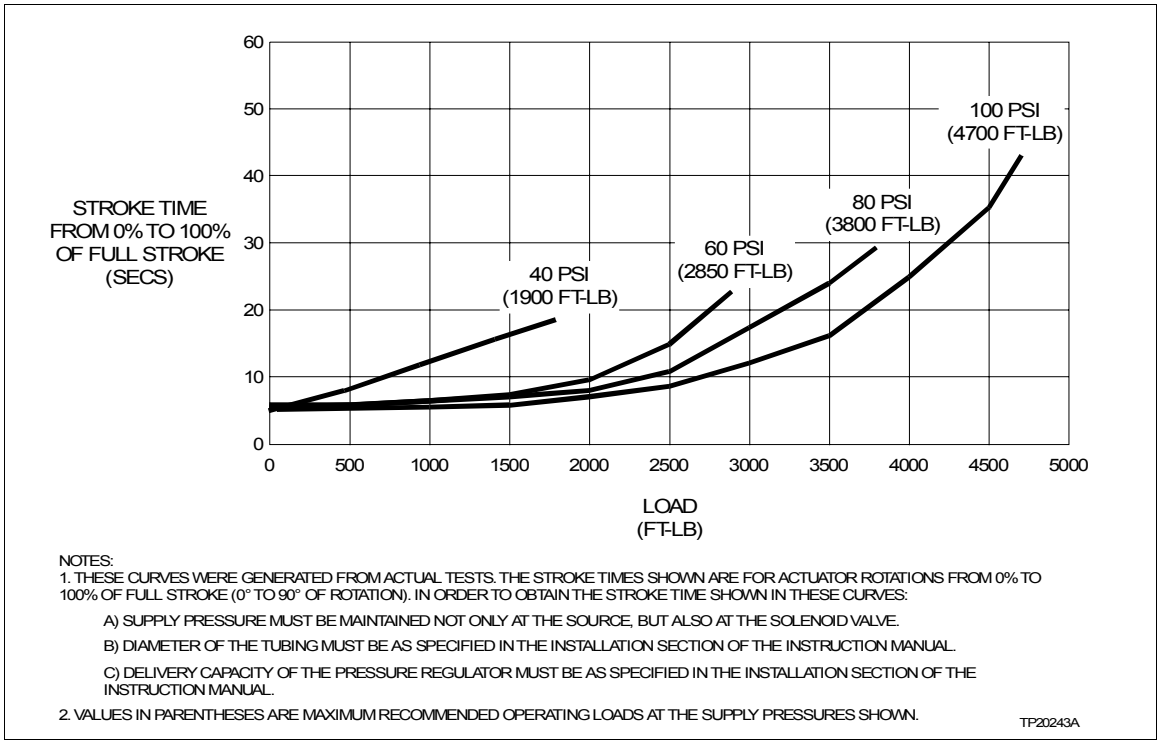
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C) DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20244B

*Figure 1-16. Stroke Times for Type UP6 Actuator with Type AV2 Positioner - 0 to 100% of Stroke*




NOTES:
1. THESE CURVES WERE GENERATED FROM ACTUAL TESTS. THE STROKE TIMES SHOWN ARE FOR ACTUATOR ROTATIONS FROM 0% TO 100% OF FULL STROKE (0° TO 90° OF ROTATION). IN ORDER TO OBTAIN THE STROKE TIME SHOWN IN THESE CURVES:

A) SUPPLY PRESSURE MUST BE MAINTAINED NOT ONLY AT THE SOURCE, BUT ALSO AT THE SOLENOID VALVE.

B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

C) DELIVERY CAPACITY OF THE PRESSURE REGULATOR MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

2. VALUES IN PARENTHESES ARE MAXIMUM RECOMMENDED OPERATING LOADS AT THE SUPPLY PRESSURES SHOWN.

TP20243A

*Figure 1-17. Stroke Times for Type UP6 Actuator with Solenoid Valve - 0 to 100% of Stroke*

# SECTION 2 - DESCRIPTION AND OPERATION

## *INTRODUCTION*

This section gives an overview of the Type UP Universal Pneumatic Rotary Actuators. A broad description of each type is included.

Types UP1 and UP2 actuators have a double-acting rotary vane power unit. The power units of Types UP3 UP4, UP5 and UP6 actuators include a double-acting cylinder with a motion conversion mechanism. This device converts linear motion to rotary motion. A differential pressure from the positioner or solenoid valve, applied across the double-acting power unit, causes rotary motion of the output shaft.

Order the actuators with a positioner or an on/off solenoid valve.

The positioner is a push-pull action, force balance type control device. The positioner offers a variety of input ranges:

- 21 to 103 kilopascals (3 to 15 pounds per square inch gage), Type AV11 positioner.
- 21 to 186 kilopascals (3 to 27 pounds per square inch gage), Type AV12 positioner.
- 4 to 20-milliamps, Types AV23 and AV33 positioners.
- Computer DDC, solid state, or contact input, Type AV44 positioner.

The positioning function can be for a variety of applications. There are standard cams for linear, square or square root relationships. Custom shaping the cam provides application flexibility. A mechanical connection to the actuator shaft feeds back the shaft position movement. The positioner provides proportional control of the differential pressure across the rotary vane or cylinder. It moves the output shaft in accordance with the control signal.

Actuators with a solenoid valve provide on/off control. In this case, positioning of the actuator is at either of the extreme ends of travel (zero percent or 100 percent). There are solenoid valves for 220 VAC at 50 Hertz, 120 VAC or 240 VAC at 60 Hertz, or 115/125 VDC service, single or dual coil.

### *Types UP__A and UP__ B Actuators*

In Types UP__A and UP__B actuators, the positioner receives a pneumatic analog input signal. It adjusts the pressure to the power unit. This moves the output shaft to the spot that matches the input signal.

### *Types UP__ C and UP__ D Actuators*

These actuators change the four to 20-milliamp signal, applied at the positioner current to pneumatic signal converter, into a pneumatic signal. A connection to the actuator shaft feed back the shaft movement. When the controller calls for the actuator to change position, the positioner acts as a pneumatic relay. Through a separate air supply, it moves the actuator into position.

### *Type UP__ E Actuators*

These actuators have a pulse input positioner. This combines the functions of a pulse-to-pneumatic signal converter, a pneumatic positioner and a position transmitter.

### *Types UP__5, UP__8 and UP__F Actuators*

These actuators have single coil solenoid valves. These move the actuator to either end of travel (zero percent or 100 percent). When the solenoid valve is energized, the rotary vane goes to the full closed position (Types UP1 and UP2 actuators) or the cylinder retracts completely (Types UP3 through UP6 actuators). The actuators stay in their positions until the solenoid is de-energized at which time the rotary vane goes to the full open position or the cylinder extends completely.

> **NOTE:** This description is for direct acting and actuators (as shipped). The description for reverse acting applications would be opposite of that described here. Refer to Section 3 for more information on reverse acting actuators with solenoid valves.

### *Types UP__6, UP__9 and UP__G Actuators*

These actuators have dual coil solenoid valves. These move the actuator to either end of travel (zero percent to 100 percent). Energizing solenoid A causes the rotary vane to go to the full closed position (Types UP1 and UP2 actuators) or the cylinder to retract completely (Types UP3 through UP6 actuators). Energizing solenoid B causes the rotary vane to go to the full closed position or the cylinder to extend completely. The solenoids do not need to be kept energized to maintain the last position.

> **NOTE:** Do not energize both coils at the same time. Doing so will cause unpredictable actuator movement.

### *Type UP6_0 Actuators*

Type UP6_0 master/slave actuators are for installations that need more torque than a single Type UP6 actuator supplies. Two or more Type UP6 actuators can be connected in parallel to drive the same load. This provides more torque than a single Type UP6 actuator. The master is a standard Type UP6 actuator with a Type AV positioner or solenoid valve. The slave drive is a standard Type UP6 actuator without a positioner or solenoid valve.

Order the master using the standard nomenclature for the actuator desired. For the additional slave drive, refer to nomenclature Type UP6_0__0_ - slave actuator. An installation kit, supplied as part of the slave actuator (kit number 258548_1), is required to install the master/slave arrangement.

The slave drive can be used alone for special applications using an external solenoid valve or other control device.

# SECTION 3 - INSTALLATION

## *INTRODUCTION*

This section contains procedures for unpacking and inspection, location, and safety considerations. There are also instructions for setup and physical installation, including wiring, cabling and tubing connections. Finally, it covers connections for optional equipment, and any adjustments that make the unit operational.

## *UNPACKING AND INSPECTION*

Before unpacking, check the outside of the shipping carton for signs of in-transit damage. Pay special attention to punctures, tears or other damage to the outer carton. Look for signs of water damage. If damaged, notify the carrier and ABB immediately.

Check the data on the nameplate, located on the actuator mounting frame. Be sure the unit is suited for the desired application.

## *LOCATION CONSIDERATIONS*

Locate the actuator according to the linkage arrangement desired (refer to ***Connecting Linkage for Universal Rotary Actuators***). For dimensions and required clearances, refer to the dimension drawings in ***DIMENSION DRAWINGS*** in Appendix B.

| | |
|---|---|
| **CAUTION** | **Protect the air lines and equipment from freezing in temperatures below 0°C (32°F). Failure to do so can damage the equipment.** |
| **ATTENTION** | **Protéger les conduites d'air et l'équipement contre le gel lorsque la température est inférieure à 0°C (32°F). Toute négligence à cet égard risque de provoquer des dommages matériels.** |

Actuators are designed for use in ambient temperatures of -40 to 82 degrees Celsius (-40 to 180 degrees Fahrenheit).[1] Unless using air dryers or heaters, impose a low temperature operating limit of zero degrees Celsius (32 degrees Fahrenheit).

1. Some actuator/positioner combinations may have a slightly lower maximum or higher minimum operating temperature. Refer to the ***Characterizable Positioner Type AV1, AV2, AV3, AV4 specification*** for temperature limitations.

## *ENCLOSURE REMOVAL*

| | |
|---|---|
| **WARNING** | **Do not operate this equipment unless the covers are in place. The covers prevent access to moving components that pose a risk of entanglement of body parts.** |
| **AVERTISSEMENT** | **Ne faites fonctionner cet équipement que si les couvercles sont en place. Les couvercles empêchent l'accès à des composantes en mouvement qui présentent un risque d'emmêlement des membres.** |

Use the enclosure removal procedures in this section to access components for wiring and tubing installation, calibration, maintenance, repair and replacement.

### *Type UP1 Actuator*

**NOTE:** Refer to Figure 3-1.

Only Type UP1 actuators with alarm/travel switches and/or the electric shaft position transmitter require disassembly to access components. The alarm/travel switches reside in an enclosure attached to the actuator frame.

1. Remove the four enclosure mounting screws holding the enclosure to the actuator frame.

2. Remove the enclosure.

### *Type UP2 Actuator*

**NOTE:** Refer to Figure 3-2.

The Type UP2 actuator has a removable side panel and top cover.

#### *SIDE PANEL*

1. There are six side panel screws that hold the side panel to the actuator frame. Remove these six screws.

2. Remove the side panel.

#### *TOP COVER*

1. There are four link lock fasteners that secure the top cover to the actuator – two on each side near the top of the actuator. Unsnap the link lock fasteners.

2. Remove the top cover.

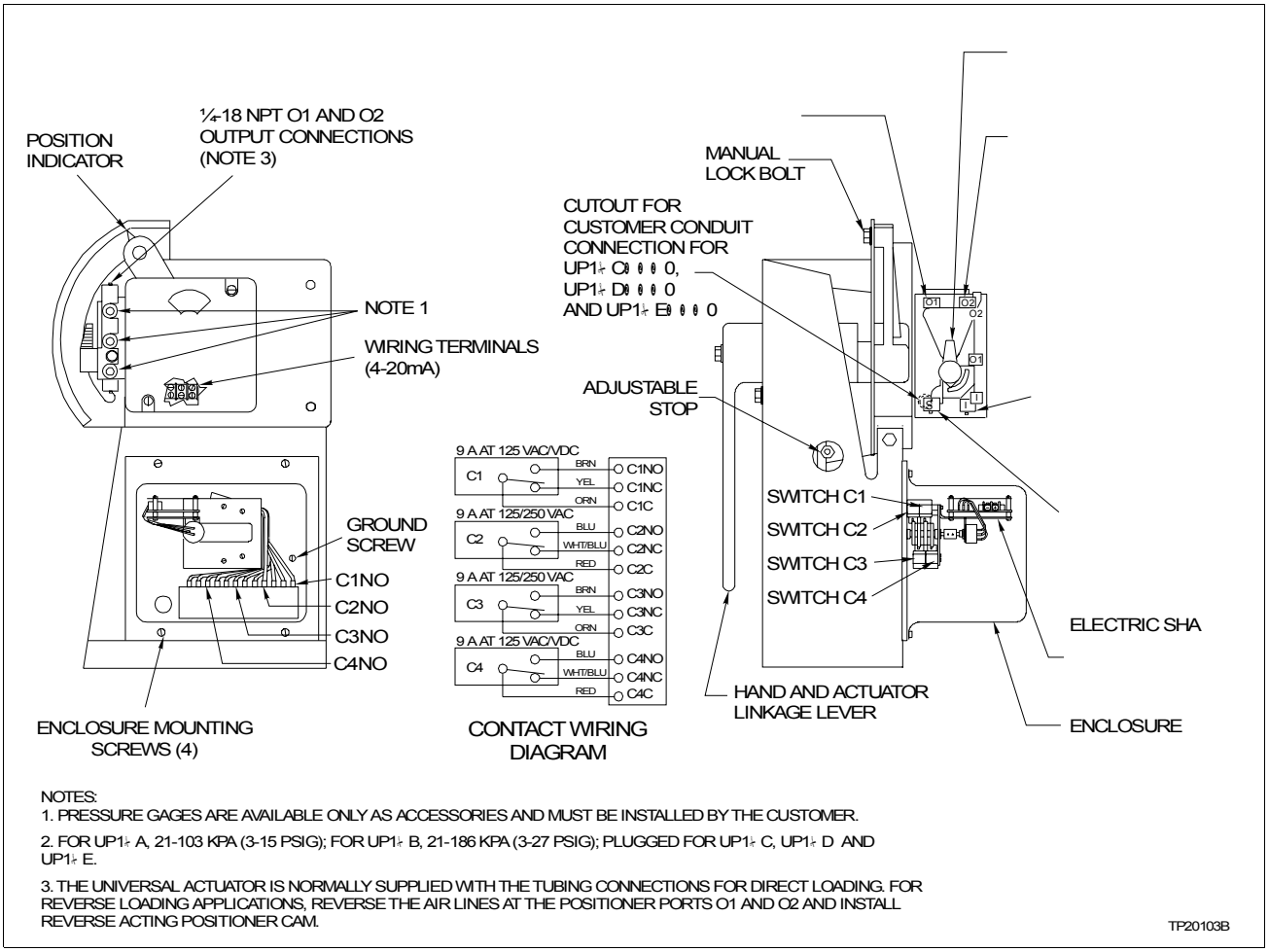



*Figure 3-1. Type UP1 Actuator with Type AV Positioner, Electric Shaft Position Transmitter and Alarm/Travel Switches*

### *Types UP3 and UP4 Actuator*

**NOTE:** Refer to Figure 3-3.

The Types UP3 and UP4 actuators have two removable side covers and a removable top cover.

#### *SIDE COVER*

1. Loosen the lock screws at the bottom of the side covers ¼-turn.

2. Release the link lock fasteners that secure the top cover to the side covers.

3. Release the link lock fasteners that secure the side covers to the actuator frame.

4. Remove the side covers by pulling down and outward from the bottom.

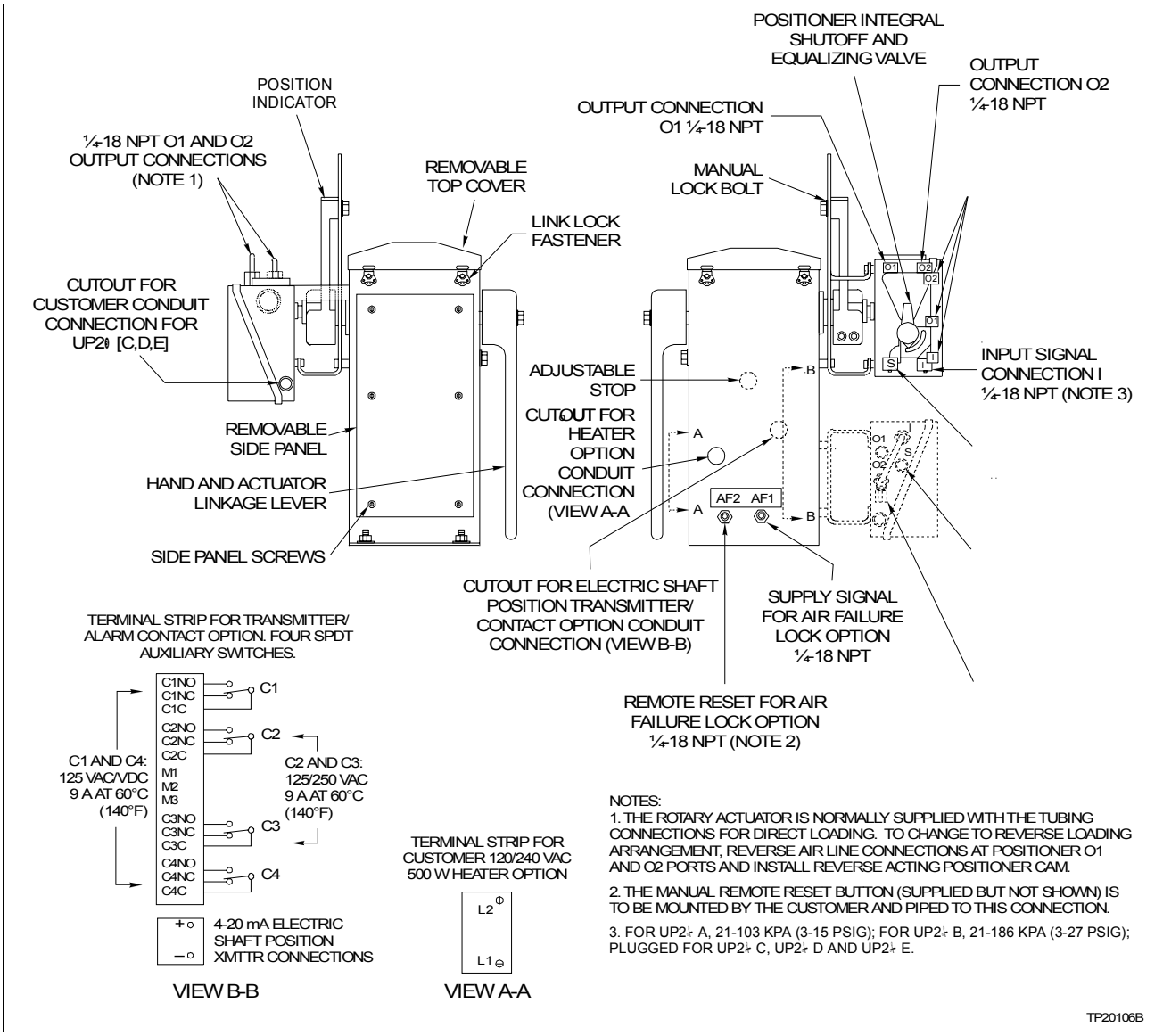



*Figure 3-2. Type UP2 Actuator with Type AV Positioner*

### *TOP COVER*

1. Remove the manual operator ratchet handle and the hand/auto transfer handle.

2. Unsnap the link lock fasteners holding the top cover to the side covers.

3. Remove the top cover.

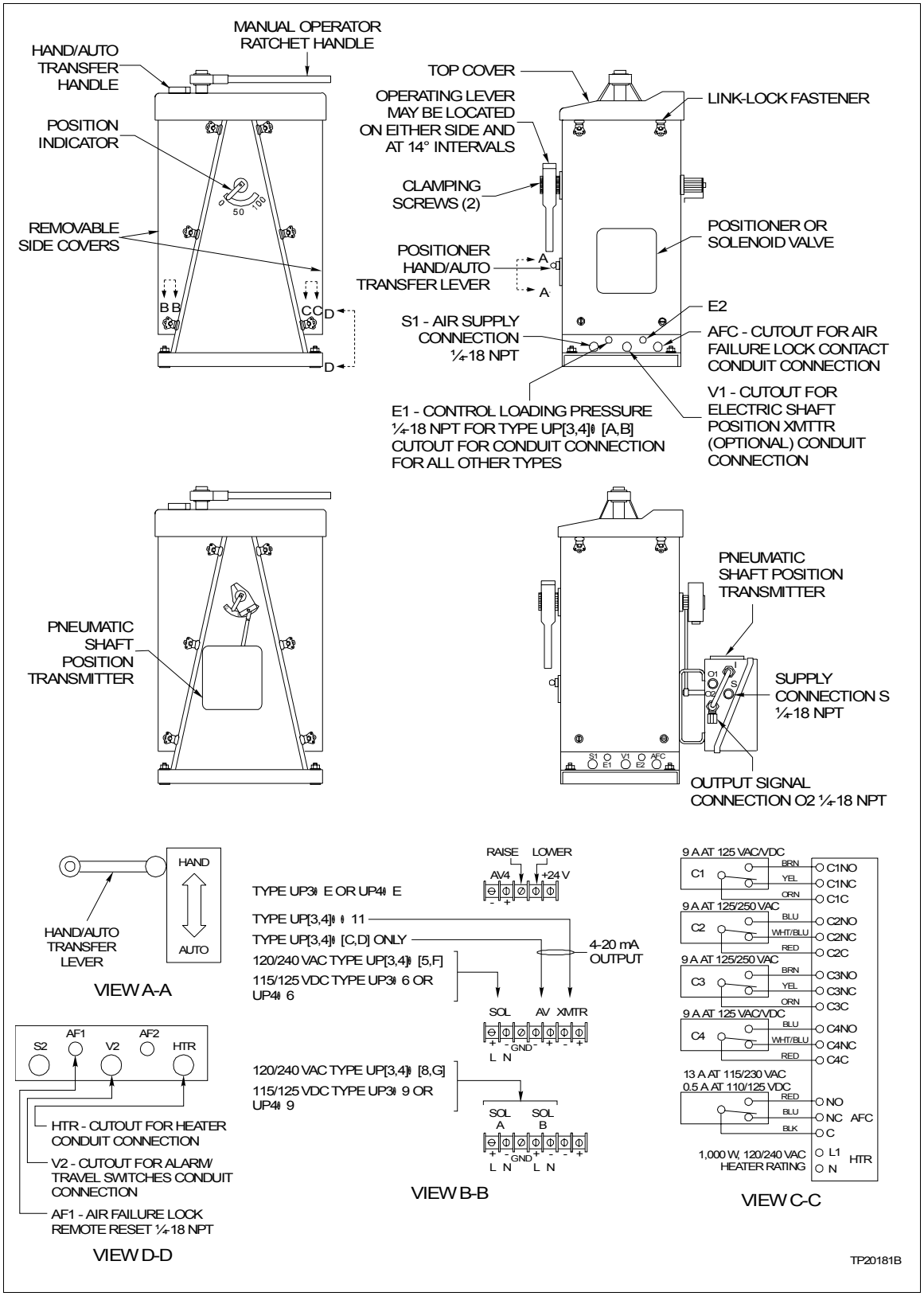



*Figure 3-3. Types UP3 and UP4 Actuators*

4. Types UP5 and UP6 Actuator Enclosure

**NOTE:** Refer to Figure 3-4.

Types UP5 and UP6 actuators have removable bottom side covers, top side covers, and a removable top cover.

***BOTTOM SIDE COVER***

1. Loosen the bottom side cover bolts.

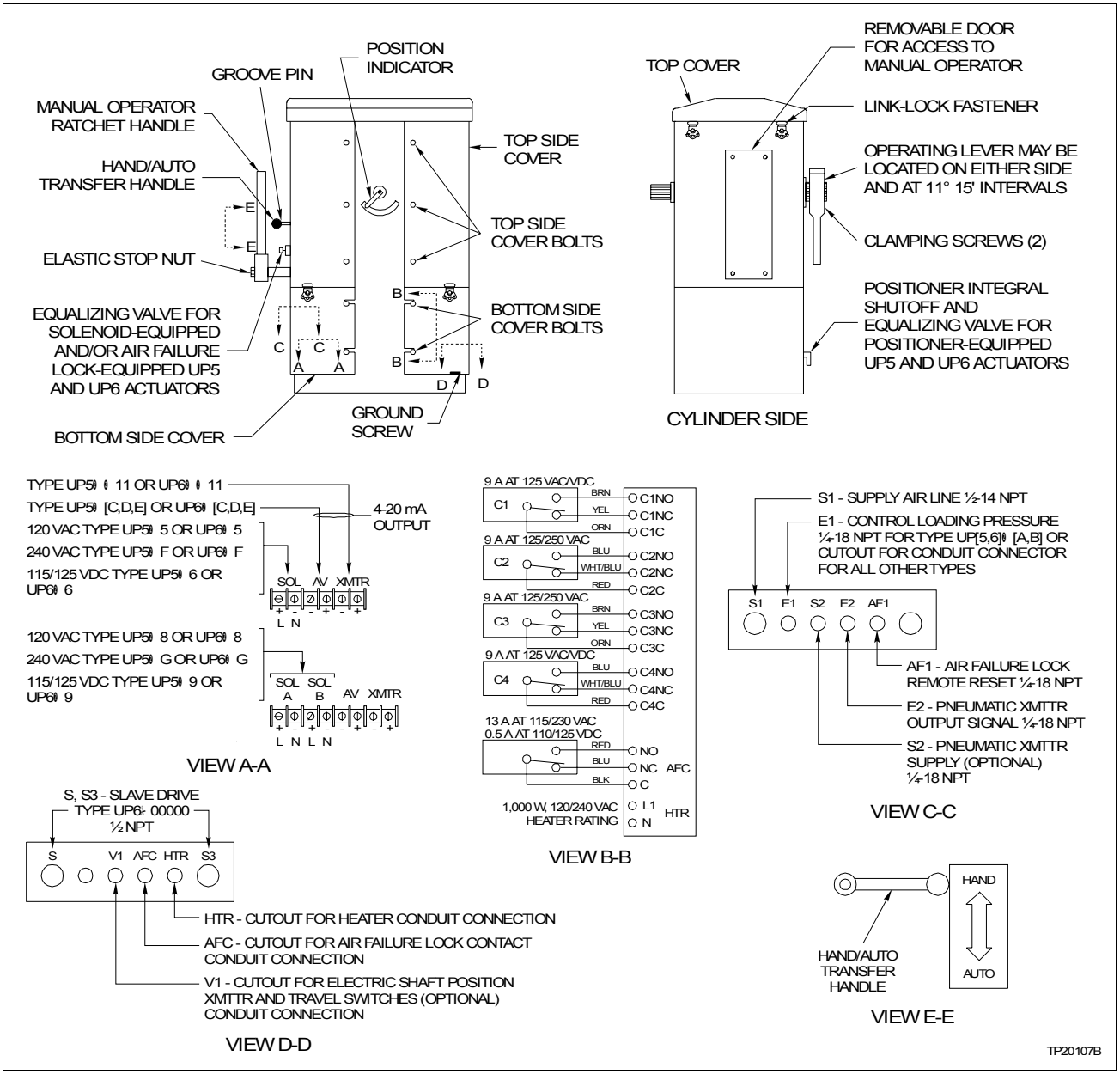



*Figure 3-4. Types UP5 and UP6 Actuators*

2. Unfasten the link lock fasteners that secure the bottom side covers to the top side covers.

3. Remove the bottom side covers by pulling down and outward on the panel.

### *TOP COVER*

1. Unsnap the link lock fasteners that secure the top cover to the top side covers.

2. Remove the top cover.

### *TOP SIDE COVER*

1. Remove the bottom side covers and top cover.

2. On the cylinder side of the actuator, loosen the top side cover bolts and lift the panel outward.

3. On the other side of the actuator, remove the manual operator ratchet handle and hand/auto transfer handle.

4. Loosen the top side cover bolts and lift the panel outward.

## *WIRING CONNECTIONS, TUBING CONNECTIONS AND CABLING*

These procedures describe wiring, tubing and cabling necessary to make the actuators operable.

### *Connecting Tubing*

Use suitable fittings and tubing sizes listed in Table 3-1 to make supply and signal connections. If supply regulation is needed, use the regulator data shown in Table 3-1. Refer to Figures 3-1 through 3-4 and 3-9 and 3-10 for the size and location of connections.

Refer to Table 3-2 for suggested maximum operating torque values versus minimum and maximum supply pressure. Refer to Figures 3-5 through 3-8 for data on operating torque and stall torque versus air supply pressure values. Use these graphs to select the air supply pressure necessary to get the required output torque. Keeping supply pressure at plus or minus five percent of the selected pressure requires no further supply regulation.

> **NOTE:** The primary units in these graphs are Newton meters and kilopascals. American units are in parentheses.

Installing a regulator with a flow capacity greater than or equal to those listed in Table 3-1 protects the driven device. It also prevents exceeding the maximum supply or operative limit of the actuator.

*Table 3-1. Tubing Sizes, Air Filters and Air Supply Regulators*

| Actuator Type | Min Supply Line Size (in.) | Signal Line Size (in.) | Regulator Part No.[1] | Regulator Capacity Approx $cm^3$/sec (scfm) | Supply Air Filter Part No.[2] |
|---|---|---|---|---|---|
| UP1 and UP2 | ¼ | ¼ | 1951029_5 ( ¼ NPT) or | 2,830 (6) | 5238563◦1<br>5238563◦2 |
| UP3 through UP6 | ½ | ¼ | 1951439◦1 ( ⅜ NPT) | 14,160 (30) | 5238563◦1<br>5238563◦2 |

**NOTES:**

1. A high capacity regulator is suggested for applications using Types UP5 and UP6 actuators where stroke speed is important.
2. In-line coalescing filter for removal of solid and liquid contaminants in compressed air. Filter comes with universal mounting bracket and grade DX filter that is 93% efficient at 0.1 microns. Part No. 5238563◦2 has an anodized aluminum bowl guard.

*Table 3-2. Suggested Maximum Operating Torque at Minimum and Maximum Supply Pressure Limits*

| Actuator Type | Min and Max Supply Pressure kPa (psig) | Max Operating Torque Nm (ft-lbs) |
|---|---|---|
| UP1 | 276 (40)<br>690 (100) | 54 (40)<br>122 (90) |
| UP2 | 276 (40)<br>690 (100) | 224 (165)<br>610 (450) |
| UP3 | 276 (40)<br>690 (100) | 441 (325)<br>1,085 (800) |
| UP4 | 276 (40)<br>690 (100) | 746 (550)<br>1,966 (1,450) |
| UP5 | 276 (40)<br>690 (100) | 1,437 (1,060)<br>3,796 (2,800) |
| UP6 | 276 (40)<br>690 (100) | 2,576 (1,900)<br>6,372 (4,700) |

### *Connecting Wiring*

Be sure all wiring and electrical connections comply with the local, National Electrical Code or Canadian Electrical Code.

### *Grounding*

It is the responsibility of the customers and/or their installation/wiring contractor to insure that the actuator, other associated control or test equipment and all exposed conductive materials are properly grounded in accordance with local, National Electrical Code or Canadian Electrical Code regulations. In addition, insure that they are not a hazard, including under fault conditions, to operation and service personnel.

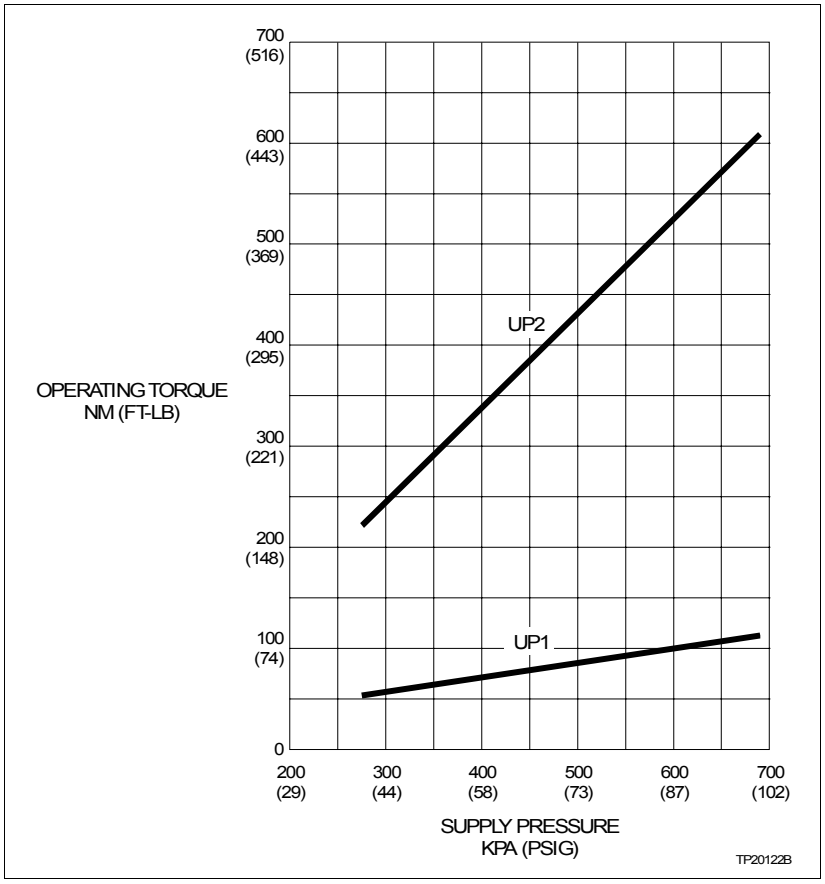



*Figure 3-5. Operating Torque Versus Air Supply Pressure (Types UP1 and UP2 Actuators)*

The actuators have a connection for a grounding conductor. Do not use it as a common point for other electrical equipment.

**NOTES:**

1. Because of the prevailing differences in soil conditions throughout the world and differences in acceptable practices, it is not within the scope of this instruction to describe grounding electrode systems. It is the responsibility of the customer to insure that a grounding electrode system that is acceptable to the local building and wiring codes exists at the facility where the actuator is to be installed.

2. The NEC, Article 250, Section H, details requirements for grounding electrode systems acceptable in the United States. The CEC, Section 10, paragraphs 700 through 712, details the requirements for grounding electrode systems acceptable in Canada.

3. The structural metal frame of a building shall not be used as the required equipment grounding conductor for the actuators.

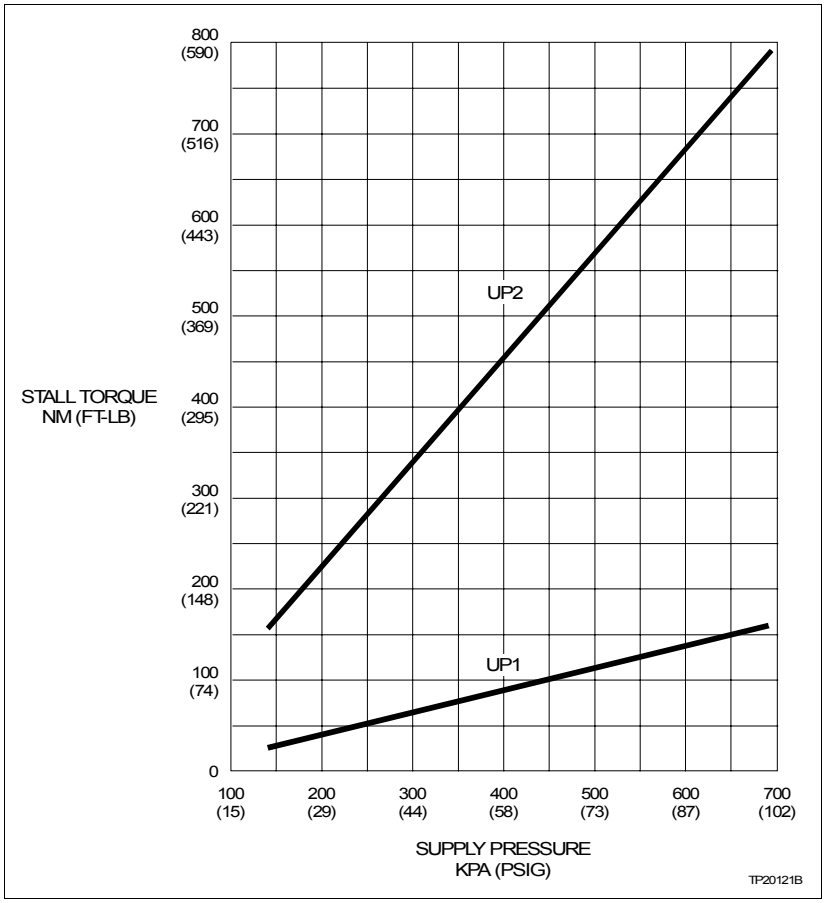



*Figure 3-6. Stall Torque Versus Air Supply Pressure (Types UP1 and UP2 Actuators)*

### *Air Quality*

**NOTE:** Installing a filter in the air supply line prevents entrained moisture or dirt from entering the positioner. Refer to Table 3-1 for the air filter part number.

1. Follow the air quality guidelines of ISA S7.3, ***Quality Standard for Instrument Air***.

2. Keep the oil content of the air as low as possible, with a maximum of one part per million.

3. Particle size in the air should not exceed three microns.

4. Keep the dew point at line pressure at least 10°C (18°F) below minimum ambient temperature.

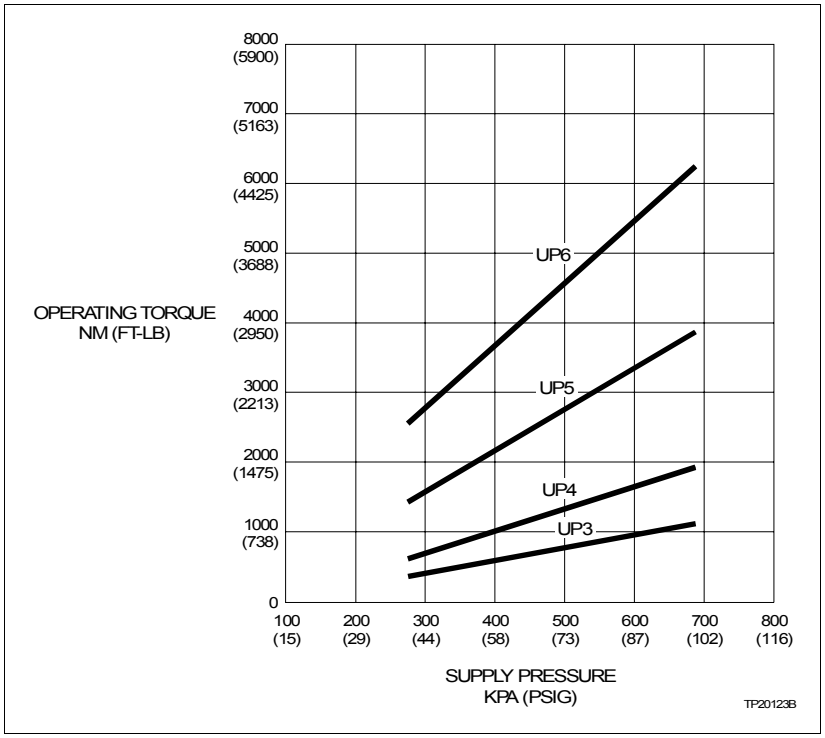



*Figure 3-7. Operating Torque Versus Air Supply Pressure (Types UP3, UP4, UP5 and UP6 Actuators)*

## *Characterizable Pneumatic Positioner Tubing*

Tubing for the Type AV1 Characterizable Pneumatic Positioner differs slightly depending on the actuator. If the actuator supplied includes the air failure lock, refer to ***Air Failure Lock Tubing***.

### *TYPES UP1 AND UP2 ACTUATORS*

**NOTE:** Refer to Figures 3-1 And 3-2.

1. Connect the supply pressure line directly to the S port on the positioner.

2. Connect the control loading pressure directly to the I port on the positioner (pneumatic input only).

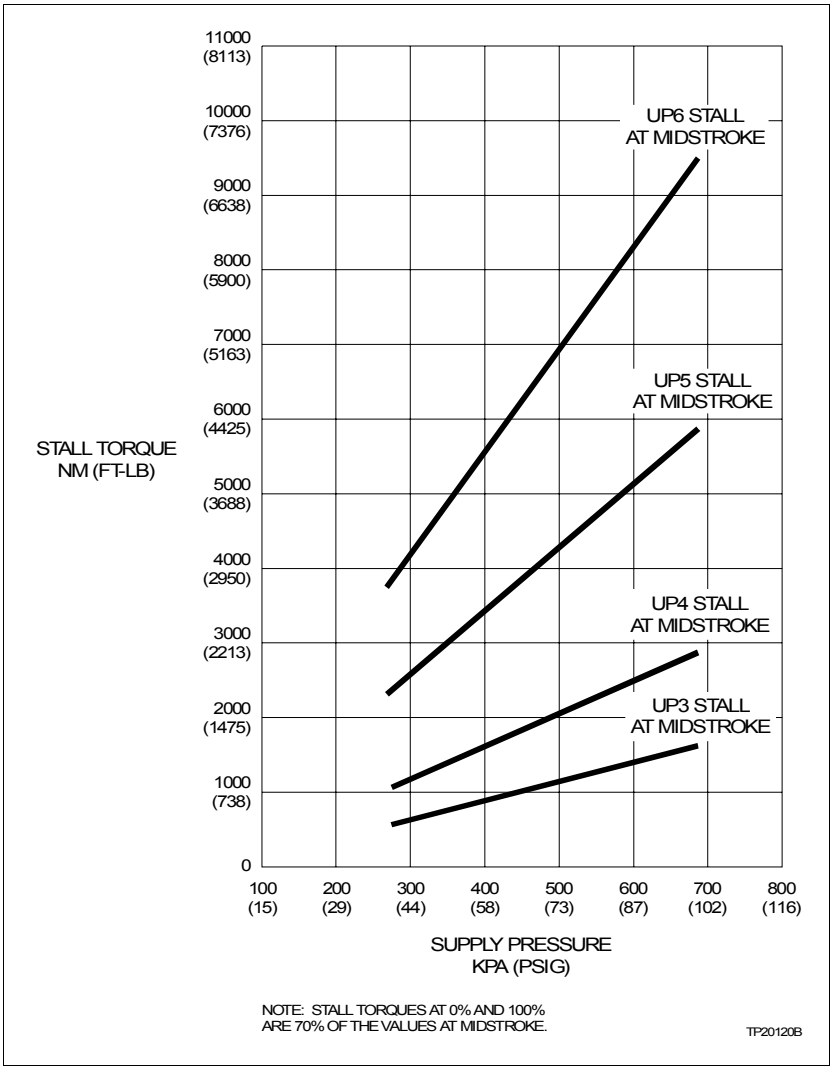



*Figure 3-8. Stall Torque at Midstroke Versus Air Supply Pressure (Types UP3, UP4, UP5 and UP6 Actuators)*

### *TYPES UP3 AND UP4 ACTUATORS*

**NOTE:** Refer to Figure 3-3.

1. Connect the supply pressure line directly to the S1 port at the base of the actuator.

2. Connect the control loading pressure directly to the E1 port at the base of the actuator.

### *TYPES UP5 AND UP6 ACTUATORS*

**NOTE:** Refer to Figure 3-4.

1. Connect the supply pressure line directly to the S1 port at the base of the actuator.

2. Connect the control loading pressure directly to the E1 port at the base of the actuator.

### *Characterizable I/P Positioner Tubing and Wiring*

Tubing for Types AV2 and AV3 Characterizable I/P Positioners differs slightly depending on the actuator. If the actuator supplied includes the air failure lock, refer to ***Air Failure Lock Tubing***.

#### *TYPES UP1 AND UP2 ACTUATORS*

**NOTE:** Refer to Figures 3-1 And 3-2.

1. Connect the supply pressure line directly to the S port on the positioner.

2. The I port is plugged.

3. There is a conduit connection on the side of the positioner housing for signal wiring with a cross-sectional area of 0.32 to 1.30 square millimeters (22 to 16 AWG). A twisted shielded pair is recommended for signal wiring. Refer to the ***Characterizable Positioner Type AV1, AV2, AV3, AV4 specification*** for the wiring procedure.

#### *TYPES UP3 AND UP4 ACTUATORS*

**NOTE:** Refer to Figure 3-3.

1. Connect the supply pressure line directly to the S1 port at the base of the actuator.

2. A conduit connection, E1, is provided at the actuator base for signal wiring to the I/P positioner. All power to the positioner is supplied over the signal wiring. Use shielded or non-shielded wire with a cross-sectional area of 0.2 to 2.1 square millimeters (24 to 14 AWG) for the control signal to the positioner.

3. Remove the side cover on the positioner side of the actuator as described in ***ENCLOSURE REMOVAL***.

4. Feed the wires through the conduit connection and connect them to the terminal block AV+ and AV- positions.

5. Replace the side cover.

### *TYPES UP5 AND UP6 ACTUATORS*

**NOTE:** Refer to Figure 3-4.

1. Connect the supply pressure line directly to the S1 port at the base of the actuator.

2. A conduit connection, E1, is provided at the actuator base for signal wiring to the I/P positioner. All power to the positioner is supplied over the signal wiring. Use shielded or non-shielded wire with a cross-sectional area of 0.2 to 2.1 square millimeters (24 to 14 AWG) for the control signal to the positioner.

3. Remove the bottom side cover as described in ***ENCLOSURE REMOVAL***.

4. Feed the wires through the conduit connection and connect them to the terminal block AV+ and AV- positions.

5. Replace the bottom side cover.

## *Solenoid Tubing and Wiring*

Solenoid tubing and wiring differs slightly depending on the actuator. If the actuator supplied includes the air failure lock, refer to ***Air Failure Lock Tubing***.

### *TYPES UP1 AND UP2 ACTUATORS*

**NOTE:** Refer to Figures 3-9 And 3-10.

1. Types UP1 and UP2 actuators have a conduit connection provided on the solenoid valve for electrical hookup.

2. The solenoid wires (AC or DC) have no color coding or polarity markings. Use either wire for positive (+).

3. Connect the supply pressure line directly to the P port on the solenoid valve.

### *TYPES UP3 AND UP4 ACTUATORS*

**NOTE:** Refer to Figure 3-3.

1. Connect the supply pressure line directly to the S1 port at the base of the actuator.

2. A conduit connection, E1, is provided at the actuator base for solenoid valve wiring (AC or DC).

3. Remove the side cover on the solenoid side of the actuator as described in ***ENCLOSURE REMOVAL***.

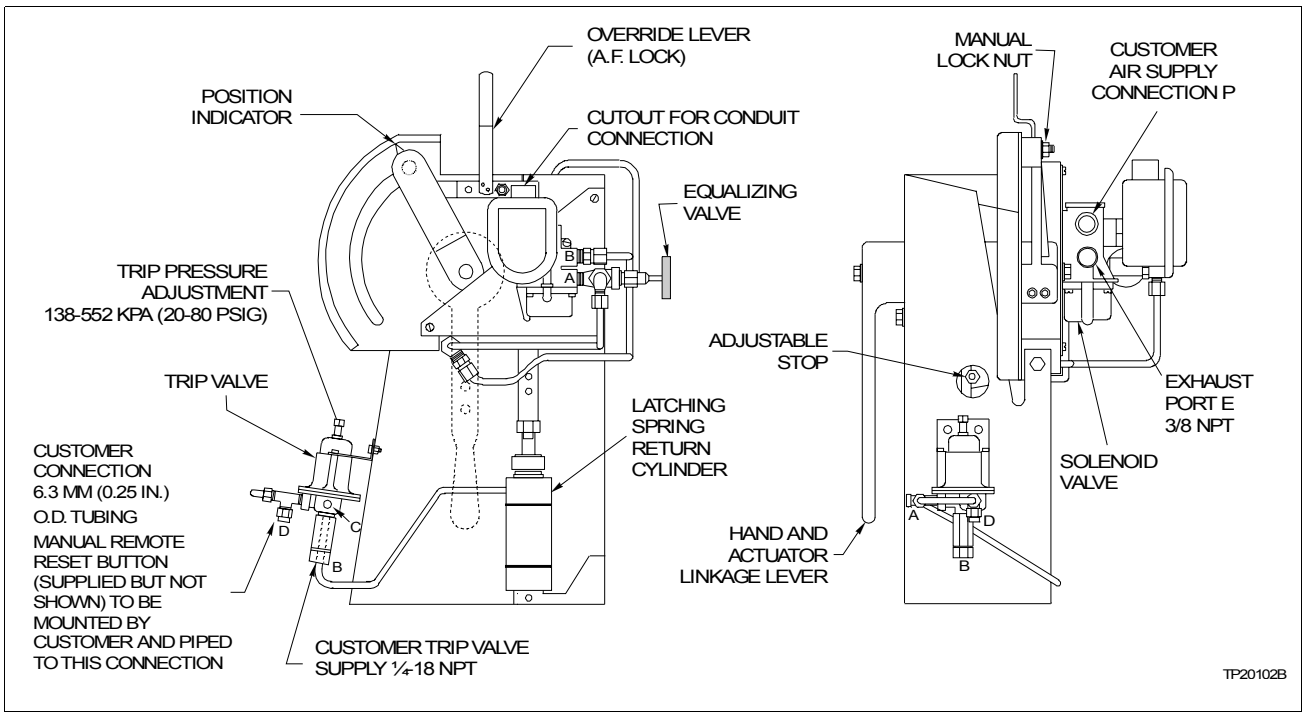



*Figure 3-9. Type UP1 Actuator with Solenoid Valve and Air Failure Lock*

4. Feed the wires through the conduit connection and connect them to the terminal block solenoid positions. The solenoid wires are not color coded or marked for polarity. Either wire can be used for positive (+).

5. Connect a grounding wire to the termination provided.

6. Replace the side cover.

### *TYPES UP5 AND UP6 ACTUATORS*

**NOTE:** Refer to Figure 3-4.

1. Connect the supply pressure line directly to the S1 port at the base of the actuator.

2. A conduit connection, E1, is provided at the actuator base for solenoid valve wiring (AC or DC).

3. Remove the bottom side cover on the solenoid side of the actuator as described in ***ENCLOSURE REMOVAL***.

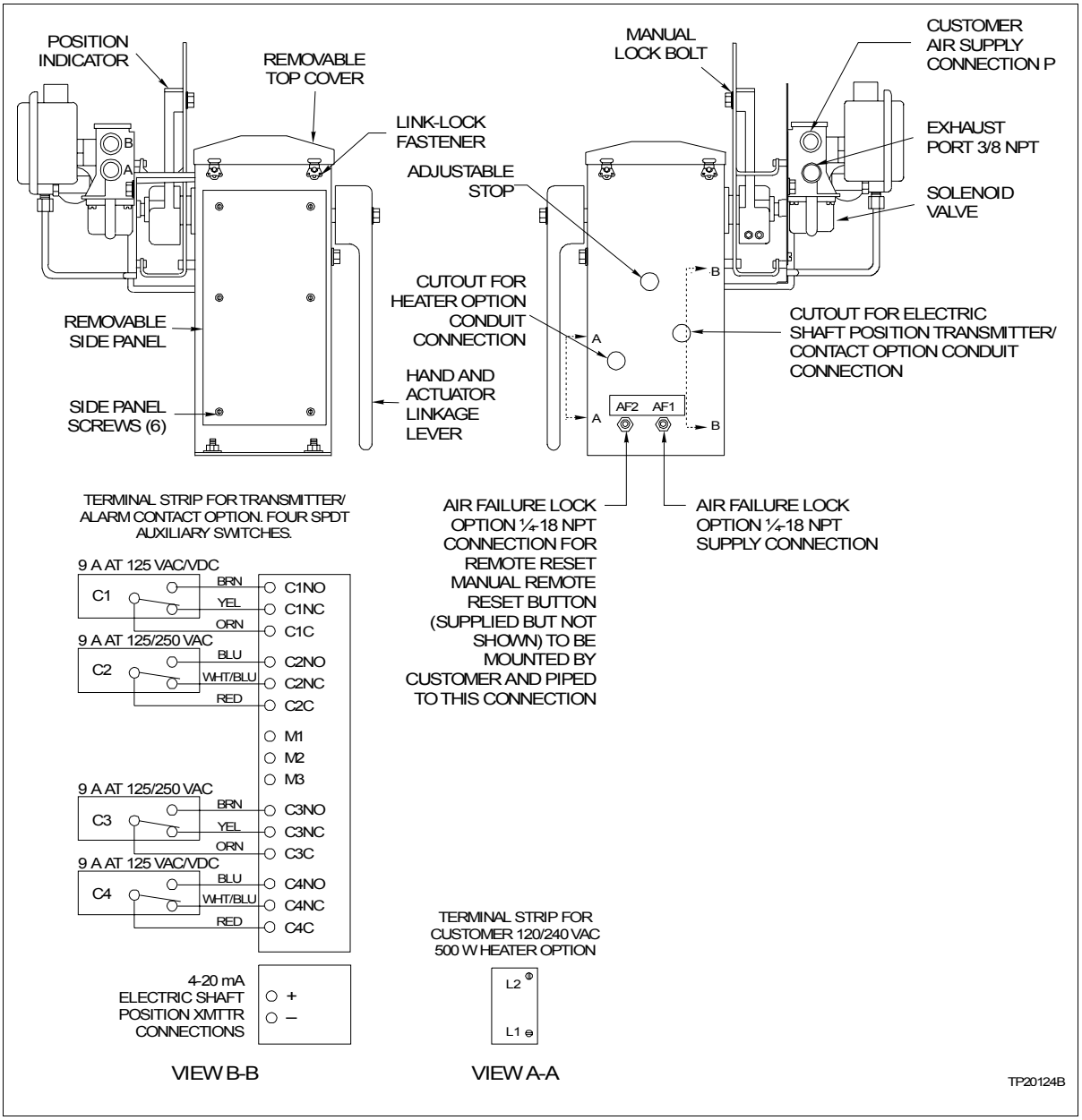



*Figure 3-10. Type UP2 Actuator with Solenoid Valve*

4. Feed the wires through the conduit connection and connect them to the terminal block solenoid positions. The solenoid wires are not color coded or marked for polarity. Either wire can be used for positive (+).

5. Connect a grounding wire to the termination provided.

6. Replace the bottom side cover.

### *Master/Slave Tubing Connections for Type UP6 Actuators*

**NOTES:**
1. Refer to Figure 3-11 and Table 3-3.

2. This installation requires the use of an installation kit (supplied as part of the slave drive), kit number 258458◦1.

1. To drive a common load, connect the master and slave actuators in parallel.

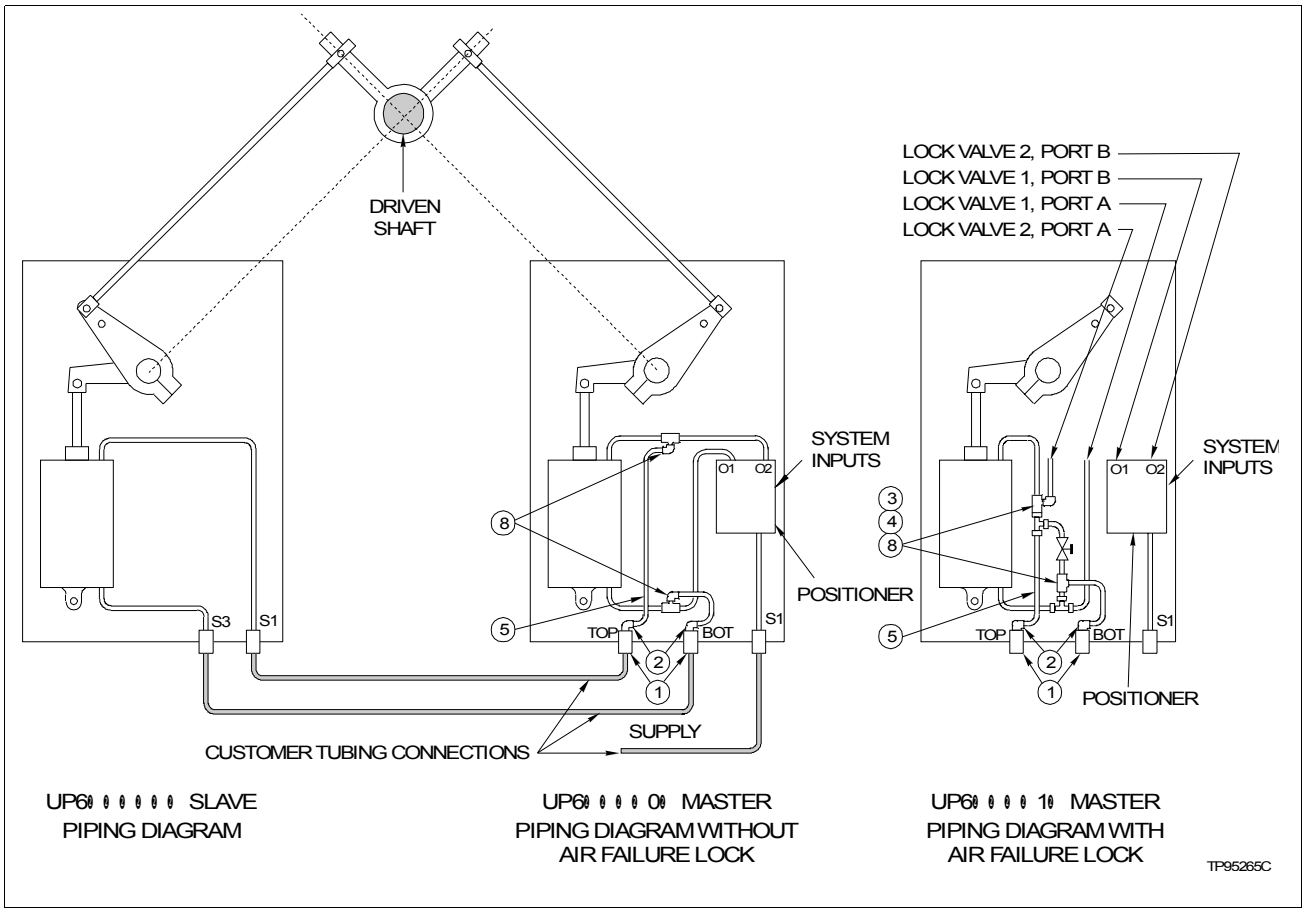



*Figure 3-11. Master/Slave Tubing Connections*

2. Be sure both actuators are properly aligned so they work together, without binding, throughout the stroke.

*Table 3-3. Master/Slave Installation Kit (Kit No. 258458_1)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 2 | 1952621_1 | ½ bulkhead fitting |
| 2 | 2 | 8-8CBI2-B | ½ tubing elbow |
| 3 | 2 | — | ⅜-18 NPT brass female tee |
| 4 | 2 | — | ⅜-18 NPT brass close nipple |
| 5 | 2 | R9021-0050 | 152 cm (60 in.) 0.50 OD tubing |
| 8 | 2 | 5323705_1 | ½ tubing elbow |

3. The total volume displacement for both actuators is 41,200 $cm^3$ (2,514 $in.^3$).

4. A supply delivery capacity of 11,800 $cm^3$/sec (25 scfm) or more is desirable, unless some decrease in stroke speed can be allowed.

5. Connect the supply air line directly to the S1 port at the base of the master actuator.

6. Refer to ***ENCLOSURE REMOVAL*** and remove the top and side covers of the master actuator.

7. If the master actuator has the air failure lock option, perform Steps 8 through 11. If the master actuator does not have the air failure lock option, go to Step 12.

8. Remove the bypass valve air line fittings from the tees in the cylinder air lines.

9. Install a second female tee into the two existing tees using the close nipples (supplied).

10. Connect the bypass valve air lines to one of the open ports in each added tee.

11. Go to Step 13.

12. Remove the pipe plugs from the tees in the cylinder air lines.

13. Install two bulkhead fittings in the two available conduit knockouts at the base of the master. The knockouts have ½-14 NPT internal threads.

14. Connect ½-inch OD nylon tubing between each bulkhead fitting and the tees in the cylinder air lines using the four elbow tube fittings supplied.

15. Route and tie down the tubing so it clears all moving parts.

16. Label the bulkhead fittings to identify the one that tees into the top of the cylinder and the one that tees into the bottom of the cylinder. The external ends of the bulkhead fittings are female ½ NPT.

17. Use ½-inch minimum air lines to connect the master and slave actuators.

18. Hook up the two air lines connecting the master and slave actuators so cylinder forces (output torques) aid each other. Polarity of this connection varies for each installation. It depends on the physical setup of the actuators and how the linkage connects.

19. On the slave actuator, S1 goes to the top of the cylinder, and S3 goes to the bottom of the cylinder.

Increased pressure on the top of the cylinder causes the output shaft on the left side (when facing the hand crank end) to rotate counterclockwise. Rotation on the master actuator is the same. Increased pressure on the bottom of the cylinder causes the output on the right side (when facing the hand crank end) to rotate clockwise. Rotation on the master actuator is the same.

To change from direct to reverse loading, refer to ***Control Loading Arrangements***.

## *INSTALLATION OF OPTIONAL EQUIPMENT*

These procedures describe the tubing, wiring and cabling necessary to make the various options operable.

### *Reserve Air Tank Tubing and Wiring*

**NOTE:** The reserve air tank option is not available for Type UP1 actuators.

All tubing connections inside the actuator for the optional reserve air tank are completed before shipment. External tubing consists of connecting the air tank to the supply air line and actuator.

#### *TYPE UP2 ACTUATORS*

**NOTE:** Refer to Figures 3-12 and B-11

1. Securely install the reserve air tank as close to the actuator as possible in a vibration-free location where the reserve air tank and air lines will not be damaged.

2. Using ¼-inch OD tubing, connect the customer air supply to the tee fitting at the S port on the positioner or the P port on the solenoid valve.

3. Using ¼-inch OD tubing, connect the inlet port on the reserve air tank to the check valve fitting on the positioner or solenoid valve.

4. Using ¼-inch OD tubing, connect the outlet port on the reserve air tank to the C port on either the upper or lower 3-way valve. The output shaft of the actuator can be rotated to either the 0% or 100% position with either connection.

**NOTE:** The unused C port must remain open to vent air.

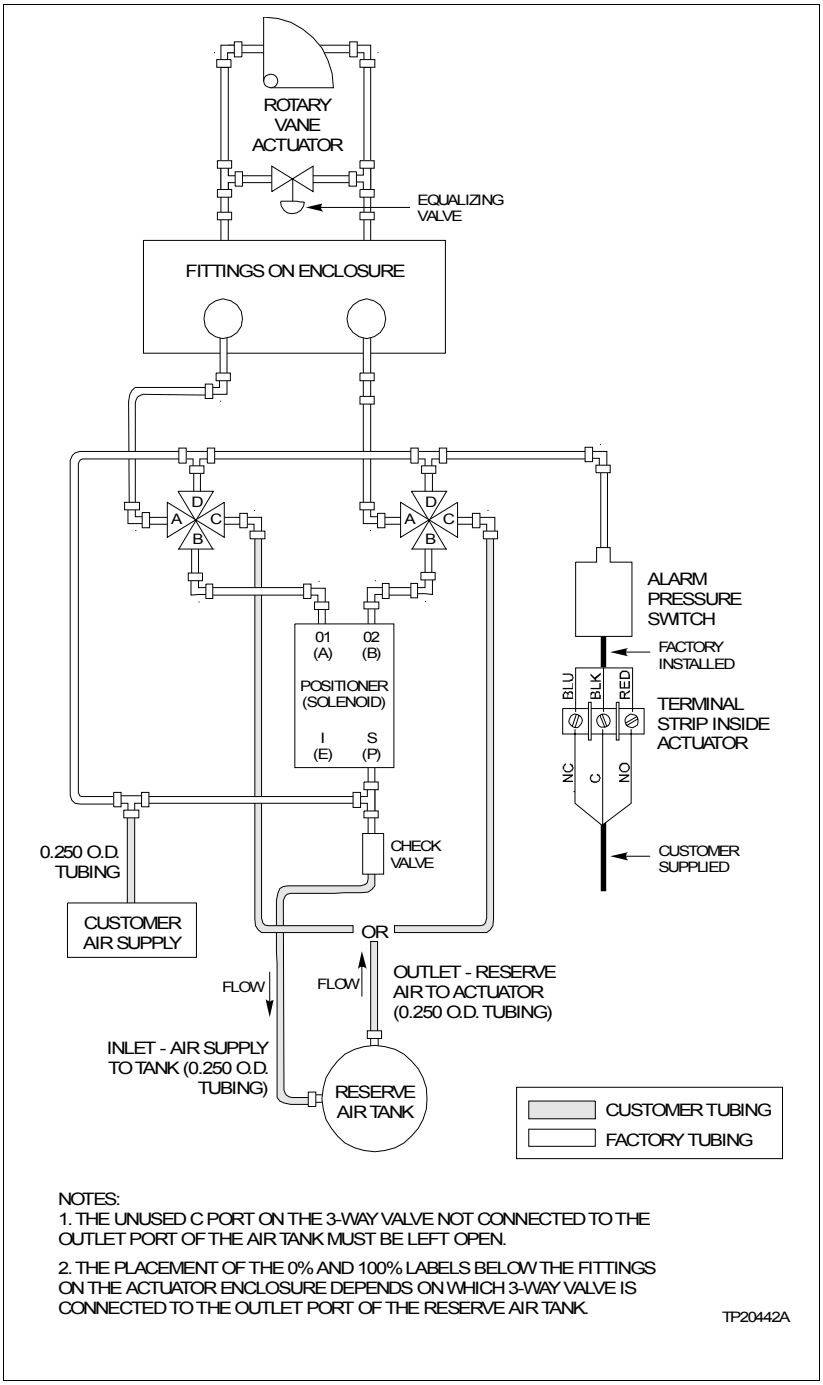



*Figure 3-12. Reserve Air Tank Tubing for Type UP2 Actuators*

5. A designation label is supplied with the reserve air tank kit. One half is marked 0% and the other half is marked 100%. Cut the label in half and apply the 0% and 100% designations below the bulkhead fittings on the actuator frame that correspond to the 0% and 100% output shaft travel limits.

6. An alarm pressure switch and terminal block are installed inside the actuator for an external air failure alarm, indicator, etc. Refer to ***Type UP2 Actuator*** and remove the cover necessary to access the terminal block.

7. Run the wires for the external alarm through one of the holes in the actuator enclosure and connect them as shown in Figure 3-12.

8. Replace the actuator cover.

### *TYPES UP3 THROUGH UP6 ACTUATORS*

**NOTE:** Refer to Figures 3-13, B-12 and B-13.

1. Securely install the reserve air tank as close to the actuator as possible in a vibration-free location where the air tank and air lines will not be damaged.

2. Using ½-inch OD tubing, connect the customer air supply directly to the S1 port on the actuator.

3. Using ½-inch OD tubing, connect the inlet port on the reserve air tank to the S2 port on the actuator.

4. Using ¼-inch OD tubing, connect the outlet port on the reserve air tank to the actuator. Select one of the following:

- For the cylinder piston to be driven to the full down position upon loss of pressure from the supply line, connect to the CYL DN port on the actuator.

  **NOTE:** The CYL UP connection must remain open to vent air from the bottom of the cylinder.

***- or -***

- For the cylinder piston to be driven to the full up position upon loss of pressure from the supply line, connect to the CYL UP port on the actuator.

  **NOTE:** The CYL DN connection must remain open to vent air from the top of the cylinder.

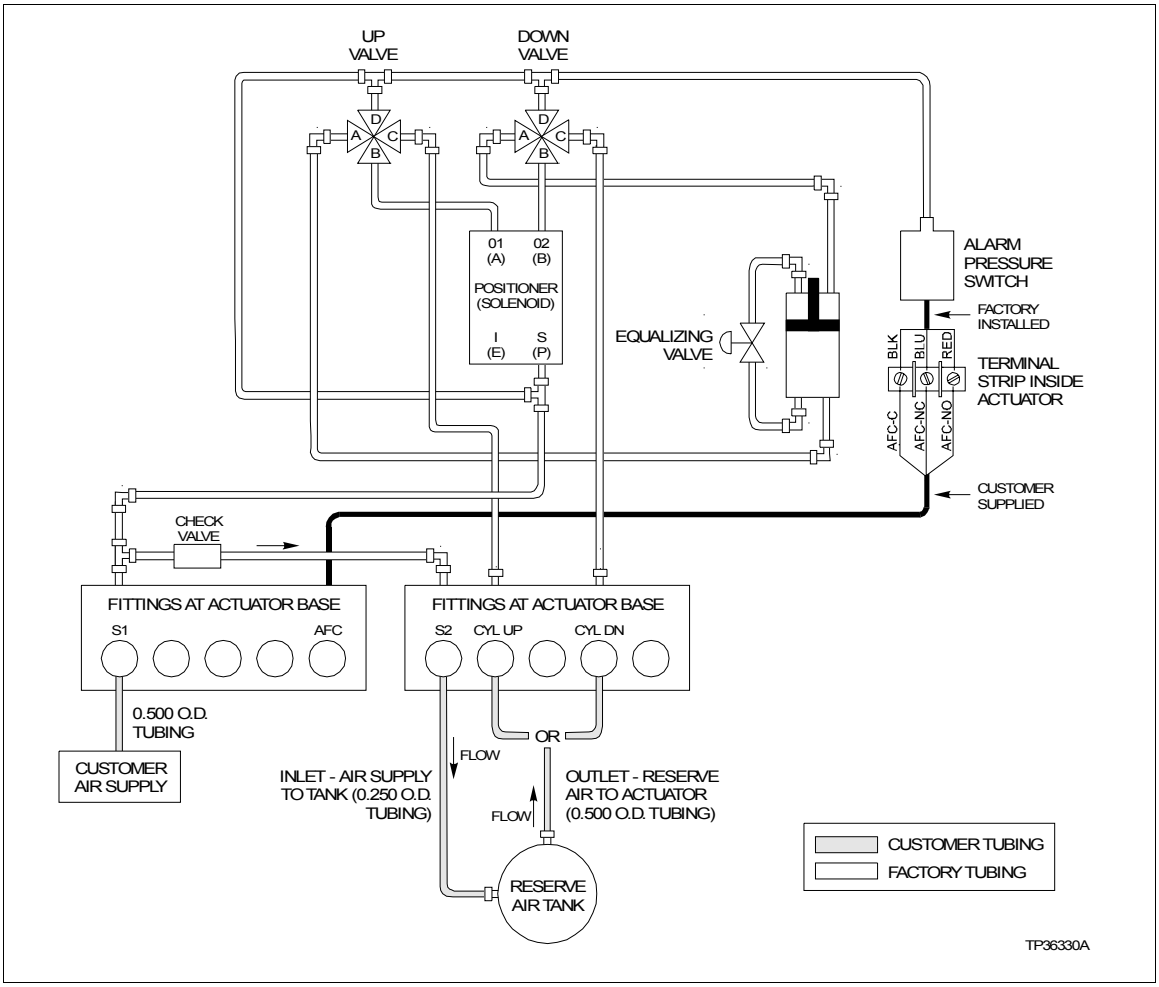



*Figure 3-13. Reserve Air Tank Tubing for Types UP3 through UP6 Actuators*

5. An alarm pressure switch and terminal block are installed inside the actuator for an external air failure alarm, indicator, etc. Refer to ***Types UP3 and UP4 Actuator*** or ***Types UP5 and UP6 Actuator Enclosure*** and remove the covers necessary to access the terminal block.

6. A conduit connection, AFC, is provided at the actuator base for access to the air failure contacts. Feed the wiring through this connection.

7. Make the connections to the proper points on the terminal strip as shown in Figure 3-13.

8. Replace the actuator covers.

### *Air Failure Lock Tubing*

There are two possible tubing arrangements for actuators with the optional air failure lock.

- ***Automatic Reset.*** The air failure lock automatically resets when the air supply exceeds the trip valve setting.

- ***Remote Reset.*** The air failure lock remains tripped until deliberately reset via a reset switch as supplied (shown in Fig. 3-14) or a normally closed solenoid valve (not supplied).

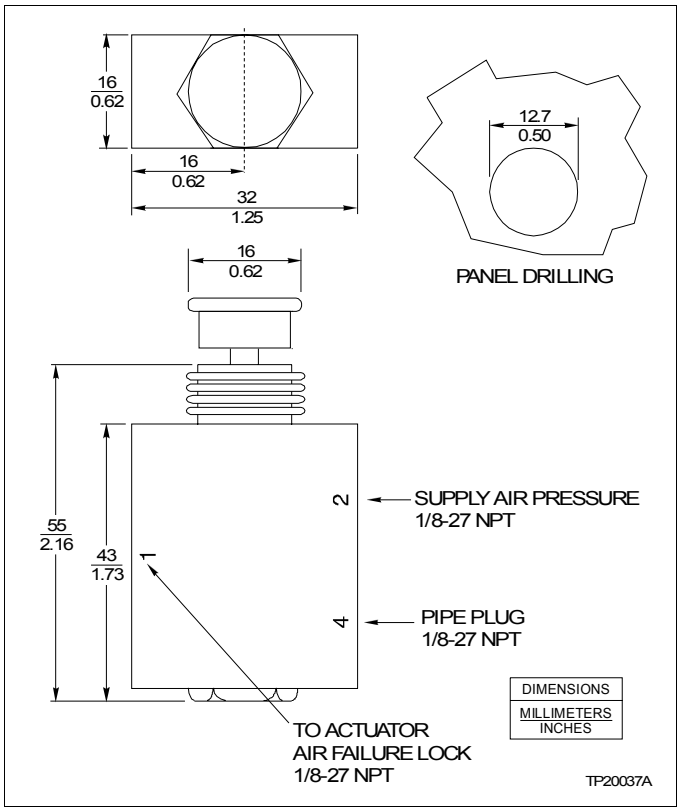



*Figure 3-14. Reset Switch for Air Failure Lock (Part Number 19515895°1)*

### *TYPE UP1 ACTUATOR*

**NOTES:**

1. Refer to Figures 3-9, 3-14 and 3-15.

2. The reset switch and pipe plug are located in a drawstring bag attached to the actuator frame.

### *Automatic Reset*

1. Connect the customer air supply directly to port B of the trip valve.

2. Connect the customer air supply also to port D on the trip valve.

### *Remote Reset*

1. Connect the customer air supply directly to port B of the trip valve.

2. Install the reset switch in a suitable location. Refer to Figure 3-14 for the dimensions.

3. Connect port 1 on the reset switch to port D on the trip valve.

4. Connect the customer air supply also to port 2 on the reset switch.

5. Install the pipe plug into port 4 of the reset switch.

### *Alarm Pressure Switch Installation*

**NOTE:** Refer to Figures 3-9 and 3-15.

If desired, connect a pressure switch (part number 1941099◦2 or equivalent) to sound an alarm or for status lights to indicate a loss of air supply.

1. Connect a tee between port 1 of the reset switch and port D of the trip valve.

2. Run tubing from the open end of the tee to the pressure switch.

3. Wire the switch to a terminal block or directly to the alarm as shown in Figure 3-15.

### *TYPE UP2 ACTUATOR*

**NOTES:**
1. Refer to Figures 3-10, 3-14 and 3-16.

2. The reset switch and pipe plug are located in a drawstring bag attached to the actuator frame.

### *Automatic Reset*

1. Connect the customer air supply directly to the AF1 port on the actuator enclosure.

2. Connect the customer air supply also to the AF2 port on the actuator enclosure.

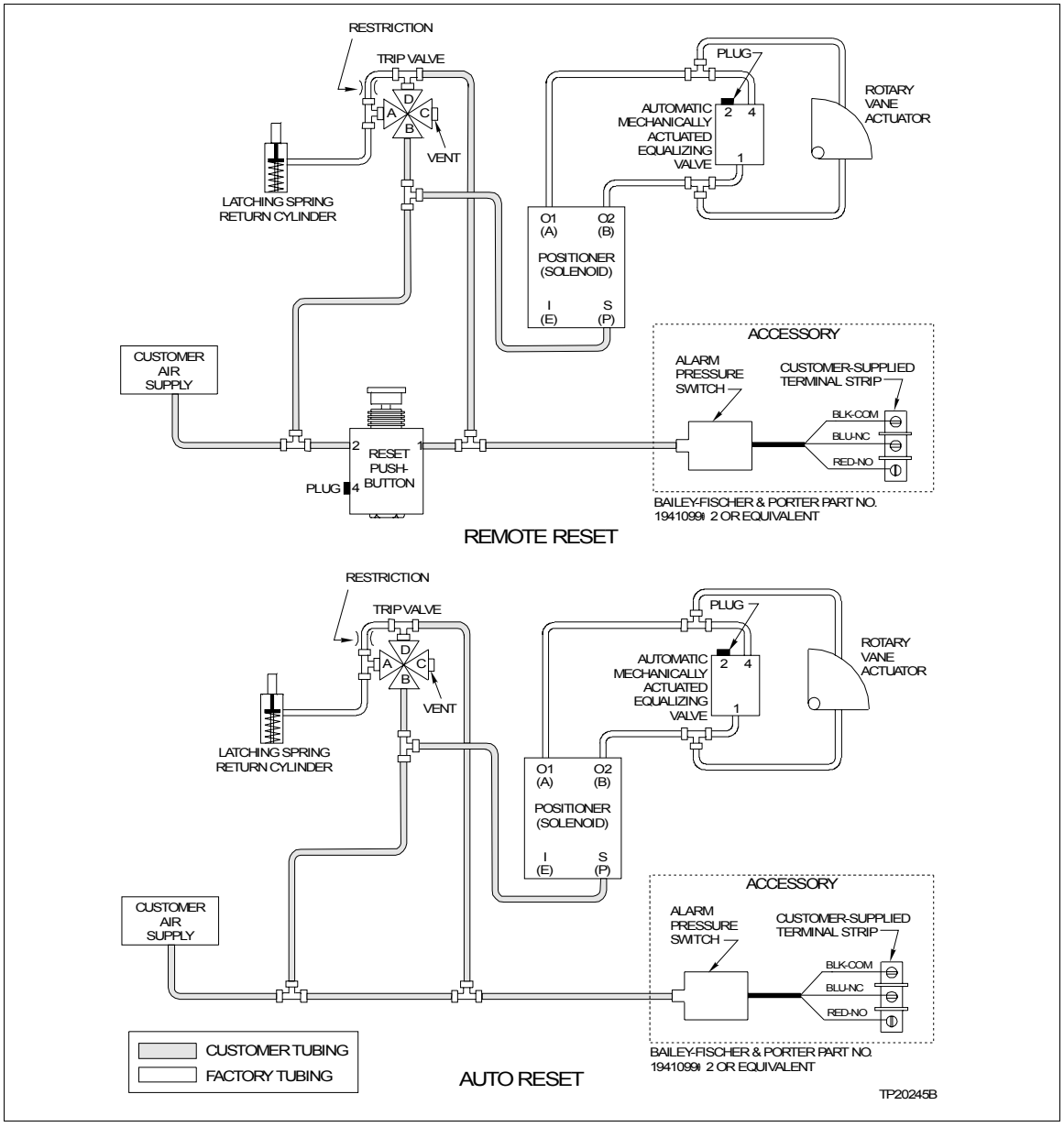



*Figure 3-15. Tubing Schematic for Type UP1 Actuator with Air Failure Lock*

***Remote Reset***

1. Install the pipe plug into port 4 of the reset switch.

2. Install the reset switch in a suitable location. Refer to Figure 3-14 for the dimensions.

3. Install a tee into the air supply line.

4. Run tubing from one outlet of the tee to port 2 of the reset switch and from the other outlet of the tee to the AF1 port on the actuator frame.

5. Run tubing from port 1 of the reset switch to the AF2 port on the actuator frame.

### *Alarm Pressure Switch Installation*

**NOTE:** Refer to Figures 3-10 and 3-16. If desired, connect a pressure switch (part number 1941099_2 or equivalent) to sound an alarm or for status lights to indicate a loss of air supply.

1. Connect a tee between port 1 of the reset switch and the AF2 port on the actuator frame.

2. Run tubing from the open end of the tee to the pressure switch.

3. Wire the switch to a terminal block or directly to the alarm as shown in Figure 3-16.

### *TYPES UP3 AND UP4 ACTUATORS*

**NOTES:**
1. Refer to Figures 3-3 and 3-17.

2. The reset switch and pipe plug are located in a drawstring bag attached to the actuator frame.

### *Automatic Reset*

1. Connect the customer air supply directly to the S1 port on the actuator enclosure.

2. Connect the customer air supply also to the AF1 port on the actuator enclosure.

### *Remote Reset*

1. Install the pipe plug into port 4 of the reset switch.

2. Install the reset switch in a suitable location. Refer to Figure 3-14 for the dimensions.

3. Install a tee into the air supply line.

4. Run tubing from one outlet of the tee to port 2 of the reset switch and from the other outlet of the tee to the S1 port at the base of the actuator.

5. Run tubing from port 1 of the reset switch to the AF1 port at the base of the actuator.

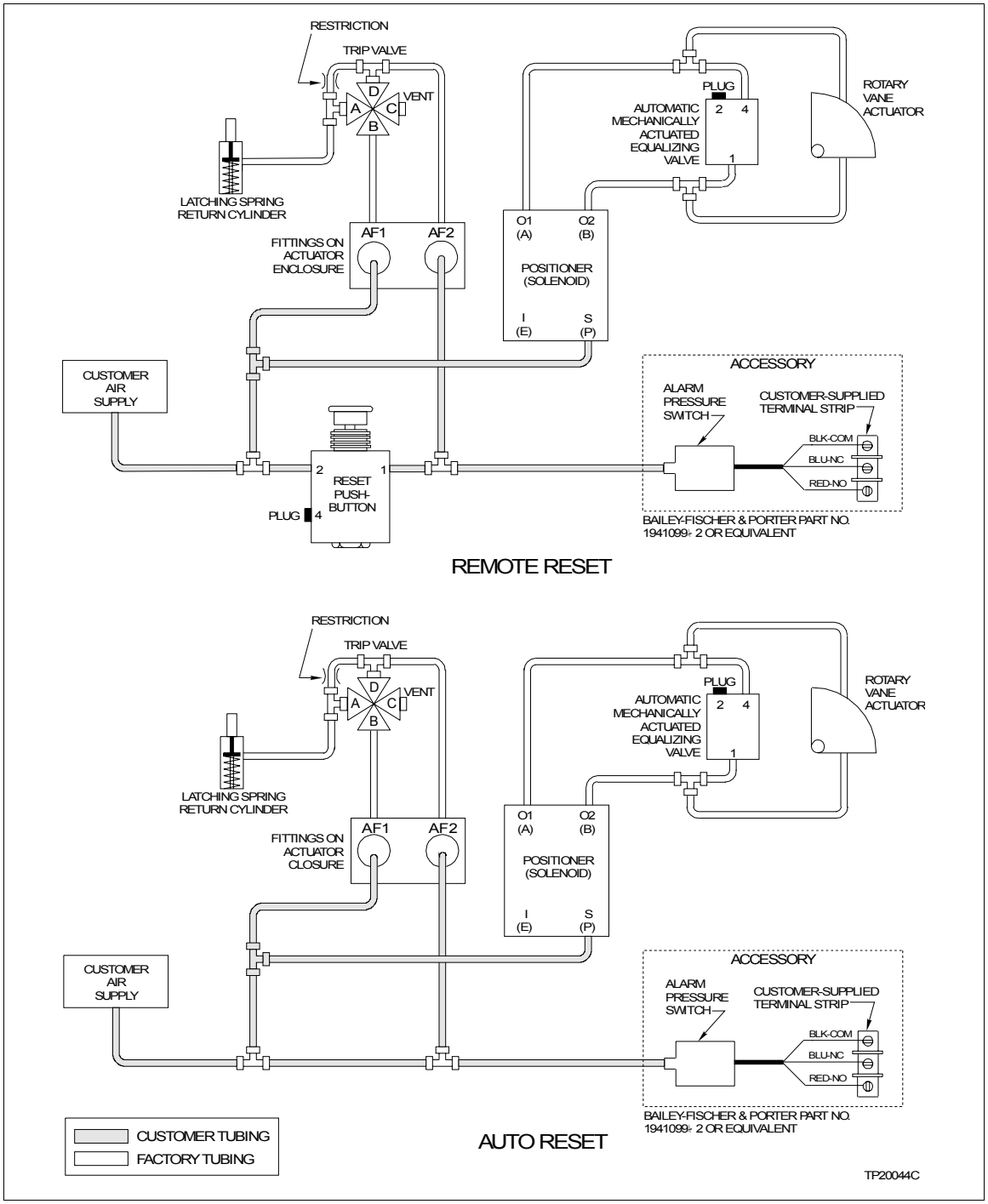



*Figure 3-16. Tubing Schematic for Type UP2 Actuator with Air Failure Lock*

### *Alarm Pressure Switch Wiring*

**NOTE:** Refer to Figures 3-3 and 3-17.

Types UP3 and UP4 actuators come with the alarm pressure switch installed. If desired, connect an alarm or status lights to indicate a loss of air supply.

1. Remove the side covers on both sides of the actuator as described in ***ENCLOSURE REMOVAL***.

2. A conduit connection, AFC, is provided at the actuator base for access to the air failure contacts. Feed the wiring through this connection.

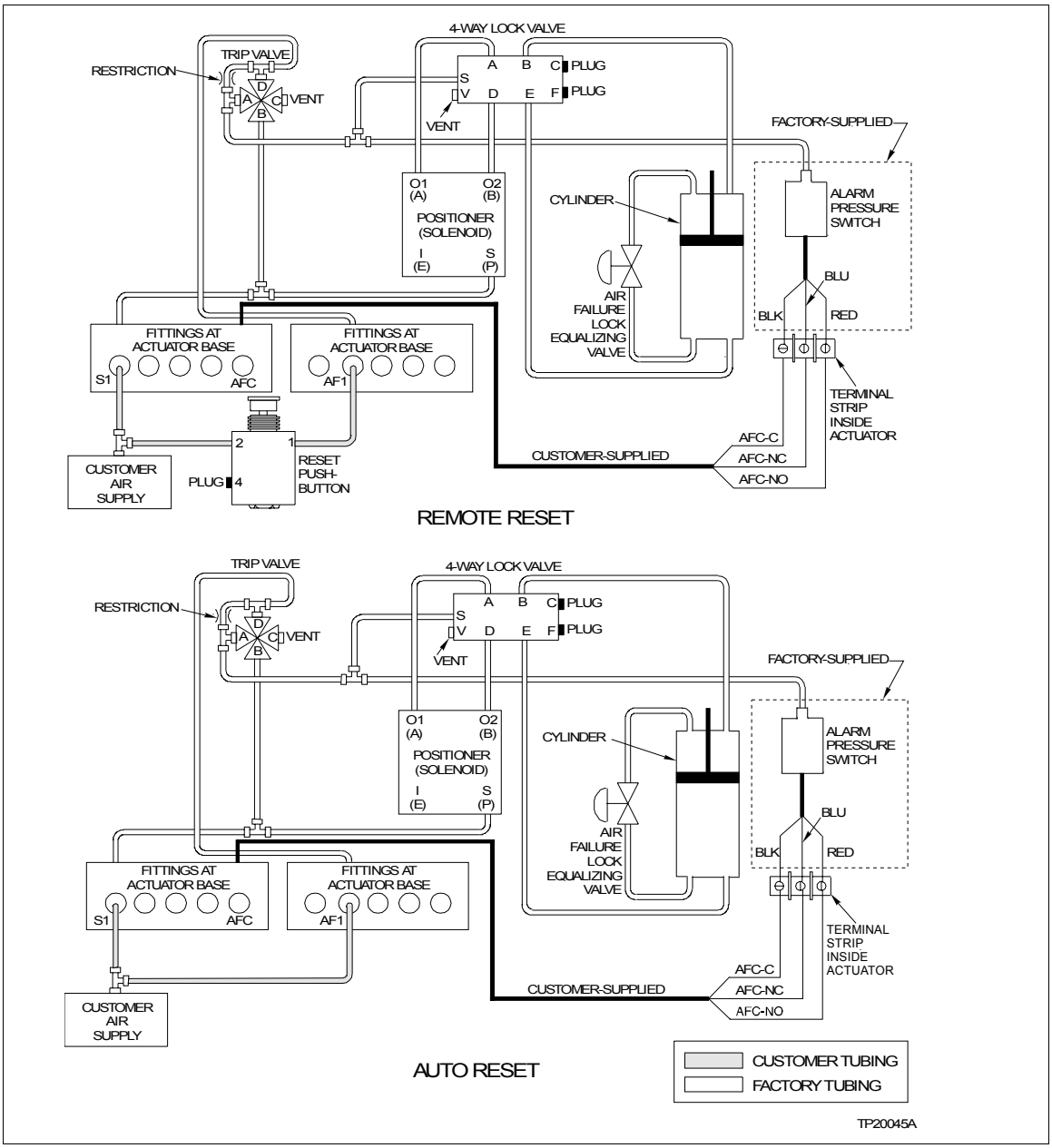



*Figure 3-17. Tubing Schematic for Types UP3 and UP4 Actuators with Air Failure Lock*

3. Make the connections to the proper points on the terminal strip as shown in Figures 3-3 and 3-17.

4. Replace the side covers.

### *TYPES UP5 AND UP6 ACTUATORS*

**NOTES:**
1. Refer to Figures 3-4 and 3-18.

2. The reset switch and pipe plug are located in a drawstring bag attached to the actuator frame.

#### *Automatic Reset*

1. Connect the customer air supply directly to the S1 port on the actuator enclosure.

2. Connect the customer air supply line to the AF1 port on the actuator enclosure.

#### *Remote Reset*

1. Install the pipe plug into port 4 of the reset switch.

2. Install the reset switch in a suitable location. Refer to Figure 3-14 for the dimensions.

3. Install a tee into the air supply line.

4. Run tubing from one outlet of the tee to port 2 of the reset switch and from the other outlet of the tee to the S1 port at the base of the actuator.

5. Run tubing from port 1 of the reset switch to the AF1 port at the base of the actuator.

#### *Alarm Pressure Switch Wiring*

**NOTE:** Refer to Figures 3-4 and 3-18.

Types UP5 and UP6 actuators come with the alarm pressure switch installed. If desired, connect an alarm or status lights to indicate a loss of air supply.

1. Remove both of the bottom side covers as described in ***ENCLOSURE REMOVAL***.

2. A conduit connection, AFC, is provided at the actuator base for access to the air failure contacts. Feed the wiring through this connection.

3. Make the connections to the proper points on the terminal strip as shown in Figures 3-4 and 3-18.

4. Replace the bottom side covers.

### *Pneumatic Shaft Position Transmitter Tubing for Types UP2 through UP6 Actuators*

**NOTE:** A pneumatic shaft position transmitter is not available for the Type UP1 actuator.

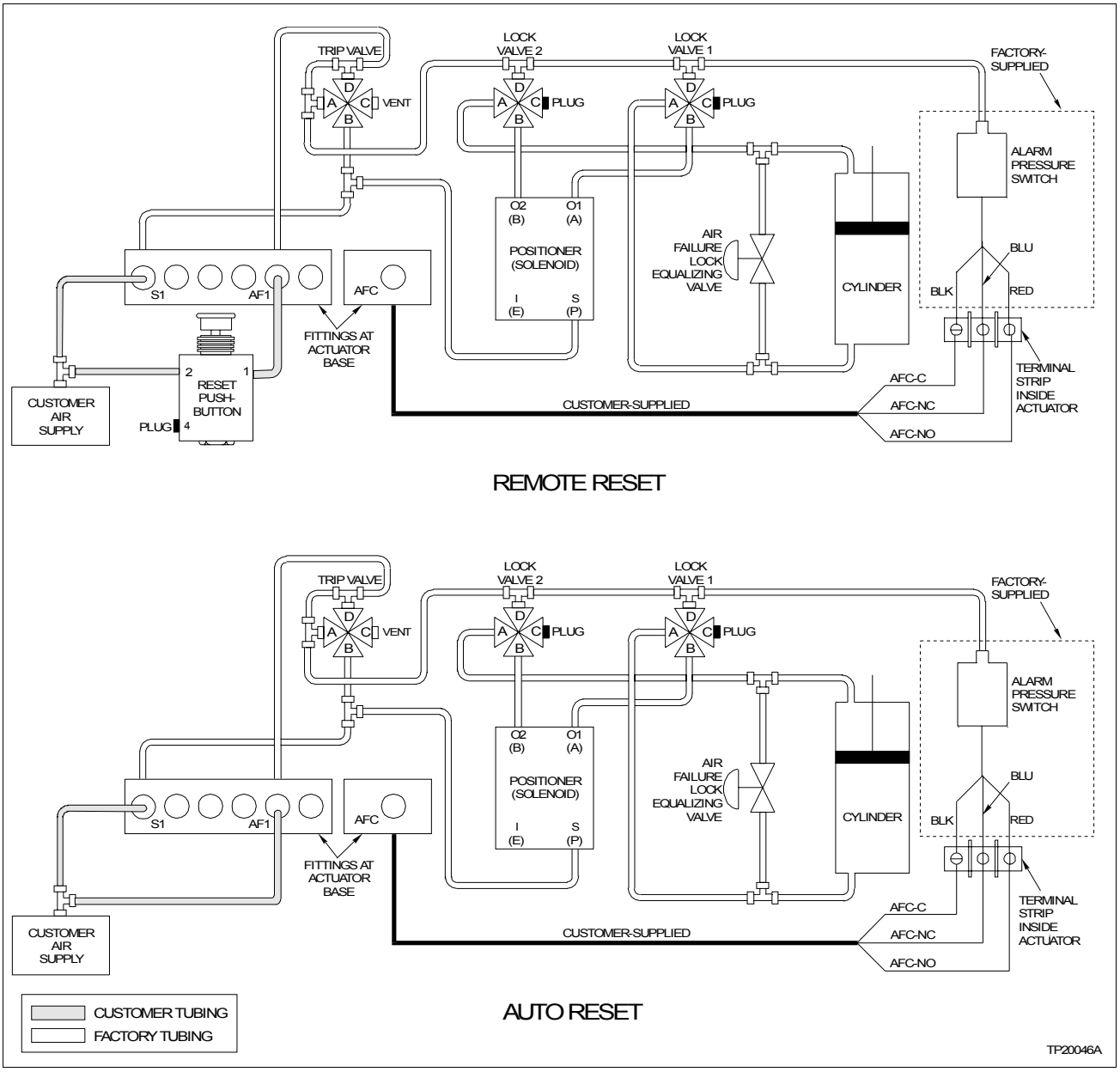



*Figure 3-18. Tubing Schematic for Types UP5 and UP6 Actuators with Air Failure Lock*

### *TYPES UP2, UP3 AND UP4 ACTUATORS*

**NOTE:** Refer to Figures 3-2 and 3-3.

These actuators have the pneumatic shaft position transmitter mounted externally.

1. Connect the required air supply line directly to the S port of the shaft position transmitter.

2. Using ¼-inch tubing and suitable fittings, connect the output line to the street tee in the O2 port of the shaft position transmitter.

3. Maintain a supply pressure of at least 35 kPa (5 psig) above the maximum desired output pressure, but not higher than 345 kPa (50 psig).

### *TYPES UP5 AND UP6 ACTUATORS*

**NOTE:** Refer to Figure 3-4.

These actuators have the pneumatic shaft position transmitter mounted internally.

1. Connect the required air supply directly to the S2 port at the base of the actuator.

2. Connect the output line directly to the E2 port at the base of the actuator.

3. Use ¼-inch tubing and suitable fittings.

4. Maintain a supply pressure of at least 35 kPa (5 psig) above the maximum desired output pressure, but not higher than 345 kPa (50 psig).

## *Volume Booster Tubing for Type UP6 Actuators*

All tubing connections inside the Type UP6 actuator for the optional volume booster are completed before shipment. External tubing is the same as that for Type UP6 actuators described in this chapter, except the S1, S2 and S3 bulkhead connections on the actuator are ¾-14 NPT. Customer tubing should be one inch OD tubing or ¾-14 NPT schedule 40 pipe.

## *Alarm/Travel Switch Contact Wiring for Types UP1 through UP6 Actuators*

**NOTE:** Refer to Figure 3-19.

If the actuator comes with alarm/travel switches, it includes four SPDT cam-actuated microswitches [two heavy-duty (C1 and C4) for DC or AC service, and two (C2 and C3) for AC service]. Switches can be used as alarm contacts or for an external indication.

### *TYPE UP1 ACTUATOR*

**NOTE:** Refer to Figures 3-1 and 3-19.

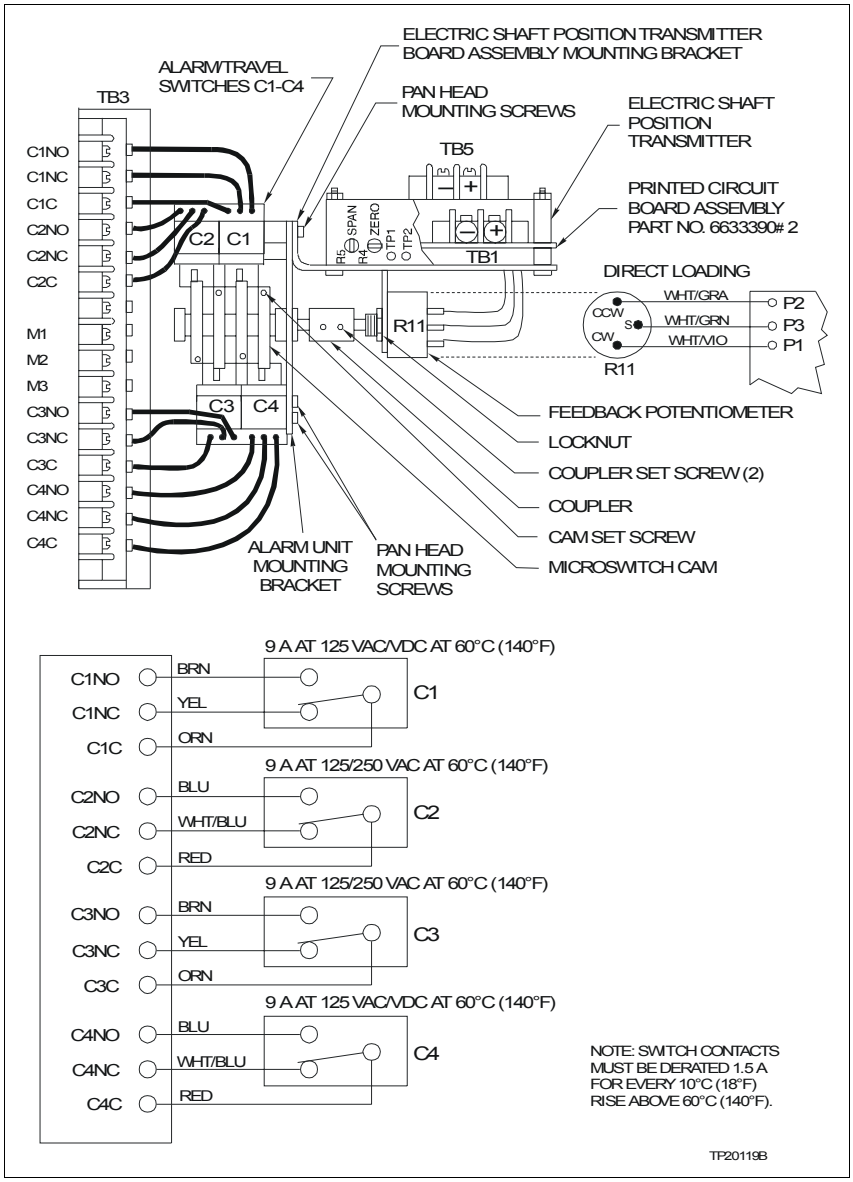



*Figure 3-19. Electric Shaft Position Transmitter and Alarm/Travel Switches (for nomenclature options 11 in the sixth and seventh positions)*

The adjustable travel switches for UP1 actuators are located inside the cover mounted to actuator frame.

1. Remove the four enclosure mounting screws holding the cover to the actuator frame.

2. Make the electrical connections from the switches at the terminal block as shown in Figures 3-1 and 3-19.

3. Run the wires through the conduit connector in the cover and replace the cover.

### *TYPE UP2 ACTUATOR*

**NOTE:** Refer to Figures 3-2 and 3-19.

1. Remove the side panel as described in ***ENCLOSURE REMOVAL***.

2. Make the electrical connections from the switches at the terminal block as shown in Figures 3-2 and 3-19.

3. Run the wires through the conduit connector in the side of the actuator frame.

4. Replace the side panel and top cover.

### *TYPES UP3 AND UP4 ACTUATORS*

**NOTE:** Refer to Figures 3-3 and 3-19.

1. Remove the side cover on the cylinder side of the actuator as described in ***ENCLOSURE REMOVAL***.

2. Make the electrical connections from the switches at the terminal block as shown in Figures 3-3 and 3-19.

3. Run the wires through conduit connector V2 at the base of the actuator.

4. Replace the side cover.

### *TYPES UP5 AND UP6 ACTUATORS*

**NOTE:** Refer to Figures 3-4 and 3-19.

1. Remove the bottom side cover and top side cover on the cylinder side of the actuator as described in ***ENCLOSURE REMOVAL***.

2. Make the electrical connections from the switches at the terminal block as shown in Figures 3-4 and 3-19.

3. Run the wires through conduit connector V1 at the base of the actuator.

4. Replace the actuator covers.

### *Electric Shaft Position Transmitter Wiring for Types UP1 through UP6 Actuators*

**NOTE:** Refer to Figures 3-19 through 3-22.

| | |
|---|---|
| **CAUTION** | **Signal wiring connected in this box must be rated for at least 300 V. Failure to use the proper wire may cause a short circuit and/or a fire which would damage the equipment and upset the process.** |
| **ATTENTION** | **La capacité nominale du cablage de signaux relié à ce boîtier doit être d'au moins 300 V. L'utilisation de cables nadéquats pourrait provoquer un court-circuit ou un incendie, ce qui endommagerait le matériel et perturberait le processus.** |

If the actuator comes with an electric shaft position transmitter (external to the characterizable positioner), it has a linkage-driven shaft position transmitter. It includes the alarm contacts described in ***Alarm/Travel Switch Contact Wiring for Types UP1 through UP6 Actuators***.

The transmitter, a two-wire, four to 20-milliamp output device, operates on 12 to 42 VDC. The signal wiring supplies power to the transmitter. Refer to Figure 3-20 for a typical wiring loop diagram. Use wire with a cross-sectional area of 0.32 to 2.10 square millimeters (22 to 14 AWG) rated at a minimum of 300 volts.

A twisted pair or shielded wire reduces the chance of noise pickup. If needed, ground the signal wiring at any location in the loop, but not at more than one point. If there are several transmitters on a single power supply, make the ground connection at the power supply.

Do not run wiring near high power electrical equipment or in the same conduit or trays as the power wiring. Although power supply regulation is not vital, ripple should not exceed 0.5 volt peak-to-peak. This insures a stable output signal. Supply voltages and load changes during operation have no effect on accuracy, since the combined load resistance falls within the operating ranges as shown in Figure 3-21. Do not exceed the indicated maximum of the combined resistance of the load and the signal wiring.

If the electric shaft position transmitter is internal to the characterizable positioner, it is a two-wire unit requiring a 12 to 34 VDC supply. It produces a four to 20-milliamp linear output relative to the actuator shaft position.

**NOTES:**

1. The procedures for accessing the electric shaft position transmitter on the actuators are the same as those for accessing alarm/travel switch contacts (described in ***ENCLOSURE REMOVAL***). After gaining access to the transmitter, continue with the wiring procedures.

2. The wiring procedures in this section describe only the connections to an electric shaft position transmitter if it is external to the characterizable positioner. To make the connections to the electric shaft position transmitter that is internal to the positioner, refer to the appropriate positioner instruction.

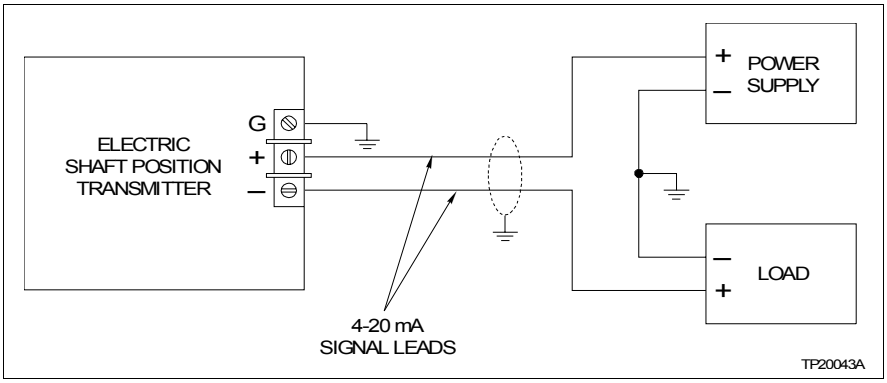



*Figure 3-20. Typical Wiring Loop Diagram for the Electric Shaft Position Transmitter*

### *TYPE UP1 ACTUATOR*

**NOTE:** Refer to Figures 3-1 and 3-19 through 3-22.

1. Make the connections to the transmitter at the terminal block locations as shown in Figures 3-1 and 3-19.

2. Run the wires through the conduit opening in the cover.

3. Replace the cover.

### *TYPE UP2 ACTUATOR*

**NOTE:** Refer to Figures 3-2 and 3-19 through 3-22.

1. Make the connections to the transmitter at the terminal block locations as shown in Figures 3-2 and 3-19.

2. Run the wires through the conduit opening in the actuator frame.

3. Replace the panel and cover.

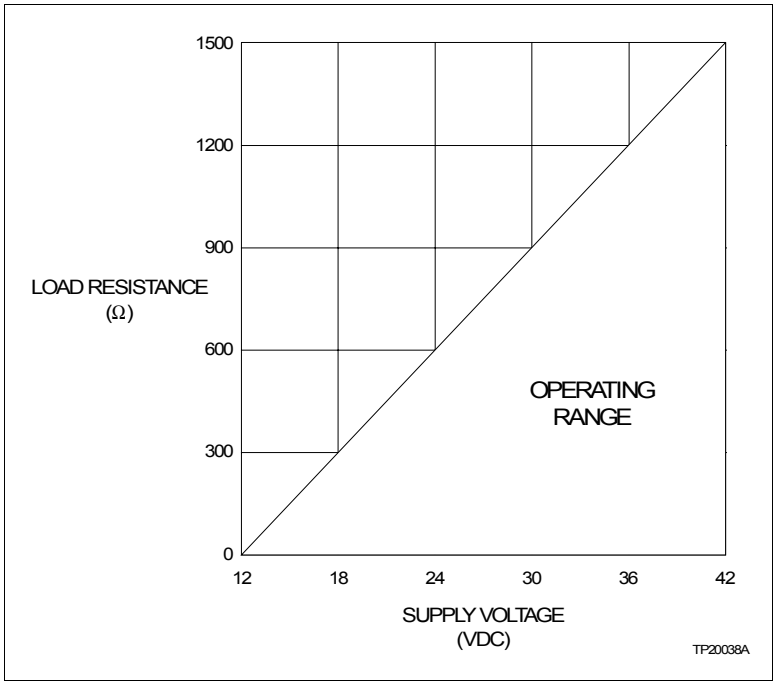



*Figure 3-21. Supply Voltage and Load Resistance Limits for the Electric Shaft Position Transmitter*

### *TYPES UP3 AND UP4 ACTUATORS*

**NOTE:** Refer to Figures 3-3 and 3-19 through 3-22.

1. Make the connections to the transmitter at the terminal strip locations as shown in Figure 3-3.

2. Run the wires through the V1 conduit opening located at the actuator base.

3. Replace the actuator covers.

### *TYPES UP5 AND UP6 ACTUATORS*

**NOTE:** Refer to Figures 3-4 and 3-19 through 3-22.

1. Make the connections to the transmitter at the terminal strip locations as shown in Figure 3-4.

2. Run the wires through the V1 conduit opening located at the base of the actuator.

3. Replace the actuator covers.

### *REVERSE LOADING WIRING FOR ELECTRIC SHAFT POSITION TRANSMITTERS*

1. Remove the cover from the electric shaft position transmitter assembly.

2. Reverse P1 and P2 on the transmitter circuit board (Fig. 3-22).

3. Refer to Table 3-4 for wire color codes on the transmitter circuit board, for direct versus reverse loading.

4. Replace the transmitter cover and calibrate as described in Section 4.

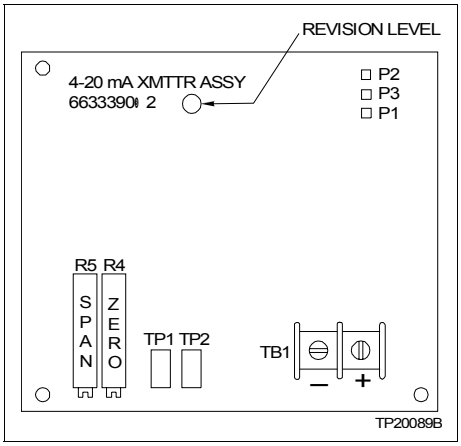



*Figure 3-22. Electric Shaft Position Transmitter Circuit Board*

*Table 3-4. Wire Color Codes for Direct Versus Reverse Loading on the Electric Shaft Position Transmitter*

| Control Loading | P1 | P2 | P3 |
|---|---|---|---|
| Direct | WHT/VIO | WHT/GRY | WHT/GRN |
| Reverse | WHT/GRY | WHT/VIO | WHT/GRN |

### *Strip Heater Wiring for Types UP2 through UP6 Actuators*

**NOTE:** Strip heaters are not available for Type UP1 actuators.

ABB recommends ordering actuators with heating elements installed for applications where the ambient temperature remains below zero degrees Celsius (32 degrees Fahrenheit) for extended periods. A thermoswitch automatically starts the heaters when the temperature drops below approximately four degrees Celsius (40 degrees Fahrenheit).

**NOTE:** Follow the procedures for gaining access to the terminal strips for the alarm/travel switches in ***Alarm/Travel Switch Contact Wiring for Types UP1 through UP6 Actuators***.

### *TYPE UP2 ACTUATOR*

**NOTE:** Refer to Figure 3-2.

1. Make the connections to the terminal strip L1 (hot) and L2 (neutral) as shown in Figure 3-2.

2. Run the wires through the conduit opening in the actuator frame.

3. Replace the actuator covers.

### *TYPES UP3 AND UP4 ACTUATORS*

**NOTE:** Refer to Figure 3-3.

1. Make the connections to the terminal strip L1 (hot) and N (neutral) as shown in Figure 3-3.

2. Run the wires through the HTR conduit opening in the actuator frame.

3. Replace the actuator covers.

### *TYPES UP5 AND UP6 ACTUATORS*

**NOTE:** Refer to Figure 3-4.

1. Make the connections to the terminal strip L1 (hot) and N (neutral) as shown in Figure 3-4.

2. Run the wires through the HTR conduit opening in the actuator frame.

3. Replace the actuator covers.

## *PRE-OPERATING ADJUSTMENTS*

Use these procedures to make any adjustments necessary to make the actuator operational.

### *Control Loading Arrangements*

The actuator normally comes with the tubing connections made for direct loading operation. If desired, change to reverse loading operation.

### *POSITIONER CONTROL LOADING ARRANGEMENTS*

The two types of positioner control loading are direct loading and reverse loading. Direct loading allows movement from zero to 100 percent (position indicator reading) as the control signal to the positioner increases. The actuator leaves the factory in this configuration.

Reverse loading allows the actuator to move from 100 to zero percent as the control signal to the positioner increases. To change from direct loading to reverse loading, remove the actuator covers (if required) necessary to access the positioner as outlined in ***ENCLOSURE REMOVAL***. Follow the instructions for reverse loading in the appropriate positioner instruction.

### *SOLENOID VALVE CONTROL LOADING ARRANGEMENTS*

The actuator normally comes with the tubing connections made for direct loading operation. If desired, change to reverse loading operation.

Direct loading allows movement from zero to 100 percent when the solenoid is energized. The actuators leave the factory in this configuration.

Reverse loading allows movement from 100 to zero percent when the solenoid is energized. To switch from direct to reverse loading:

1. Remove the actuator covers (if required) to gain access to the solenoid valve as described in ***ENCLOSURE REMOVAL***.

2. Loosen the air line connections at the A and B ports of the solenoid.

3. Reverse the air line connections and tighten these connections.

   **NOTE:** For dual coil solenoid valves, reverse either the air lines or the electrical connections to the coils.

4. Replace the actuator covers.

### *Operating Lever Adjustment*

| | |
|---|---|
| **WARNING** | **Failure to tighten the lever assembly bolts to the torque specifications may cause the load to shift and bodily injury could result.** |
| **AVERTISSEMENT** | **Toute négligence à serrer les boulons du levier conformément au couple prescrit pourrait entraîner le déplacement de la charge et par conséquent provoquer des blessures.** |

#### *TYPE UP1 ACTUATOR*

**NOTE:** Refer to the drawings in ***SPARE PARTS*** in Appendix A and ***DIMENSION DRAWINGS*** in Appendix B.

1. Loosen the two socket hex-head cap screws in the lever hub using a $^{5}/_{16}$ -inch socket wrench.

2. Determine at what angle to locate the lever for zero percent position (normally parallel to the driven lever).

3. Rotate the lever to the correct position.

4. Secure the lever assembly to the shaft by tightening the socket hex-head cap screws to 71 to 79 Newton meters (52 to 57 foot-pounds).

5. Connect the linkage to the lever in the desired arrangement.

6. Refer to ***Connecting Linkage for Universal Rotary Actuators*** for alternate linkage arrangements.

#### *TYPE UP2 ACTUATOR*

**NOTE:** Refer to the drawings in ***SPARE PARTS*** in Appendix A and ***DIMENSION DRAWINGS*** in Appendix B.

1. Loosen the two socket hex-head cap screws in the lever hub using a ½-inch hex wrench.

2. Determine at what angle to locate the lever for zero percent position (normally parallel to the driven lever).

3. Rotate the lever to the correct position.

4. Secure the lever assembly to the shaft by tightening the socket hex-head cap screws to 85 to 91 Newton meters (63 to 67 foot-pounds).

5. Connect the linkage to the lever in the desired arrangement.

6. Refer to ***Connecting Linkage for Universal Rotary Actuators*** for alternate linkage arrangements.

### *TYPES UP3/4/5/6 ACTUATORS*

**NOTE:** Refer to the drawings in ***SPARE PARTS*** in Appendix A and ***DIMENSION DRAWINGS*** in Appendix B.

1. Loosen the clamping screws in the lever hub.

2. Pull the lever off of the splined shaft.

3. Determine at what angle to locate the lever for zero percent position (normally parallel to the driven lever).

**NOTE:** The lever may be located on either end of the shaft.

4. Push the lever onto the shaft in the desired position.

5. Secure the lever to the shaft by tightening the clamping screws to 38 to 44 Newton meters (28 to 32 foot-pounds).

6. Connect the linkage to the lever in the desired arrangement.

7. Refer to ***Connecting Linkage for Universal Rotary Actuators*** for alternate linkage arrangements.

## *Position Indicator*

Upon changing the control loading of the actuator, switch the scale for the position indicator to match the rotation of the actuator.

**NOTE:** Before mounting the position indicator, clean dust, dirt, oil, moisture, etc. from the mounting surface.

### *TYPES UP1 AND UP2 ACTUATORS*

Types UP1 and UP2 actuators come with two adhesive-backed position indicator scales. They are graduated from zero to 100 percent in ten percent increments. One scale, fixed to the sector plate at the factory, reads zero to 100 percent from left to right. The second scale, taped to the rear side of the sector plate, reads zero to 100 percent from right to left. Install the latter scale on reverse acting actuators to match the rotation of the driven device. Simply remove the backing, and place the reverse indicating scale over the scale installed at the factory.

### *TYPES UP3/4/5/6 ACTUATORS*

Types UP3, UP4, UP5 and UP6 actuators come with a shaft-mounted position indicator and indicator scales graduated from zero to 100 percent in 25 percent increments. One scale reads zero to 100 percent from right to left. The second scale reads zero to 100 percent from left to right. These scales come in a separate bag. Choose the scale that matches the closed versus open position of the driven device. Two punch marks on the actuator at the output shaft help position the scale

### *Mechanical Stop Adjustment for Types UP1 and UP2 Actuators*

**NOTES:**
1. Refer to Figures 3-1 and 3-2.

2. The mechanical stop is only available on the types UP1 and UP2 actuators.

The nominal setting of the stroke is for a rotation of 90 degrees. Adjustable mechanical stops, located on each end of the actuator, allow adjustment over a range of 80 to 92 degrees.

1. Loosen the $^{5}/_{16}$ -18 hex nut located on the socket head stop-screw.

2. Hold the hex nut and adjust the stopscrew clockwise to decrease the rotation, or counterclockwise to increase rotation.

3. Tighten the hex nut.

4. Calibrate the positioner (if supplied) for the new output stroke. Refer to ***Zero Adjustment for Positioner-Equipped Types UP1 through UP6 Actuators*** and ***Span Adjustment for Positioner-Equipped Types UP1 through UP6 Actuators*** in Section 4.

# SECTION 4 - CALIBRATION

## *INTRODUCTION*

This section includes the calibration required before placing the actuator into operation. Calibration procedures for optional equipment appear here.

## *EQUIPMENT REQUIRED FOR CALIBRATION*

- A full complement of screwdrivers, hex wrenches and Allen wrenches.
- Instrument pressure gage - part number 5326605_4, or equivalent.
- Two output pressure gages - part number 5326605_6, or equivalent.
- Milliammeter capable of reading 4 to 20-milliamp output.

## *CALIBRATION PROCEDURES*

The positioner calibration procedures described in this section apply to the actuator only as a function of the positioner. The procedures for positioner calibration are printed in the appropriate instruction for the positioner in use and are not reprinted here.

### *Positioner Access*

Access to the positioner on Types UP1 and UP2 actuators is not restricted by an enclosure. Refer to the proper enclosure removal procedure in the installation section to access the positioner on Types UP3 through UP6 actuators.

### *Zero Adjustment for Positioner-Equipped Types UP1 through UP6 Actuators*

The actuator comes set for full travel proportional to full range input signal. The positioner range spring assembly applies a proportional feedback force to the input signal diaphragm assembly. The zero adjustment nut in the positioner applies initial tension on the range spring and provides a zero adjustment. Install the actuator as directed, check the positioner zero and adjust if necessary.

If requiring another relationship between travel and input signal, set the zero before any other adjustment. This sets the cam zero relative to the minimum input signal [21 kilopascals (three pounds per square inch gage) or four milliamps].

For an elevated zero, an initial tension imposed on the range spring prevents the actuator from moving from its minimum position until the input signal increases above the elevated zero value. Refer to Table 4-1 for zero elevations.

*Table 4-1. Zero Elevation*

| Actuator Type | Calibrated Zero | Elevated Zero |
|---|---|---|
| UP__A | 21 kPa (3.0 psig) | Any value between 21 and 62 kPa (3 and 9 psig) |
| UP__B | 21 kPa (3.0 psig) | Any value between 21 and 103 kPa (3 and 15 psig) |
| UP__C | 4 mA | Any value between 4 and 12 mA by adjusting pneumatic zero |
| UP__D | 4 mA | Any value between 4 and 12 mA by adjusting pneumatic zero |

Some applications that might use an elevated zero are when two or more actuators are operated in sequence or when the characteristics of the device moved by the actuator need to match those of another regulated device.

1. Gain access to the positioner.

2. Take off the cover to the positioner by removing the two cover screws.

3. Refer to the appropriate positioner instruction for the step-by-step zero adjustment procedure.

### *Span Adjustment for Positioner-Equipped Types UP1 through UP6 Actuators*

The span adjustment affords a variation of actuator motion for a given span of control signal pressure.

With any of the characterized cams, the span adjustment allows full actuator travel to occur with a signal change as small as 50 percent of its full span. This is referred to as split ranging. This is valuable when running two or more actuators in sequence. For example, one actuator could fully open a damper from a 21 to 62 kilopascals (three to nine pounds per square inch gage) signal, while the next opens fully from a 62 to 103 kilopascal (nine to 15 pounds per square inch gage) signal. In this case, the second actuator requires zero elevation.

At the other extreme, the span adjustment can be set to produce as little as 50 percent of the travel capability of the actuator over the full input signal span. This is referred to as travel limiting. This is valuable when the device the actuator regulates is oversized and a full open

position is not desirable. Before starting the procedure, determine the percentage of travel desired.

1. Gain access to the positioner.

2. Refer to the appropriate positioner instruction for the step-by-step span adjustment procedure.

### *Speed Adjustment for Positioner-Equipped Types UP1 through UP6 Actuators*

When the system involves only a single actuator, a high positioning speed is usually an advantage. However, in a complex control system it is generally desirable to operate all power devices at the same speed. This helps to avoid interaction between units that produce undesirable process conditions. If it is necessary to reduce the speed of operation, 1.02 millimeter (0.04 inch) speed control orifices (Part No. 5327327_1) are available from ABB. If these orifices are too small, they may be drilled out to obtain the desired speed control. To reduce the speed even more, blank orifices (Part No. 5327327_2) are also available.

> **NOTE:** Do not use the speed control orifices to correct an instability (hunting action). Use the orifices only to vary the stroke time.

1. Gain access to the positioner.

2. Refer to the appropriate positioner instruction for the speed adjustment procedure.

### *Gain Adjustment for Positioner-Equipped Types UP1 through UP6 Actuators*

Gain adjustment on positioner-equipped Types UP1 through UP6 actuators is accomplished by changing the positioner gain hinge spring. The hinge installed at the factory is suitable for most applications. However, if the gain is too great for an application, oscillation of the driven element could result. If this is the case, install a gain hinge spring that yields a lower gain.

1. Gain access to the positioner.

2. Take off the cover to the positioner by removing the two cover screws.

3. Refer to the appropriate positioner instruction for the gain adjustment procedure.

## *OPTIONAL EQUIPMENT CALIBRATION*

Use the following procedures to calibrate any optional equipments that may be installed on the actuator.

### *Electric Shaft Position Transmitter Calibration for Types UP1 through UP6 Actuators*

**NOTES:**
1. Refer to Figure 3-19.

2. This procedure is for an electric shaft position transmitter external to the positioner. To calibrate transmitters internal to the positioner, refer to the appropriate positioner instruction.

1. Refer to the proper enclosure removal procedure in the installation section to access the electric shaft position transmitter.

2. Connect a milliammeter in series with the positive (+) or negative (-) leads of the transmitter output, or across the test jacks TP1 (+) and TP2 (-) (Fig. 3-19).

3. Activate the 12 to 42 VDC power in the transmitter loop.

4. Manually position the actuator to the zero percent travel position (100 percent for reverse acting) and observe the reading on the milliammeter.

5. Adjust the zero potentiometer (R4 - Fig. 3-19) until the milliammeter reads 4.0 mA.

6. Manually position the actuator to the 100 percent position (zero percent for reverse acting) and observe the reading on the milliammeter.

7. Adjust the span potentiometer (R5 - Fig. 3-19) until the milliammeter reads 20.0 mA.

8. Repeat Steps 4 through 7 until the milliammeter indicates the correct reading at both extremes of travel.

9. Manually position the actuator to the 50% position and verify that the milliammeter reads 12.0 mA.

### *Alarm/Travel Switch Calibration*

**NOTE:** Refer to Figure 3-19.

This option consists of four linkage-driven, cam-operated SPDT microswitches, adjustable over the full stroke of the actuator. Switches can be used as alarm contacts or for external indicators.

Set the microswitch alarm contacts that make up the alarm/ travel switch assembly to operate at any desired position. To do so, adjust the switch cam to make or break a contact at that point.

1. Refer to the proper enclosure removal procedure in the installation section to access the alarm/travel switches.

2. Manually position the actuator output shaft to the desired actuating position.

3. Loosen the cam setscrew holding the cam to the switch assembly shaft.

4. Rotate the microswitch cam to the desired actuating position.

5. Tighten the setscrew to lock the cam on the shaft.

### *Pneumatic Shaft Position Transmitter Calibration*

**NOTE:** The pneumatic shaft position transmitter option is not available for Type UP1 actuators.

1. The pneumatic shaft position transmitter mounts on the outside of the Types UP2, UP3 and UP4 actuators. Refer to the proper enclosure removal procedure in the installation section to access the pneumatic shaft position transmitter on Types UP5 and UP6 actuators.

2. Refer to the appropriate positioner instruction to calibrate the pneumatic shaft position transmitter.

### *Reserve Air Tank Calibration*

No adjustment is required for the trip valves or pressure switch. All adjustments are made before shipment.

### *Volume Booster Calibration*

The volume booster has a bypass restriction adjustment for stable actuator performance. Refer to the appropriate volume booster instruction for the adjustment procedure.

### *Air Failure Lock Calibration*

The trip and lock valves require adjustment based on the required or available air supply to obtain the required output torque.

Factory personnel set the trip valve at 240 kilopascals (35 pounds per square inch gage) for Types UP1 and UP2 actuators and 380 kilopascals (55 pounds per square inch gage) for Types UP3, UP4, UP5 and UP6 actuators. If the application requires a different setting, refer to Figures 3-5 and 3-7 for the suggested maximum operating torque versus air supply pressure. The stall torque graphs in Figures 3-6 and 3-8 show the minimum supply pressure needed to hold the actual load imposed on the actuators. Consider this pressure as the minimum trip valve setting. The maximum trip valve setting is 103 kilopascals (15 pounds per square inch gage) below the available or required air supply for actuators with positioners and 138 kilopascals (20 pounds per square inch gage) for actuators with solenoid valves.

The recommended lock valve setting is a minimum of 103 kilopascals (15 pounds per square inch gage) below the trip valve setting.

Types UP1 and UP2 actuators use a mechanical latch device with a three-way pneumatic trip valve as the air supply sensor. A customer-supplied pressure switch may be added to signal an air failure alarm or for a status light. Types UP3, UP4, UP5 and UP6 actuators come with lock valves along with the trip valve. They use a three-way pneumatic trip valve as the air supply sensor that trips one four-way (Types UP3 and UP4 actuators) or two three-way (Types UP5 and UP6 actuators) lock valves to lock the actuator in the last position. Types UP3 through UP6 actuators include a pressure switch that can be used to signal an air failure alarm or for a status light.

The trip valve mounts on the outside of the Type UP1 actuator. Refer to the proper enclosure removal procedure in the installation section to access the air failure lock on Types UP2 through UP6 actuators.

### *TRIP VALVE ADJUSTMENT FOR TYPES UP1 THROUGH UP6 ACTUATORS*

1. Install a supply pressure gage in the supply pressure line.

   **NOTE:** If the air supply connected according to Figures 3-15 through 3-18 in Section 3 is not adjustable, or if adjustment would disrupt other processes, disconnect it and connect a 345 kPa (50 psig) up to 689 kPa (100 psig) air supply for Types UP1 and UP2 actuators, or a 482 kPa (70 psig) to 689 kPa (100 psig) air supply for Types UP3 through UP6 actuators.

2. Loosen the trip valve adjusting screw locknut (Fig. 3-9).

3. On positioner-equipped units, make sure the control loading signal is connected as described in the installation section.

4. Increase the air supply pressure to the operating value and press the remote pushbutton, if installed.

5. Decrease the air pressure to the desired trip value.

6. Turn the trip valve adjusting screw clockwise to increase the trip pressure or counterclockwise to decrease the trip pressure.

7. Repeat Steps 4 through 6 until the trip valve drops out at the desired trip pressure.

8. Tighten the adjusting screw locknut.

### *LOCK VALVE ADJUSTMENT FOR TYPES UP3/4/5/6 ACTUATORS*

**NOTE:** Refer to Figures 3-17 and 3-18.

Types UP3 through UP6 actuators have lock valves along with the trip valve. The trip valve dumps the control pressure to the lock valves, trapping the air in the cylinder. Factory personnel set the lock valves at 138 kilopascals (20 pounds per square inch gage). If the trip valve setting is decreased below 345 kilopascals (50 pounds per square inch gage), adjust the lock valves to at least 103 kilopascals (15 pounds per square inch gage) below the trip valve setting. An increase in trip valve setting requires no change in lock valve setting.

1. Install a supply pressure gage in the supply pressure line.

2. Disconnect the tubing from the inlet port of the lock valve (S port for Types UP3 and UP4 actuators and D port for Types UP5 and UP6 actuators).

3. Connect the adjustable air supply to the inlet port and set the pressure for 103 to 137 kPa (15 to 20 psig) below the trip valve pressure setting.

4. Reduce the lock valve pressure adjustment until the lock switches.

5. Disconnect the adjustable air supply and connect the original tubing.

# SECTION 5 - OPERATING PROCEDURES

## *INTRODUCTION*

This section of the manual has procedures for normal operation of the Type UP Universal Pneumatic Rotary Actuators. Descriptions of the controls reside here.

| | |
|---|---|
| **WARNING** | **Do not operate this equipment unless the covers are in place. The covers prevent access to moving components that pose a risk of entanglement of body parts.** |
| **AVERTISSEMENT** | **Ne faites fonctionner cet équipement que si les couvercles sont en place. Les couvercles empêchent l'accès à des composantes en mouvement qui présentent un risque d'emmêlement des membres.** |

## *NORMAL OPERATING CONSIDERATIONS*

All actuators can operate in either an automatic or a manual mode.

Positioner-equipped actuators make use of the integral shutoff and equalizing valve (Figs. 5-1, 5-2 and 5-3) on the positioner. This allows either manual or automatic operation of the actuator power unit. When set for automatic operation, the valve is locked into position by a safety latch. This safety latch prevents the valve from being bumped or jarred out of position.

Changing to manual operation cuts off the supply pressure to the actuator and couples the O1 and O2 ports of the positioner to equalize pressure across the vane (Types UP1 and UP2 actuators) or cylinder (Types UP3, UP4, UP5 and UP6 actuators). This allows manual positioning of the actuator unit.

Solenoid-equipped actuators have an equalizing valve (Figs. 5-1, 5-2 and 5-3). On the Types UP1 and UP2 actuators, this valve equalizes pressure on both sides of the rotary vane paddle. This allows manual positioning of the vane paddle. On Types UP3, UP4, UP5 and UP6 actuators, the valve equalizes pressure on both sides of the cylinder. This allows manual positioning of the actuator using the hand operator ratchet handle.

The remote reset air failure lock (if supplied) locks the actuator in place on loss of air supply pressure. The pneumatic pushbutton allows release of the air failure lock from a local or remote location upon restoration of the air supply pressure.

On Types UP1 and UP2 actuators, the air failure lock consists of a latching spring return cylinder (nonadjustable) that is triggered from an adjustable trip valve. This latches a rack gear mechanism. When

the air supply fails, the latching spring return cylinder opens the equalizing valve across the vane power unit. This permits manual operation of the actuator. A customer-supplied pressure switch (Figs. 3-15 and 3-16) may be used to signal an air failure alarm or a status light.

On Types UP3, UP4, UP5 and UP6 actuators, the air failure lock is a pneumatic device that uses a three-way pneumatic trip valve as the air supply sensor. It trips a four-way lock-up valve on Types UP3 and UP4 actuators, or two three-way lock-up valves on Types UP5 and UP6 actuators. The actuators include a pressure switch for use as an air failure alarm or a status light.

## *TYPES UP1 AND UP2 ACTUATOR OPERATION*

Types UP1 and UP2 actuator operation differs slightly depending on whether control of the actuator comes from a positioner or a solenoid valve. The addition of the air failure lock option also varies the operation. The reserve air tank option (Type UP2 actuator only) has no effect on normal actuator operation.

### *Positioner-Equipped Types UP1 and UP2 Actuators without Air Failure Lock – Transfer from Automatic to Manual Operation*

**NOTE:** Refer to Figure 5-1.

When a Type UP1 or UP2 actuator is supplied with a positioner and is in the automatic mode, the integral shutoff and equalizing valve on the positioner is in the *AUTO* position. When the application calls for manual operation:

1. Pull the manual lock bolt up tight.

2. Push down on the integral shutoff and equalizing valve on the positioner and turn it counterclockwise to the *MAN* position.

3. When not in the automatic mode, pull the manual lock bolt up tight. If it is necessary to reposition the load while in the manual mode:

    a. Loosen the manual lock bolt.

    b. Reposition the load using the extended handle on the linkage.

    c. Tighten the manual lock bolt.

4. Note the position of the rotary vane on the position indicator.

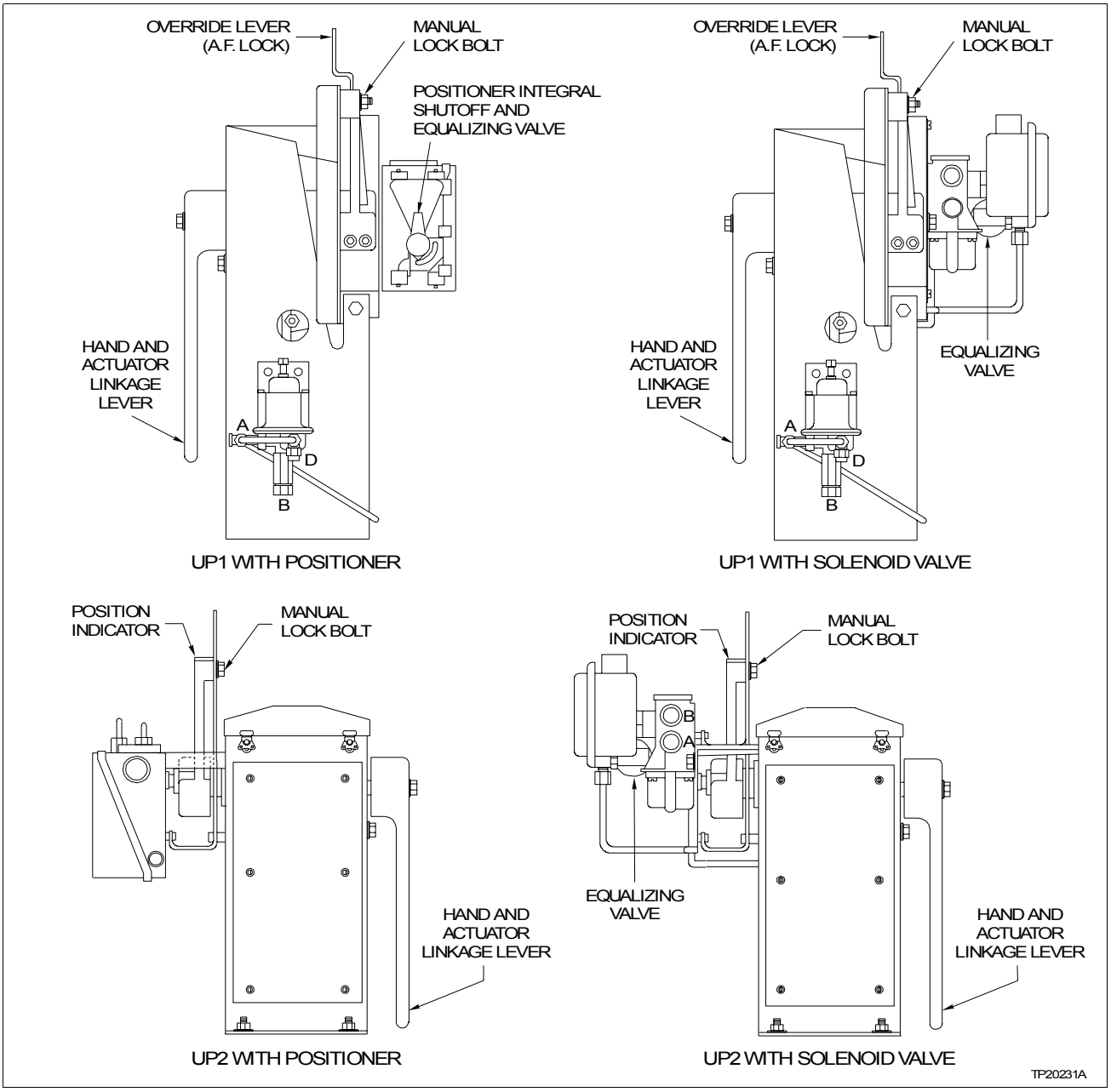



*Figure 5-1. Operating Controls - Types UP1 and UP2 Actuators*

5. If the manual lock bolt does not lock the rotary vane unit in position, and the actuator must stay in that initial position, adjust the input signal to correspond with:

a. The actuator position as indicated by the balanced positioner output pressures,

***- or -***

b. A plot of the actuator position versus the input signal, developed from prior knowledge of the unit.

### *Positioner-Equipped Types UP1 and UP2 Actuators without Air Failure Lock – Transfer from Manual to Automatic Operation*

**NOTE:** Refer to Figure 5-1.

When a Type UP1 or UP2 actuator is supplied with a positioner and is in the manual mode, the integral shutoff and equalizing valve on the positioner is in the *MAN* position. When the application calls for automatic operation:

1. Before shifting to *AUTO*, the actuator position must agree, as close as possible, to the input signal. If not, the hand and actuator linkage lever jumps when the transfer takes place. Adjust the input signal to correspond to the actuator position (or vice versa). Estimate by watching the balanced positioner output pressures. If the setup needs more precision, use a previously prepared plot of the input signal versus the actuator position.

2. Turn the integral shutoff and equalizing valve on the positioner to the *AUTO* position.

3. Release the manual lock bolt slowly. Let the actuator move slightly to get a balanced condition.

4. The actuator positions itself automatically.

### *Solenoid-Equipped Types UP1 and UP2 Actuators without Air Failure Lock – Transfer from Automatic to Manual Operation*

**NOTE:** Refer to Figure 5-1.

When a Type UP1 or UP2 actuator is supplied with a solenoid valve and is in the automatic mode, the customer air supply shutoff valve is open and the solenoid equalizing valve is closed. When the application calls for manual operation:

1. Tighten the manual lock bolt.

2. Close the customer air supply shutoff valve.

3. Open the solenoid equalizing valve.

4. When the hand and actuator linkage lever is not being operated, the manual lock bolt is pulled up tight. Temporarily release the manual lock bolt and position the actuator by manual operation of the hand and actuator linkage lever.

5. If desired, lock the actuator pointer arm and hand and linkage lever in position with the manual lock bolt.

### *Solenoid-Equipped Types UP1 and UP2 Actuators without Air Failure Lock – Transfer from*

### *Manual to Automatic Operation*

**NOTE:** Refer to Figure 5-1.

When a Type UP1 or UP2 actuator is supplied with a solenoid valve and is in the manual mode, the customer air supply shutoff valve is closed and the solenoid equalizing valve is open. When the application calls for automatic operation:

1. Open the customer air supply shutoff valve.

2. Close the solenoid equalizing valve.

3. Slowly and carefully release the manual lock bolt.

4. Unless the actuator is already at the full end of travel dictated by the action of the solenoid valve, it will move in that direction.

### *Remote Reset Air Failure Lock Equipped Types UP1 and UP2 Actuators – Transfer from Automatic to Manual Operation*

**NOTE:** Refer to Figure 5-1.

If the customer air supply fails, the latching spring return cylinder opens the equalizing valve across the vane power unit. This permits manual operation of the actuator. If desired, switch to manual operation even if the customer air supply has not failed.

1. Disengage the lock latch by use of the override lever.

2. Follow the instructions under ***Positioner-Equipped Types UP1 and UP2 Actuators without Air Failure Lock – Transfer from Automatic to Manual Operation*** or ***Solenoid-Equipped Types UP1 and UP2 Actuators without Air Failure Lock – Transfer from Automatic to Manual Operation*****.**

### *Remote Reset Air Failure Lock Equipped Types UP1 and UP2 Actuators – Transfer from Manual to Automatic Operation*

**NOTE:** Refer to Figure 5-1.

If the actuator is in the manual mode and it is desired to switch to automatic operation, the customer air supply must be operational.

1. Press the remote release pushbutton (if used) to release the air failure lock.

2. Engage the lock latch by use of the override lever.

3. Follow the instructions under ***Positioner-Equipped Types UP1 and UP2 Actuators without Air Failure Lock – Transfer from Manual to Automatic Operation*** or ***Solenoid-Equipped Types UP1 and UP2 Actuators without Air Failure Lock – Transfer from Manual to Automatic Operation*.**

## *TYPES UP3 AND UP4 ACTUATOR OPERATION*

Types UP3 and UP4 actuator operation differs slightly depending on whether control of the actuator comes from a positioner or a solenoid valve. The addition of the air failure lock option also varies the operation. The reserve air tank option has no effect on normal actuator operation.

### *Positioner-Equipped Types UP3 and UP4 Actuators without Air Failure Lock – Transfer from Automatic to Manual Operation*

**NOTE:** Refer to Figure 5-2.

When a Type UP3 or UP4 actuator is supplied with a positioner and is in the automatic mode, the positioner integral shutoff and equalizing valve is in the *AUTO* position, and the *HAND/AUTO* transfer handle is in the *AUTO* position. When the application calls for manual operation:

1. Move the *HAND/AUTO* transfer handle on top of the actuator to the *HAND* position.

**NOTE:** The *HAND/AUTO* transfer handle may not engage immediately with the split nut. Turn the hand operator ratchet handle in either direction until the split nut mechanism snaps in place.

2. Press in the safety latch on the positioner integral shutoff and equalizing valve. Turn the valve to the *HAND* position.

3. Move the actuator to the desired position by means of the hand operator ratchet handle.

**NOTE:** The manual operating mechanism is self-locking and holds any position to which it is set.

### *Positioner-Equipped Types UP3 and UP4 Actuators without Air Failure Lock – Transfer from Manual to Automatic Operation*

**NOTE:** Refer to Figure 5-2.

When a Type UP3 or UP4 actuator is supplied with a positioner and is in the manual mode, the positioner integral shutoff and equalizing valve is in the *HAND* position, and the *HAND/AUTO* transfer handle is in the  in the *HAND* position. When the application calls for automatic operation:

| | |
|---|---|
| **WARNING** | **Undesirable motion of the drive arm and linkage may occur which could cause injury or upset the process if the transfer instructions are not followed.** |
| **AVERTISSEMENT** | **Danger d'un mouvement inopportun du bras de commande et de la tringlerie pouvant causer des blessures ou bouleverser le procede. Suivre attentivement les procedures du transfert de commande manuelle a automatique.** |

**NOTE:** If a *HAND/AUTO* remote-mounted control station exists, it should be in the *HAND* mode before attempting the transfer.

1. Before shifting to *AUTO*, the actuator position must agree, as close as possible, to the input signal. If not, the drive arm jumps when the transfer takes place.

2. Adjust the input signal to correspond to the actuator position (or vice versa if the system conditions permit). This can be closely approximated by using a previously prepared plot of the input signal versus the actuator position.

3. Two methods of transfer exist. ***Method A*** is most often used.

### *METHOD A – CHANGING THE INPUT SIGNAL TO MATCH THE ACTUATOR POSITION*

**NOTE:** Use Method A if it is ***not*** possible to move the actuator without endangering the operation of the system.

a. Turn the positioner shutoff and equalizing valve to the *AUTO* position.

b. Slowly change the input signal to match the actuator position.

c. Exert ***moderate*** force on the *HAND/AUTO* transfer handle toward the *AUTO* position while adjusting the input signal. Do this until the *HAND/AUTO* transfer handle moves freely to the *AUTO* position.

### *METHOD B – MANUALLY POSITIONING THE ACTUATOR TO MATCH THE INPUT SIGNAL*

**NOTE:** Use Method B if it is possible to move the actuator position without endangering the operation of the system.

a. Turn the positioner shutoff and equalizing valve to the *AUTO* position.

b. Turn the hand operator ratchet handle to determine the direction of the least load resistance. Use the selector button at the hub of the ratchet to change the direction of rotation.

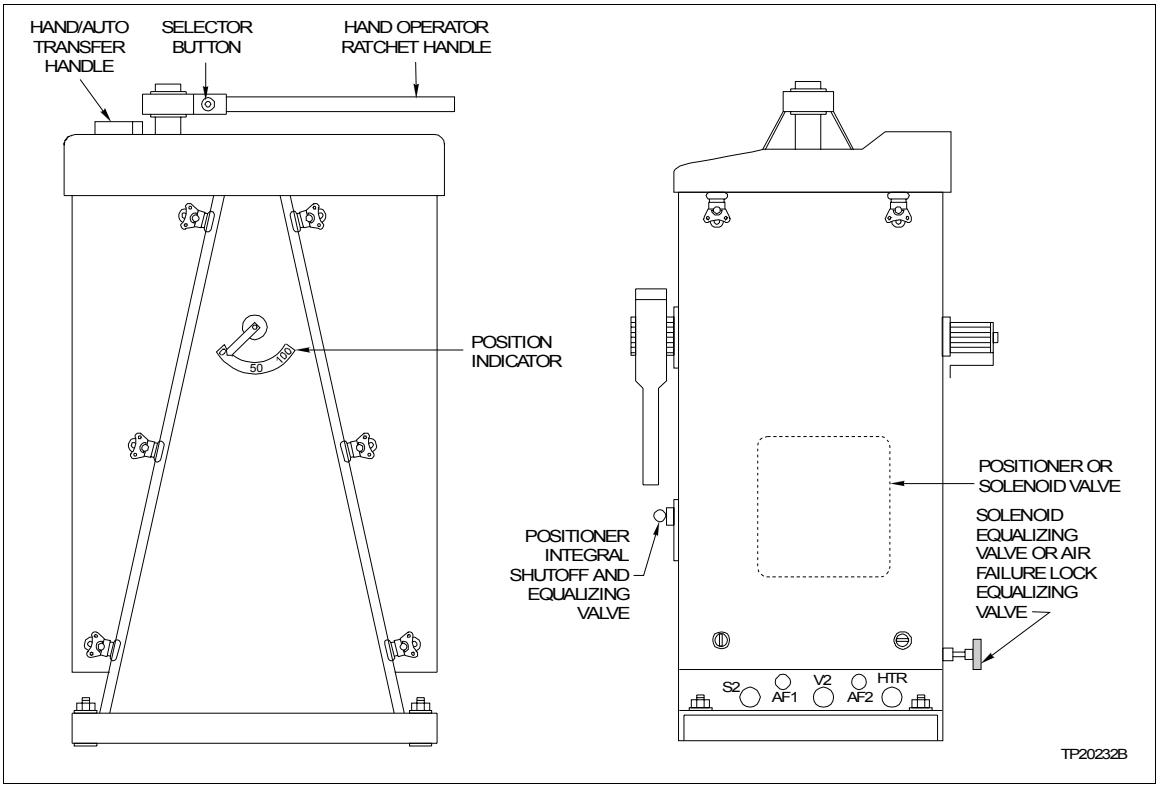



*Figure 5-2. Operating Controls - Types UP3 and UP4 Actuators*

c. While turning the hand operator ratchet handle in the direction of least resistance, exert ***moderate*** force on the *HAND/AUTO* transfer handle toward the *AUTO* position. Do this until the *HAND/AUTO* transfer handle moves freely to the *AUTO* position.

After completing the transfer via Method A or Method B, the actuator positions itself automatically.

### *Solenoid-Equipped Types UP3 and UP4 Actuators without Air Failure Lock – Transfer from Automatic to Manual Operation*

**NOTE:** Refer to Figure 5-2.

When a Type UP3 or UP4 actuator is supplied with a solenoid valve and is in the automatic mode, the customer air supply valve is open, the solenoid equalizing valve is closed and the *HAND/AUTO* transfer handle is in *AUTO*. When the application calls for manual operation:

1. Turn the *HAND/AUTO* transfer handle to *HAND*.

2. Open the solenoid equalizing valve.

3. Close the customer-installed air supply shutoff valve.

**NOTE:** The *HAND/AUTO* transfer handle may not engage immediately with the split nut. Turn the hand operator ratchet handle in either direction until the split nut snaps in.

4. Move the actuator to the desired position by means of the hand operator ratchet handle.

**NOTE:** The manual operating mechanism is self-locking and holds any position to which it is set.

### *Solenoid-Equipped Types UP3 and UP4 Actuators without Air Failure Lock – Transfer from Manual to Automatic Operation*

**NOTE:** Refer to Figure 5-2.

When a Type UP3 or UP4 actuator is supplied with a solenoid valve and is in the manual mode, the customer air supply shutoff valve is closed, the solenoid equalizing valve is open and the *HAND/AUTO* transfer handle is in *HAND*. When the application calls for automatic operation:

1. Manually position the actuator to the extreme end of travel corresponding to solenoid demand.

2. Close the solenoid equalizing valve.

3. Slowly open the customer air supply shutoff valve.

4. Turn the *HAND/AUTO* transfer handle to *AUTO*.

After completing the transfer, the actuator is under solenoid control.

### *Remote Reset Air Failure Lock Equipped Types UP3 and UP4 Actuators – Transfer from Automatic to Manual Operation*

**NOTE:** Refer to Figure 5-2.

If the customer air supply fails, the actuator may be put into manual operation. It may also be desirable to switch to manual operation even if the customer air supply has not failed.

1. Open the air failure lock equalizing valve.

2. Follow the instructions under ***Positioner-Equipped Types UP3 and UP4 Actuators without Air Failure Lock – Transfer from Automatic to Manual Operation*** or ***Solenoid-Equipped Types UP3 and UP4 Actuators without Air Failure Lock – Transfer from Automatic to Manual Operation***.

### *Remote Reset Air Failure Lock Equipped Types UP3 and UP4 Actuators – Transfer from Manual to Automatic Operation*

**NOTE:** Refer to Figure 5-2.

If the actuator is in the manual mode and it is desired to switch to automatic operation, the customer air supply must be operational.

1. Press the remote release pushbutton (if used) to release the air failure lock.

2. Close the air failure lock equalizing valve.

3. Follow the instructions under ***Positioner-Equipped Types UP3 and UP4 Actuators without Air Failure Lock – Transfer from Manual to Automatic Operation*** or ***Solenoid-Equipped Types UP3 and UP4 Actuators without Air Failure Lock – Transfer from Manual to Automatic Operation***.

## *TYPES UP5 AND UP6 ACTUATOR OPERATION*

Types UP5 and UP6 actuator operation differs slightly depending on whether control of the actuator comes from a positioner or a solenoid valve. The addition of the air failure lock option also varies the operation. The reserve air tank option has no effect on actuator operation.

### *Positioner-Equipped Types UP5 and UP6 Actuators without Air Failure Lock – Transfer from Automatic to Manual Operation*

**NOTE:** Refer to Figure 5-3.

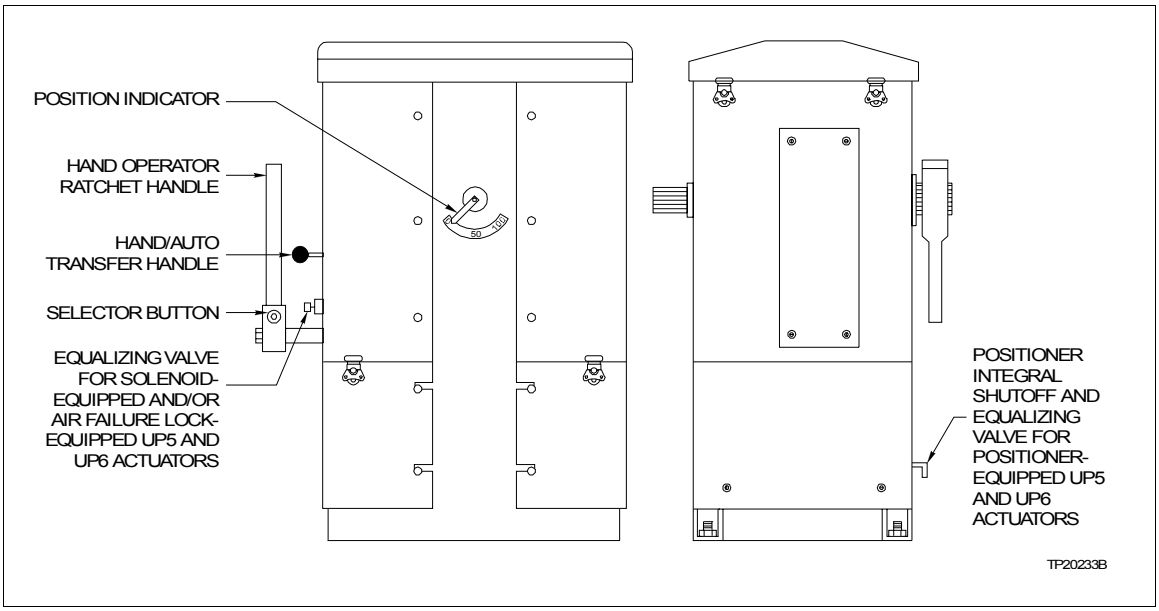



*Figure 5-3. Operating Controls - Types UP5 and UP6 Actuators*

When a Type UP5 or UP6 actuator is supplied with a positioner and is in the automatic mode, the positioner integral shutoff and equalizing valve is in the *AUTO* position, and the *HAND/AUTO* transfer handle is in the *AUTO* position. When the application calls for manual operation:

1. Move the *HAND/AUTO* transfer handle to the *HAND* position.

   **NOTE:** The *HAND/AUTO* transfer handle may not engage immediately with the clutch mechanism. Turn the hand operator ratchet handle in either direction until the clutch mechanism snaps in place.

2. Press in the safety latch on the positioner integral shutoff and equalizing valve (located on the side of the actuator). Turn the valve to the *HAND* position.

3. Move the actuator to the desired position by means of the hand operator ratchet handle.

   **NOTE:** The manual operating mechanism is self-locking and holds any position to which it is set.

***Positioner-Equipped Types UP5 and UP6 Actuators without Air Failure Lock – Transfer from Manual to Automatic Operation***

**NOTE:** Refer to Figure 5-3.

When a Type UP5 or UP6 actuator is supplied with a positioner and is in the manual mode, the positioner integral shutoff and equalizing valve is in the *HAND* position, and the *HAND/AUTO* transfer handle is in the *HAND* position.

| | |
|---|---|
| **WARNING** | **Undesirable motion of the drive arm and linkage may occur which could cause injury or upset the process if the transfer instructions are not followed.** |
| **AVERTISSEMENT** | **Danger d'un mouvement inopportun du bras de commande et de la tringlerie pouvant causer des blessures ou bouleverser le procede. Suivre attentivement les procedures du transfert de commande manuelle a automatique.** |

**NOTE:** If a *HAND/AUTO* remote mounted control station exists, it should be in the *HAND* mode before attempting the transfer.

When the application calls for automatic operation:

1. Before shifting to *AUTO*, the actuator position must agree, as close as possible, to the input signal. If not, the drive arm jumps when the transfer takes place.

2. Adjust the input signal to correspond to the actuator position (or vice versa if the system conditions permit). This can be closely approximated by using a previously prepared plot of the input signal versus the actuator position.

3. Two methods of transfer exist. ***Method A*** is most often used.

### *METHOD A – CHANGING THE INPUT SIGNAL TO MATCH THE ACTUATOR POSITION*

**NOTE:** Use Method A if it is ***not*** possible to move the actuator without endangering the operation of the system.

a. Turn the positioner shutoff and equalizing valve to the *AUTO* position.

b. Slowly change the input signal to match the actuator position.

c. Exert ***moderate*** force on the *HAND/AUTO* transfer handle toward the *AUTO* position while adjusting the input signal. Do this until the *HAND/AUTO* transfer handle moves freely to the *AUTO* position.

### *METHOD B – MANUALLY POSITIONING THE ACTUATOR TO MATCH THE INPUT SIGNAL*

**NOTE:** Use Method B if it is possible to move the actuator position without endangering the operation of the system.

a. Turn the positioner shutoff and equalizing valve to the *AUTO* position.

b. Turn the hand operator ratchet handle to determine the direction of the least load resistance. Use the selector button at the hub of the ratchet to change the direction of rotation.

c. While turning the hand operator ratchet handle in the direction of least resistance, exert ***moderate*** force on the *HAND/AUTO* transfer handle toward the *AUTO* position. Do this until the *HAND/AUTO* transfer handle moves freely to the *AUTO* position.

After completing the transfer via Method A or Method B, the actuator positions itself automatically.

## *Solenoid-Equipped Types UP5 and UP6 Actuators without Air Failure Lock – Transfer from Automatic to Manual Operation*

**NOTE:** Refer to Figure 5-3.

When a Type UP5 or UP6 actuator is supplied with a solenoid valve and is in the automatic mode, the customer air supply valve is open, the solenoid equalizing valve is closed and the *HAND/AUTO* transfer handle is in *AUTO*. When the application calls for manual operation:

1. Turn the *HAND/AUTO* transfer handle to *HAND*.

2. Open the solenoid equalizing valve.

3. Close the customer-installed air supply shutoff valve.

**NOTE:** The *HAND/AUTO* transfer handle may not engage immediately with the clutch mechanism. Turn the hand operator ratchet handle in either direction until the clutch mechanism snaps into place.

4. Move the actuator to the desired position by means of the hand operator ratchet handle.

**NOTE:** The manual operating mechanism is self-locking and holds any position to which it is set.

### *Solenoid-Equipped Types UP5 and UP6 Actuators without Air Failure Lock – Transfer from Manual to Automatic Operation*

**NOTE:** Refer to Figure 5-3.

When a Type UP5 or UP6 actuator is supplied with a solenoid valve and is in the manual mode, the customer air supply valve is closed, the solenoid equalizing valve is open and the *HAND/AUTO* transfer handle is in *HAND*. When the application calls for automatic operation:

1. Manually position the actuator to the extreme end of travel corresponding to solenoid demand.

2. Close the solenoid equalizing valve.

3. Slowly open the customer air supply shutoff valve.

4. Turn the *HAND/AUTO* transfer handle to *AUTO*.

After completing the transfer, the actuator moves automatically.

### *Remote Reset Air Failure Lock Equipped Types UP5 and UP6 Actuators – Transfer from Automatic to Manual Operation*

**NOTE:** Refer to Figure 5-3.

If the customer air supply fails, the actuator may be put into manual operation. It may also be desired to switch to manual operation even if the customer air supply has not failed.

1. Open the air failure lock equalizing valve.

2. Follow the instructions under ***Positioner-Equipped Types UP5 and UP6 Actuators without Air Failure Lock – Transfer from Automatic to Manual Operation*** or ***Solenoid-Equipped Types UP5 and UP6 Actuators without Air Failure Lock – Transfer from Automatic to Manual Operation*****.**

***Remote Reset Air Failure Lock Equipped Types UP5 and UP6 Actuators – Transfer from Manual to Automatic Operation***

**NOTE:** Refer to Figure 5-3.

If the actuator is in the manual mode and it is desired to switch to automatic operation, the customer air supply must be operational.

1. Press the remote release pushbutton to release the air failure lock.

2. Close the air failure lock equalizing valve.

3. Follow the instructions under ***Positioner-Equipped Types UP5 and UP6 Actuators without Air Failure Lock – Transfer from Manual to Automatic Operation*** or ***Solenoid-Equipped Types UP5 and UP6 Actuators without Air Failure Lock – Transfer from Manual to Automatic Operation***.

# SECTION 6 - TROUBLESHOOTING

## *INTRODUCTION*

If an obvious fault occurs, check the supply pressure, input and output connections, gage connections, and mechanical linkage adjustments before removing the system from service.

**WARNING**

**Disconnect the supply signal source or remove the equipment from the process before servicing. Failure to do so can cause unexpected movement posing a risk of bodily injury.**

**Do not operate this equipment unless the covers are in place. The covers prevent access to moving components that pose a risk of entanglement of body parts.**

**AVERTISSEMENT**

**Débranchez le signal ou retirez l'équipement du processus avant de procéder à l'entretien. Toute négligence à cet égard risque de donner lieu à des mouvements inattendus pouvant provoquer des blessures.**

**Ne faites fonctionner cet équipement que si les couvercles sont en place. Les couvercles empêchent l'accès à des composantes en mouvement qui présentent un risque d'emmêlement des membres.**

## *PROBLEM DETERMINATION AND VERIFICATION PROCEDURE*

If a fault occurs with the actuator, refer to Table 6-1 and correct any problems that occur with the actuator, positioner or associated components.

*Table 6-1. Fault Correction Chart*

| Fault | Probable Cause | Corrective Action |
|---|---|---|
| Final actuation element at one end of stroke and does not respond to change. | Air lines in wrong ports. | Reverse lines connected to positioner O1 and O2 ports. |
| | Reversed positioner cam rotation. | Install proper positioner cam. Refer to the appropriate positioner instruction. |
| | I/P not functioning.[1] | Monitor the I/P at the I port on the positioner manifold. If output changes from 21 to 103 kPa (3 to 15 psig) with input change of 4 to 20 mA, the I/P is working. If not, replace I/P as outlined in the appropriate positioner instruction. |

*Table 6-1. Fault Correction Chart (continued)*

| Fault | Probable Cause | Corrective Action |
|---|---|---|
| Excessive air consumption (exhaust loud). | Leakage at joints of manifold assembly of positioner. | Remove positioner manifold and check O-rings. |
| | Positioner pilot valve leaking excessively or stuck in place. | Remove pilot valve body. Refer to the appropriate positioner instruction. |
| | Check for continuity of solenoid coils. | Replace solenoid coils or entire solenoid. |
| Oscillation of final actuation element. | Gain too high. | Change gain hinge spring to greater thickness. Refer to the appropriate positioner instruction. |
| | Drive arm not securely attached to final actuation element. | Tighten or correct linkage as necessary. |
| Slow response. | Positioner pilot valve blocked. | Remove and clean pilot valve. Refer to the appropriate positioner instruction. |
| | Leaky seals in rotary vane or cylinder. | Replace seals. |
| | Supply input drops when actuator moves. | Monitor supply input pressure. Correct if necessary. |
| Final actuation element at either travel stop and will not respond to input change. | Air lines in wrong ports. | Check air line connections. |
| | Incorrect cam installed for application. | Determine application (direct or reverse acting) and check cam. |
| | Signal diaphragm leaking. | Replace diaphragm. Refer to the appropriate positioner instruction. |
| | No output from I/P assembly. | Verify air supply to the I/P as 138 ±10 kPa (20 ±1.5 psig). If input is correct replace the I/P assembly as outlined in the appropriate positioner instruction. If not, check the regulator and replace if necessary. |
| Uprange zero shift that cannot be adjusted. | Signal diaphragm leakage. | Check and replace if necessary. Refer to appropriate positioner instruction. |
| | No output from I/P assembly. | Verify air supply to the I/P as 138 ±10 kPa (20 ±1.5 psig). If input is correct, replace the I/P assembly as outlined in the appropriate positioner instruction. If not, check the regulator and replace if necessary. |
| Full range cannot be obtained with adjustment. | Signal diaphragm leaking. | Check and replace if necessary. Refer to the appropriate positioner instruction. |
| Actuator will not operate below freezing. | Trapped moisture frozen in air lines. | If supplied with heaters, check for continuity across heater or thermoswitch leads. If defective, refer to Section 8. If not supplied with heaters, check instrument air drying equipment. |
| Pneumatic shaft position transmitter will not operate. | Pneumatic transmitter defective. | Repair or replace transmitter. Refer to Section 8. |
| Electric shaft position transmitter will not operate | Transmitter board assembly defective. | Replace transmitter board assembly. Refer to Section 8. |
| | Feedback potentiometer defective. | Check potentiometer resistance. If open, replace feedback potentiometer. Refer to Section 8. If not defective, check transmitter board. |

*Table 6-1. Fault Correction Chart (continued)*

| Fault | Probable Cause | Corrective Action |
|---|---|---|
| Alarm/travel switch unit will not operate. | Loose microswitch cam. | Tighten cam. |
| | Microswitches defective. | Replace microswitches. Refer to Section 8. |
| Air failure lock will not operate. | Trip valve or lock valve improperly set. | Refer to Section 4 and properly adjust the trip or lock valve. |
| | Trip valve or lock valve defective. | Replace trip valve or lock valves. Refer to Section 8. |
| | Latching spring return cylinder defective (Types UP1 and UP2 actuators only). | Replace latching spring return cylinder. Refer to Section 8. |
| Reserve air tank will not operate the actuator. | Trip valve defective. | Replace the trip valve. Refer to Section 8. |
| | Check valve to air tank defective. | Replace the check valve. Refer to Section 8. |
| | Air lines from reserve air tank to actuator are plugged or leaking. | Clean or replace air lines from the air tank to the actuator. |

**NOTE:**

1. Types AV2 and AV3 positioners only.

# SECTION 7 - MAINTENANCE

## *INTRODUCTION*

This section contains maintenance procedures to be performed on a scheduled and as needed basis.

| | |
|---|---|
| **WARNING** | **Stay clear of moving components when performing procedures that require the equipment to be energized. The equipment can operate automatically. There is a risk of entanglement of body parts when performing these procedures.** |
| **AVERTISSEMENT** | **Restez à l'écart des composantes en mouvement lorsque vous effectuez des procédures nécessitant que l'équipement soit sous tension. L'équipement peut se déplacer de façon automatique. Ces procédures présentent un risque d'emmêlement des membres.** |

## *PERIODIC MAINTENANCE*

| | |
|---|---|
| **WARNING** | **Disconnect the supply signal source or remove the equipment from the process before servicing. Failure to do so can cause unexpected movement posing a risk of bodily injury.** |
| **AVERTISSEMENT** | **Débranchez le signal ou retirez l'équipement du processus avant de procéder à l'entretien. Toute négligence à cet égard risque de donner lieu à des mouvements inattendus pouvant provoquer des blessures.** |

| | |
|---|---|
| **CAUTION** | **If the connections require tightening, do not exceed the maximum torque of 6.8 Nm (60 in.-lbs) for ¼-18 NPT connections, or 3.4 Nm (30 in.-lbs) for ⅛-27 NPT connections. Do not use teflon tape to seal threaded fittings. Use only liquid or paste pipe sealant. Use of Loctite® sealants, which are polyacrylate or acrylic diesters based, is not recommended. Water based Loctite sealant, such as Vibra Seal No. 503, is acceptable.** |
| **ATTENTION** | **Si les connecteurs exigent us serrage, ne pas depasser le couple maximal de 6.8 Nm (60 pouces-livres) pour filetage ¼-18 NPT ou 3.4 Nm (30 pouces-livres) pour filetage ⅛-27 NPT. Nepas employer du ruban de teflon pour sceller les raccords filetes. Employer sculement un scelle-joint liquide ou en pate pour tuyanterie. L'emploi de scelle-joint Loctite a base de polyacrylique ou d'acrylique n'est pas recommande. Le scelle-joint Loctite base d'eau, tel que Vibra-Seal No. 503 est acceptable.** |

1. Check all air connections for leakage. While under pressure, pour soapsuds solution on the connections. If the solution bubbles, tighten the connections.

2. Check the linkage for mechanical wear or binding. Lubricate as often as required as determined by equipment use (refer to ***Connecting Linkage for Universal Rotary Actuators***).

3. Periodically check for loose bolts. If needed, torque the bolts to the required specifications. Refer to the drawings in Appendix B for torque specifications.

4. Maintain a clean air supply (free of dirt, oil and moisture) to insure sound operation of the positioner.

5. If the supply line has the suggested filter, remove and clean it if needed. Refer to ***Air Quality*** in Section 3.

6. Whenever the positioner is out of service (or when needed), perform the maintenance procedures outlined in the maintenance section of the appropriate positioner instruction.

## *ANNUAL OR SEMIANNUAL MAINTENANCE*

1. Check the adjustment and calibration of the positioner and the final actuator element. The procedure is outlined in the calibration section of the appropriate positioner instruction.

2. Verify that the reserve air tank option can drive the cylinder or rotary vane to the end of its stroke. Drain moisture from air tank if required, through a drain provided in the bottom of the tank.

3. Check the adjustment of the air failure brake as described in ***Air Failure Lock Calibration*** in Section 4.

4. Every six months, apply a streak of dry, graphite-based lubricant to the Types UP5 and UP6 actuator shaft bearings, roller chain and air cylinder. Remove the rear panel and side covers to see the grease fittings and chain.

5. On Types UP5 and UP6 actuators, check the roller chain for undue slack. Do not let slack exceed ½-inch on either side (one inch total). Refer to ***ROLLER CHAIN ADJUSTMENT (TYPES UP5 AND UP6 ACTUATORS)*** in Section 8.

6. Once a year (or when needed), apply dry, graphite-based lubricant to the drag pins of the Types UP5 and UP6 actuator clutch assembly.

7. Check the clutch for undue wear. Refer to ***CLUTCH FORK INSPECTION AND REPLACEMENT (TYPES UP5 AND UP6 ACTUATORS)*** in Section 8 for the procedure.

**NOTE:** Inspect the clutch yearly for an actuator exposed to normal use, and more often if exposed to harsh conditions.

8. Check that the positioner integral shutoff and equalizing valve moves easily. If not, refer to the appropriate positioner instruction for cleaning procedures.

9. Lubricate the grease fittings on the cylinders for Types UP4 through UP6 actuators until the grease comes out the relief. See Figures 8-3 through 8-5 for the location of these fittings. For Type UP3 actuators, lubricate the inside diameter of the bushing as shown in Figure 8-2.

## *MAINTENANCE AS REQUIRED*

| | |
|---|---|
| **WARNING** | **Use solvents only in well-ventilated areas. Avoid prolonged or repeated breathing of vapors. Avoid prolonged or repeated contact with the skin. Solvents can cause nausea, dizziness and skin irritation. In some cases, overexposure to solvents has caused nerve and brain damage. Solvents are flammable – do not use near extreme heat or open flame.** |
| **AVERTISSEMENT** | **N'utilisez des solvants que dans des zones bien aérées. Evitez de respirer les vapeurs de facon prolongée ou répétée. Evitez les contacts prolongés ou répétés avec la peau. Les solvants peuvent provoquer des nausées, des étourdissements et l'irritation cutanée. Cans certains cas, une surexposition aux solvants provoque des dommages au système nerveux ou au cerveau. Les solvants sont inflammables – il ne faut pas les utiliser près d'une source de chaleur ou d'une flamme ouverte.** |

1. Completely disassemble and clean the positioner. Refer to the appropriate positioner instruction for cleaning procedures.

2. Completely disassemble and clean the actuator as described in Section 8.

3. Unless detecting excessive leakage, do not service the air cylinder or rotary vane. If needed, refer to ***ROTARY VANE SEAL REPAIR AND HOUSING CLEANING*** or ***CYLINDER ASSEMBLY REPAIR AND CLEANING*** in Section 8.

# SECTION 8 - REPAIR AND REPLACEMENT PROCEDURES

## *INTRODUCTION*

Occasionally, the actuator may need to have components replaced. Use these procedures if a fault is found as determined by the methods described in the troubleshooting section.

| | |
|---|---|
| **WARNING** | **Disconnect the supply signal source or remove the equipment from the process before servicing. Failure to do so can cause unexpected movement posing a risk of bodily injury.** |
| **AVERTISSEMENT** | **Débranchez le signal ou retirez l'équipement du processus avant de procéder à l'entretien. Toute négligence à cet égard risque de donner lieu à des mouvements inattendus pouvant provoquer des blessures.** |

| | |
|---|---|
| **CAUTION** | **If the connections require tightening, do not exceed the maximum torque of 6.8 Nm (60.0 in.-lbs) for ¼-18 NPT connections, or 3.4 Nm (30.0 in.-lbs) for ⅛-27 NPT connections. Do not use teflon tape to seal threaded fittings. Use only liquid or paste pipe sealant. Use of Loctite sealants, which are polyacrylate or acrylic diesters based, is not recommended. Water based Loctite sealant, such as Vibra-Seal No. 503, is acceptable.** |
| **ATTENTION** | **Si les connecteurs exigent us serrage, ne pas depasser le couple maximal de 6.8 Nm (60.0 pouces-livres) pour filetage ¼-18 NPT ou 3.4 Nm (30.0 pouces-livres) pour filetage ⅛-27 NPT. Nepas employer du ruban de teflon pour sceller les raccords filetes. Employer sculement un scelle-joint liquide ou en pate pour tuyanterie. L'emploi de scelle-joint Loctite a base de polyacrylique ou d'acrylique n'est pas recommande. Le scelle-joint Loctite base d'eau, tel que Vibra-Seal No. 503 est acceptable.** |

## *ENCLOSURE REMOVAL*

| | |
|---|---|
| **WARNING** | **Do not operate this equipment unless the covers are in place. The covers prevent access to moving components that pose a risk of entanglement of body parts.** |
| **AVERTISSEMENT** | **Ne faites fonctionner cet équipement que si les couvercles sont en place. Les couvercles empêchent l'accès à des composantes en mouvement qui présentent un risque d'emmêlement des membres.** |

Refer to the proper enclosure removal procedure in Section 3 to access the components referred to in this section.

## *POSITIONER REMOVAL AND REPLACEMENT*

**NOTE:** Refer to the applicable parts drawings in Appendix A.

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Place the positioner integral shutoff and equalizing valve in the manual position to shut off the air supply to the positioner.

3. Allow the air pressure to subside completely.

4. Remove the covers (if necessary) to access the positioner.

5. For Type AV1 positioners, disconnect and label the O1, O2, signal and supply lines from the positioner.

6. For Types AV2, AV3 and AV4 positioners, disconnect and label the O1, O2 and supply line from the positioner, remove the cover and disconnect and label the two wires from the input terminal block.

7. For Types UP1 and UP2 actuators, perform Step 7a. For Types UP3 through UP6 actuators, perform Steps 7b and 7c.

   a. Remove the three ¼-inch fasteners that hold the positioner to the actuator.

   b. Remove the linkage from the positioner.

   c. Remove the mounting screws securing the positioner to its mounting bracket.

8. Remove the positioner.

9. To repair the positioner, refer to the appropriate positioner instruction.

10. Reverse the procedure to install the positioner. Use the torque values specified in the drawings in Appendix A to tighten all fasteners when assembling.

## *SOLENOID VALVE REMOVAL AND REPLACEMENT*

**NOTE:** Refer to the applicable parts drawings in Appendix A.

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the solenoid equalizing valve to shut off the air supply.

3. Allow the air pressure to subside completely.

4. Remove the covers (if necessary) to access the solenoid valve.

5. For Types UP1 and UP2 actuators, perform Step 5a. For Types UP3 through UP6 actuators, perform Step 5b.

   a. Disconnect and label the solenoid valve leads from the solenoid valve.

   b. Disconnect and label the solenoid valve leads from the terminal strip inside the actuator (refer to Figures 3-3 and 3-4).

6. Disconnect and label the supply air line from port P and the outlet air lines from ports A and B.

7. Remove the screws holding the solenoid valve to the mounting bracket.

8. Remove the solenoid valve.

9. Reverse the procedure to install the new solenoid valve.

## *ROTARY VANE REMOVAL AND REPLACEMENT (TYPES UP1 AND UP2 ACTUATORS)*

**NOTE:** Refer to Figure 8-1.

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air pressure to subside completely.

4. Remove the covers (if necessary) to access the rotary vane.

5. Disconnect and label the two air lines from the rotary vane at the connecting elbows.

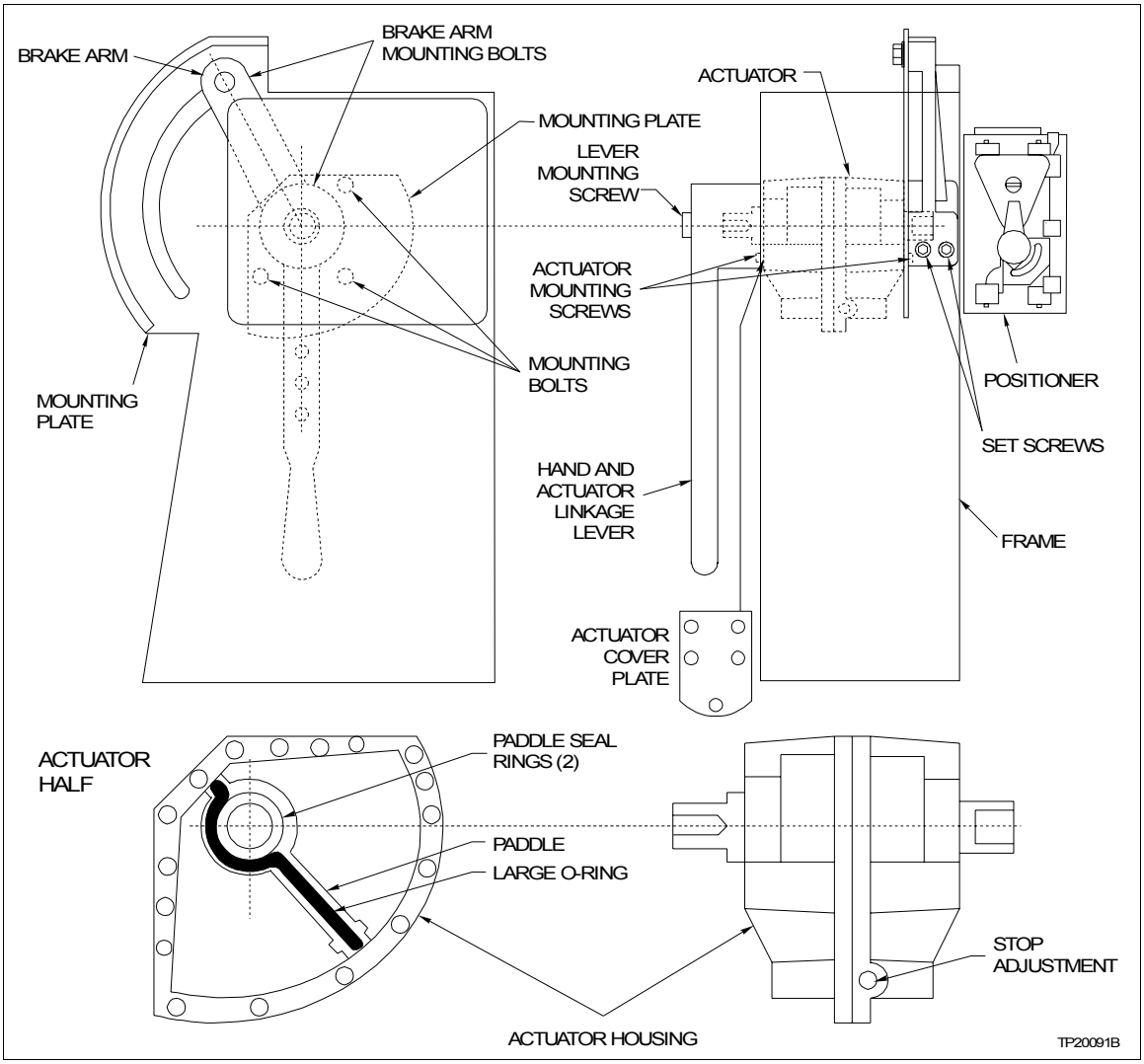



*Figure 8-1. Rotary Vane Removal and Seal Replacement*

6. Feed the lines through the actuator frame.

7. Refer to ***POSITIONER REMOVAL AND REPLACEMENT*** or ***SOLENOID VALVE REMOVAL AND REPLACEMENT*** and remove the positioner or solenoid valve.

8. Loosen the cap screw holding the hand and actuator linkage lever to the actuator shaft.

9. Remove the hand and actuator linkage lever.

10. Remove the cap screws holding the brake arm to the bottom of the actuator shaft.

11. Remove the bolt securing the top of the brake arm to the mounting plate.

12. Remove the brake arm.

13. Loosen the three large bolts holding the mounting plate to the actuator frame.

14. Loosen the two smaller bolts securing the mounting plate to the actuator frame.

15. Loosen the cap screw holding the mounting plate to the actuator frame.

16. Remove the mounting plate.

17. Remove the five bolts holding the actuator shaft cover plate in place.

18. Remove the actuator shaft cover plate.

19. Remove the three large bolts holding the actuator to the actuator frame.

20. Lift the actuator out of the actuator frame.

21. Reverse this procedure to install the rotary vane.

## *ROTARY VANE SEAL REPAIR AND HOUSING CLEANING*

| | |
|---|---|
| **WARNING** | **Use solvents only in well ventilated areas. Avoid prolonged or repeated breathing of vapors or contact with skin. Solvents can cause nausea, dizziness and skin irritation. In some cases, overexposure to solvents has caused nerve and brain damage. Solvents are flammable - do not use near extreme heat or open flame.** |
| **AVERTISSEMENT** | **N'utilisez des solvants que dans des zones bien aérées. Evitez de respirer les vapeurs de facon prolongée ou répétée. Evitez les contacts prolongés ou répétés avec la peau. Les solvants peuvent provoquer des nausées, des étourdissements et l'irritation cutanée. Cans certains cas, une surexposition aux solvants provoque des dommages au système nerveux ou au cerveau. Les solvants sont inflammables - il ne faut pas les utiliser près d'une source de chaleur ou d'une flamme ouverte.** |

**NOTE:** Refer to Figure 8-1.

1. Refer to ***ROTARY VANE REMOVAL AND REPLACEMENT (TYPES UP1 AND UP2 ACTUATORS)*** and remove the rotary vane from the actuator frame.

2. Remove the screws holding the housing together.

3. Separate the covers and remove the paddle.

4. Clean the inside surface of the rotary vane housing with a suitable grease solvent.

5. Remove the sealant on the joining surfaces of the housing with lacquer thinner.

6. Lubricate the internal surfaces with lubricant, Part No. 199354_1 (No. 55M Dow Corning® Grease).

7. Replace the large O-ring on the paddle assembly.

8. Replace the seal rings on each side of the paddle shaft.

9. Lubricate the O-ring and seal rings with lubricant, Part No. 199354_1.

10. Place the paddle in the housing.

11. Coat the housing joining surfaces with sealant Part No. 199926_1 (GE® Silmate® RTV 1473 Sealant).

12. Replace the housing.

13. With the paddle turned to the right side, snug down the bolts on the left side.

14. Rotate the paddle to the left side of the rotary vane and snug down the screws on the right side.

15. Tighten all screws and bolts securely.

16. Rotate the shaft several times through a full 90 degree rotation to remove any excess sealant inside the housing.

> **NOTE:** Do not place the rotary vane in service for at least four hours to allow the sealant to set up completely.

17. Refer to ***ROTARY VANE REMOVAL AND REPLACEMENT (TYPES UP1 AND UP2 ACTUATORS)*** to install the rotary vane in the actuator housing.

## *CYLINDER ASSEMBLY REPLACEMENT (TYPES UP3/4/5/6 ACTUATORS)*

**NOTE:** Refer to the drawings in Appendix A.

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air pressure to subside completely.

4. Remove the covers necessary to access the cylinder assembly.

5. Disconnect and label the air lines from the top and bottom of the cylinder.

6. Remove the pin assembled through the piston rod end and the crank arm assembly.

7. Remove the pin attaching the cylinder to the actuator stand.

8. Lift the assembly out of the stand.

9. Reverse this procedure to install the cylinder assembly.

## *CYLINDER ASSEMBLY REPAIR AND CLEANING*

**NOTE:** Refer to Tables 8-1 through 8-4 and Figures 8-3 through 8-5.

1. Refer to ***CYLINDER ASSEMBLY REPLACEMENT (TYPES UP3/4/5/6 ACTUATORS)*** and remove the cylinder from the actuator frame.

2. Remove the hex full nuts (on Type UP3 actuators), or retaining rings (on Types UP4 through UP6 actuators).

3. Remove the bottom end flange.

4. To remove the piston assembly, rod and top flange, pull the piston out of the cylinder.

5. Remove the retaining ring from the top flange assembly.

6. Extract the bushing.

7. Remove the O-rings from the end flanges.

8. Remove the rod seals from the bushing.

9. Remove the rod wiper from the bushing.

10. Inspect the O-rings for signs of wear and replace them if necessary.

*Table 8-1. Parts List for Type UP3 Actuator Cylinder Assembly (Part Number 5328775◦1)*[1]

| Item | Qty | Part No. | Description | Item | Qty | Part No. | Description |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 5327215_1 | Bottom flange | 12 | 1 | 1951416_218 | O-ring |
| 2 | 2 | 1951416_256 | O-ring | 13 | 1 | 5327205_1 | Bushing |
| 3 | 1 | 5328773_1 | Piston | 14 | 1 | 197164_150 | Retaining ring |
| 4 | 2 | 5328772_1 | Back-up plate | 15 | 1 | 1951401_1 | Wiper ring |
| 5 | 2 | 5328776_1 | Spacer | 16 | 1 | 5328778_1 | Piston rod |
| 6 | 1 | 195825_15 | O-ring | 17 | 1 | 199355_1 | Lube label not shown |
| 7 | 1 | 5328777_1 | Spacer | 18 | 1 | 197120_22 | Elastic stop nut |
| 8 | 8 | 19781_6 | Stud | 19 | 16 | 0.375-16 | Hex full nut |
| 9 | 1 | 53406ac1 | Cylinder body | 21 | 2 | 1/8-27 | Plastic pipe plug |
| 10 | 1 | 1951399_214 | O-ring | 22 | 4 | 1/8-27 | Steel Hex head pipe plug |
| 11 | 1 | 5327214_1 | Upper flange | 23 | A/R | 199354_1 | Lube not shown |

**NOTE:**

1. Order cylinder spare parts kit by Part No. 258240◦1. Refer to Appendix A for parts list.

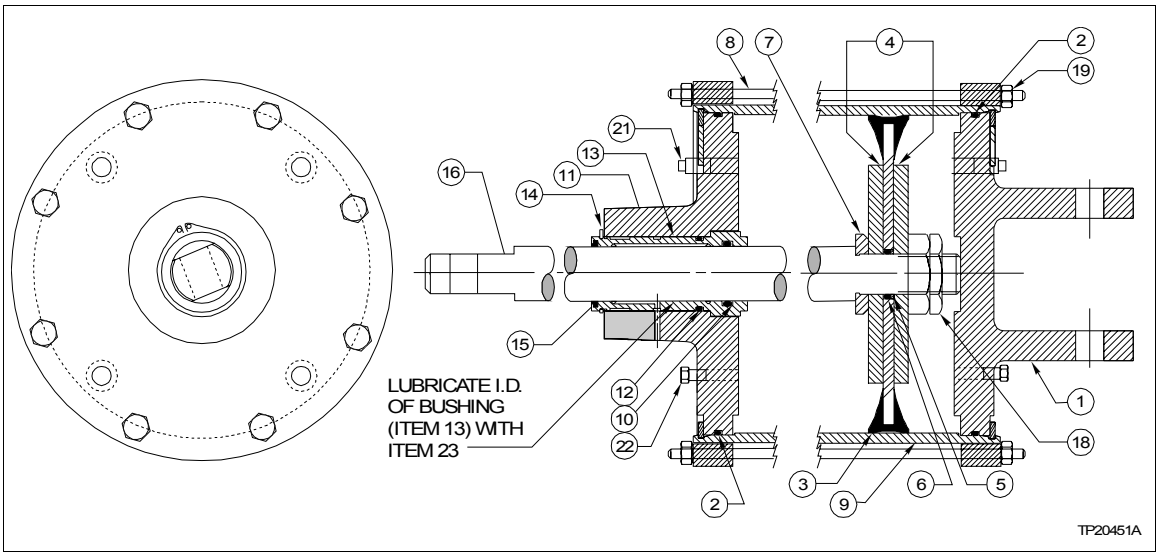



*Figure 8-2. Cylinder Assembly for Type UP3 Actuators (Part Number 5328775◦1)*

*Table 8-2. Parts List for Type UP4 Actuator Cylinder Assembly (Part Number 5328769°1)*[1]

| Item | Qty | Part No. | Description | Item | Qty | Part No. | Description |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 5311428_41 | O-ring | 10 | 1 | 5316536_1 | Stop spacer |
| 2 | 2 | 197736_1 | Retaining ring | 11 | 1 | 5328695_1 | Top flange assembly |
| 3 | 2 | 5328697_1 | Ring lock | 12 | 1 | 5328692_1 | Piston rod |
| 4 | 1 | 5328671_1 | Bottom flange | 13 | 1 | 5319921_1 | Cylinder body |
| 5 | 1 | 197132_7 | Locknut | 14 | 2 | 195148_1 | Pipe plug |
| 6 | 2 | 5328744_1 | Back-up plate | 15 | 4 | NIDAC16005 | Pan head sems |
| 7 | 1 | 5328743_1 | Spacer | 16 | 1 | NLHAC38000 | Hex Jam Nut |
| 8 | 1 | 195825_9 | O-ring | 17 | 2 | — | ¼ pipe thread protector |
| 9 | 1 | 5328768_1 | Piston | 18 | A/R | 199354_1 | Lube not shown |

**NOTE:**

1. Order cylinder spare parts kit by Part No. 258241°1. Refer to Appendix A for parts list.

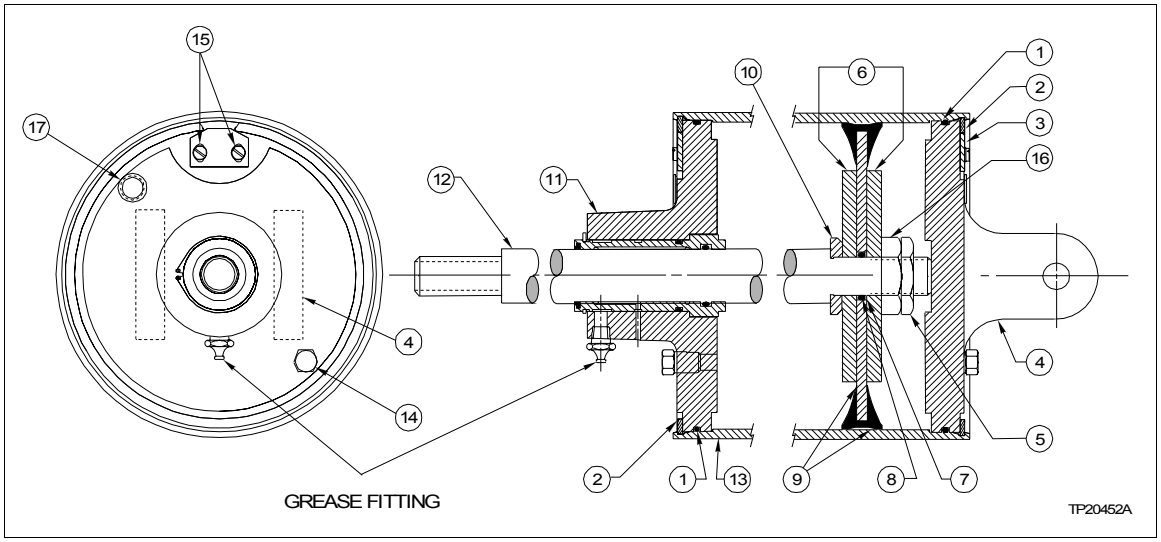



*Figure 8-3. Cylinder Assembly for Type UP4 Actuators (Part Number 5328769°1)*

*Table 8-3. Parts List for Type UP5 Actuator Cylinder Assembly (Part Number 5328952°1)*[1]

| Item | Qty | Part No. | Description | Item | Qty | Part No. | Description |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 5311428_41 | O-ring | 10 | 1 | 5316536_1 | Stop spacer |
| 2 | 2 | 197736_1 | Retaining ring | 11 | 1 | 5328695_1 | Top flange assembly |
| 3 | 2 | 5328697_1 | Ring lock | 12 | 1 | 5328943_2 | Piston rod |
| 4 | 1 | 5328951_1 | Bottom flange | 13 | 1 | 5319921_2 | Cylinder body |
| 5 | 1 | 197132_7 | Locknut | 14 | 3 | 195148_2 | Pipe plug |
| 6 | 2 | 5328744_1 | Back-up plate | 15 | 4 | NIDAC16005 | Pan head sems |
| 7 | 1 | 5328743_1 | Spacer | 16 | 1 | NLHAC38000 | Hex jam nut |
| 8 | 1 | 195825_9 | O-ring | 17 | A/R | 199354_1 | Lube not shown |
| 9 | 1 | 5328768_1 | Piston | — | | | |

**NOTE:**

**1.** Order cylinder spare parts kit by Part No. 258241°1. Refer to Appendix A for parts list.

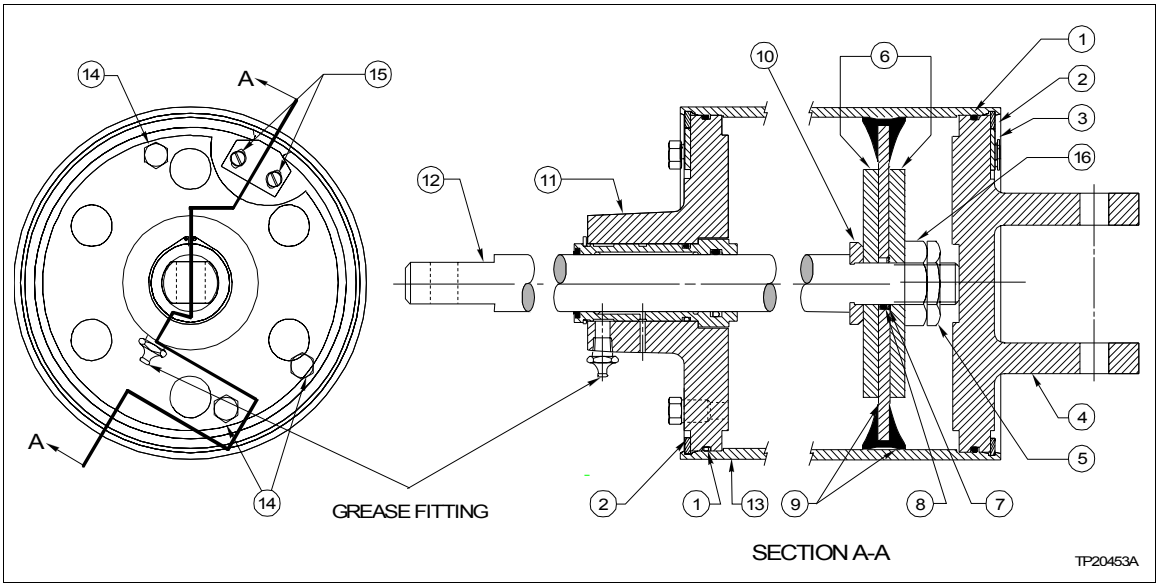



*Figure 8-4. Cylinder Assembly for Type UP5 Actuators (Part Number 5328952°1)*

*Table 8-4. Parts List for Type UP6 Actuator Cylinder Assembly (Part Number 5328945°1)*[1]

| Item | Qty | Part No. | Description | Item | Qty | Part No. | Description |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 5328697_1 | Ring lock | 9 | 1 | 5328743_1 | Spacer |
| 2 | 1 | 197132_7 | Locknut | 10 | 1 | 195825_9 | O-ring |
| 3 | 1 | 5328944_1 | Bottom flange | 11 | 1 | 5328946_1 | Top flange assembly |
| 4 | 2 | 197737_1 | Retaining ring | 12 | 1 | 5328943_1 | Piston rod |
| 5 | 2 | 5311428_39 | O-ring | 13 | 2 | 1951421_2 | Pipe plug |
| 6 | 2 | 5328942_1 | Back-up plate | 14 | 4 | 0.190-32 | Pan head sems ext |
| 7 | 1 | 5317659_1 | Cylinder body | 15 | 1 | 1.000-14 | Hex pull nut |
| 8 | 1 | 5328941_1 | Piston | 16 | A/R | 199354_1 | Lube not shown |

**NOTE:**

**1.** Order cylinder spare parts kit by Part No. 258242°1. Refer to Appendix A for parts list.

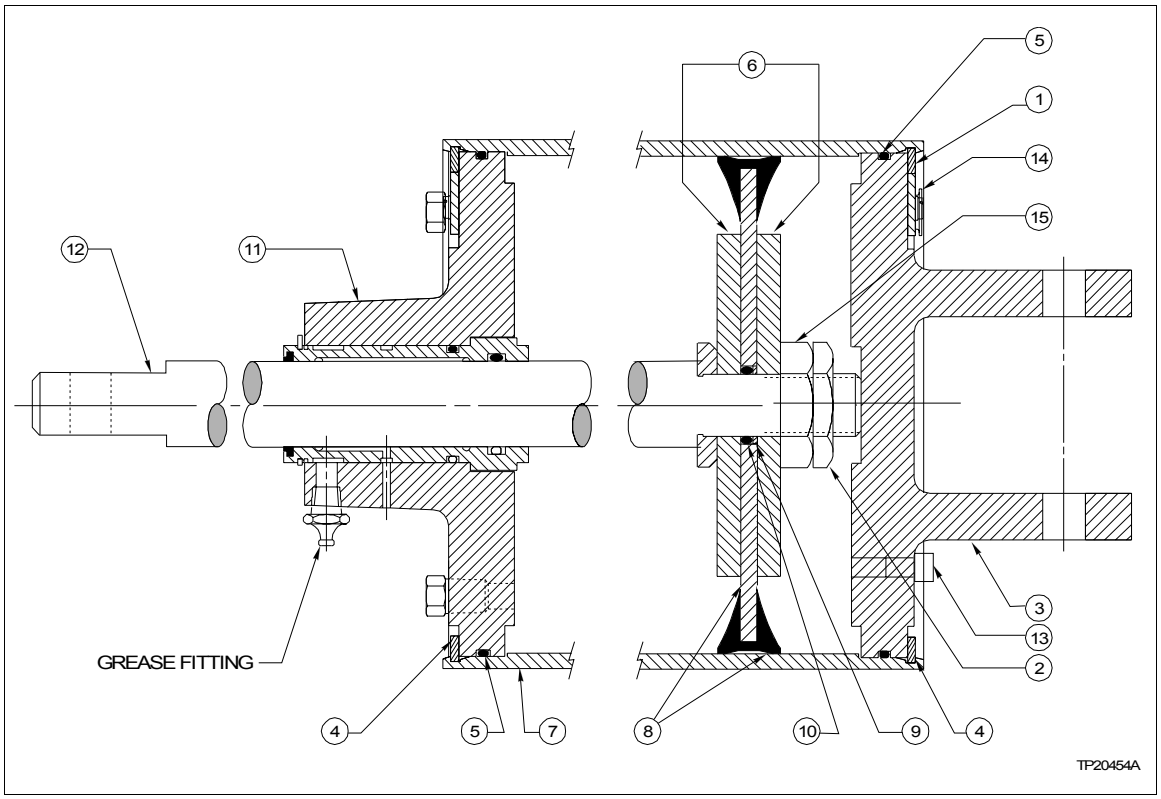



*Figure 8-5. Cylinder Assembly for UP6 Actuators (Part Number 5328945°1)*

11. Inspect the piston seal for signs of wear and replace if necessary.

12. Clean the cylinder and the empty O-ring grooves with a suitable grease solvent.

| | |
|---|---|
| **WARNING** | **Use solvents only in well ventilated areas. Avoid prolonged or repeated breathing of vapors or contact with skin. Solvents can cause nausea, dizziness and skin irritation. In some cases, overexposure to solvents has caused nerve and brain damage. Solvents are flammable - do not use near extreme heat or open flame.** |
| **AVERTISSEMENT** | **N'utilisez des solvants que dans des zones bien aérées. Evitez de respirer les vapeurs de facon prolongée ou répétée. Evitez les contacts prolongés ou répétés avec la peau. Les solvants peuvent provoquer des nausées, des étourdissements et l'irritation cutanée. Cans certains cas, une surexposition aux solvants provoque des dommages au système nerveux ou au cerveau. Les solvants sont inflammables - il ne faut pas les utiliser près d'une source de chaleur ou d'une flamme ouverte.** |

13. Lubricate the piston seal and O-rings with lubricant. Part No. 199354_1 (No. 55M Dow Corning Grease).

14. Place the piston seal and O-rings into the piston rod, end flanges and bushing.

15. Inspect the insides of the cylinder, piston rod and upper flange for signs of scoring or wear.

16. Replace the scored or worn parts, as they might damage the seals.

17. Lubricate the inside of the cylinder, upper flange and bushing with lubricant, Part No. 199354◦1.

18. Paying added attention not to damage the O-rings, reassemble the cylinder assembly.

19. This step applies only to Type UP3 actuators. Tighten the hex full nuts to 8.1 Nm (72 in.-lbs).

20. This step applies only to Types UP4 through UP6 actuators. Install the retaining rings and the bottom end flange.

21. Check the assembly for leaks using soapsuds solution by applying 345 to 690 kPa (50 to 100 psi).

22. Refer to ***CYLINDER ASSEMBLY REPLACEMENT (TYPES UP3/4/5/6 ACTUATORS)*** to install the cylinder assembly.

## *CLUTCH FORK INSPECTION AND REPLACEMENT (TYPES UP5 AND UP6 ACTUATORS)*

**NOTE:** Refer to Figure 8-6.

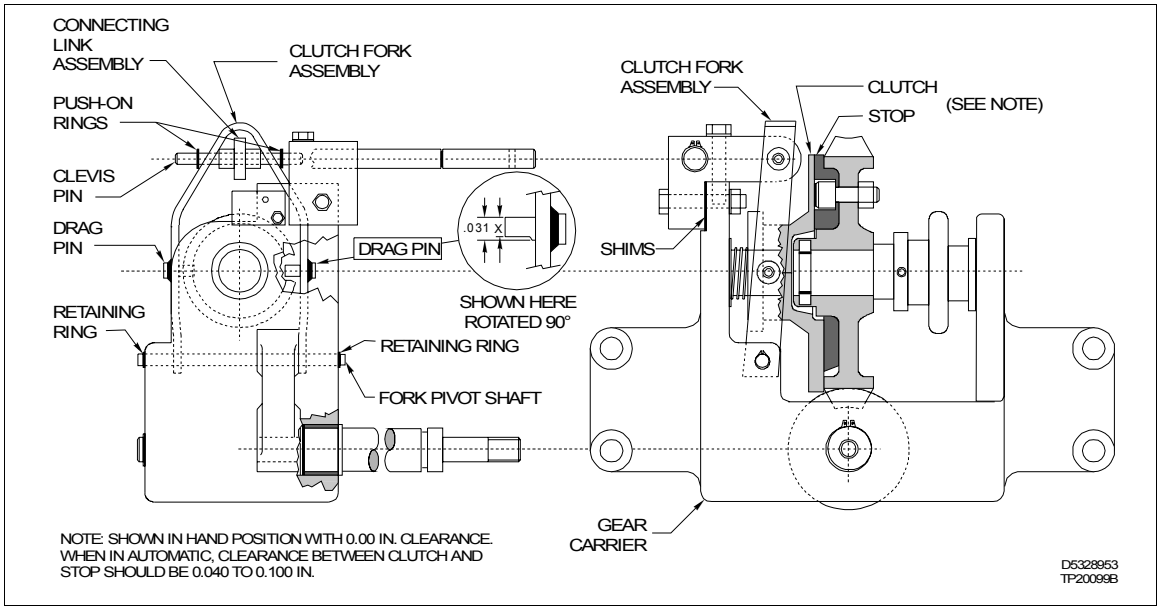



*Figure 8-6. Clutch and Clutch Fork Assembly*

The clutch assembly disengages the gear from the output shaft during manual operation. The clutch has two drag pins, subject to wear. Excessive wear causes the clutch to approach the stop, resulting in engagement of the manual operator gears. This engagement prevents normal automatic operation of the control drive, i.e., it locks in place.

Lubricating extends the life of the drag pins. Lubricate the pins, and the plate they bear upon, with dry graphite-based lubricant. Inspect the clutch assembly once a year for a drive subject to normal operation or more often to one exposed to harsh conditions.

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air supply to subside completely.

4. Remove the covers to allow access to the clutch fork assembly.

5. Place the clutch assembly in the lock position.

6. Measure the distance between the clutch and stop with feeler gages, or equivalent.

7. If the gage shows less than 1.0 mm (0.04 in.), remove the clutch fork assembly and measure the drag pins directly. Refer to Figure 8-6 for proper inspection of the clutch clearance and the drag pins.

8. Remove the push on rings at each end of the clevis pin at the top of the clutch fork assembly.

9. Remove the clevis pin.

10. Remove the retaining rings at each end of the fork pivot shaft at the bottom of the clutch fork assembly.

11. Remove the fork pivot shaft.

12. Remove the clutch fork assembly.

13. Normally, a drag pin measures 7.9 mm (0.31 in.) in diameter. If the diameter measures less than 6.4 mm (0.25 in.), replace the clutch fork assembly. The diameter is represented as x in Figure 8-6 and must be between 6.4 and 7.9 mm (0.25 and 0.31 in.) to pass the inspection.

14. If the drag pins pass the inspection, lubricate them with Plastilube NLG-1, Grade 1.

15. Reverse Steps 12 through 8 to install the new clutch fork assembly.

## *ROLLER CHAIN ADJUSTMENT (TYPES UP5 AND UP6 ACTUATORS)*

**NOTE:** Refer to Figure 8-7.

| | |
|---|---|
| **WARNING** | **Turn off the air supply and allow the pressure to bleed off completely before adjusting the chain. Do not attempt to connect or disconnect the chain. Due to the risk of entanglement of body parts, ABB recommends that replacement of the chain be done only by ABB personnel.** |
| **AVERTISSEMENT** | **Interrompez le débit d'air et assurez-vous qu'il n'y a plus aucune pression avant d'ajuster la chaîne. Ne tentez pas de fixer ou de retirer la chaîne. Compte tenu des risques d'emmêlement des membres, nous recommandons que seul un employé de ABB procède au remplacement de la chaîne conformément aux directives du fabricant.** |

The Types UP5 and UP6 actuators come with the roller chain adjusted for proper operation in the manual mode. Should the slack in the chain ever exceed ½-inch movement on either side (one inch total), the chain needs adjusting.

1. Secure the driven load to prevent sudden movement of the actuator.

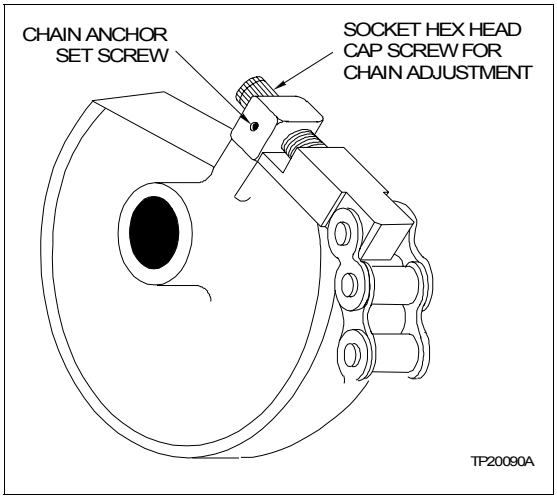



*Figure 8-7. Roller Chain Adjustment for Types UP5 and UP6 Actuators*

2. Place the actuator in the manual mode to prevent the load from shifting.

3. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

4. Allow the air supply to subside completely.

5. Remove the covers to allow access to the roller chain assembly.

6. Loosen the setscrew in the chain anchor.

7. Turn the socket hex head cap screw clockwise to remove undue chain slack (tighten chain).

**NOTE:** The suggested chain slack is between ¼-inch and ½-inch per side (½-inch to one inch total).

8. After removing undue slack, tighten the setscrew in the chain anchorReplace the actuator cover.

9. Restore the air supply to the actuator.

## *OPTIONAL EQUIPMENT REPAIR/REPLACEMENT PROCEDURES*

**NOTE:** Refer to the drawings in Appendix A for part numbers and locations of optional equipment.

### *Reserve Air Tank Component Removal and Replacement (Types UP2 through UP6 Actuators)*

The Types UP2 through UP6 actuators have trip valves and pressure switch. Use these procedures if it is necessary to remove any of the reserve air tank kit components.

#### *TRIP VALVE REMOVAL AND REPLACEMENT*

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air supply to subside completely.

4. Remove the covers necessary to allow access to the trip valve (Types UP3 through UP6 actuators only).

5. Label and disconnect the air lines attached to the trip valve.

6. Remove the bolts holding the trip valve to the mounting bracket.

7. Remove the trip valve.

8. Reverse this procedure to install the new trip valve.

#### *PRESSURE SWITCH REMOVAL AND REPLACEMENT*

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air supply to subside completely.

4. Remove the covers necessary to allow access to the pressure switch.

5. Label and disconnect the air lines attached to the pressure switch.

6. Remove the pressure switch assembly from the mounting plate.

7. Remove the cover plate from the pressure switch housing.

8. Disconnect the red (normally open), black (common), and blue (normally closed) wires from the microswitch in the pressure switch housing.

9. Reverse this procedure to install the new pressure switch.

### *Air Failure Lock Component Removal and Replacement (Types UP1 and UP2 Actuators)*

Use these procedures if it is necessary to remove or replace any of the air failure lock components on Types UP1 and UP2 actuators.

#### *TRIP VALVE REPLACEMENT*

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air supply to subside completely.

4. Remove the covers (if necessary) to access the trip valve.

5. Remove and label the air lines from the trip valve.

6. Remove the two screws securing the trip valve to the mounting bracket.

7. Remove the trip valve.

8. Reverse the procedure to install the new trip valve.

#### *LATCHING SPRING RETURN CYLINDER REPLACEMENT*

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air supply to subside completely.

4. Remove the covers (if necessary) to access the latching spring return cylinder.

5. Remove the air line from the latching spring return cylinder.

6. Loosen the 0.500-20 hex jam nut holding the piston to the adapter (Type UP1 actuator) or clevis arm (Type UP2 actuator).

7. For Type UP1 actuators, perform Step 7a. For Type UP2 actuators, perform Step 7b.

   a. Remove the clevis pin and retaining ring holding the base of the latching spring return cylinder to the mounting yoke.

   b. Remove the retaining ring holding the base of the latching spring return cylinder to the support stud.

8. Remove the latching spring return cylinder.

9. Reverse the procedure to install the new latching spring return cylinder.

### *AUTOMATIC MECHANICALLY ACTUATED EQUALIZING VALVE REPLACEMENT*

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air supply to subside completely.

4. Remove the covers (if necessary) to access the automatic mechanically actuated equalizing valve.

5. Remove and label the air lines from ports 1 and 4 of the automatic mechanically actuated equalizing valve.

6. Remove the nut and washer holding the automatic mechanically actuated equalizing valve to the mounting bracket.

7. Remove the automatic mechanically actuated equalizing valve.

8. To install the new automatic mechanically actuated equalizing valve, reverse the procedure.

   **NOTE:** Be sure the plug is installed in port 2 of the new automatic mechanically actuated equalizing valve.

## *Air Failure Lock Component Removal and Replacement (Types UP3 through UP6 Actuators)*

The Types UP3 and UP4 actuators have a trip valve and a lock valve. Types UP5 and UP6 actuators have a trip valve and two lock valves. Use these procedures if it is necessary to remove any of the air failure lock components on Types UP3 through UP6 actuators.

### *LOCK VALVES REMOVAL AND REPLACEMENT*

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air supply to subside completely.

4. Remove the covers necessary to allow access to the lock valves.

5. Label and disconnect the air lines attached to the lock valves.

6. Remove the bolts that hold the lock valves to the mounting bracket.

7. Remove the lock valves.

8. Reverse this procedure to install the new lock valves.

### *TRIP VALVE REMOVAL AND REPLACEMENT*

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air supply to subside completely.

4. Remove the covers necessary to allow access to the trip valve.

5. Label and remove the air lines attached to the trip valve.

6. Remove the bolts holding the trip valve to the mounting bracket.

7. Remove the trip valve.

8. Reverse this procedure to install the new trip valve.

### *PRESSURE SWITCH REMOVAL AND REPLACEMENT*

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air supply to subside completely.

4. Remove the covers necessary to allow access to the pressure switch.

5. Label and remove the air lines attached to the pressure switch.

6. Remove the pressure switch assembly from the lock and trip valve mounting plate.

7. Remove the cover plate from the pressure switch housing.

8. Remove the red (normally open), black (common), and blue (normally closed) wires from the microswitch in the pressure switch housing.

9. Reverse this procedure to install the new pressure switch.

### *Electric Shaft Position Transmitter Assembly Removal and Replacement*

**NOTE:** Refer to Figures 3-19, 3-22 and the drawings in Appendix A.

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air supply to subside completely.

4. Remove the covers necessary to allow access to the electric shaft position transmitter.

5. This step applies only to Types UP3 and UP4 actuators. If the actuator has the air failure lock option, remove it by:

   a. Removing the mounting screws holding the air failure lock assembly to the actuator mounting frame.

   b. Removing the entire assembly, attached to its mounting bracket.

6. This step applies only to Types UP3 through UP6 actuators:

   a. Remove the cotter pins that hold the cylinder to the lever.

   b. Remove the dowel pin that holds the cylinder to the lever.

   c. Place the dowel pin between the cylinder and the actuator frame to avoid damage to the supply line and its fitting.

7. Remove the cover from the top of the electric shaft position transmitter assembly.

8. Remove and label the two wires connected to TB5 (+) and TB5 (-).

9. Remove and label the wires from P1, P2 and P3.

10. Remove the three screws holding the electric shaft position transmitter assembly to its mounting bracket.

11. If defective, replace the electric shaft position transmitter assembly.

12. Adjust as described in ***OPTIONAL EQUIPMENT CALIBRATION*** in Section 4.

13. Reverse this procedure to put the unit back together.

### *Feedback Potentiometer Removal and Replacement*

**NOTE:** Refer to Figures 3-19, 3-22 and the drawings in Appendix A.

1. Perform Steps 1 through 5 in ***Electric Shaft Position Transmitter Assembly Removal and Replacement***.

2. Remove the pan head mounting screws (0.1875-32 x 0.250) holding the electric shaft position transmitter board assembly mounting bracket to the alarm unit mounting bracket.

3. Rotate the transmitter mounting bracket clockwise to expose the setscrews holding the feedback potentiometer to the coupler.

4. Slide the electric transmitter board assembly, with feedback potentiometer attached, out of the coupler.

5. Pull the assembly out of the actuator frame.

6. Remove the locknut holding the feedback potentiometer to the electric transmitter board assembly mounting bracket.

7. Disconnect and label the wire leads from P1, P2 and P3 on the electric transmitter board.

8. Install the new feedback potentiometer.

9. Reverse this procedure to assemble the unit – make sure to center the feedback potentiometer, with the actuator at the 50% position, before tightening the coupling setscrews.

### *Alarm/Travel Switch Removal and Replacement*

**NOTE:** Refer to Figures 3-19, 3-22 and the drawings in Appendix A.

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air supply to subside completely.

4. Remove the covers necessary to allow access to the alarm/travel switches.

5. Remove the electric shaft position transmitter assembly and feedback potentiometer assembly, with its mounting bracket, from the alarm mounting bracket. Refer to ***Electric Shaft Position Transmitter Assembly Removal and Replacement*** and ***Feedback Potentiometer Removal and Replacement***.

6. Locate the mounting bracket that is part of the actuator frame.

7. Remove the three mounting screws securing the alarm unit mounting bracket to the actuator frame mounting bracket.

8. Disconnect the linkage from the alarm unit mounting bracket.

9. Take the alarm unit assembly out of the actuator frame.

10. Remove the pan head screws (0.112-40 x 2.0) holding the microswitches to the alarm unit mounting bracket.

11. Remove the cover from terminal block TB3.

12. Disconnect the microswitch wiring from the terminal block.

13. Replace the microswitches.

14. Wire the microswitches according to the corresponding markings on the switches and the terminal block (NO=Normally Open, NC=Normally Closed, and C=Common).

15. With the spacer blocks arranged so that the switch rollers align with the cam, mount the microswitch assemblies to the alarm unit mounting bracket.

16. Adjust the microswitches as outlined in ***Alarm/Travel Switch Calibration*** in Section 4.

17. Reverse this procedure to assemble the rest of the unit.

### *Pneumatic Shaft Position Transmitter Replacement (Types UP2 through UP6 Actuators)*

**NOTES:**

1. The Pneumatic Shaft Position Transmitter is not available for Type UP1 actuators.

2. Refer to the drawings in Appendix A.

1. To prevent the load from shifting, place the actuator in the manual mode.

2. Shut off the air supply to the pneumatic shaft position transmitter.

3. Allow the air supply to subside completely.

4. Remove the covers (if necessary) to allow access to the pneumatic shaft position transmitter.

5. Disconnect the S supply line from the pneumatic shaft position transmitter.

6. Disconnect the O1 output line from the pneumatic shaft position transmitter.

7. Disconnect the linkage from the pneumatic shaft position transmitter.

8. Remove the mounting bolts.

9. Reverse this procedure to install the new pneumatic position shaft transmitter.

### *Strip Heater Replacement (Types UP2 through UP6 Actuators)*

**NOTES:**
1. Strip heaters are not available for the Type UP1 actuator.

2. Refer to the drawings in Appendix A.

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air supply to subside completely.

4. Remove the covers necessary to allow access to the strip heaters.

5. Remove the mounting screws holding the heaters in place.

6. Remove the mounting screws holding the harness to the actuator frame.

7. Pull the heater assembly away from the actuator frame.

8. Remove the cover from the heater terminal block.

9. Disconnect the wiring harness.

10. Install the new heaters.

11. Reverse this procedure to put the unit back together.

### *Thermoswitch Replacement (Types UP2 through UP6 Actuators)*

**NOTES:**
1. Strip heaters are not available for the Type UP1 actuator.

2. Refer to the drawings in Appendix A.

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air supply to subside completely.

4. Remove the covers necessary to access the thermoswitch.

5. Slide the thermoswitch out of its mounting bracket.

6. Label the thermoswitch wires.

7. The new thermoswitch comes with a length of wire attached. Cut the old thermoswitch wires at a point that leaves a length of wire attached to the old thermoswitch that is shorter than that attached to the new thermoswitch.

8. Splice the wires from the new thermoswitch to the wires cut in Step 7.

9. Slide the new thermoswitch into the mounting bracket.

10. Replace the actuator covers.

### *Volume Booster Replacement (Type UP6 Actuators)*

**NOTE:** Refer to the drawings in Appendix A.

1. Place the actuator in the manual mode to prevent the load from shifting.

2. Use the positioner integral shutoff and equalizing valve or the solenoid equalizing valve to shut off the air supply.

3. Allow the air supply to subside completely.

4. Remove the covers necessary to access the volume booster.

5. Label and disconnect the air lines connected to the volume booster.

6. Remove the three bolts that secure the volume booster to its mounting bracket. Do not remove the mounting bracket from the actuator.

7. Mount the new volume booster onto the mounting bracket with the three bolts removed in Step 6.

8. Connect the air lines to the volume booster.

9. Replace the actuator covers.

# SECTION 9 - SUPPORT SERVICES

## *INTRODUCTION*

ABB is ready to help in the use, application and repair of its products. Contact your nearest sales office to make requests for sales, applications, installation, repair, overhaul and maintenance contract services.

The parts drawings in Appendix A cover the actuators. These drawings normally apply to the units furnished. However, there may be individual differences in specific assemblies due to:

1. Design changes made since the printing of this product instruction.

2. Special design of equipment furnished to make it suitable for a special application.

Therefore, when ordering individual parts, insure correct replacement by specifying the complete nomenclature and series number of equipment for which parts are desired, and the title and number of the parts drawing on which each part is illustrated.

## *REPLACEMENT PARTS*

Recommended spare parts for each actuator assembly are listed in the tables in Appendix A.

## *TRAINING*

ABB has a modern training facility available for training your personnel. On-site training is also available. Contact a ABB sales office for specific information and scheduling.

## *TECHNICAL DOCUMENTATION*

Additional copies of this instruction as well as copies of other ABB documents are available at the nearest sales office at a reasonable charge.

# APPENDIX A - SPARE PARTS

## INTRODUCTION

This appendix has spare parts information as it relates to the various actuators. There are tables as well as figures illustrating the part numbers, descriptions and locations of these parts. It includes complete spare parts kits and option kits.

Each figure has the corresponding ABB engineering drawing number printed in its lower right-hand corner. Use this number if requesting a full-size copy of that drawing. The engineering drawings include the NEMA 4X versions of the actuators as well as the standard versions included in this appendix.

## TYPE UP1 ACTUATORS

Refer to Tables A-1 through A-8, A-48, and A-49; and Figures A-1 through A-5 and A-30 for spare parts information for Type UP1 actuators.

*Table A-1. UP1 with Positioner, Figure A-1 (Drawing No. 5328573)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 5328574_1 | Lever |
| 2 | 1 | 5328575_1 | Vane actuator |
| 3 | 4 | 4-4CBI2-B | Elbow |
| 4 | 1 | 5328576_3 | Brake arm |
| 5 | 1 | Refer to Table A-2 | Positioner |
| 6 | 1 | 5328577_3 | Mounting plate |
| 7 | 1 | 5328578_3 | Frame |
| 8 | 1 | 1963353__01 | Label, universal, CSA |
| 10 | 1 | 197452_3 | Long-lok set screw |
| 12 | 1 | 1963302_1 | Scale |
| 13 | 1 | 5328585_1 | Insert |
| 14 | 1 | — | Plain Zn plated steel washer (0.500 x 1.250 x 0.083) |
| 15 | 1 | 1963302_2 | Scale |
| 17 | 3 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.750) |
| 18 | 3 | — | Ext lockwasher Zn plated steel hex keps (0.250-20) |
| 20 | 61 cm (24 in.) | R1021-0022 | 0.250 OD x 0.040 wall Al tubing with polyethylene jacket |
| 21 | 7 | — | Hex head Zn plated steel cap screw (0.375-16 x 0.750) |
| 22 | 7 | — | Zn plated steel reg spring lockwasher (0.375) |
| 23 | 1 | — | Hex head Zn plated steel cap screw (0.375-16 x 1.250) |
| 24 | 1 | 1963318__ | Nameplate |
| 25 | 1 | 1962207_1 | Styleplate |

*Table A-1. UP1 with Positioner, Figure A-1 (Drawing No. 5328573) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 28 | 3 | NLJHA21000 | Hex full nut (0.250-20) |
| 29 | 3 | 452219_8 | Seal screw |
| 30 | 1 | NTCHA11000 | Flat washer (0.250) |
| 31 | 1 | NBJAU21010 | 0.250-20 hex washer head screw (whiz lock) |

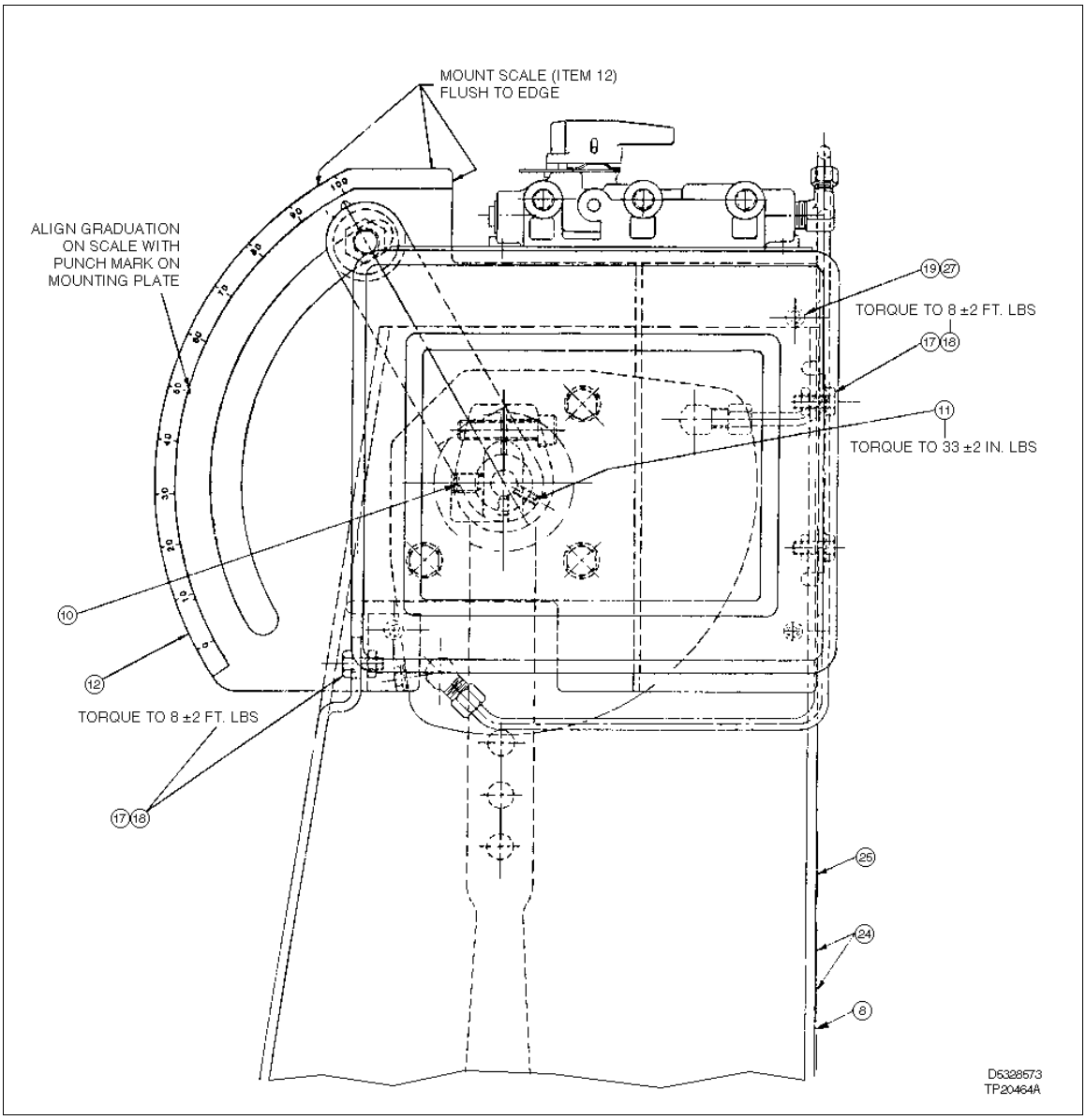



*Figure A-1. UP1 with Positioner, Tables A-1 and A-2 (Sheet 1 of 3)*

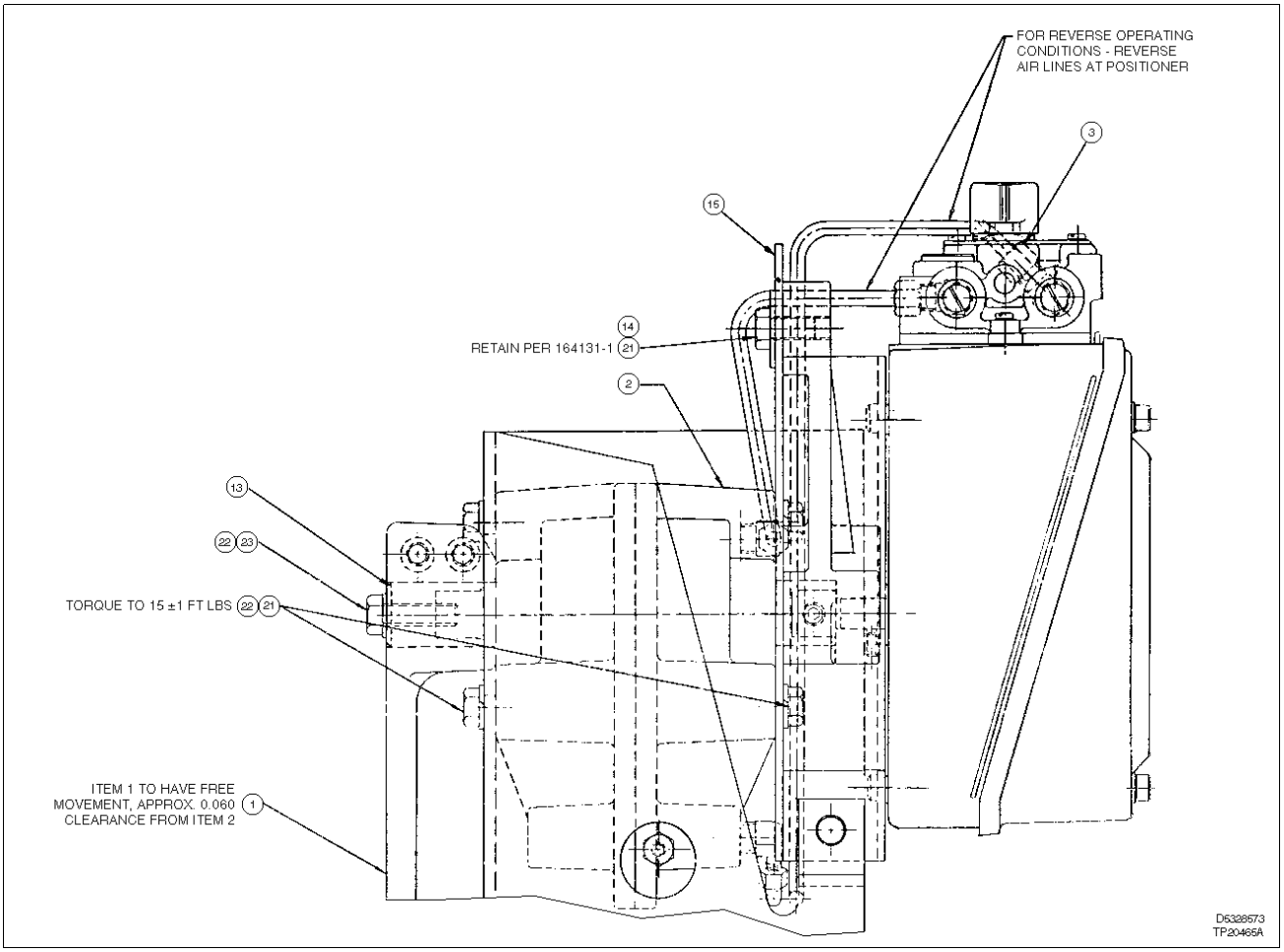



*Figure A-1. UP1 with Positioner, Tables A-1 and A-2 (Sheet 2 of 3)*

*Table A-2. UP1 Positioners, Figure A-1*

| Type | Item 5 | Type | Item 5 | Type | Item 5 |
|---|---|---|---|---|---|
| UP1□A | AV1121□3 | UP1□C | AV2321□3 | UP1□E | AV442103 |
| UP1□B | AV1221□3 | UP1□D | AV3321□3 | | |

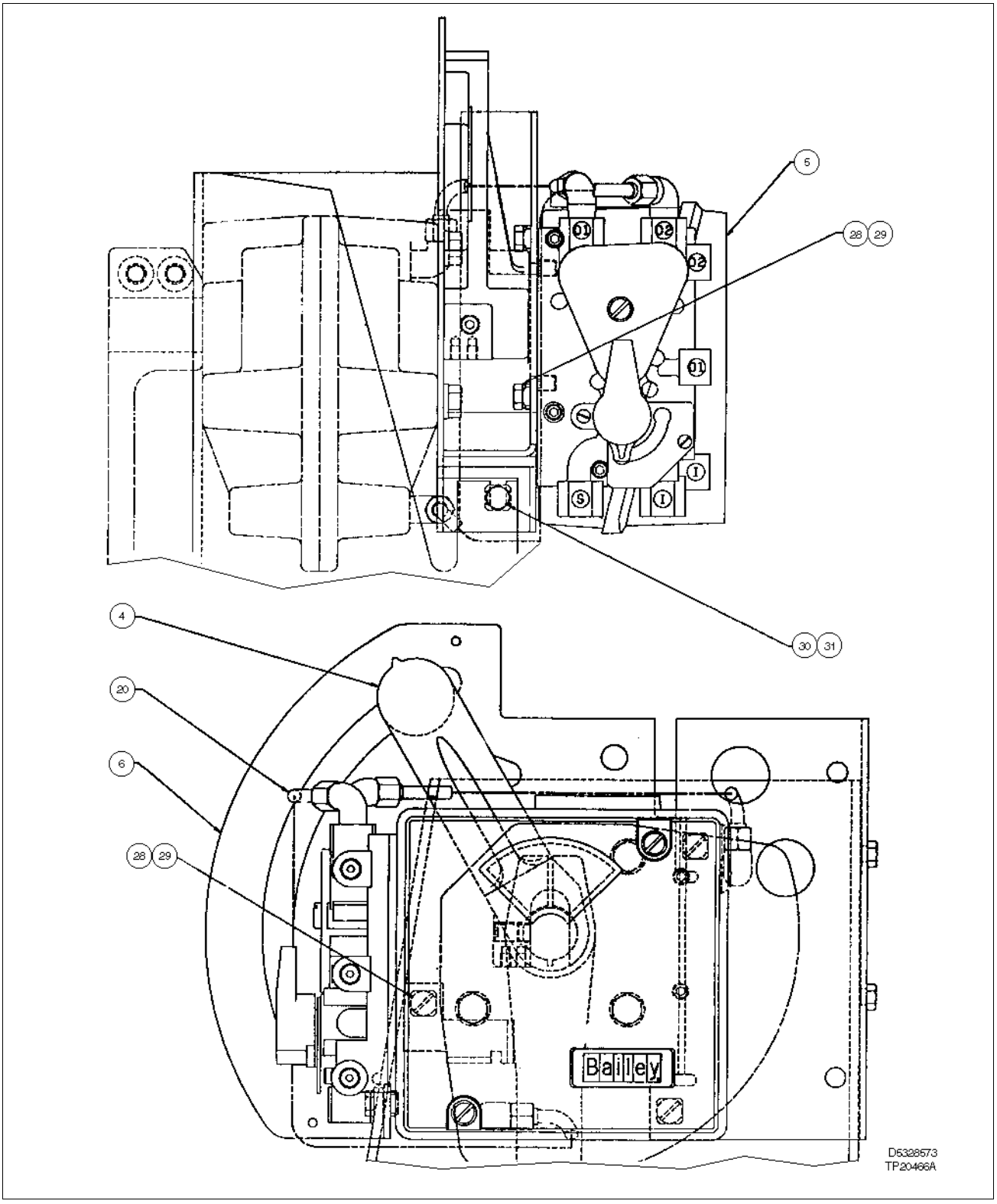



*Figure A-1. UP1 with Positioner, Tables A-1 and A-2 (Sheet 3 of 3)*

*Table A-3. UP1 with Solenoid Valve, Figure A-2 (Drawing No. 5328581)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 5328574_1 | Lever |
| 2 | 1 | 5328575_1 | Vane actuator |
| 3 | 1 | 4-4FBI2-B | Straight fitting |
| 4 | 1 | Refer to Table A-4 | Solenoid valve |
| 5 | 1 | 5328577_3 | Mounting plate |
| 6 | 2 | 4-4CBI2-B | Elbow |
| 7 | 1 | 5328578_3 | Frame |
| 8 | 1 | 5328576_3 | Brake arm |
| 9 | 1 | 5328580_1 | Plate |
| 10 | 1 | 4-4DBI2-B | Elbow |
| 11 | 1 | 195161_¼ | Needle valve |
| 12 | 1 | 197452_3 | Long-lok set screw |
| 13 | 1 | 1963302_1 | Scale |
| 14 | 1 | 5328585_1 | Insert |
| 15 | 7 | — | Hex head Zn plated steel cap screw (0.375-16 x 0.750) |
| 16 | 7 | — | Zn plated steel reg spring lockwasher (0.375) |
| 18 | 1 | — | Plain Zn plated steel washer (0.500 x 1.250 x 0.083) |
| 20 | 8 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.750) |
| 22 | 8 | — | Ext lockwasher Zn plated steel hex keps (0.250-20) |
| 23 | 1 | 4-4-4RBI2-B | Male run tee |
| 24 | 1 | ¼ RRS-B | Male tee |
| 25 | 1 | — | Hex head Zn plated steel cap screw (0.375-16 x 1.250) |
| 26 | 84 cm (33 in.) | R1021-0022 | 0.25 OD Al tubing polyethylene jacket |
| 27 | 1 | 1963318__ | Nameplate |
| 28 | 1 | 1962207_1 | Styleplate |
| 29 | 1 | 1963353__01 | Label, universal, CSA |
| 30 | 1 | 1963302_2 | Scale |

*Table A-4. UP1 Solenoid Valves, Figure A-2*

| Type | Item 5 | Type | Item 5 |
|---|---|---|---|
| UP1□5 | 5322137□8 (120 VAC), single coil | UP1□9 | 1951672□2 (115/125 VDC), dual coil |
| UP1□6 | 5322137□9 (115/125 VDC), single coil | UP1□F | 5322137□10 (220VAC at 50 Hz/240 VAC at 60 Hz), single coil |
| UP1□8 | 1951672□1 (120 VAC), dual coil | UP1□G | 1951672□3 (220VAC at 50 Hz/240 VAC at 60 Hz), dual coil |

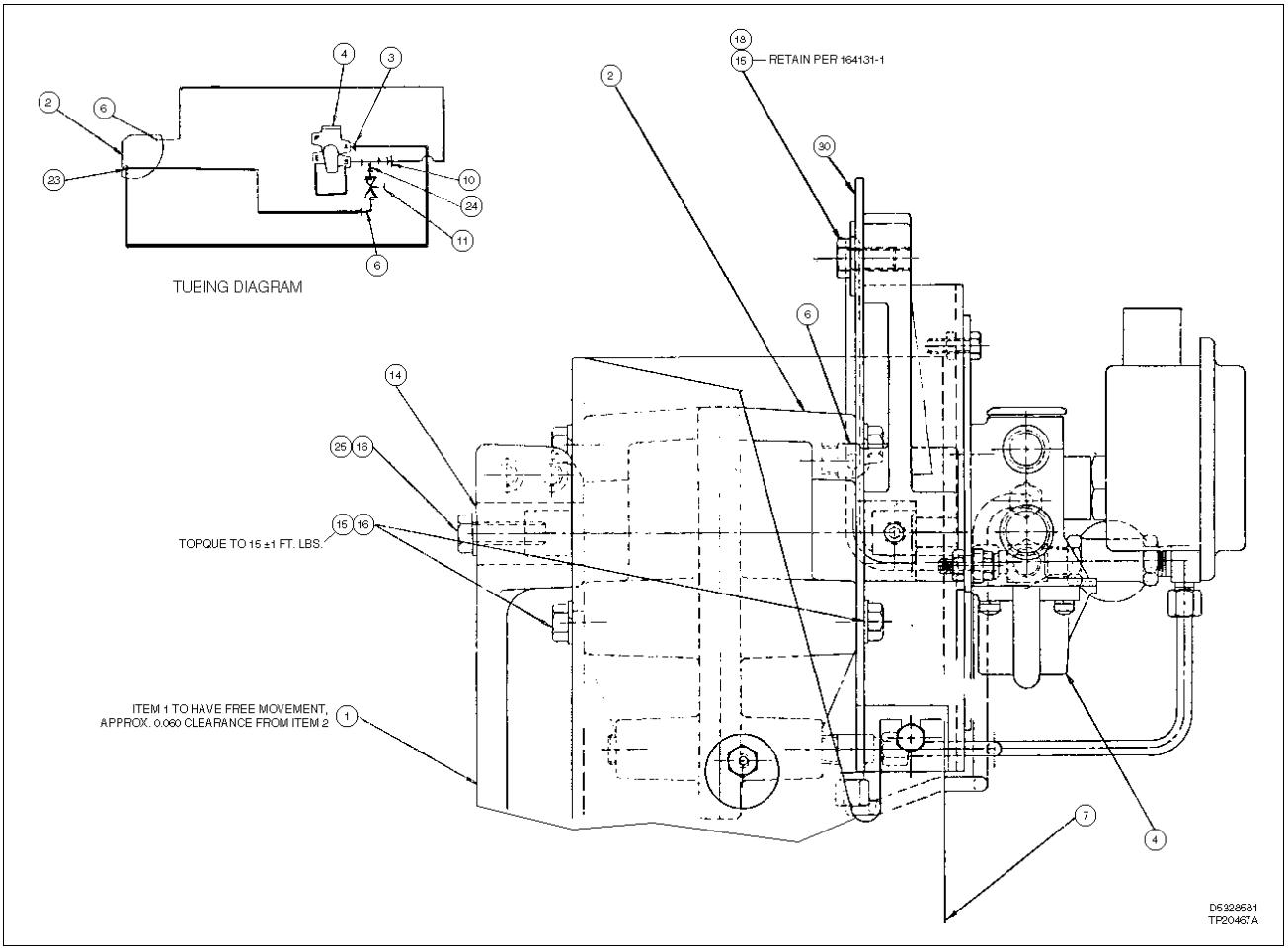



*Figure A-2. UP1 with Solenoid Valve, Tables A-3 and A-4 (Sheet 1 of 2)*

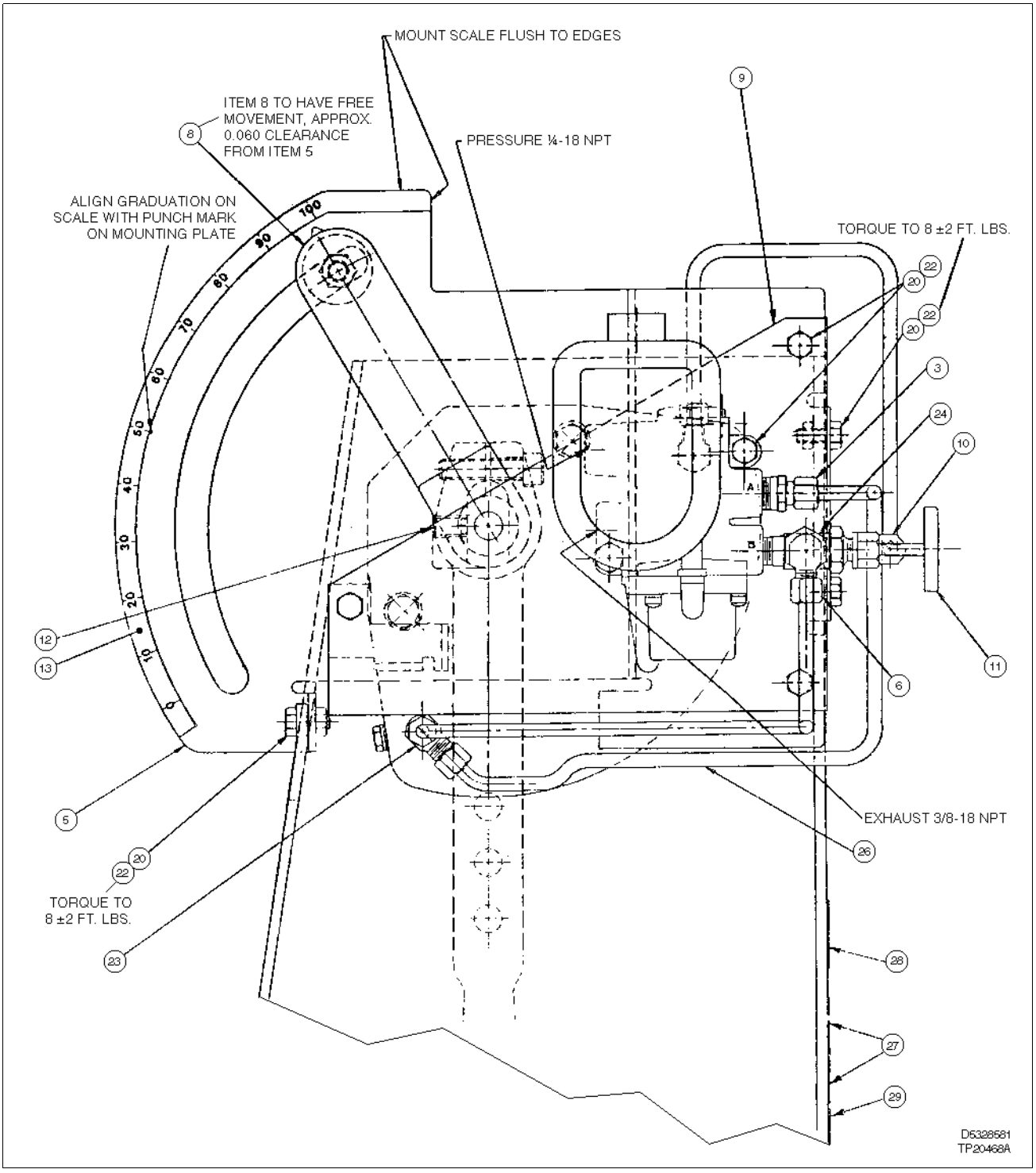



*Figure A-2. UP1 with Solenoid Valve, Tables A-3 and A-4 (Sheet 2 of 2)*

*Table A-5. UP1 Alarm/Travel Switch Kit, Figure A-3 (Kit No. 5328745_1)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 12 | 1943825_1 | Terminal lug |
| 2 | 1 | 194956_12 | Terminal block |
| 3 | 1 | 1947282_1 | Desig plate assembly |
| 4 | 4 | 6614403_1 | Cam |
| 5 | 1 | 5312449_13 | Connecting link |
| 6 | 1 | 5328742_1 | Link arm |
| 7 | 1 | 5328596_1 | Arm |
| 8 | 1 | 5328801_1 | Support bracket |
| 9 | 1 | 5328701_1 | Bracket |
| 10 | 1 | 5328589_1 | Switch mounting bracket |
| 11 | 4 | 1942989_1 | Microswitch |
| 12 | 2 | 1947261_1 | Shield |
| 13 | 1 | 1963353__12 | Label, universal, CSA |
| 14 | 1 | 5328700_1 | Shaft |
| 15 | 2 | 5328703_1 | Spacer block |
| 16 | 2 | 197164_37 | Retaining ring |
| 17 | 1 | 5328741_1 | Cover |
| 18 | 81 cm (32 in.) | 5327724_3H | Sealing strip |
| 19 | 1 | 197676_1 | Ground screw |
| 20 | 1 | 197675_1 | Washer |
| 21 | 1 | 1963318__ | Nameplate |
| 22 | 6 | — | Ext lockwasher Zn plated steel hex keps (0.250-20) |
| 23 | 6 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.750) |
| 25 | 4 | — | Pan head Zn plated steel screw (0.138-32 x 0.750) |
| 26 | 2 | — | Hex socket head Zn plated steel cap screw (0.112-40 x 0.625) |
| 27 | 6 | 1204-00 | Zn plated steel shakeproof lockwasher |
| 28 | 1 | — | Hex socket head Zn plated steel cap screw (0.138-32 x 0.500) |
| 29 | 2 | — | Pan head Zn plated steel sems int (0.190-32 x 0.312) |
| 30 | 2 | — | Pan head Zn plated steel sems int (0.190-32 x 0.875) |
| 31 | 3 | — | Plain Zn plated steel washer (0.4375 x 1.000 x 0.083) |
| 33 | 4 | — | Pan head stainless steel machine screw (0.112-40 x 2.000) |
| 34 | 4 | — | Pan head Zn plated steel sems int (0.190-32 x 0.625) |
| 35 | 18 cm (7 in.) | R2041-0070 | 18 AWG brown leadwire |
| 36 | 18 cm (7 in.) | R2041-0035 | 18 AWG red leadwire |
| 37 | 18 cm (7 in.) | R2041-0050 | 18 AWG orange leadwire |
| 38 | 18 cm (7 in.) | R2041-0075 | 18 AWG yellow leadwire |
| 39 | 18 cm (7 in.) | R2041-0055 | 18 AWG blue leadwire |
| 40 | 18 cm (7 in.) | R2041-1712 | 18 AWG white/blue leadwire |
| 41 | 1 | 5328745 | Print |
| 42 | 1 | No. 10 | Carton |

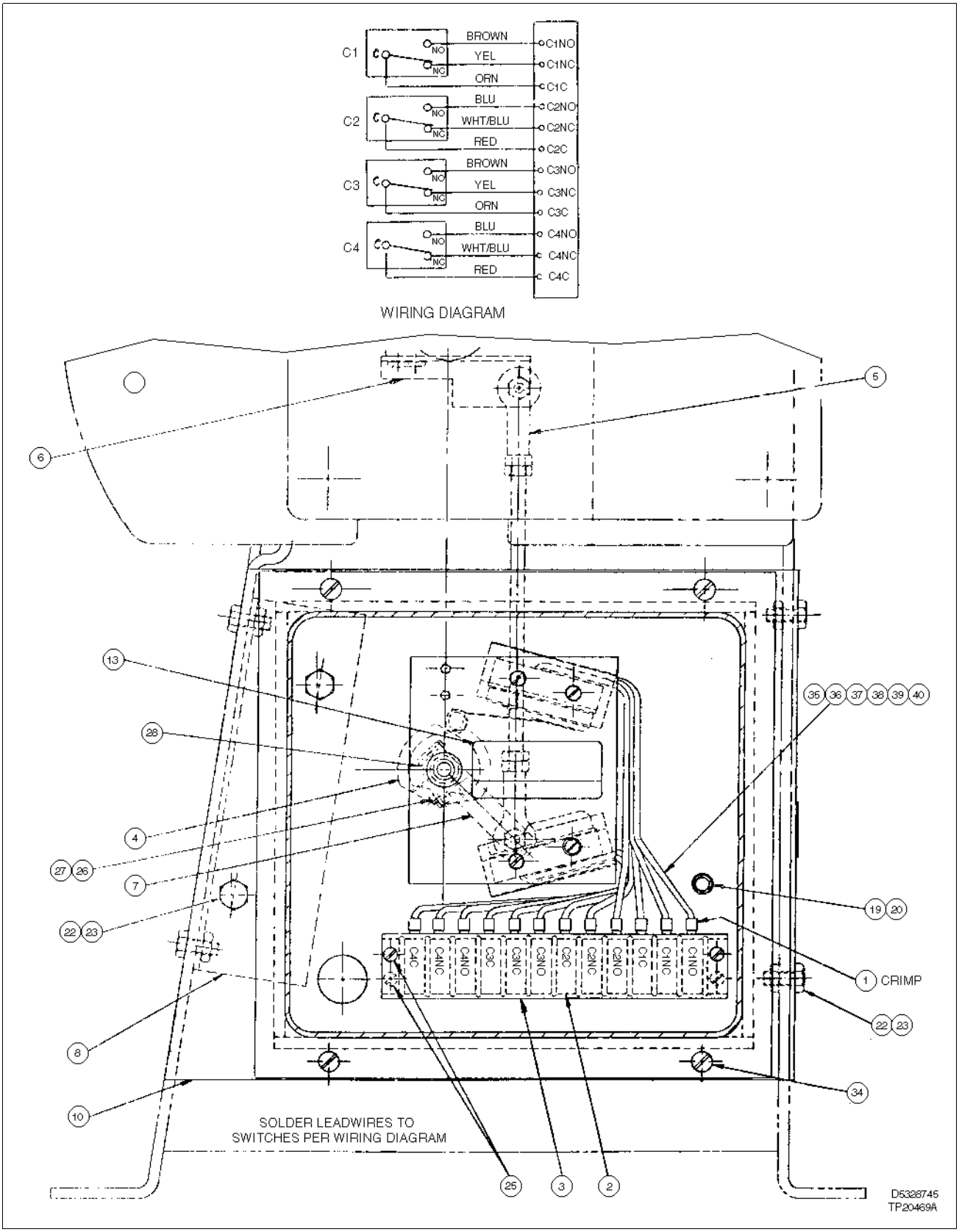



*Figure A-3. UP1 Alarm/Travel Switch Kit, Table A-5 (Sheet 1 of 2)*

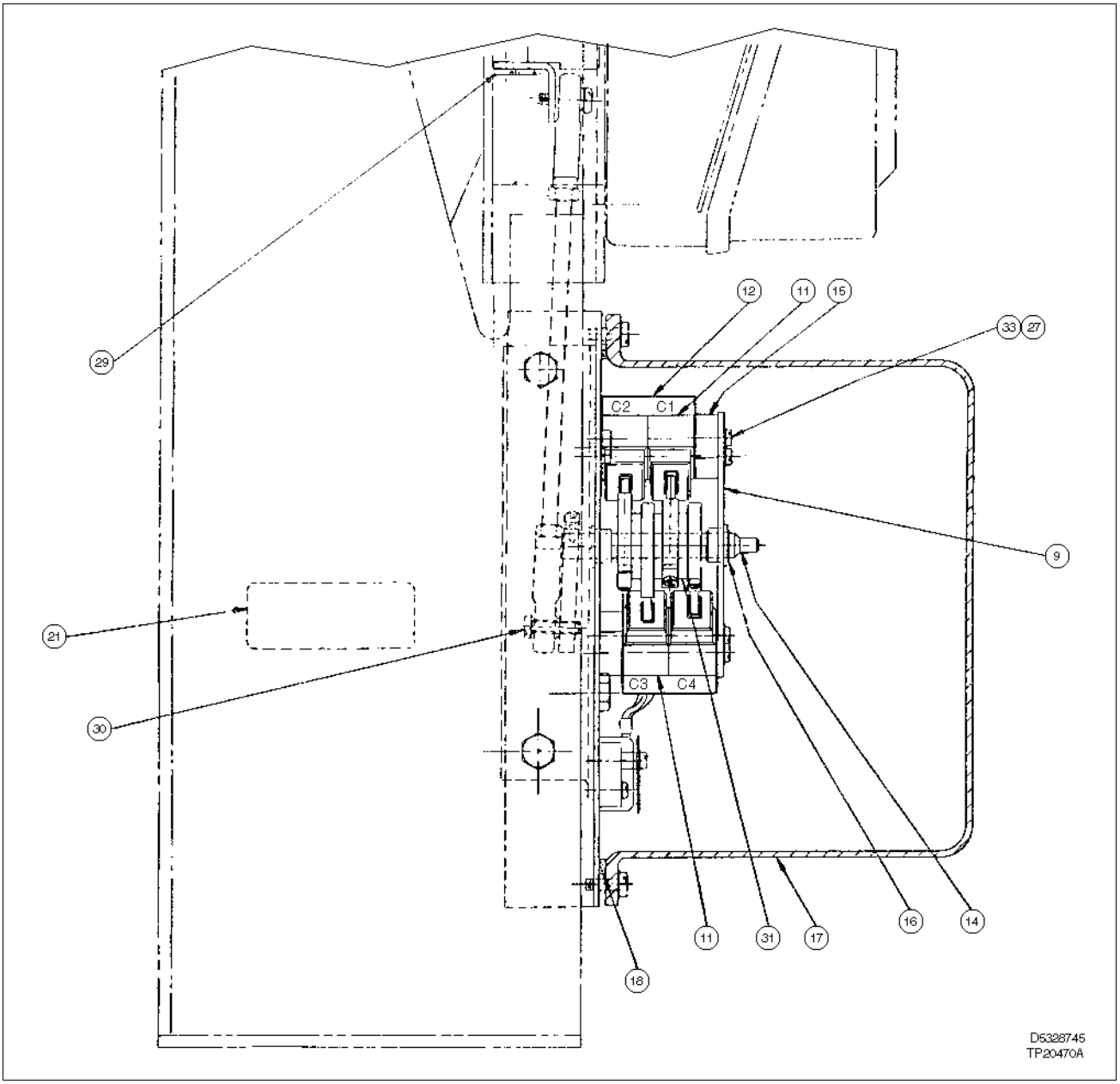



*Figure A-3. UP1 Alarm/Travel Switch Kit, Table A-5 (Sheet 2 of 2)*

*Table A-6. UP1 Electric Shaft Position Transmitter Kit, Figure A-4 (Kit No. 5328748 _1)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 5328745_1 | Alarm unit kit |
| 2 | 1 | 5328702_1 | Coupler |
| 3 | 2 | 197723_1 | Set screw, brass tip |
| 4 | 1 | 5328704_1 | Transmitter bracket |
| 5 | 1 | 5839B01P0001 | Feedback potentiometer |
| 6 | 3 | 197727_6 | Support |

*Table A-6. UP1 Electric Shaft Position Transmitter Kit, Figure A-4 (Kit No. 5328748_1) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 7 | 1 | 6633390_2 | 4 to 20-mA transmitter board assembly |
| 8 | 3 | 1946162_1 | Pin receptacle |
| 9 | 1 | 5328594_1 | Cover |
| 10 | 3 | 197688_3 | Threaded spacer |
| 11 | 1 | 1963318__ | Nameplate |
| 13 | 11.0 cm (4.5 in.) | R2041-1664 | 22 AWG wht/grn leadwire |
| 14 | 11.0 cm (4.5 in.) | R2041-1666 | 22 AWG wht/vio leadwire |
| 15 | 11.0 cm (4.5 in.) | R2041-1667 | 22 AWG wht/gra leadwire |
| 16 | 3 | — | Pan head Zn plated steel sems ext (0.138-32 x 0.250) |
| 19 | 4.0 cm (1.5 in.) | R9023-0175 | Insulation tubing |
| 20 | 2 | — | Pan head Zn plated steel sems int (0.190-32 x 0.312) |
| 22 | 1 | 5328748 | Print |

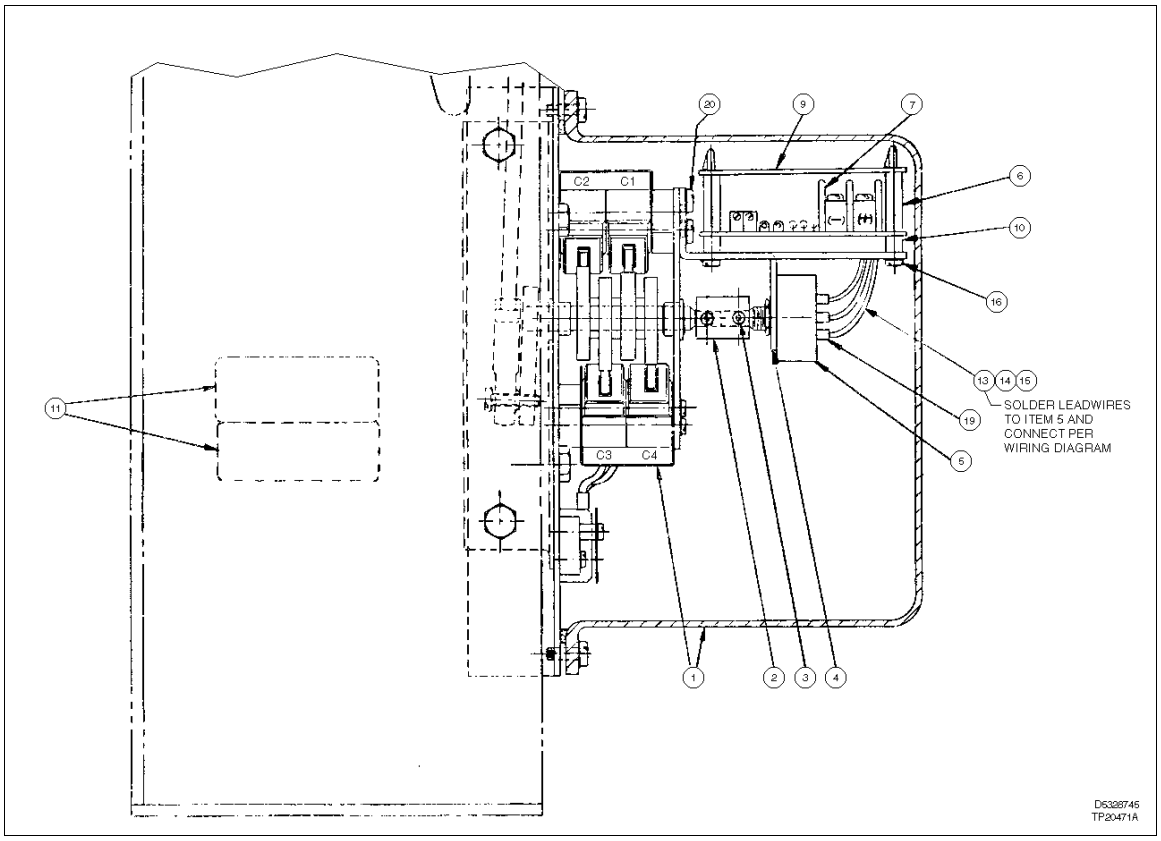



*Figure A-4. UP1 Electric Shaft Position Transmitter Kit, Table A-6 (Sheet 1 of 2)*

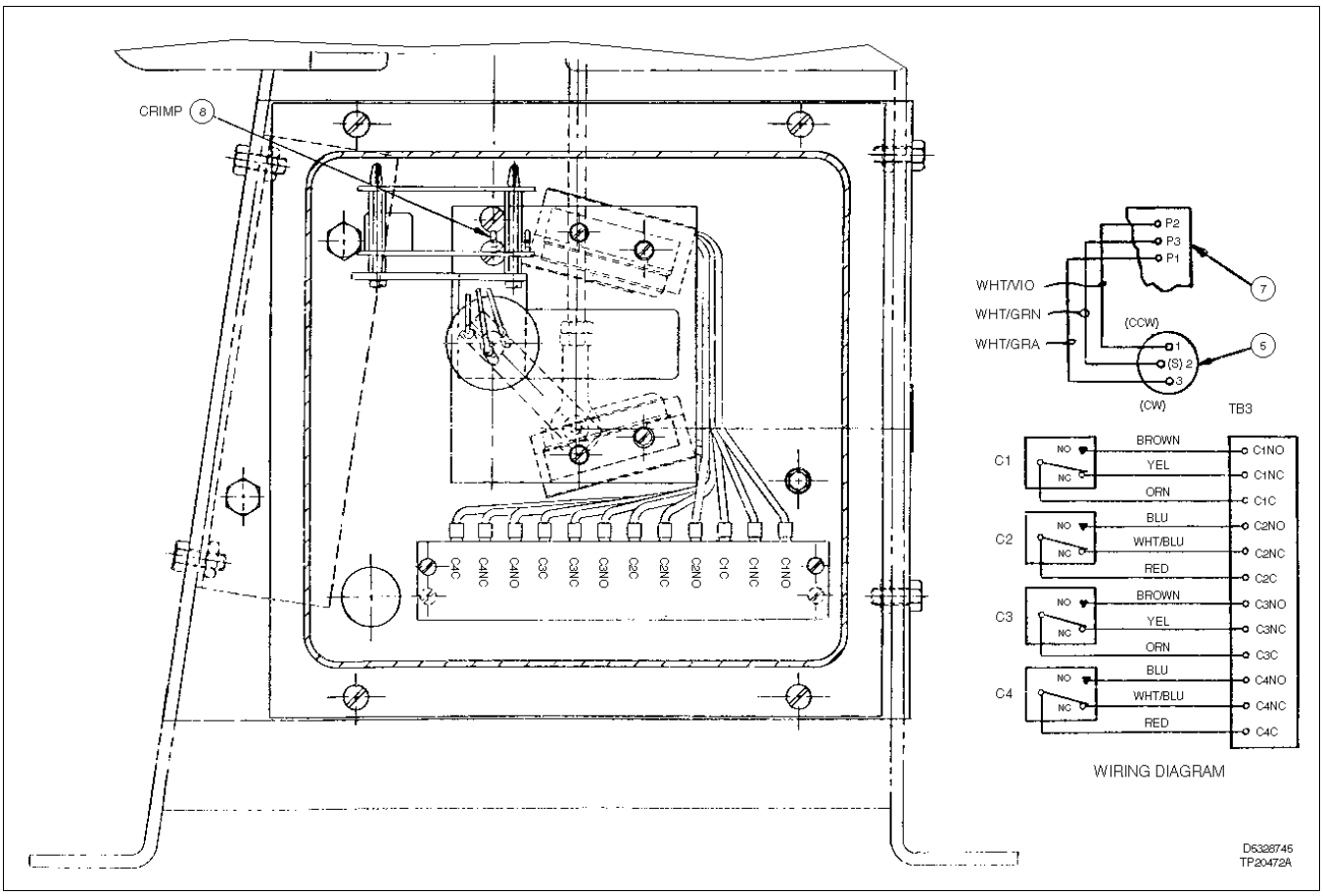



*Figure A-4. UP1 Electric Shaft Position Transmitter Kit, Table A-6 (Sheet 2 of 2)*

*Table A-7. UP1 Air Failure Lock Kit, Figure A-5 (Kit No. 5328826_1)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 5329023_1 | Rack gear assembly |
| 2 | 1 | 5329022_1 | Saddle |
| 3 | 1 | 5328811_1 | Toggle assembly |
| 4 | 1 | 5328810_1 | Toggle link assembly |
| 5 | 1 | 5328753_1 | Spacer |
| 6 | 1 | 5328816_1 | Center pivot |
| 7 | 1 | 5328818_1 | Adapter |
| 8 | 1 | 5328726_1 | Drive link |
| 9 | 1 | 5328725_1 | Eccentric assembly |
| 10 | 1 | — | Semi-fin stainless steel reg hex (0.375-16) full nut |
| 11 | 1 | — | Hex socket head steel cap screw (0.375-16 x 0.875) |
| 12 | 1 | 5328751_1 | Hand lever |
| 13 | 1 | 5328763_1 | Hand lock clamp |
| 14 | 1 | 5328721_1 | Clevis pin |
| 15 | 2 | 5327327_3 | Adapter |
| 16 | 1 | 5328766_1 | Rack cover |

*Table A-7. UP1 Air Failure Lock Kit, Figure A-5 (Kit No. 5328826_1) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 17 | 1 | 5328728_1 | Locking rack |
| 18 | 1 | 5328730_1 | Rack plate |
| 19 | 1 | 5328729_1 | Mounting yoke |
| 20 | 4 | 197164_37 | Retaining ring |
| 21 | 1 | 1951589_2 | Air valve |
| 22 | 1 | 1951589_1 | Air valve |
| 23 | 1 | 1951610_1 | Air cylinder |
| 24 | 3 | 197120_8 | Elastic stop nut |
| 25 | 1 | 197259_1 | Hex lock nut |
| 26 | 1 | 1951606_1 | 3-way valve |
| 27 | 1 | 5328788_1 | Mounting bracket |
| 28 | 1 | 4-4CB12-B | Male elbow |
| 29 | 2 | 4-4FB12-B | Male connector |
| 30 | 3 | 4-4-4RB12-B | Male run tee |
| 31 | 1 | — | ¼ NPT brass tee |
| 32 | 1 | — | ¼ NPT brass close nipple |
| 33 | 1 | 5328825_1 | Felt washer |
| 34 | 1 | 197745_1 | Extension spring |
| 35 | 1.2 m (4.0 ft) | R1021-0022 | 0.250 OD x 0.040 Wall Al tubing |
| 36 | 1 | 1951041_2 | ⅛ NPT socket head pipe plug |
| 37 | 2 | — | Pan head stainless steel machine screw (0.164-32 x 0.188) |
| 38 | 2 | — | Pan head ph Zn plated steel rolok (0.190-32 x 0.625) |
| 39 | 1 | — | Hex head Zn plated steel cap screw (0.250-20 x 1.000) |
| 40 | 5 | — | Hex socket head Zn plated steel cap screw (0.190-32 x 0.500) |
| 41 | 3 | — | Hex socket head Zn plated steel cap screw (.0250-20 x 0.750) |
| 42 | 6 | — | Pan head Zn plated steel sems int (0.190-32 x 0.625) |
| 43 | 1 | — | Zn plated steel reg spring lockwasher (0.250) |
| 44 | 1 | — | Steel milled stud (0.375-16 x 1.500) |
| 45 | 5 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.750) |
| 46 | 7 | — | Ext lockwasher Zn plated steel hex keps (0.250-20) |
| 47 | 1 | — | Plain Zn plated steel washer (0.312 x 0.734 x 0.065) |
| 48 | 1 | — | Semi-fin Zn plated steel reg hex jam nut (0.500-20) |
| 49 | 1 | 1224-00 | Zn plated steel shakeproof lockwasher |
| 50 | 2 | — | Pan head Zn plated steel threaded ctg type 1 screw (0.190-32 x 1.500) |
| 51 | 1 | — | 3 x 5 cotton draw string bag |
| 52 | 1 | 5328826 | Print |
| 53 | 1 | No. 24 | Carton |
| 54 | 1 | — | Hex socket head stainless steel cap screw (0.250-20 x 1.250) |
| 55 | 2 | 4CBI2-B | Male elbow |
| 56 | 1 | 197164_31 | Retaining ring |

*Table A-7. UP1 Air Failure Lock Kit, Figure A-5 (Kit No. 5328826 _1) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 57 | 1 | 1963318__ | Nameplate |
| 58 | 1 | — | Zn plated steel reg spring lockwasher (0.375) |
| 59 | 1 | — | 1/8 NPT brass pipe plug |
| 60 | 1 | 3053306 | Print |
| 61 | 3 | — | Zn plated steel reg spring lockwasher (0.190) |

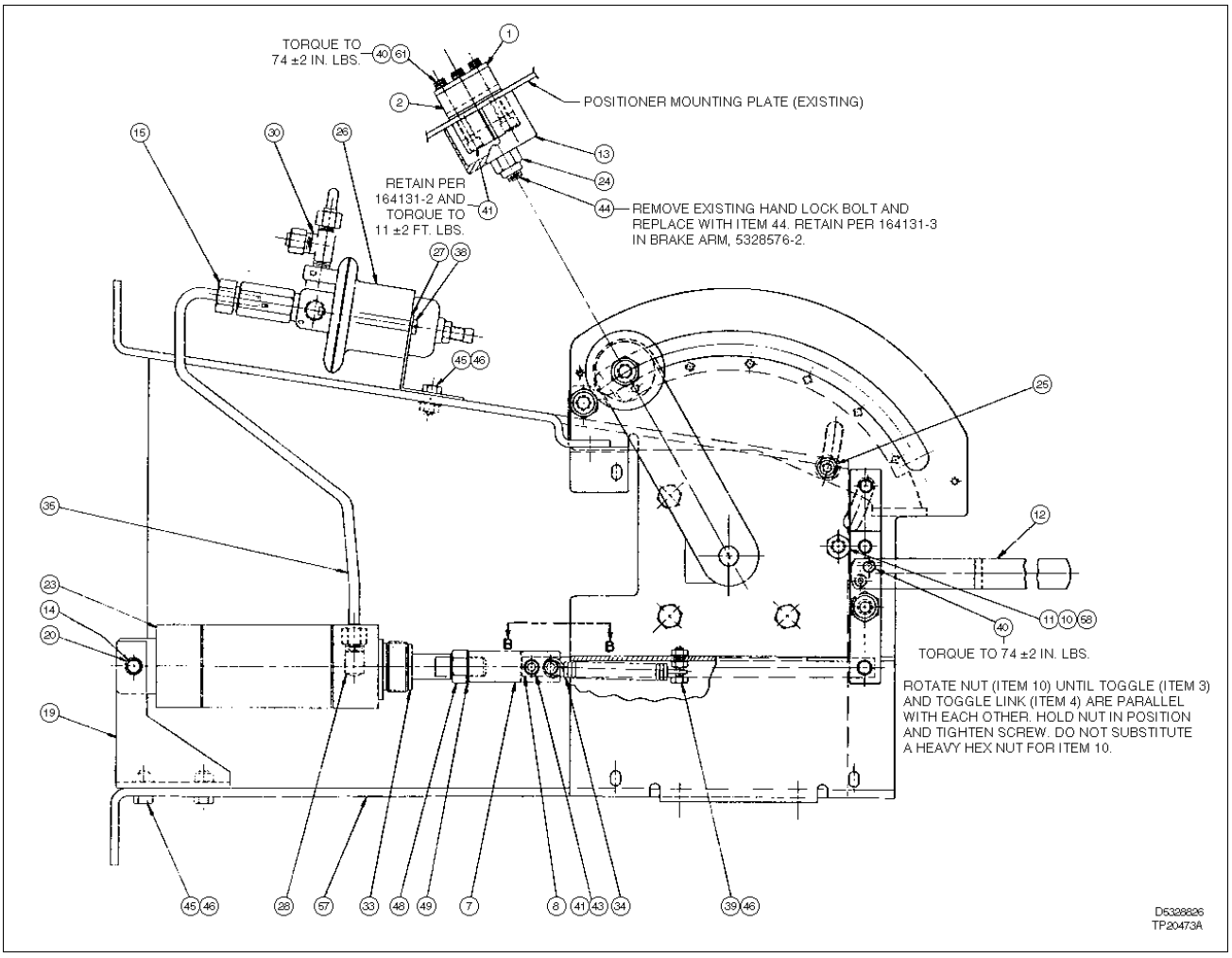



*Figure A-5. UP1 Air Failure Lock Kit, Table A-7 (Sheet 1 of 2)*

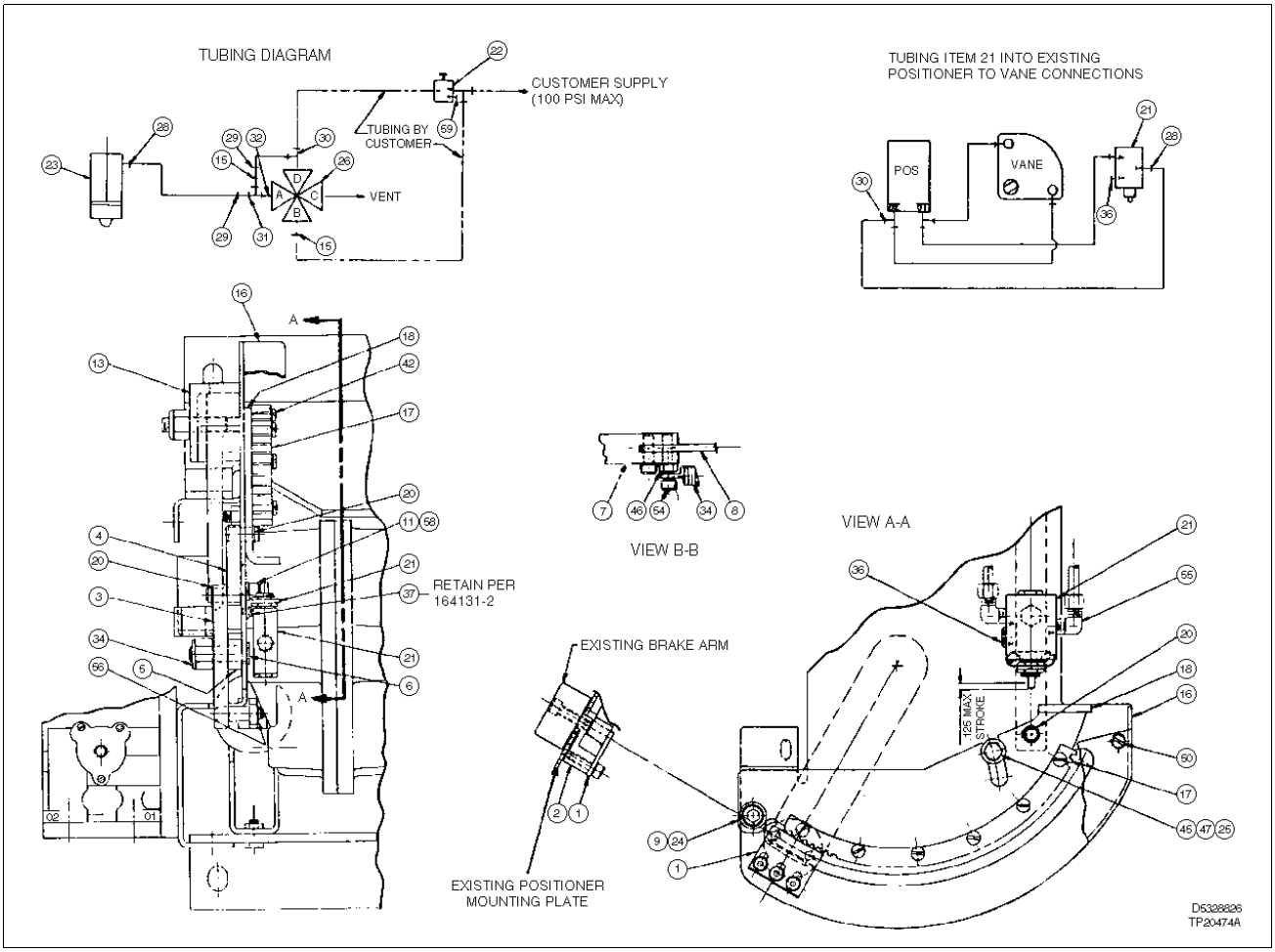



*Figure A-5. UP1 Air Failure Lock Kit, Table A-7 (Sheet 2 of 2)*

*Table A-8. UP1 Rotary Vane Seal Repair Kit, Figure 8-1 (Kit No. 285244 _1)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 2 | 341816_212 | O-ring (shaft) |
| 2 | 1 | 1951631_425 | O-ring (vane) |
| | A/R | 199354_1 | Lubricant |
| | A/R | 199926_1 | Sealant |

## *TYPE UP2 ACTUATORS*

Refer to Tables A-9 through A-18, A-48 and A-49, and Figures A-6 through A-11 and A-30 for spare parts information for Type UP2 actuators.

*Table A-9. UP2 Actuator with Positioner, Figure A-6 (Drawing No. 5328874)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1[1] | 1 | 5329141_1 | Side cover |
| 2 | 1 | 5328642_3 | Case assembly |
| 3 | 1 | 5328838_1 | Vane actuator |
| 4 | 2 | 5328862_1 | Spacer |
| 5 | 2 | 5328863_1 | Spacer |
| 6 | 1 | 5328860_2 | Brake plate |
| 7 | 1 | 5328871_1 | Cover plate |
| 8 | 1 | 5328864_1 | Drive plate |
| 9 | 1 | 197452_4 | Set screw, locking |
| 10 | 1 | Refer to Table A-10 | Positioner |
| 11 | 1 | 5328868_2 | Shaft assembly |
| 12 | 2 | 4-4CBI2-B | Male elbow |
| 13[1] | 1 | 5329157_2 | Top cover |
| 14 | 4 | 6613970_1 | Link lock fastener |
| 15 | 1 | 5328869_2 | Shaft extension |
| 16 | 1 | 5328872_1 | Cover plate |
| 17 | 1 | 5328841_1 | Drive lever |
| 18 | 7 | 19981_30 | Plug button |
| 19 | 1 | 19981_1 | Plug button |
| 20 | 1 | 1963485_1 | Scale |
| 21 | 1 | 5328873_1 | Pointer |
| 22 | 1 | 5328845_1 | Brake arm |
| 23 | 1 | 1963318__ | Nameplate |
| 24 | 2 | 67125_15 | Rubber grommet |
| 25 | 1 | 19981_11 | Plug button |
| 26 | 2 | 19981_31 | Plug button |
| 27 | 3 | 5328862_2 | Spacer |
| 28 | 1 | 1951611_2 | Shaft seal |
| 29 | 1 | 1951611_1 | Shaft seal |
| 30 | 2 | 1943785_4 | Cable tie |
| 31 | 2 | 1951569_9 | Plug button |
| 32 | 5 | 1114-00 | Zn plated steel shakeproof lockwasher |
| 33 | 5 | — | Hex head Zn plated steel cap screw (.0250-20 x 0.375) |
| 34 | 8 | NIDAC09005 | Pan head sems ext (0.112) |
| 36 | 2 | — | Hex head Zn plated steel cap screw (0.250-20 x 1.250) |
| 37 | 2 | — | Hex socket head stainless steel cap screw (.0250-20 x 1.250) |
| 38 | 6 | — | Hex head Zn plated steel cap screw (0.500-13 x 1.000) |
| 39 | 2 | — | Hex head Zn plated steel cap screw (0.500-13 x 2.250) |
| 40 | 1 | 1963485_2 | Scale |
| 41 | 2 | — | Ext lockwasher Zn plated steel hex keps nut (0.250-20) |
| 42 | 1 | — | Semi-fin Zn plated steel heavy hex full nut (0.500-13) |

*Table A-9. UP2 Actuator with Positioner, Figure A-6 (Drawing No. 5328874) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 43 | 6 | — | Zn plated steel reg spring lockwasher (0.500) |
| 44 | 1 | — | Plain Zn plated steel washer (0.562 x 1.375 x 0.109) |
| 45 | 1 | — | Round head Zn plated steel threaded frmg screw type U (0.060 x 0.188) |
| 46 | 132 cm (52 in.) | R1021-0022 | 0.250 OD x 0.040 wall Al tubing with polyethylene jacket |
| 47 | 9 | — | Pan head Zn plated steel sems int (0.138-32 x 0.437) |
| 48 | 9 | — | Zn plated steel hex nut (0.138-32) |
| 49 | 1 | 5328865_1 | Retainer |
| 50 | 1 | — | Hex socket head Zn plated steel cap screw (0.250-20 x 1.500) |
| 51 | 1 | — | Plain Zn plated steel washer (0.281 x 0.625 x 0.065) |
| 52 | 3 | — | Semi-fin Zn plated steel reg hex full nut (0.250-20) |
| 53 | 1 | — | Hex socket head stainless steel cap screw (0.112-40 x 0.250) |
| 54 | 1 | — | Stainless steel reg spring lockwasher (0.112) |
| 55 | 1 | 5328914_1 | Transfer shaft bushing |
| 56 | 2 | 4-4FBI2-B | Male connector |
| 57 | 1 | 1963353__ | Label, universal, CSA |
| 58 | 3 | NTMHA21000 | Int sems lockwasher (0.250) |
| 59 | 3 | NBAHA21016 | Hex socket head screw (0.250-20) |
| 60 | 3 | NTCHA11000 | Flat washer (0.250) |
| 61 | 3 | NNBHA21000 | Hex keps nut (0.250-20) |
| 64 | 1 | MF274-593 | Warning label |
| 65 | 1 | 1964034_1 | Ground label |
| 66 | 1 | NNBAC16000 | Hex keps nut (0.190) |

**NOTE:**

1. Older models have plastic covers. To order a plastic side cover, use part no. 5328660_1. To order a plastic top cover, use part no. 5328670_1.

*Table A-10. UP2 Positioners, Figure A-6*

| Type | Item 5 |
|---|---|
| UP2☐A | AV1121☐3 |
| UP2☐B | AV1221☐3 |
| UP2☐C | AV2321☐3 |
| UP2☐D | AV3321☐3 |
| UP2☐E | AV442103 |

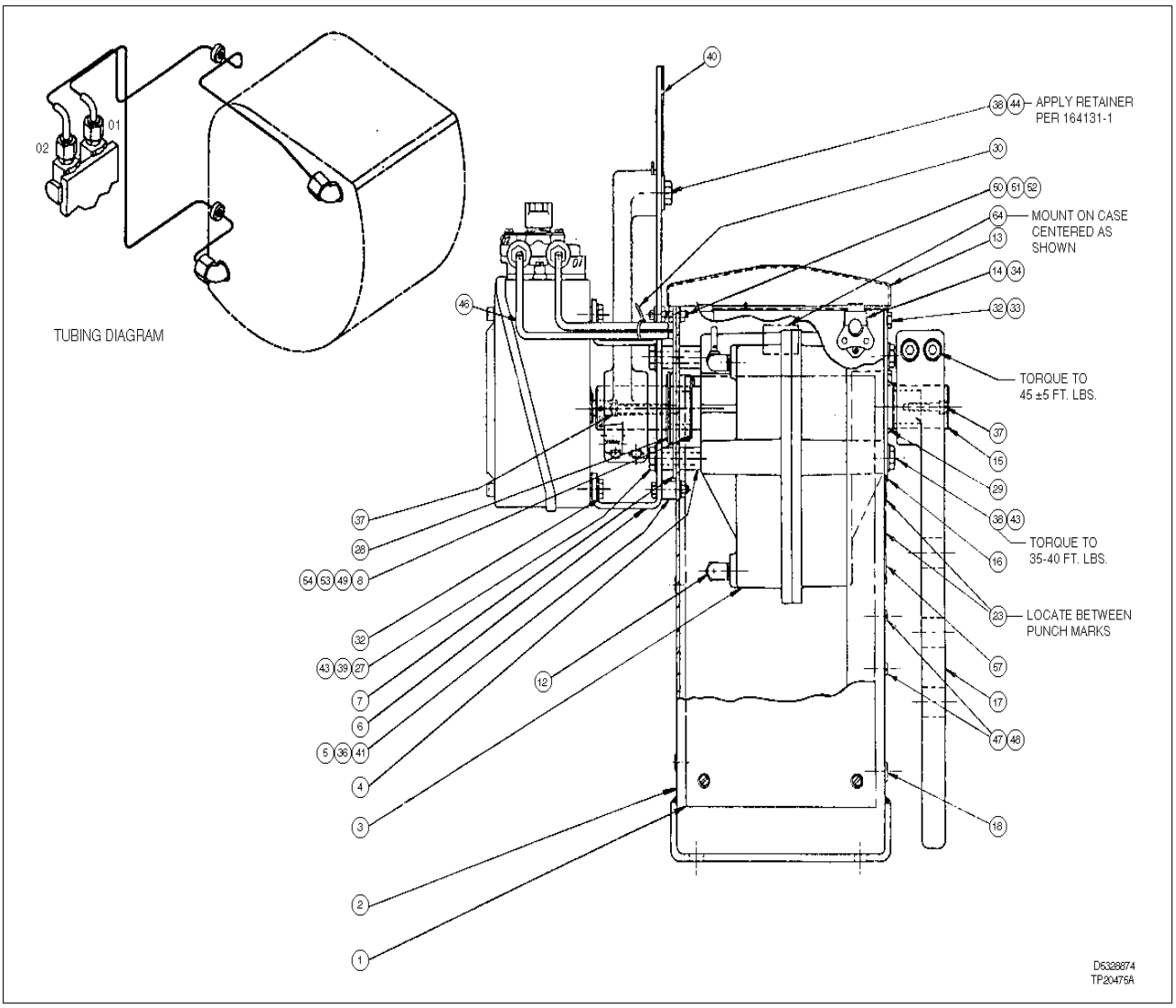



*Figure A-6. UP2 with Positioner, Tables A-9 and A-10 (Sheet 1 of 3)*

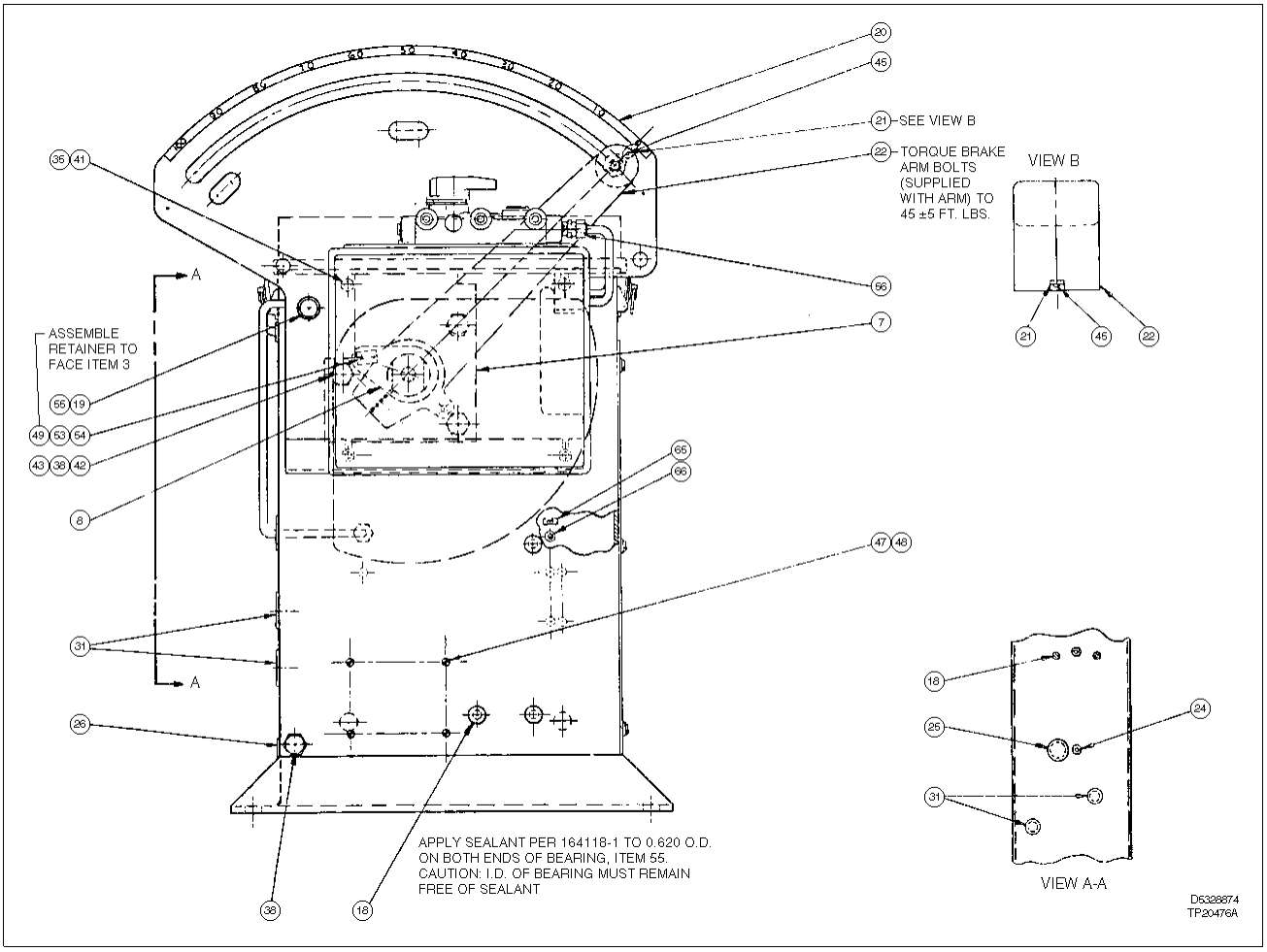



*Figure A-6. UP2 with Positioner, Tables A-9 and A-10 (Sheet 2 of 3)*

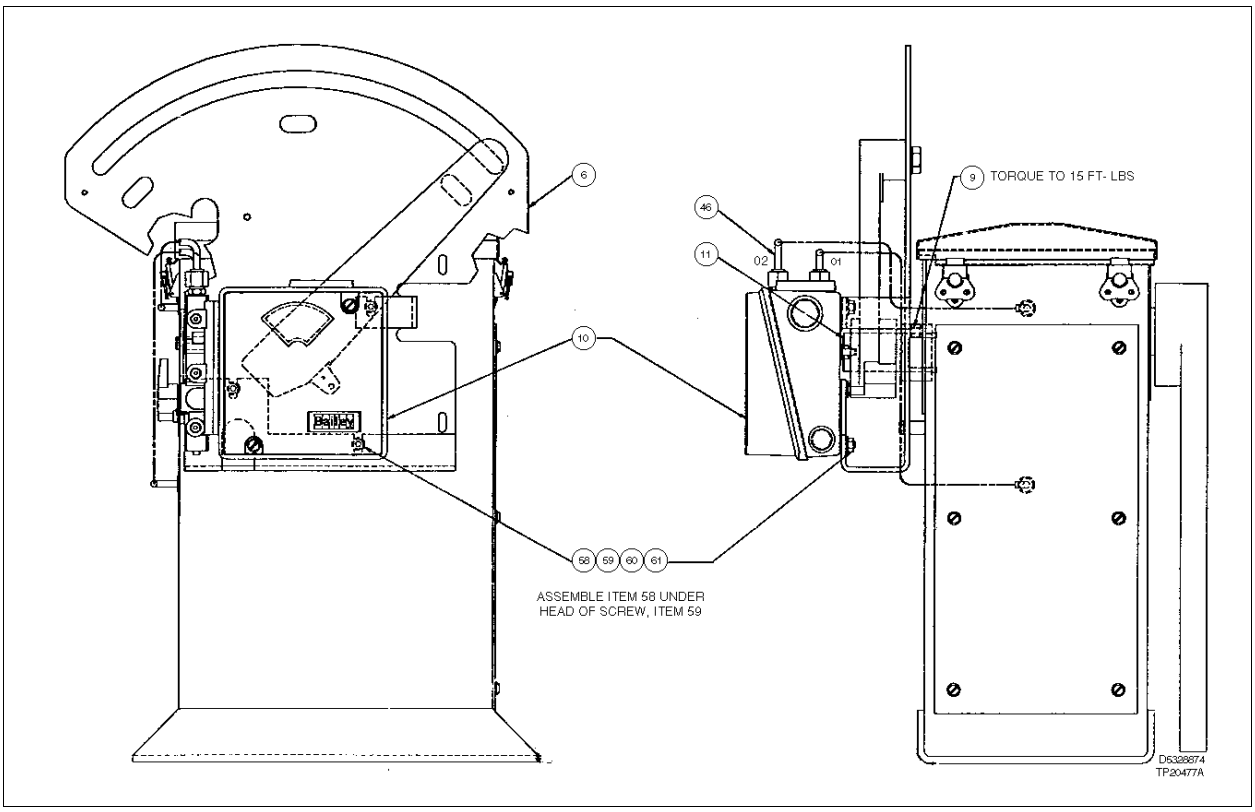



*Figure A-6. UP2 with Positioner, Tables A-9 and A-10 (Sheet 3 of 3)*

*Table A-11. UP2 with Solenoid Valve,*
*Figure A-7 (Drawing No. 5328891)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1[1] | 1 | 5329141_1 | Side cover |
| 2 | 1 | 5328642_3 | Case assembly |
| 3 | 1 | 5328838_1 | Vane actuator |
| 4 | 2 | 5328862_1 | Spacer |
| 5 | 2 | 5328863_1 | Spacer |
| 6 | 1 | 5328860_1 | Brake plate |
| 7 | 1 | 5328871_1 | Cover plate |
| 8 | 1 | 5328864_1 | Drive plate |
| 9 | 1 | Refer to Table A-12 | Solenoid valve |
| 10 | 1 | 5328868_2 | Shaft assembly |
| 11 | 3 | 4-4CBI2-B | Male elbow |
| 12[1] | 1 | 5329157_2 | Top cover |
| 13 | 4 | 6613970_1 | Link lock fastener |
| 14 | 1 | 5328869_2 | Shaft extension |
| 15 | 1 | 5328872_1 | Cover plate |
| 16 | 1 | 1951611_1 | Shaft seal |
| 17 | 1 | 5328841_1 | Drive lever |

*Table A-11. UP2 with Solenoid Valve, Figure A-7 (Drawing No. 5328891) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 18 | 7 | 19981_30 | Plug button |
| 19 | 1 | 19981_1 | Plug button |
| 20 | 1 | 5328865_1 | Retainer |
| 21 | 1 | 1963485_1 | Scale |
| 22 | 1 | 5328873_1 | Pointer |
| 23 | 1 | 5328845_1 | Brake arm |
| 24 | 1 | 1963318__ | Nameplate |
| 25 | 1 | 1951611_2 | Shaft seal |
| 26 | 2 | 67125_15 | Rubber grommet |
| 27 | 2 | 19981_31 | Plug button |
| 28 | 1 | 19981_11 | Plug button |
| 29 | 3 | 5328862_2 | Spacer |
| 30 | 1 | 5328580_1 | Mounting plate |
| 31 | 1 | 195161_¼ | Needle valve |
| 32 | 1 | ¼RRS-B | Male pipe tee |
| 33 | 1 | 4-4DBI2-B | Female elbow |
| 34 | 1 | 4-4-4RBI2-B | Male run tee |
| 35 | 1 | 1963485_2 | Scale |
| 36 | 2.1 m (7.0 ft) | R1021-0022 | 0.250 OD x 0.040 Wall Al tubing |
| 37 | 8 | NIDAC09005 | Pan head sems ext (0.112) |
| 38 | 5 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.750) |
| 39 | 3 | — | Hex head Zn plated steel cap screw (.0250-20 x 1.250) |
| 40 | 5 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.375) |
| 41 | 2 | — | Hex socket head stainless steel cap screw (0.250-20 x 1.250) |
| 42 | 6 | — | Hex head Zn plated steel cap screw (0.500-13 x 1.000) |
| 43 | 2 | — | Hex head Zn plated steel cap screw (0.500-13 x 2.250) |
| 44 | 2 | 1951569_9 | Plug button |
| 45 | 8 | — | Ext lockwasher Zn plated steel hex keps nut (0.250-20) |
| 46 | 1 | — | Semi-fin Zn plated steel heavy hex full nut (0.500-13) |
| 47 | 7 | — | Zn plated steel reg spring lockwasher (0.500) |
| 48 | 1 | — | Plain Zn plated steel washer (0.562 x 1.375 x 0.109) |
| 49 | 1 | — | Round head Zn plated steel threaded frmg screw type U (0.060 x 0.188) |
| 50 | 5 | 1214-00 | Zn plated steel shakeproof lockwasher |
| 51 | 9 | — | Pan head Zn plated steel sems int (0.138-32 x 0.437) |
| 52 | 9 | — | Zn plated steel hex nut (0.138-32) |
| 53 | 1 | — | Hex socket head stainless steel cap screw (0.112-40 x 0.250) |
| 54 | 1 | — | Stainless steel reg spring lockwasher (0.112) |
| 55 | 1 | — | Hex socket head Zn plated steel cap screw (0.250-20 x 1.500) |
| 56 | 1 | — | Plain Zn plated steel washer (0.281 x 0.625 x 0.065) |

*Table A-11. UP2 with Solenoid Valve, Figure A-7 (Drawing No. 5328891) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 57 | 3 | — | Semi-fin Zn plated steel Reg hex full nut (0.250-20) |
| 58 | 1 | 5328914_1 | Transfer shaft bearing |
| 59 | 1 | 1963353__01 | Label, universal, CSA |
| 60 | 1 | 197452_4 | Set screw |
| 64 | 1 | MF274-593 | Warning label |
| 65 | 1 | 1964034_1 | Ground label |
| 66 | 1 | NNBAC16000 | Hex keps nut (0.190) |

**NOTE:**

1. Older models have plastic covers. To order a plastic side cover, use part no. 5328660_1. To order a plastic top cover, use part no. 5328670_1.

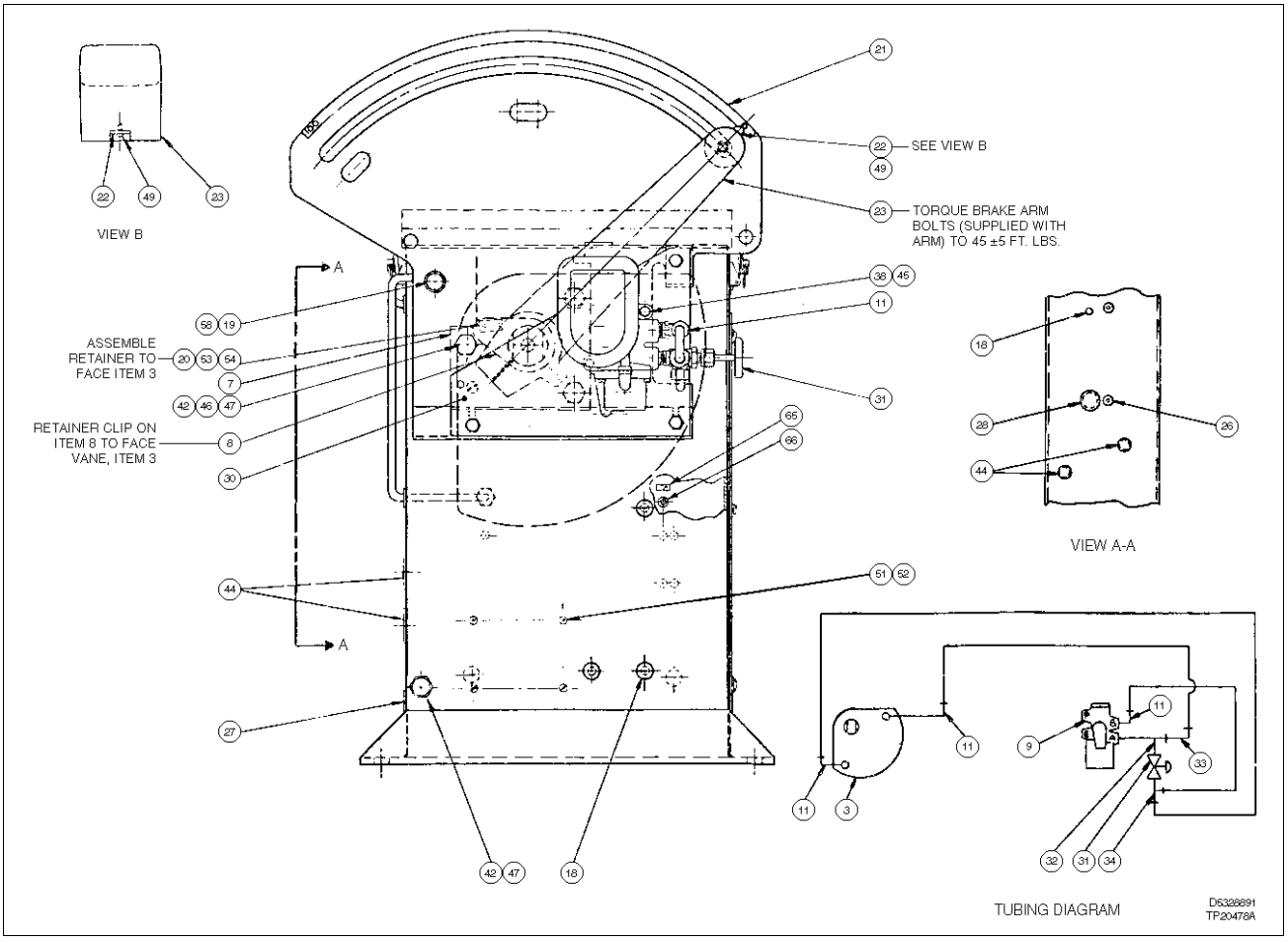



*Figure A-7. UP2 with Solenoid Valve, Tables A-11 and A-12 (Sheet 1 of 2)*

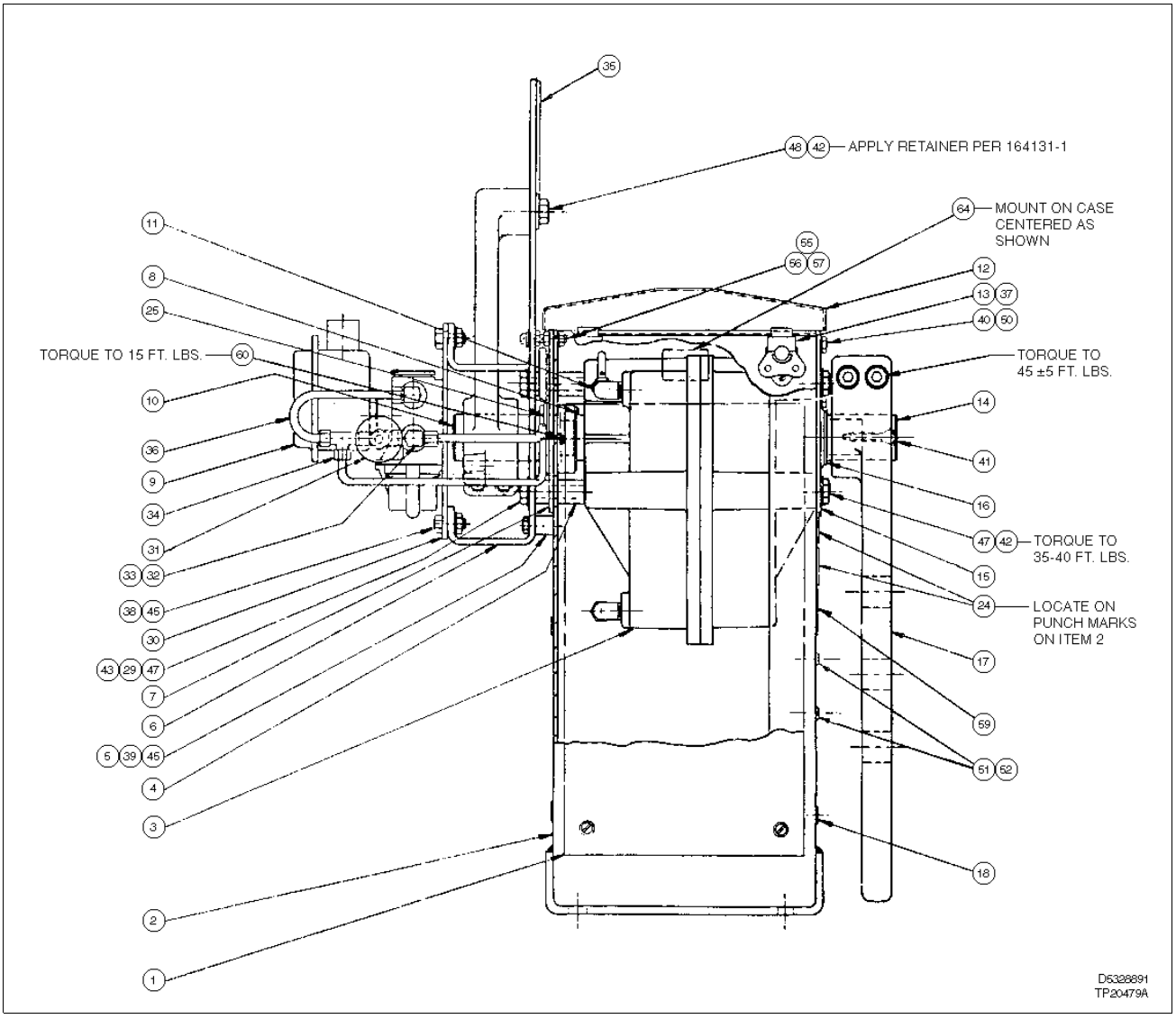



*Figure A-7. UP2 with Solenoid Valve, Tables A-11 and A-12 (Sheet 2 of 2)*

*Table A-12. UP2 Solenoid Valves, Figure A-7*

| Type | Item 5 |
|---|---|
| UP2□5 | 5322137□8 (120 VAC), single coil |
| UP2□6 | 5322137□9 (115/125 VDC), single coil |
| UP2□8 | 1951672□1 (120 VAC), dual coil |
| UP2□9 | 1951672□2 (115/125 VDC), dual coil |
| UP2□F | 5322137□10 (220 VAC at 50 Hz /240 VAC at 60 Hz), single coil |
| UP2□G | 1951672□3 (220VAC at 50 Hz/240 VAC at 60 Hz), dual coil |

*Table A-13. UP2 Alarm/Travel Switch Kit, Figures A-8 and A-30 (Kit No. 5328932_1)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 5328596_1 | Arm |
| 2 | 1 | 5328931_1 | Linkage assembly |
| 3 | 3 | 19934_198 | Spacer |
| 4 | 1 | 5328698_1 | Alarm unit |
| 5 | 1 | 1963318__ | Nameplate |
| 9 | 1 | — | Pan head Zn plated steel sems int (0.190-32 x 0.625) |
| 11 | 1 | — | Pan head screw (0.190-32) |
| 12 | 3 | NBZHA16028 | Hex keps nut (0.190-32) |
| 13 | 3 | NNBHA16000 | Zn plated steel hex nut (0.190-32) |
| 14 | 1 | No. 20 | Carton |
| 15 | 1 | 5328932 | Print |

*Table A-14. UP2 Electric Shaft Position Transmitter Kit, Figures A-8 and A-30 (Kit No. 5328932_2)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 5328596_1 | Arm |
| 2 | 1 | 5328931_1 | Linkage assembly |
| 3 | 3 | 19934_198 | Spacer |
| 4 | 1 | 5328698_2 | Electric shaft position transmitter |
| 5 | 1 | 1963318_ | Nameplate |
| 9 | 1 | — | Pan head Zn plated steel sems int (0.190-32 x 0.625) |
| 11 | 1 | — | Hex socket head stainless steel cap screw (0.138-32 x 0.500) |
| 12 | 3 | NBZHA16028 | Pan head screw (0.190-32) |
| 13 | 3 | NNBHA16000 | Hex keps nut (0.190-32) |
| 15 | 1 | 5328932 | Print |

*Table A-15. UP2 Pneumatic Shaft Position Transmitter Kit, Figure A-9 (Kit No. 5328936_2/3)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | AV112000 | Pneumatic shaft position transmitter for Type UP2_AC___ (kit no. 5328936_2) |
| | | AV122000 | Pneumatic shaft position transmitter for Type UP2_BD___ (kit no. 5328936_3) |
| 2 | 1 | 5312449_21 | Connecting link |
| 3 | 1 | 5328846_2 | Positioner mounting bracket |
| 4 | 1 | 19934_110 | Spacer |
| 5 | 1 | 197120_5 | Elastic stop nut |
| 6 | 1 | 1963318__ | Nameplate |
| 7 | 1 | 1951041_1 | ¼ NPT socket head pipe plug |
| 8 | 1 | 4-4-4RBI2-B | ¼ male run tee |

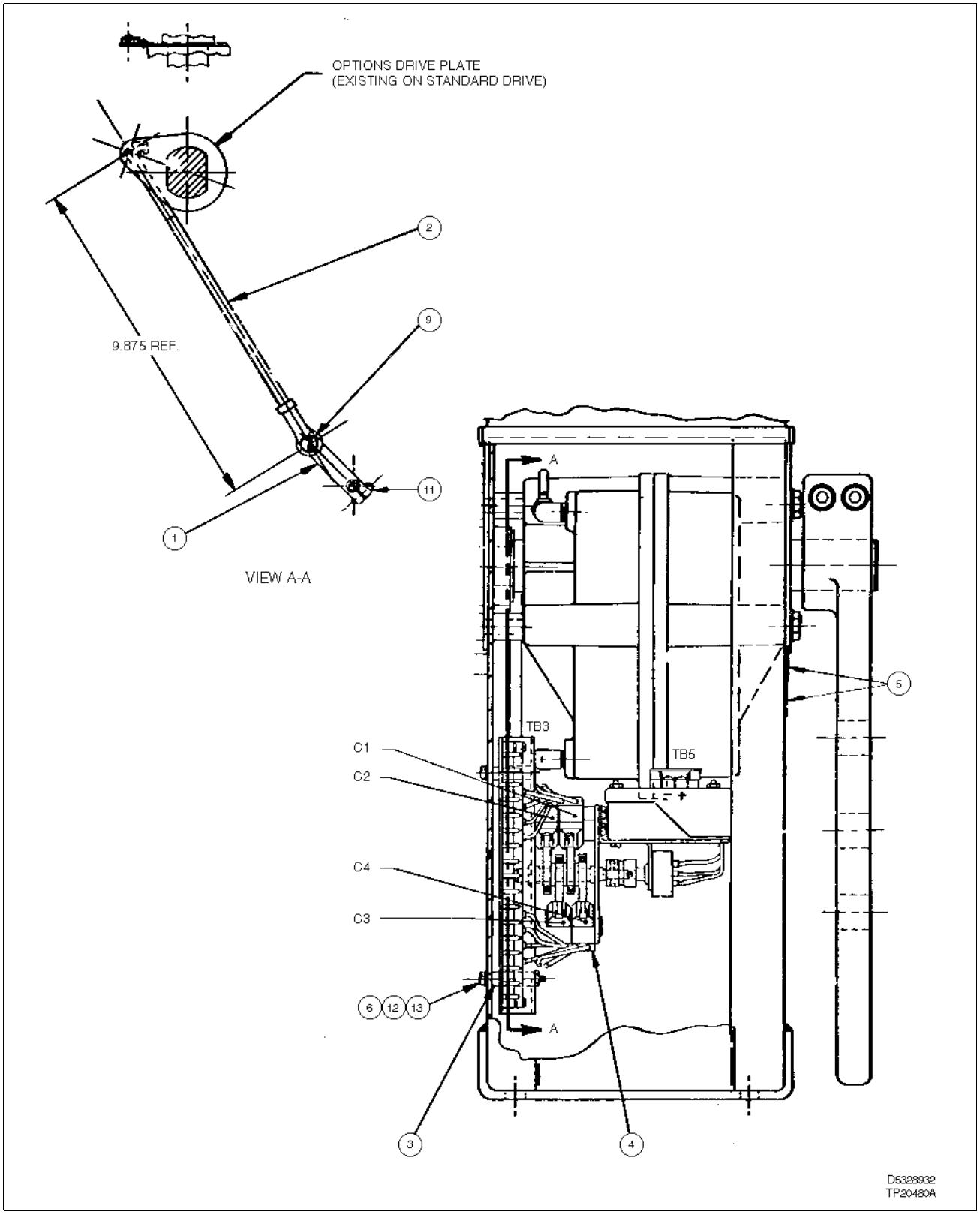



*Figure A-8. UP2 with Electric Shaft Position Transmitter and/or Alarm/Travel Switches, Tables A-13, A-14, A-48 and A-49 (Sheet 1 of 2)*

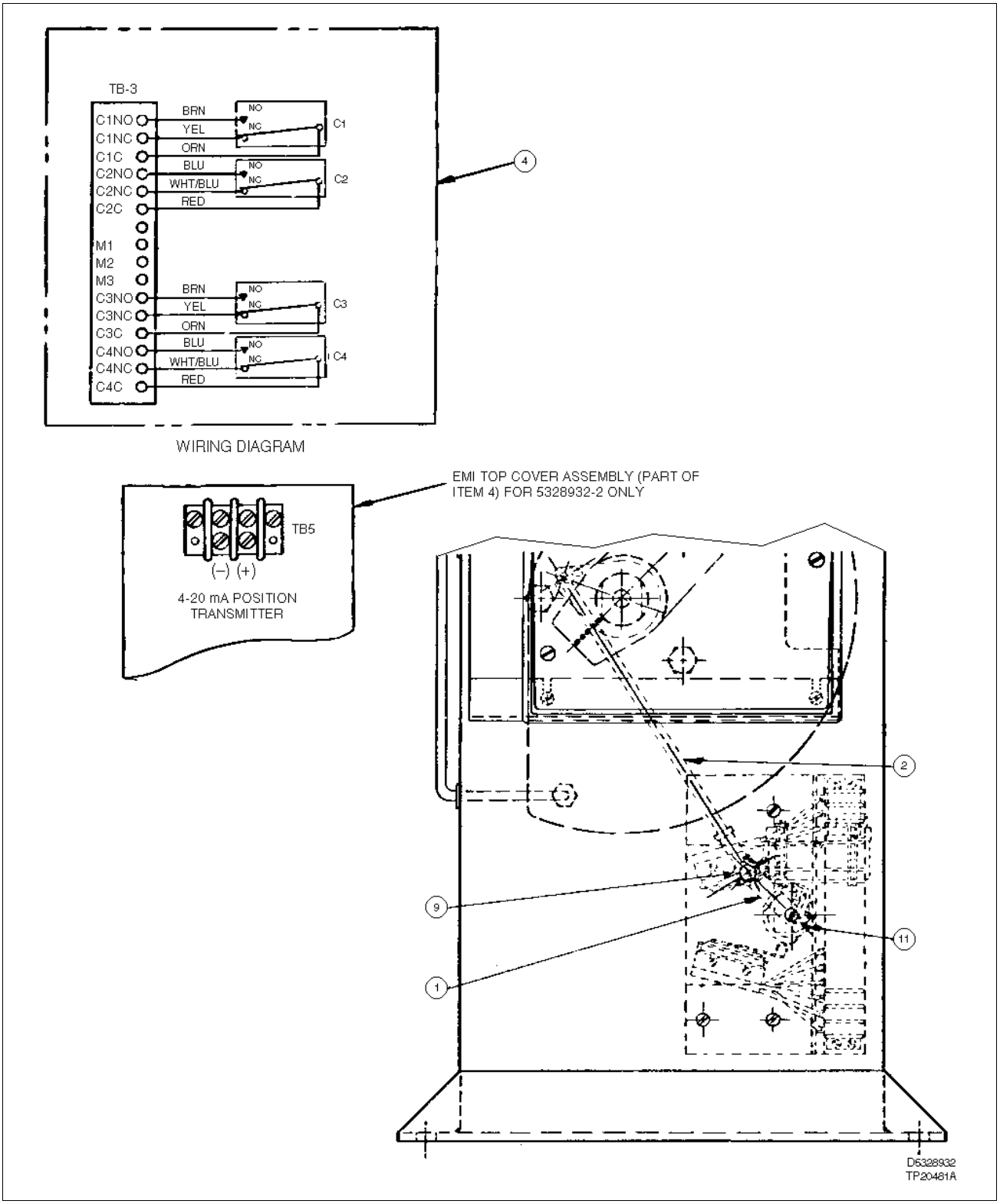



*Figure A-8. UP2 with Electric Shaft Position Transmitter and/or Alarm/Travel Switches, Tables A-13, A-14, A-48 and A-49 (Sheet 2 of 2)*

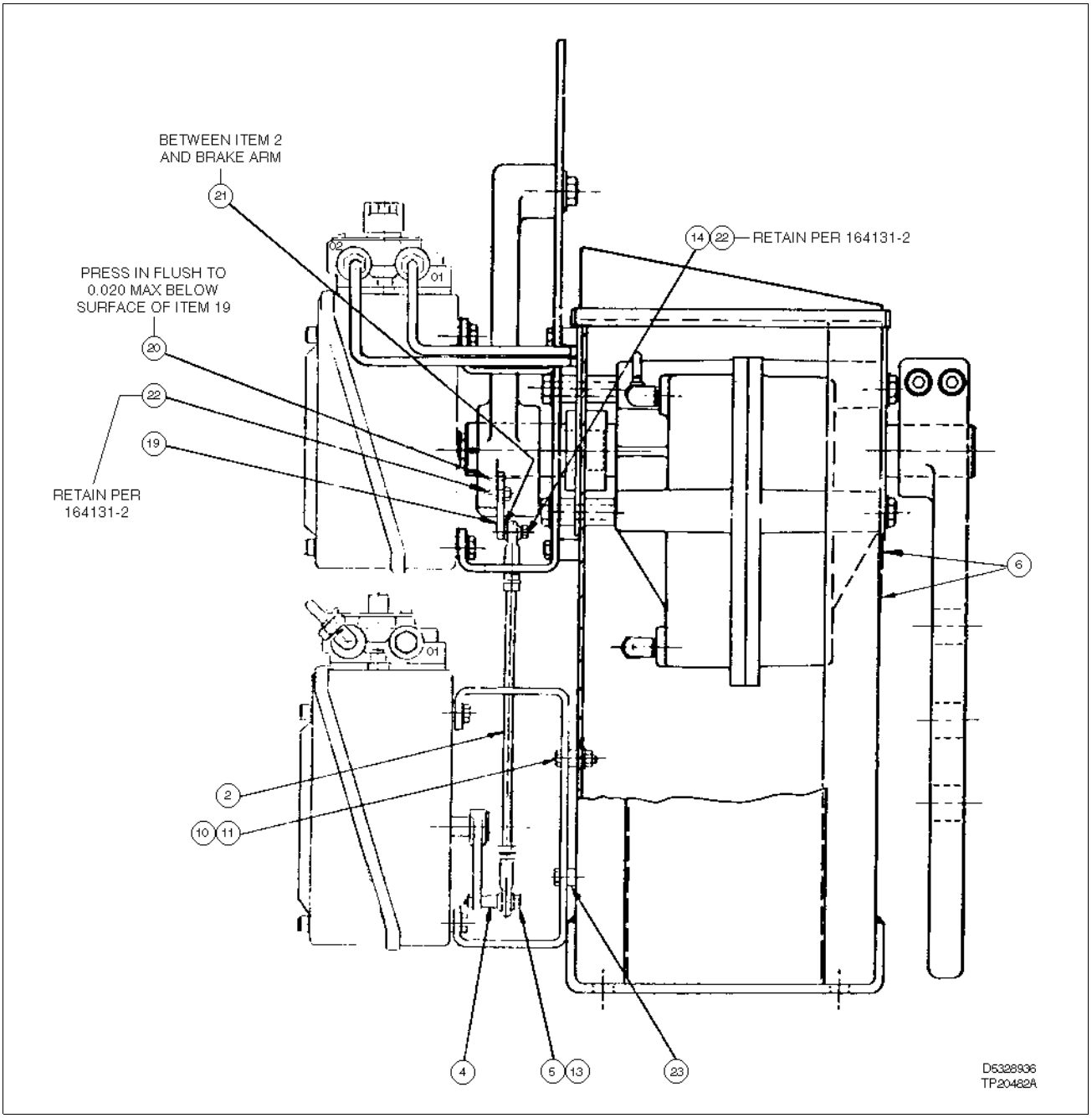



*Figure A-9. UP2 with Pneumatic Shaft Position Transmitter, Table A-15 (Sheet 1 of 2)*

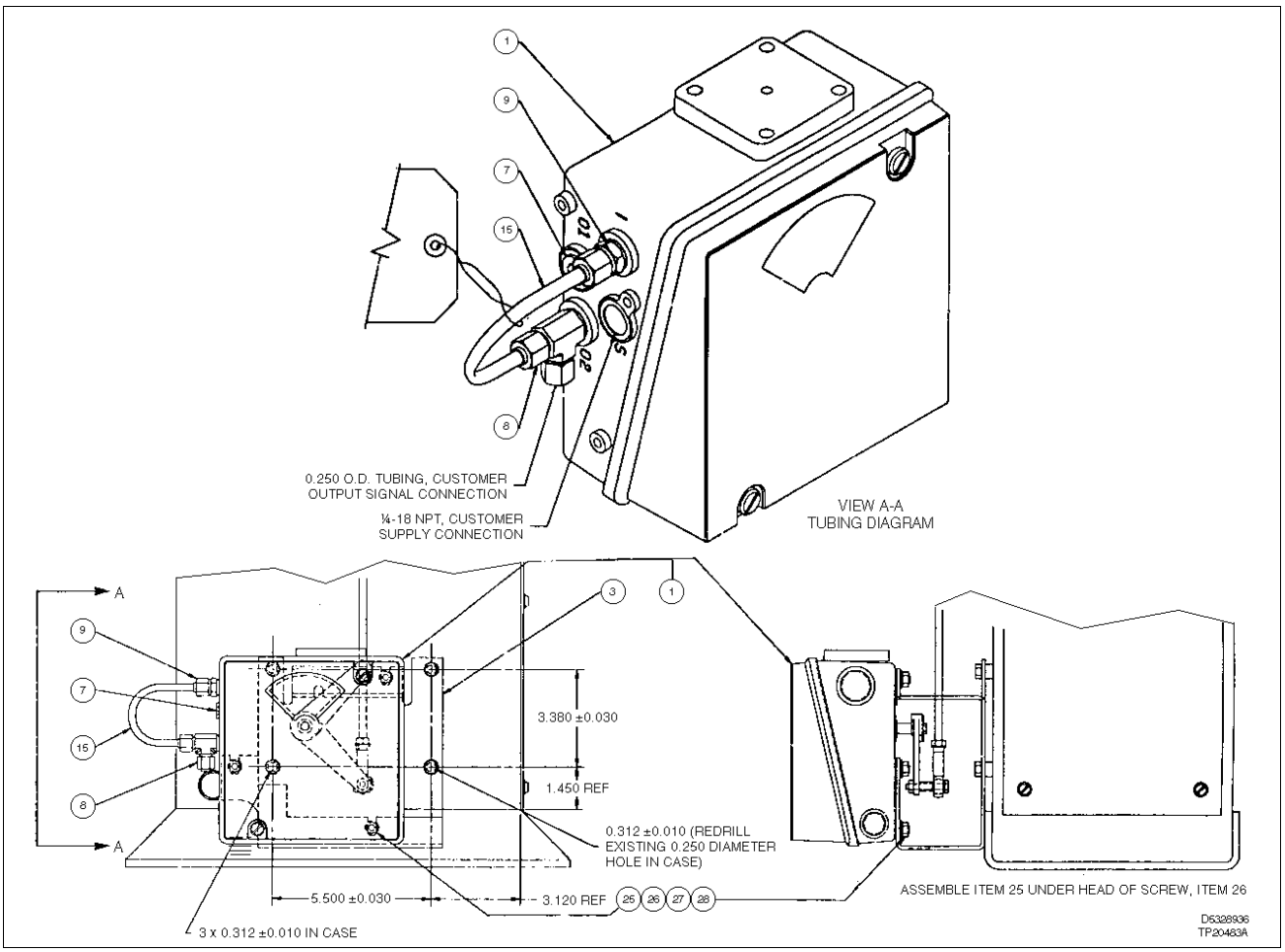



*Figure A-9. UP2 with Pneumatic Shaft Position Transmitter, Table A-15 (Sheet 2 of 2)*

*Table A-15. UP2 Pneumatic Shaft Position Transmitter Kit, Figure A-9 (Kit No. 5328936_2/3) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 10 | 4 | — | Hex head Zn plated steel cap screw (0.250-20 x 1.000) |
| 11 | 4 | — | Ext lockwasher Zn plated steel hex keps nut (0.250-20) |
| 13 | 1 | — | Hex head Zn plated steel cap screw (0.190-32 x 1.375) |
| 14 | 1 | 1210-00 | Zn plated steel shakeproof lockwasher |
| 15 | 15 cm (6 in.) | R1021-0022 | 0.250 OD x 0.040 wall Al tubing w/polyethylene jacket |
| 16 | 1 | FORM MP290 | Warning tag |
| 17 | 1 | 5328936 | Print |
| 18 | 1 | No. 24 | Carton |
| 19 | 1 | 5329040_1 | Link mounting bracket |
| 20 | 1 | — | Stainless steel roll pin (0.094 dia x 0.438) |
| 21 | 1 | — | Plain Zn plated steel washer (0.203 x 0.406 x 0.040) |
| 22 | 2 | — | Hex head Zn plated steel cap screw (0.190-32 x 0.750) |
| 23 | 4 | 19934_107 | Spacer |

*Table A-15. UP2 Pneumatic Shaft Position Transmitter Kit, Figure A-9 (Kit No. 5328936 _2/3) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 25 | 3 | NTMHA21000 | Int sems lockwasher (0.250) |
| 26 | 3 | NBAHA21016 | Hex socket head screw (0.250-20) |
| 27 | 3 | NTCHA11000 | Flat washer (0.250) |
| 28 | 3 | NNBHA21000 | Hex keps nut (0.250-20) |

*Table A-16. UP2 Air Failure Lock Kit, Figure A-10 (Kit No. 5328925 _1)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 2 | 1951609_1 | Bulkhead fitting |
| 2 | 1 | 5328917_1 | Manual lock |
| 3 | 1 | 5328863_2 | Spacer |
| 4 | 1 | 5328938_1 | Transfer shaft assembly |
| 5 | 1 | 5328909_1 | Pin |
| 6 | 3 | 197164_37 | Retaining ring |
| 7 | 1 | 5328915_1 | Lever |
| 8 | 2 | 1941718_1 | Conduit gasket |
| 9 | 2 | 5328918_1 | Pin |
| 10 | 5 | 197164_50 | Retaining ring |
| 11 | 1 | 5328929_1 | Eccentric assembly |
| 12 | 6 | NNBHA21000 | Hex keps nut (0.250-20) |
| 13 | 1 | 5328912_1 | Link |
| 14 | 1 | 5328861_1 | Rack cover |
| 15 | 1 | 5328921_1 | Rack |
| 16 | 1 | 5328910_1 | Rack gear |
| 17 | 1 | 5328922_1 | Sector plate |
| 18 | 1 | 5328927_1 | Eccentric assembly |
| 19 | 1 | 1951589_2 | Air valve |
| 20 | 1 | 5328788_1 | Mounting bracket |
| 21 | 1 | 1951606_1 | 3-way valve |
| 22 | 1 | 5328911_1 | Support stud |
| 23 | 1 | 1951610_1 | Air cylinder |
| 24 | 1 | 5328919_1 | Clevis arm |
| 25 | 2 | 5327327_3 | Adapter |
| 26 | 1 | 197745_1 | Extension spring |
| 27 | 3 | 4-4-4RBI2-B | Male run tee |
| 28 | 2 | 4CB12-B | Male elbow |
| 29 | 5 | 4-4CB12-B | Male elbow |
| 30 | 1 | — | ¼ street elbow |
| 31 | 1 | 1951589_1 | Air valve |
| 32 | 1 | 197120_10 | Elastic stop nut |

*Table A-16. UP2 Air Failure Lock Kit, Figure A-10 (Kit No. 5328925_1) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 33 | 1 | 1963487_1 | Label |
| 34 | 2 | — | Plain Zn plated steel washer (0.0312 x 0.734 x 0.065) |
| 35 | 1.8 m (6.0 ft) | R1021-0022 | 0.250 OD x 0.040 wall Al tubing |
| 36 | 1 | — | ¼ close brass nipple |
| 37 | 1 | 195273_¼ | Tee |
| 38 | 1 | — | ⅛ brass pipe plug |
| 39 | 2 | — | Pan head stainless steel cap screw (0.164-32 x 0.188) |
| 40 | 2 | NAUHA21006 | Hex head cap screw (0.250-20) |
| 41 | 2 | NAUHA21032 | Hex head cap screw (0.250-20) |
| 42 | 1 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.500) |
| 43 | 7 | — | Pan head Zn plated steel machine screw (0.190-32 x 0.875) |
| 44 | 3 | — | Hex socket head Zn plated steel cap screw (0.250-20 x 1.500) |
| 45 | 1 | 6618445_2 | Nylon washer |
| 46 | 1 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.750) |
| 47 | 3 | — | Plain Zn plated steel flat washer (0.250 x 0.562 x 0.065) |
| 48 | 1 | — | Hex socket head Zn plated steel cap screw (0.250-20 x 1.000) |
| 49 | 2 | — | Rolled split spacer cem |
| 50 | 2 | — | Pan head Zn plated steel machine screw (0.164-32 x 2.750) |
| 51 | 1 | 1963318__ | Nameplate |
| 52 | 2 | NTJHA15030 | Spring lockwasher (0.500) |
| 53 | 1 | NLHHA29000 | Hex jam nut (0.500-13) |
| 55 | 1 | — | Cotton draw string bag 7.6 x 12.7 cm (3.0 x 5.0 in.) |
| 56 | 1 | 5328925 | Print |
| 57 | 4 | NTMHA21000 | Int lockwasher (0.250) |
| 58 | 1 | — | Semi-fin Zn plated steel reg hex jam nut (0.500-20) |
| 59 | 1 | — | ⅛ brass pipe plug |
| 60 | 1 | 3053306 | Print |
| 61 | 2 | — | Ext lockwasher Zn plated steel hex keps (0.164-32) |
| 62 | 1 | NLJHA21000 | Hex nut (0.250-20) |

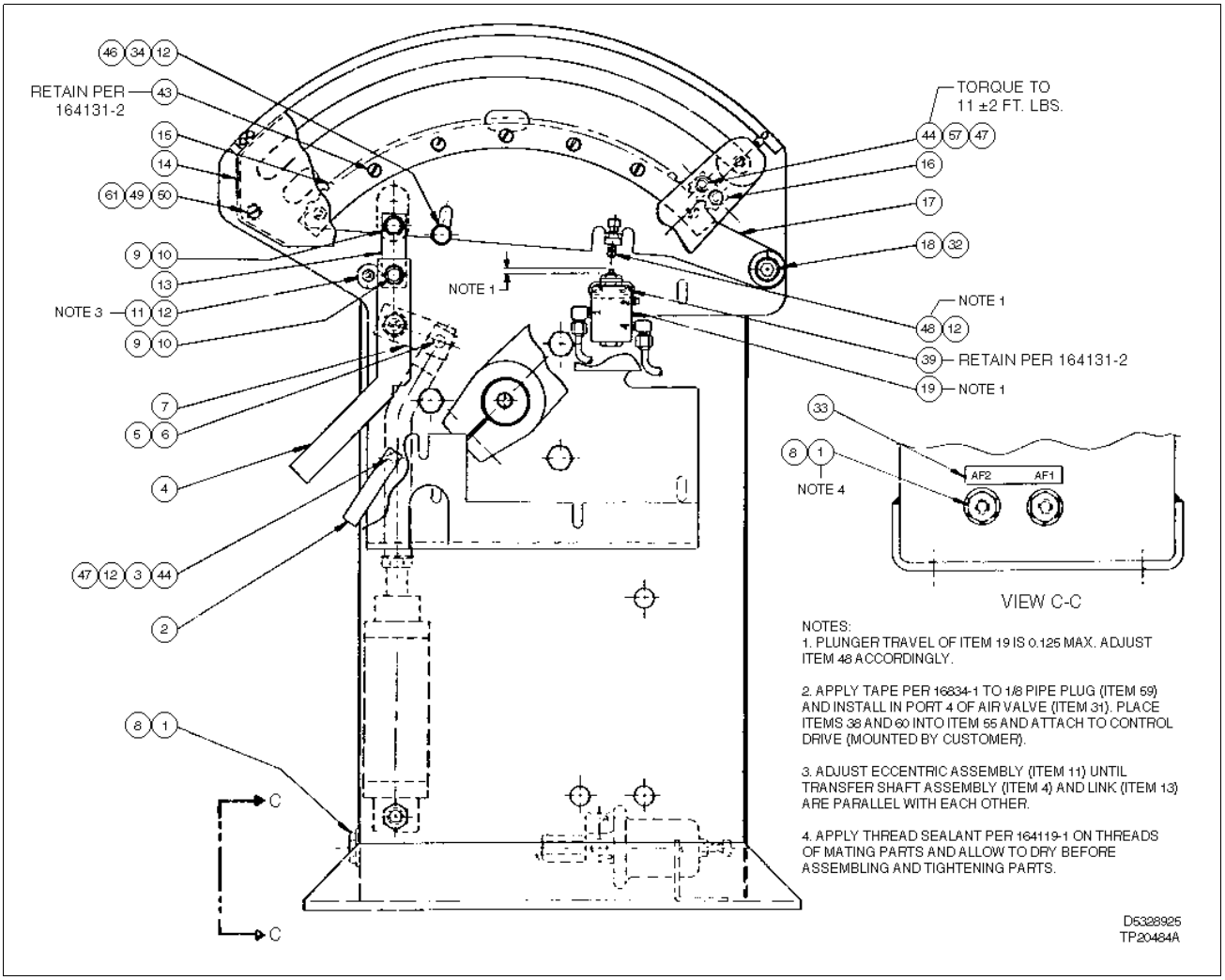



*Figure A-10. UP2 with Air Failure Lock, Table A-16 (Sheet 1 of 2)*

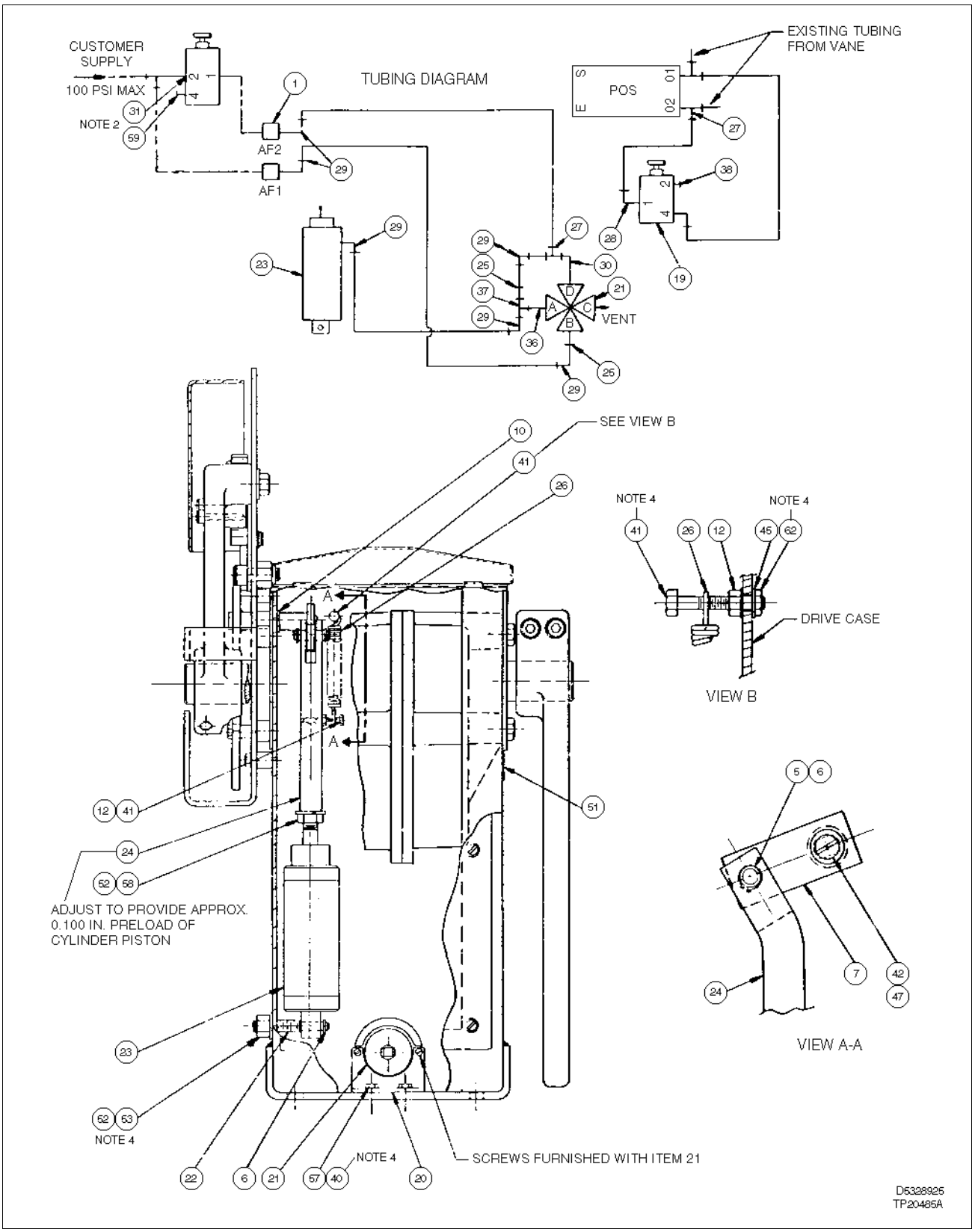



*Figure A-10. UP2 with Air Failure Lock, Table A-16 (Sheet 2 of 2)*

*Table A-17. UP2 Reserve Air Tank Kit, Figure A-11 (Kit No. 5328925 _2)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 5328642_4 | Case assembly |
| 2 | 2 | 5328788_1 | Mounting bracket |
| 3 | 2 | 1951606_1 | 3-way pneumatic valve |
| 4 | 1 | 1941099_2 | Pressure switch |
| 5 | 1 | 1941147_1 | ½ molded bushing |
| 6 | 1 | 5328782_1 | Air failure lock harness |
| 7 | 1 | 194956_3 | Terminal block |
| 8 | 1 | 5329189_1 | Terminal designation assembly |
| 9 | 1 | 5329190_1 | Switch mounting plate |
| 10 | 1 | 67125_15 | Rubber grommet |
| 11 | 4 | 4-4-4SBI2-B | Male branch tee |
| 12 | 10 | 4-4CBI2-B | Male elbow |
| 13 | 2 | 1951609_1 | Bulkhead fitting |
| 14 | 2 | 1941817_1 | Conduit gasket |
| 15 | 1 | 1951712_1 | Check valve |
| 16 | 1 | 1963318__ | Universal nameplate |
| 17 | 1 | 1963489_4 | Designation plate |
| 18 | 1 | 1951785_5 | 20.8 liter (5.5 gallon) air tank assembly (Fig. B-11) |
| 19 | 2 | 4-4FBI2-B | Male connector |
| 20 | 1 | 1951608_1 | Shutoff valve |
| 21 | 1 | 1963478_1 | Instruction plate |
| 23 | 2 | NIDAC13008 | Pan head ext sems (0.138) |
| 24 | 2 | NIDAC13012 | Pan head ext sems (0.138) |
| 25 | 2 | NBJAC16010 | Hex washer head screw (0.190) |
| 26 | 4 | NTMAC19000 | Int lockwasher (0.190) |
| 27 | 4 | NBZAC17014 | Pan head screw (0.190-24) |
| 28 | 2 | NAUAC21006 | Hex cap screw (0.250) |
| 29 | 2 | NTLAC25000 | Ext lockwasher (0.250) |
| 30 | 4 | NBJAC21008 | Hex whiz lock (0.250) |
| 31 | 1 | NTLAC50000 | Ext lockwasher (0.500) |
| 32 | 1 | — | ¼ NPT brass street elbow |
| 33 | 2 | — | ¼ NPT brass tee |
| 34 | 1 | — | ¼ NPT x 1.250 long brass nipple |
| 36 | 3 m (10 ft) | R1021-0022 | 0.250 OD x 0.040 wall Al tubing with black poly jacket |
| 38 | 1 | C3053544 - sh3 | Print |

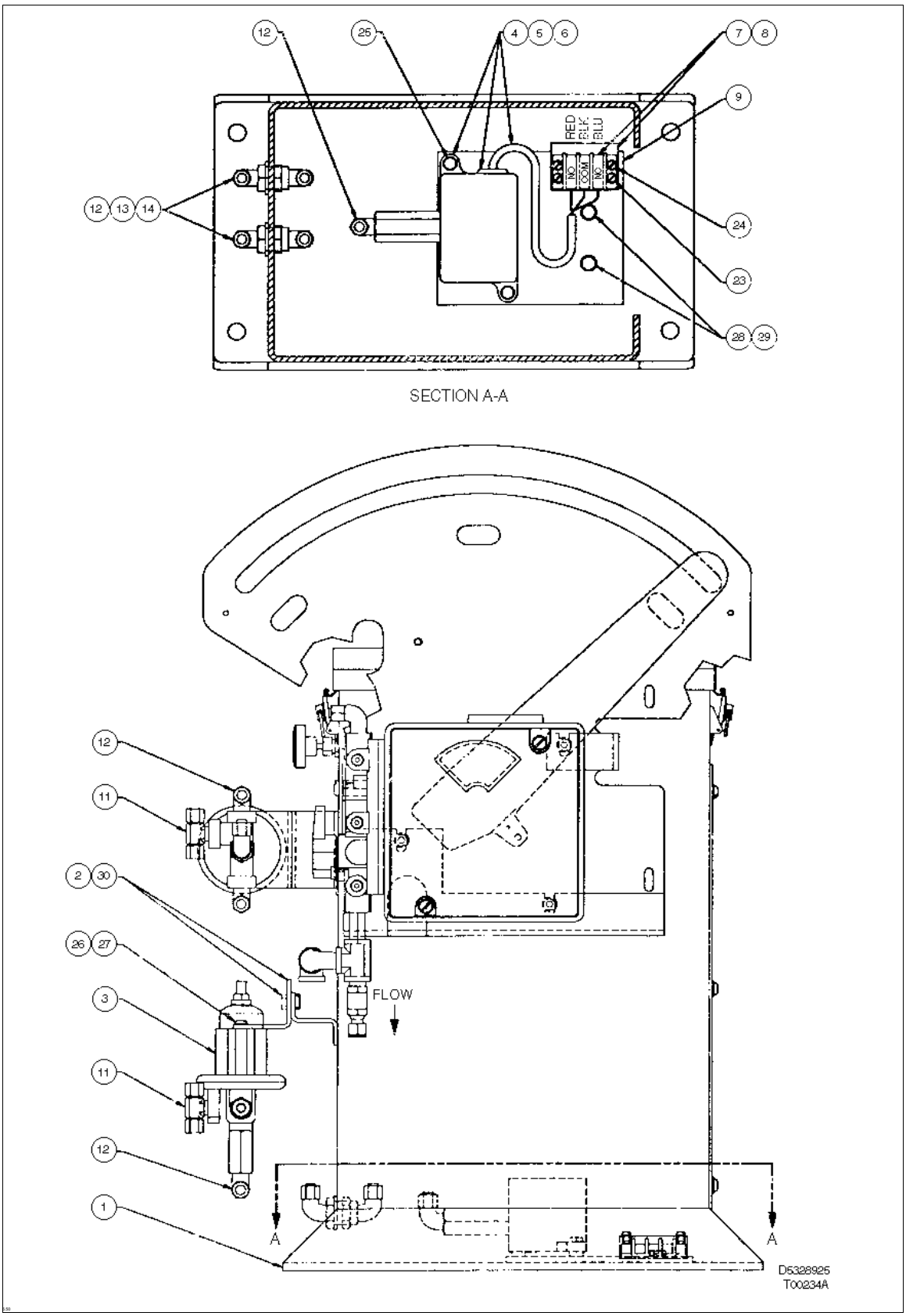



*Figure A-11. UP2 Reserve Air Tank Kit, Table A-17 (Sheet 1 of 2)*

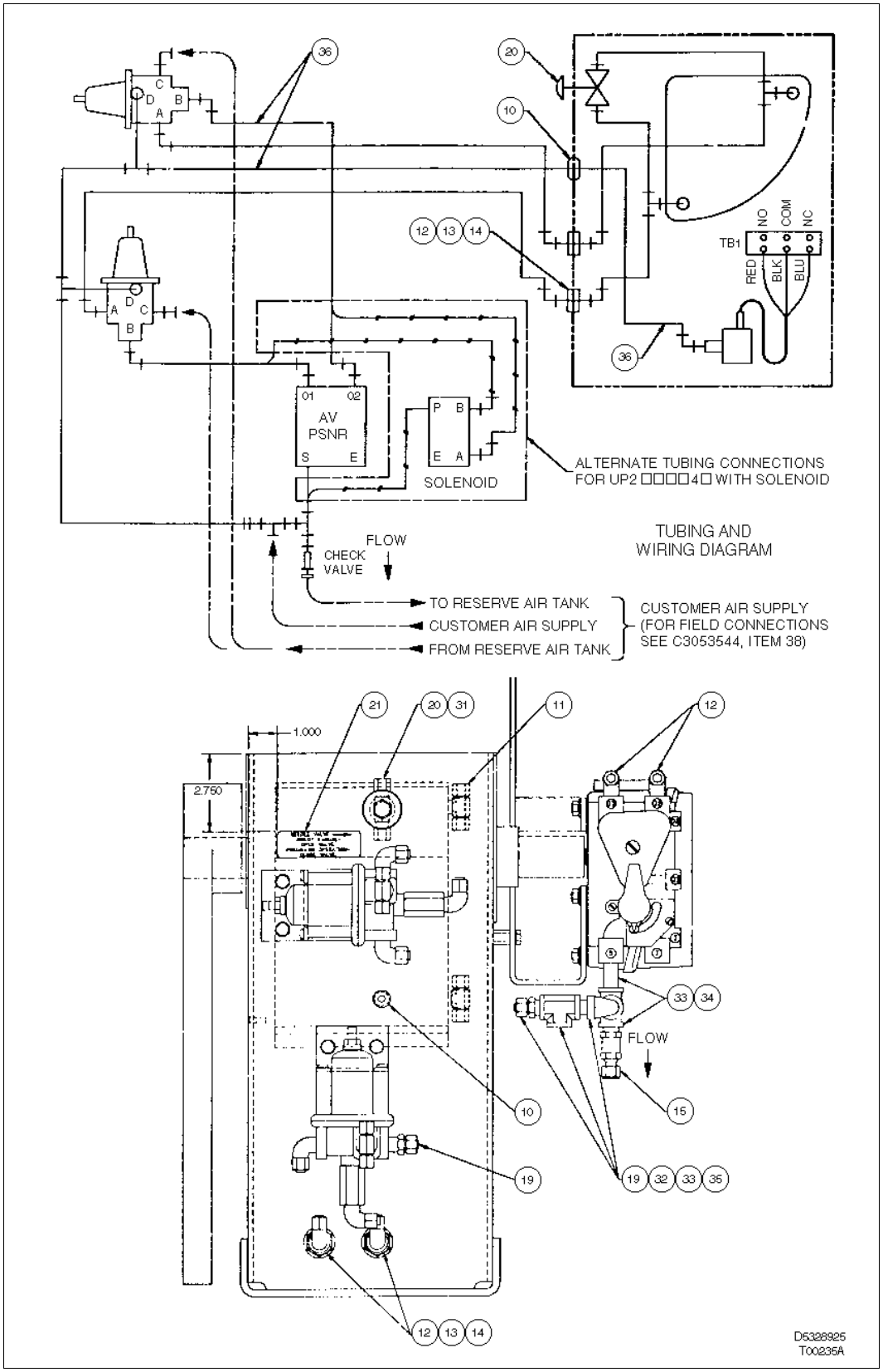



*Figure A-11. UP2 Reserve Air Tank Kit, Table A-17 (Sheet 2 of 2)*

*Table A-18. UP2 Rotary Vane Seal Repair Kit, Figure 8-1 (Kit No. 258244 _2)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 2 | 341816_218 | O-ring (shaft) |
| 2 | 1 | 1951631_443 | O-ring (vane) |
| | A/R | 199354_1 | Lubricant |
| | A/R | 199926_1 | Sealant |

*Table A-19. UP2 Heater Kits, Figure A-12 (Kit Nos. 5328935 _1/2)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 6612345_2 | Desig plate assembly |
| 2 | 1 | 194956_3 | Terminal block |
| 3 | 2 | 1943825_8 | Terminal lug |
| 4 | 2 | 19934_87 | Spacer |
| 5 | 1 | 1943002_1 | Strip heater (500 W) for 120 VAC operation |
| | | 1943002_2 | Strip heater (500 W) for 240 VAC operation |
| 6 | 1 | 662460_1 | Thermoswitch |
| 7 | 1 | 195105_10 | Tube clamp |
| 8 | 2 | 1941401_2 | Solderless terminal |
| 11 | 1 | 197118_2 | Conduit connector |
| 12 | 3 | NBZHA13012 | Pan head stainless steel screw (0.138) |
| 13 | 5 | NNBAC13000 | Hex keps nut (0.138-32) |
| 14 | 36 cm (14 in.) | 5318366_1U | Fiberglass insulation |
| 15 | 1 | NBZHA16010 | Pan head stainless steel screw (0.190) |
| 16 | 4 | NNBHA16000 | Stainless steel hex keps (0.190) |
| 17 | 2 | NBZHA16020 | Pan head stainless steel machine screw (0.190-32) |
| 18 | 1 | 5328935 | Print |
| 19 | 1 | No. 84 | Mailer |
| 20 | 1.2 m (4.0 ft) | R2049-0100 | 14 AWG natural leadwire |
| 21 | 2 | NTCHA09000 | Plain stainless steel washer (0.190) |
| 22 | 1 | 195105_6 | Tube clamp |
| 23 | 2 | 1943825_11 | Terminal lug |
| 24 | 2 | NBZHA13016 | Pan head stainless steel sems ext (0.138) |
| 25 | 1 | 1963318__ | Nameplate |
| 26 | 5 | 197496_6 | Sealing washer |
| 27 | 3 | 197496_10 | Sealing washer |

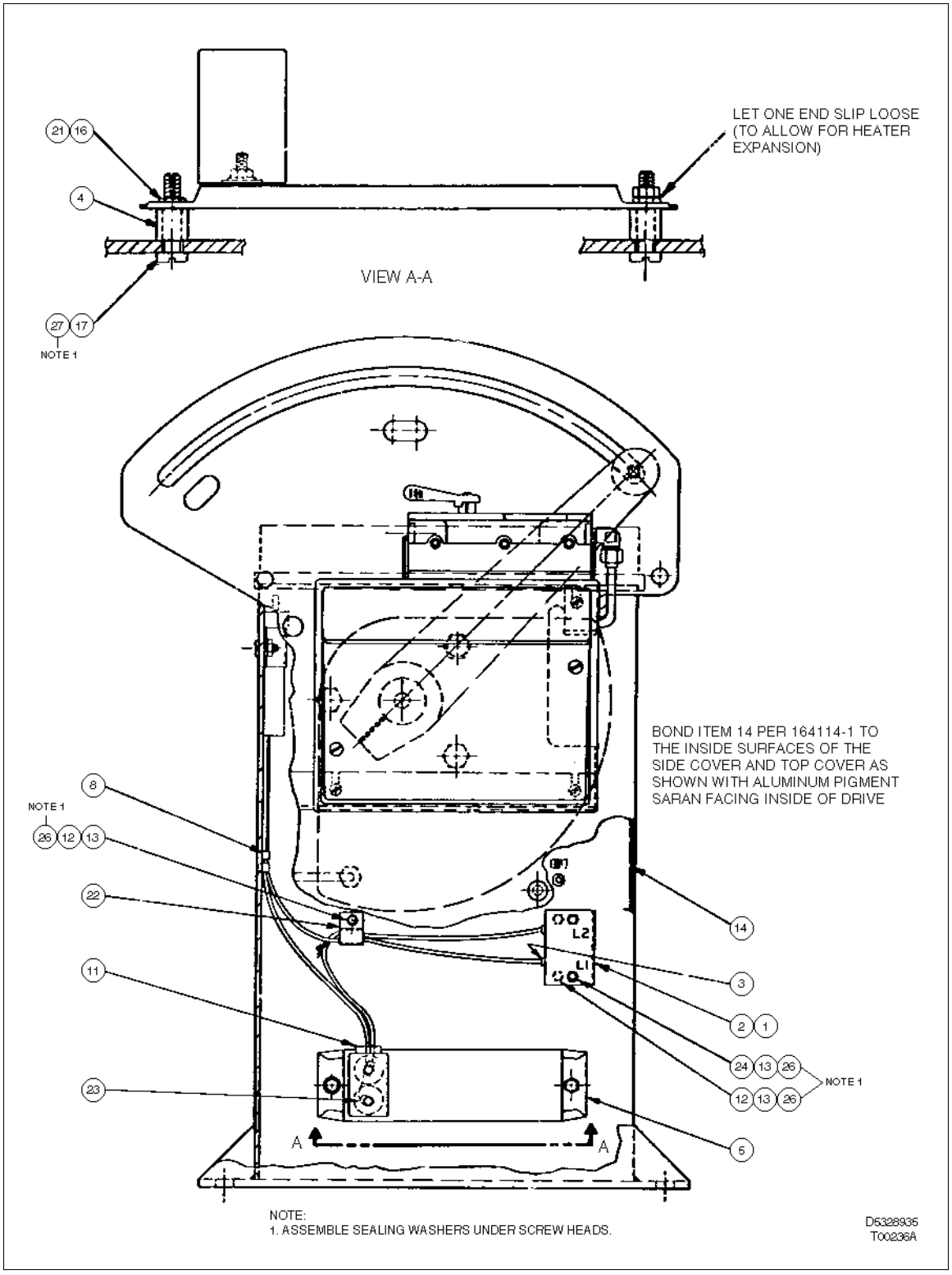



*Figure A-12. UP2 with Heater, Table A-19 (Sheet 1 of 2)*

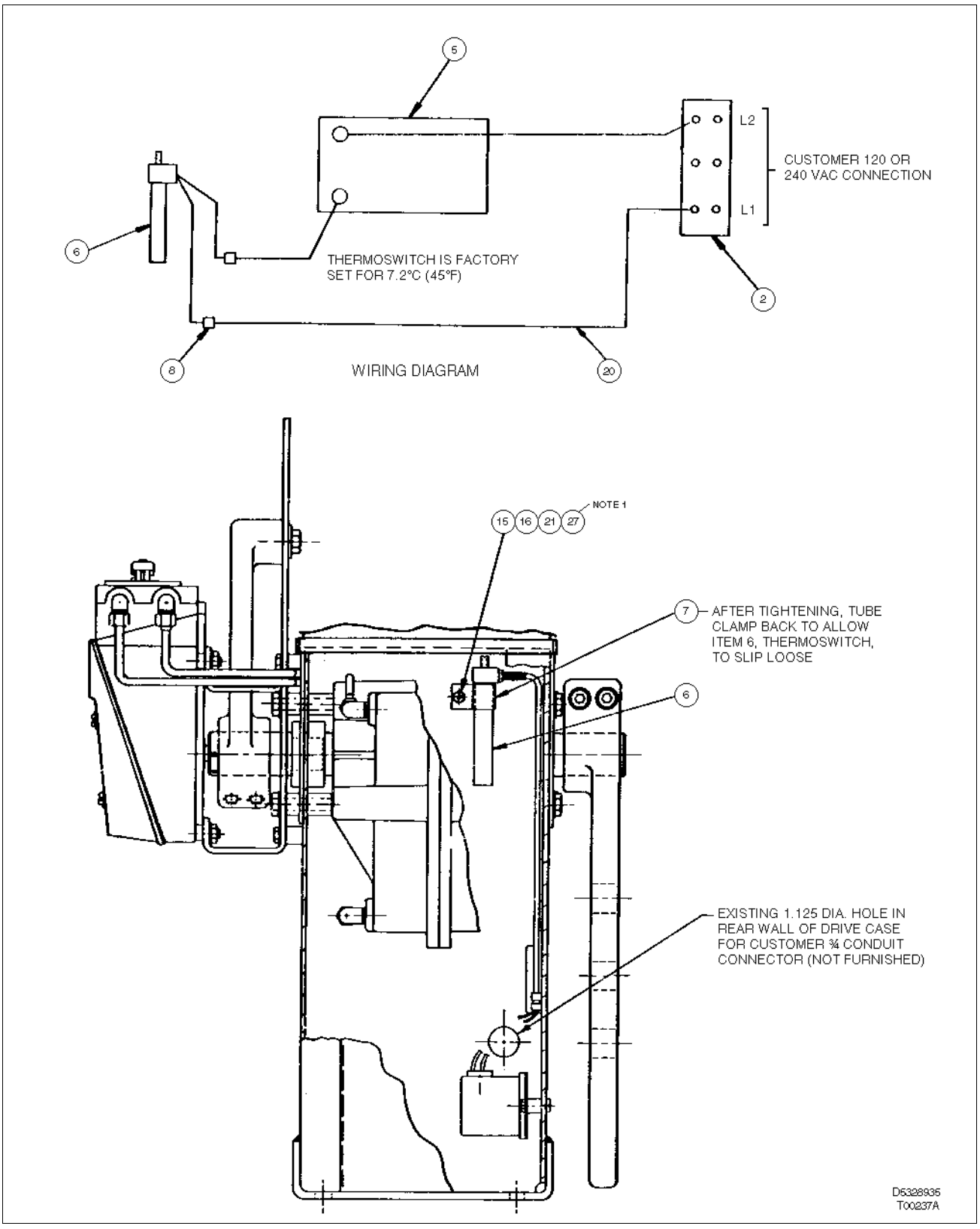



*Figure A-12. UP2 with Heater, Table A-19 (Sheet 2 of 2)*

## *TYPES UP3 AND UP4 ACTUATORS*

Refer to Tables A-20 through A-31, A-48 and A-49; Figures A-13 through A-21, and A-30 for spare parts information for Types UP3 and UP4 actuators.

*Table A-20. UP3 and UP4 with Positioner, Figure A-13 (Drawing No. 5328749)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| Refer to sheets 1 and 2 of Figure A-13. | | | |
| 1 | 1 | 5328740_3 | Frame assembly |
| 2 | 4 | 197730_1 | Cotter pin |
| 3 | 8 | 1951569_9 | Plug button |
| 4 | 1 | 194956_17 | Terminal block |
| 5 | 1 | 1947271_2 | Desig plate |
| 6 | 8 | 197743_3 | Ty-wrap |
| 7 | 1 | Refer to Tables A-21, 8-1, 8-2 and Figures 8-2 and 8-3 | Cylinder assembly |
| 8 | 1 | 5328779_1 | Arm and shaft assembly |
| 9 | 1 | — | Zn plated roll pin (0.500 dia x 3.500) |
| 10 | 1 | 5328735_1 | Drive pin |
| 11 | 2 | 5328774_1 | Roller bearing |
| 12 | 2 | 197164_75 | Retaining ring |
| 13 | 2 | 5328737_1 | Retainer plate |
| 14 | 1 | 5328789_1 | Spring plunger |
| 15 | 1 | 5328732_1 | Spring keeper |
| 16 | 1 | 5328785_1 | Spring |
| 17 | 1 | 5328733_1 | Spring guide |
| 18 | 1 | 5328734_1 | Cam |
| 19 | 2 | 5328754_3 | Support panel |
| 20 | 1 | 5328747_1 | Split nut |
| 21 | 1 | 5328736_1 | Operator rod |
| 22 | 1 | 5328738_1 | H wheel shaft |
| 23 | 1 | Refer to Table A-21 | Positioner |
| 24 | 1 | Refer to Table A-21 | Desig plate |
| 25 | 1 | 194956_7 | Terminal block |
| 26 | 2 | 5328770_1 | Clevis pin |
| 27 | Refer to Table A-21 | 1951407_1 | Male connector |
| 28 | 1 | 5328718_1 | Bearing support |
| 29 | 1 | 5328771_1 | Clevis |
| 30 | 1 | 5328765_2 | Gasket |
| 31 | 6 | 5313297_1 | Washer |
| 32 | 2 | 5313299_1 | Thrust bearing |
| 33 | 2 | 5311759_1 | Ball joint |

*Table A-20. UP3 and UP4 with Positioner, Figure A-13 (Drawing No. 5328749) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| Refer to sheets 1 and 2 of Figure A-13. | | | |
| 34 | 1 | 5400311_1 | Connecting link (AV) |
| 35 | Refer to Table A-21 | 1951609_1 | Bulkhead fitting |
| 36 | Refer to Table A-21 | 19981_31 | Plug button |
| 37 | 1 | 197676_1 | Ground screw |
| 38 | 1 | 197675_1 | Washer |
| 39 | Refer to Table A-21 | 4-4CBI2-B | Male elbow |
| 40 | Refer to Table A-21 | 4CBI2-B | Male elbow |
| 41 | Refer to Table A-21 | 4-4FBI2-B | Male connector |
| 42 | 1 | 5328793_1 | Sleeve |
| 43 | 1 | 1963318_ _ | Nameplate |
| 44 | 1 | 5328758_2 | Instruction plate |
| 45 | 2 | — | Hex head Zn plated steel cap screw (0.500-13 x 0.625) |
| 46 | 2 | — | Hex head Zn plated steel cap screw (0.250-20 x 3.000) |
| 47 | Refer to Table A-21 | — | ¼ NPT brass street elbow |
| 48 | Refer to Table A-21 | — | ¼ NPT x 1.250 long brass nipple |
| 49 | 4 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.500) |
| 50 | 4 | — | Hex head Zn plated steel machine screw (0.250-20 x 0.750) |
| 51 | 2 | — | Semi-fin Zn plated steel heavy hex full nut (0.500-13) |
| 52 | 2 | — | Hex head Zn plated steel cap screw (0.500-13 x 1.500) |
| 53 | 2 | 1224-00 | Zn plated steel shakeproof lockwasher |
| 54 | Refer to Table A-21 | 1943825_1 | Terminal lug |
| 55 | 1 | — | Hex jam nut (1.000-14) |
| 56 | 1 | — | Hex nut (0.750-16) |
| 57 | Refer to Table A-21 | R1021-0022 | 0.250 OD x 0.040 wall Al tubing with polyethylene jacket |
| 58 | 1 | 5400313_1 | Mounting plate |
| 59 | 8 | SSP-68 | Zn plated steel rivet |
| 60 | 4 | — | Pan head Zn plated steel machine screw (0.138-32 x 1.000) |
| 61 | 4 | — | Pan head Zn plated steel machine screw (0.138-32 x 0.625) |
| 62 | 1 | 5329067_1 | Stop plate |
| 63 | 1 | 5329066_1 | Shaft extension |
| 64 | 10 | 1214-00 | Zn plated steel shakeproof int lockwasher |
| 65 | 1 | 5320156_1 | Spring |

*Table A-20. UP3 and UP4 with Positioner, Figure A-13 (Drawing No. 5328749) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| Refer to sheets 1 and 2 of Figure A-13. | | | |
| 66 | 1 | 5329065_1 | Shaft seal |
| 67 | 1 | — | ¼ NPT brass tee |
| 68 | 1 | — | ¼ NPT brass pipe plug |
| 69 | 3 | — | MDP spiral pin (0.188 dia x 1.000) |
| 70 | 1 | 1963503_1 | Designation label |
| 71 | 1 | 1963503_2 | Designation label |
| 72 | 1 | 1963503_3 | Designation label |
| 73 | 1 | 1963503_4 | Designation label |
| 74 | 8 | — | Ext lockwasher Zn plated steel hex keps (0.250-20) |
| 75 | Refer to Table A-21 | R2041-0030 | 18 AWG white leadwire |
| 76 | Refer to Table A-21 | R2041-0010 | 18 AWG black leadwire |
| 77 | A/R | 6634752_1 | Shim |
| 79 | 4 | — | Indented hex washer Zn plated steel (0.250-20 x 0.500) |
| 80 | Refer to Table A-21 | 4VBI2-B | 45° male elbow |
| 81 | Refer to Table A-21 | — | ¼ NPT brass elbow |
| 82 | 1 | 197120_5 | Elastic stop nut |
| 84 | 2 | 19734_45 | Small washer |
| 85 | 1 | 5311459_1 | Handle valve |
| 86 | 1 | — | Zn plated steel roll pin (0.125 x 0.750) |
| 87 | 1 | 4808-09-01-4102 | Stainless steel shakeproof lockwasher |
| 88 | 1 | — | Plain Zn plated steel washer (0.188 x 0.438 x 0.049) |
| 89 | 4 | 1114-00 | Zn plated steel shakeproof lockwasher |
| 90 | 1 | — | Pan head Zn plated steel machine screw (0.164-32 x 0.625) |
| 91 | Refer to Table A-21 | 1943825_3 | Terminal lug |
| 92 | A/R | 1963353__01 | Label, universal, CSA |
| 93 | Refer to Table A-21 | 1951408_1 | Male elbow |
| 94 | Refer to Table A-21 | R9021-0050 | 0.500 OD x 0.062 wall nylon tubing |
| 96 | 3 | NTJHA11030 | Spring lockwasher (0.250) |
| 97 | 3 | NBAHA21014 | Hex socket head screw (0.250-20) |
| 98 | Refer to Table A-21 | 1941147_1 | Bushing |
| 99 | Refer to Table A-21 | R2041-1576 | 22 AWG black leadwire |
| 100 | 1 | NNBAC20000 | Hex keps nut (0.250-28) |
| 101 | 2 | NTLAC19000 | Ext shakeproof lockwasher (0.250) |
| 107 | 76.2 cm (30.0 in.) | R2041-1577 | 22 AWG brown leadwire |
| 108 | 76.2 cm (30.0 in.) | R2041-1578 | 22 AWG red leadwire |
| 109 | 76.2 cm (30.0 in.) | R2041-1580 | 22 AWG yellow leadwire |

*Table A-20. UP3 and UP4 with Positioner, Figure A-13 (Drawing No. 5328749) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 110 | 76.2 cm (30.0 in.) | R2041-1581 | 22 AWG blue leadwire |
| 111 | 76.2 cm (30.0 in.) | R2041-1700 | 22 AWG green leadwire |
| Refer to sheet 3 of Figure A-13. | | | |
| 1 | 1 | 5328792_1 | Handle |
| 2 | 1 | 198517_2 | Handle and ratchet assembly |
| 6[1] | 1 | 5328759_8 | Side cover |
| 7 | 1 | 1963339_1 | Scale |
| 8 | 1 | 5328609_2 | Pointer |
| 9[1] | 1 | 5328759_7 | Side cover |
| 10[1] | 1 | 5329164_2 | Top cover assembly |
| 12 | 1 | 1962207_1 | Style plate |
| 13 | 1 | 5328797_1 | Operating lever |
| 14 | 1 | 5324259_1 | Hand/auto nameplate |
| 15 | 1 | 198531_1 | Woodruff key |
| 16 | 1 | 1963339_2 | Scale |
| 24 | 1 | NRNHA19016 | Spiral pin (0.188) |
| 29 | 4.3 m (14.0 ft) | 1951480_1U | Sealing strip |
| 31 | 1 | NAUHA21008 | Hex cap screw (0.250-20) |
| 33 | 1 | NTJHA11030 | Spring lockwasher (0.250) |
| 34 | 6.3 cm (2.5 in.) | R9410-0025 | Vinyl tape (0.250 X 0.375) |

**NOTE:**

1. Older models have plastic covers. To order a plastic side cover, user part nos. 5328759_2 (Item 9). To order a plastic top cover, use part no. 5328795_1 (Item 10).

*Table A-21. UP3 and UP4 Positioners and Unique Items, Figure A-13*

| Type | Item 7 | Item 23 | Item 24 | Item 27 | Item 35 | Item 36 | Item 39 | Items 40,80 |
|---|---|---|---|---|---|---|---|---|
| UP3_A0 | 5328775_1 | AV112100 | 1947271_8 | Omit | 2 | 4 | 4 | 1 |
| UP3_A11 | 5328775_1 | AV112100 | 1947271_8 | Omit | 2 | 4 | 4 | 1 |
| UP3_AA | 5328775_1 | AV112110 | 1947271_8 | Omit | 2 | 4 | 4 | 1 |
| UP3_AB | 5328775_1 | AV112120 | 1947271_8 | Omit | 2 | 4 | 4 | 1 |
| UP3_AC | 5328775_1 | AV112100 | 1947271_8 | Omit | 2 | 4 | 4 | 1 |
| UP3_B0 | 5328775_1 | AV122100 | 1947271_8 | Omit | 2 | 4 | 4 | 1 |
| UP3_B11 | 5328775_1 | AV122100 | 1947271_8 | Omit | 2 | 4 | 4 | 1 |
| UP3_BA | 5328775_1 | AV122110 | 1947271_8 | Omit | 2 | 4 | 4 | 1 |
| UP3_BB | 5328775_1 | AV122120 | 1947271_8 | Omit | 2 | 4 | 4 | 1 |
| UP3_BD | 5328775_1 | AV122100 | 1947271_8 | Omit | 2 | 4 | 4 | 1 |
| UP3_C0 | 5328775_1 | AV232100 | 1947271_8 | Omit | 1 | 5 | 3 | 1 |
| UP3_C11 | 5328775_1 | AV232100 | 1947271_8 | Omit | 1 | 5 | 3 | 1 |
| UP3_CA | 5328775_1 | AV232110 | 1947271_8 | Omit | 1 | 5 | 3 | 1 |
| UP3_CB | 5328775_1 | AV232120 | 1947271_8 | Omit | 1 | 5 | 3 | 1 |
| UP3_D0 | 5328775_1 | AV332100 | 1947271_8 | Omit | 1 | 5 | 3 | 1 |

*Table A-21. UP3 and UP4 Positioners and Unique Items, Figure A-13 (continued)*

| Type | Item 7 | Item 23 | Item 24 | Item 27 | Item 35 | Item 36 | Item 39 | Items 40,80 |
|---|---|---|---|---|---|---|---|---|
| UP3_D11 | 5328775_1 | AV332100 | 1947271_8 | Omit | 1 | 5 | 3 | 1 |
| UP3_DA | 5328775_1 | AV332110 | 1947271_8 | Omit | 1 | 5 | 3 | 1 |
| UP3_DB | 5328775_1 | AV332120 | 1947271_8 | Omit | 1 | 5 | 3 | 1 |
| UP3_E0 | 5328775_1 | AV442100 | 1947271_9 | Omit | 1 | 5 | 3 | 1 |
| UP3_E11 | 5328775_1 | AV442100 | 1947271_9 | Omit | 1 | 5 | 3 | 1 |
| UP4_A0 | 5328769_1 | AV112100 | 1947271_8 | 2 | 2 | 4 | 1 | Omit |
| UP4_A11 | 5328769_1 | AV112100 | 1947271_8 | 2 | 2 | 4 | 1 | Omit |
| UP4_AA | 5328769_1 | AV112110 | 1947271_8 | 2 | 2 | 4 | 1 | Omit |
| UP4_AB | 5328769_1 | AV112120 | 1947271_8 | 2 | 2 | 4 | 1 | Omit |
| UP4_AC | 5328769_1 | AV112100 | 1947271_8 | 2 | 2 | 4 | 1 | Omit |
| UP4_B0 | 5328769_1 | AV122100 | 1947271_8 | 2 | 2 | 4 | 1 | Omit |
| UP4_B11 | 5328769_1 | AV122100 | 1947271_8 | 2 | 2 | 4 | 1 | Omit |
| UP4_BA | 5328769_1 | AV122110 | 1947271_8 | 2 | 2 | 4 | 1 | Omit |
| UP4_BB | 5328769_1 | AV122120 | 1947271_8 | 2 | 2 | 4 | 1 | Omit |
| UP4_BD | 5328769_1 | AV122100 | 1947271_8 | 2 | 2 | 4 | 1 | Omit |
| UP4_C0 | 5328769_1 | AV232100 | 1947271_8 | 2 | 1 | 5 | Omit | Omit |
| UP4_C11 | 5328769_1 | AV232100 | 1947271_8 | 2 | 1 | 5 | Omit | Omit |
| UP4_CA | 5328769_1 | AV232110 | 1947271_8 | 2 | 1 | 5 | Omit | Omit |
| UP4_CB | 5328769_1 | AV232120 | 1947271_8 | 2 | 1 | 5 | Omit | Omit |
| UP4_D0 | 5328769_1 | AV332100 | 1947271_8 | 2 | 1 | 5 | Omit | Omit |
| UP4_D11 | 5328769_1 | AV332100 | 1947271_8 | 2 | 1 | 5 | Omit | Omit |
| UP4_DA | 5328769_1 | AV332110 | 1947271_8 | 2 | 1 | 5 | Omit | Omit |
| UP4_DB | 5328769_1 | AV332120 | 1947271_8 | 2 | 1 | 5 | Omit | Omit |
| UP4_E0 | 5328769_1 | AV442100 | 1947271_9 | 2 | 1 | 5 | Omit | Omit |
| UP4_E11 | 5328769_1 | AV442100 | 1947271_9 | 2 | 1 | 5 | Omit | Omit |

*Table A-21. UP3 and UP4 Positioners and Unique Items, Figure A-13*

| Type | Item 41 | Items 47, 81 | Item 48 | Item 54 | Item 57 | Items 75, 76 | Items 91, 98 | Item 93 |
|---|---|---|---|---|---|---|---|---|
| UP3_A0 | 2 | Omit | 1 | 0 | 2.4 m (8.0 ft) | Omit | Omit | Omit |
| UP3_A11 | 2 | Omit | 1 | 0 | 2.4 m (8.0 ft) | Omit | Omit | Omit |
| UP3_AA | 2 | Omit | 1 | 7 | 2.4 m (8.0 ft) | Omit | 1 | Omit |
| UP3_AB | 2 | Omit | 1 | 5 | 2.4 m (8.0 ft) | Omit | 1 | Omit |
| UP3_AC | 2 | Omit | 1 | 0 | 2.4 m (8.0 ft) | Omit | Omit | Omit |
| UP3_B0 | 2 | Omit | 1 | 0 | 2.4 m (8.0 ft) | Omit | Omit | Omit |
| UP3_B11 | 2 | Omit | 1 | 0 | 2.4 m (8.0 ft) | Omit | Omit | Omit |
| UP3_BA | 2 | Omit | 1 | 7 | 2.4 m (8.0 ft) | Omit | 1 | Omit |
| UP3_BB | 2 | Omit | 1 | 5 | 2.4 m (8.0 ft) | Omit | 1 | Omit |
| UP3_BD | 2 | Omit | 1 | 0 | 2.4 m (8.0 ft) | Omit | Omit | Omit |
| UP3_C0 | 1 | Omit | 1 | 5 | 2.1 m (7.0 ft) | 0.6 m (2.0 ft) | 1 | Omit |
| UP3_C11 | 1 | Omit | 1 | 5 | 2.1 m (7.0 ft) | 0.6 m (2.0 ft) | 1 | Omit |

*Table A-21. UP3 and UP4 Positioners and Unique Items, Figure A-13 (continued)*

| Type | Item 41 | Items 47, 81 | Item 48 | Item 54 | Item 57 | Items 75, 76 | Items 91, 98 | Item 93 |
|---|---|---|---|---|---|---|---|---|
| UP3_CA | 1 | Omit | 1 | 11 | 2.1 m (7.0 ft) | 0.6 m (2.0 ft) | 1 | Omit |
| UP3_CB | 1 | Omit | 1 | 9 | 2.1 m (7.0 ft) | 0.6 m (2.0 ft) | 1 | Omit |
| UP3_D0 | 1 | Omit | 1 | 5 | 2.1 m (7.0 ft) | 0.6 m (2.0 ft) | 1 | Omit |
| UP3_D11 | 1 | Omit | 1 | 5 | 2.1 m (7.0 ft) | 0.6 m (2.0 ft) | 1 | Omit |
| UP3_DA | 1 | Omit | 1 | 11 | 2.1 m (7.0 ft) | 0.6 m (2.0 ft) | 1 | Omit |
| UP3_DB | 1 | Omit | 1 | 9 | 2.1 m (7.0 ft) | 0.6 m (2.0 ft) | 1 | Omit |
| UP3_E0 | 1 | Omit | 1 | 11 | 2.1 m (7.0 ft) | 1.8 m (6.0 ft) | 1 | Omit |
| UP3_E11 | 1 | Omit | 1 | 11 | 2.1 m (7.0 ft) | 1.8 m (6.0 ft) | 1 | Omit |
| UP4_A0 | 1 | 1 | 2 | 0 | 0.3 m (1.0 ft) | Omit | Omit | 4 |
| UP4_A11 | 1 | 1 | 2 | 0 | 0.3 m (1.0 ft) | Omit | Omit | 4 |
| UP4_AA | 1 | 1 | 2 | 7 | 0.3 m (1.0 ft) | Omit | 1 | 4 |
| UP4_AB | 1 | 1 | 2 | 5 | 0.3 m (1.0 ft) | Omit | 1 | 4 |
| UP4_AC | 1 | 1 | 2 | 0 | 0.3 m (1.0 ft) | Omit | Omit | 4 |
| UP4_B0 | 1 | 1 | 2 | 0 | 0.3 m (1.0 ft) | Omit | Omit | 4 |
| UP4_B11 | 1 | 1 | 2 | 0 | 0.3 m (1.0 ft) | Omit | Omit | 4 |
| UP4_BA | 1 | 1 | 2 | 7 | 0.3 m (1.0 ft) | Omit | 1 | 4 |
| UP4_BB | 1 | 1 | 2 | 5 | 0.3 m (1.0 ft) | Omit | 1 | 4 |
| UP4_BD | 1 | 1 | 2 | 0 | 0.3 m (1.0 ft) | Omit | Omit | 4 |
| UP4_C0 | Omit | 1 | 2 | 5 | Omit | 0.6 m (2.0 ft) | 1 | 4 |
| UP4_C11 | Omit | 1 | 2 | 5 | Omit | 0.6 m (2.0 ft) | 1 | 4 |
| UP4_CA | Omit | 1 | 2 | 11 | Omit | 0.6 m (2.0 ft) | 1 | 4 |
| UP4_CB | Omit | 1 | 2 | 9 | Omit | 0.6 m (2.0 ft) | 1 | 4 |
| UP4_D0 | Omit | 1 | 2 | 5 | Omit | 0.6 m (2.0 ft) | 1 | 4 |
| UP4_D11 | Omit | 1 | 2 | 5 | Omit | 0.6 m (2.0 ft) | 1 | 4 |
| UP4_DA | Omit | 1 | 2 | 11 | Omit | 0.6 m (2.0 ft) | 1 | 4 |
| UP4_DB | Omit | 1 | 2 | 9 | Omit | 0.6 m (2.0 ft) | 1 | 4 |
| UP4_E0 | Omit | 1 | 2 | 11 | Omit | 1.8 m (6.0 ft) | 1 | 4 |
| UP4_E11 | Omit | 1 | 2 | 11 | Omit | 1.8 m (6.0 ft) | 1 | 4 |

*Table 21. UP3 and UP4 Positioners and Unique Items, Figure A-13 (continued)*

| Type | Item 94 | Item 99 | Item 107 | Item 108 | Item 109 | Item 110 | Item 111 |
|---|---|---|---|---|---|---|---|
| UP3_A0 | Omit | Omit | Omit | Omit | Omit | Omit | Omit |
| UP3_A11 | Omit | Omit | Omit | Omit | Omit | Omit | Omit |
| UP3_AA | Omit | Omit | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.5 m (1.7 ft) |
| UP3_AB | Omit | Omit | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | Omit | 0.5 m (1.7 ft) |
| UP3_AC | Omit | Omit | Omit | Omit | Omit | Omit | Omit |
| UP3_B0 | Omit | Omit | Omit | Omit | Omit | Omit | Omit |
| UP3_B11 | Omit | Omit | Omit | Omit | Omit | Omit | Omit |
| UP3_BA | Omit | Omit | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.5 m (1.7 ft) |
| UP3_BB | Omit | Omit | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | Omit | 0.5 m (1.7 ft) |

*Table 21. UP3 and UP4 Positioners and Unique Items, Figure A-13 (continued)*

| Type | Item 94 | Item 99 | Item 107 | Item 108 | Item 109 | Item 110 | Item 111 |
|---|---|---|---|---|---|---|---|
| UP3_BD | Omit | Omit | Omit | Omit | Omit | Omit | Omit |
| UP3_C0 | Omit | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | Omit | Omit | 0.5 m (1.7 ft) |
| UP3_C11 | Omit | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | Omit | Omit | 0.5 m (1.7 ft) |
| UP3_CA | Omit | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.5 m (1.7 ft) |
| UP3_CB | Omit | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | Omit | 0.5 m (1.7 ft) |
| UP3_D0 | Omit | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | Omit | Omit | 0.5 m (1.7 ft) |
| UP3_D11 | Omit | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | Omit | Omit | 0.5 m (1.7 ft) |
| UP3_DA | Omit | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.5 m (1.7 ft) |
| UP3_DB | Omit | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | Omit | 0.5 m (1.7 ft) |
| UP3_E0 | Omit | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.5 m (1.7 ft) |
| UP3_E11 | Omit | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.5 m (1.7 ft) |
| UP4_A0 | 2.1 m (7.0 ft) | Omit | Omit | Omit | Omit | Omit | Omit |
| UP4_A11 | 2.1 m (7.0 ft) | Omit | Omit | Omit | Omit | Omit | Omit |
| UP4_AA | 2.1 m (7.0 ft) | Omit | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.5 m (1.7 ft) |
| UP4_AB | 2.1 m (7.0 ft) | Omit | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | Omit | 0.5 m (1.7 ft) |
| UP4_AC | 2.1 m (7.0 ft) | Omit | Omit | Omit | Omit | Omit | Omit |
| UP4_B0 | 2.1 m (7.0 ft) | Omit | Omit | Omit | Omit | Omit | Omit |
| UP4_B11 | 2.1 m (7.0 ft) | Omit | Omit | Omit | Omit | Omit | Omit |
| UP4_BA | 2.1 m (7.0 ft) | Omit | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.5 m (1.7 ft) |
| UP4_BB | 2.1 m (7.0 ft) | Omit | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | Omit | 0.5 m (1.7 ft) |
| UP4_BD | 2.1 m (7.0 ft) | Omit | Omit | Omit | Omit | Omit | Omit |
| UP4_C0 | 2.1 m (7.0 ft) | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | Omit | Omit | 0.5 m (1.7 ft) |
| UP4_C11 | 2.1 m (7.0 ft) | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | Omit | Omit | 0.5 m (1.7 ft) |
| UP4_CA | 2.1 m (7.0 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.5 m (1.7 ft) |
| UP4_CB | 2.1 m (7.0 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | Omit | 0.5 m (1.7 ft) |
| UP4_D0 | 2.1 m (7.0 ft) | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | Omit | Omit | 0.5 m (1.7 ft) |
| UP4_D11 | 2.1 m (7.0 ft) | 0.8 m (2.5 ft) | Omit | 0.8 m (2.5 ft) | Omit | Omit | 0.5 m (1.7 ft) |
| UP4_DA | 2.1 m (7.0 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.5 m (1.7 ft) |
| UP4_DB | 2.1 m (7.0 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | Omit | 0.5 m (1.7 ft) |
| UP4_E0 | 2.1 m (7.0 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.5 m (1.7 ft) |
| UP4_E11 | 2.1 m (7.0 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.8 m (2.5 ft) | 0.5 m (1.7 ft) |

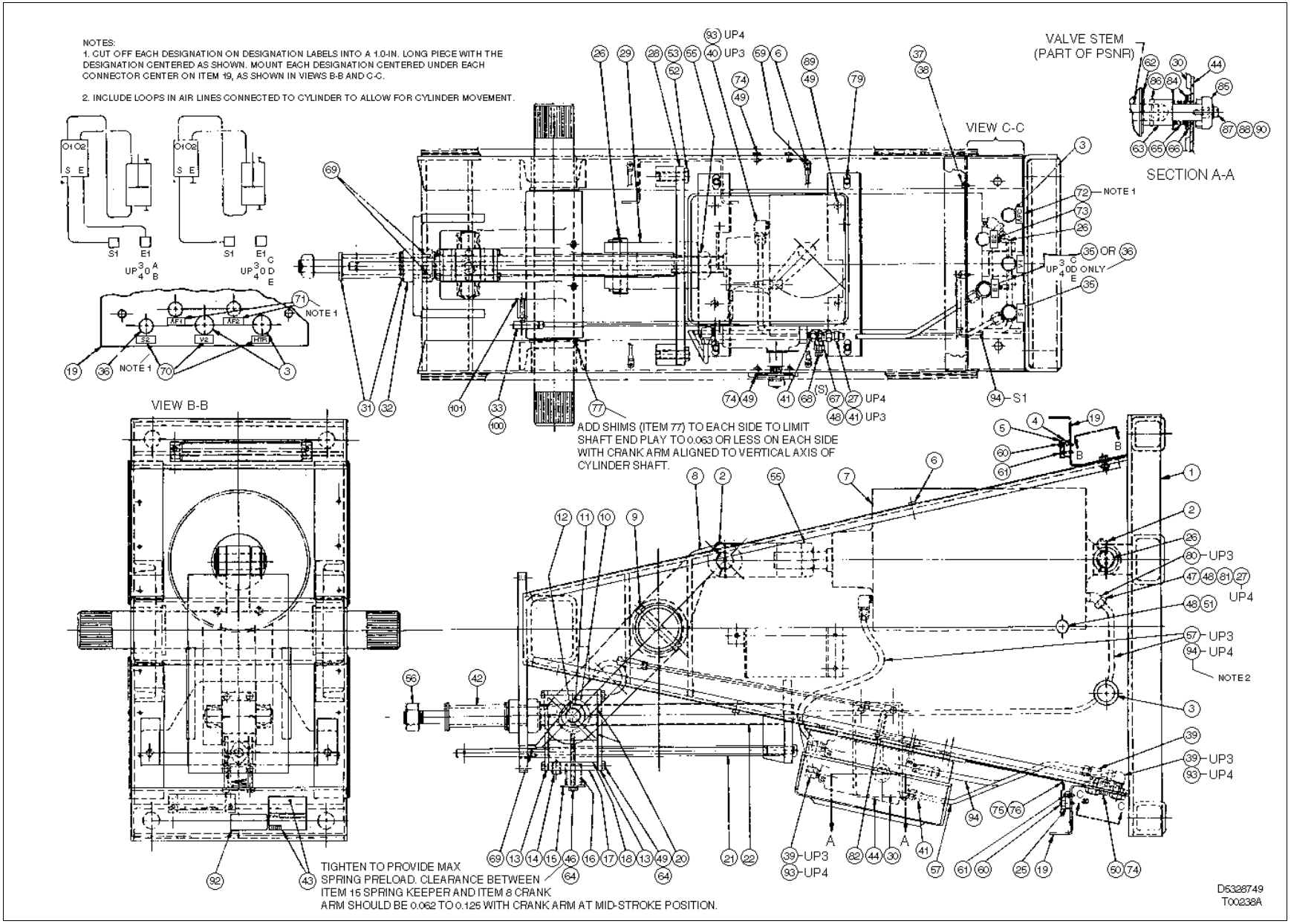



*Figure A-13. UP3 and UP4 with Positioner, Tables A-20 and A-21 (Sheet 1 of 3)*

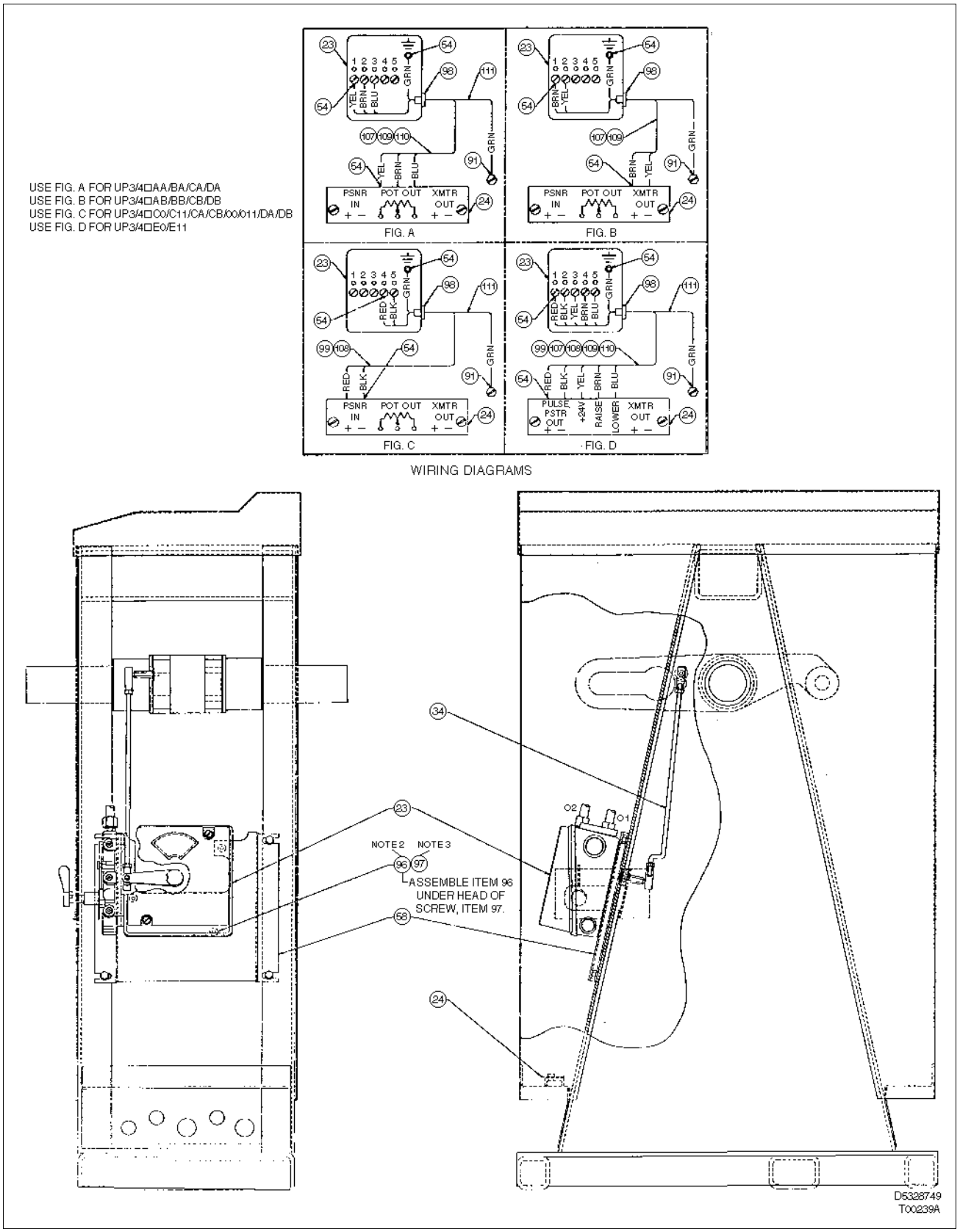



*Figure A-13. UP3 and UP4 with Positioner, Tables A-20 and A-21 (Sheet 2 of 3)*

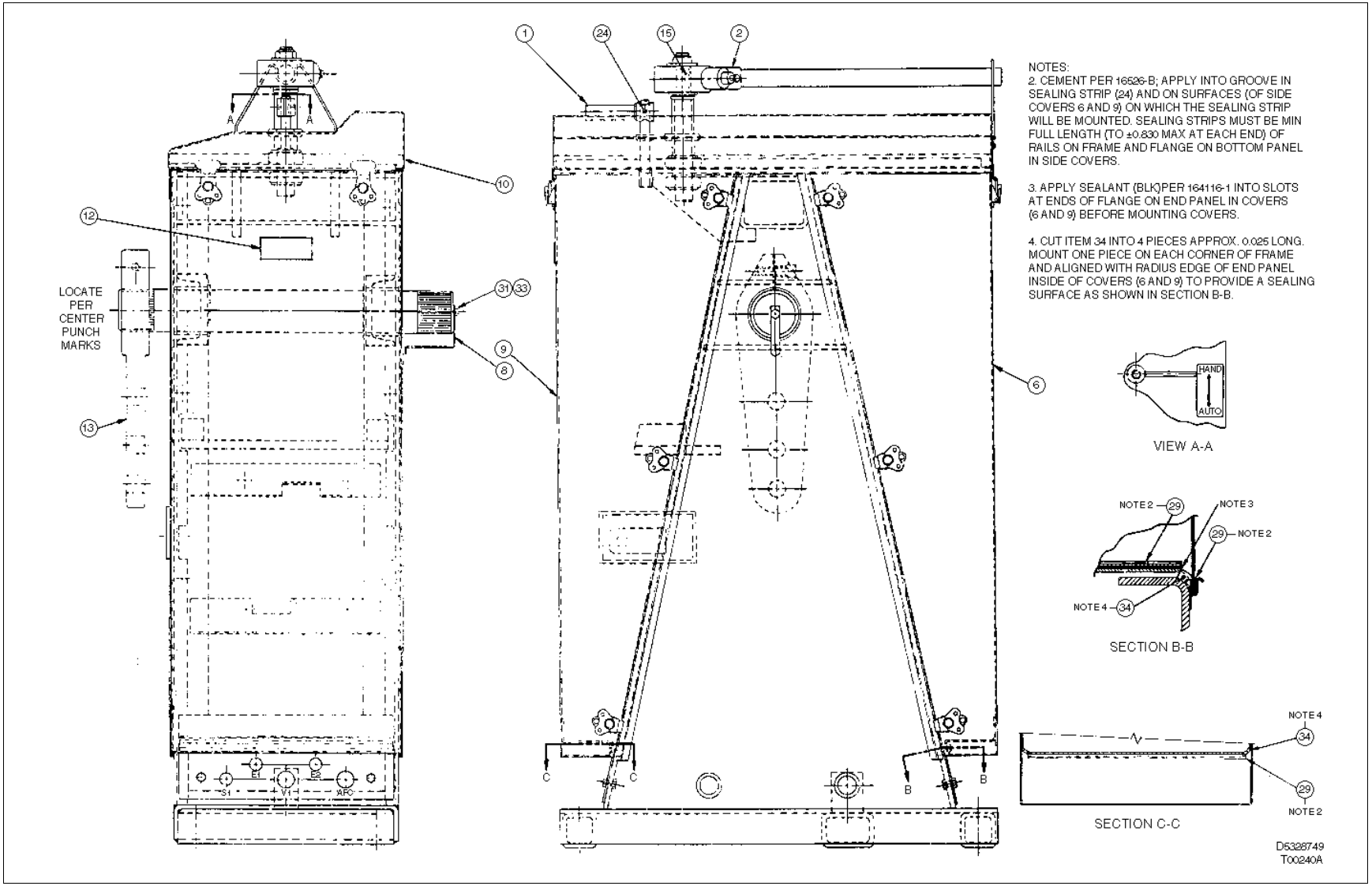



*Figure A-13. UP3 and UP4 with Positioner, Tables A-20 and A-21 (Sheet 3 of 3)*

*Table A-22. UP3 and UP4 with Solenoid Valve, Figure A-14 (Drawing No. 5328799)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| Refer to sheet 1 of Figure A-14. | | | |
| 1 | 1 | 5328740_3 | Frame assembly |
| 2 | 4 | 197730_1 | Cotter pin |
| 3 | 8 | 1951569_9 | Plug button |
| 4 | 1 | 194956_17 | Terminal block |
| 5 | 1 | 1947271_2 | Desig plate |
| 6 | 8 | 197743_3 | Ty-wrap |
| 7 | 1 | Refer to Tables A-23, 8-1, 8-2 and 8-3 | Cylinder assembly |
| 8 | 1 | 5328779_1 | Arm and shaft assembly |
| 9 | 1 | — | Zn plated roll pin (0.500 dia x 3.500) |
| 10 | 1 | 5328735_1 | Drive pin |
| 11 | 2 | 5328774_1 | Roller bearing |
| 12 | 2 | 197164_75 | Retaining ring |
| 13 | 2 | 5328737_1 | Retainer plate |
| 14 | 1 | 5328789_1 | Spring plunger |
| 15 | 1 | 5328732_1 | Spring keeper |
| 16 | 1 | 5328785_1 | Spring |
| 17 | 1 | 5328733_1 | Spring guide |
| 18 | 1 | 5328734_1 | Cam |
| 19 | 2 | 5328754_3 | Support panel |
| 20 | 1 | 5328747_1 | Split nut |
| 21 | 1 | 5328736_1 | Operator rod |
| 22 | 1 | 5328738_1 | H wheel shaft |
| 23 | 1 | Refer to Table A-23 | Solenoid valve |
| 24 | 1 | Refer to Table A-23 | Desig plate |
| 25 | 1 | 194956_7 | Terminal block |
| 26 | 2 | 5328770_1 | Clevis pin |
| 27 | Refer to Table A-23 | 1951407_1 | Male connector |
| 28 | 1 | 5328718_1 | Bearing support |
| 29 | 1 | 5328771_1 | Clevis |
| 30 | 1 | 5328800_1 | Cover plate |
| 31 | 6 | 5313297_1 | Washer |
| 32 | 2 | 5313299_1 | Thrust bearing |
| 33 | 1 | 5400313_1 | Mounting plate |
| 34 | 1 | 1951608_1 | Shut off valve |
| 35 | 1 | 1951609_1 | Bulkhead fitting |
| 36 | 5 | 19981_31 | Plug button |
| 37 | 1 | 197676_1 | Ground screw |
| 38 | 1 | 197675_1 | Washer |

*Table A-22. UP3 and UP4 with Solenoid Valve, Figure A-14 (Drawing No. 5328799) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| Refer to sheet 1 of Figure A-14. | | | |
| 39 | Refer to Table A-23 | 4CBI2-B | Male elbow |
| 40 | Refer to Table A-23 | 4-4CBI2-B | Male elbow |
| 41 | Refer to Table A-23 | 4FBI2-B | Male connector |
| 42 | Refer to Table A-23 | 4-4FBI2-B | Male connector |
| 43 | 1 | — | Hex head Zn plated steel cap screw (0.500-13 x 0.625) |
| 44 | 4 | — | Pan head Zn plated steel machine screw (0.136-32 x 1.000) |
| 45 | 4 | — | Pan head Zn plated steel machine screw (0.136-32 x 0.625) |
| 46 | 2 | — | Hex head Zn plated steel cap screw (0.250-20 x 3.000) |
| 47 | Refer to Table A-23 | — | ¼ NPT x 1.250 brass nipple |
| 48 | Refer to Table A-23 | — | ¼ NPT brass street elbow |
| 49 | 4 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.500) |
| 50 | 2 | NBJAC21012 | Hex washer head screw (0.250-20) |
| 51 | 1 | — | Semi-fin Zn plated steel heavy hex full nut (0.500-13) |
| 52 | 2 | — | Hex head Zn plated steel cap screw (0.500-13 x 1.500) |
| 53 | 2 | 1224-00 | Zn plated steel shakeproof lockwasher |
| 54 | A/R | 6634752_1 | Shim, as required |
| 55 | 1 | — | Hex jam nut (1.000-14) |
| 56 | 1 | — | Hex nut (0.750-16) |
| 57 | 8 | SSP-68 | Zn plated steel rivet |
| 58 | Refer to Table A-23 | — | ¼ NPT brass elbow |
| 59 | Refer to Table A-23 | R1021-0022 | 0.250 OD x 0.040 wall Al tubing with polyethylene jacket |
| 60 | 1 | 1963318__ | Nameplate |
| 61 | 1 | 5328793_1 | Sleeve |
| 62 | 1 | 5328765_2 | Cover gasket |
| 63 | Refer to Table A-23 | R2041-1594 | 14 AWG black leadwire |
| 64 | 1 | 195273_¼ | ¼ NPT brass tee |
| 65 | Refer to Table A-23 | 1943825_7 | Terminal lug |
| 66 | Refer to Table A-23 | 1941401_2 | Solderless terminal |
| 67 | 1 | 194879-½ | Insulating bushing |
| 68 | 1 | 1963478_1 | Instruction plate |
| 69 | 1 | — | ¼ NPT brass pipe plug |
| 70 | 3 | — | MDP spiral pin (0.188 DIA x 1.000) |
| 71 | 1 | 1963503_1 | Designation label |
| 72 | 1 | 1963503_2 | Designation label |
| 73 | 1 | 1963503_3 | Designation label |
| 74 | 1 | 1963503_4 | Designation label |
| 75 | 10 | 1114-00 | Shakeproof int lockwasher |
| 76 | 8 | — | Ext lockwasher Zn plated steel hex keps (0.250-20) |
| 77 | 91 cm (36 in.) | R9090-0030 | Spiral wrap |

*Table A-22. UP3 and UP4 with Solenoid Valve, Figure A-14 (Drawing No. 5328799) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| Refer to sheet 1 of Figure A-14. | | | |
| 78 | Refer to Table A-23 | 4VBI2-B | 45° male elbow |
| 79 | Refer to Table A-23 | 1951408_1 | Male elbow |
| 80 | Refer to Table A-23 | 1951406_1 | Male connector |
| 81 | 4 | — | Indented hex washer Zn plated steel (0.250-20 x 0.500) |
| 82 | 4 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.750) |
| 83 | 1 | 1963353__01 | Label, universal, CSA |
| 84 | Refer to Table A-23 | R9021-0050 | 0.500 OD x 0.062 wall nylon with polyester tubing |
| 85 | Refer to Table A-23 | — | ( ⅜ x ¼) brass reducing bushing |
| Refer to sheet 2 of Figure A-14. | | | |
| 1 | 1 | 5328792_1 | Handle |
| 2 | 1 | 198517_2 | Handle and ratchet assembly |
| 6[1] | 1 | 5328759_8 | Side cover |
| 7 | 1 | 1963339_1 | Scale |
| 8 | 1 | 5328609_2 | Pointer |
| 9[1] | 1 | 5328759_7 | Side cover |
| 10[1] | 1 | 5329164_2 | Top cover assembly |
| 12 | 1 | 1962207_1 | Style plate |
| 13 | 1 | 5328797_1 | Operating lever |
| 14 | 1 | 5324259_1 | Hand/auto nameplate |
| 15 | 1 | 198531_1 | Woodruff key |
| 16 | 1 | 1963339_2 | Scale |
| 24 | 1 | NRNHA19016 | MDP spiral pin (0.188) |
| 29 | 4.3 m (14.0 ft) | 1951480_1U | Sealing strip |
| 31 | 1 | NAUHA21008 | Hex cap screw (0.250-20) |
| 32 | 1 | — | 20 x 33 cm (8 x 13 in.) poly bag |
| 33 | 1 | NTJHA11030 | Spring lockwasher (0.250) |
| 34 | 6.3 cm (2.5 in.) | R9410-0025 | Vinyl tape |

**NOTE:**

1. Older models have plastic covers. To order a plastic side cover, user part nos. 5328759_2 (Item 9). To order a plastic top cover, use part no. 5328795_1 (Item 10).

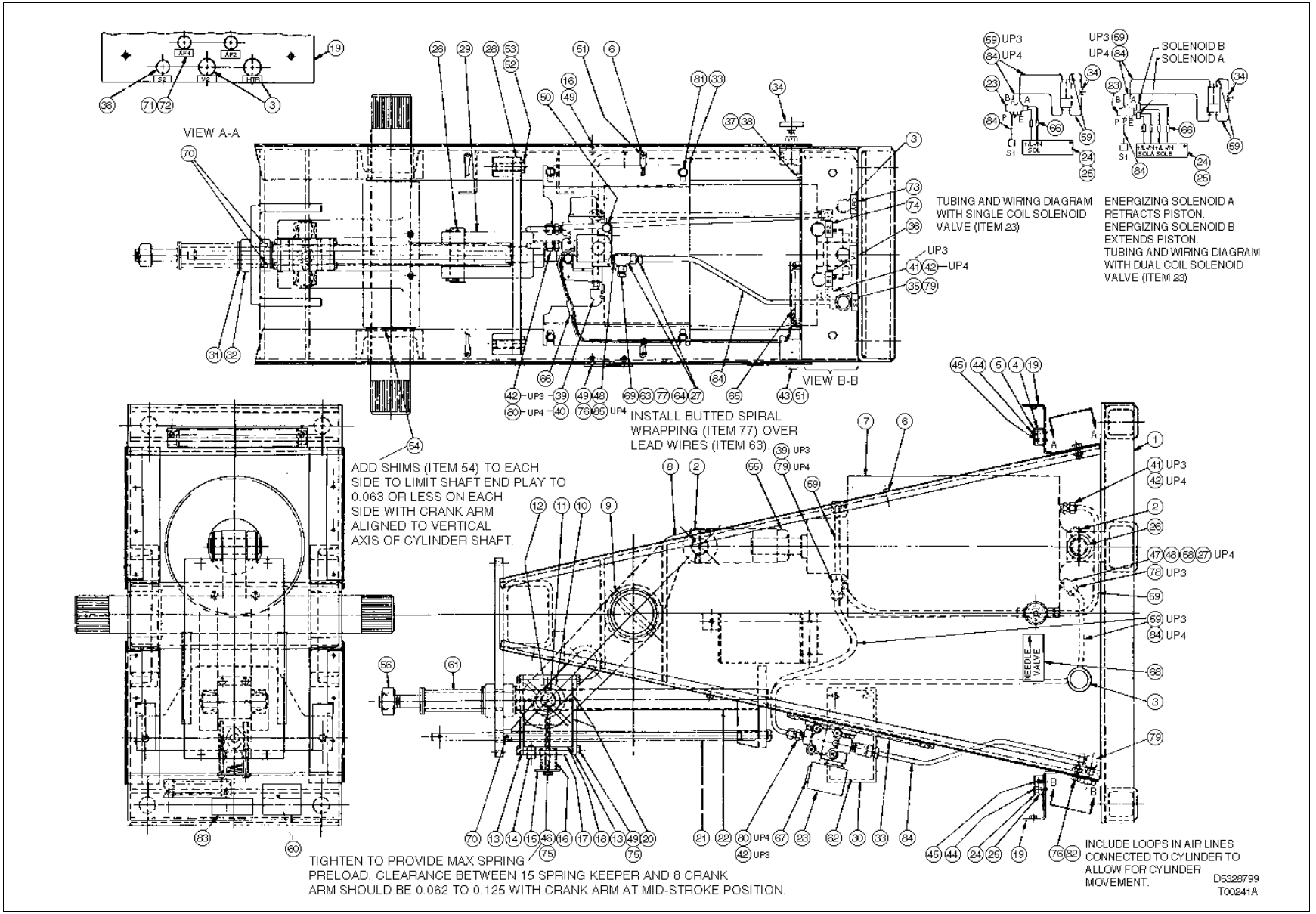



*Figure A-14. UP3 and UP4 with Solenoid Valve, Tables A-22 and A-23 (Sheet 1 of 2)*

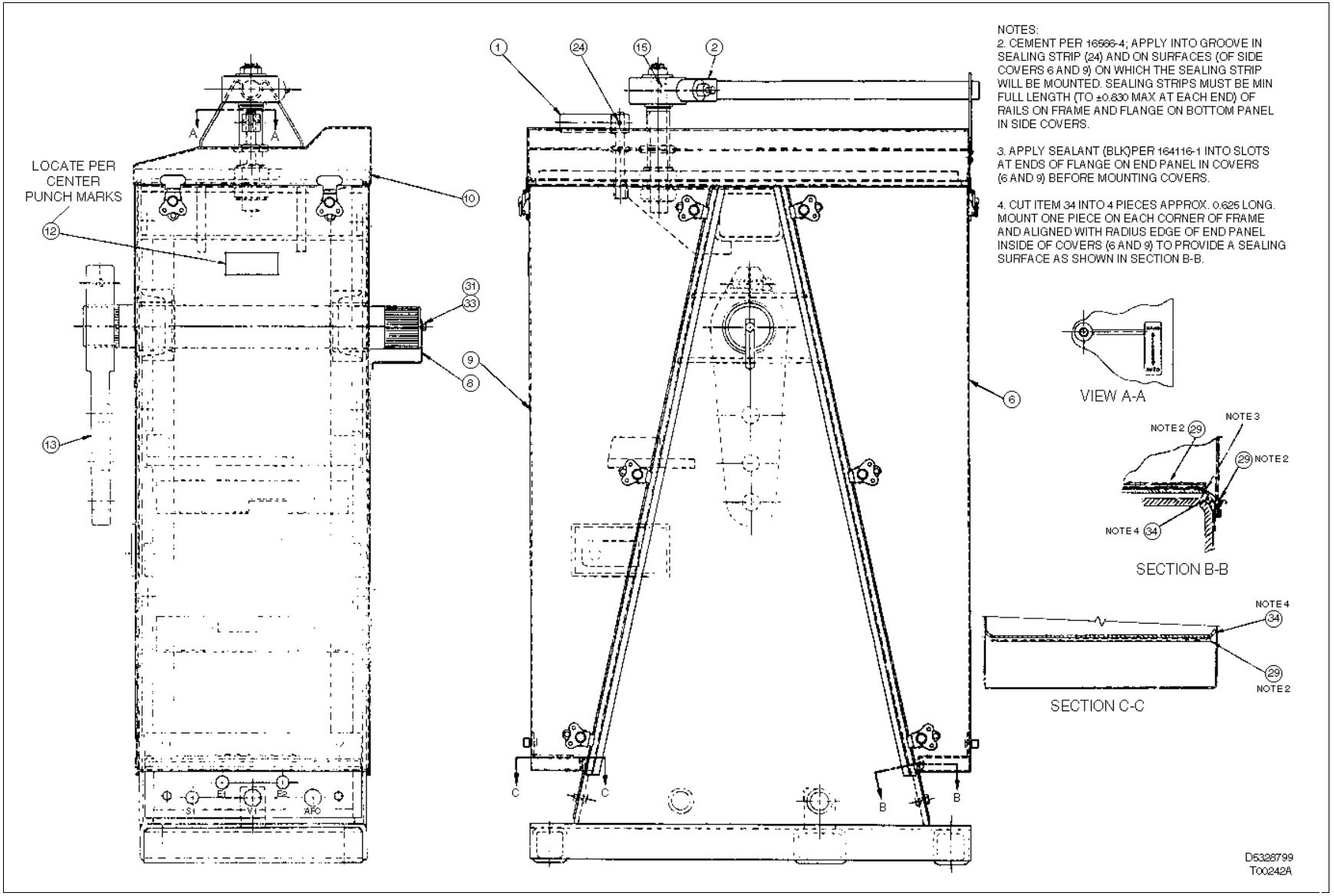



*Figure A-14. UP3 and UP4 with Solenoid Valve, Tables A-22 and A-23 (Sheet 2 of 2)*

*Table A-23. UP3 and UP4 Solenoid Valves and Unique Items, Figure A-14*

| Type | Item 7 | Item 23 | Rating | Item 24 | Items 27, 48, 79 | Item 39 | Items 40, 47, 58, 85 | Items 41, 48 |
|---|---|---|---|---|---|---|---|---|
| UP3_5 | 5328775_1 | 5322137_3 | 120 VAC | 1947271_1 | 1 req | 2 req | Omit | 1 req |
| UP3_6 | 5328775_1 | 5322137_2 | 115/125 VDC | 1947271_1 | 1 req | 2 req | Omit | 1 req |
| UP3_8 | 5328775_1 | 1951433_1 | 120 VAC | 1947271_6 | 1 req | 2 req | Omit | 1 req |
| UP3_9 | 5328775_1 | 1951433_2 | 115/125 VDC | 1947271_6 | 1 req | 2 req | Omit | 1 req |
| UP3_F | 5328775_1 | 5322137_6 | 220/240 VAC | 1947271_1 | 1 req | 2 req | Omit | 1 req |
| UP3_G | 5328775_1 | 1951433_5 | 220/240 VAC | 1947271_6 | 1 req | 2 req | Omit | 1 req |
| UP4_5 | 5328769_1 | 1951013_1 | 120 VAC | 1947271_1 | 2 req | Omit | 1 req | Omit |
| UP4_6 | 5328769_1 | 1951013_3 | 115/125 VDC | 1947271_1 | 2 req | Omit | 1 req | Omit |
| UP4_8 | 5328769_1 | 1951135_1 | 120 VAC | 1947271_6 | 2 req | Omit | 1 req | Omit |
| UP4_9 | 5328769_1 | 1951135_2 | 115/125 VDC | 1947271_6 | 2 req | Omit | 1 req | Omit |
| UP4_F | 5328769_1 | 1951013_2 | 220/240 VAC | 1947271_1 | 2 req | Omit | 1 req | Omit |
| UP4_G | 5328769_1 | 1951135_4 | 220/240 VAC | 1947271_6 | 2 req | Omit | 1 req | Omit |

| Type | Item 42 | Item 59 | Item 63 | Items 65, 66 | Item 78 | Item 80 | Item 84 |
|---|---|---|---|---|---|---|---|
| UP3_5 | 2 req | 2.4 m (8.0 ft) | 183 cm (72 in.) | 2 req | 1 req | Omit | Omit |
| UP3_6 | 2 req | 2.4 m (8.0 ft) | 183 cm (72 in.) | 2 req | 1 req | Omit | Omit |
| UP3_8 | 2 req | 2.4 m (8.0 ft) | 366 cm (144 in.) | 4 req | 1 req | Omit | Omit |
| UP3_9 | 2 req | 2.4 m (8.0 ft) | 366 cm (144 in.) | 4 req | 1 req | Omit | Omit |
| UP3_F | 2 req | 2.4 m (8.0 ft) | 183 cm (72 in.) | 2 req | 1 req | Omit | Omit |
| UP3_G | 2 req | 2.4 m (8.0 ft) | 366 cm (144 in.) | 4 req | 1 req | Omit | Omit |
| UP4_5 | 1 req | 0.9 m (3.0 ft) | 183 cm (72 in.) | 2 req | Omit | 2 req | 1.5 m (5.0 ft) |
| UP4_6 | 1 req | 0.9 m (3.0 ft) | 183 cm (72 in.) | 2 req | Omit | 2 req | 1.5 m (5.0 ft) |
| UP4_8 | 1 req | 0.9 m (3.0 ft) | 366 cm (144 in.) | 4 req | Omit | 2 req | 1.5 m (5.0 ft) |
| UP4_9 | 1 req | 0.9 m (3.0 ft) | 366 cm (144 in.) | 4 req | Omit | 2 req | 1.5 m (5.0 ft) |
| UP4_F | 1 req | 0.9 m (3.0 ft) | 183 cm (72 in.) | 2 req | Omit | 2 req | 1.5 m (5.0 ft) |
| UP4_G | 1 req | 0.9 m (3.0 ft) | 366 cm (144 in.) | 4 req | Omit | 2 req | 1.5 m (5.0 ft) |

*Table A-24. UP3 and UP4 Alarm/Travel Switch Kit, Figures A-15 and A-30 (Kit No. 5328787 _1)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 5328786_1 | Wiring harness |
| 2 | 1 | 5328698_1 | Alarm unit |
| 4 | 1 | 1942978_2 | Spacer |
| 5 | 1 | 5312449_13 | Connecting link |
| 6 | 1 | 5328596_2 | Arm |
| 7 | 1 | 1963318__ | Nameplate |
| 8 | 3 | — | Hex head Zn plated steel sems ext (0.190-32 x 0.500) |
| 11 | 2 | 1210-00 | Zn plated steel shakeproof lockwasher |
| 12 | 2 | — | Hex head Zn plated steel machine screw (0.190-32 x 0.750) |
| 13 | 1 | — | Hex socket head Zn plated steel cap screw (0.138-32 x 0.500) |

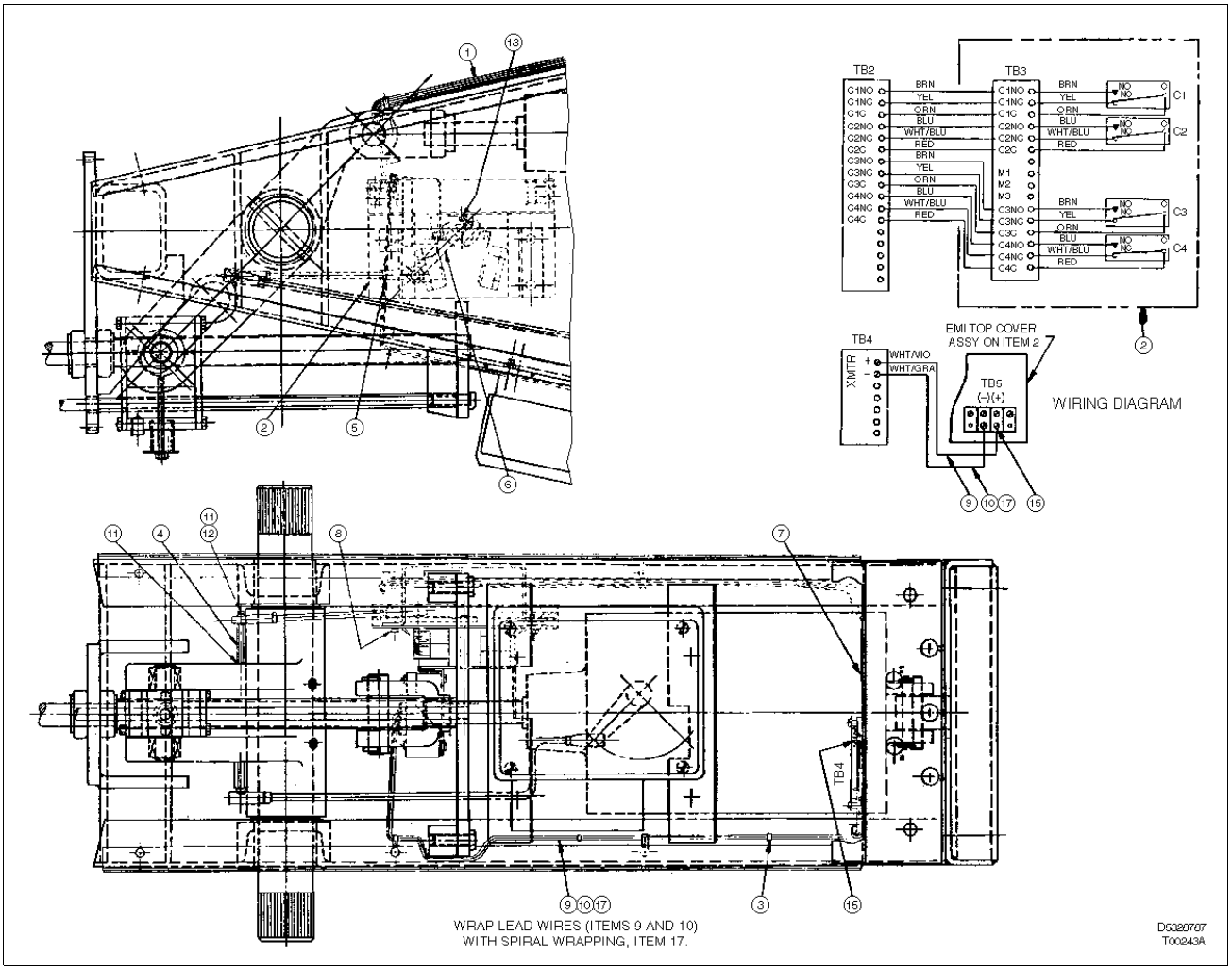



*Figure A-15. UP3 and UP4 with Electric Shaft Position Transmitter and/or Alarm/Travel Switches, Tables A-24, A-25, A-48 and A-49*

*Table A-25. UP3 and UP4 Electric Shaft Position Transmitter Kit, Figures A-15 and A-30 (Kit No. 5328787_2)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 5328786_1 | Wiring harness |
| 2 | 1 | 5328698_2 | Electric shaft position transmitter |
| 3 | 6 | 1943785_3 | Cable tie |
| 4 | 1 | 1942978_2 | Spacer |
| 5 | 1 | 5312449_13 | Connecting link |
| 6 | 1 | 5328596_2 | Arm |
| 7 | 1 | 1963318__ | Nameplate |
| 8 | 3 | — | Hex head Zn plated steel sems ext (0.190-32 x 0.500) |
| 9 | 93 cm (37 in.) | R2041-1582 | 22 AWG white/violet leadwire |
| 10 | 93 cm (37 in.) | R2041-1583 | 22 AWG white/gray leadwire |
| 11 | 2 | 1210-00 | Zn plated steel shakeproof lockwasher |

*Table A-25. UP3 and UP4 Electric Shaft Position Transmitter Kit, Figures A-15 and A-30 (Kit No. 5328787 _2) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 12 | 2 | — | Hex head Zn plated steel machine screw (0.190-32 x 0.750) |
| 13 | 1 | — | Hex socket head Zn plated steel cap screw (0.138-32 x 0.500) |
| 15 | 4 | 1943825_1 | Terminal lug |
| 17 | 122 cm (48 in.) | R9090-0030 | Spiral wrapping |

*Table A-26. UP3 and UP4 Pneumatic Shaft Position Transmitter Kits, Figure A-16 (Kit Nos. 5328798 _315/327)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 5329089_1 | Clevis pin |
| 2 | 1 | 5312449_10 | Connecting link |
| 3 | 1 | 5329090_1 | Drive lever |
| 4 | 1 | 197120_5 | Elastic stop nut |
| 5 | 1 | AV112000 | Shaft position transmitter for kit no. 5328798_315 |
| | | AV122000 | Shaft position transmitter for kit no. 5328798_327 |
| 8 | 1 | 5329144_1 | Mounting plate |
| 10 | 2 | — | Zn plated steel cotter pin (0.063 dia x 0.375) |
| 13 | 1 | 1963318__ | Nameplate |
| 14 | 1 | — | Brass hex head pipe plug (¼-18 NPT) |
| 22 | 1 | 5329091_1 | Pointer |
| 23 | 1 | FORM MP290 | Warning tag |
| 24 | 1 | 1945750_1 | Pull plug |
| 25 | 1 | 5400307_1 | Airline connector assembly |
| 26 | 1 | 195167_4 | ¼-18 male connector |
| 27 | 1 | 195171_3 | ¼-18 male run tee |
| 28 | 3 | NTMHA21000 | Int shakeproof lockwasher (0.250) |
| 29 | 3 | NBAHA21016 | Hex socket head screw (0.250-20) |
| 30 | 3 | NBJAU21010 | Hex wshr head screw (0.250-20) |
| 31 | 4 | NNBHA21000 | Hex keps nut (0.250-20) |
| 32 | 1 | NBPAC16014 | Slotted hex head screw (0.190-32) |

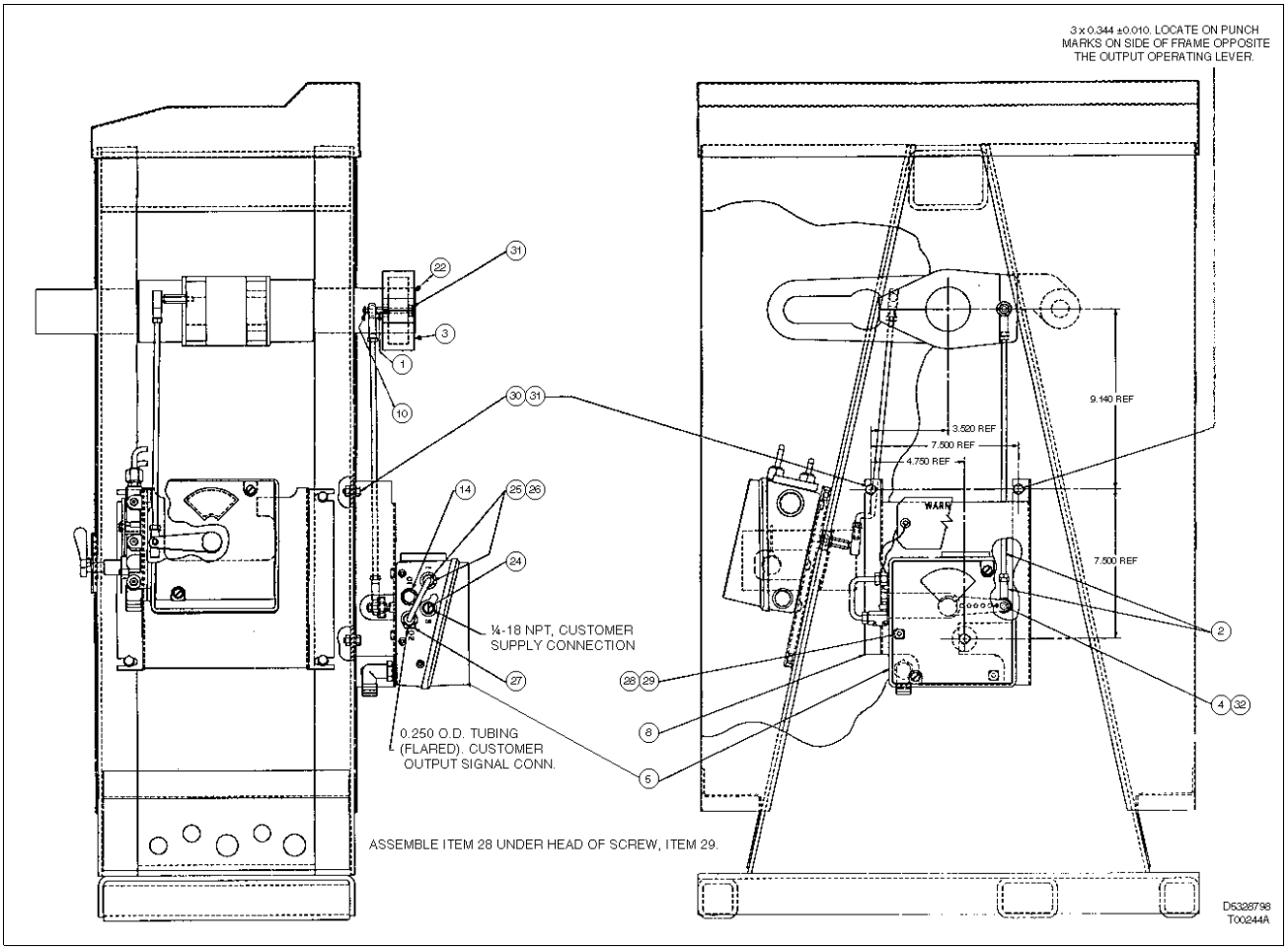



*Figure A-16. UP3 and UP4 with Pneumatic Shaft Position Transmitter, Table A-26*

*Table A-27. UP3 Air Failure Lock Kits, Figure A-17 (Kit Nos. 5328781_1/2)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 1951607_1 | Trip valve |
| 2 | 1 | 1941099_2 | Pressure switch |
| 3 | 1 | 1951606_1 | 3-way valve |
| 4 | 1 | 1941147_1 | ½ molded bushing |
| 5 | 1 | 1951608_1 | Shutoff valve for UP3 with positioner (kit no. 5328781_1) |
| | Omit | — | Omit for UP3 with solenoid valve (kit no. 5328781_2) |
| 6 | 1 | 5328782_1 | Air failure lock harness |
| 7 | 1 | 1951589_1 | Air valve |
| 8 | 1 | 5328788_1 | Mounting bracket |
| 9 | 1 | 4-4FBI2-B | Male connector |
| 10 | 8 | 4-4CBI2-B | Male elbow |
| 11 | 2 | 4-4-4RBI2-B | Male run tee |
| 12 | 1 | — | Brass tee (¼ NPT) |

*Table A-27. UP3 Air Failure Lock Kits, Figure A-17 (Kit Nos. 5328781 _1/2) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 13 | 6 | 4CBI2-B | Male elbow |
| 14 | 1 | 1951609_1 | Bulkhead fitting |
| 15 | 1 | 5328674_1 | Valve mounting bracket |
| 16 | 1 | 1963318__ | Nameplate |
| 17 | 4 m (13 ft) | R1021-0022 | 0.250 OD x 0.040 wall tubing |
| 18 | 1 | — | Brass street elbow (¼ NPT) |
| 19 | 1 | 5327327_3 | Adaptor |
| 20 | 2 | — | Pan head Zn plated steel machine screw (0.190-24 x 0.875) |
| 21 | 9 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.875) |
| 22 | 1 | — | Hex head Zn plated steel cap screw (0.250-20 x 4.000) |
| 23 | 10 | — | Ext lockwasher Zn plated steel hex keps (0.250-20) |
| 24 | 2 | 1210-00 | Zn plated steel shakeproof lockwasher |
| 25 | 2 | — | Brass pipe plug (¼ NPT) |
| 26 | 1 | — | Close brass nipple (¼ NPT) |
| 27 | 1 | I-P81-20 | Instruction |
| 28 | 1 | — | Cotton drawstring bag |
| 29 | 1 | 5328781 | Print |
| 30 | 1 | No. 100 | Carton |
| 31 | 2 | — | Brass reducing bushing (¼ x $\frac{1}{8}$) |
| 32 | 1 | — | Brass pipe plug ( $\frac{1}{8}$ NPT) |
| 33 | 1 | 3053306 | Print |

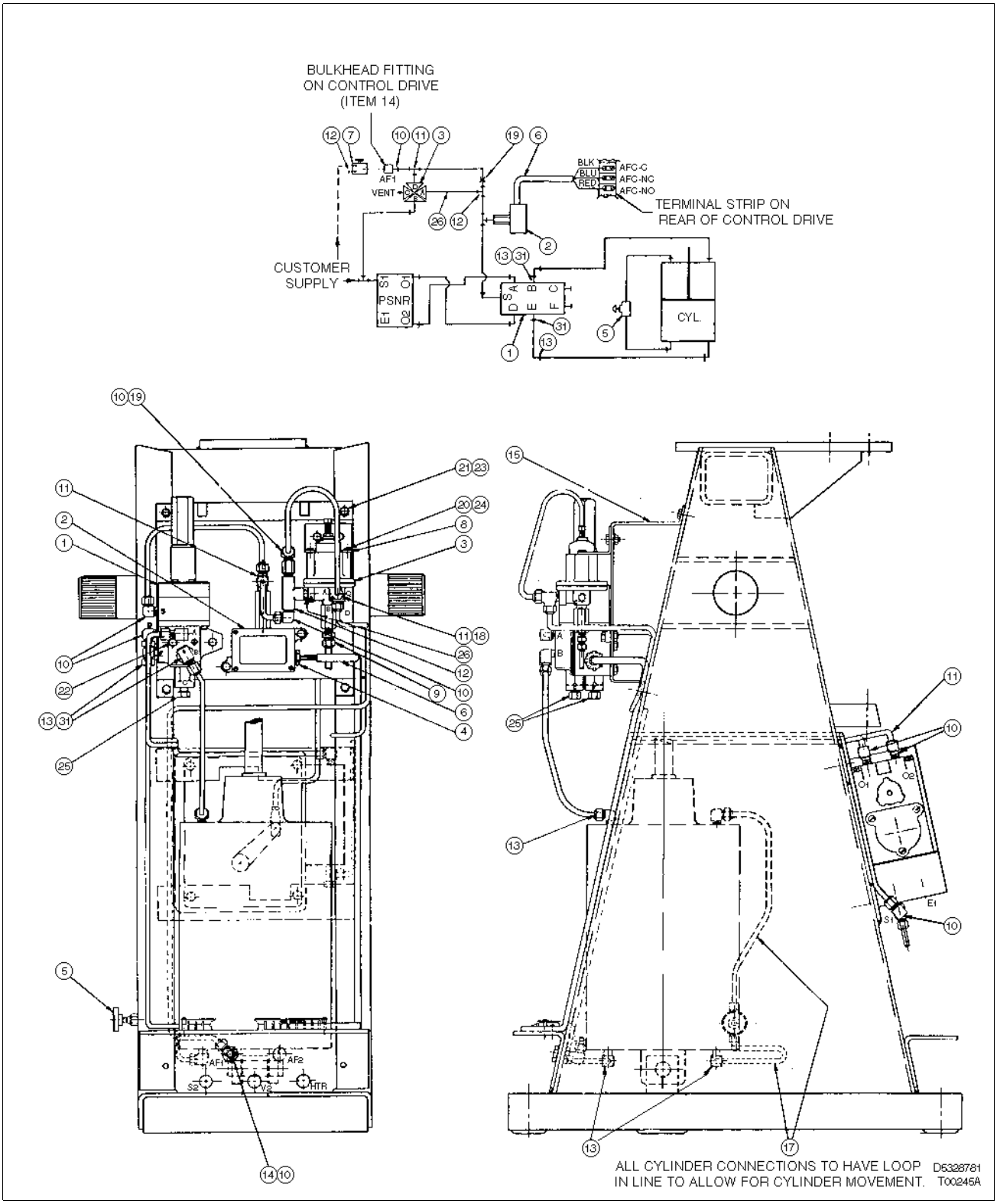



*Figure A-17. UP3 with Air Failure Lock, Table A-27*

*Table A-28. UP4 Air Failure Lock Kits, Figure A-18 (Kit Nos. 5328781_3/4)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 1951607_1 | Trip valve |
| 2 | 1 | 1941099_2 | Pressure switch |
| 3 | 1 | 1951606_1 | 3-way valve |
| 4 | 1 | 1941147_1 | ½ molded bushing |
| 5 | 1 | 5328781_3 | Shutoff valve for UP4 with positioner (kit no. 5328781_3) |
| | Omit | — | Omit for UP4 with solenoid valve (kit no. 5328781_4) |
| 6 | 1 | 5328782_1 | Air failure lock harness |
| 7 | 1 | 1951589_1 | Air valve |
| 8 | 1 | 5328788_1 | Mounting bracket |
| 9 | 1 | 4-4FBI2-B | Male connector |
| 10 | 8 | 4-4CBI2-B | Male elbow |
| 11 | 2 | 4-4-4RBI2-B | Male run tee |
| 12 | 1 | — | Brass tee (¼ NPT) |
| 13 | 4 | 1951408_1 | Male elbow |
| 14 | 1 | 1951609_1 | Bulkhead fitting |
| 15 | 1 | 5328674_1 | Valve mounting bracket |
| 16 | 1 | 1963318__ | Nameplate |
| 17 | 0.9 m (3 ft) | R1021-0022 | 0.250 OD x 0.040 wall tubing |
| 18 | 4 | 1951407_1 | Male connector |
| 19 | 1 | 5327327_3 | Adaptor |
| 20 | 2 | — | Pan head Zn plated steel machine screw (0.190-24 x 0.875) |
| 21 | 9 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.875) |
| 22 | 1 | — | Hex head Zn plated steel cap screw (0.250-20 x 4.000) |
| 23 | 10 | — | Ext lockwasher Zn plated steel hex keps (0.250-20) |
| 24 | 2 | 1210-00 | Zn plated steel shakeproof lockwasher |
| 25 | 2 | — | Brass pipe plug (¼ NPT) |
| 26 | 2 | — | Close brass nipple (¼ NPT) |
| 27 | 1 | I-P81-20 | Instruction |
| 28 | 1 | — | Cotton drawstring bag |
| 29 | 1 | 5328781 | Print |
| 30 | 1 | No. 100 | Carton |
| 31 | 4 | — | ¼ NPT brass street elbow |
| 32 | 1 | — | Brass pipe plug ( ⅛ NPT) |
| 33 | 1 | 3053306 | Print |
| 34 | 3 | — | ¼ NPT brass elbow |
| 35 | 1 | — | ¼ NPT x 1.250 long brass nipple |
| 36 | 2.9 m (9.5 ft) | R9021-0050 | 0.500 OD x 0.062 wall polyester reinforced nylon tubing |
| 37 | 1 | — | ¼ NPT x 2.000 long brass nipple |
| 38 | 1 | — | ¼ NPT x 1.500 long brass nipple |

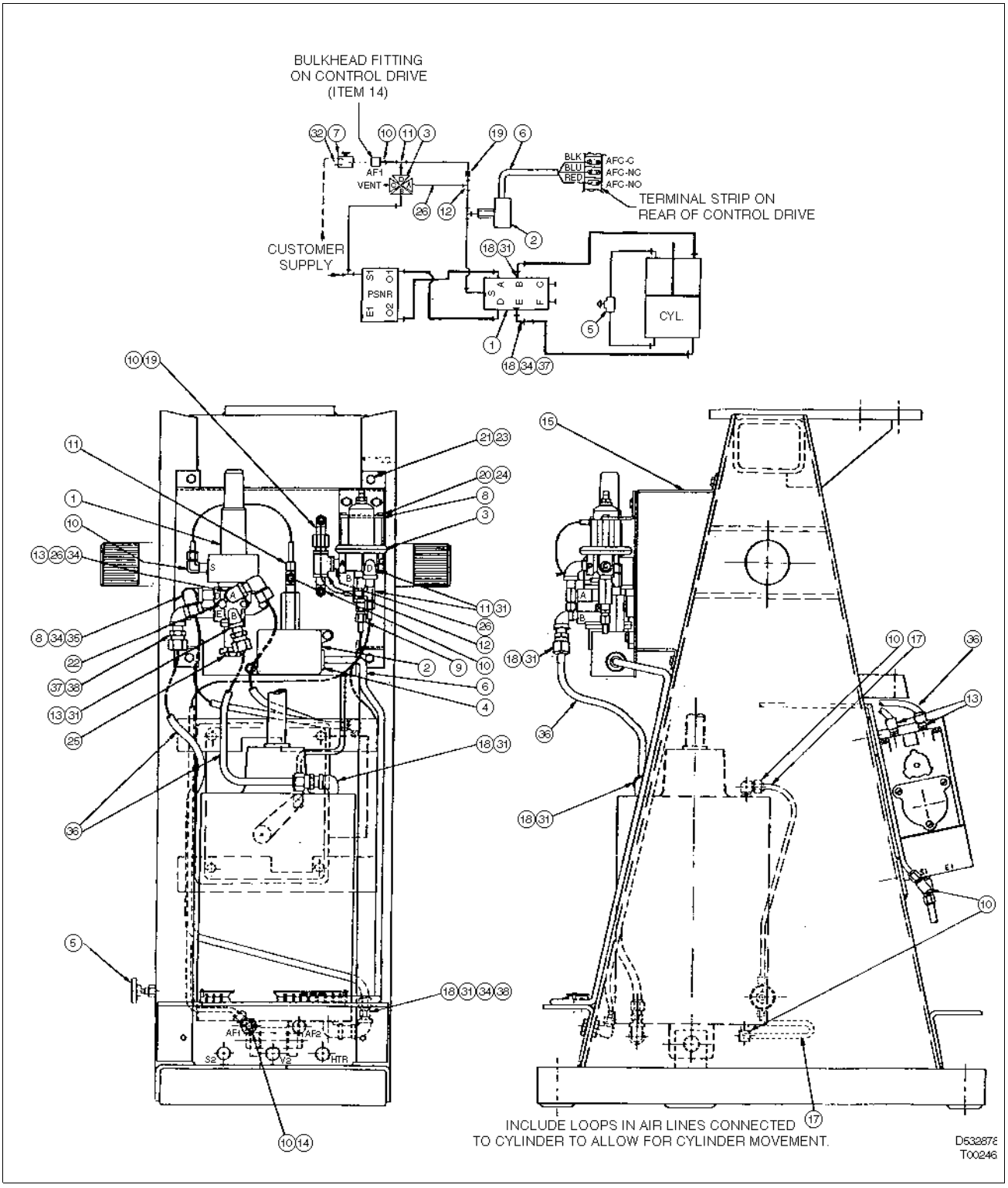



*Figure A-18. UP4 with Air Failure Lock, Table A-28*

*Table A-29. UP3 Reserve Air Tank Kits, Figure A-19 (Kit Nos. 5328781 _31/32)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 1951712_1 | Check valve |
| 2 | 1 | 1941099_2 | Pressure switch |
| 3 | 2 | 1951606_1 | 3-way pneumatic valve |
| 4 | 1 | 1941147_1 | ½ molded bushing |
| 5 | 1 | 1951608_1 | Shut-off valve for UP3 with positioner (kit no. 5328787_31) |
| | Omit | — | Omit for UP3 with solenoid valve (kit no. 5328787_32) |
| 6 | 1 | 5328782_1 | Air failure lock harness |
| 8 | 2 | 5328788_1 | Mounting bracket |
| 9 | 6 | 4-4FB12-B | Male connector |
| 10 | 9 | 4-4CB12-B | Male elbow |
| 11 | 2 | 4-4-4SB12-B | Male branch tee |
| 12 | 2 | — | ¼ NPT brass tee |
| 13 | 4 | 4CB12-B | Male elbow |
| 14 | 4 | 1951609_1 | Bulkhead fitting |
| 15 | 1 | 5328674_1 | Valve mounting bracket |
| 16 | 1 | 1963318__ | Universal nameplate |
| 17 | 4 m (13 ft) | R1021-0022 | 0.250 OD x 0.040 wall Al tubing with black poly jacket |
| 20 | 4 | NBZAC17014 | Pan head screw (0.190-24) |
| 21 | 10 | NAUAC21016 | Hex cap screw (0.250-20) |
| 22 | 10 | NTCAC11000 | Flat washer (0.250) |
| 23 | 10 | NNBAC21000 | Hex keps nut (0.250-20) |
| 24 | 4 | NTMAC19000 | Int sems lockwasher (0.190) |
| 33 | 1 | C3053544-Sh 1 | Print |
| 34 | 2 | — | ¼ NPT brass elbow |
| 35 | 2 | — | ¼ NPT x 1.250 long brass nipple |
| 39 | 4 | 1941817_1 | Conduit gasket |
| 40 | 1 | 1963489_4 | Designation plate |
| 41 | 1 | 1951785_8 | 30.3 liter (8.0 gallon) air tank assembly (Fig. B-12) |
| 42 | 1 | 1963478_1 | Shut-off valve for UP3 with positioner (kit no. 5328787_31) |
| | Omit | — | Omit for UP3 with solenoid valve (kit no. 5328787_32) |

## *TYPES UP5 AND UP6 ACTUATORS*

Refer to Tables A-34 through A-49, and Figures A-22 through A-30 for spare parts information for Types UP5 and UP6 actuators.

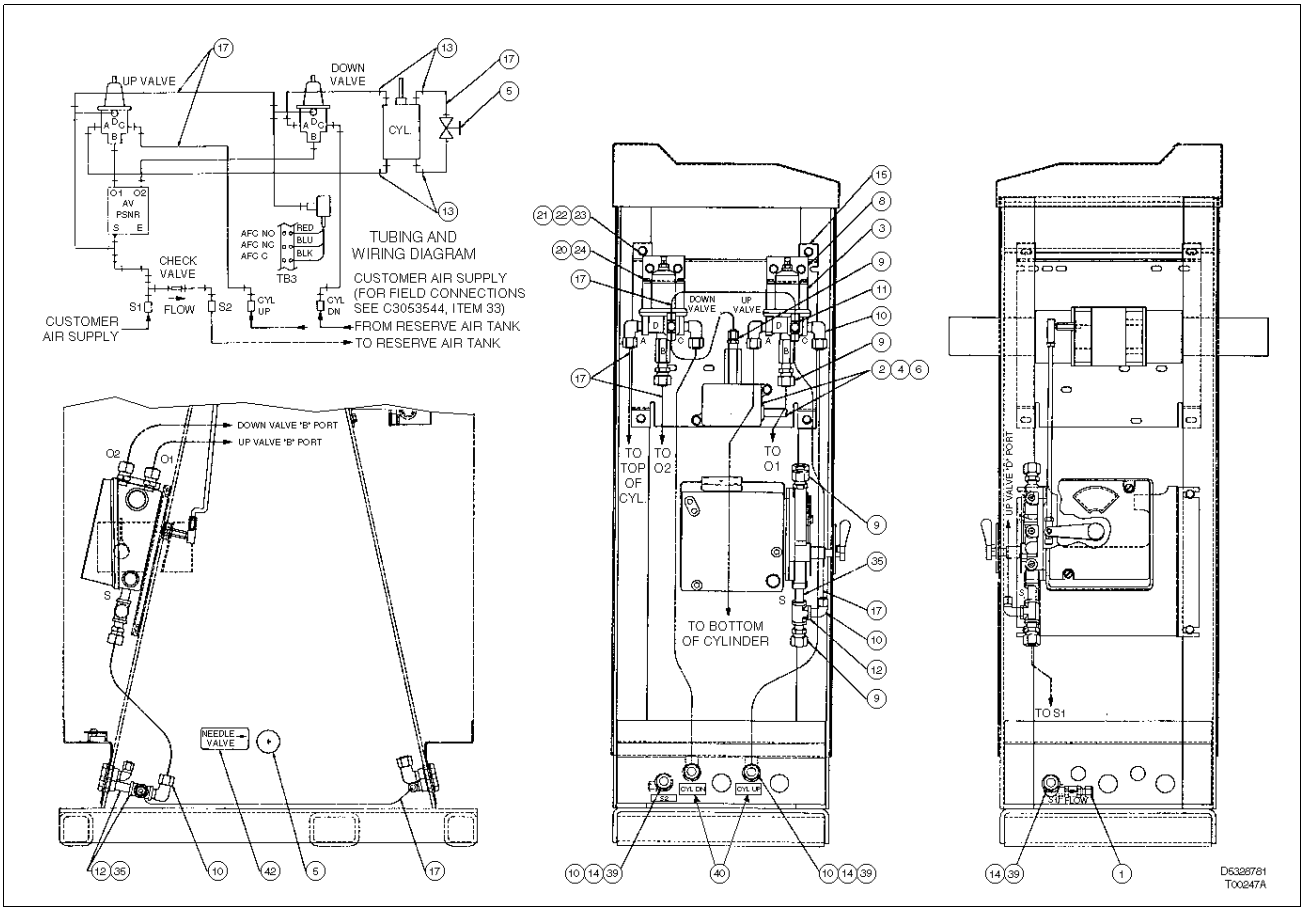



*Figure A-19. UP3 with Reserve Air Tank, Table A-29*

*Table A-30. UP4 Reserve Air Tank Kits, Figure A-20 (Kit Nos. 5328781_41/42)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 1951712_1 | Check valve |
| 2 | 1 | 1941099_2 | Pressure switch |
| 3 | 2 | 1951606_1 | 3-way pneumatic valve |
| 4 | 1 | 1941147_1 | ½ molded bushing |
| 5 | 1 | 1951608_1 | Shut-off valve for UP4 with positioner (kit no. 5328787_41) |
| | Omit | — | Omit for UP4 with solenoid valve (kit no. 5328787_42) |
| 6 | 1 | 5328782_1 | Air failure lock harness |
| 8 | 2 | 5328788_1 | Mounting bracket |
| 9 | 1 | 4-4FB12-B | Male connector |
| 10 | 4 | 4-4CB12-B | Male elbow |
| 11 | 2 | 4-4-4SB12-B | Male branch tee |
| 12 | 2 | — | ¼ NPT brass tee |
| 13 | 7 | 1951408_1 | Male elbow |
| 14 | 4 | 1951609_1 | Bulkhead fitting |
| 15 | 1 | 5328674_1 | Valve mounting bracket |
| 16 | 1 | 1963318__ | Universal nameplate |

*Table A-30. UP4 Reserve Air Tank Kits, Figure A-20 (Kit Nos. 5328781_41/42) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 17 | 0.9 m (3.0 ft) | R1021-0022 | 0.250 OD X 0.040 wall Al tubing with black poly jacket |
| 18 | 7 | 1951407_1 | Male connector |
| 20 | 4 | NBZAC17014 | Pan head screw (0.190-24) |
| 21 | 10 | NAUAC21016 | Hex cap screw (0.250-20) |
| 22 | 10 | NTCAC11000 | Flat washer (0.250) |
| 23 | 10 | NNBAC21000 | Hex keps nut (0.250-20) |
| 24 | 4 | NTMAC19000 | Int sems lockwasher (0.190) |
| 31 | 1 | — | ¼ NPT brass street elbow |
| 33 | 1 | C3053544-Sh 1 | Print |
| 34 | 1 | — | ¼ NPT brass elbow |
| 35 | 2 | — | ¼ NPT X 1.250L brass nipple |
| 36 | 3.1 m (10.0 ft) | R9021-0050 | 0.500 OD X 0.062 wall poly reinforced black nylon tubing |
| 38 | 1 | — | ¼ NPT X 1.500L brass nipple |
| 39 | 4 | 1941817_1 | Conduit gasket |
| 40 | 1 | 1963489_4 | Designation plate |
| 41 | 1 | 1951785_8 | 30.0 liter (8.0 gallon) air tank assembly (Fig. B-12) |
| 42 | 1 | 1963478_1 | Shut-off valve for UP3 with positioner (kit no. 5328787_31) |
| | Omit | — | Omit for UP3 with solenoid valve (kit no. 5328787_32) |

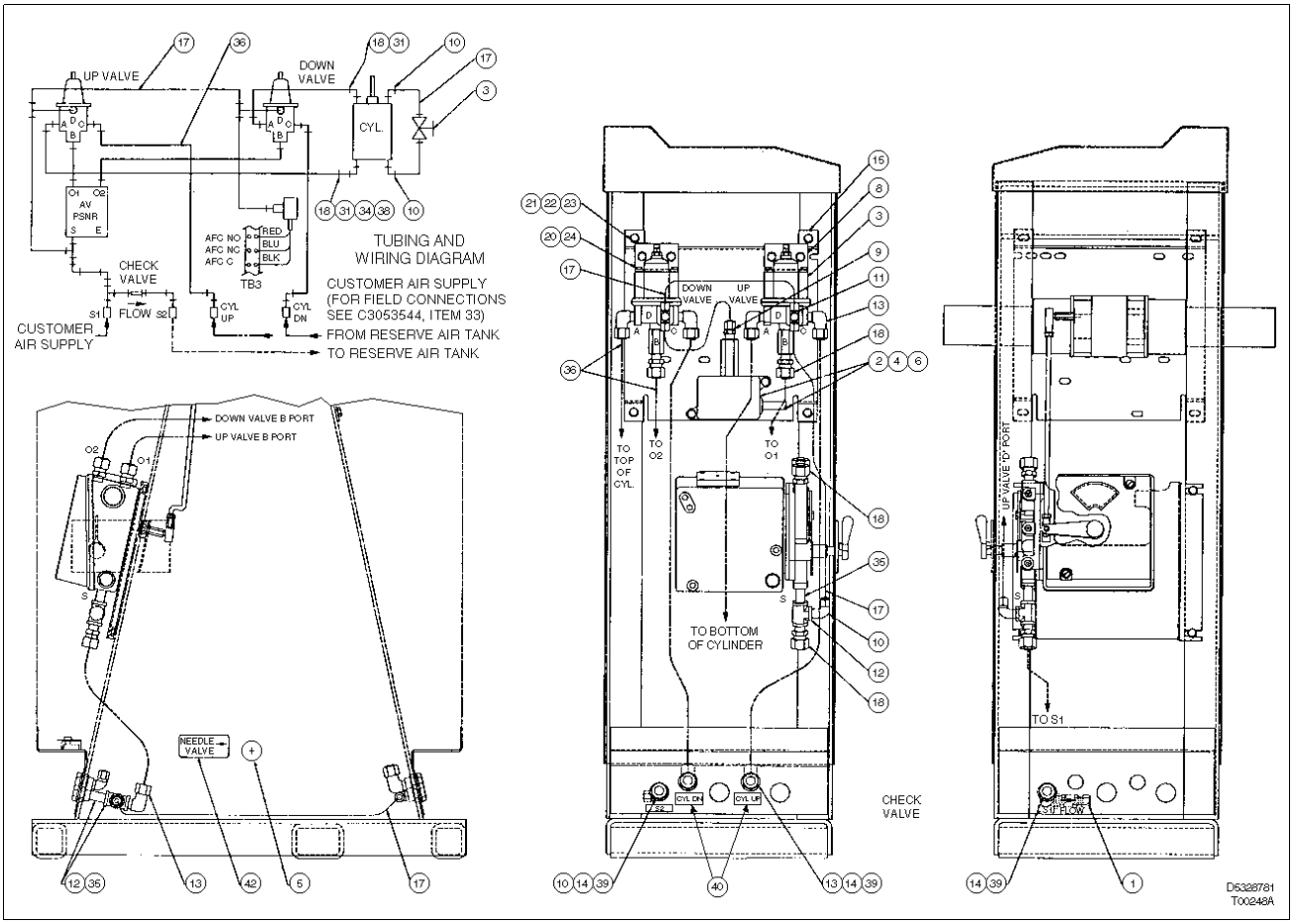



*Figure A-20. UP4 with Reserve Air Tank, Table A-30*

*Table A-31. UP3 and UP4 Heater Kits, Figure A-21*
*(Kit Nos. 5328784_1/2)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 6 | 1943825_11 | Stud terminal |
| 2 | 2 | 1943825_8 | Stud terminal |
| 3 | 3 | 195586_1 | Plastic clamp |
| 4 | 2 | 1941401_2 | Solderless terminal |
| 5 | 10 | 1943785_3 | Cable tie |
| 7 | 1 | 662460_1 | Thermoswitch |
| 8 | 1 | 195105_10 | Tube clamp |
| 9 | 2.9 m (9.5 ft) | 5318366_1U | Fiberglass insulation |
| 10 | 2 | 197118_2 | Conduit connector |
| 11 | 4 | 19934_87 | Spacer |
| 12 | 2 | 1943002_1 | Strip heater for 120 VAC operation |
| | | 1943002_2 | Strip heater for 240 VAC operation |
| 13 | 1 | 1963318_ | Nameplate |
| 16 | 4.6 m (15.0 ft) | R2049-0100 | 14 AWG natural leadwire |

*Table A-31. UP3 and UP4 Heater Kits, Figure A-21*
*(Kit Nos. 5328784 _1/2) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 17 | 4 | — | Pan head Zn plated steel sems int (0.190-32 x 0.375) |
| 18 | 4 | NTKAC19000 | Shakeproof lockwasher (0.190) |
| 21 | 4 | NBZAC16016 | 0.190-32 pan head screw |
| 22 | 2.1 m (7.0 ft) | R9090-0030 | Spiral wrapping |
| 24 | 1 | 5328784 | Print |
| 25 | 1 | No. 17 | Carton |

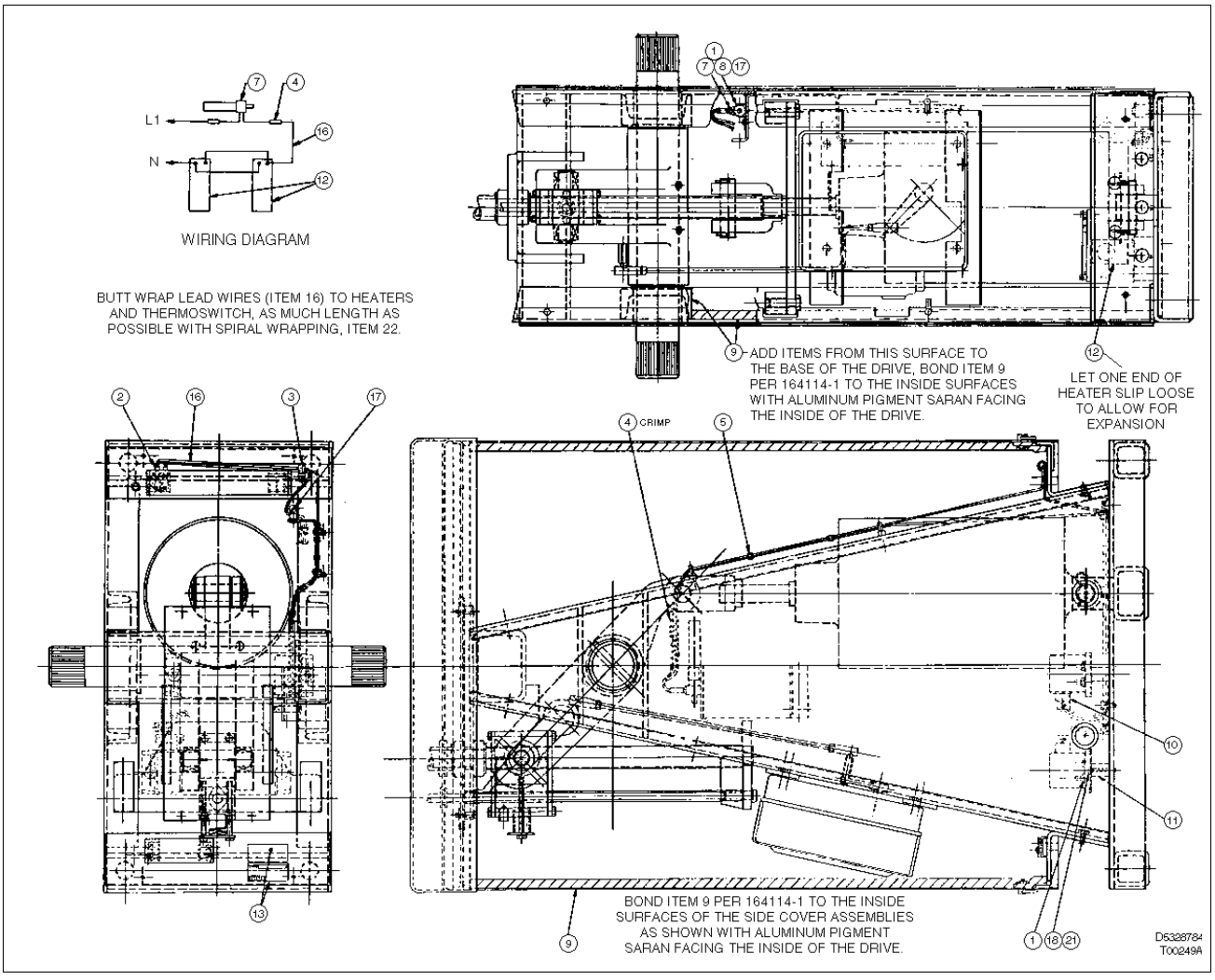



*Figure A-21. UP3 and UP4 with Heater, Table A-31*

*Table A-32. UP3 Cylinder Spare Parts Kit, Figure 8-2 (Kit No. 258240 _1)*

| Qty | Part No. | Description | Qty | Part No. | Description |
|---|---|---|---|---|---|
| 2 | 1951416_256 | O-ring | 1 | 1951401_1 | Wiper ring |
| 1 | 5328773_1 | Piston | A/R | 199354_1 | Lubricant |
| 1 | 195825_15 | O-ring | 1 | No. 62A | Carton |
| 1 | 1951399_214 | O-ring | 1 | 258240 | Print |
| 1 | 1951416_218 | O-ring | | | |

*Table A-33. UP4 Cylinder Spare Parts Kit, Figure 8-3 (Part No. 258241 _1)*

| Qty | Part No. | Description | Qty | Part No. | Description |
|---|---|---|---|---|---|
| 2 | 5311428_41 | O-ring | 1 | 195852_1 | Wiper ring |
| 1 | 195825_9 | O-ring | 1 | 5311428_24 | O-ring |
| 1 | 5328768_15 | Piston | A/R | 199354_1 | Lubricant |
| 1 | 1951359_220 | O-ring | 1 | No. 39 | Carton |
| 2 | 195851_1 | Back up ring | 1 | 258241 | Print |

*Table A-34. UP5 and UP6 Positioner, Figure A-22 (Drawing No. 5328960)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 6631317_1 | Operating lever |
| 2 | 1 | 5328953_2 | Gear carrier |
| 3 | 1 | 1963318__ | Nameplate |
| 4 | Refer to Table A-35 | 19981_31 | Plug button |
| 5 | 1 | 5328877_1 | Frame |
| 6 | 2 | 5328890_1 | Support panel |
| 7 | 1 | 1951612_1 | ½ bulkhead fitting |
| 8 | 2 | 1951408_1 | Elbow |
| 9 | 1 | 194956_8 | Terminal block |
| 10 | Refer to Table A-35 | 1947578_3 | Desig plate |
| 11 | 1 | 5328905_2 | Bottom side cover |
| 12 | 8 | 197743_3 | Ty-wrap |
| 14 | 1 | 1951611_4 | Shaft seal |
| 15 | 1 | 197120_22 | Elastic stop nut |
| 16 | 1 | 198517_2 | Ratchet assembly |
| 17 | 1 | 5325349_1 | Clutch lever |
| 18 | 1 | 1951611_3 | Shaft seal |
| 20 | 1 | 5328930_1 | Pointer |
| 21 | 1 | 5328934_2 | Drive shaft |
| 22 | 1 | 5328967_2 | Top side cover |
| 23 | Refer to Table A-35 | R2041-0030 | 18 AWG white leadwire |
| 24[1] | 1 | 5329162_1 | Top cover assembly |
| 25 | 1 | 5329067_1 | Stop plate |
| 26 | 1 | 5329010_1 | Roller chain |

*Table A-34. UP5 and UP6 Positioner, Figure A-22 (Drawing No. 5328960) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 28 | 1 | 5324693_2 | Bushing |
| 29 | 1 | 5328956_2 | Chain sector |
| 30 | 2 | 197754_1 | Retaining ring |
| 31 | 1 | 197164_275 | Retaining ring |
| 32 | 2 | 193221_1 | Bearing |
| 33 | 2 | 197105_4 | Alemite fitting |
| 34 | 1 | 198512_2 | Key |
| 35 | 1 | 1963488_1 | Scale |
| 36 | 1 | 5329008_1 | Chain anchor |
| 37 | 4 | 197730_1 | Cotter pin |
| 38 | 1 | 5311459_1 | Valve handle |
| 41 | 1 | 5329059_1 | Top side cover |
| 42 | 1 | Refer to Tables A-35, 8-3, 8-4 and Figures 8-4 and 8-5 | Cylinder |
| 43 | 1 | 1947271_2 | Desig plate |
| 44 | 1 | 194956_17 | Terminal block |
| 45 | 1 | 197676_1 | Ground screw |
| 46 | 1 | 197675_1 | Washer |
| 47 | 4 | 5328949_1 | Bolt plate |
| 48 | 3 | 1951569_5 | Button plug |
| 49 | 2 | 5328889_1 | Clevis pin |
| 50 | 1 | 1963489_2 | Desig plate |
| 51 | 1 | 1963489_1 | Desig plate |
| 52 | 1 | 1951569_4 | Button plug |
| 53 | 1 | 5329083_1 | Shaft extension |
| 54 | 2 | — | Pan head Zn plated steel sems ext (0.190-32 x 0.438) |
| 55 | 2 | 5328436_1 | Cap screw |
| 56 | 1 | 198531_1 | Woodruff key |
| 57 | 1 | 5328892_1 | Instruction plate |
| 58 | 1 | 5328765_2 | Gasket |
| 59 | 2 | 19934_135 | Spacer |
| 60 | 1 | Refer to Table A-35 | Positioner |
| 61 | 4 | — | Hex head Zn plated steel cap screw (0.625-11 x 2.750) |
| 62 | 4 | — | Semi-fin steel reg hex full nut (0.625-11) |
| 63 | 4 | — | Zn plated steel reg spring lockwasher (0.625) |
| 64 | 21 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.500) |
| 65 | 20 | — | Indented hex washer, Zn plated steel threaded cutting screw (0.250-20 x 0.500) |
| 66 | 8 | — | Pan head Zn plated steel machine screw (0.138-32 x 1.000) |
| 67 | 8 | SSP-68 | Zn plated steel rivet |

*Table A-34. UP5 and UP6 Positioner, Figure A-22 (Drawing No. 5328960) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 68 | 1 | — | Zn plated steel roll pin (0.125 x 0.750) |
| 69 | 4 | — | Plain Zn plated steel washer (0.812 x 1.469 x 0.134) |
| 70 | 1 | — | Zn plated steel type 1 groove pin (0.250 dia x 1.250) |
| 71 | 1 | — | Pan head Zn plated steel machine screw (0.164-32 x 0.625) |
| 73 | 2 | — | 3/8 -18 NPT pipe plug |
| 74 | 1 | — | Hex socket head steel cap screw (0.625-11 x 3.500) |
| 75 | 1 | — | Soc hex hdls Zn plated steel set screw (0.190-32 x 0.312) |
| 76 | 1 | 4808-09-01-4102 | Stainless steel shakeproof lockwasher |
| 77 | 1 | — | Zn plated steel washer (0.188 x 0.433 x 0.049) |
| 78 | 2 | 8OBI2-B | Female branch tee |
| 79 | Refer to Table A-35 | 8-8CBI2-B | Elbow |
| 80 | Refer to Table A-35 | 5323705_1 | Elbow |

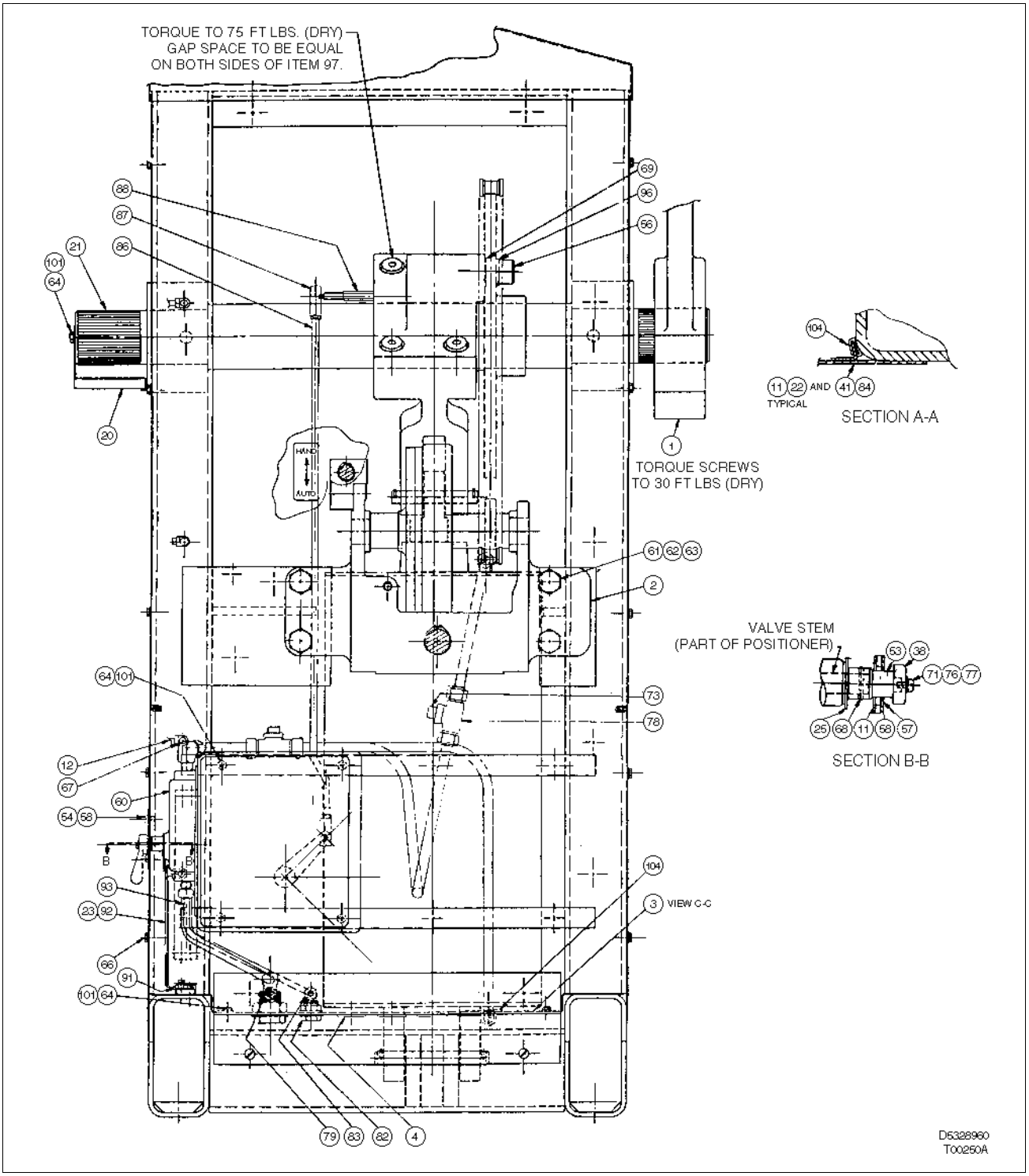



*Figure A-22. UP5 and UP6 with Positioner, Tables A-34 and A-35 (Sheet 1 of 2)*

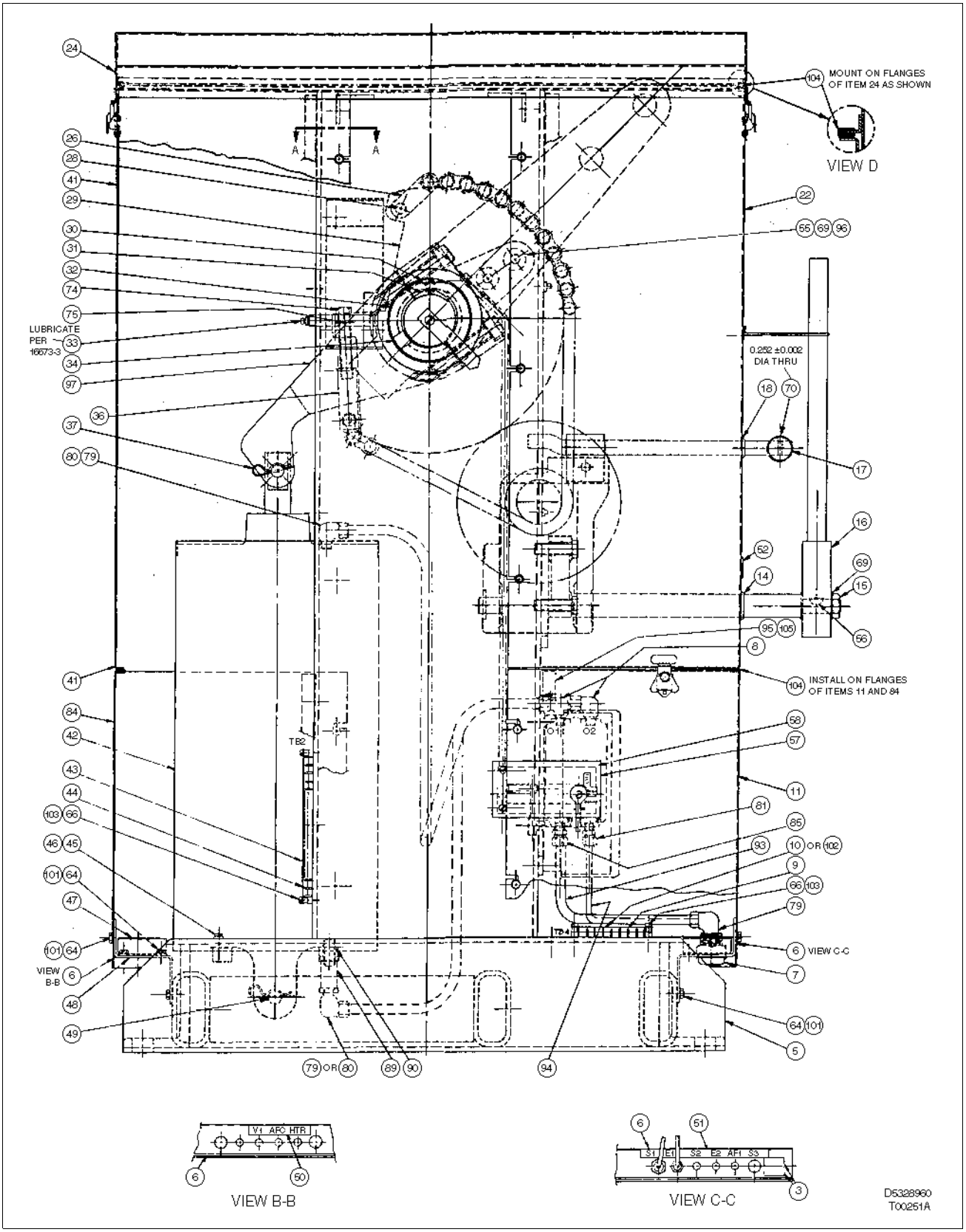



*Figure A-22. UP5 and UP6 with Positioner, Tables A-34 and A-35 (Sheet 2 of 2)*

*Table A-34. UP5 and UP6 Positioner, Figure A-22 (Drawing No. 5328960) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 81 | Refer to Table A-35 | 4-4FBI2-B | Male connector |
| 82 | Refer to Table A-35 | 1951609_1 | Bulkhead fitting |
| 83 | Refer to Table A-35 | 4CBI2-B | Elbow |
| 84 | 1 | 5328905_1 | Bottom side cover |
| 85 | 1 | 1951407_1 | Male connector |
| 86 | 1 | 5328957_1 | Positioner drive rod |
| 87 | 2 | 5311759_1 | Ball joint |
| 88 | 1 | 5328968_1 | Stud |
| 89 | Refer to Table A-35 | — | Brass coupling ( 3/8) |
| 90 | Refer to Table A-35 | — | Brass close nipple ( 3/8) |
| 91 | Refer to Table A-35 | 1943825_1 | Terminal lug |
| 92 | Refer to Table A-35 | R2041-0010 | 18 AWG black leadwire |
| 93 | 183 cm (72 in.) | R9021-0050 | 0.500 OD nylon tubing |
| 94 | Refer to Table A-35 | R1021-0022 | 0.250 OD x 0.040 wall Al tubing |
| 96 | 4 | — | Zn plated steel spring lockwasher (0.750) |
| 97 | 1 | 5328902_1 | Crank arm |
| 98 | 1 | 1963488_2 | Scale |
| 99 | 1 | — | Poly bag |
| 100 | Refer to Table A-35 | 1943825_3 | Terminal lug |
| 101 | 21 | 1114-00 | Zn plated steel shakeproof int lockwasher |
| 102 | Refer to Table A-35 | 1947578_4 | Desig plate |
| 103 | 8 | 1206-00 | Zn plated steel shakeproof int lockwasher |
| 104 | 10.4 m (34.0 ft) | 1951480_1U | Sealing strip |
| 109 | 1 | 1963353__ | Label, universal, CSA |

**NOTE:**
1. Older models have plastic top covers. To order a plastic top cover, use Part No. 5329053_1.

*Table A-35. UP5 and UP6 Positioners and Unique Items, Figure A-22*

| Type | Item 4 | Item 10 | Item 23 | Item 42 | Item 60 | Item 79 | Item 80 | Item 81 |
|---|---|---|---|---|---|---|---|---|
| UP5_A | 7 req | 1 req | Omit | 5328952_1 | AV1121_0 | 1 req | 2 req | 1 req |
| UP5_B | 7 req | 1 req | Omit | 5328952_1 | AV1221_0 | 1 req | 2 req | 1 req |
| UP5_C | 8 req | 1 req | 46 cm (18 in.) | 5328952_1 | AV2321_0 | 1 req | 2 req | Omit |
| UP5_D | 8 req | 1 req | 46 cm (18 in.) | 5328952_1 | AV3321_0 | 1 req | 2 req | Omit |
| UP5_E | 8 req | Omit | 91 cm (36 in.) | 5328952_1 | AV442100 | 1 req | 2 req | Omit |
| UP6_A | 7 req | 1 req | Omit | 5328945_1 | AV1121_0 | 3 req | Omit | 1 req |
| UP6_B | 7 req | 1 req | Omit | 5328945_1 | AV1221_0 | 3 req | Omit | 1 req |
| UP6_C | 8 req | 1 req | 46 cm (18 in.) | 5328945_1 | AV2321_0 | 3 req | Omit | Omit |
| UP6_D | 8 req | 1 req | 46 cm (18 in.) | 5328945_1 | AV3321_0 | 3 req | Omit | Omit |
| UP6_E | 8 req | Omit | 91 cm (36 in.) | 5328945_1 | AV442100 | 3 req | Omit | Omit |

*Table A-35. UP5 and UP6 Positioners and Unique Items, Figure A-22 (continued)*

| Type | Item 82 | Item 83 | Items 89,90 | Item 91 | Item 92 | Item 94 | Item 100 | Item 102 |
|---|---|---|---|---|---|---|---|---|
| UP5_A | 1 req | 1 req | 1 req | Omit | Omit | 38 cm (15 in.) | Omit | Omit |
| UP5_B | 1 req | 1 req | 1 req | Omit | Omit | 38 cm (15 in.) | Omit | Omit |
| UP5_C | Omit | Omit | 1 req | 4 req | 46 cm (18 in.) | Omit | Omit | Omit |
| UP5_D | Omit | Omit | 1 req | 4 req | 46 cm (18 in.) | Omit | Omit | Omit |
| UP5_E | Omit | Omit | 1 req | 5 req | 137 cm (54 in.) | Omit | 5 req | 1 req |
| UP6_A | 1 req | 1 req | Omit | Omit | Omit | 38 cm (15 in.) | Omit | Omit |
| UP6_B | 1 req | 1 req | Omit | Omit | Omit | 38 cm (15 in.) | Omit | Omit |
| UP6_C | Omit | Omit | Omit | 4 req | 46 cm (18 in.) | Omit | Omit | Omit |
| UP6_D | Omit | Omit | Omit | 4 req | 46 cm (18 in.) | Omit | Omit | Omit |
| UP6_E | Omit | Omit | Omit | 5 req | 137 cm (54 in.) | Omit | 5 req | 1 req |

*Table A-36. UP5 and UP6 with Solenoid Valve, Figure A-23 (Drawing No. 5328961)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 6631317_1 | Operating lever |
| 2 | 1 | 5328953_2 | Gear carrier |
| 3 | 1 | 1963318__ | Nameplate |
| 4 | 8 | 19981_31 | Plug button |
| 5 | 1 | 5328877_1 | Frame |
| 6 | 2 | 5328890_1 | Support panel |
| 7 | 1 | 1951612_1 | ½ bulkhead fitting |
| 8 | Refer to Table A-37 | 8-8CBI2-B | Elbow |
| 9 | 1 | 194956_8 | Terminal block |
| 10 | 1 | Refer to Table A-37 | Desig plate |
| 11 | 2 | 5328905_1 | Bottom side cover |
| 12 | 8 | 197743_3 | Ty-wrap |
| 14 | 1 | 1951611_4 | Shaft seal |
| 15 | 1 | 197120_22 | Elastic stop nut |
| 16 | 1 | 198517_2 | Ratchet assembly |
| 17 | 1 | 5325349_1 | Clutch lever |
| 18 | 1 | 1951611_3 | Shaft seal |
| 20 | 1 | 5328930_1 | Pointer |
| 21 | 1 | 5328934_2 | Drive shaft |
| 22 | 1 | 5328967_2 | Top side cover |
| 23 | 1 | 1963478_1 | Instruction plate |
| 24[1] | 1 | 5329162_1 | Top cover assembly |
| 26 | 1 | 5329010_1 | Roller chain |
| 28 | 1 | 5324693_2 | Bushing |
| 29 | 1 | 5328956_2 | Chain sector |
| 30 | 2 | 197754_1 | Retaining ring |

*Table A-36. UP5 and UP6 with Solenoid Valve, Figure A-23 (Drawing No. 5328961) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 31 | 1 | 197164_275 | Retaining ring |
| 32 | 2 | 193221_1 | Bearing |
| 33 | 2 | 197105_4 | Alemite fitting |
| 34 | 1 | 198512_2 | Key |
| 35 | 1 | 1963488_1 | Scale |
| 36 | 1 | 5329008_1 | Chain anchor |
| 37 | 4 | 197730_1 | Cotter pin |
| 41 | 1 | 5329059_1 | Top side cover |
| 42 | 1 | Refer to Tables A-37, 8-3, 8-4 and Figures 8-4 and 8-5 | Cylinder |
| 43 | 1 | 1947271_2 | Desig plate |
| 44 | 1 | 194956_17 | Terminal block |
| 45 | 1 | 197676_1 | Ground screw |
| 46 | 1 | 197675_1 | Washer |
| 47 | 4 | 5328949_1 | Bolt plate |
| 48 | 2 | 1951569_5 | Button plug |
| 49 | 2 | 5328889_1 | Clevis pin |
| 50 | 1 | 1963489_2 | Desig plate |
| 51 | 1 | 1963489_1 | Desig plate |
| 52 | 1 | 1951608_1 | Shut off valve |
| 53 | Refer to Table A-37 | 1943825_8 | Terminal lug |
| 54 | | 1941401_2 | Solderless terminal |
| 55 | 2 | 5328436_1 | Cap screw |
| 56 | 1 | 198531_1 | Woodruff key |
| 57 | 1 | Refer to Table A-37 | Solenoid valve |
| 58 | Refer to Table A-37 | 5323705_1 | Elbow |
| 59 | 1 | 5328435_1 | Mounting plate |
| 60 | 140 cm (55 in.) | R9021-0050 | 0.500 OD nylon tubing |
| 61 | 4 | — | Hex head Zn plated steel cap screw (0.625-11 x 2.750) |
| 62 | 4 | — | Semi-fin steel reg hex full nut (0.625-11) |
| 63 | 4 | — | Zn plated steel reg spring lockwasher (0.625) |
| 64 | 17 | — | Hex head Zn plated steel cap screw (0.250-20 x 0.500) |
| 65 | 20 | — | Indented hex washer, Zn plated steel threaded cutting screw (0.250-20 x 0.500) |
| 66 | 8 | — | Pan head Zn plated steel machine screw (0.138-32 x 1.000) |
| 67 | 8 | SSP-68 | Zn plated steel rivet |
| 68 | 152 cm (60 in.) | R1021-0022 | 0.250 OD Al tubing |
| 69 | 4 | — | Plain Zn plated steel washer (0.812 x 1.469 x 0.134) |

*Table A-36. UP5 and UP6 with Solenoid Valve, Figure A-23 (Drawing No. 5328961) (continued)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 70 | 1 | — | Zn plated steel type 1 groove pin (0.250 dia x 1.250) |
| 71 | 2 | — | Zn plated steel reg spring lockwasher (0.750) |
| 73 | Refer to Table A-37 | — | ⅜ NPT brass coupling |
| 74 | 1 | | Hex socket head steel cap screw (0.625-11 x 3.500) |
| 75 | 1 | — | Soc hex hdls Zn plated steel set screw (0.190-32 x 0.312) |
| 76 | 91 cm (36 in.) | R2041-1594 | 14 AWG black leadwire |
| 77 | 6 | — | Pan head Zn plated steel machine screw (0.250-20 x 0.750) |
| 78 | 6 | — | Ext lockwasher Zn plated steel hex keps (0.250-20) |
| 79 | Refer to Table A-37 | 488907_9 | Grommet |
| 80 | 2 | 4-4FBI2-B | Male connector |
| 81 | Refer to Table A-37 | — | Brass close nipple (⅜) |
| 82 | 2 | 8-4OBI2-B | Female branch tee |
| 83 | 1 | 5328902_1 | Crank arm |
| 84 | 1 | 1963488_2 | Scale |
| 85 | 1 | — | 8 x 13 poly bag |
| 86 | 17 | 1214-00 | Zn plated steel shakeproof int lockwasher |
| 87 | 8 | 1206-00 | Zn plated steel shakeproof int lockwasher |
| 88 | 9.5 m (34.0 ft) | 1951480_1U | Sealing strip |
| 91 | 1 | 1963353__01 | Label, universal, CSA |

**NOTE:**

1. Older models have plastic top covers. To order a plastic top cover, use Part No. 5329053_1.

*Table A-37. UP5 and UP6 Solenoid Valves and Unique Items, Figure A-23*

| Type | Voltage | Item 8 | Item 10 | Item 42 | Items 53, 54 | Item 57 | Item 58 | Item 73 | Item 79 | Item 81 |
|---|---|---|---|---|---|---|---|---|---|---|
| UP5_5 | 120 VAC | 1 req | 1947578_1 | 5328952_1 | 2 req | 1951013_1 | 5 req | 1 req | 1 req | 1 req |
| UP5_6 | 115/125 VDC | 1 req | 1947578_1 | 5328952_1 | 2 req | 1951013_3 | 5 req | 1 req | 1 req | 1 req |
| UP5_8 | 120 VAC | 1 req | 1947711_1 | 5328952_1 | 4 req | 1951135_1 | 5 req | 1 req | 2 req | 1 req |
| UP5_9 | 115/125 VDC | 1 req | 1947711_1 | 5328952_1 | 4 req | 1951135_2 | 5 req | 1 req | 2 req | 1 req |
| UP5_F | 220/240 VAC | 1 req | 1947578_1 | 5328952_1 | 2 req | 1951013_2 | 5 req | 1 req | 1 req | 1 req |
| UP5_G | 220/240 VAC | 1 req | 1947711_1 | 5328952_1 | 4 req | 1951135_4 | 5 req | 1 req | 2 req | 1 req |
| UP6_5 | 120 VAC | 3 req | 1947578_1 | 5328945_1 | 2 req | 1951013_1 | 3 req | Omit | 1 req | Omit |
| UP6_6 | 115/125 VDC | 3 req | 1947578_1 | 5328945_1 | 2 req | 1951013_3 | 3 req | Omit | 1 req | Omit |
| UP6_8 | 120 VAC | 3 req | 1947711_1 | 5328945_1 | 4 req | 1951135_1 | 3 req | Omit | 2 req | Omit |
| UP6_9 | 115/125 VDC | 3 req | 1947711_1 | 5328945_1 | 4 req | 1951135_2 | 3 req | Omit | 2 req | Omit |
| UP6_F | 220/240 VAC | 3 req | 1947578_1 | 5328945_1 | 2 req | 1951013_2 | 3 req | Omit | 1 req | Omit |
| UP6_G | 220/240 VAC | 3 req | 1947711_1 | 5328945_1 | 4 req | 1951135_4 | 3 req | Omit | 2 req | Omit |

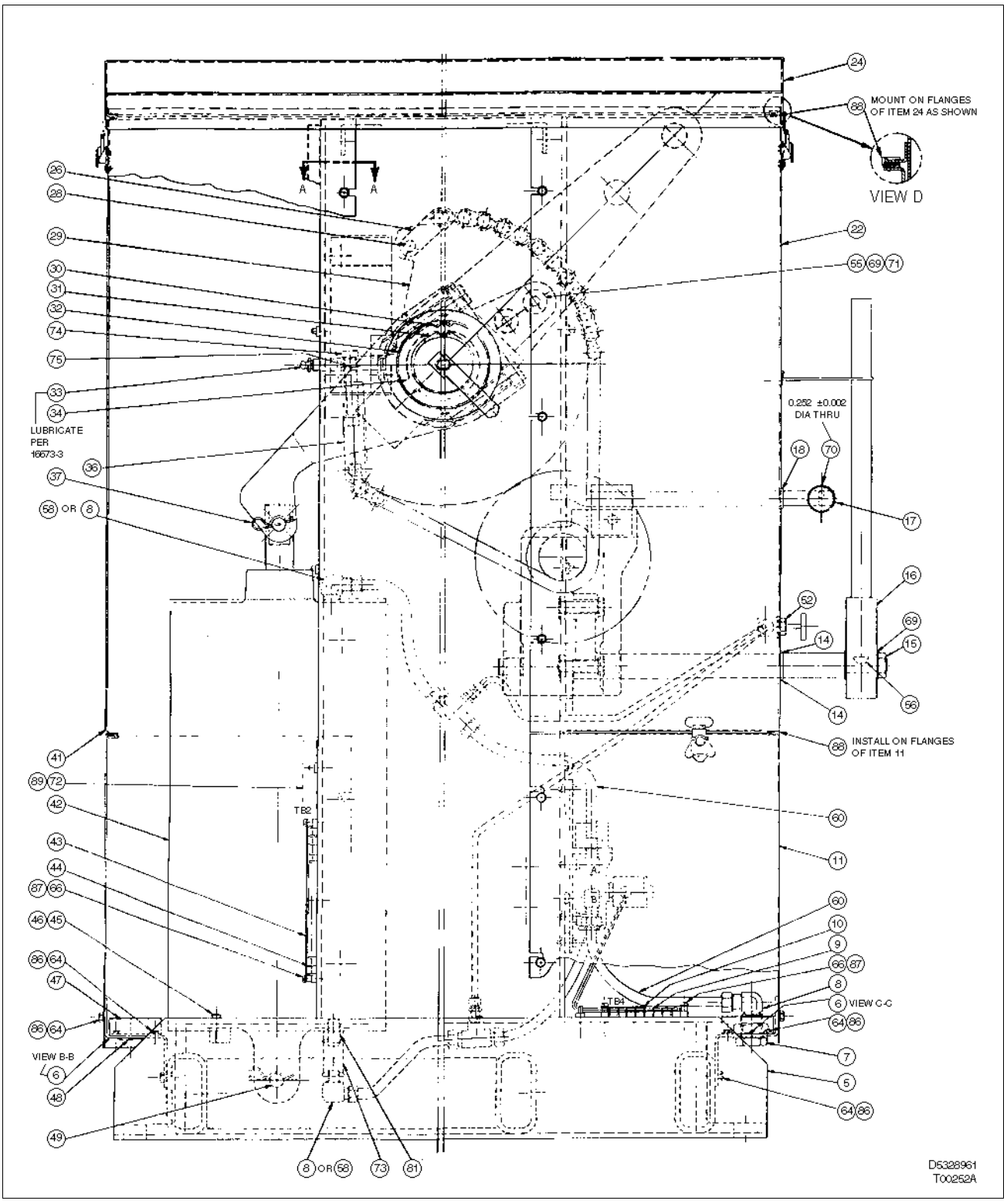



*Figure A-23. UP5 and UP6 with Solenoid Valve, Tables A-36 and A-37 (Sheet 1 of 2)*

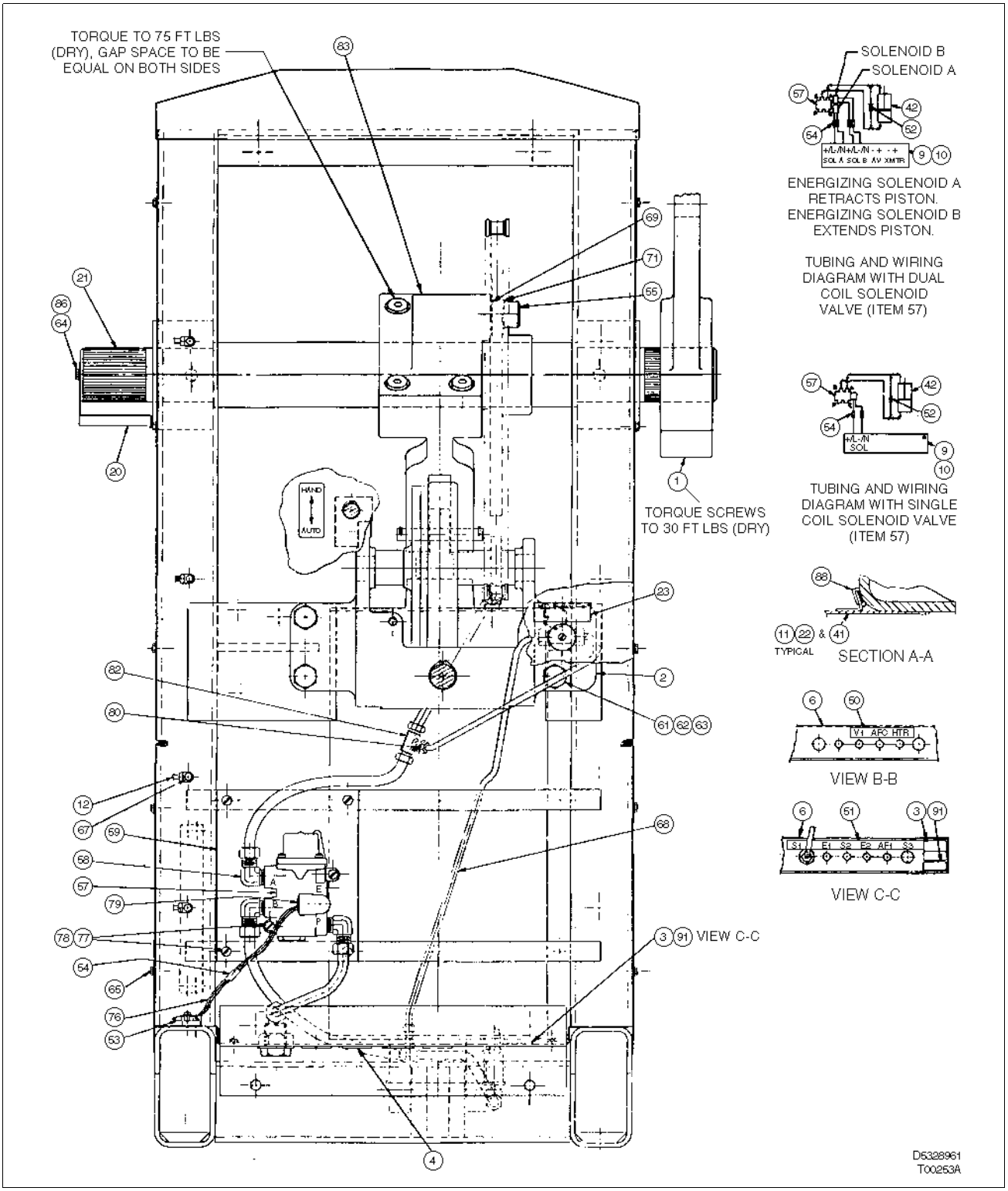



*Figure A-23. UP5 and UP6 with Solenoid Valve, Tables A-36 and A-37 (Sheet 2 of 2)*

*Table A-38. UP5 and UP6 Alarm/Travel Switch Kit, Figure A-24 (Kit No. 5328962_1)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 19934_208 | Spacer |
| 2 | 2 | — | Pan head Zn plated steel machine screw (0.190-32 x 1.000) |
| 3 | 1 | 5328596_2 | Arm |
| 4 | 1 | 5312449_12 | Connecting link |
| 6 | 1 | 5328698_1 | Alarm unit |
| 7 | 1 | — | Steel dowel pin (0.375 x 1.500) |
| 8 | 1 | 5328924_1 | Coupler |
| 12 | 3 | — | Hex head Zn plated steel sems ext (0.190-32 x 0.500) |
| 13 | 2 | — | Hex socket hdls Zn plated steel cup pt set screw (0.190-32 x 0.312) |
| 14 | 1 | — | Hex socket head Zn plated steel cap screw (0.138-32 x 0.500) |
| 15 | 1 | 5328933_1 | Wiring harness |
| 16 | 2 | 1210-00 | Zn plated steel shakeproof int lockwasher |
| 17 | 1 | 1963318__ | Nameplate |
| 18 | 1 | No. 20 | Carton |
| 19 | 1 | 5328962 | Print |

*Table A-39. UP5 and UP6 Electric Shaft Position Transmitter Kit, Figure A-24 (Kit No. 5328962_2)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 19934_208 | Spacer |
| 2 | 2 | — | Pan head Zn plated steel machine screw (0.190-32 x 1.000) |
| 3 | 1 | 5328596_2 | Arm |
| 4 | 1 | 5312449_12 | Connecting link |
| 6 | 1 | 5328698_2 | Electric shaft position transmitter |
| 7 | 1 | — | Steel dowel pin (0.375 x 1.500) |
| 8 | 1 | 5328924_1 | Coupler |
| 9 | 4 | 1943825_1 | Stud terminal |
| 10 | 1.5 m (5.0 ft) | R2041-1583 | 22 AWG white/gray leadwire |
| 11 | 1.5 m (5.0 ft) | R2041-1582 | 22 AWG white/violet leadwire |
| 12 | 3 | — | Hex head Zn plated steel sems ext (0.190-32 x 0.500) |
| 13 | 2 | — | Hex socket hdls Zn plated steel cup pt set screw (0.190-32 x 0.312) |
| 14 | 1 | — | Hex socket head Zn plated steel cap screw (0.138-32 x 0.500) |
| 15 | 1 | 5328933_1 | Wiring harness |
| 16 | 2 | 1210-00 | Zn plated steel shakeproof int lockwasher |
| 17 | 1 | 1963318__ | Nameplate |
| 18 | 1 | No. 20 | Carton |
| 19 | 1 | 5328962 | Print |

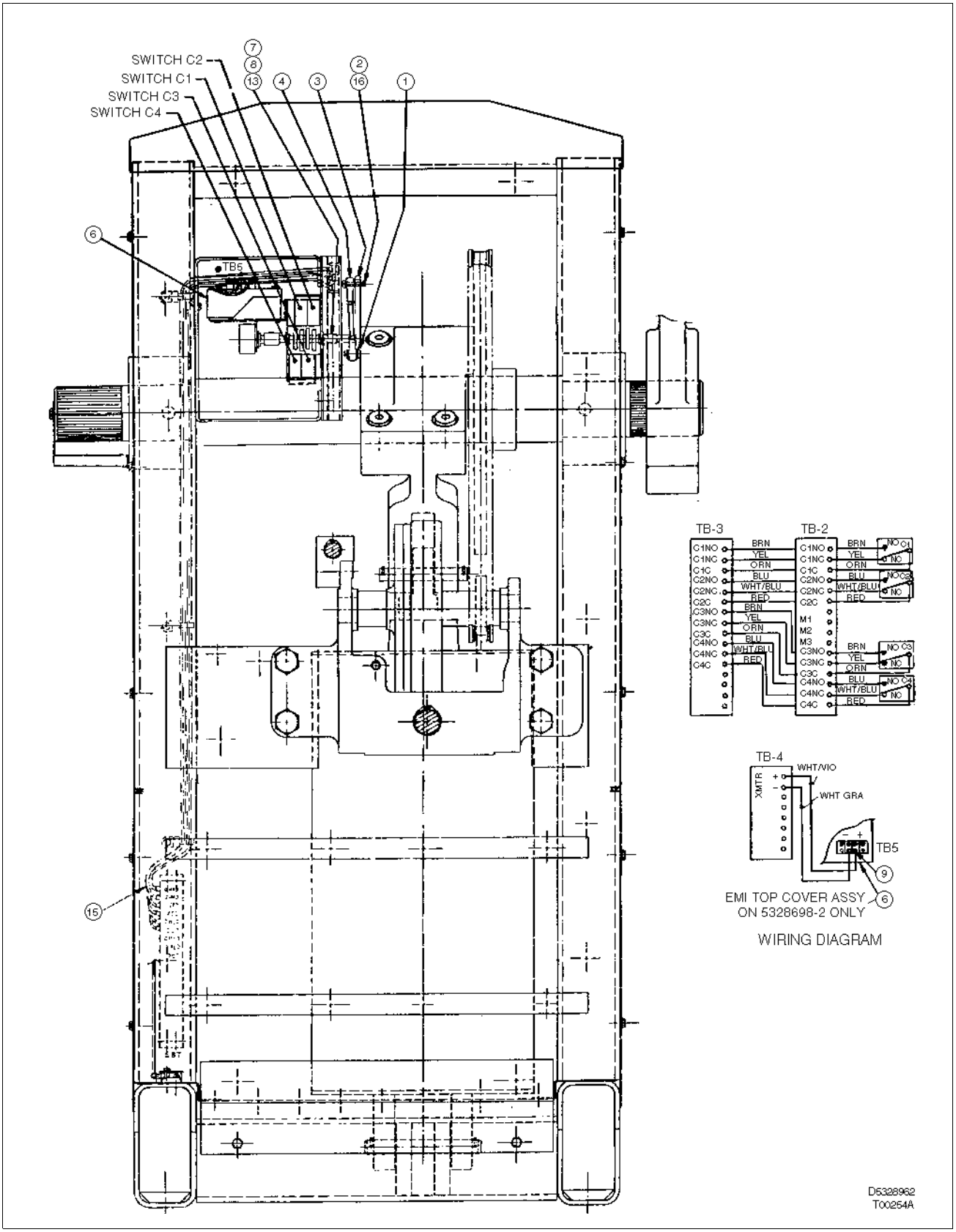



*Figure A-24. UP5 and UP6 with Electric Shaft Position Transmitter and/or Alarm/Travel Switches, Tables A-38, A-39, A-48 and A-49 (Sheet 1 of 2)*

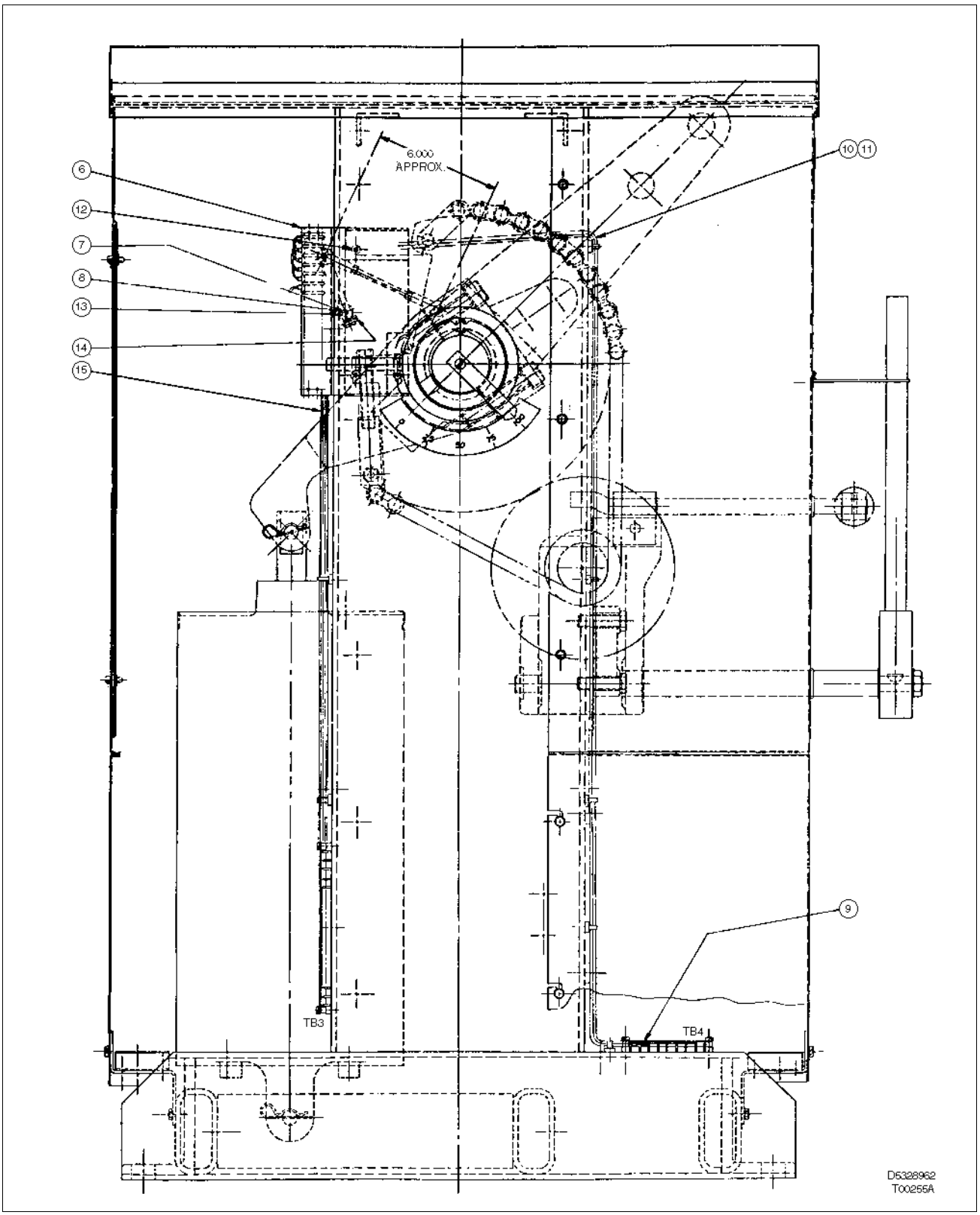



*Figure A-24. UP5 and UP6 with Electric Shaft Position Transmitter and/or Alarm/Travel Switches, Tables A-38, A-39, A-48 and A-49 (Sheet 2 of 2)*

*Table A-40. UP5 and UP6 Pneumatic Shaft Position Transmitter Kit, Figure A-25(Kit No. 5328963 _1)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 2 | 1951609_1 | Bulkhead fitting |
| 2 | 2 | 5311759_1 | Ball joint |
| 3 | 1 | 5328958_1 | Transmitter drive rod |
| 4 | 4 | 1114-00 | Zn plated steel shakeproof lockwasher |
| 5 | 4 | — | Pan head Zn plated steel cap screw (0.250-20 x 0.500) |
| 6 | 3 | 4-4CBI2-B | Male elbow |
| 7 | 1 | 4-4FBI2-B | Male connector |
| 8 | 1 | 4-4-4RBI2-B | Male run tee |
| 9 | 122 cm (4 ft) | R1021-0022 | 0.250 OD x 0.040 wall Al tubing |
| 10 | 1 | FORM MP290 | Warning tag |
| 11 | 1 | — | ¼-18 NPT brass pipe plug |
| 12 | 1 | 197120_5 | Elastic stop nut |
| 13 | 1 | AV1_2000 | Positioner assembly |
| 14 | 1 | 1963318__ | Nameplate |
| 16 | 1 | No. 24 | Carton |
| 17 | 1 | 5328963 | Print |
| 18 | 2 | — | Ext lockwasher Zn plated steel hex keps (0.250-28) |
| 19 | 1 | 1210-00 | Zn plated steel shakeproof lockwasher |

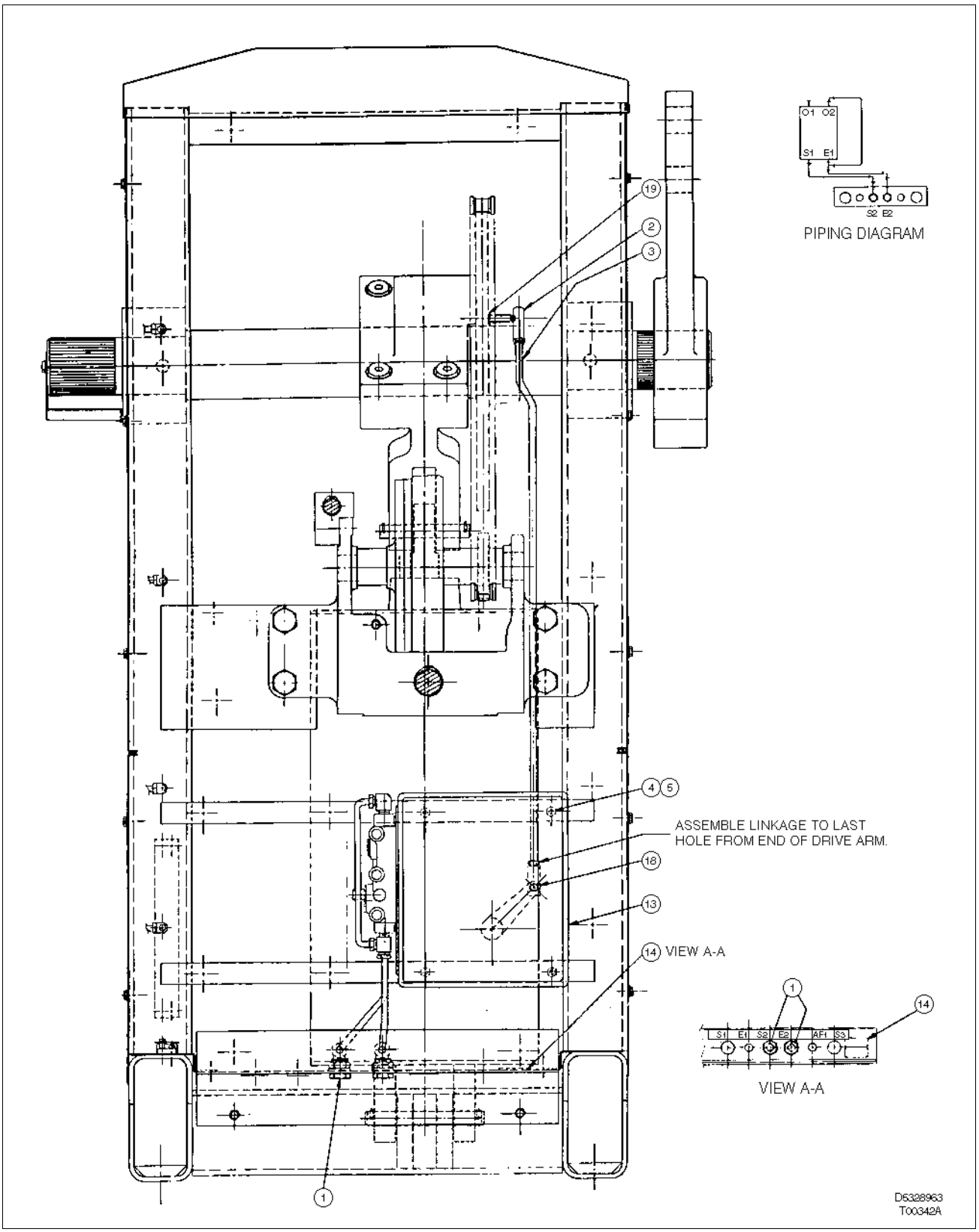



*Figure A-25. UP5 and UP6 with Pneumatic Shaft Position Transmitter, Table A-40 (Sheet 1 of 2)*

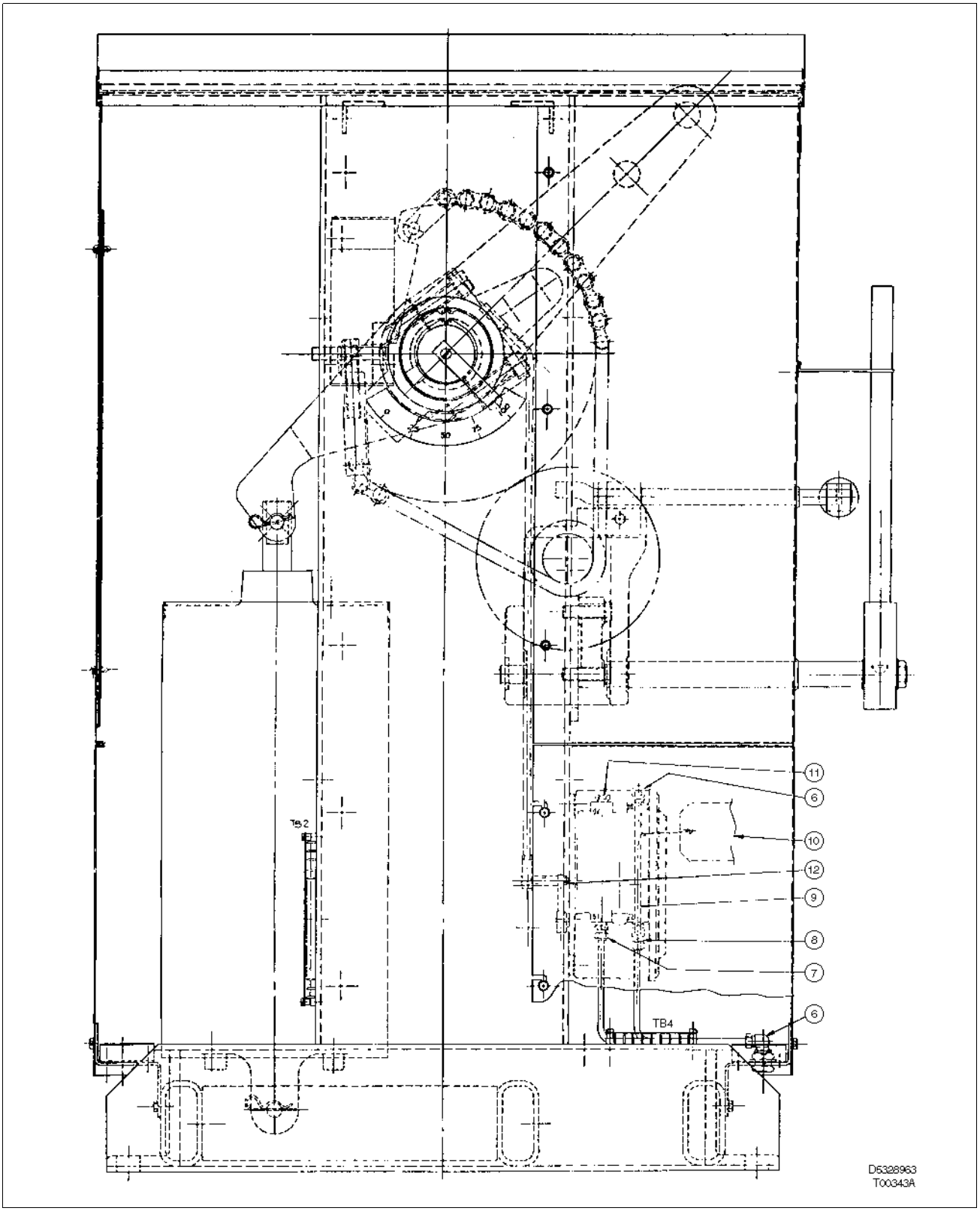



*Figure 25. UP5 and UP6 with Pneumatic Shaft Position Transmitter, Table A-40 (Sheet 2 of 2)*

*Table A-41. UP5 and UP6 with Positioner Air Failure Lock Kit, Figure A-26 (Kit No. 5328964 _1)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 1941099_2 | Pressure switch |
| 2 | 1 | 1941147_1 | ½ molded bushing |
| 3 | 1 | 1951608_1 | Shutoff valve |
| 4 | 1 | 5328959_1 | Valve mounting bracket |
| 5 | 3 | 5318451_2 | 3-way pneumatic valve |
| 6 | 1 | 1963478_1 | Instruction plate |
| 7 | 1 | 1951609_1 | Bulkhead fitting |
| 8 | 1 | 5328782_2 | Air failure lock harness |
| 9 | 1 | 1951589_1 | Air valve |
| 10 | 1 | 1963318__ | Nameplate |
| 11 | 1 | — | ¼ NPT brass tee |
| 12 | 1 | — | Brass reducing bushing (½ x ¼) |
| 13 | 2 | 4-4CBI2-B | Male elbow |
| 14 | 4 | 1951407_1 | Male connector |
| 15 | 2 | 8-8CBI2-B | Male elbow |
| 16 | 4 | 4-4-4SBI2-B | Male branch tee |
| 17 | 1 | — | ¼ NPT brass close nipple |
| 18 | 2 | — | Brass reducing bushing ( ⅜ x ¼) |
| 19 | 4 | 4-4FBI2-B | Male connector |
| 20 | 4.3 m (14.0 ft) | R9021-0050 | ½ OD nylon tubing |
| 21 | 4.3 m (14.0 ft) | R1021-0022 | 0.250 OD x 0.040 wall Al tubing |
| 22 | 10 | — | Hex head Zn plated steel cap screw (0.250-20 x 1.000) |
| 23 | 10 | — | Ext lockwasher Zn plated steel hex keps (0.250-20) |
| 24 | 3 | — | ½ std brass pipe plug |
| 25 | 1 | — | Cotton draw string bag |
| 26 | 1 | No. 100 | Carton |
| 27 | 1 | 5328964 | Print |
| 28 | 6 | — | Plain Zn plated steel washer (0.312 x 0.734 x 0.065) |
| 29 | 1 | — | ⅛ brass pipe plug |
| 30 | 1 | 3053306 | Print |

*Table A-42. UP5 and UP6 with Solenoid Valve Air Failure Lock Kit, Figure A-26 (Kit No. 5328964 _2)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 1941099_2 | Pressure switch |
| 2 | 1 | 1941147_1 | ½ molded bushing |
| 4 | 1 | 5328959_1 | Valve mounting bracket |
| 5 | 3 | 5318451_2 | 3-way pneumatic valve |
| 6 | 1 | 1963478_1 | Instruction plate |
| 7 | 1 | 1951609_1 | Bulkhead fitting |
| 8 | 1 | 5328782_2 | Air failure lock harness |
| 9 | 1 | 1951589_1 | Air valve |
| 10 | 1 | 1963318__ | Nameplate |
| 11 | 1 | — | ¼ NPT brass tee |
| 12 | 1 | — | Brass reducing bushing (½ x ¼) |
| 13 | 2 | 4-4CBI2-B | Male elbow |
| 14 | 4 | 1951407_1 | Male connector |
| 15 | 2 | 8-8CBI2-B | Male elbow |
| 16 | 4 | 4-4-4SBI2-B | Male branch tee |
| 17 | 1 | — | ¼ NPT brass close nipple |
| 18 | 2 | — | Brass reducing bushing (⅜ x ¼) |
| 19 | 4 | 4-4FBI2-B | Male connector |
| 20 | 4.3 m (14.0 ft) | R9021-0050 | ½ OD nylon tubing |
| 21 | 4.3 m (14.0 ft) | R1021-0022 | 0.250 OD x 0.040 wall Al tubing |
| 22 | 10 | — | Hex head Zn plated steel cap screw (0.250-20 x 1.000) |
| 23 | 10 | — | Ext lockwasher Zn plated steel hex keps (0.250-20) |
| 24 | 3 | — | ½ std brass pipe plug |
| 25 | 1 | — | Cotton draw string bag |
| 26 | 1 | No. 100 | Carton |
| 27 | 1 | 5328964 | Print |
| 28 | 6 | — | Plain Zn plated steel washer (0.312 x 0.734 x 0.065) |
| 29 | 1 | — | ⅛ brass pipe plug |
| 30 | 1 | 3053306 | Print |

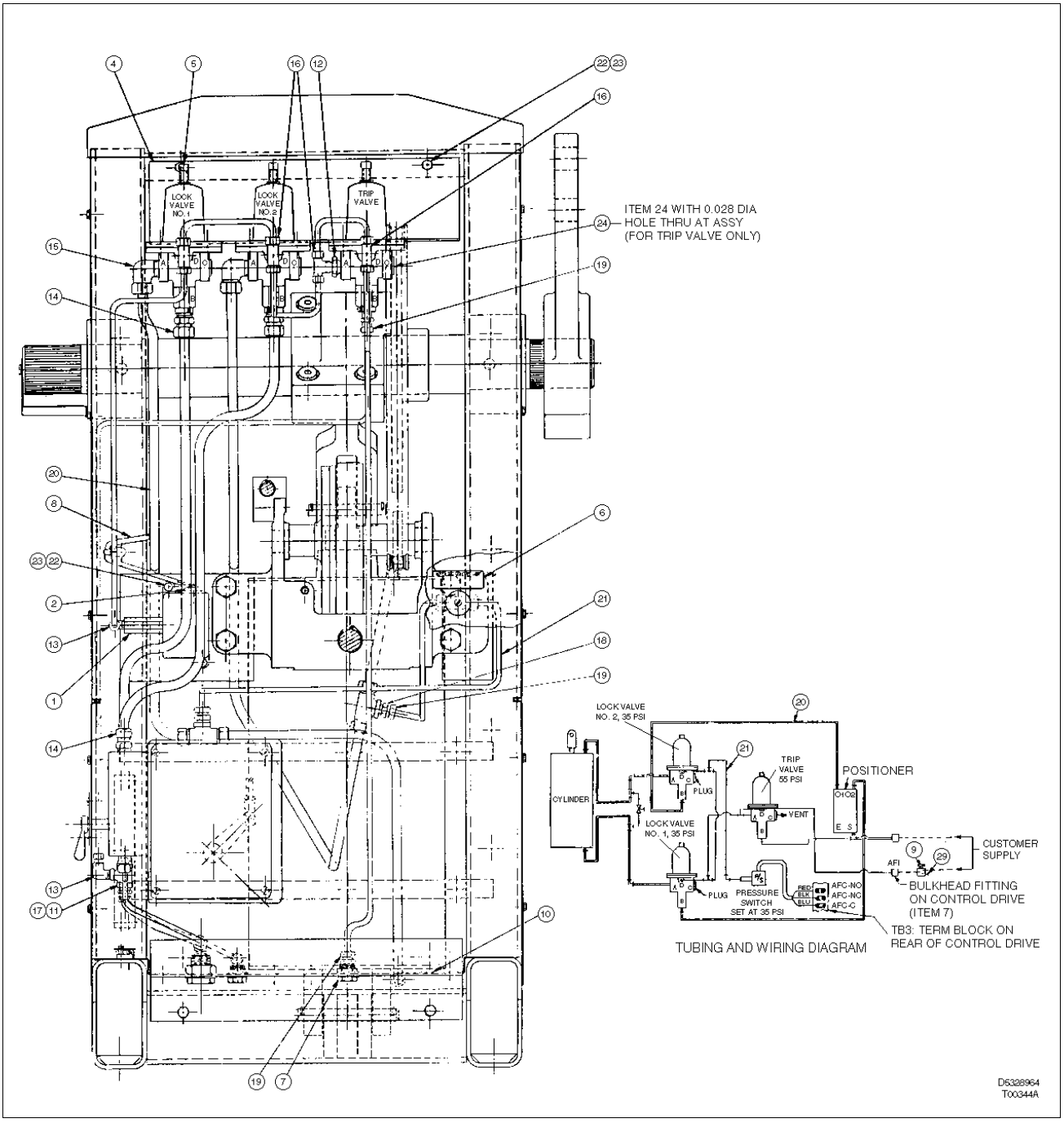



*Figure A-26. UP5 and UP6 with Air Failure Lock, Tables A-41 and A-42 (Sheet 1 of 2)*

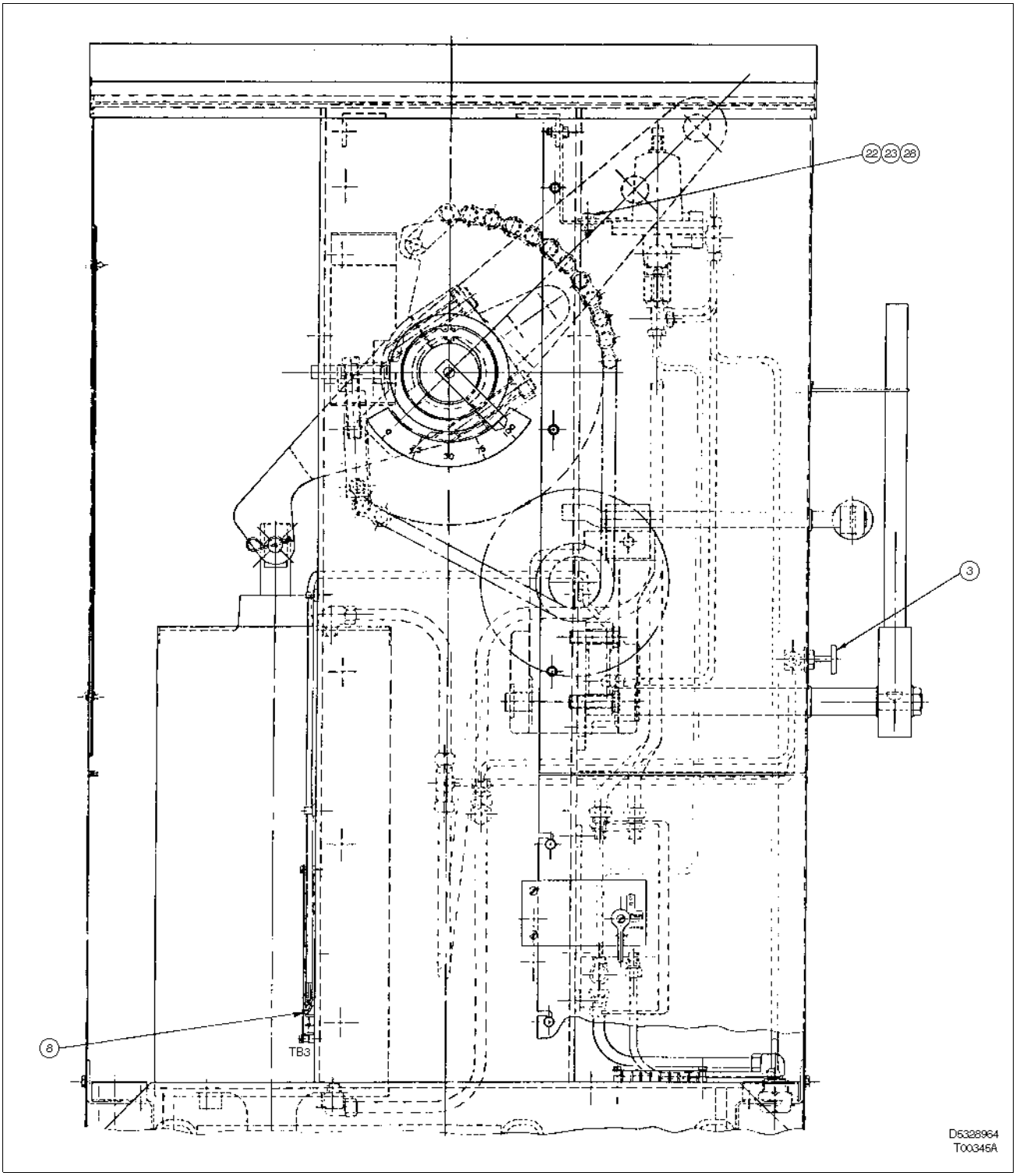



*Figure A-26. UP5 and UP6 with Air Failure Lock, Tables A-41 and A-42 (Sheet 2 of 2)*

*Table A-43. UP5 and UP6 Reserve Air Tank Kits, Figure A-27 (Kit Nos. 5328964___)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 1941099_2 | Pressure switch |
| 2 | 1 | 1941147_1 | ½ molded bushing |
| 3 | 1 | 1951608_1 | Shut-off valve for UP5 and UP6 with positioner (kit no. 5328964__1). Omit for UP5 and UP6 with solenoid valve (kit no. 5328964__2). |
| 4 | 1 | 5328959_1 | Valve mounting bracket |
| 5 | 2 | 5318451_2 | 3-way pneumatic valve |
| 6 | 1 | 1963478_1 | Instruction plate |
| 7 | 1 | 1951609_1 | Bulkhead fitting |
| 8 | 1 | 5328782_1 | Air failure lock harness |
| 9 | 1 | 1951712_1 | Check valve |
| 10 | 1 | 1963318__ | Universal nameplate |
| 11 | 1 | — | ¼ NPT brass tee |
| 12 | 1 | — | (½ x ¼) brass reducing bushing |
| 13 | 3 | 4-4CB12-B | Male elbow |
| 14 | 4 | 1951407_1 | Male connector |
| 15 | 7 | 8-8CB12-B | Male elbow |
| 16 | 2 | 4-4-4SB12-B | Male branch tee |
| 17 | 1 | — | ¼ NPT brass close nipple |
| 18 | 2 | — | ( ⅜ x ¼) brass reducing bushing for UP5 and UP6 with positioner (kit no. 5328964__1). Omit for UP5 and UP6 with solenoid valve (kit no. 5328964__2). |
| 19 | 2 | 4-4FB12-B | Male connector for UP5 and UP6 with positioner (kit no. 5328964__1). Omit for UP5 and UP6 with solenoid valve (kit no. 5328964__2). |
| 20 | 4.3 m (14 ft) | R9021-0050 | 0.500 OD nylon tubing |
| 21 | 4.3 m (14 ft) | R1021-0022 | 0.250 OD x 0.040 wall tubing |
| 22 | 8 | NAUAC21016 | Hex cap screw (0.250-20) |
| 23 | 8 | NNBAC21000 | Hex keps nut (0.250-20) |
| 24 | 1 | — | ½ NPT brass tee |
| 25 | 1 | — | ½ NPT brass close nipple |
| 27 | 1 | 1951408_1 | Male elbow |
| 28 | 4 | NTCAC11000 | Flat washer (0.250) |
| 29 | 1 | 1941817_1 | Conduit gasket |
| 30 | 2 | 1941817_3 | Conduit gasket |
| 31 | 2 | 1951612_1 | Bulkhead fitting |
| 32 | 1 | 1963489_4 | Designation plate |
| 33 | 1 | 1951785_8 | 30.3 liter (8.0 gallon) air tank assembly for UP5 (kit no. 5328964_5_) (Fig. B-11). |
| | | 1951785_17 | 64.4 liter (17.0 gallon) air tank assembly for UP6 (kit no. 5328964_6_) (Fig. B-12) |
| 34 | 1 | C3053544-Sh2 | Print |

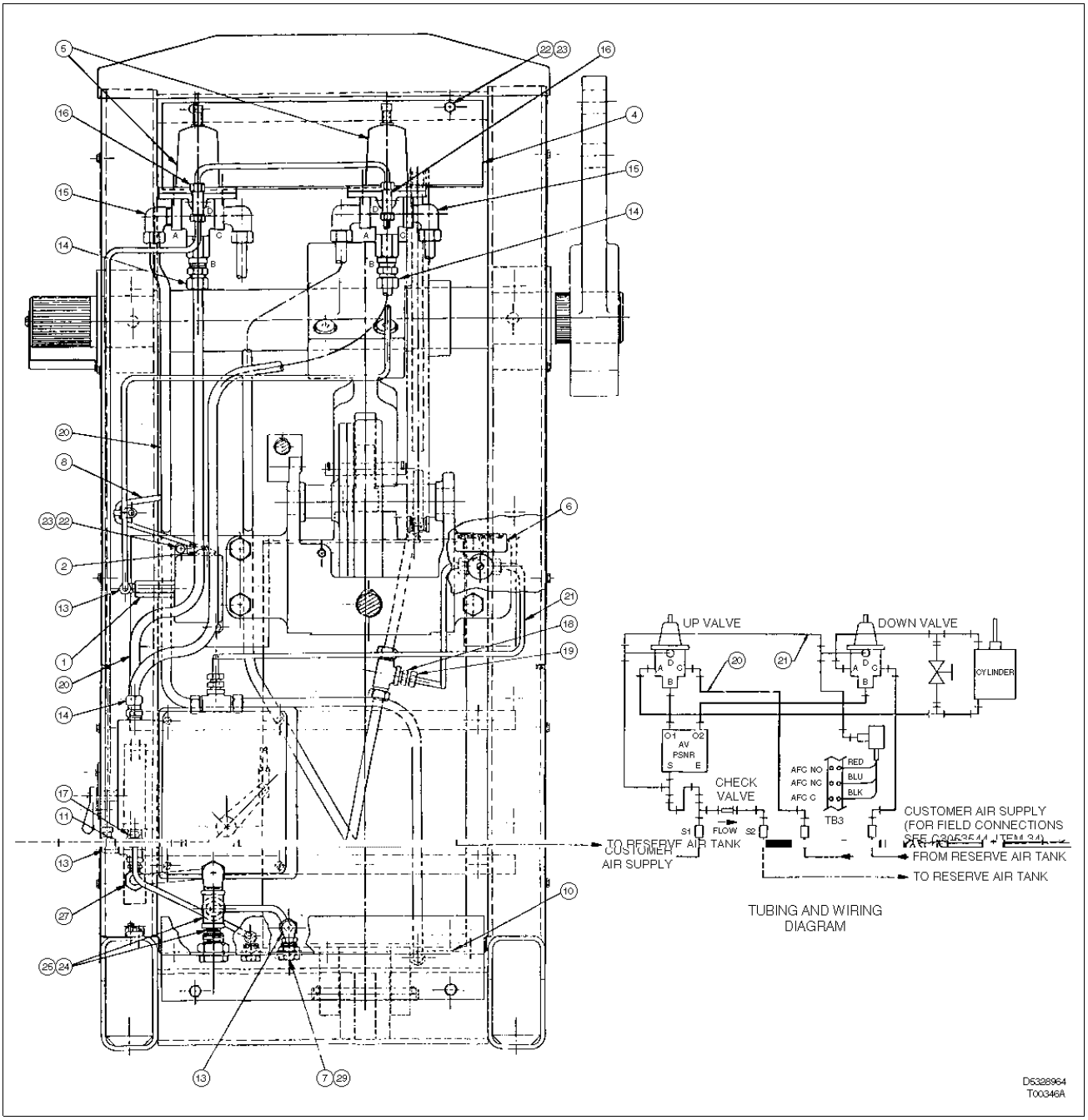



*Figure A-27. UP5 and UP6 with Reserve Air Tank, Table A-43 (Sheet 1 of 2)*

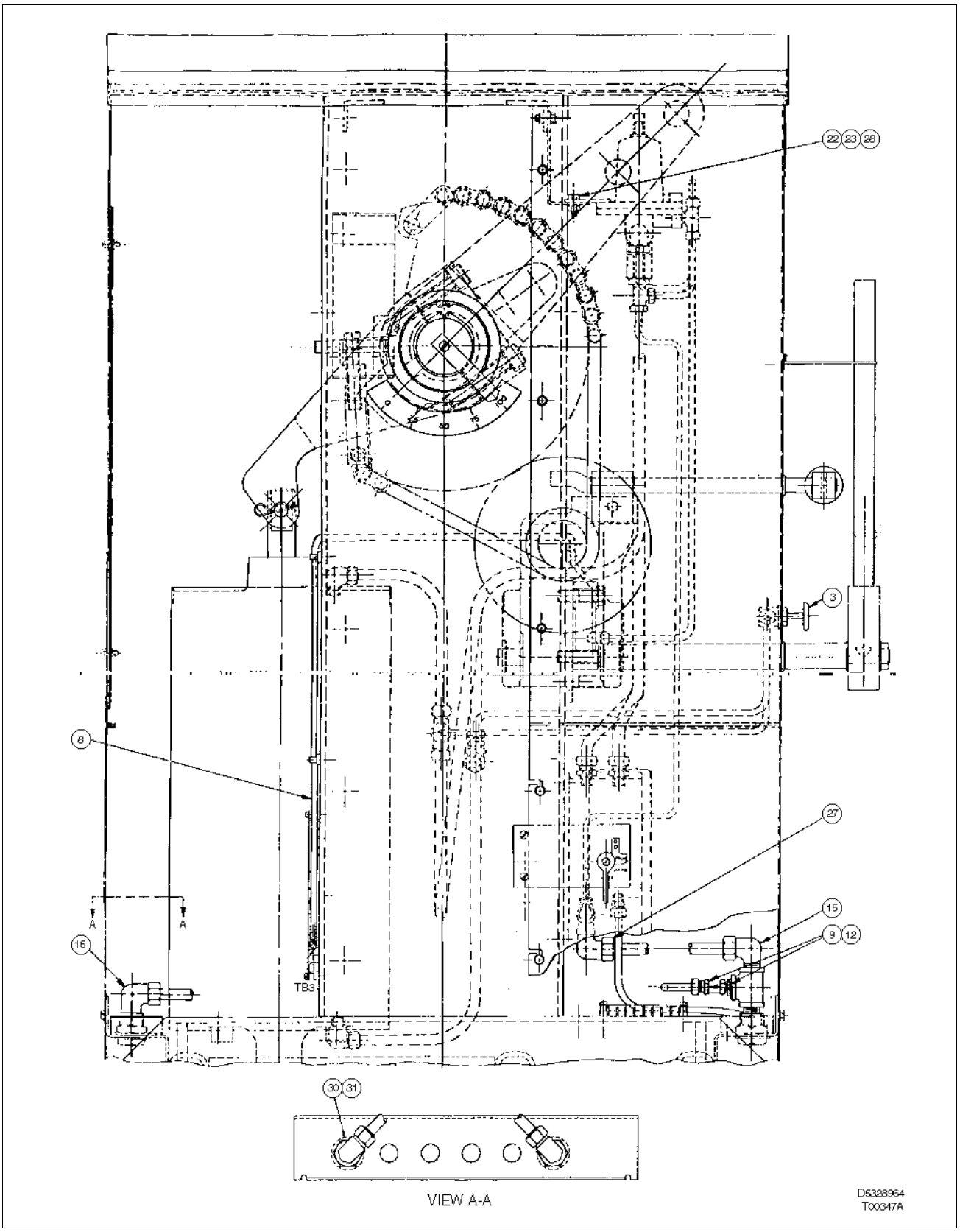



*Figure A-27. UP5 and UP6 with Reserve Air Tank, Table A-43 (Sheet 2 of 2)*

*Table A-44. UP5 Cylinder Spare Parts Kit, Figure 8-4 (Kit No. 258241 _1)*

| Qty | Part No. | Description | Qty | Part No. | Description |
|---|---|---|---|---|---|
| 2 | 5311428_41 | O-ring | 1 | 195852_1 | Wiper ring |
| 1 | 195825_9 | O-ring | 1 | 5311428_24 | O-ring |
| 1 | 5328768_1 | Piston | A/R | 199354_1 | Lubricant |
| 1 | 1951359_220 | O-ring | 1 | No. 39 | Carton |
| 2 | 195851_1 | Back up ring | 1 | 258241 | Print |

*Table A-45. UP6 Cylinder Spare Parts Kit, Figure 8-5 (Kit No. 258242 _1)*

| Qty | Part No. | Description | Qty | Part No. | Description |
|---|---|---|---|---|---|
| 2 | 5311428_39 | O-ring | 1 | 5311428_24 | O-ring |
| 1 | 5328941_1 | Piston | 1 | 195852_1 | Wiper ring |
| 1 | 195825_9 | O-ring | A/R | 199354_1 | Lubricant |
| 2 | 195851_1 | Back up ring | 1 | No. 18 | Carton |
| 1 | 1951359_220 | O-ring | 1 | 258242 | Print |

*Table A-46. UP5 and UP6 Heater Kits, Figure A-28 (Kit Nos. 5328965 _1/3)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 662460_1 | Thermoswitch |
| 2 | 2 | 1941401_2 | Solderless terminal |
| 3 | 1 | 195105_10 | Tube clamp |
| 4 | 2 | 1943825_8 | Stud terminal |
| 5 | 2 | 197118_2 | Conduit connector |
| 6 | 6 | 1943825_11 | Stud terminal |
| 7 | 2 | 1943002_1 | Strip heater for 120 VAC operation (kit no. 5328965_1) |
| | | 1943002_2 | Strip heater for 240 VAC operation (kit no. 5328965_3) |
| 8 | 4 | 19934_87 | Spacer |
| 9 | 2.6 $m^2$ (28.0 $ft^2$) | 5318366_1U | Fiberglass insulation |
| 10 | 1 | 1963318__ | Nameplate |
| 12 | 3 m (10 ft) | R2049-0100 | 14 AWG natural leadwire |
| 13 | 1 | — | Pan head Zn plated steel sems int (0.190-32 x 0.375) |
| 14 | 4 | NBZAC21016 | slotted pan head screw (0.250-20) |
| 15 | 4 | NTKAC25000 | Shakeproof lockwasher (0.250) |
| 16 | 1 | 5328965 | Print |
| 17 | 1 | No. 17 | Carton |

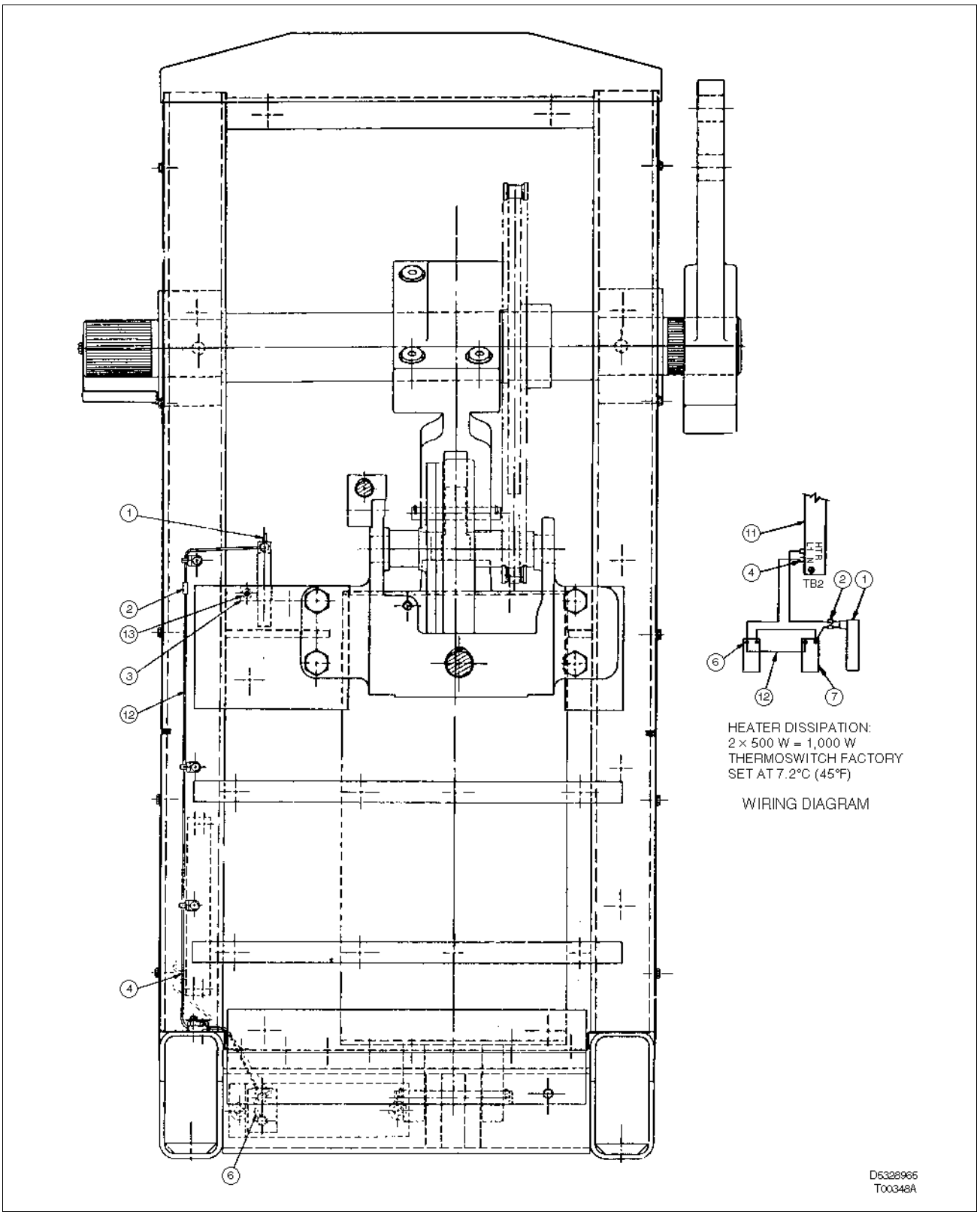



*Figure A-28. UP5 and UP6 Actuators with Heater, Table A-46 (Sheet 1 of 2)*

*Table A-47. UP6 Volume Boosters Kit, Figure A-29 (Kit No. 5329155)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 5328566_1 | Mounting plate |
| 2 | 2 | 5329020_1 | Mounting bracket |
| 3 | 2 | 5328021_2 | Volume booster |
| 4 | 1 | 5328018_1 | Supply manifold |
| 5 | 2 | 5328018_2 | Supply manifold |
| 6 | 1 | 5329016_1 | Bottom flange |
| 7 | 1 | 5329017_1 | Top flange |
| 8 | 2 | 1951772_1 | Hose fitting (male) |
| 9 | 8 | 1951773_1 | Hose fitting (female) |
| 11 | 5 | 5328013_1 | SAE/NPT male elbow |
| 12 | 3 | 5328014_1 | SAE/NPT male connector |
| 13 | 1 | 5323705_1 | Elbow |
| 14 | 2 | 1951407_1 | Male connector |
| 15 | 4 | 195426_1 | ¾ brass close nipple |
| 17 | 3 | 195153_¾ | ¾ brass tee |
| 18 | 2 | 1951408_1 | Male elbow |
| 19 | 4 | 195137_¾ | 90_ street elbow |
| 20 | 1 | 1963318__ | Nameplate |
| 21 | A/R | 197743_3 | Ty-wrap |
| 23 | 2 | — | ¾-14 NPT brass pipe plug |
| 24 | 6.1 m (20.0 ft) | R9025-0033 | 0.750 ID black synthetic rubber hose with textile braid reinforcement |
| 25 | 2.4 m (8.0 ft) | R9021-0050 | 0.062 wall x 0.500 OD polyester reinforced nylon tubing |
| 26 | A/R | NPTAC18032 | Cherry N rivet |
| 27 | 6 | NIEAC16008 | Hex sems ext (0.190-32) |
| 28 | 6 | NTCAC09000 | Flat washer (0.190) |
| 29 | 6 | NAUAC21012 | Hex cap screw (0.250-20) |
| 30 | 12 | NTAAC11000 | Flat washer (0.250) |
| 31 | 6 | NNBAC21000 | Hex keps nut (0.250-20) |
| 32 | 1 | 3053268 Sh 2 | Print |

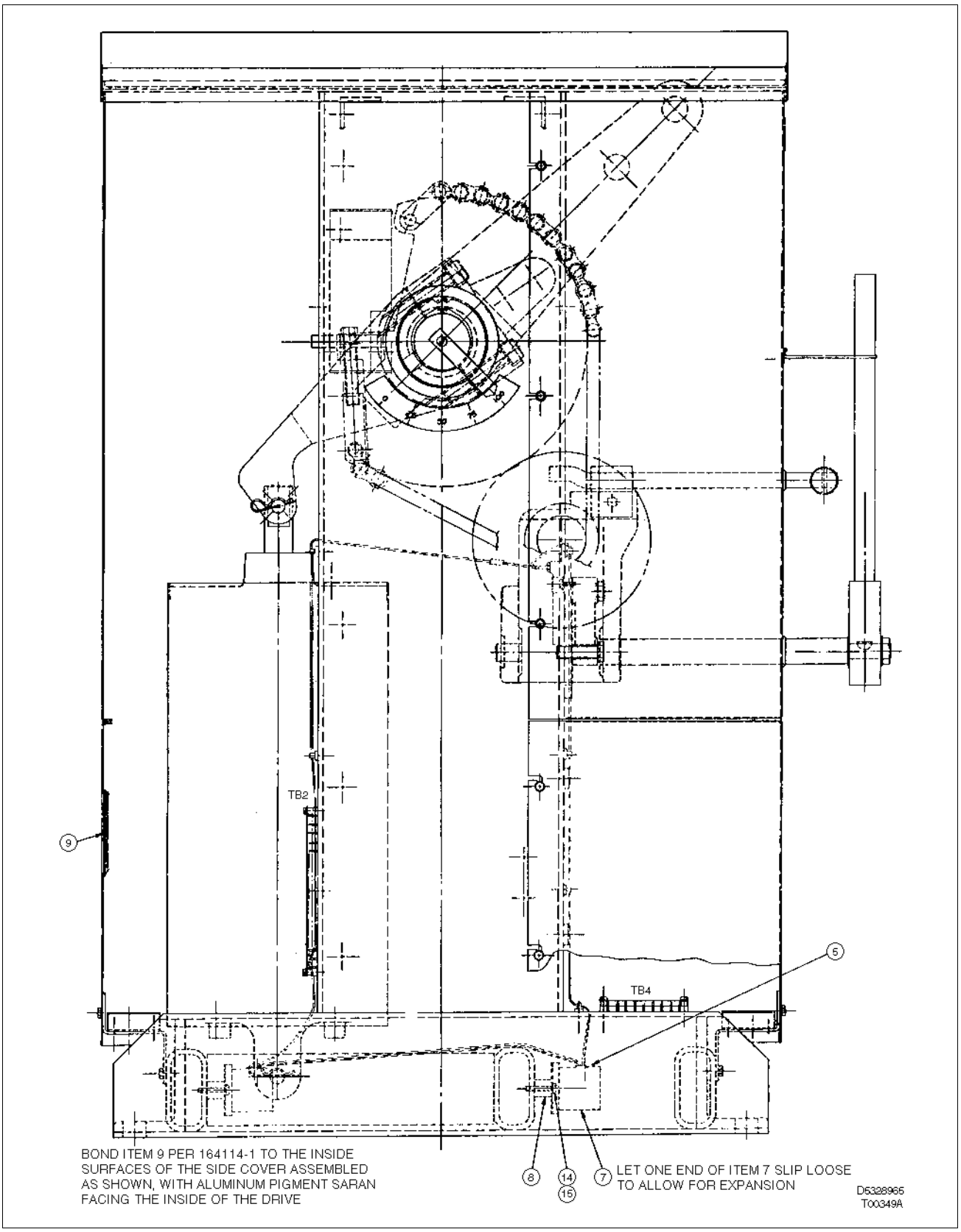



*Figure A-28. UP5 and UP6 Actuators with Heater, Table A-46 (Sheet 2 of 2)*

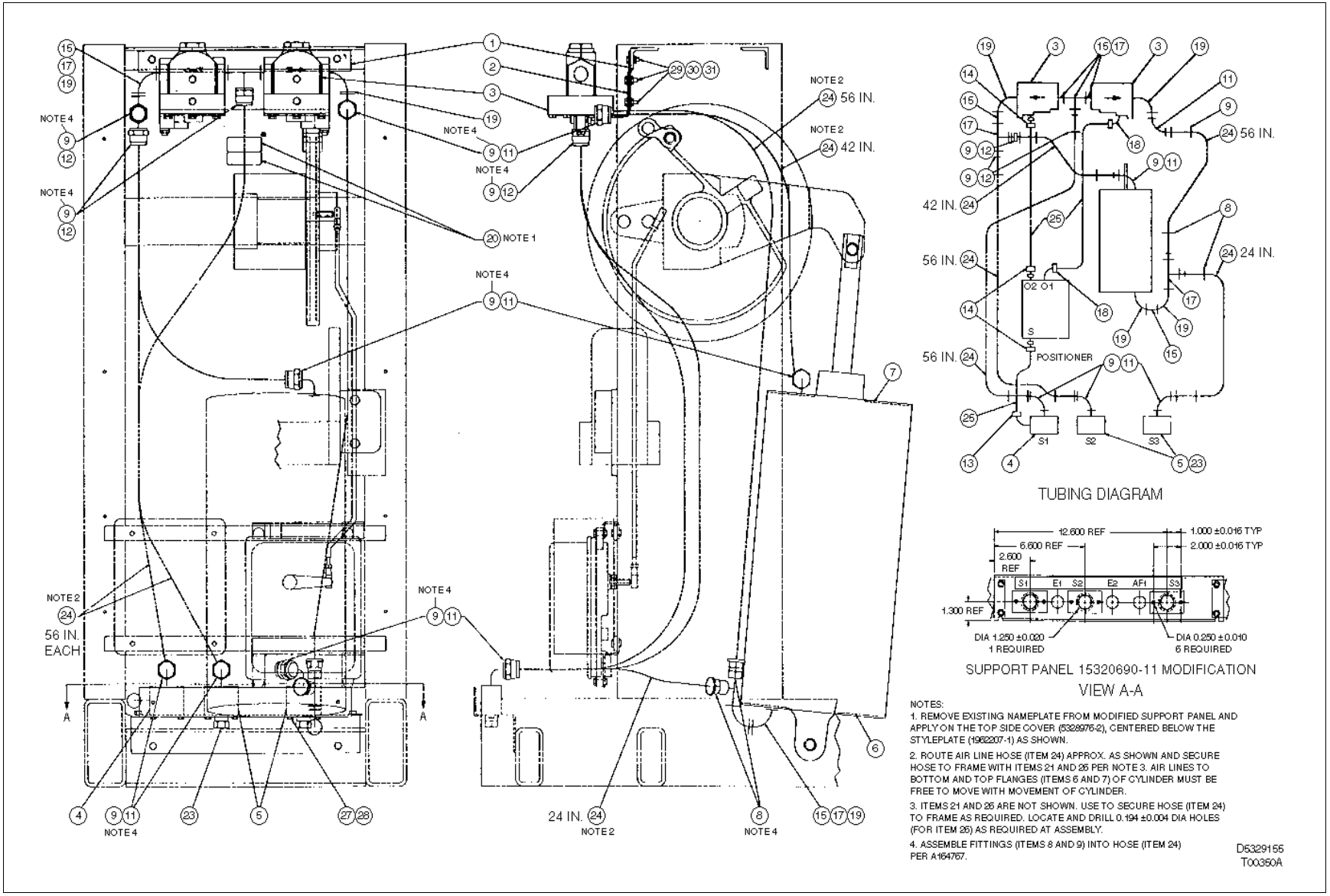



*Figure A-29. UP6 Actuators with Volume Boosters, Table A-47*

## *PARTS KITS FOR ALL ACTUATORS*

Tables A-48 and A-49 and Figure A-30 apply to all types of actuators.

*Table A-48. Parts List for Alarm/Travel Switch Kit, Figure A-30 (Part No. 5328698 _1)*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 1 | 1 | 5328699_1 | Mounting bracket |
| 2 | 1 | 197675_1 | Washer |
| 3 | 1 | 197676_1 | Ground screw |
| 4 | 12 | 1943825_1 | Terminal lug |
| 5 | 1 | 1947256_1 | Desig plate assembly |
| 6 | 4 | 6614403_1 | Switch cam |
| 7 | 2 | 1942768_1 | Microswitch |
| 8 | 1 | 5328700_1 | Shaft |
| 9 | 1 | 194956_16 | Terminal block |
| 11 | 2 | 1947261_1 | Shield |
| 12 | 1 | 5328701_1 | Bracket |
| 13 | 2 | 197164_37 | Retaining ring |
| 21 | 2 | 5328703_1 | Spacer block |
| 22 | 2 | 1942989_1 | Microswitch |
| 25 | 1.1 cm (4.5 in.) | R2041-0070 | 18 AWG brown leadwire |
| 26 | 1.1 cm (4.5 in.) | R2041-0075 | 18 AWG yellow leadwire |
| 27 | 1.1 cm (4.5 in.) | R2041-0050 | 18 AWG orange leadwire |
| 28 | 1.1 cm (4.5 in.) | R2041-0055 | 18 AWG blue leadwire |
| 29 | 1.1 cm (4.5 in.) | R2041-1712 | 18 AWG white/blue leadwire |
| 30 | 1.1 cm (4.5 in.) | R2041-0035 | 18 AWG red leadwire |
| 35 | 2 | — | Pan head Zn plated steel sems ext (0.138-32 x 0.500) |
| 36 | 2 | — | Pan head Zn plated steel sems ext (0.138-32 x 0.750) |
| 37 | 4 | — | Pan head Zn plated steel machine screw (0.114-40 x 2.000) |
| 38 | 8 | 1104-00 | Zn plated steel shakeproof lockwasher |
| 39 | 3 | — | Plain Zn plated steel washer (0.4375 x 1.0000 x 0.0830) |
| 42 | 4 | — | Hex socket head Zn plated steel cap screw (0.112-40 x 0.625) |
| 45 | 1 | No. 62 | Carton |

*Table A-49. Parts List for Electric Shaft Position Transmitter Kit, Figure A-30 (Part No. 5328698 _2)[1]*

| Item | Qty | Part No. | Description |
|---|---|---|---|
| 14 | 1 | 5328702_1 | Coupler |
| 15 | 2 | 197723_1 | Brass tip set screw |
| 16 | 1 | 5839B01P0001 | Feedback potentiometer |
| 17 | 1 | 5328704_1 | Transmitter bracket |
| 18 | 3 | 197688_3 | Threaded spacer |
| 19 | 1 | 6633390_2 | Transmitter board assembly |
| 23 | 3 | 1946162_1 | Pin receptacle |
| 24 | 3 | 197688_6 | Hex standoff |
| 31 | 10 cm (4 in.) | R2041-1664 | 22 AWG white/green leadwire |
| 32 | 10 cm (4 in.) | R2041-1666 | 22 AWG white/violet leadwire |
| 33 | 10 cm (4 in.) | R2041-1667 | 22 AWG white/gray leadwire |
| 34 | 3 | — | Pan head Zn plated steel sems ext (0.138-32 x 0.250) |
| 41 | 2 | — | Pan head Zn plated steel sems int (0.190-32 x 0.250) |
| 43 | 2.5 cm (1.0 in.) | R9023-0165 | Insulation tubing |
| 46 | 1 | 67125_3 | Grommet |
| 47 | 1 | 6637721_1 | EMI bottom cover |
| 48 | 1 | 6637740_1 | EMI top cover |
| 49 | 3 | NTMAC13000 | Lockwasher |
| 50 | 3 | NLMAC13000 | Hex nut |

**NOTE**:

1. Use alarm/travel switch kit part no. 5328698 _1 (refer to Table A-48) as a base and add the parts listed in this table to complete the electric shaft position transmitter kit.

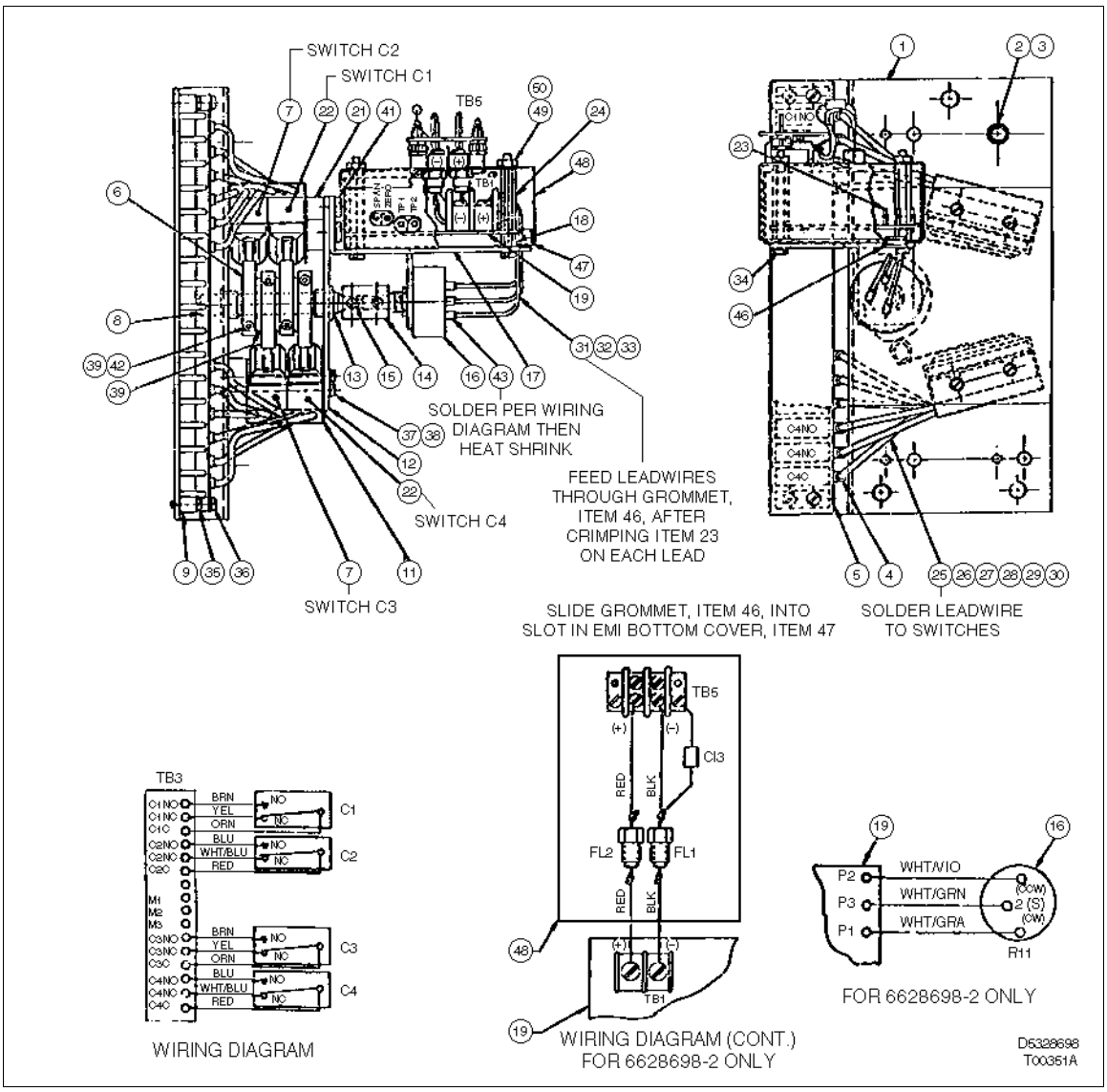



*Figure A-30. Alarm/Travel Switches and Electric Shaft Position Transmitter, Tables A-48 and A-49*

# APPENDIX B - DIMENSION DRAWINGS

## *DIMENSION DRAWINGS*

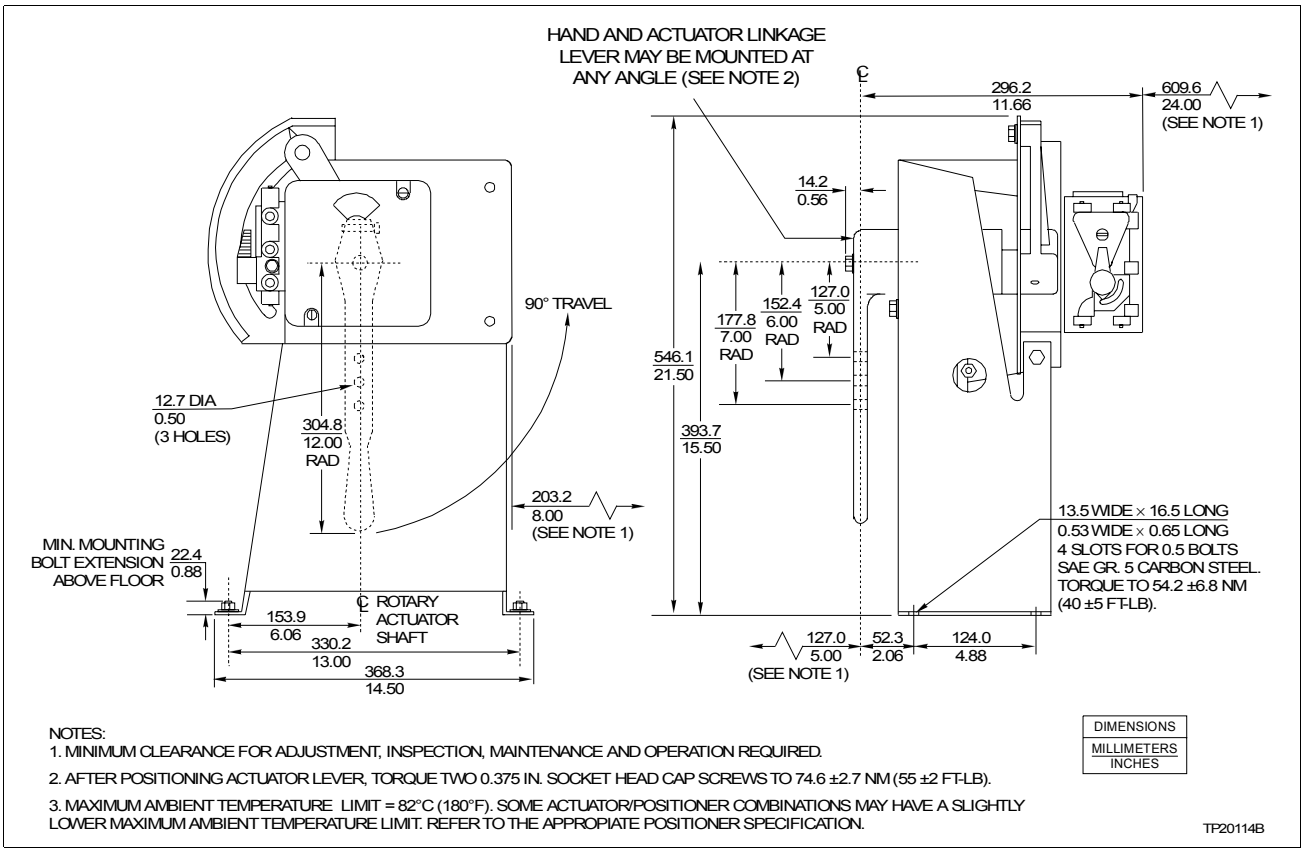



*Figure B-1. Type UP1 Actuator with Type AV Positioner*

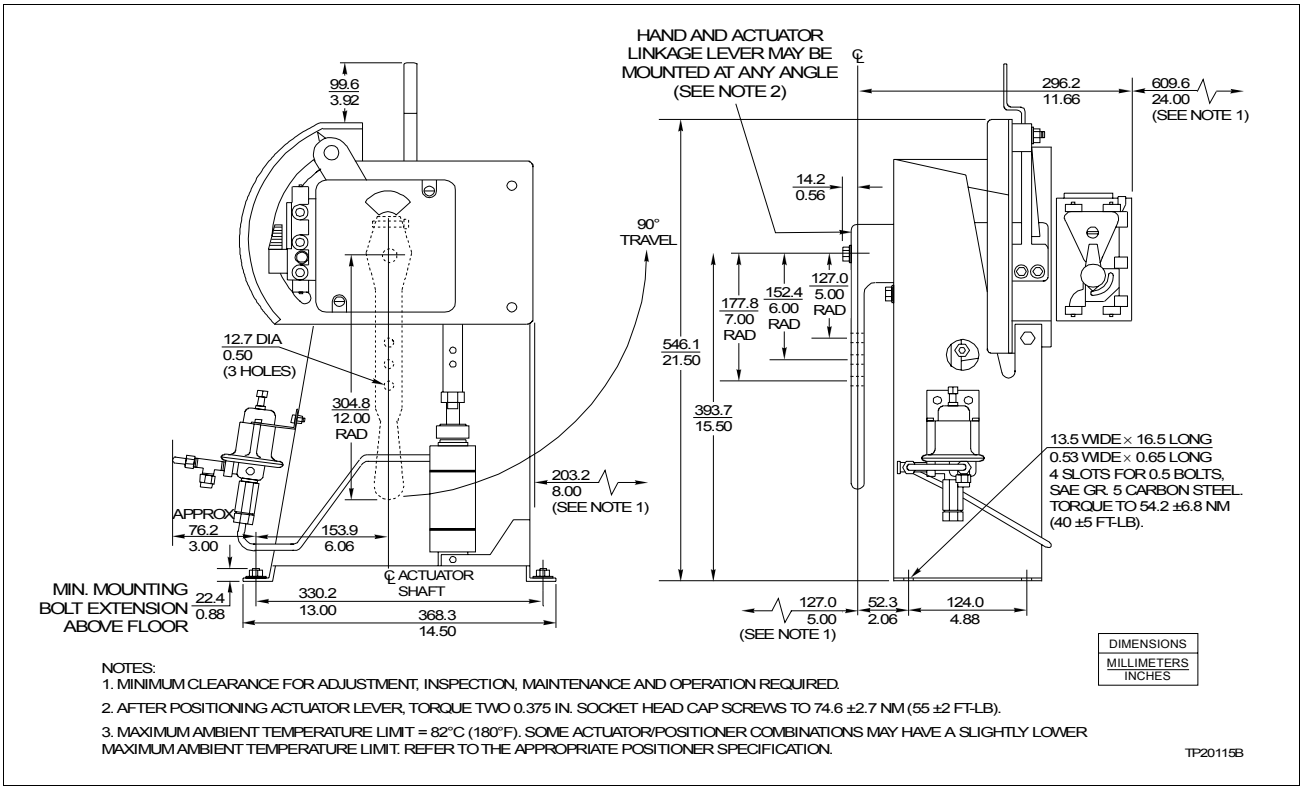



*Figure B-2. Type UP1 Actuator with Type AV Positioner and Air Failure Lock*

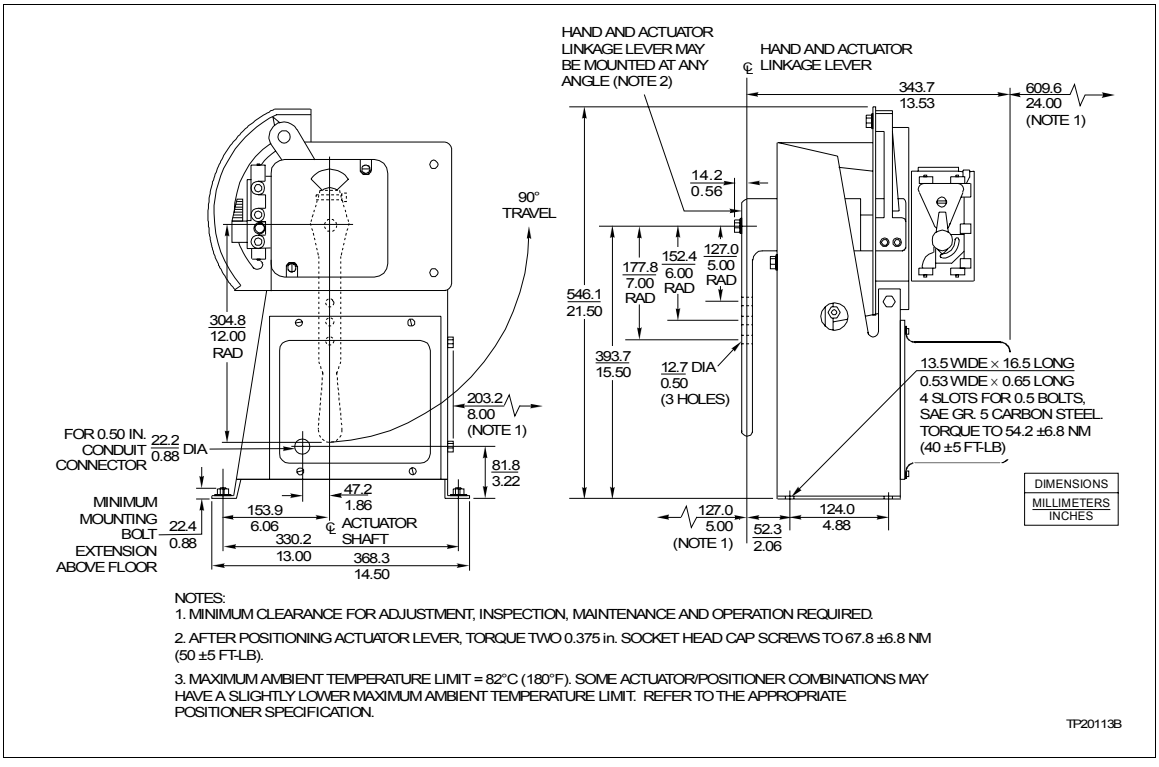



*Figure B-3. Type UP1 Actuator with Type AV Positioner, Electric Shaft Positioner and/or Alarm/Travel Switches*

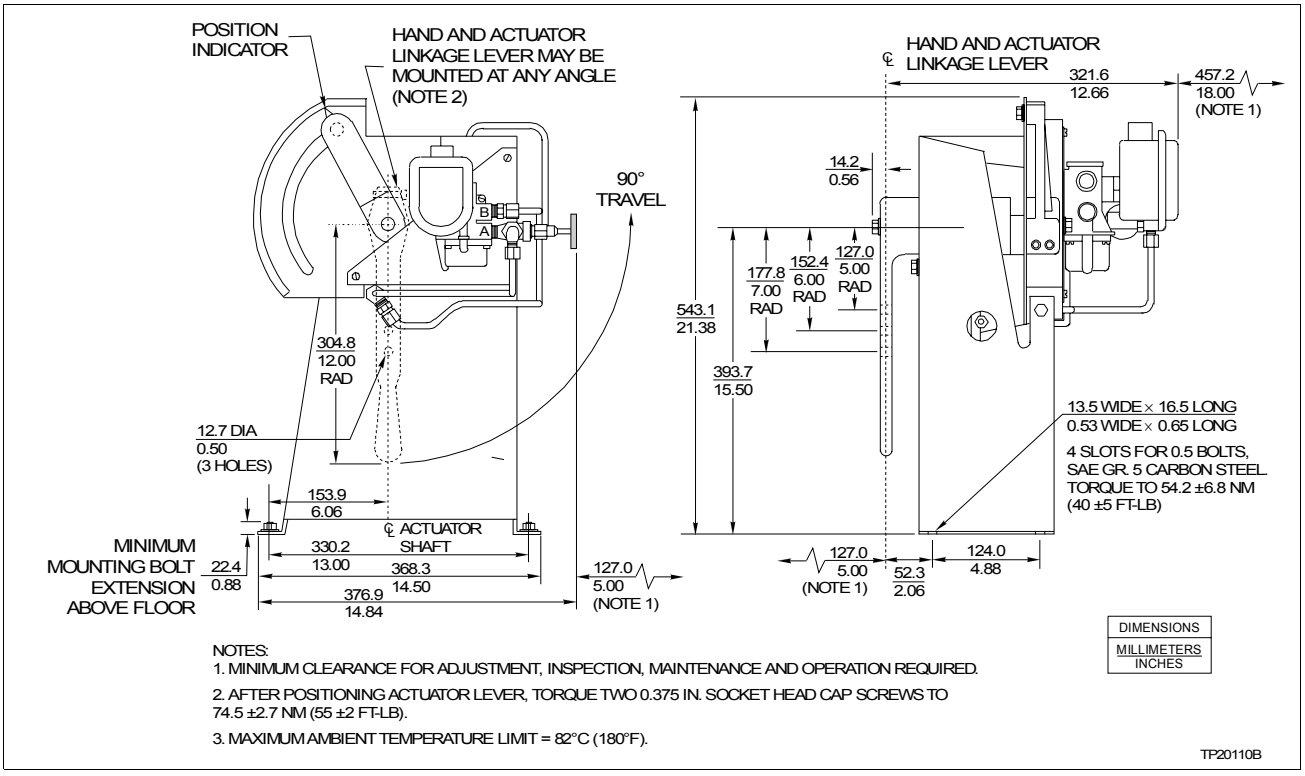



*Figure B-4. Type UP1 Actuator with Solenoid Valve*

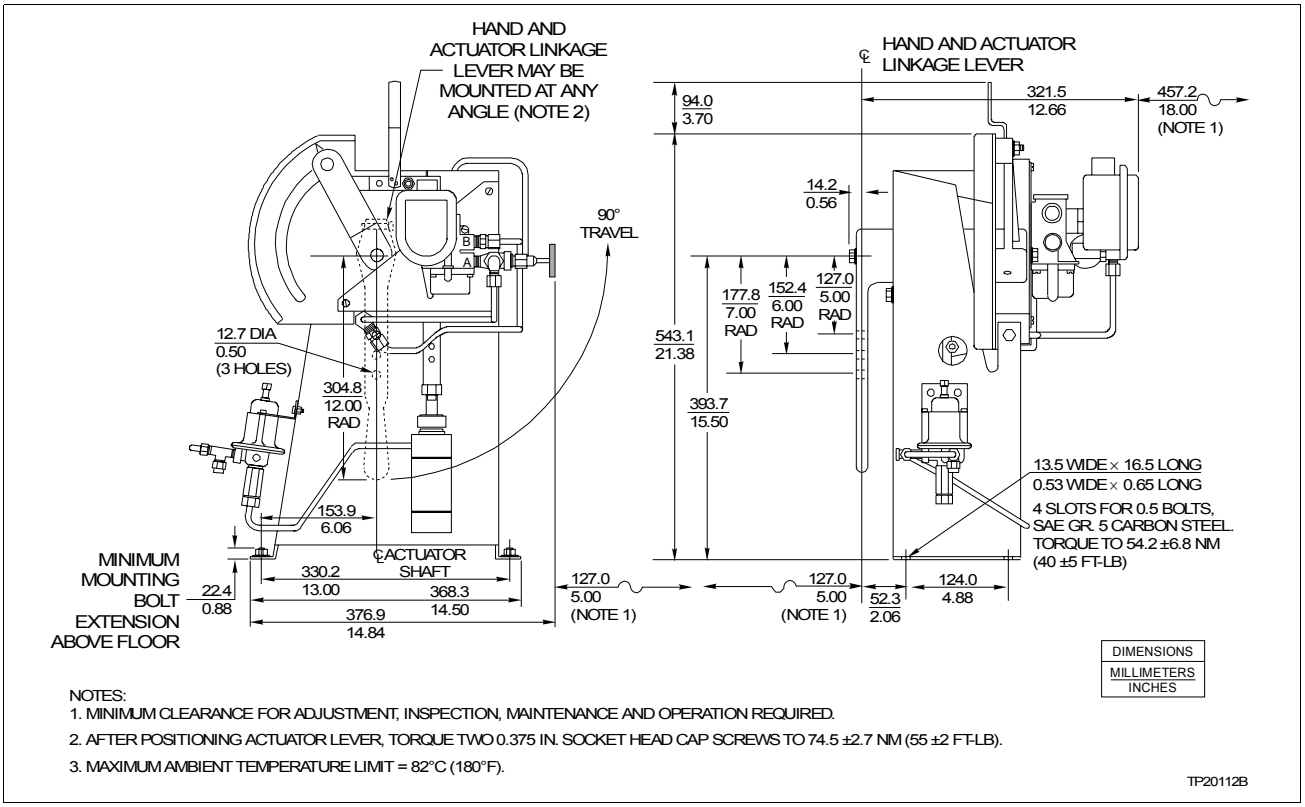



*Figure B-5. Type UP1 Actuator with Solenoid Valve and Air Failure Lock*

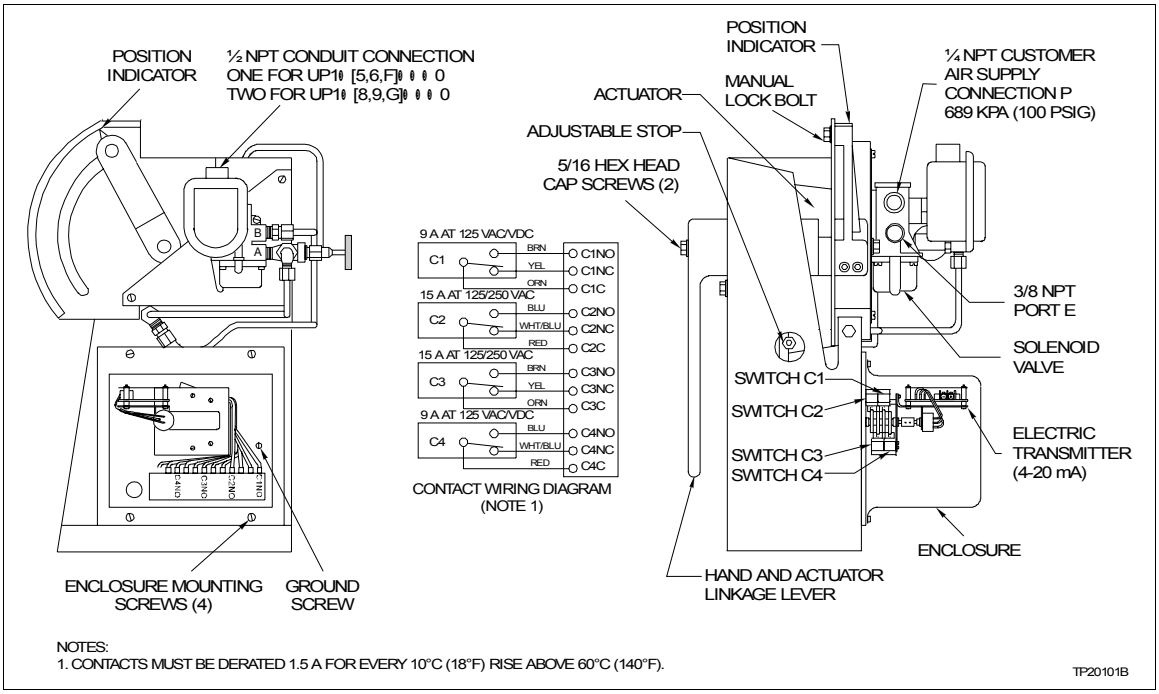



*Figure B-6. Type UP1 Actuator with Solenoid Valve, Electric Shaft Position Transmitter and/or Alarm/Travel Switches*

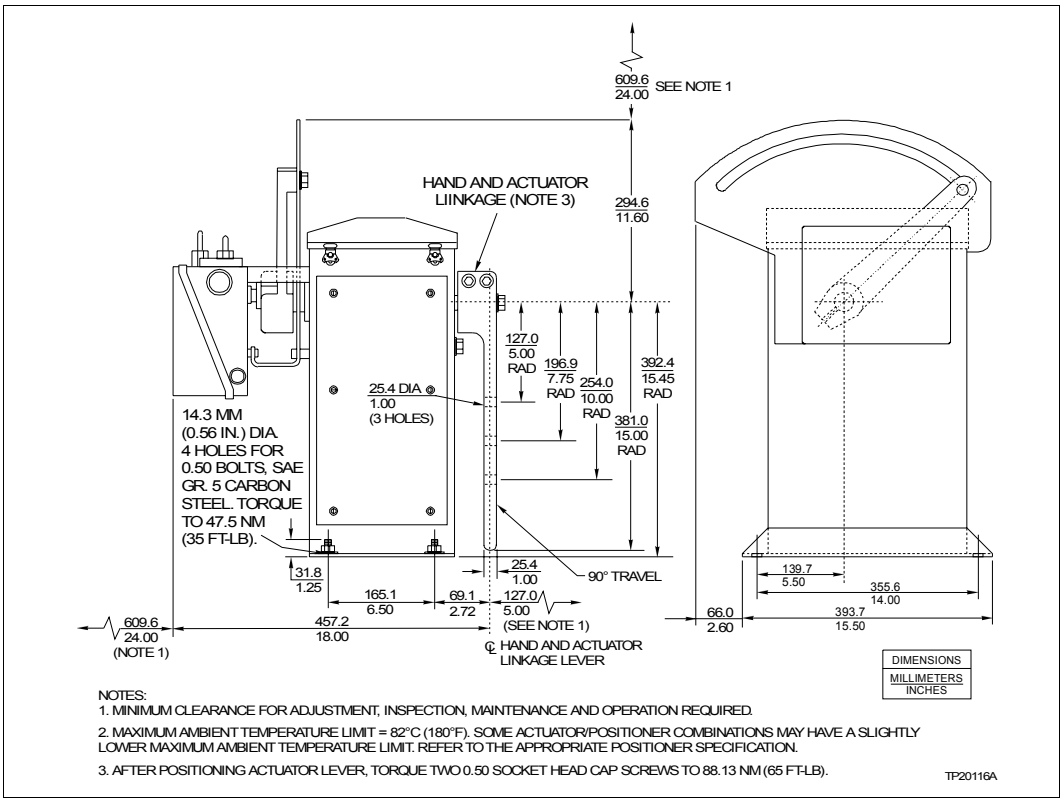
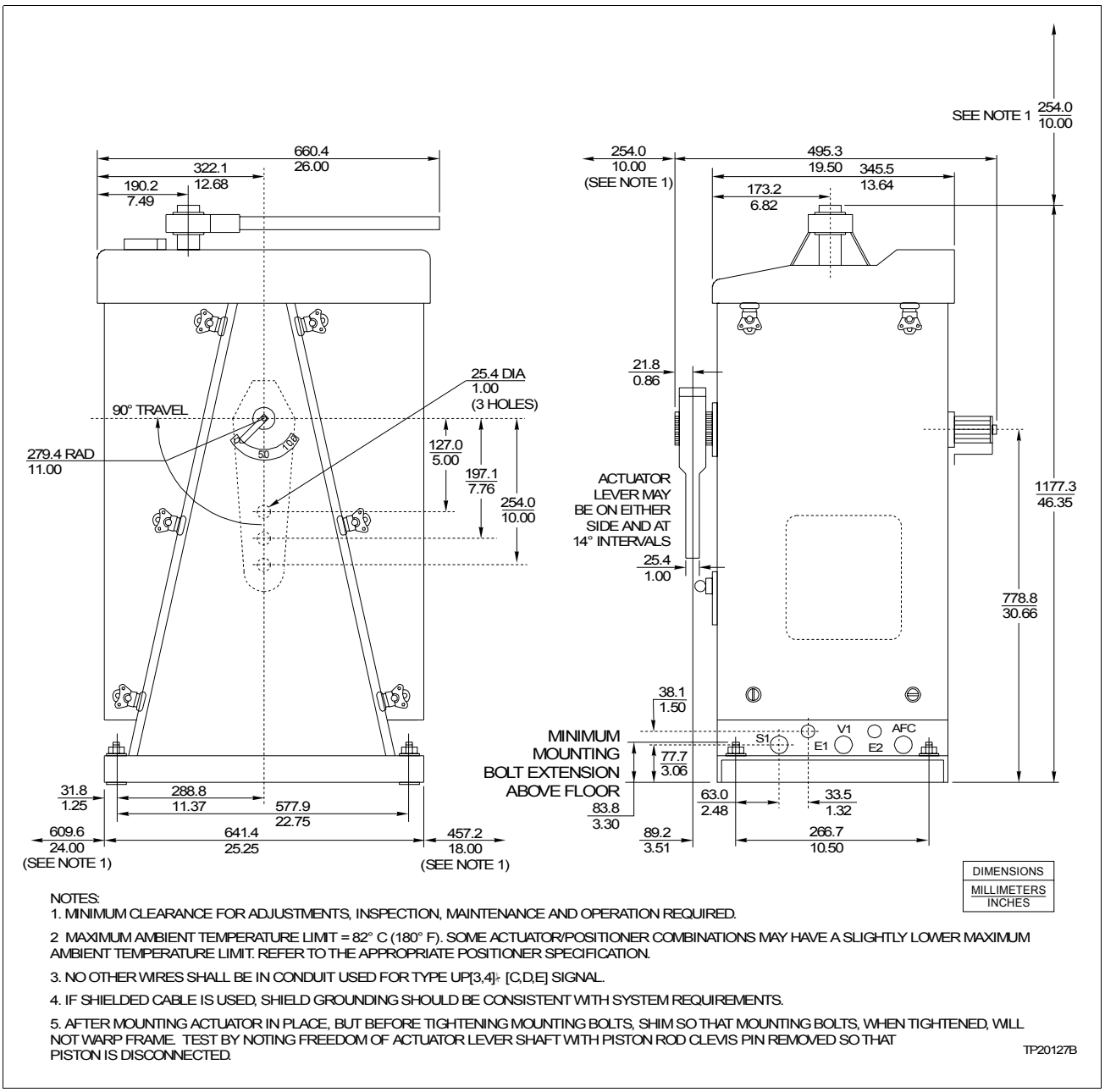



*Figure B-7. Type UP2 Actuator with Type AV Positioner or Solenoid Valve*




NOTES:
1. MINIMUM CLEARANCE FOR ADJUSTMENTS, INSPECTION, MAINTENANCE AND OPERATION REQUIRED.

2 MAXIMUM AMBIENT TEMPERATURE LIMIT = 82° C (180° F). SOME ACTUATOR/POSITIONER COMBINATIONS MAY HAVE A SLIGHTLY LOWER MAXIMUM AMBIENT TEMPERATURE LIMIT. REFER TO THE APPROPRIATE POSITIONER SPECIFICATION.

3. NO OTHER WIRES SHALL BE IN CONDUIT USED FOR TYPE UP[3,4]- [C,D,E] SIGNAL.

4. IF SHIELDED CABLE IS USED, SHIELD GROUNDING SHOULD BE CONSISTENT WITH SYSTEM REQUIREMENTS.

5. AFTER MOUNTING ACTUATOR IN PLACE, BUT BEFORE TIGHTENING MOUNTING BOLTS, SHIM SO THAT MOUNTING BOLTS, WHEN TIGHTENED, WILL NOT WARP FRAME. TEST BY NOTING FREEDOM OF ACTUATOR LEVER SHAFT WITH PISTON ROD CLEVIS PIN REMOVED SO THAT PISTON IS DISCONNECTED.

TP20127B

*Figure B-8. Types UP3 and UP4 Actuators (Page 1 of 2)*

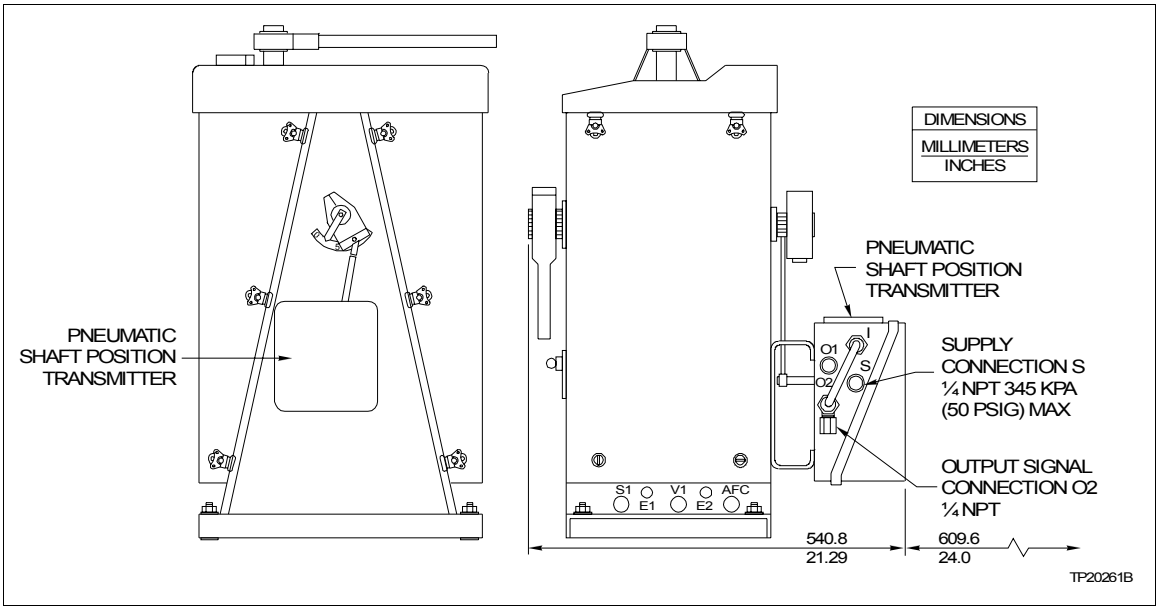



*Figure B-9. Types UP3 and UP4 Actuators (Page 2 of 2)*

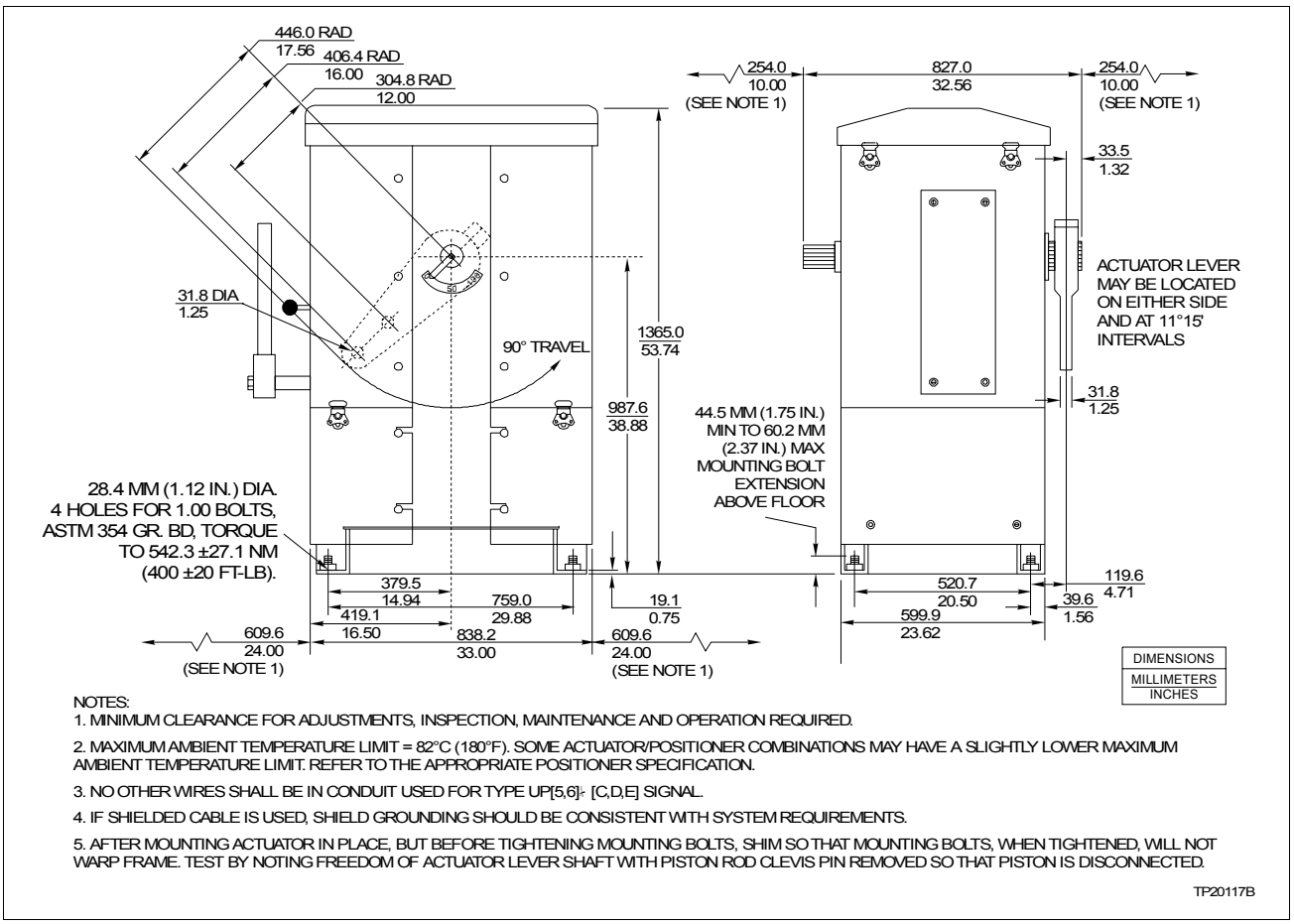



*Figure B-10. Types UP5 and UP6 Actuators*

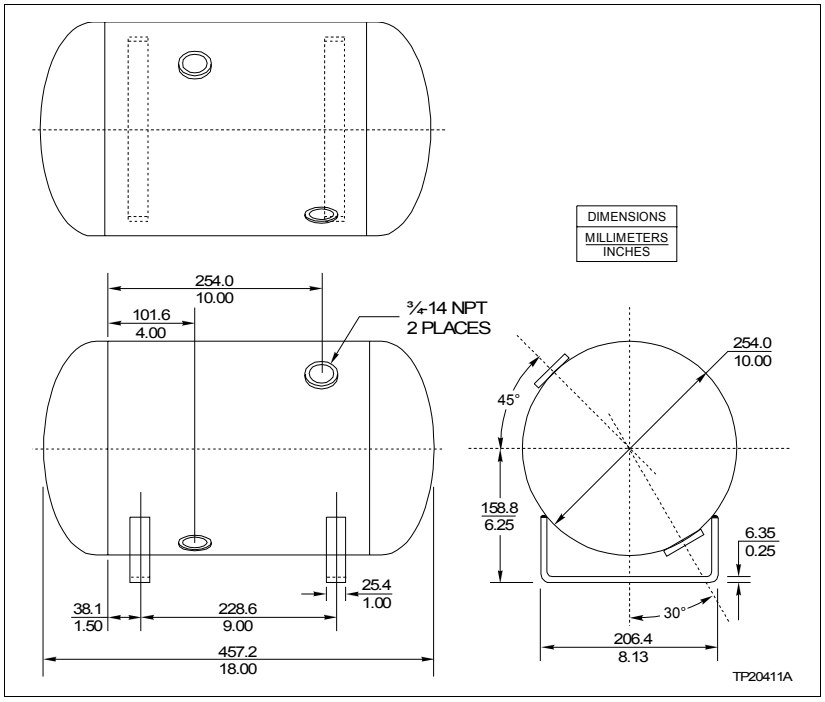



*Figure B-11. 20.8 LIter (5.5 Gallon) Reserve Air Tank Option for Type UP2 Actuators*

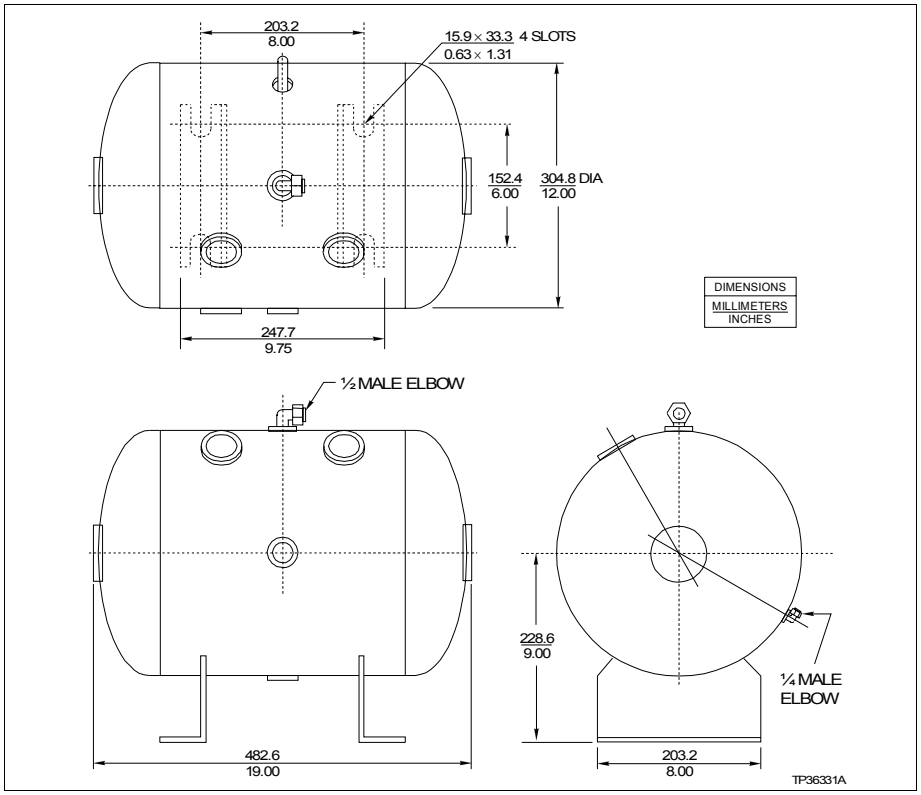



*Figure B-12. 30.3 Liter (8.0 Gallon) Reserve Air Tank Option for Types UP3, UP4 and UP5 Actuators*

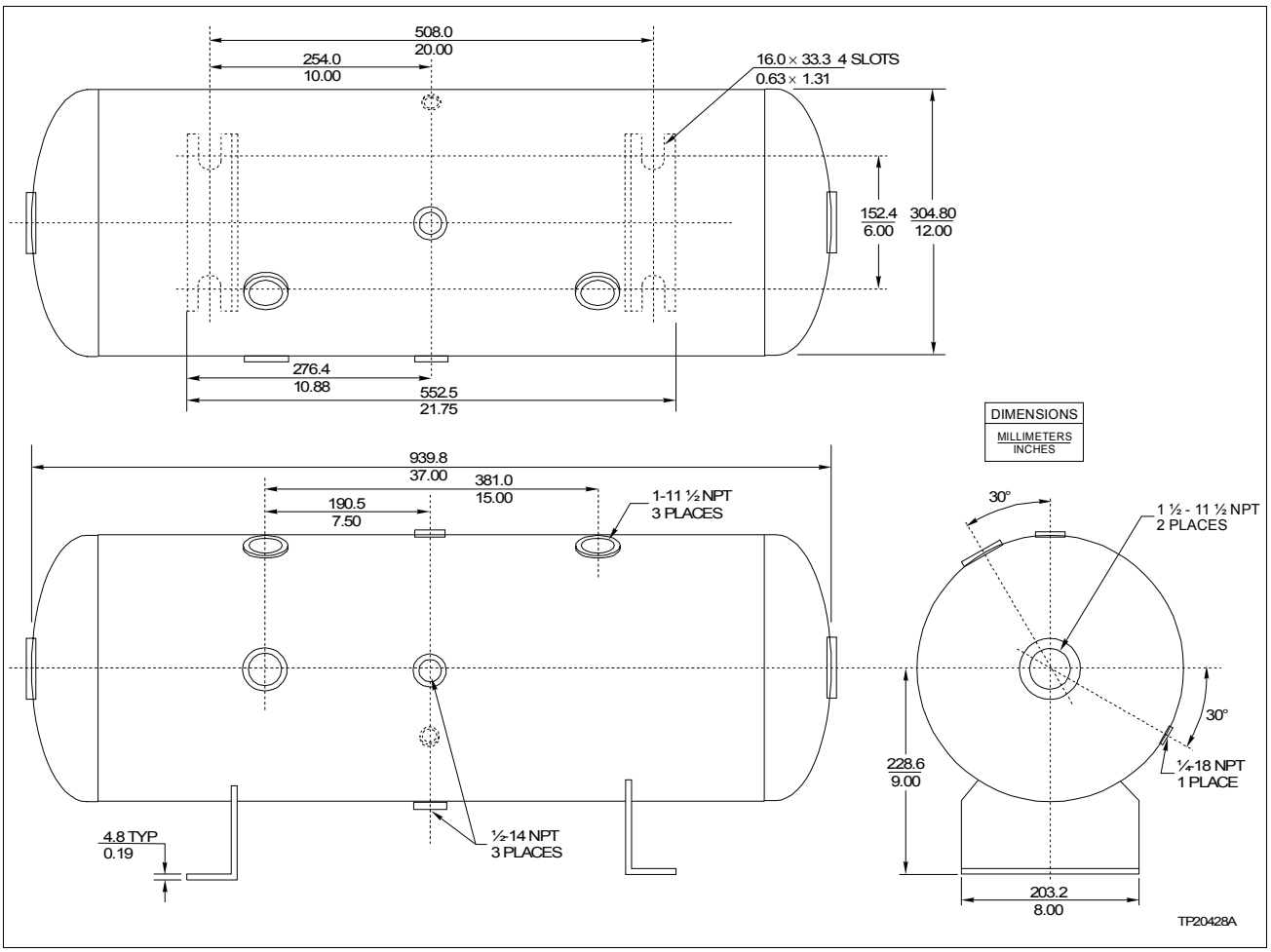



*Figure B-13. 64.4 Liter (17.0 Gallon) Reserve Air Tank for Type UP6 Actuators*

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