UP1/2/3/4/5/6/7

Universal pneumatic rotary actuators

Measurement made easy

—
High performance actuators for precision damper control

Overview

The UP pneumatic universal rotary actuators regulate dampers, fan inlet vanes, lever-operated valves, turbine governors, fluid drives and other final control elements.

These actuators accept electric or pneumatic control signals. This provides modulating or on/off control power to position devices through mechanical linkage or by direct coupling.

For more information

Further publications for the UP series of universal pneumatic rotary actuators are available for free download from:

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(see links and reference numbers below) or by scanning this code:

	Search for or click on
Data Sheet UP/1/2/3/4/5/6/7 Universal pneumatic rotary actuators	DS/A/UP-EN
Installation manual UP1/2/3/4/5/6/7 Universal pneumatic rotary actuators	OI/UP-EN

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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.

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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 AV2, AV3, TZIDC Positioners
- Computer DDC, solid state, or contact input, Type AV4 positioner
- The positioning function can be characterized for a unique application.
  For AV positioners, cams for linear, square or square root relationships exist. Custom shaping the cam provides for user specific positioning. The TZIDC positioner has a linear, equal percent, and user configurable characterization. For all positioners, a mechanical connection to the actuator 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, conventional or smart positioners or solenoids, 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
D-AAP-UP	Universal Rotary Actuators Type UP Pneumatic specification
D-APE-AV1234	Characterizable Positioner Type AV1, AV2, AV3, AV4, TZIDC specification
10/18-0.22 EN	Electro-Pneumatic Positioner TZIDC specification
10/18-0.32 EN	Electro-Pneumatic Positioner TZIDC-200 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
42/18-79 EN	TZIDC Positioner Operating Instructions
42/18-73 EN	TZIDC-200 Positioner Operating Instructions
45/18-79 EN	TZIDC/TZIDC-200 Configuration Instructions

NOMENCLATURE

The Type UP actuator has ten 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	10	
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 with solenoid)[1]
											Control Input
					0						None - Slave Drive (Type UP6 Actuator only)
					A						3 to 15 psig Characterizable Pneumatic Positioner, AV1121_ _0
					B						3 to 27 psig Characterizable Pneumatic Positioner, AV1221_ _0
					C						4 to 20-mA Characterizable I/P Positioner, AV2321_ _0 (Fail Open/Closed upon loss of signal)
					D						4 to 20-mA Characterizable I/P Positioner, AV3321_ _0 (Fail in place upon loss of signal)
					E						Type AV4 Characterizable Pulse Input Positioner, AV4421_ _0
					U						4 to 20 mA Smart TZIDC, fail open/close

Table 1-2. Nomenclature (continued)

Position	1	2	3	4	5	6	7	8	9	10	
Type	**U**	**P**	_	_	_	_	_	_	_	_	**Universal Rotary Actuators Type UP Pneumatic (All Metal Enclosure)**
					W						4 to 20mA Smart TZIDC, fail-in-place
					Y						4 to 20-mA Smart TZIDC-200, fail open/close
					Z						4 to 20-mA Smart TZIDC-200, fail-in-place
					5						On-Off Solenoid (120 VAC), Single Coil
					6						On-Off Solenoid (115/125 VDC), Single Coil
					8						On-Off Solenoid (120 VAC), Dual Coil
					9						On-Off Solenoid (115/125 VDC), Dual Coil
					F						On-Off Solenoid (220 Vac, 50 Hz / 240 VAC, 60 Hz), Single Coil
					G						On-Off Solenoid (220 Vac, 50 Hz / 240 VAC, 60 Hz), Dual Coil
											Shaft Position Transmitter
						0					None
						A					Potentiometric Resistive Output (Built into only AV Positioner for UP_ _ A, B, & C only)[2]
						B					4 to 20-mA Output (Built into Positioner, for UP_ _ A, B, C, D, U, W, Y & Z only)
						C					3 to 15 psig Pneumatic Position Transmitter Output (AV112000 Positioner) (for UP_ _A only)[3,4]
											Adjustable Travel Switches
							0				None
							1				Included (4 SPDT switches)
							2				Included (2 SPDT switches)
											Air Failure Control/Volume Boosters
								0			None
								1			Air failure lock-up (for all but Type UP6_0 actuators)
								2			Volume boosters (to increase actuator stroke speed) [UP6 only]
								3			Air failure lock and volume boosters [UP6 only]
								4			Reserve air tank[3] (goes to 0 or 100% on loss of air supply)
											Actuator Heaters
									0		None
									1		120 VAC[3,5]
									2		240 VAC[3,5]
											Special Options
										0	Standard tubing
										S	Stainless Steel Tube fittings

NOTES:
1. For UP1 or UP2, NEMA4X applies only to the Positioner enclosure.
2. Potentiometer output not available with TZIDC positioners.
3. Not available on Type UP1 actuators. Heater option not suitable for explosion proof or intrinsically

safe applications.

4. 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 Type AV1 Positioner Specification**.

5. Heater option not suitable for explosionproof or intrinsically safe applications.

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 3-6 and 3-8 for operating torque versus air supply pressure.
Operating air supply pressure[3]	276 to 690 kPa (40 to 100 psig) With AV Positioners or Solenoids. 276 to 620 kPa (40 to 90 psig) with TZIDC Positioners
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 [1]	-40° to 82°C (-40° to 180°F) 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 or TZIDC specifications*** for details on positioners available for use with Type UP actuators.
Positioner input signal	AV1 or TZIDC: 21 to 103 kPa (3 to 15 psig), 21 to 186 kPa (3 to 27 psig), 50% range suppression and/or zero elevation capability. AV2 or TZIDC: 4 to 20-mA (goes to 0% (normal acting) or 100% (reverse acting) on loss of input signal). AV3: 4 to 20-mA (holds position on loss of input signal) AV4: Computer DDC, solid state or switch contact (holds position on loss of input signal)
Typical air consumption (nominal) at balance with positioner	With AV Positioners: 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. With TZIDC Positioners: <0.03 Kg/hr (0.015 SCFM) independent of supply pressure.
Positioner action	Direct or reverse is standard

Table 1-3. Specifications (continued)

Property	Characteristic/Value
Performance specifications	Refer to the ***Characterizable Positioner Type AV1, AV2, AV3, AV4 or TZIDC 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) 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
External connections	
Air supply	UP1, UP2, UP3 and UP4: ¼-18 NPT female 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 conduit connection
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
	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)
	NEMA 4X (optional).
Agency approvals	Canadian Standards Association (CSA) certified for use in general purpose (nonhazardous) locations except for units with TZIDC-200 Explosion-Proof Positioner. Refer to TZIDC-200 specification for approvals.
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, TZIDC specification*** for temperature limitations. Furthermore, consult the factory for UP3 through UP6 minimum positioner ambient temperature limit when using internal strip heater option. The po-

sitioner is inside the heated enclosure for UP3 through UP6, therefore as long as the heaters function with the covers in place, the positioner does not see the ambient temperature. Therefore, the positioner ambient temperature can often be exceeded. Consult factory for details.

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.

3. For UP actuators equipped with Air Failure Lockup. also refer to Section 4, Air Failure :Lock.

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 (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.
Pneumatic	Produces a 21 to 103 kPa (3 to 15 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: <15 A at 125 VAC or 0.05 A at 125 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) 0.5 A at 110/125 VDC at 60°C (140°F) 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. 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. 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[4]	2 heater elements, 500 W (1000 W total) at 120 VAC or 240 VAC
Volume Boosters and Exhaust Valves	To increase stroke speed. Available as an option for Type UP6 actuators. Refer to Table 1-2 and Figure 1-16.
Accessories	
Filters & Regulators[1]	
UP1 and UP2	Coalescing Air Filter Part No. 5328563_2 with Bracket (standard capacity) Supply Air Regulator Part No. 1951029_5 with Bracket and Gauge (standard capacity)
UP3, UP4, UP5, UP6	Supply Air Filter/Regulator Part No. 1951439_1 with Bracket and Gauge (high capacity) Coalescing filter for removal of solid and liquid contaminants in compressed air. Grade 6 filter that is 99.97% efficient at 0.01 microns, with sight gauge, auto float drain, and metal bowl
Pressure switch[5]	Part No. 1941099_2 to sound an alarm or for status lights to signal loss of air supply.
Pressure gages[2]	Part No. 5326605_4: instrument Part No. 5326605_5: supply Part No. 5326605_6: output (two required)
Speed control orifices[3]	For AV positioners, regulate time constant of positioner and final control element. Installed directly in AV output ports. Part No. 5327327_1: 1 mm (0.04 in.) Part No. 5327327_2: blank (drill to suit)

NOTES:

1. Refer to Table 3-1 for regulator capacity and tubing 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).

3. For TZIDC positioner, use Ramp Up and Ramp Down configuration parameters to slow down stroking speed in each direction.

4. Furthermore, Consult the factory for UP3 through UP6 minimum positioner ambient temperature limit when using internal strip heater option. The positioner is inside the heated enclosure for UP3 through UP6; therefore, as long as the heaters function with the covers in place, the positioner does not see the ambient temperature. Therefore, the positioner minimum ambient temperature can often be exceeded. Consult factory for details.

5. For UP Actuators equipped Air Failure Lockup or Reverse Air Tank. Not available for UP Actuators equipped with TZIDC-200 Positioners.

SHIPPING WEIGHTS

Table 1-5 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,B,C,D,U,W,Y,Z	25 (55)
UP1_5,6,8,9,F,G	23 (50)
UP2_A,B,C,D,U,W,Y,Z	45 (100)
UP2_5,6,8,9,F,G	43 (95)
UP3_A,B,C,D,U,W,Y,Z	145 (320)
UP3_5,6,8,9,F,G	143 (315)
UP4_A,B,C,D,U,W,Y,Z	163 (360)
UP4_5,6,8,9,F,G	161 (355)
UP5_A,B,C,D,U,W,Y,Z	336 (741)
UP5_5,6,8,9,F,G	334 (736)
UP6_A,B,C,D,U,W,Y,Z	369 (814)
UP6_5,6,8,9,F,G	367 (809)

Table 1-6. Option Shipping Weights[1]

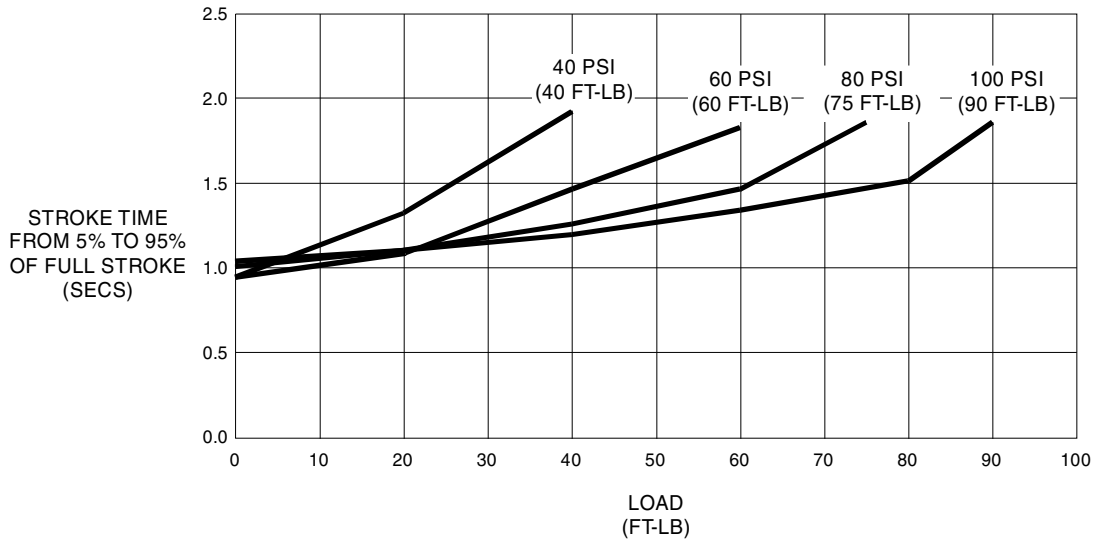
Option	Shipping Weight kg (lb)
Pneumatic Shaft Position Transmitter	5.0 (11.0)
Alarm/Travel Switches	1.1 (2.5)
Strip Heaters	
UP2	1.1 (2.5)
UP3, UP4, UP5 and UP6	2.0 (4.5)
Air Failure Lock	
UP1	3.6 (8.0)
UP2	5.0 (11.0)
UP3 and UP4	5.9 (13.0)
UP5 and UP6	6.8 (15.0)
Reserve Air Tank	
20.8 l (5.5 gal.) 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.



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.

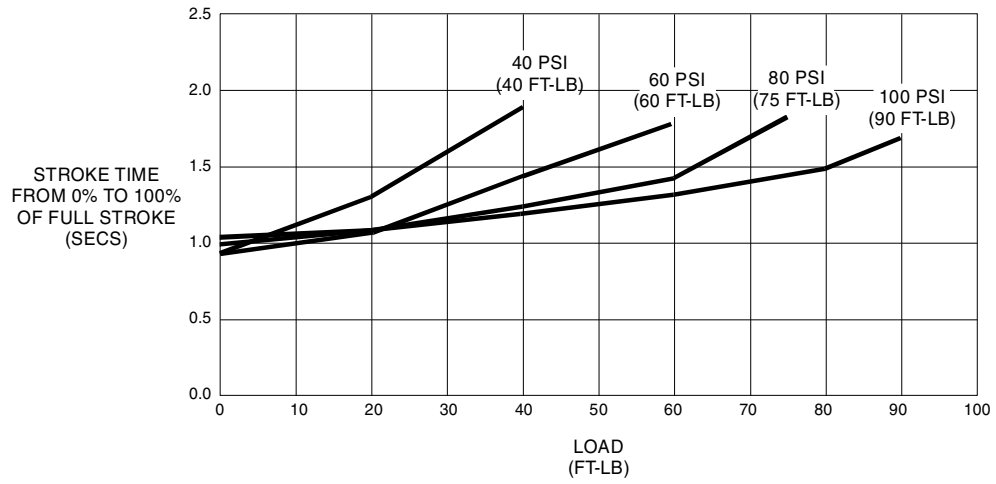
   B. DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

   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.

TP20255A

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.

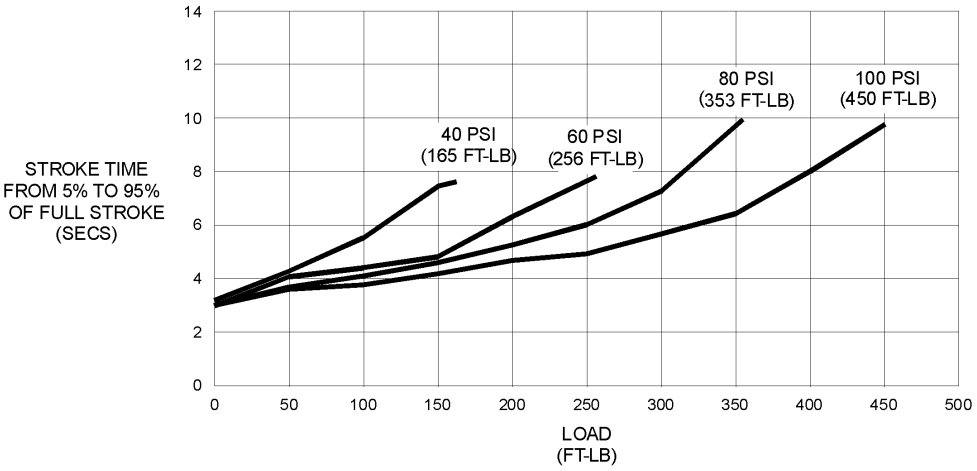
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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.

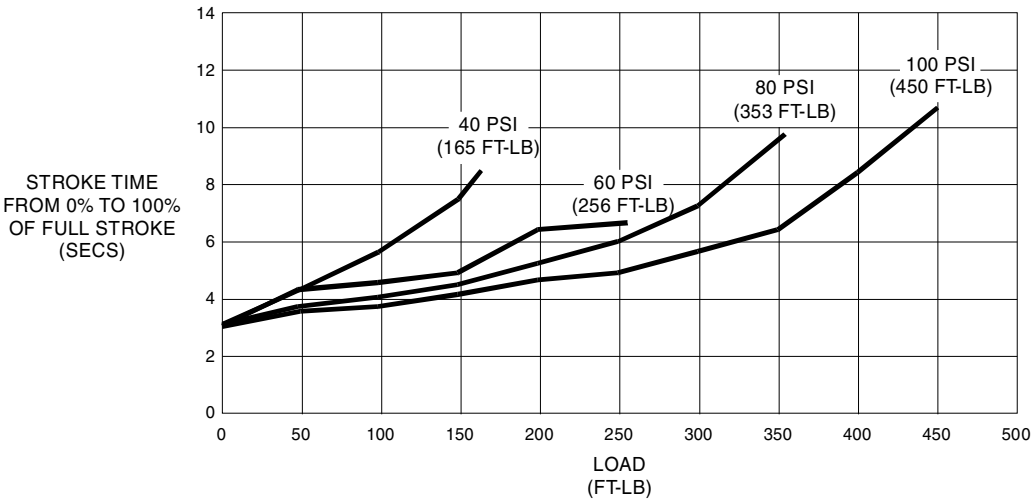
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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.

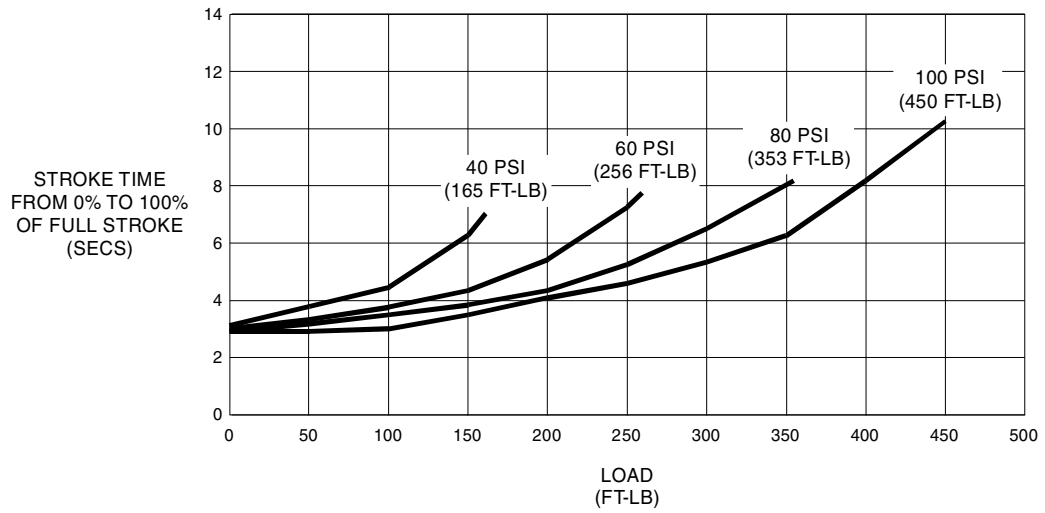
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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.

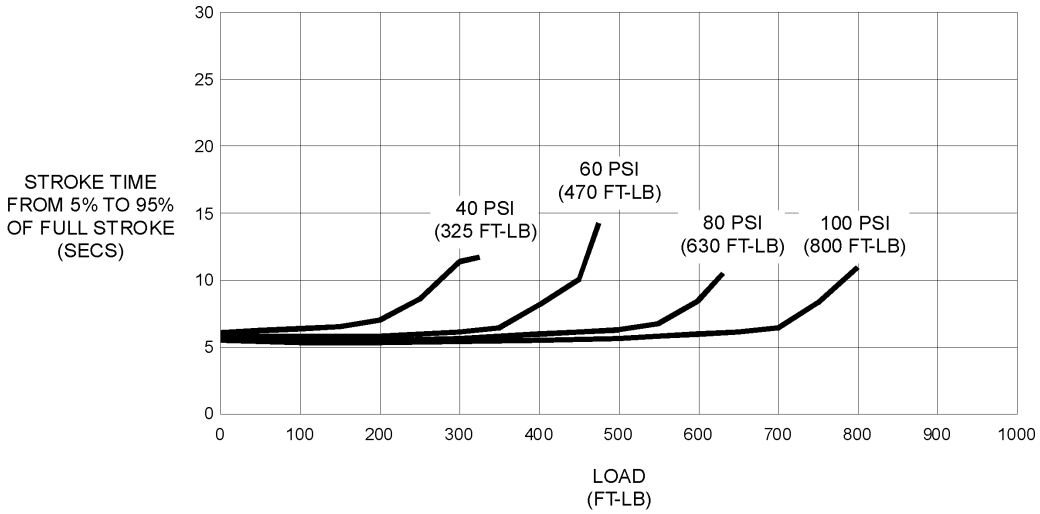
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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.

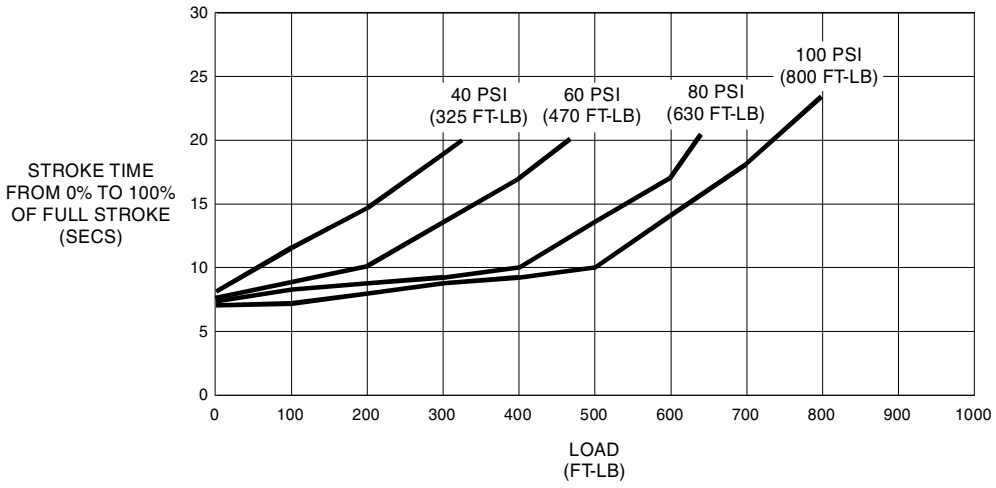
B. DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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.

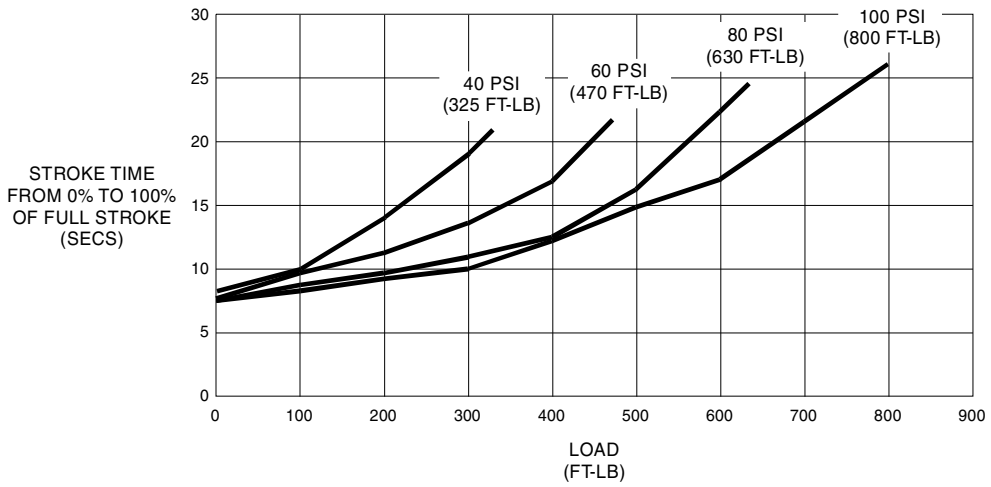
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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.

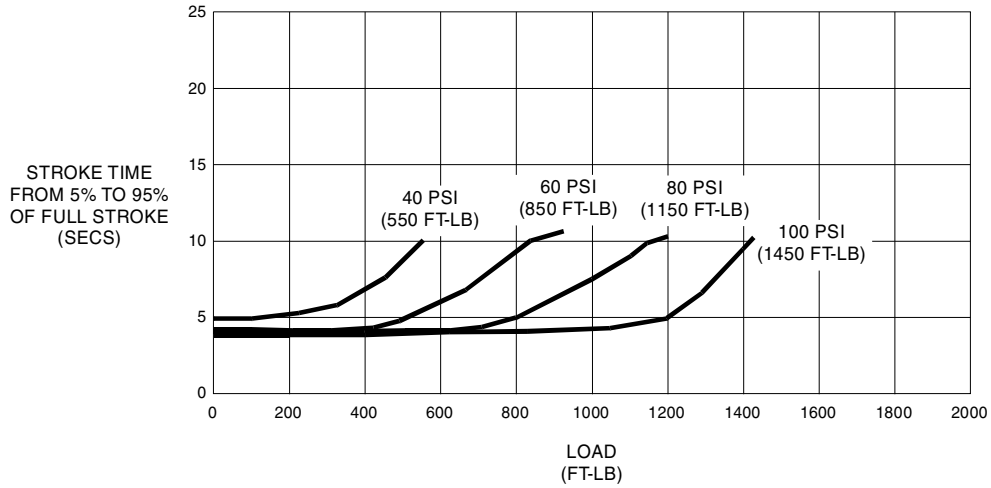
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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.

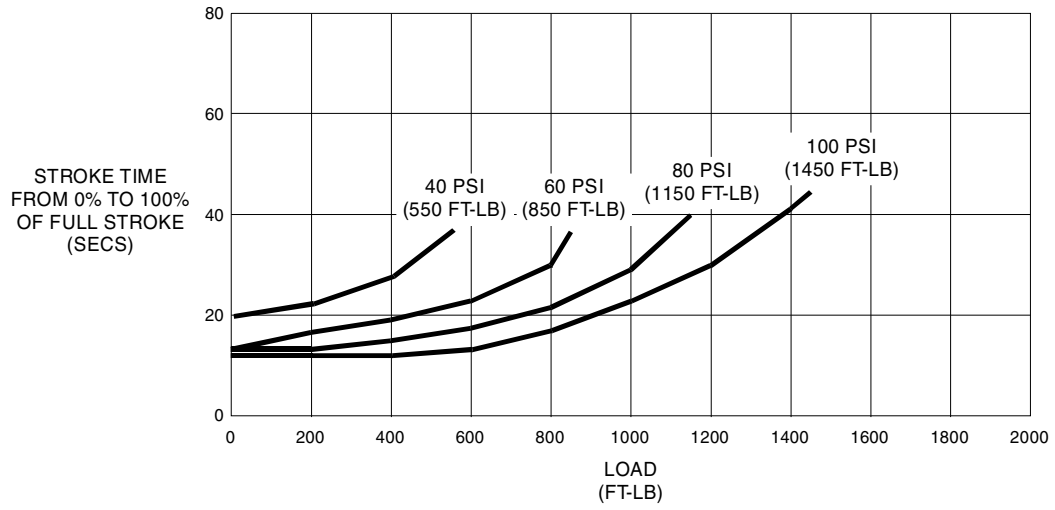
B. DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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.

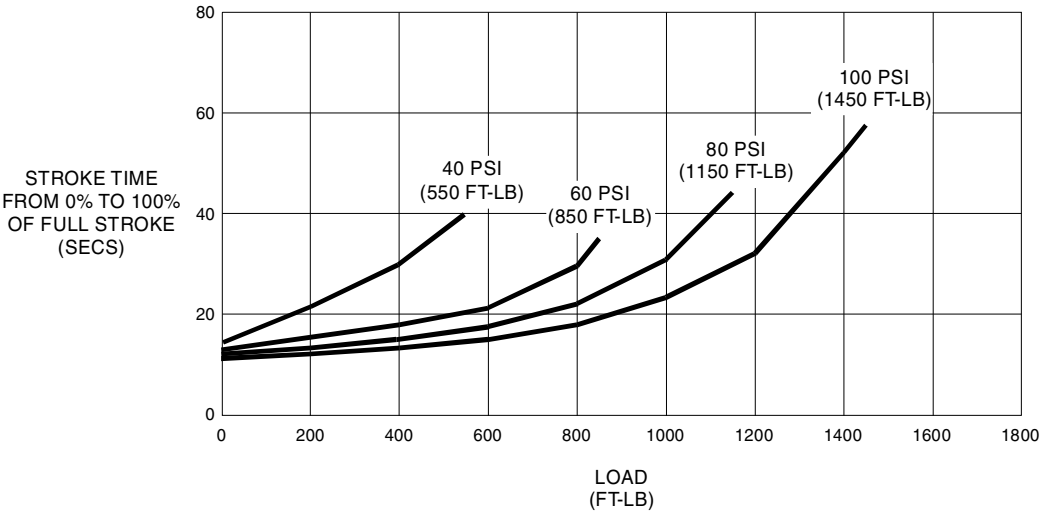
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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.

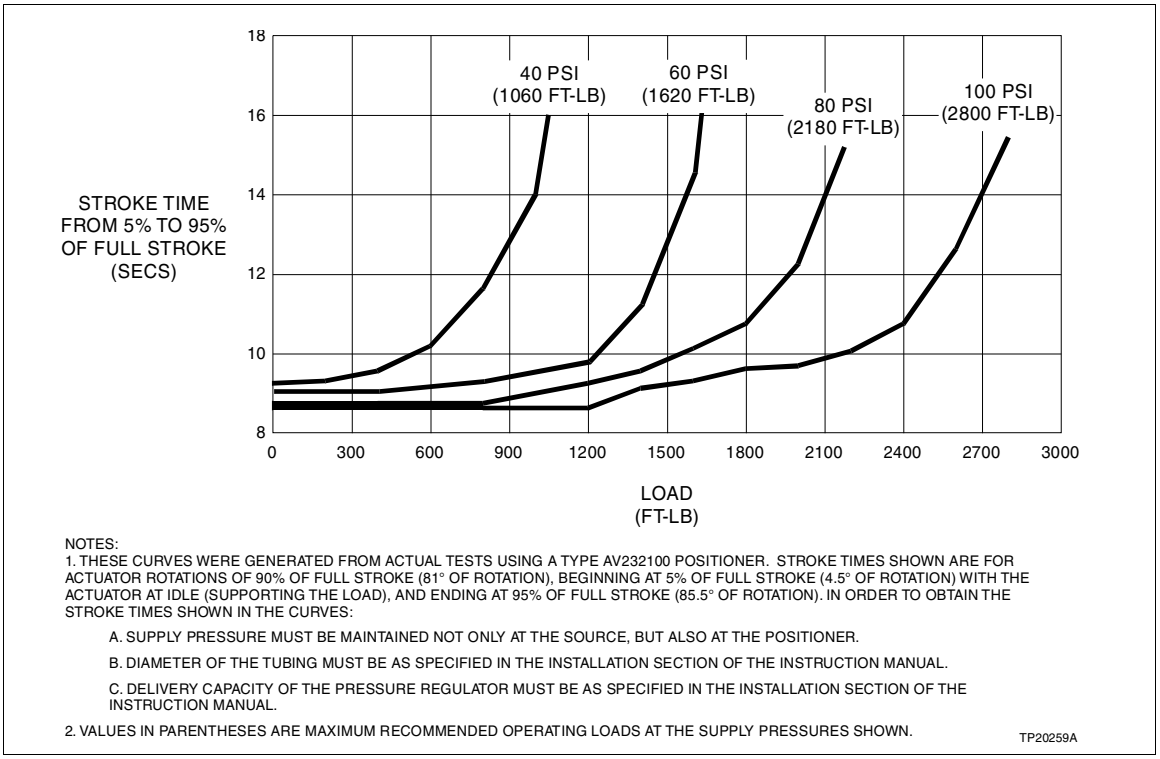
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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.

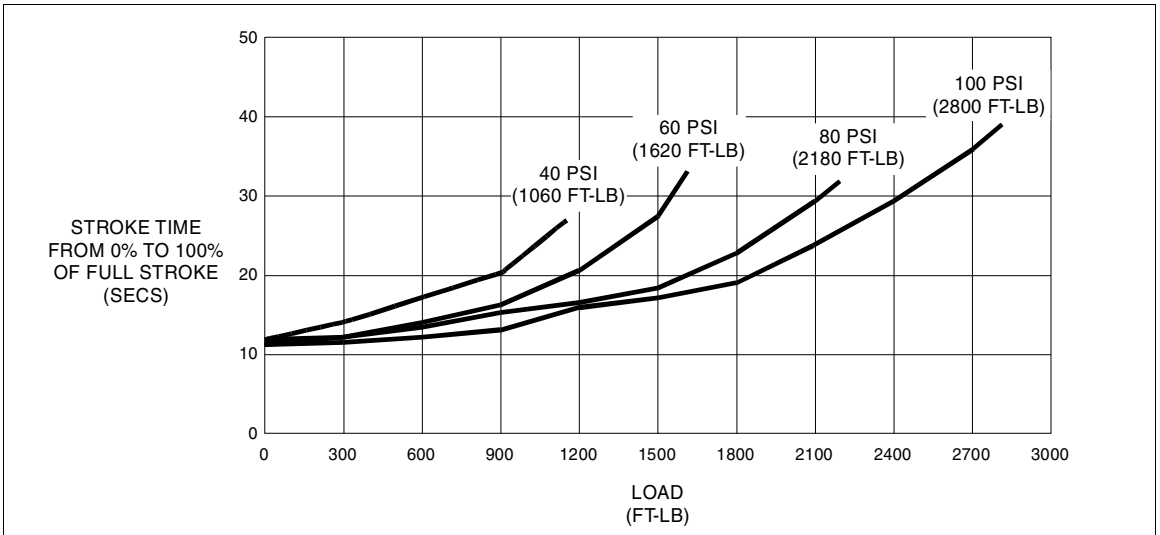
B. DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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.

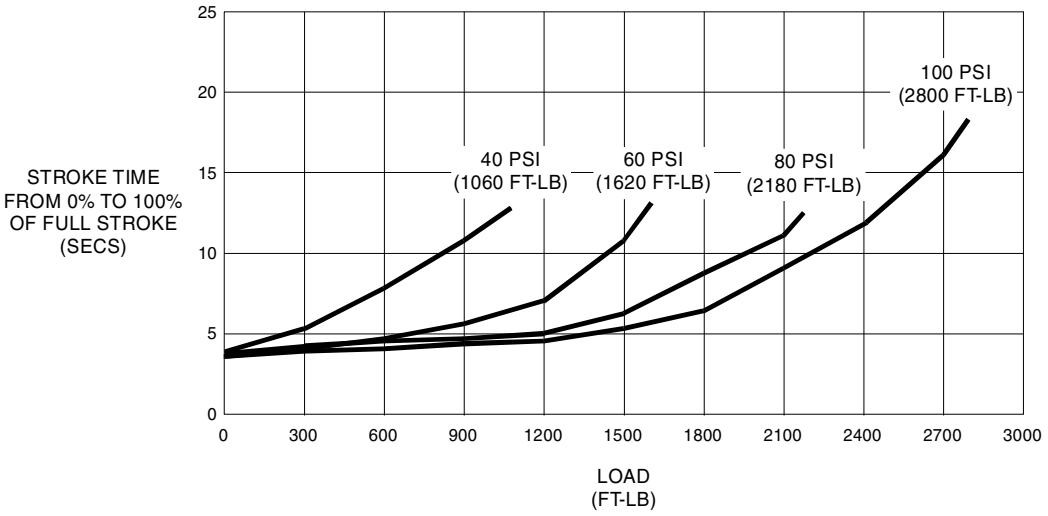
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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.

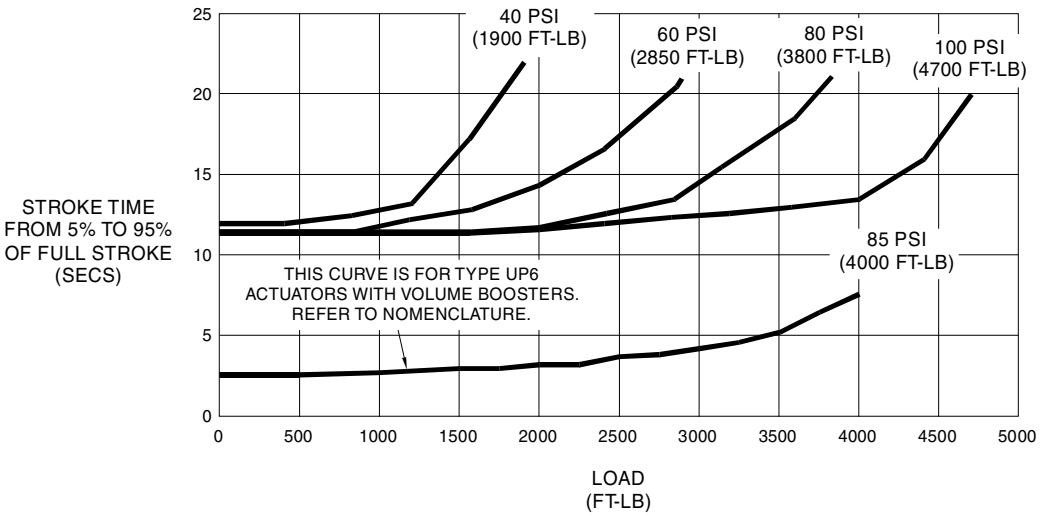
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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.

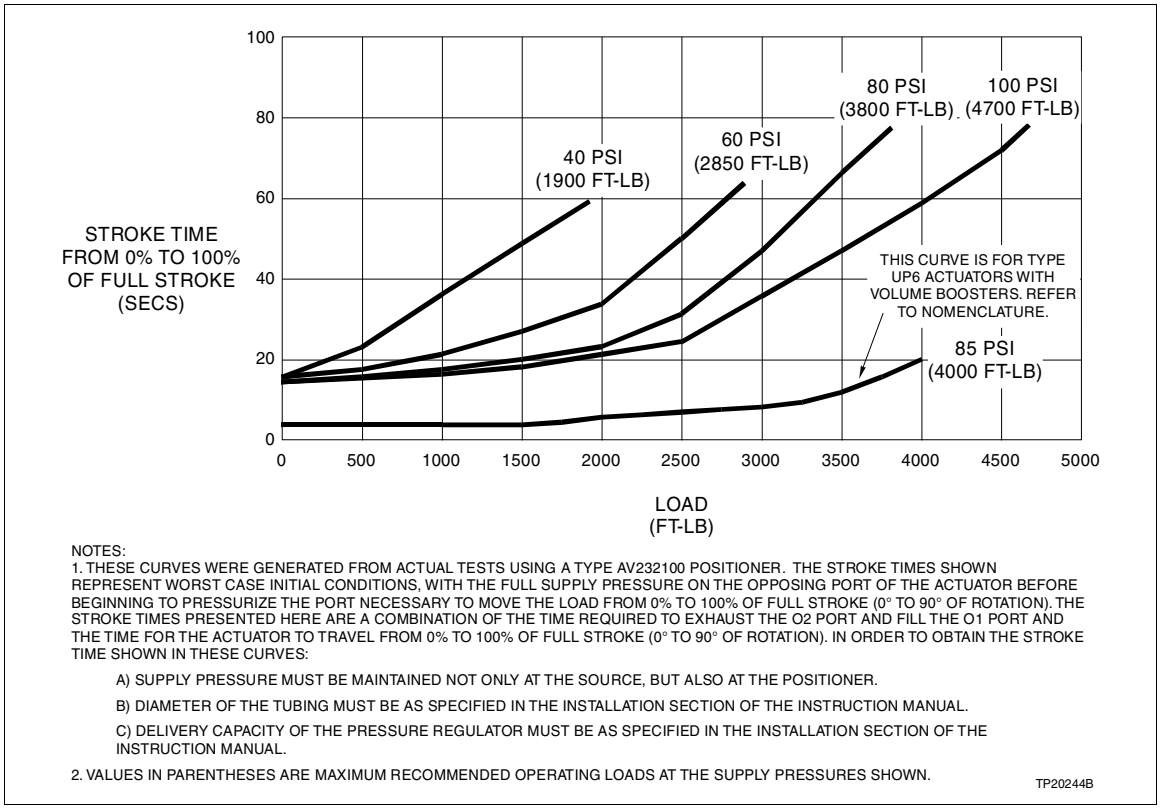
B. DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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.

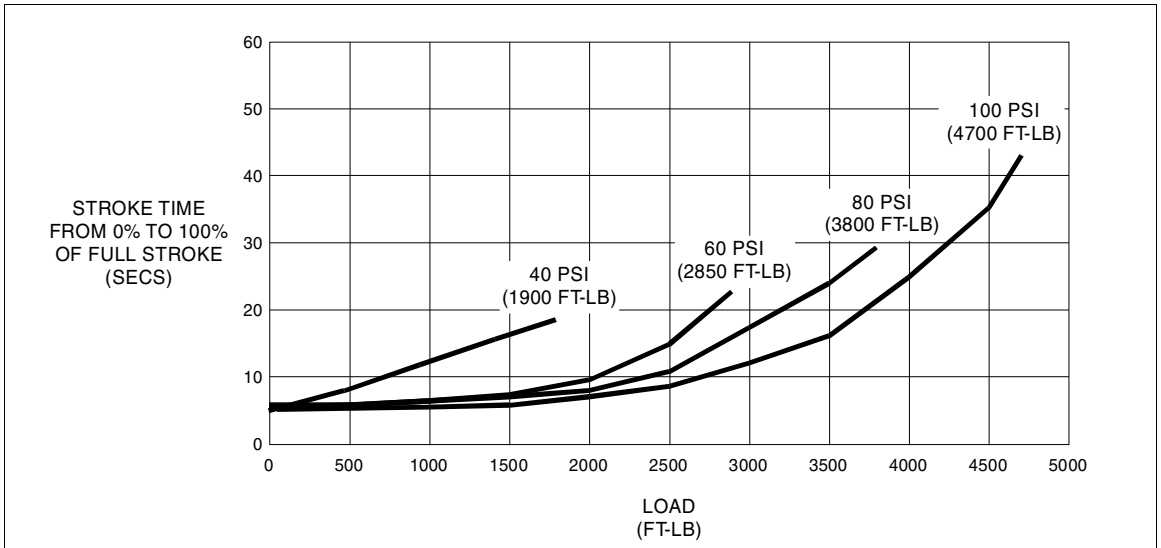
B) DIAMETER OF THE TUBING MUST BE AS SPECIFIED IN THE INSTALLATION SECTION OF THE INSTRUCTION MANUAL.

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 AV2 AV3 & TZIDC Positioners.
- Computer DDC, solid state or contact input, Type AV4 Positioner.

The positioning function can be different for a variety of applications. For the AV positioner, there are standard cams for linear, square or square root relationships.
Custom shaping the cam can provide application flexibility. For the TZIDC positioner, characterization is done electronically. A mechanical connection to the actuator shaft feeds back the shaft position movement. The positioner provides proportional control of the differential pressure across 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 4 to 20-milliamp signal, applied at the Positioner current to pneumatic signal converter, into a pneumatic signal. A connection to the actuator shaft serves as feed back. 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 pulse-to-pneumatic converter, pneumatic positioner, and position transmitter

Type UP_ _U, W, Y, Z Actuators

These actuators are equipped with a 4 to 20 mA digital Positioner with expanded communication, configuration and diagnostic capability.

Types UP_ _5, UP_ _6 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 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_ _8, 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 open 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 Slave 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 or TZIDC Positioner, or solenoid valve. The slave drive is a 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 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 also 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 higher maximum, and slightly lower minimum operating temperature. Refer to the **Characterizable Positioner Type AV1, AV2, AV3, AV4, or TZIDC specification** for temperature limitations. Furthermore, consult the factory for UP3 through UP6 minimum positioner ambient temperature limit when using internal strip heater option. The positioner is inside the heated enclosure for UP3 through UP6, therefore, as along as the heaters function with the covers in place, the positioner does not see the ambient temperature. Therefore, the positioner minimum ambient temperature can often be exceeded. Consult the factory for details.

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

NOTES: Refer to Figure 3-1a for UP1 with AV Positioner.
Refer to Figure 3-1b for UP1 with TZIDC Positioner.

Type UP1 actuators do not have an enclosure; the positioner and/or travel switch mount to the UP1 frame. To access the positioner, position transmitter, or travel switch terminals for field wiring, remove the positioner cover and/or the travel switch cover

NOTE: Refer to TZIDC or AV Manual for wiring details (Refer to Table 1-1)..

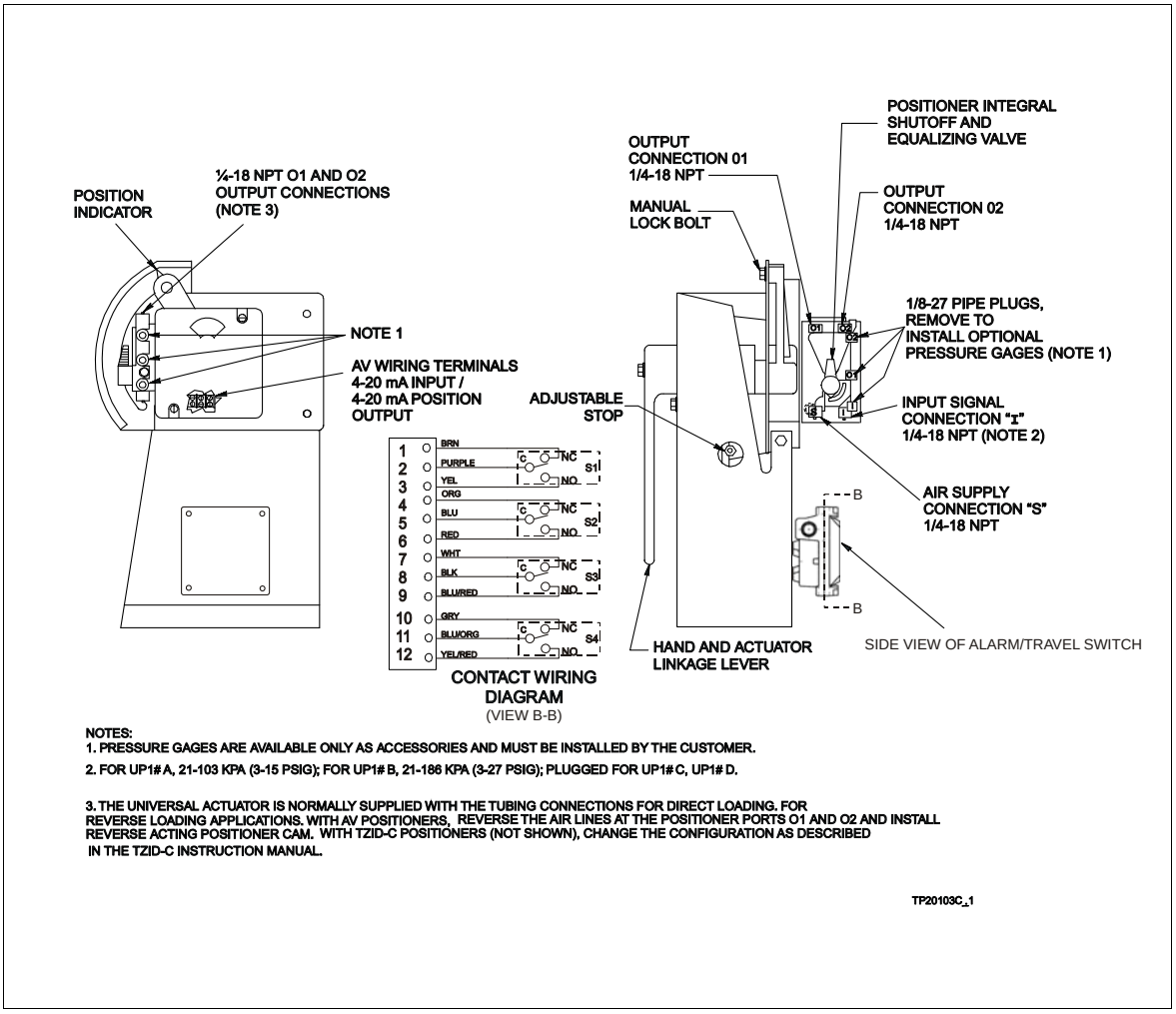


Figure 3-1a. Type UP1 Actuator with Type AV Positioner and optional Alarm/Travel Switch

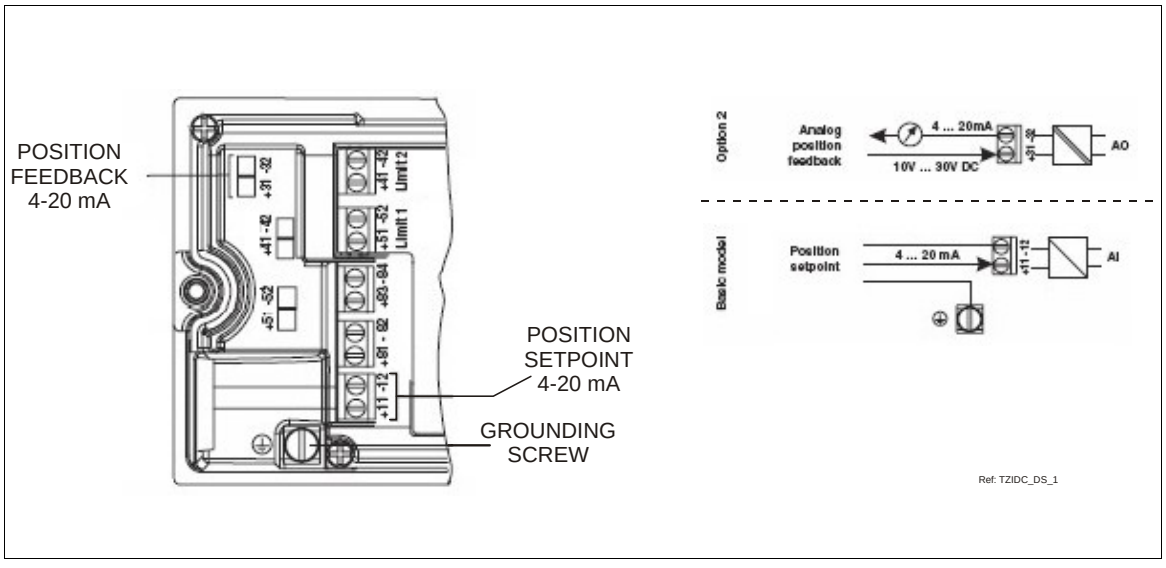


Figure 3-1b. TZIDC Wiring Diagram

Type UP2 Actuator

NOTES: Refer to Figure 3-2, for UP2 with AV Positioner
Refer to Fig. 3-1b for UP2 with TZIDC Positioner

The Type UP2 actuator with AV or TZIDC Positioner and travel switches require the covers of the positioner and the travel switch assembly to be removed to access the field wiring terminals.

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.

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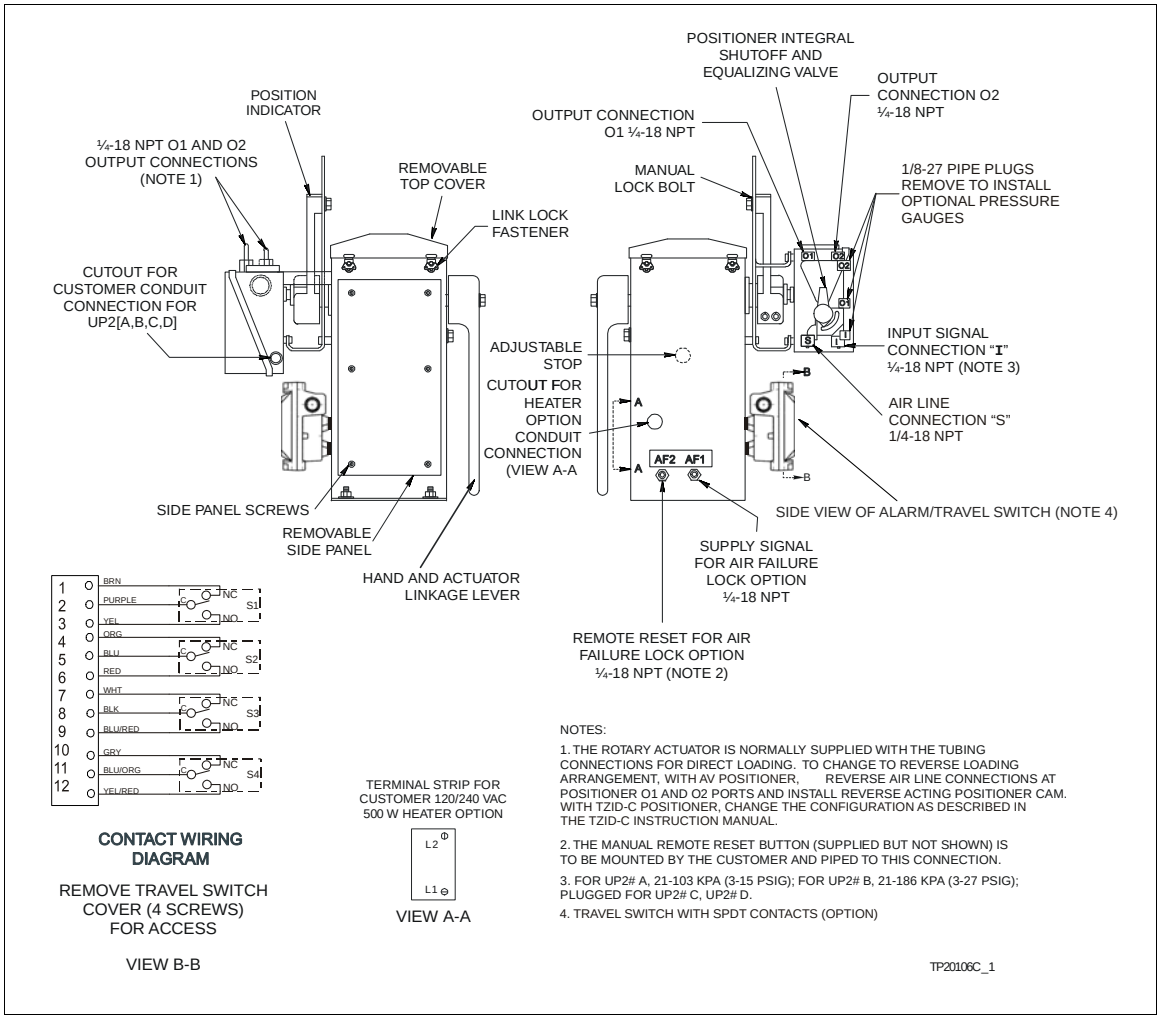

Figure 3-2. Type UP2 Actuator with Type AV Positioner and Optional Alarm/Travel Switch

Types UP3 and UP4 Actuator

NOTES: Refer to Figure 3-3. for UP3/4 with AV Positioner
Refer to Fig. 3-1b for UP3/4 with TZIDC Positioner

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

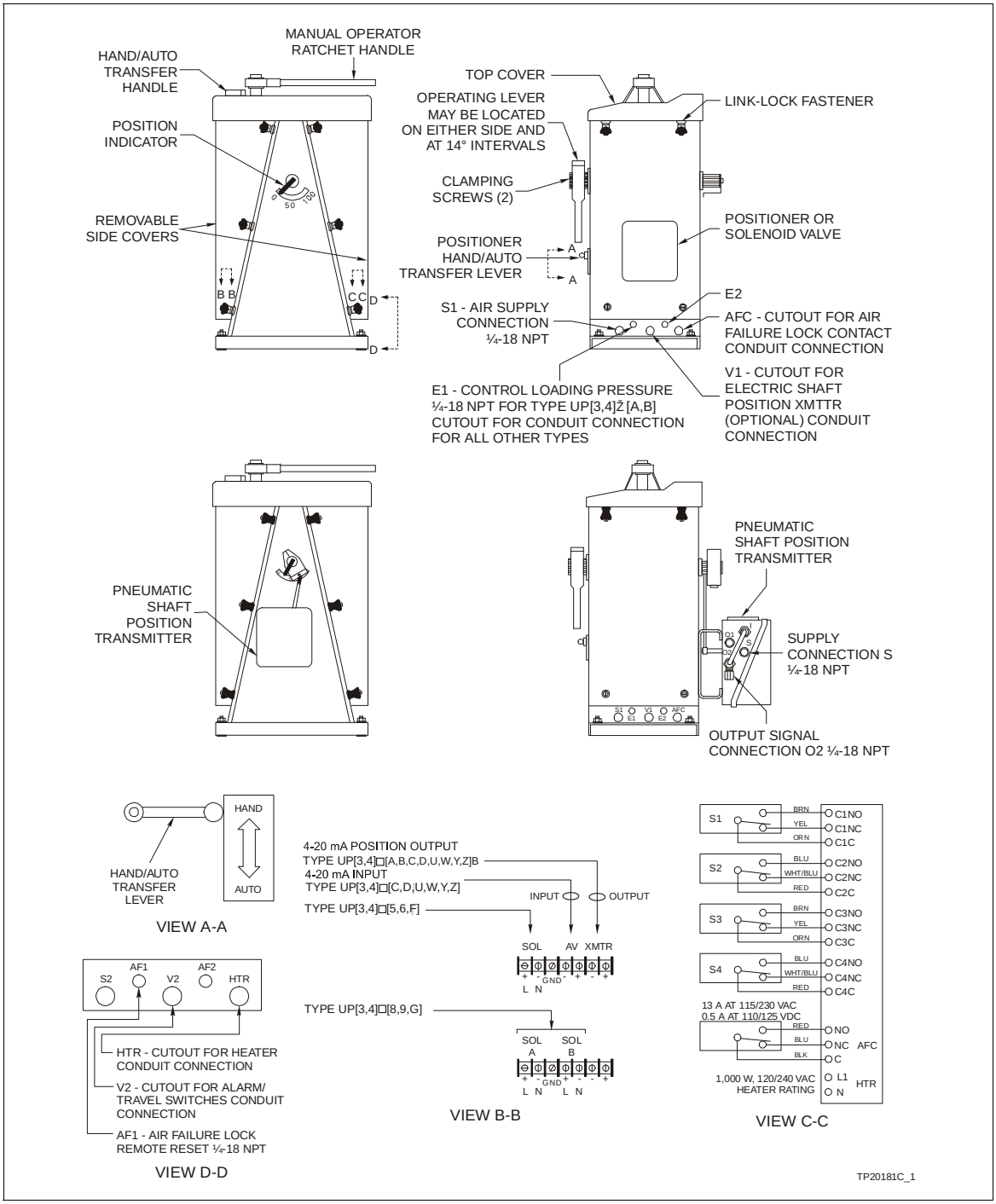

Figure 3-3. Types UP3 and UP4 Actuators

Side Panel

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

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

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

3. Remove the top cover.

Types UP5 and UP6 Actuator

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.

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.

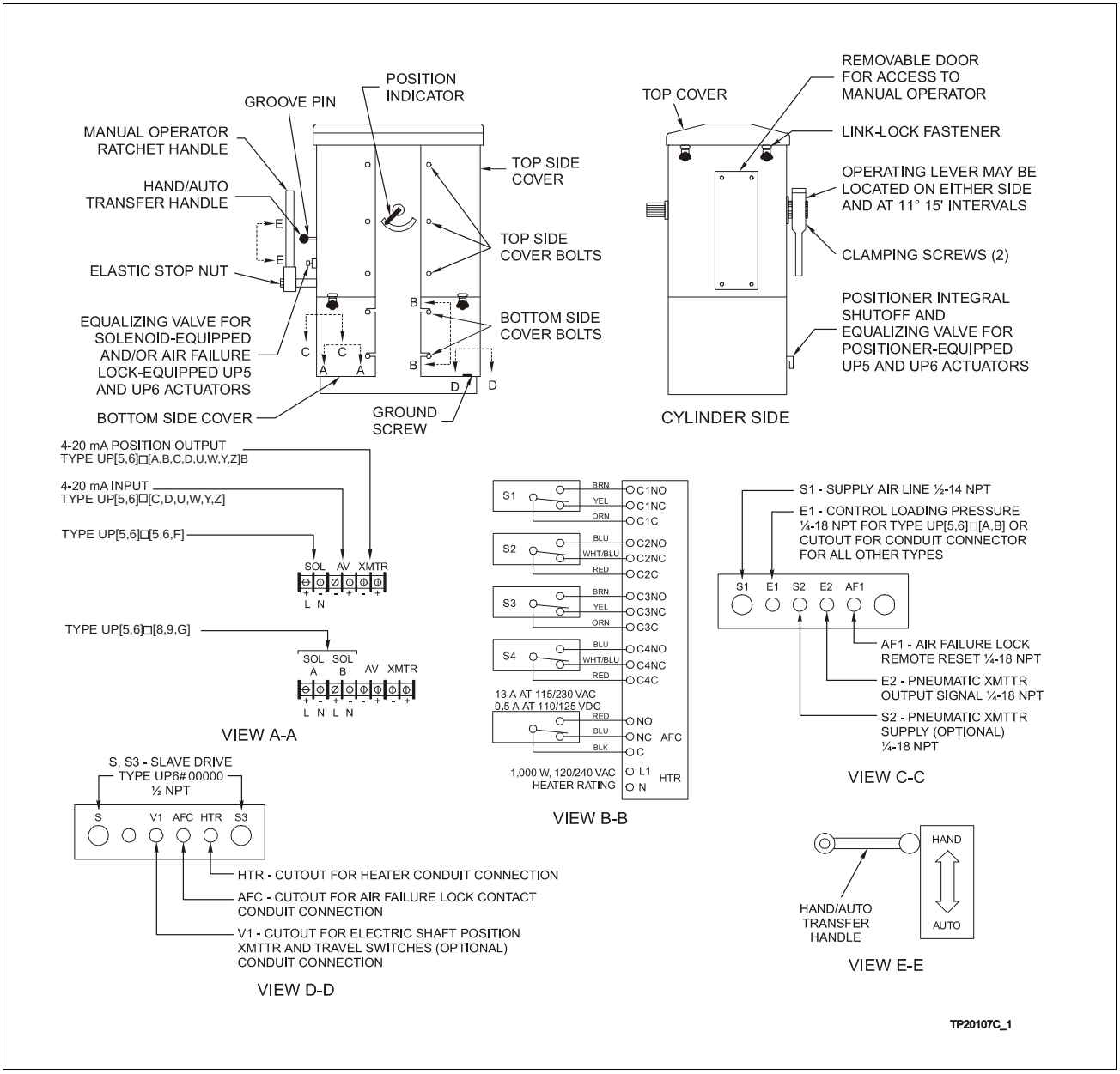

Figure 3-4. Types UP5 and UP6 Actuators

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 3-1a 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. English 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 and Air Filter Regulator

Actuator Type	Min Supply Line Size (in.)	Signal Line Size (in.)	Filter Regulator Part No.[1]	Air Regulator Part No.	Air Filter Regulator Part No.	Capacity m^3/sec (scfm)
UP1 and UP2	¼	¼	5328563_2	1951029_5		1.27 (45)
UP3,UP4, UP5,UP6	½	¼			1951439_1	1.13 (40)

Table 3-2. Suggested 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) 620 (90) 690 (100)	54 (40) 110 (81) 122 (90)
UP2	276 (40) 620 (90) 690 (100)	224 (165) 550 (405) 610 (450)
UP3	276 (40) 620 (90) 690 (100)	441 (325) 976 (720) 1,085 (800)

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

Actuator Type	Min and Max Supply Pressure * kPa (psig)	Max Operating Torque Nm (ft-lbs)
UP4	276 (40) 620 (90) 690 (100)	746 (550) 1770 (1305) 1,966 (1,450)
UP5	276 (40) 620 (90) 690 (100)	1,437 (1,060) 3417 (2520) 3,796 (2,800)
UP6	276 (40) 620 (90) 690 (100)	2,576 (1,900) 5857 (4230) 6,372 (4,700)

* Maximum supply pressure for UPs with TZIDC positioners is 90 psig.

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.

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.

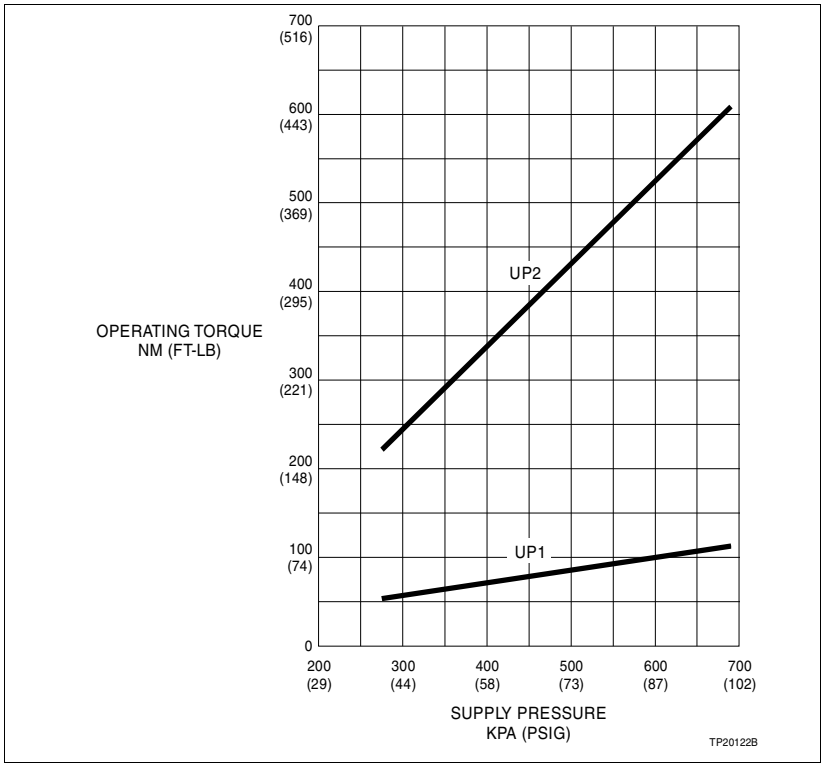

Figure 3-5. Operating Torque Versus Air Supply Pressure (Types UP1 and UP2 Actuators)

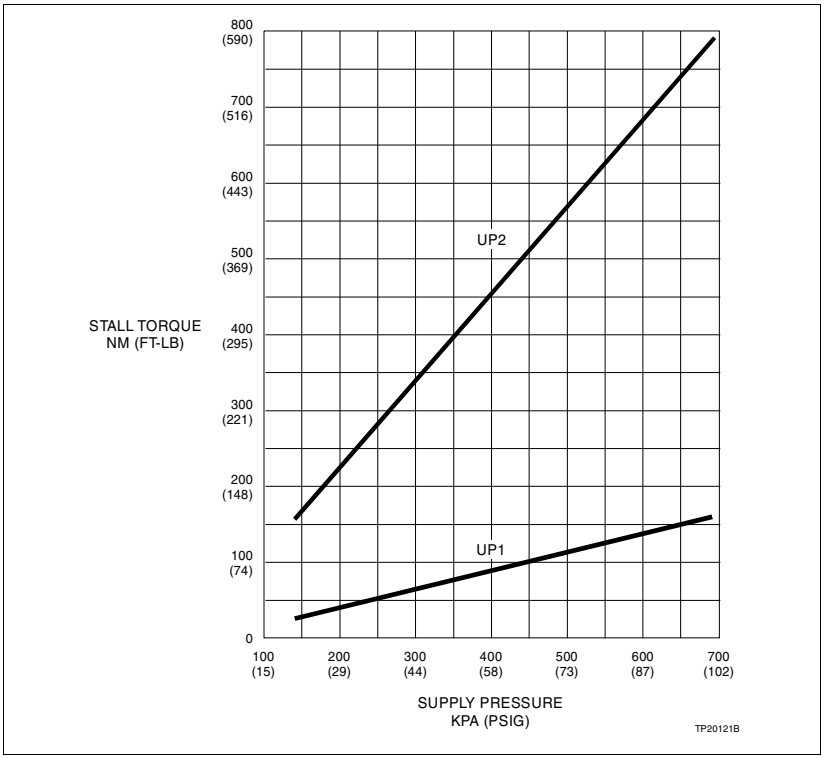

Figure 3-6. Stall Torque Versus Air Supply Pressure (Types UP1 and UP2 Actuators)

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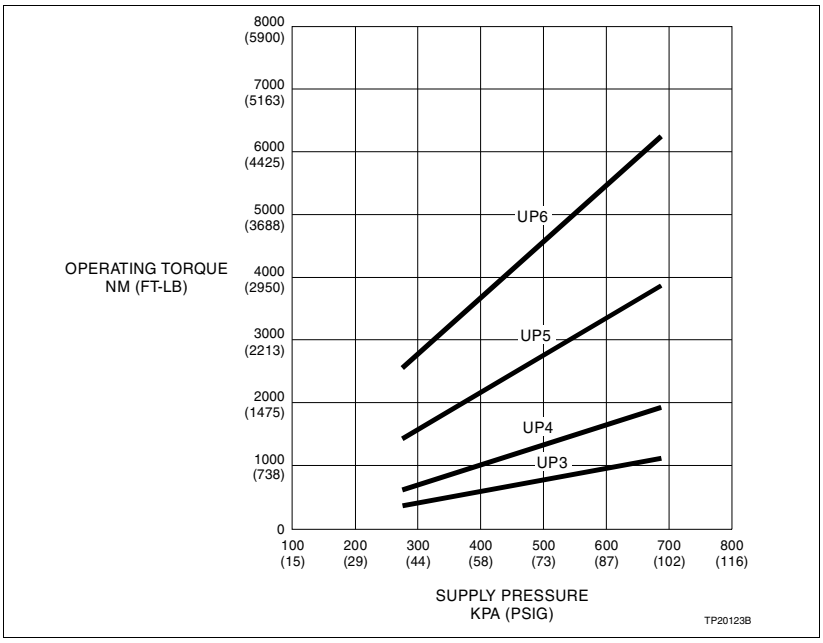


Figure 3-7. Operating Torque Versus Air Supply Pressure (Types UP3, UP4, UP5 and UP6 Actuators)

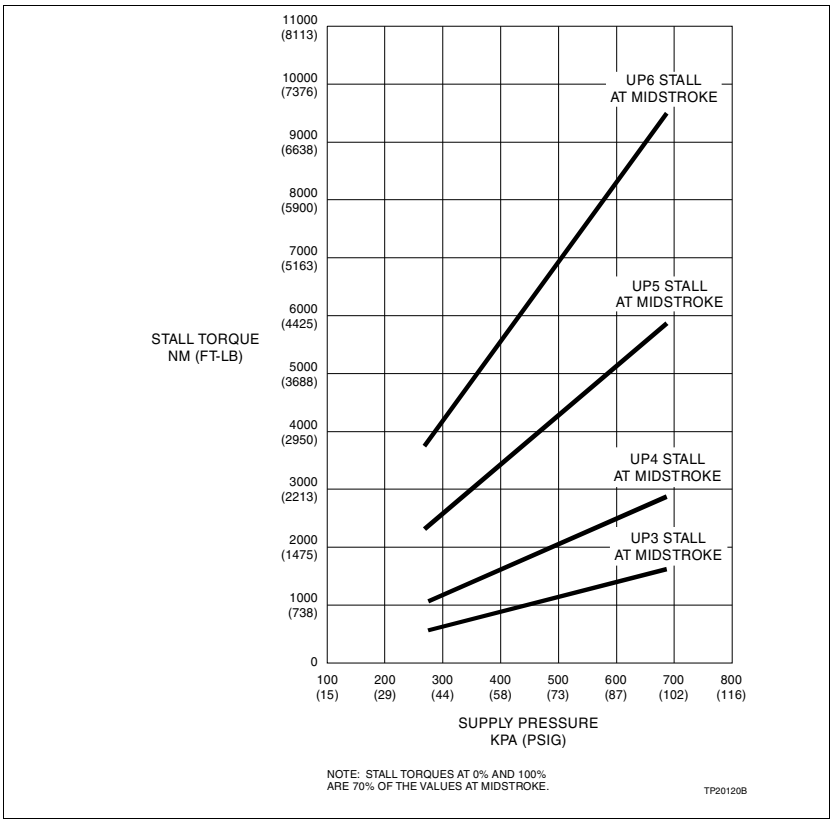


Figure 3-8. Stall Torque at Midstroke Versus Air Supply Pressure (Types UP3, UP4, UP5 and UP6 Actuators)

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 for UP actuators equipped with AV Positioner and five microns for UP actuators equipped with TZIDC Positioners.

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

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 3-1a, 3-1b 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)

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 (pneumatic input only).

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 (pneumatic input only).

Characterizable I/P Positioner Tubing and Wiring

Tubing for Types AV2, AV3 and TZIDC 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 3-1a, 3-1b and 3-2

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

2. The I port is plugged, for UP actuators equipped with AV2 and AV3 Positioners.

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.

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 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 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***.

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.

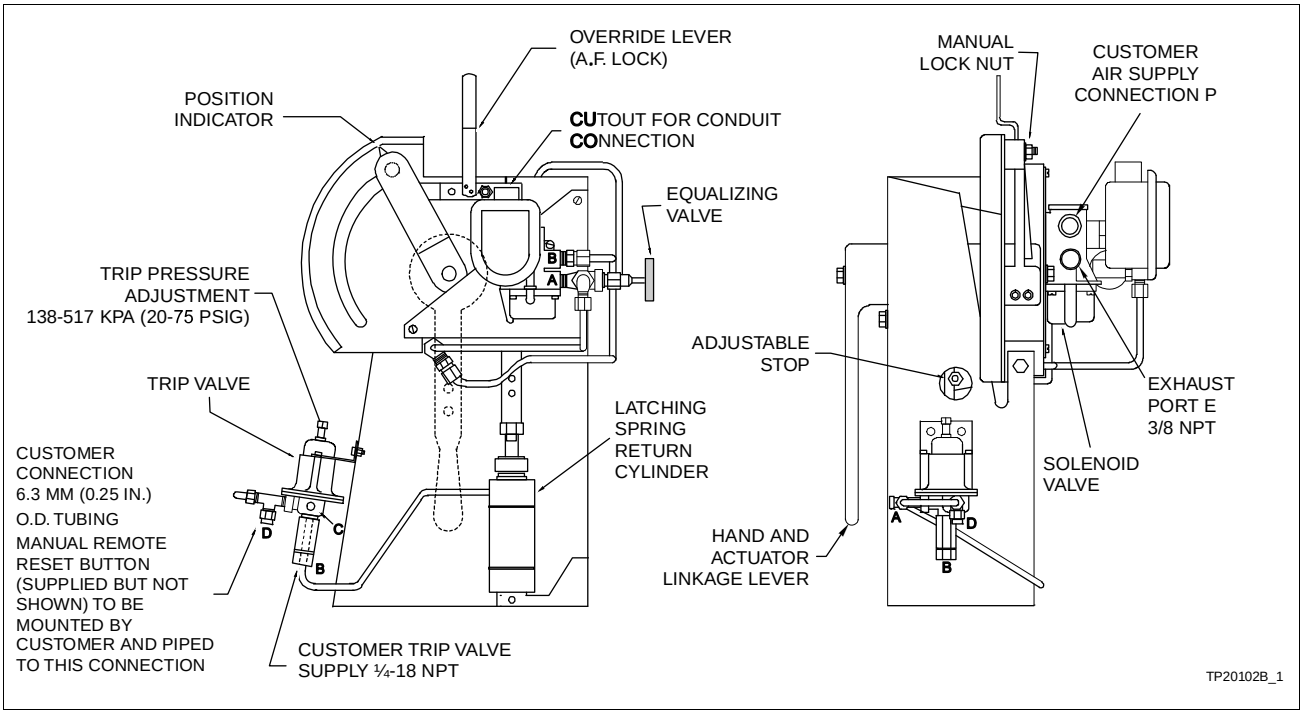


Figure 3-9. Type UP1 Actuator with Solenoid Valve and Air Failure Lock

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***.

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.

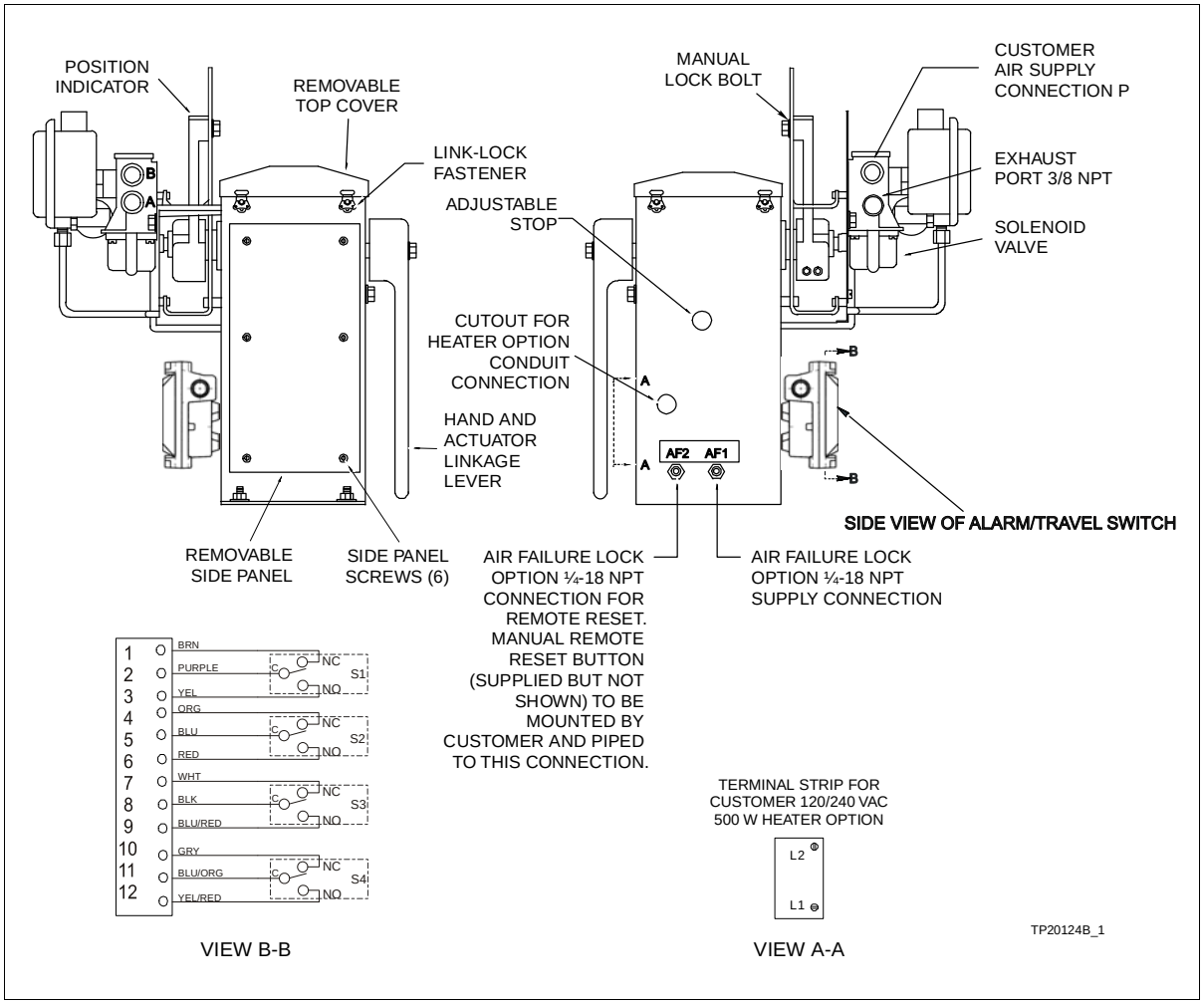


Figure 3-10. Type UP2 Actuator with Solenoid Valve

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.

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

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.

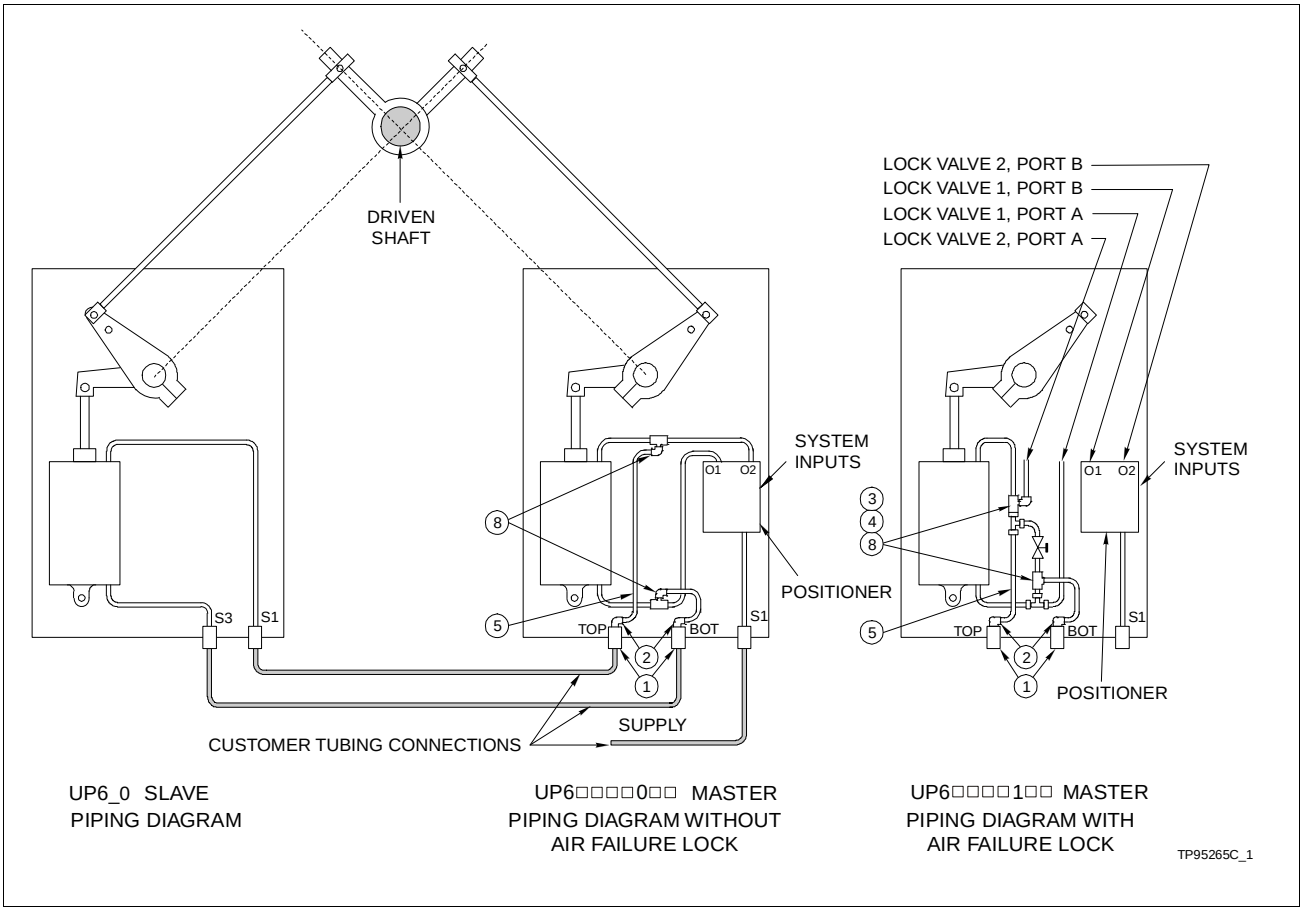


Figure 3-11. Master/Slave Tubing Connections

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

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.

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.

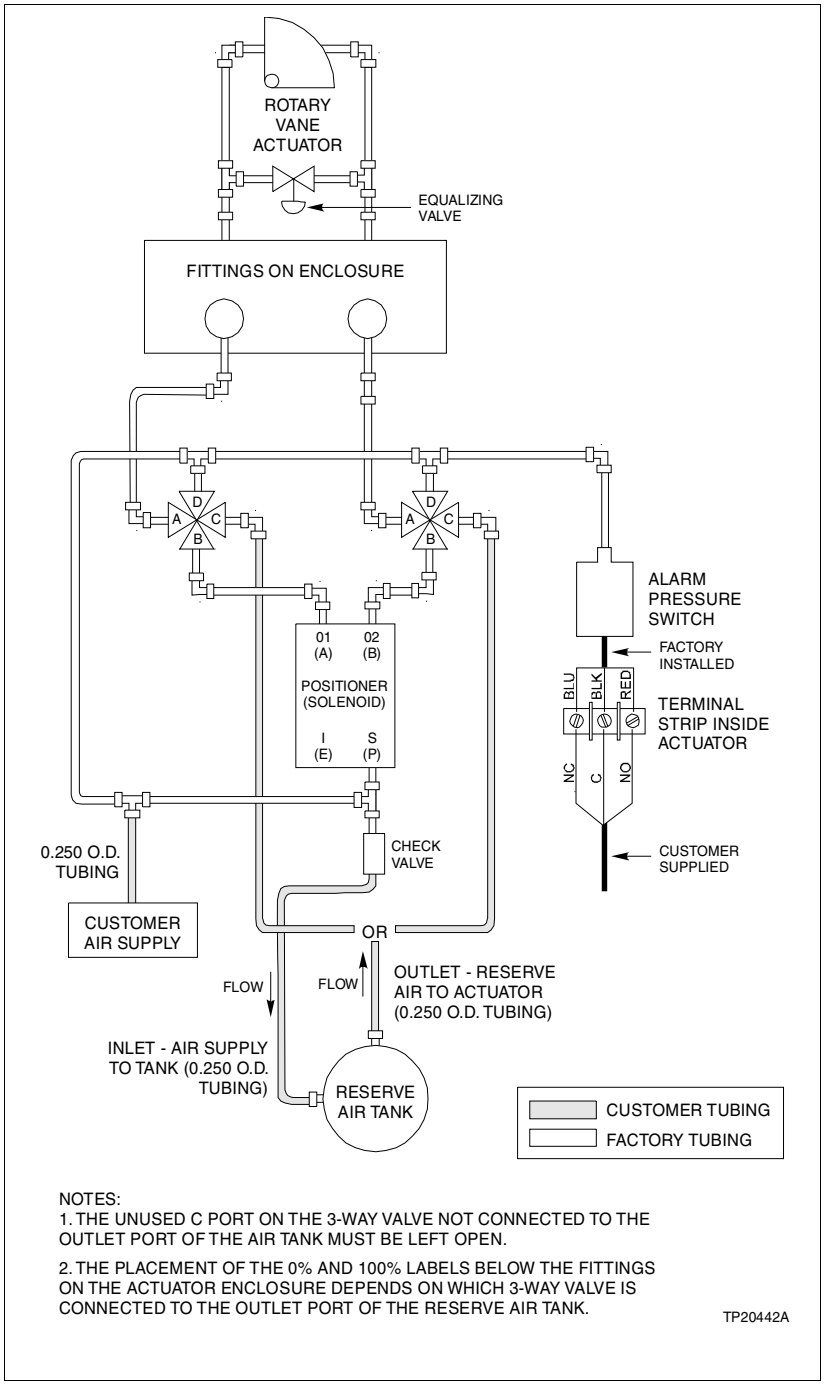


Figure 3-12. Reserve Air Tank Tubing for Type UP2 Actuators

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.

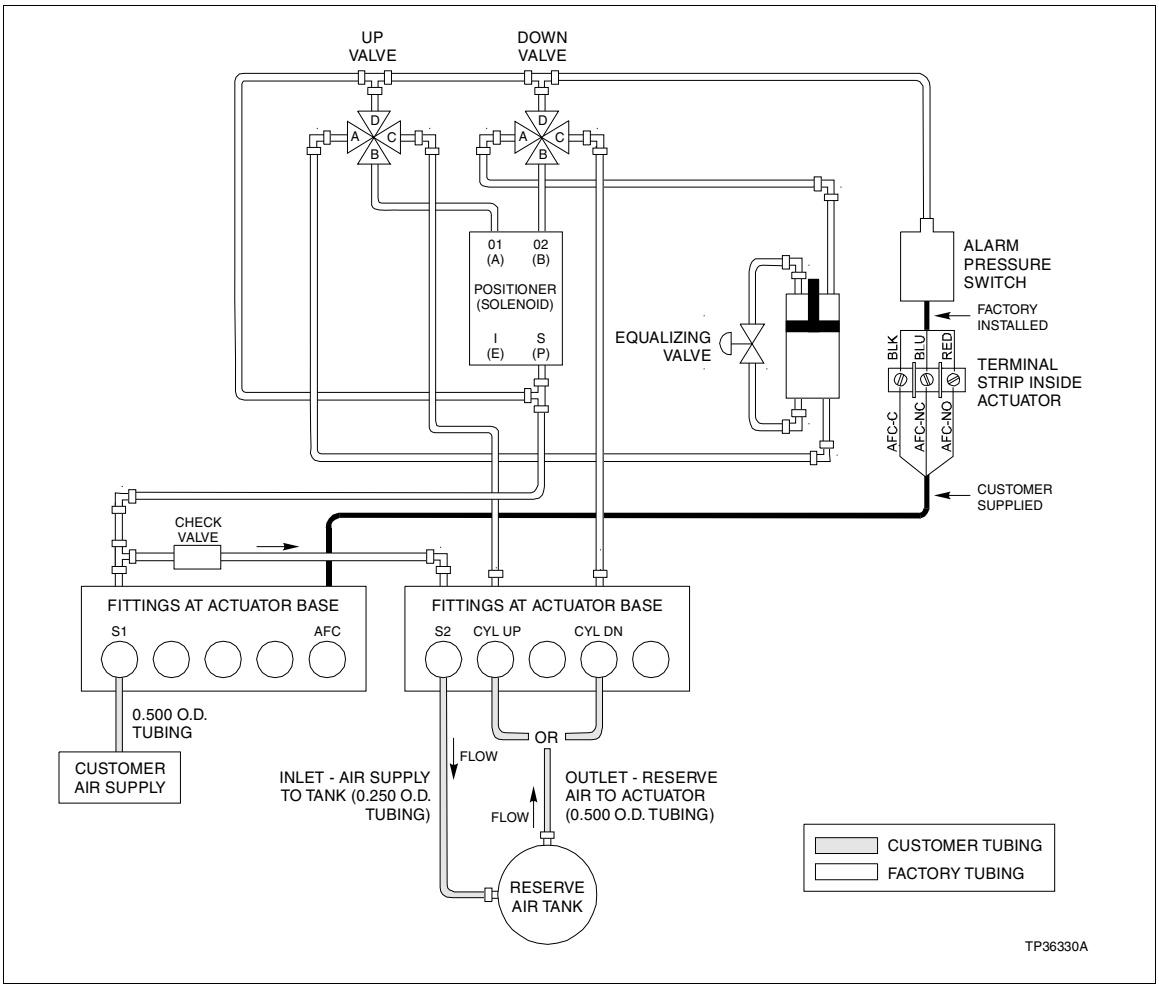


Figure 3-13. Reserve Air Tank Tubing for Types UP3 through UP6 Actuators

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.

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).

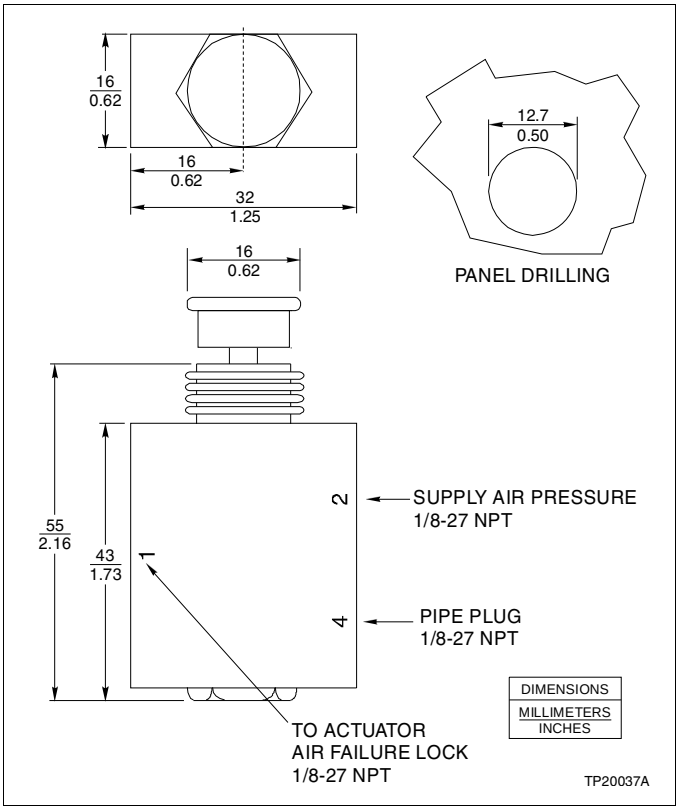


Figure 3-14. Reset Switch for Air Failure Lock (Part Number 19515895_1)

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.

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.

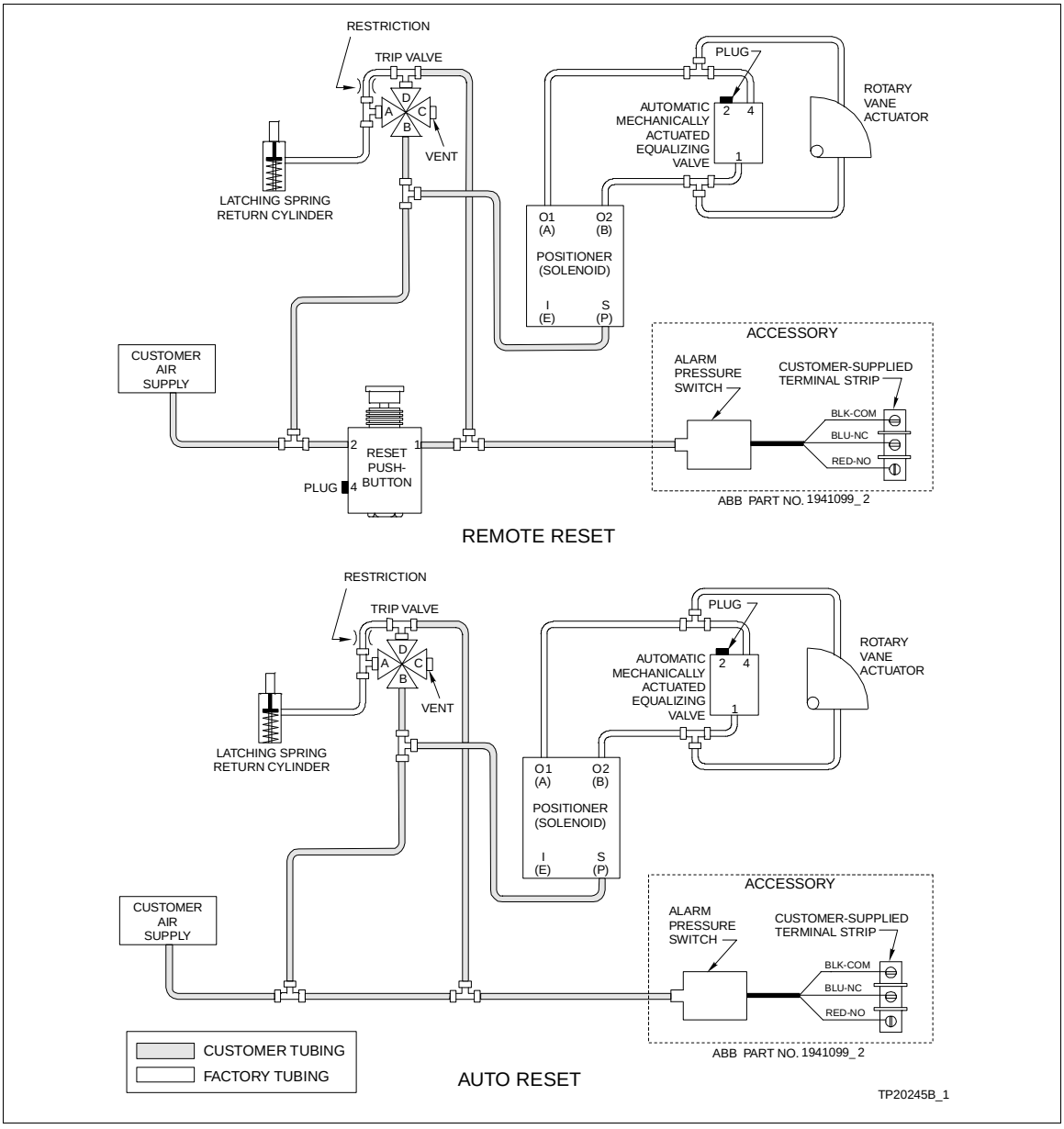


Figure 3-15. Tubing Schematic for Type UP1 Actuator with Air Failure Lock

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.

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.

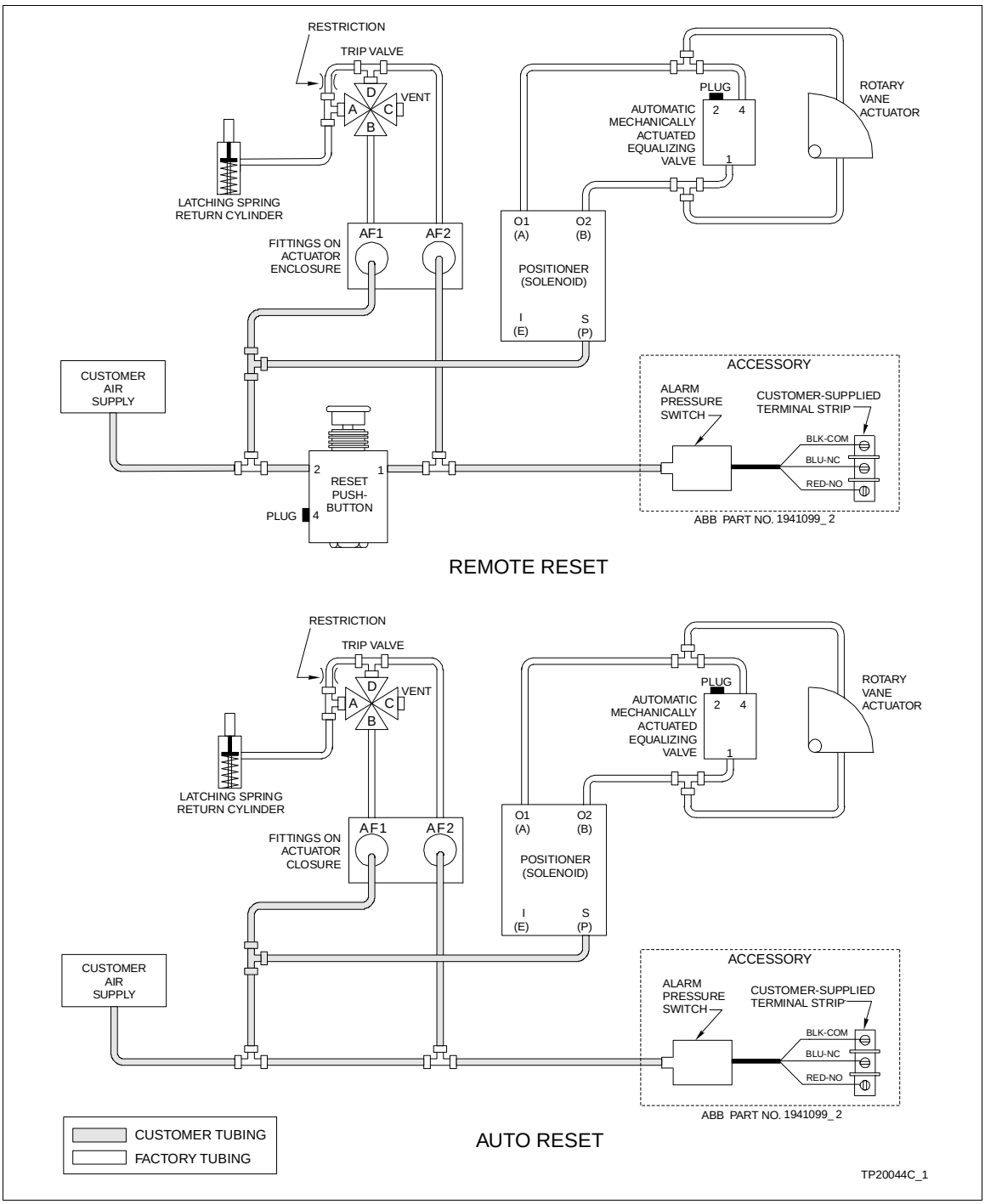


Figure 3-16. Tubing Schematic for Type UP2 Actuator with Air Failure Lock

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.

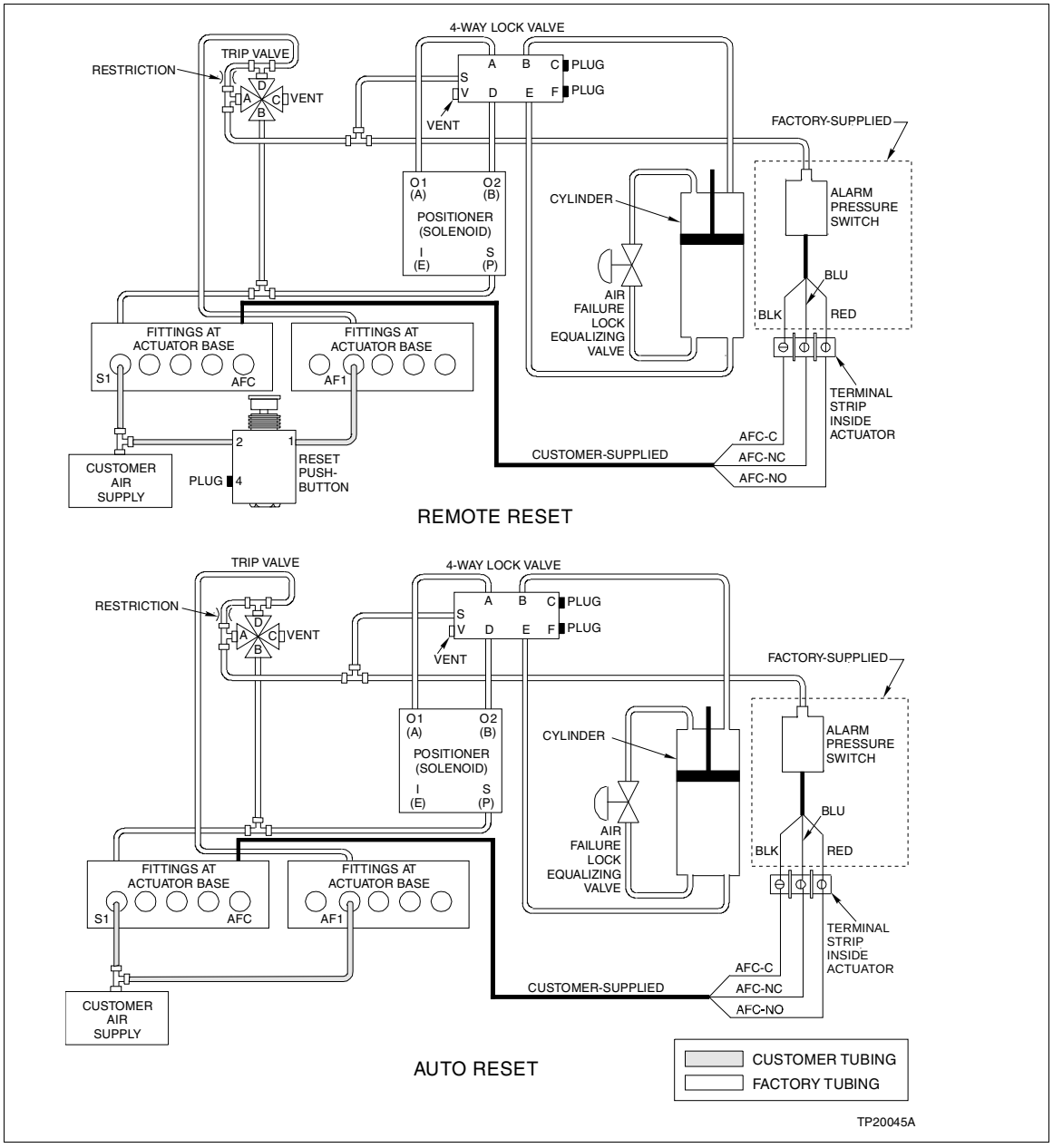


Figure 3-17. Tubing Schematic for Types UP3 and UP4 Actuators with Air Failure Lock

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.

Types UP2, UP3 and UP4 Actuators

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

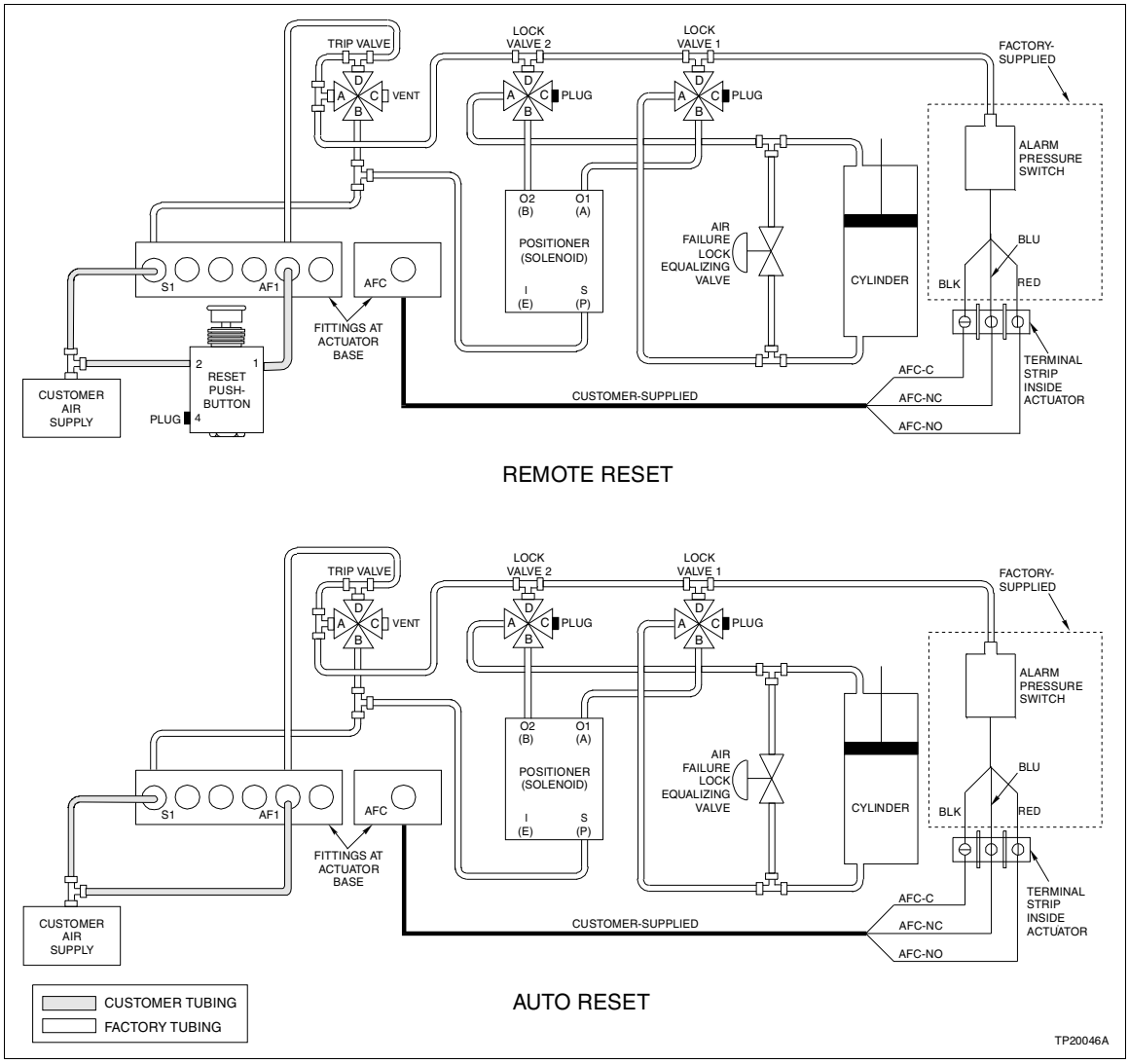


Figure 3-18. Tubing Schematic for Types UP5 and UP6 Actuators with Air Failure Lock

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. Switches can be used as alarm contacts or for an external indication.

Types UP1 & UP2 Actuator

NOTE: Refer to Figures 3-1, 3-2 and 3-19.

The adjustable travel switches for UP1 and UP2 actuators are located inside the cover of the limit switch assembly mounted to actuator frame.

1. Remove the four screws holding the cover of the limit switch assembly.

2. Run the wires through the conduit connector, make the electrical connections to the switches at the terminal block as shown in Figures 3-1a & 3-19 and replace the cover, of the limit switch assembly.

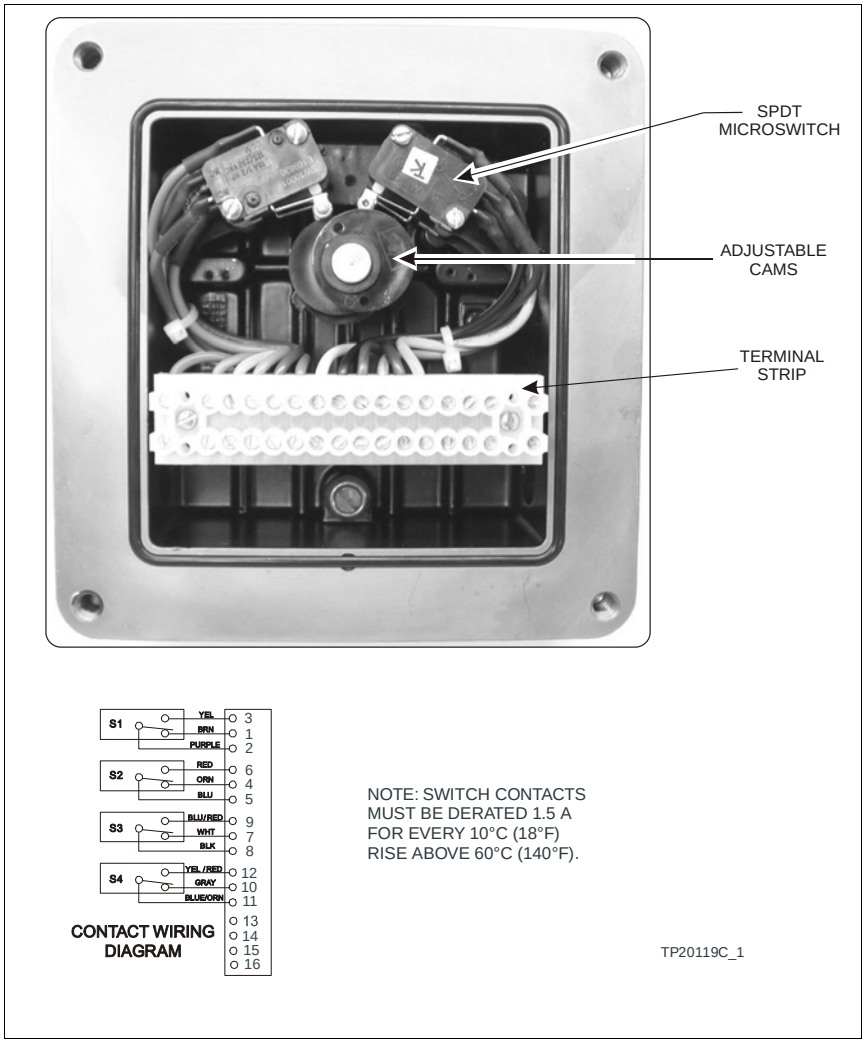


Figure 3-19. Alarm/Travel Switches UP Actuator

Types UP3 and UP4 Actuators

NOTE: Refer to Figures 3-3.

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 located on the actuator frame as shown in Figure 3-3.

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.

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 located on the actuator frame as shown in Figure 3-4.

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

4. Replace the actuator covers.

Shaft Position Transmitter Wiring for Types UP1 and UP2 Actuators

The position transmitter is located within the AV or TZIDC Positioner if a Shaft Position Transmitter is designated in the UP nomenclature.

Wiring for the Shaft Position Transmitter is terminated directly at the AV or TZIDC Positioner. Refer to AV or TZIDC Instruction Manuals for wiring details.

Shaft Position Transmitter Wiring for Types UP3 through UP6 Actuators

NOTES: Refer to Figure 3-3 for UP3/4
Refer to Figure 3-4 for UP5/6

The position transmitter is located within the AV or TZIDC positioner if a Shaft Position Transmitter is designated in the UP nomenclature. The AV or TZIDC Positioner is located inside the UP enclosure.

A conduit connection, V1, is provided at the actuator base for signal wiring to the Shaft Position Transmitter.

Wiring for the Shaft Position Transmitter is terminated at the actuator base terminal block

.

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.**

The transmitter, a two-wire, 4 to 20-milliamp output device, operates on 12 to 30 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. Do not exceed the maximum of the combined resistance of the load and the signal wiring, as applicable to the Shaft Position Transmitter.

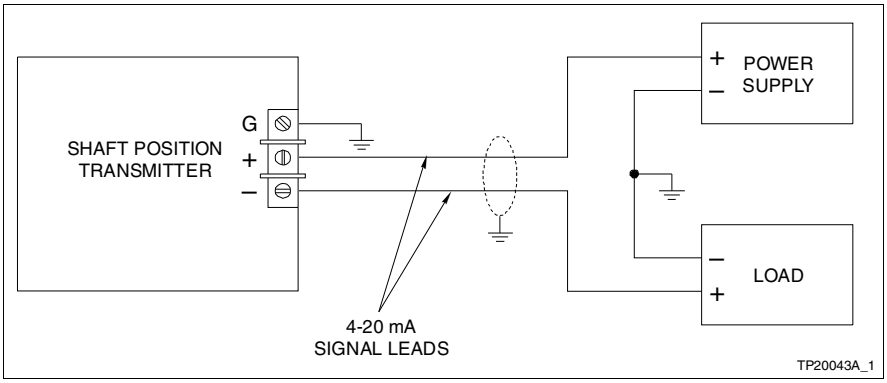


Figure 3-20. Typical Wiring Loop Diagram for the Shaft Position Transmitter

Refer to the AV or TZIDC instruction manuals for more detail on the position transmitters.

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 3-1a 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. Applicable to UP Actuators equipped with AV Positioners.
- 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 AV 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 AV 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 AV 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 AV 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.

Calibration Of UP1 through UP6 Actuators Equipped With TZIDC Positioners

The TZIDC Positioner has an auto-calibration feature. Refer to the TZIDC instruction manual for the complete calibration procedure, see Table 1-1..

OPTIONAL EQUIPMENT CALIBRATION

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

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. Unlatch and rotate the microswitch cam to the desired actuating position and release the cam latch.

4. Reinstall the covers and enclosure.

Pneumatic Shaft Position Transmitter Calibration

NOTE: The pneumatic shaft position transmitter option is not available for Type UP1 actuators, or actuators equipped with Type TZIDC Positioners.

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

Adjustment is normally not required for the trip valves or pressure switch. All adjustments are made before shipment. If necessary, the trip valve may be adjusted in the field to operate at a different trip pressure.

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 for AV, 90 psig for TZIDC) air supply for Types UP1 and UP2 actuators, or a 482 kPa (70 psig) to 689 kPa (100 psig for AV, 90 psig for TZIDC) 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 output 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.

> **NOTE:** On units equipped with TZIDC positioners or solenoids, the supply pressure must be shut-off externally.

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 (On units equipped with TZIDC positioners, turn off the local air supply).

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.

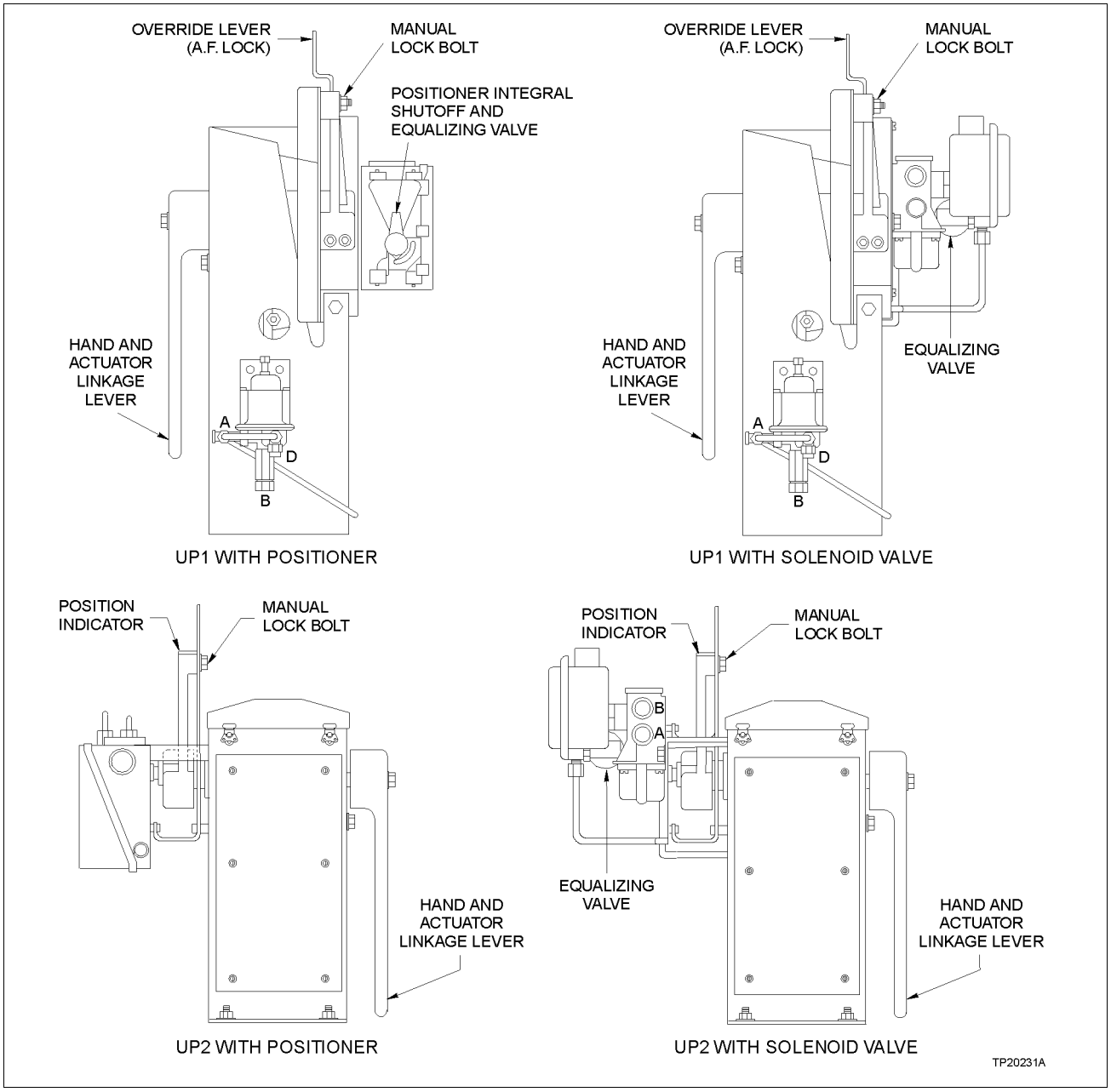


Figure 5-1. Operating Controls - Types UP1 and UP2 Actuators
[TZIDC Positioner with Equalizing Valve not shown]

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 (On units equipped with TZIDC positioners, turn-on the local air supply).

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. For actuators with TZIDC Positioners, the HAND/AUTO transfer handle is situated on the positioner. 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. If the actuator is equipped with a TZIDC positioner, also turn-off the air supply to the positioner.

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. For actuators with TZIDC Positioners, the

HAND/AUTO transfer handle is situated on the positioner. 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. Slowly change the input signal to match the actuator position.

b. Turn the positioner shutoff and equalizing valve to the *AUTO* position. If the actuator is equipped with a TZIDC positioner, also turn-on the local air supply to the positioner.

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. Turn-on the air supply to the TZIDC positioner.

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..

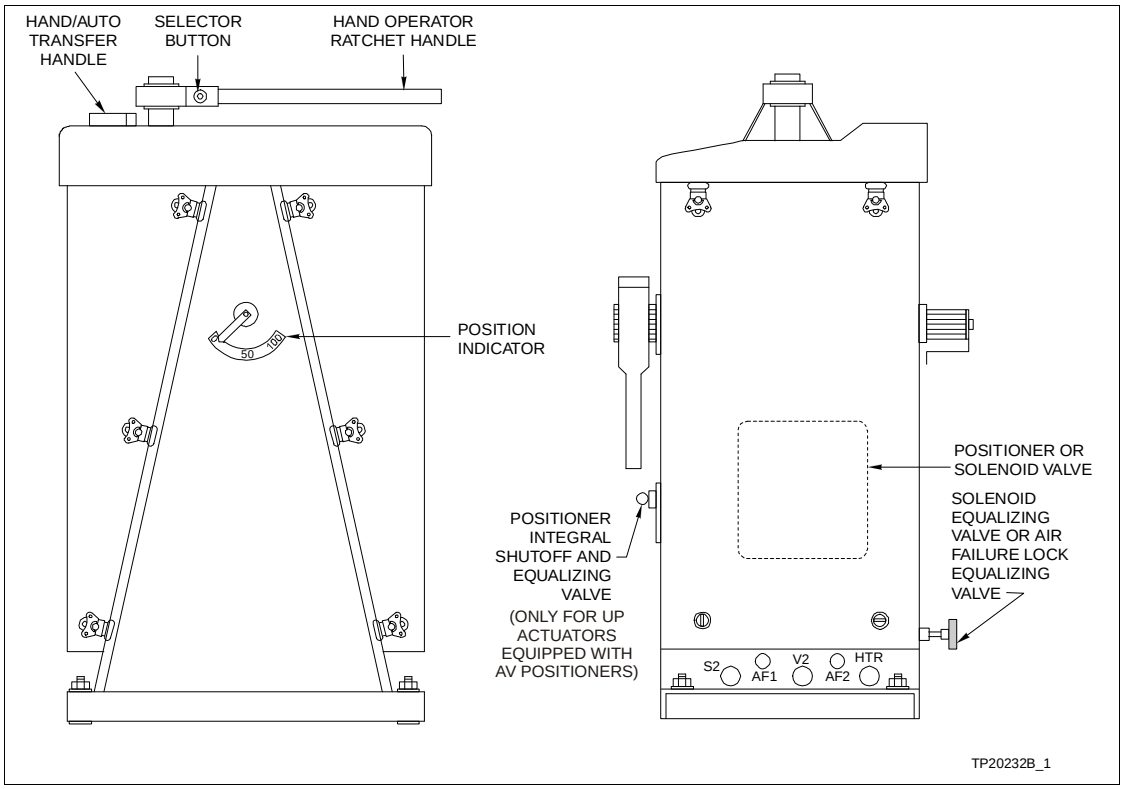


Figure 5-2. Operating Controls - Types UP3 and UP4 Actuators

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.

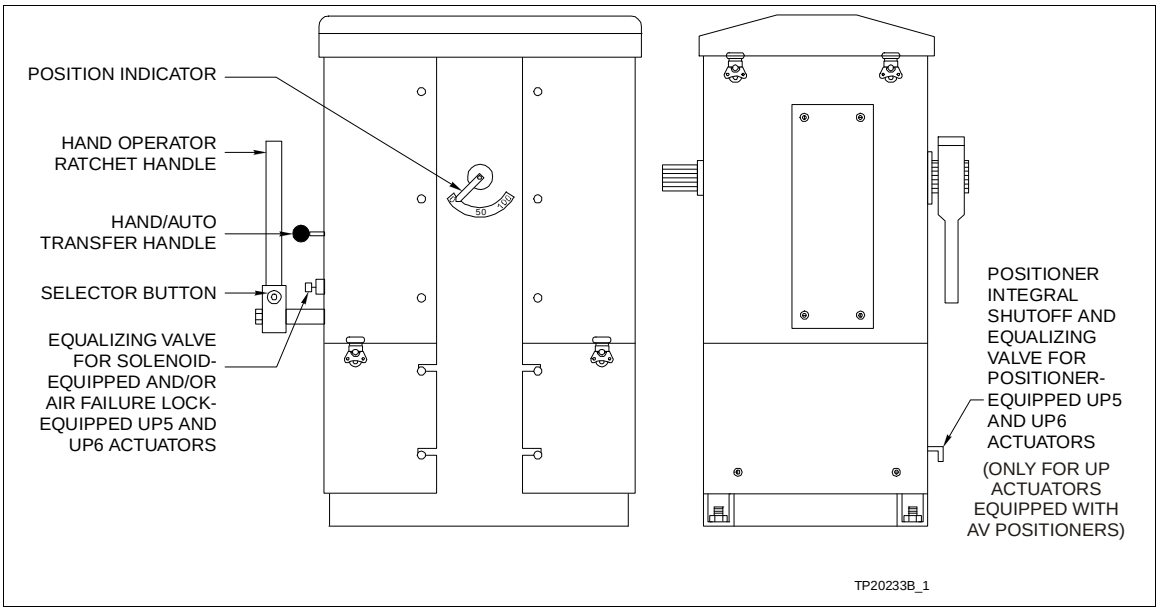


Figure 5-3. Operating Controls - Types UP5 and UP6 Actuators

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. For actuators supplied with TZIDC Positioners, the HAND/AUTO transfer handle is situated on the positioner. 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. Turn the valve to the *HAND* position. If the actuator is equipped with a TZIDC positioner, also turn off the air supply to the actuator.

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. For actuators supplied with TZIDC Positioners, the HAND/AUTO transfer handle is situated on the positioner.

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 and turn-on the air supply to the TZIDC positioner.

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 and turn-on the air supply to the TZIDC positioner.

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
See Note 3 for UP Actuator Equipped with TZIDC Positioner

Fault	Probable Cause	Corrective Action
Final actuation element at one end of stroke and does not respond to change.	Air lines in wrong ports.[2]	Reverse lines connected to positioner O1 and O2 ports.
	Reversed positioner cam rotation.[2]	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
See Note 3 for UP Actuator Equipped with TZIDC Positioner

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.[2]	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.[2]	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.[2]	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.[2]	Check air line connections.
	Incorrect cam installed for application.[2]	Determine application (direct or reverse acting) and check cam.
	Signal diaphragm leaking.[2]	Replace diaphragm. Refer to the appropriate positioner instruction.
	No output from I/P assembly.[2]	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.[2]	Check and replace if necessary. Refer to appropriate positioner instruction.
	No output from I/P assembly.[1]	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.[2]	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**.
Shaft position transmitter will not operate	Transmitter assembly defective.	Replace transmitter board assembly. Refer to the appropriate positioner instruction.
	Feedback potentiometer defective.[2]	Check potentiometer resistance. If open, replace feedback potentiometer. If not defective, check transmitter board.

Table 6-1. Fault Correction Chart
See Note 3 for UP Actuator Equipped with TZIDC Positioner

Fault	Probable Cause	Corrective Action
Alarm/travel switch unit will not operate.	Loose microswitch cam.	Tighten cam.
	Microswitches defective.	Replace microswitches.
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.

NOTES:
1. Types AV2 and AV3 positioners only.
2. Type AV Positioners only.
3. For UP Actuators equipped with TZIDC Positioners.
   Refer to Tables 6-1a and 6 6-1b Troubleshooting
   Refer to Table 1-1 for Instructions

Table 6-1a. Fault Correction Chart

Troubleshooting TZIDC / 200
Hunting problem

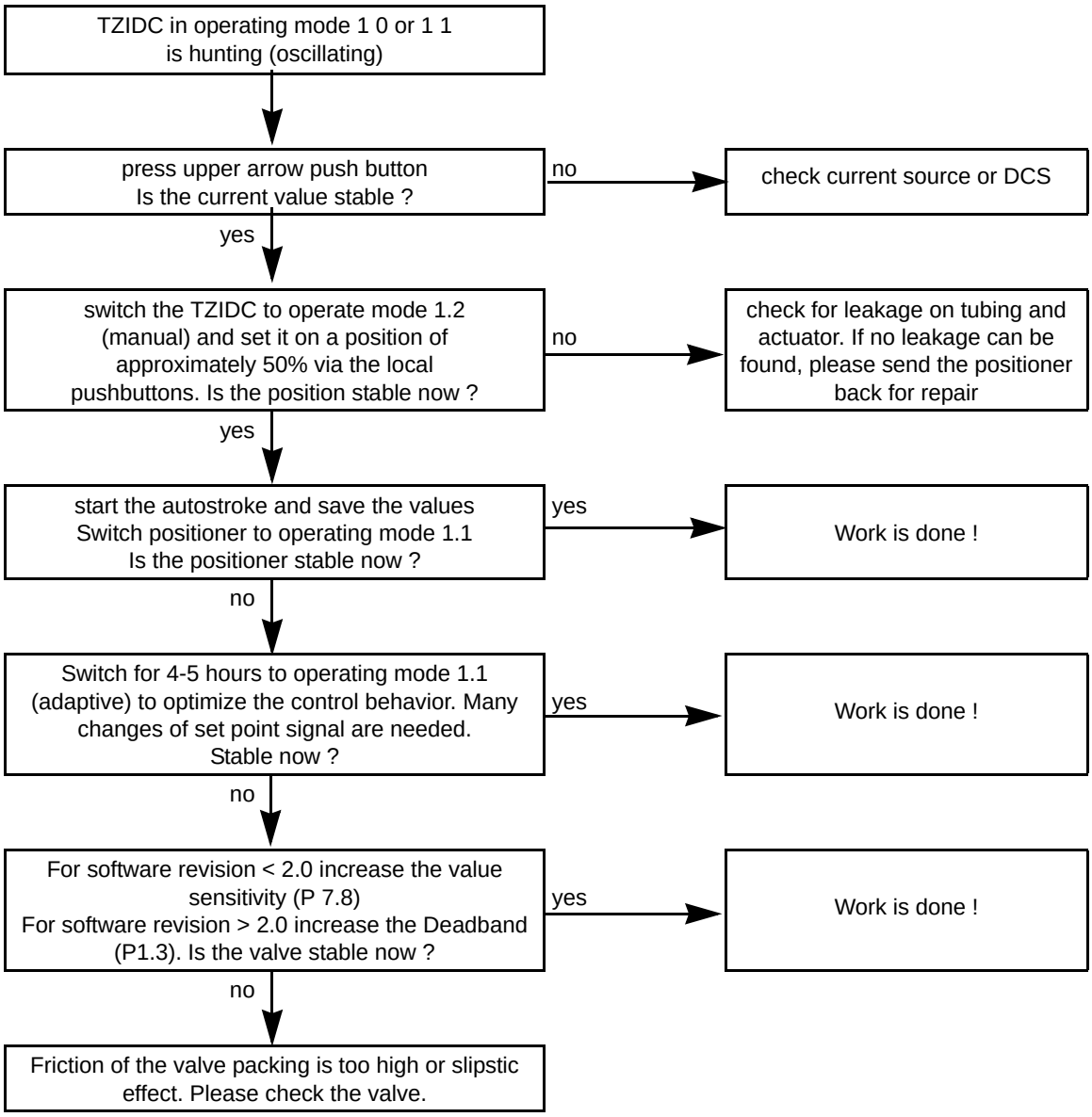
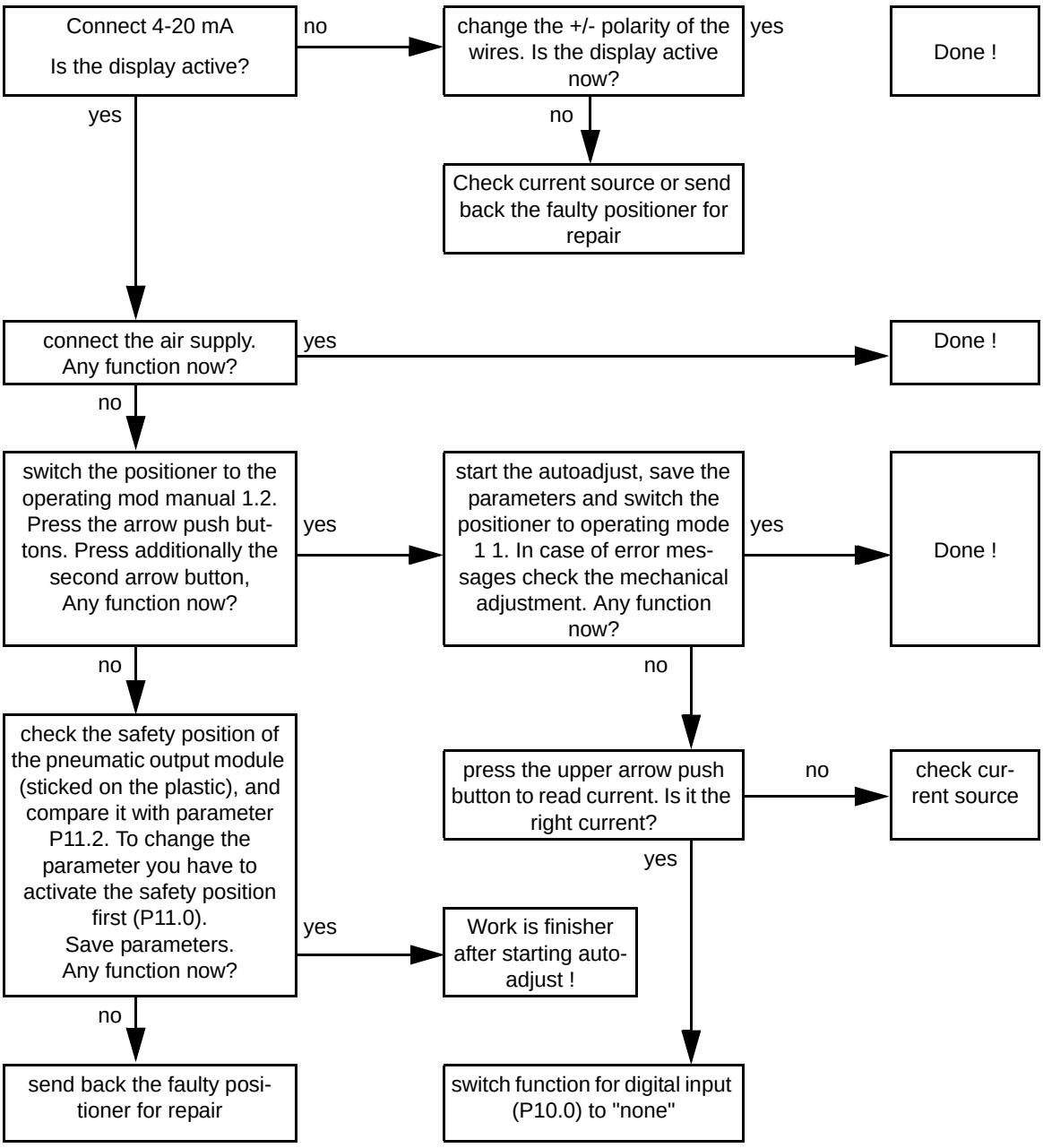


Table 6-1b. Fault Correction Chart

Troubleshooting TZIDC / 200

No Function



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 PTFE 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 PTFE 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 equalizing valve and/or integral shut off valve moves easily. If not, refer to the appropriate positioner instruction for cleaning procedures.

9. Lubricate the grease fittings on the cylinders for Types UP3 through UP6 actuators until the grease comes out the relief. See Figures 8-3 through 8-5 for the location of these fittings.

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 PTFE 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 PTFE 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 2 to access the components referred to in this section.

POSITIONER REMOVAL AND REPLACEMENT

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

1. Lock the actuator in place using the hand mechanism or locking bolt 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. For UP actuators with TZIDC Positioners, also turn off the air supply to the actuator.

3. Allow the air pressure to subside completely.

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

5. Disconnect and label the output signal and supply lines from the positioner. Label and remove wiring connections.

6. For Types UP1 and UP2 actuators, perform Step 6a. For Types UP3 through UP6 actuators, perform Steps 6b and 6c.

   a. Remove the 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.

7. Remove the positioner.

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

9. 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. For UP actuators with TZIDC Positioners, also turn off the air supply to the actuator.

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.

6. Feed the lines through the actuator frame.

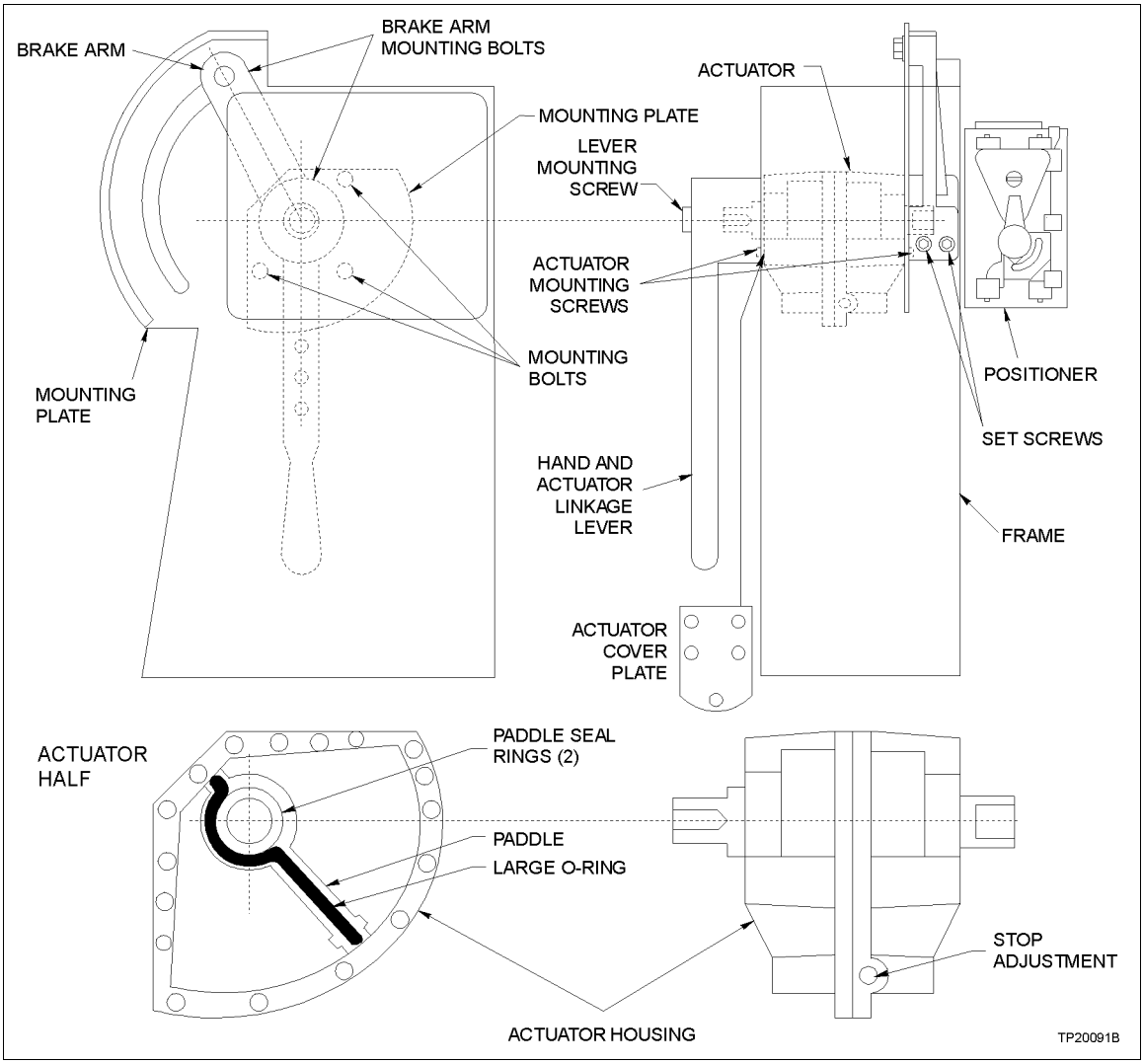


Figure 8-1. Rotary Vane Removal and Seal Replacement

7. Refer to Appendix A or Appendix A 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 Appendix A 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. For actuators with TZIDC Positioners, also turn off the air supply to the actuator.

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 Figure 8-2 through 8-5.

1. Refer to Appendix A 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.

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
for UP3, items 2, 3, 6 in Fig. 8-2;
for UP4, items 1, 8, 9 in Figs. 8-3 and 8-4
for UP6, items 5, 8, 10 in Fig. 8-5
with No. 55M Dow Corning lubricant, part number 199354_1.

14. Place the piston seal and O-rings into the piston rod.

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, circumference of the upper flange and bushing with No. 55 Dow Corning lubricant, Part No. 199354_ 1.

18. Paying added attention not to damage the O-rings, reassemble the cylinder.

19. Lubricate the inside of the bushing (item 13 in figure 8-2) with TEXACO Multifak® EP2 lubricant. [Also refer to item 23]

20. This step applies only to Type UP3 actuators. Tighten the hex full nuts to 8.1 Nm (72 in-lbs).

21. This step applies only to Types UP4 through UP6 actuators. Install the retaining rings and the bottom end flange.

22. Check the assembly for leaks using soapsuds solution by applying 345 to 690 kPa (50 to 100 psi).

23. Lubricate the cylinder via grease fittings with TEXACO Multifak® EP2 lubricant until first lubricant exits the weep holes.

24. Refer to **CYLINDER ASSEMBLY REPLACEMENT (TYPES UP3/4/5/6 ACTUATORS** to install the cylinder assembly.

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	Multifak® EP2 Texaco	Lube 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.

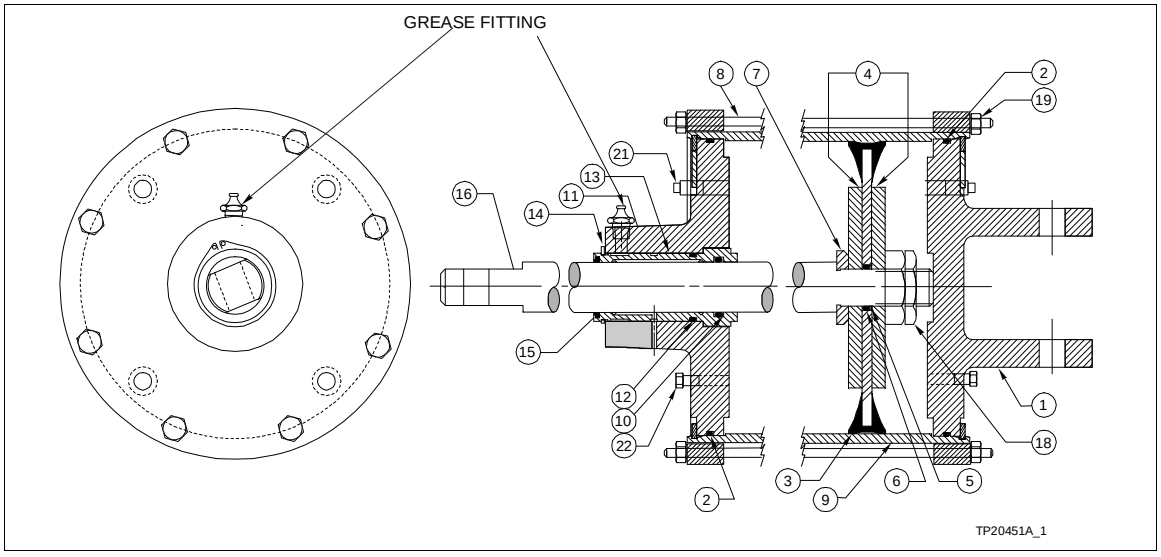


Figure 8-2. Cylinder Assembly for Type UP3 Actuators (Part Number 5328775 _1)

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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.

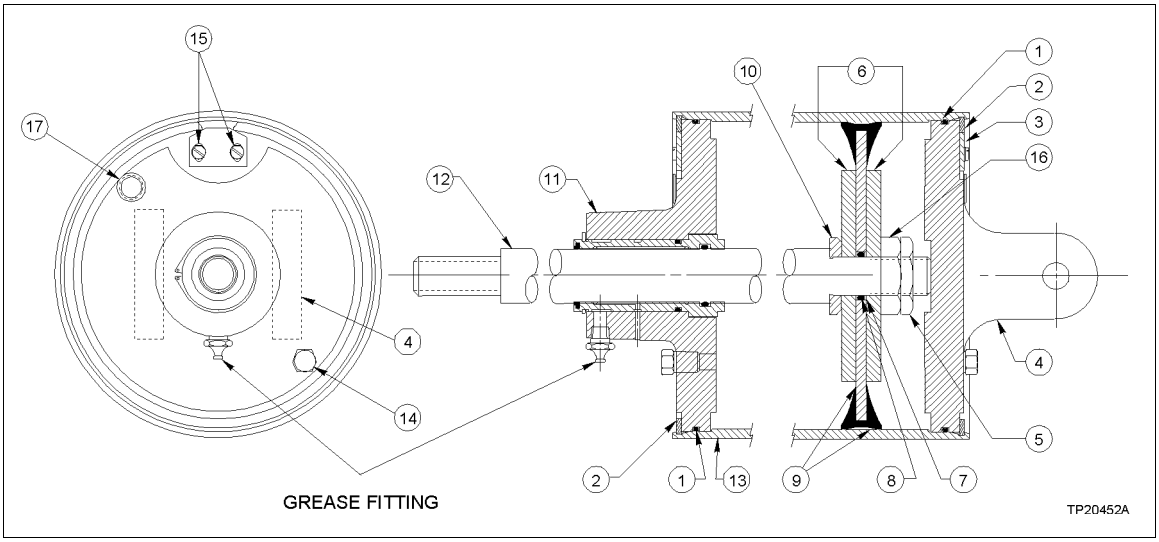


Figure 8-3. Cylinder Assembly for Type UP4 Actuators (Part Number 5328769_1)

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..

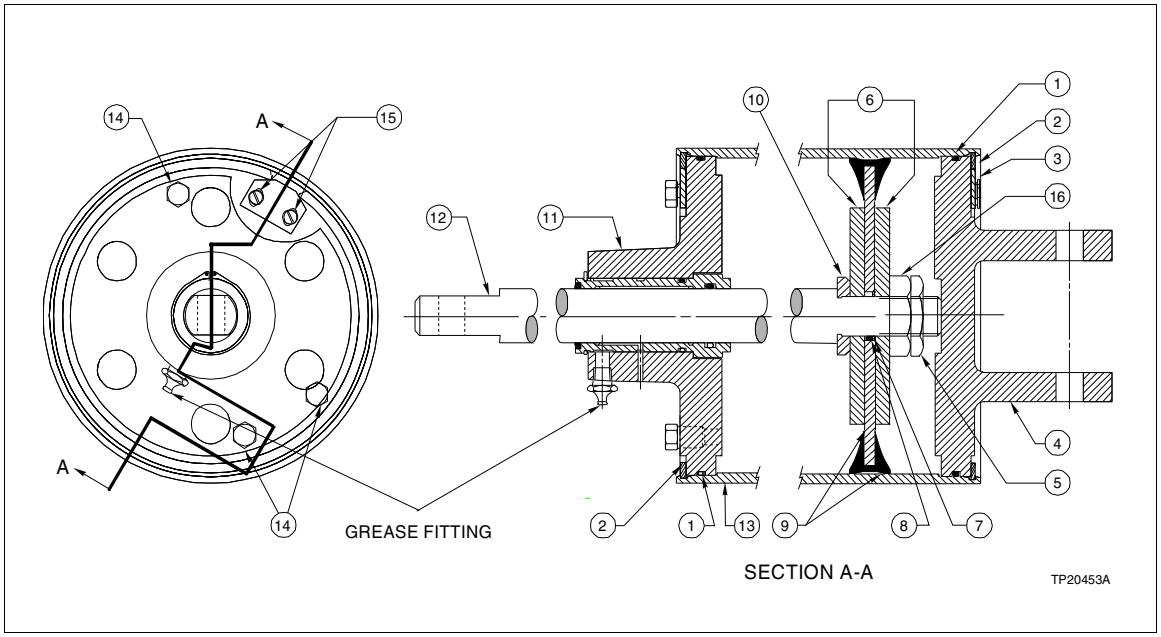


Figure 8-4. Cylinder Assembly for Type UP5 Actuators (Part Number 5328952 _1)

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

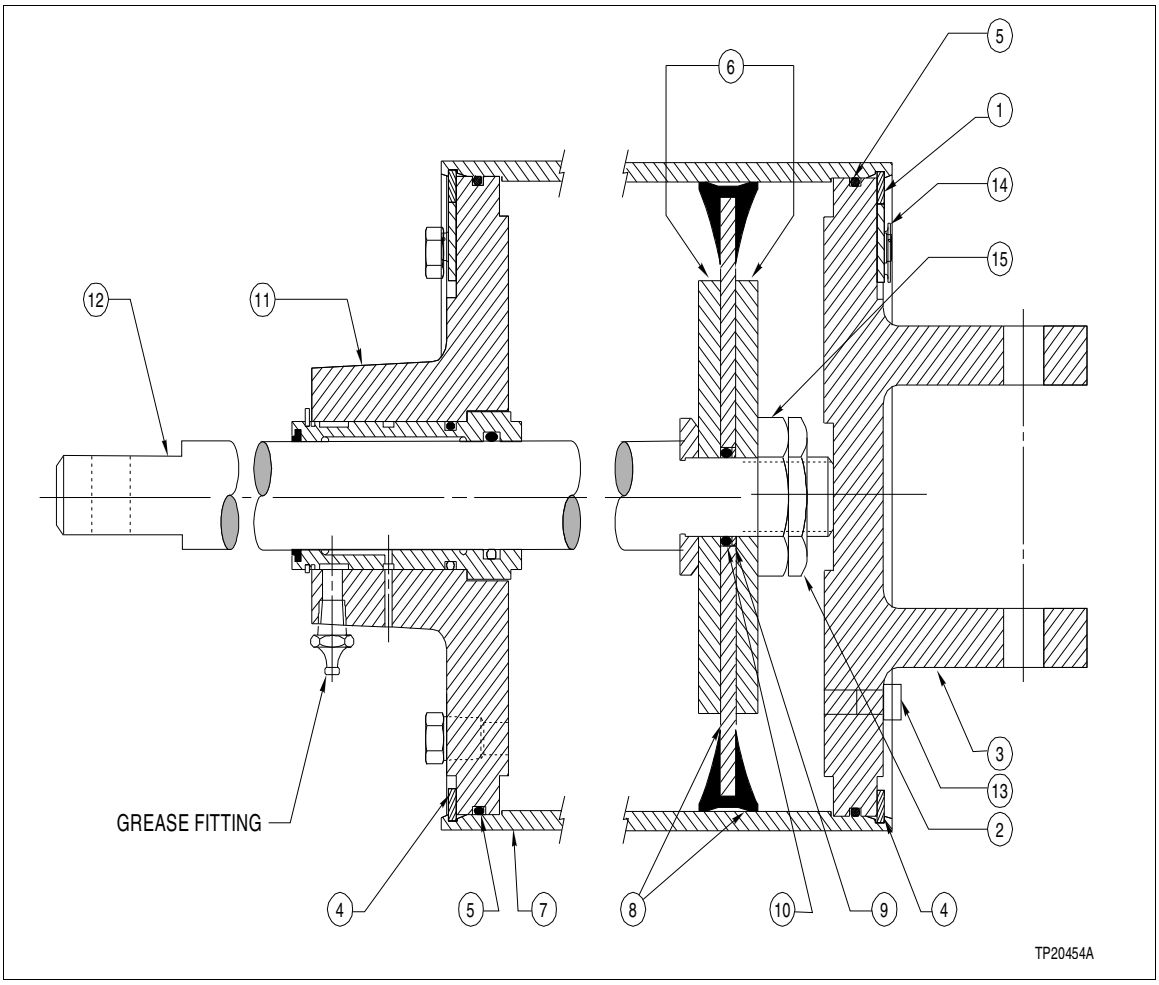


Figure 8-5. Cylinder Assembly for UP6 Actuators (Part Number 5328945 _1)

CLUTCH FORK INSPECTION AND REPLACEMENT (TYPES UP5 AND UP6 ACTUATORS)

NOTE: Refer to Figure 8-6.

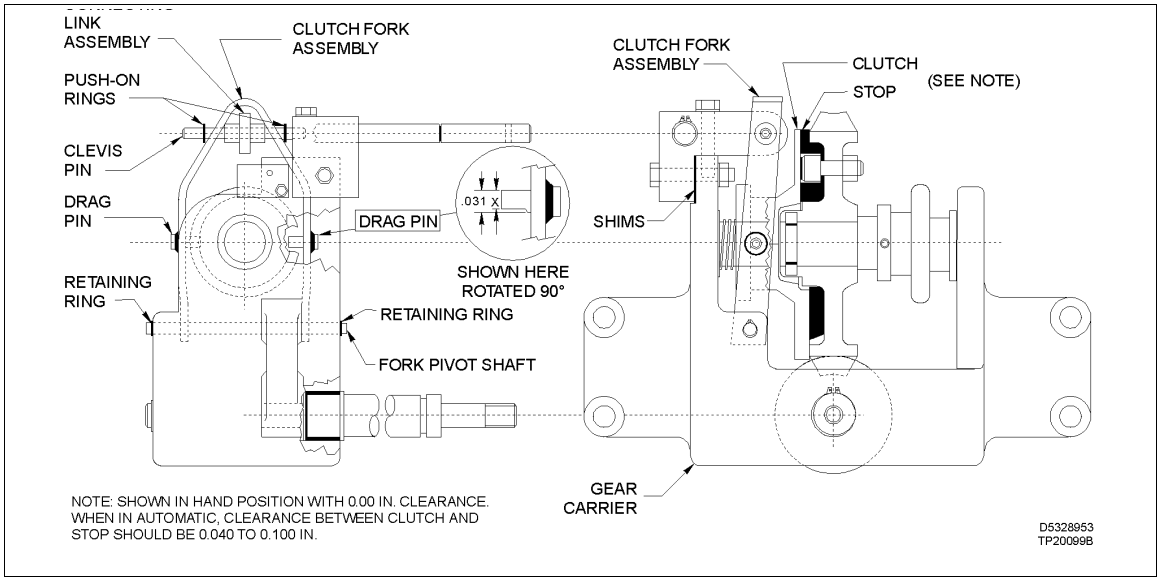


Figure 8-6. Clutch and Clutch Fork Assembly

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.

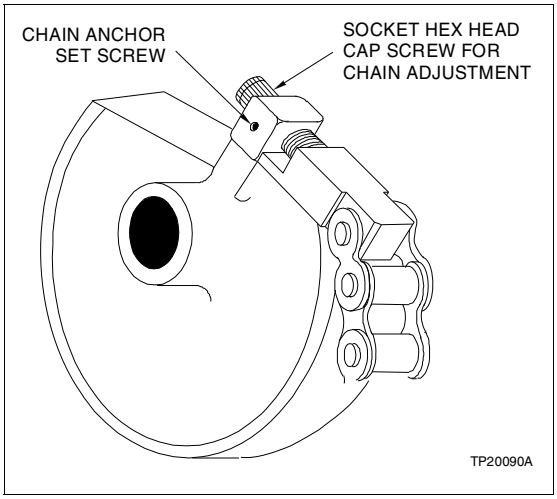


Figure 8-7. Roller Chain Adjustment for Types UP5 and UP6 Actuators

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 anchor. Replace 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.

Alarm/Travel Switch Removal and Replacement

NOTE: Refer to Figure 3-19 and the drawings in Appendix A.

The alarm/travel switch design changed in April 2004. See figure A-29 for details of the pre-2004 obsolete design. Parts are no longer available for the old pre-2004 switch. Repair of the pre-2004 switch is by replacement; use the replacement switch kit part number appropriate for UP actuator size listed in the following table.

If adding a new alarm/travel switch to a UP actuator that was originally supplied without the alarm/travel switch option, use the Add-On switch kit part number appropriate for the actuator size listed in the following table.

Table 8-5. UP Actuator Travel Switch Kits

UP Size	Replacement Switch Kit Part Number
UP1	5328745A3
UP2	5328932L3
UP3/4	5328787A2
UP5/6	5328962A3
UP ZSize	**Add-On Switch Kit Part Number**
UP1	5328745A2
UP2	5328932L4
UP3/4	5328787A1
UP5/6	5328962A1
The Add-On switch kits include the linkage necessary to connect the UP shaft to the switch.	

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. For all actuators with TZIDC Positioner, also turn off the air supply to the actuator.

3. Allow the air supply to subside completely.

4. Remove the covers necessary to allow access to the alarm/travel switch assembly.

5. Locate the mounting bracket that is part of the actuator frame.

6. Remove the four mounting screws securing the travel switch unit to the actuator frame mounting bracket.

7. Disconnect the linkage from the travel switch unit.

8. Remove the travel switch unit assembly from the actuator frame.

9. Replace the complete travel switch assembly.

10. Adjust the microswitches as outlined in **Alarm/Travel Switch Calibration** in Section 4.

11. Reassemble 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-7; and Figures A-1 through A-5 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	FrameLong-lok
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
28	3	NLJHA21000	Hex full nut (0.250-20)

Table A-1. UP1 with Positioner, Figure A-1 (Drawing No. 5328573) (continued)

Item	Qty	Part No.	Description
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)

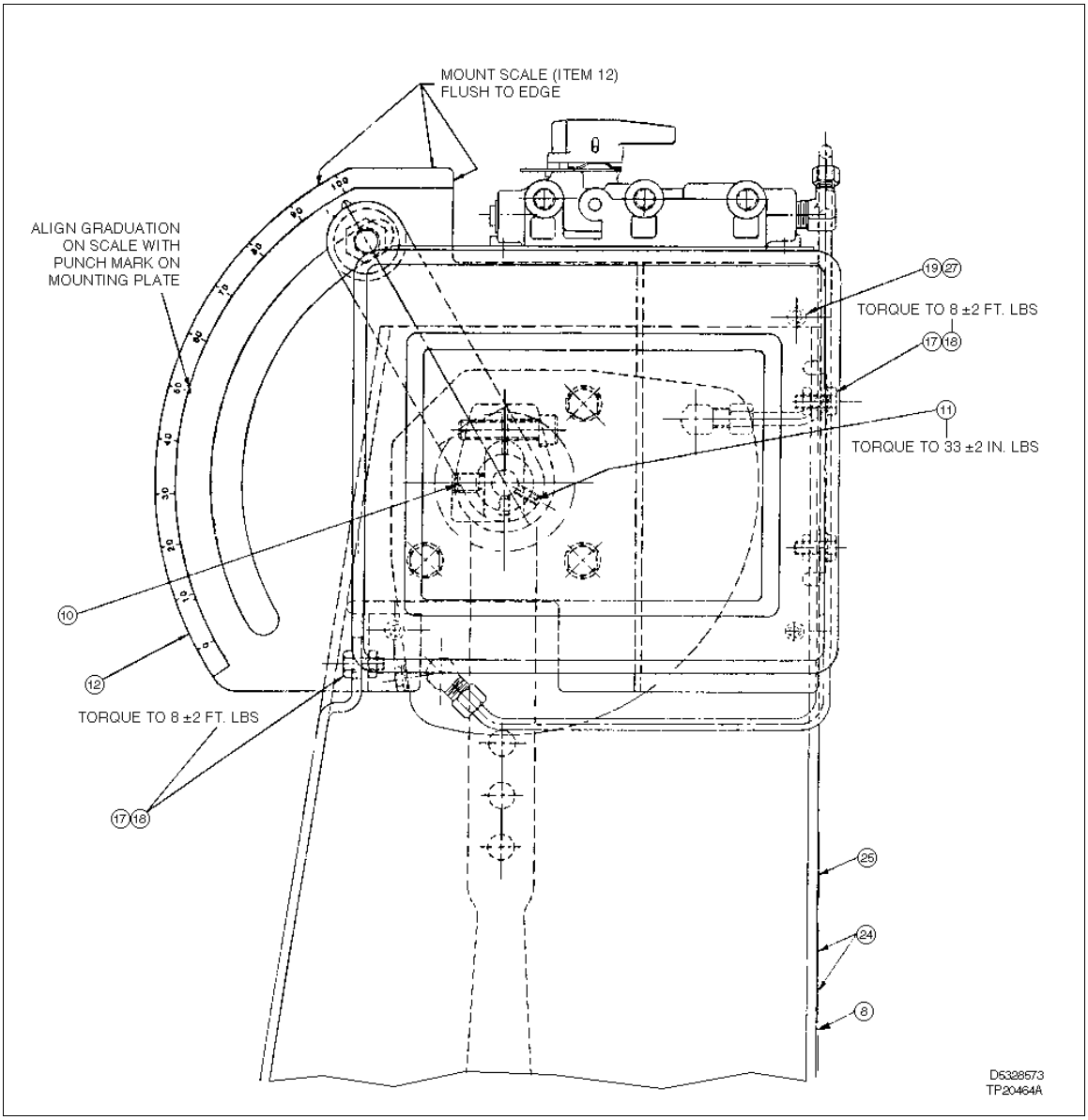


Figure A-1. UP1 with Positioner, Tables A-1 and A-2 (Sheet 1 of 3)

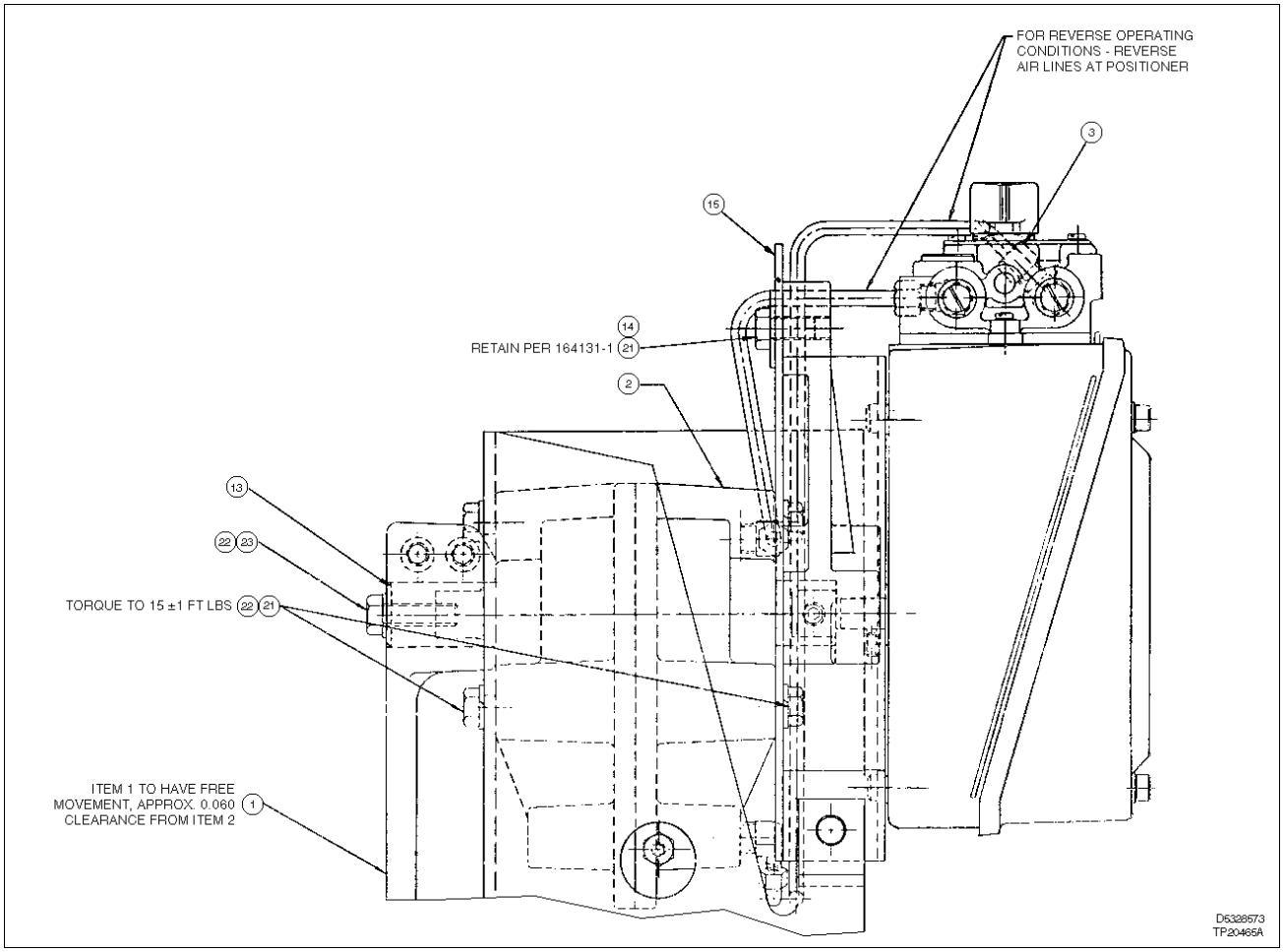


Figure A-1. UP1 with Positioner, Tables A-1 and A-2 (Sheet 2 of 3)

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_U	V18345-202_42_001
UP1_A	AV1221_3	UP1_D	AV3321_3	UP1_W	V18345-202_52_001
				UP1_Y	V18348-201_33_0110
				UP1_Z	V18348-201_43_0110

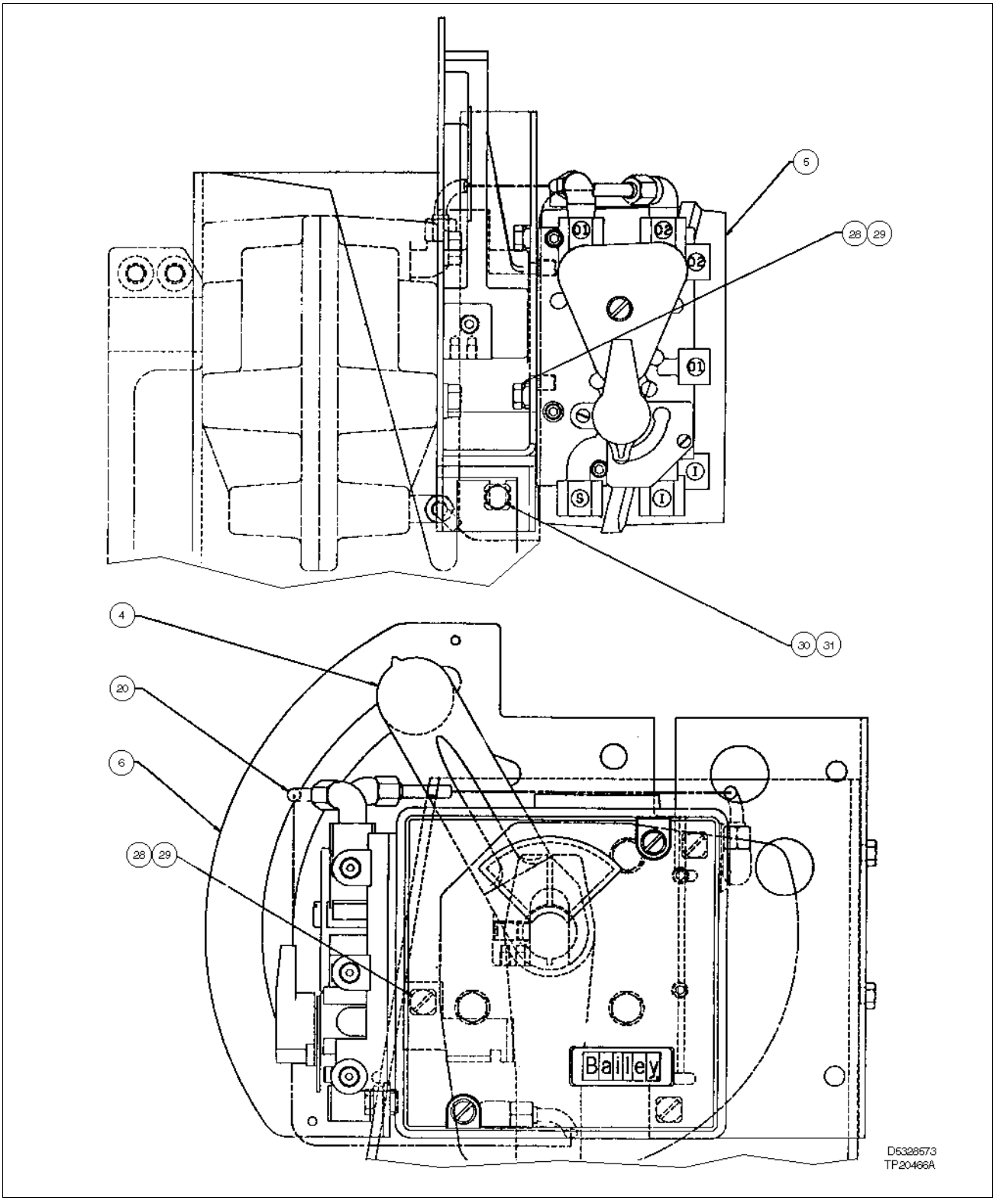


Figure A-1. UP1 with Positioner, Tables A-1 and A-2 (Sheet 3 of 3)

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

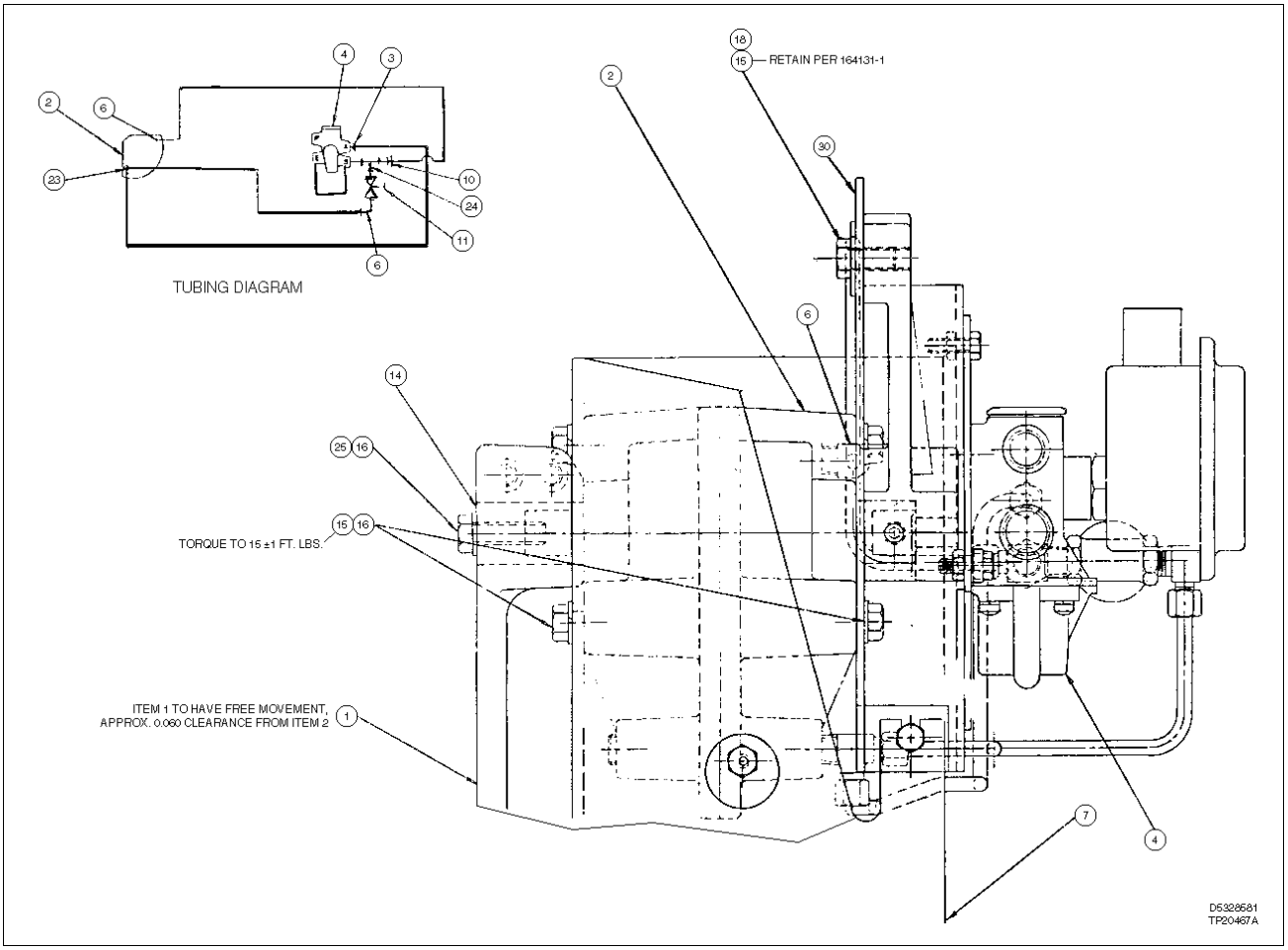


Figure A-2. UP1 with Solenoid Valve, Tables A-3 and A-4 (Sheet 1 of 2)

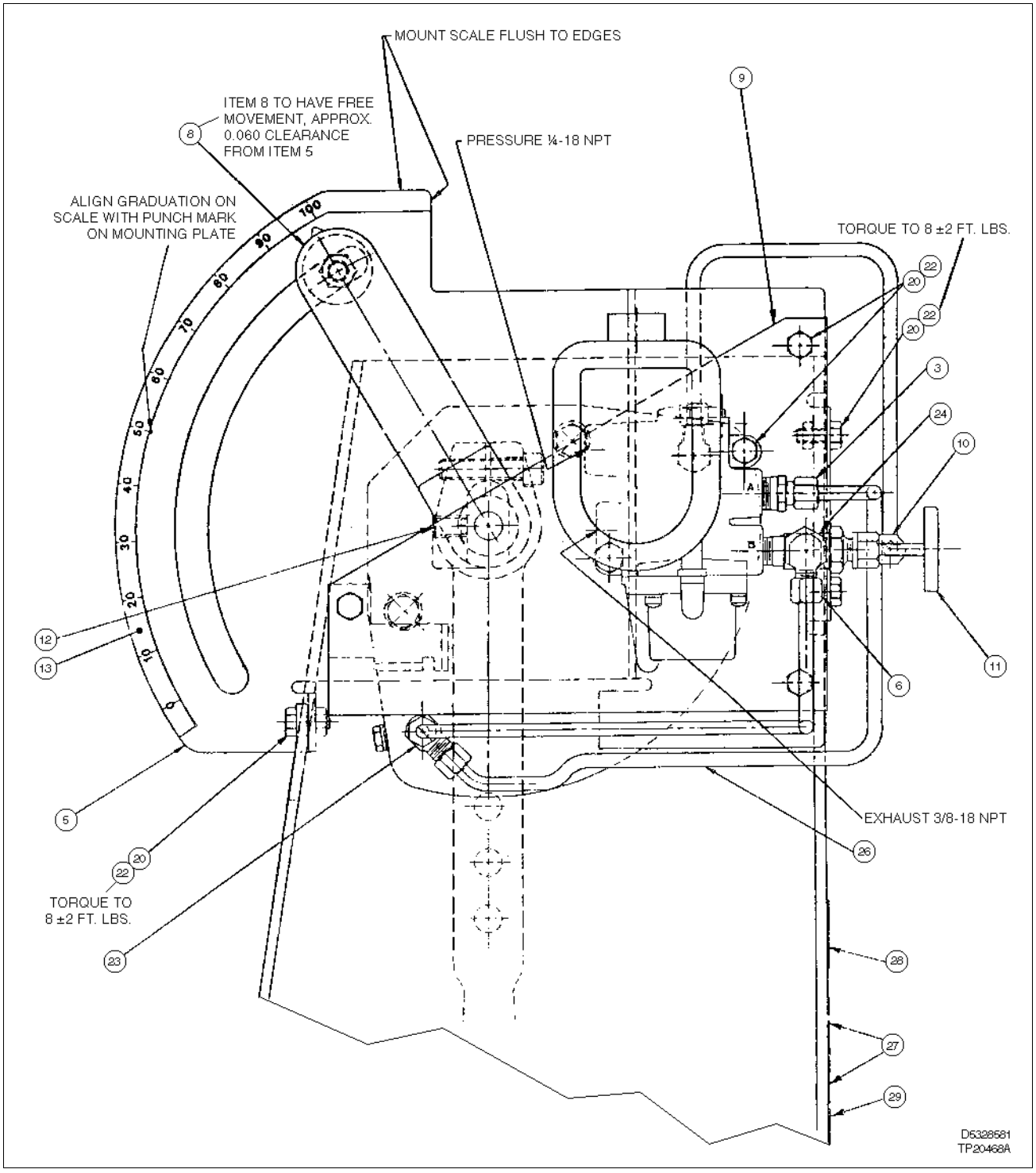


Figure A-2. UP1 with Solenoid Valve, Tables A-3 and A-4 (Sheet 2 of 2)

Table A-5. UP1 Alarm/Travel Switch Kit, Figure A-3 (Kit No. 5328745 _1)

Item	Qty	Part No.	Description
1	1	155C003U01	Alarm/travel SW-UP1,2,5,6-4SW
2	1	355C647U02	Mtg. plate travel SW UP1
3	1	5312449A13	Conn. link
4	1	5328742B1	Arm, link
5	1	5328596A1	Arm, drive
6	1	5328801A1	Bracket, support
7	6	NNBAC21000	Nut Hex-Ext Washer 1/4-20
8	6	NAUAC21012	Bolt Hex Hd-Fin 1/4-20 x 3/4
9	1	NBAAC13008	Hex Soc Hd Cap Scr 6-32 x 1/2
10	2	NHSAC16014	Sem Slt Pan Int 10-32 x 7/8
11	2	NHSAC16005	Sem Slt Pan Int 10-32 x 5/16
12	4	040D101T10	5/16-18 x 5/8 Screw Cap Hex Hd
13	4	085D516T10	5/16 Spring Lock Washer
14	1	150A164U01	Conduit nipple #502
15	1	114B026U01	1/2” Protection cap
16	1	172A049U91	Conduit plug recessed Hd 3/4”
17	1	SD-50-3016	UP10 w/cast encl travel SW

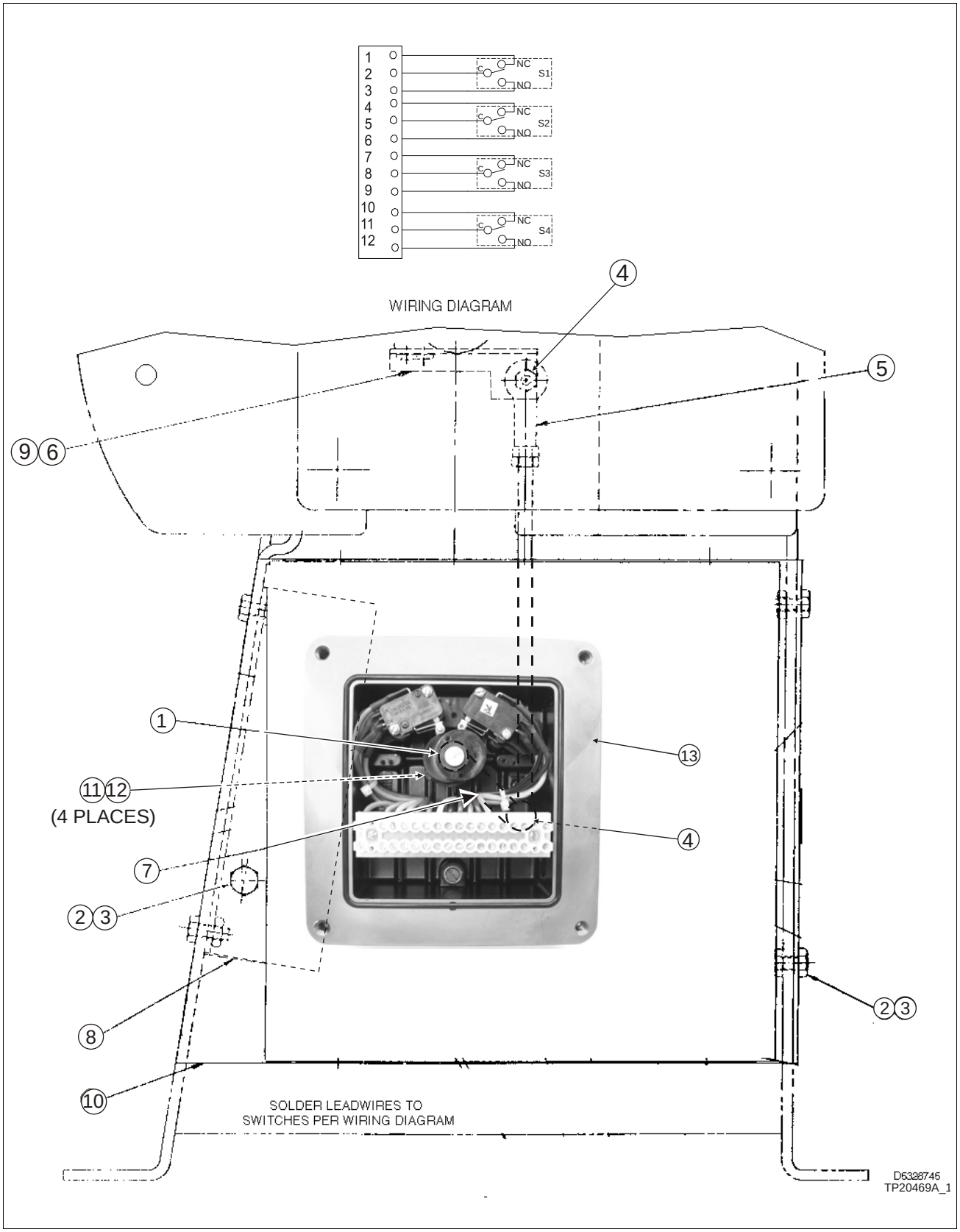


Figure A-3. UP1 Alarm/Travel Switch Kit, Table A-5

Table A-6. UP1 Air Failure Lock Kit, Figure A-4 (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
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	$\frac{1}{8}$ 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)

Table A-6. UP1 Air Failure Lock Kit, Figure A-4 (Kit No. 5328826_1) (continued)

Item	Qty	Part No.	Description
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
57	1	1963318_ _	Nameplate
58	1	—	Zn plated steel reg spring lockwasher (0.375)
59	1	—	$\frac{1}{8}$ NPT brass pipe plug
60	1	3053306	Print
61	3	—	Zn plated steel reg spring lockwasher (0.190)

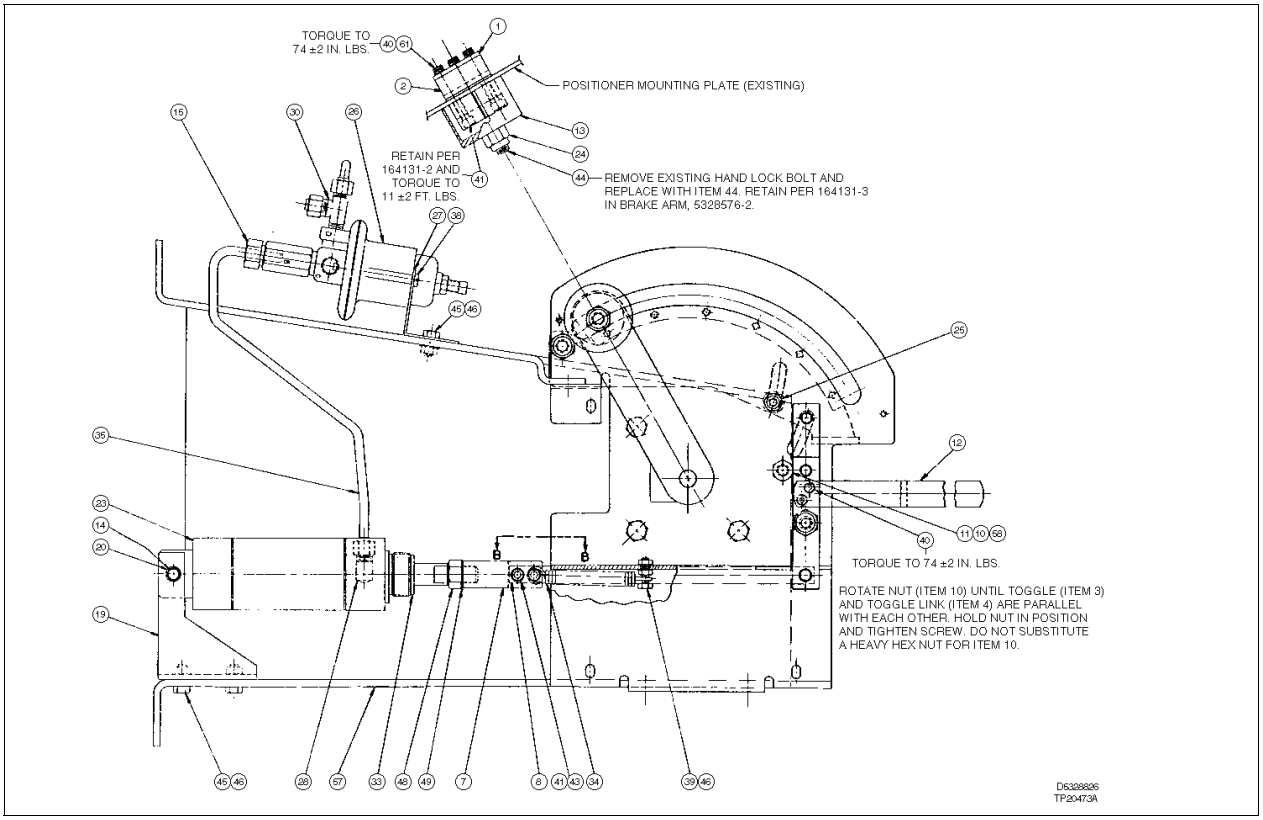


Figure A-4. UP1 Air Failure Lock Kit, Table A-6 (Sheet 1 of 2)

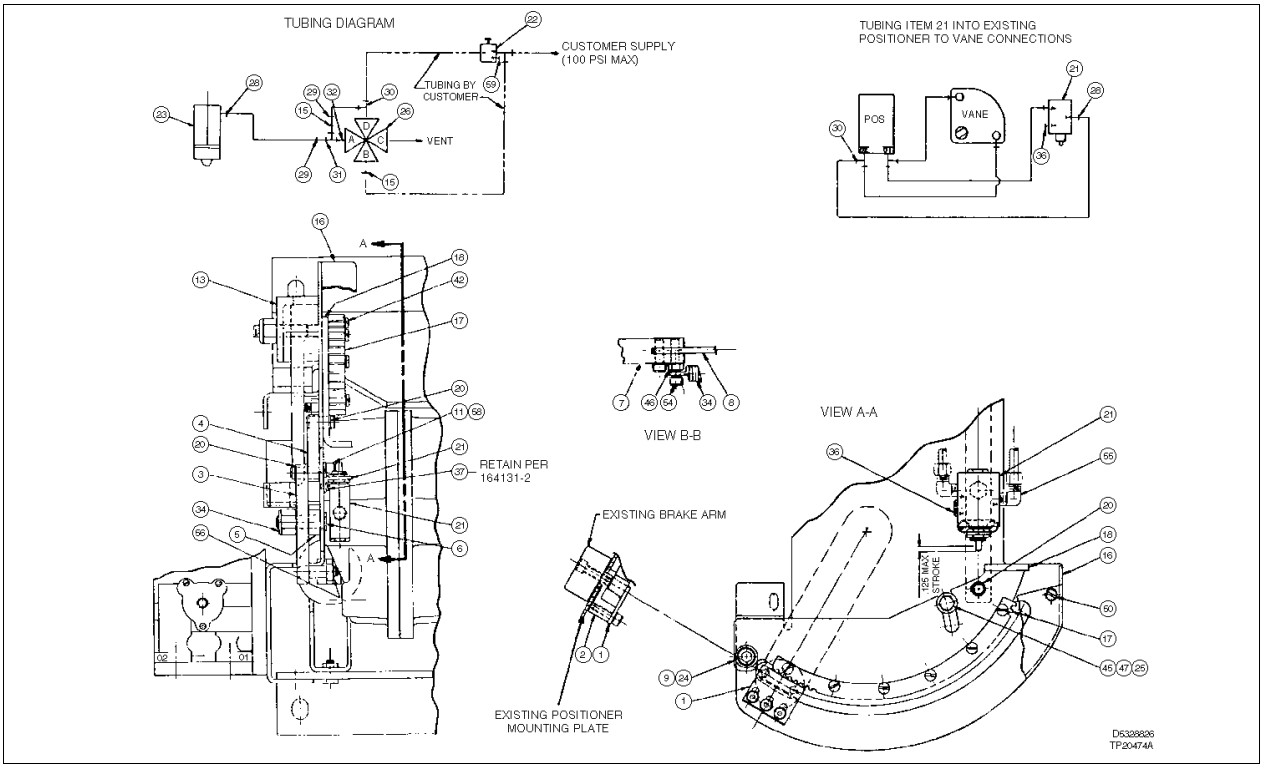


Figure A-4. UP1 Air Failure Lock Kit, Table A-6 (Sheet 2 of 2)

Table A-7. UP1 Rotary Vane Seal Repair Kit, Figure 8-1 (Kit No. 258244 _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-8 through A-16, and Figures A-5 through A-11 for spare parts information for Type UP2 actuators.

Table A-8. UP2 Actuator with Positioner, Figure A-5 (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-9	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

Table A-8. UP2 Actuator with Positioner, Figure A-5 (Drawing No. 5328874) (continued)

Item	Qty	Part No.	Description
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)
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-9. UP2 Positioners, Figure A-5

Type	Item 5
UP2_A	AV1121_3
UP2_B	AV1221_3
UP2_C	AV2321_3
UP2_D	AV3321_3
UP2_U	V18345-202_4
UP2_W	V18345-202_5
UP2_Y	V18348-201_3
UP2_Z	V18348-201_4

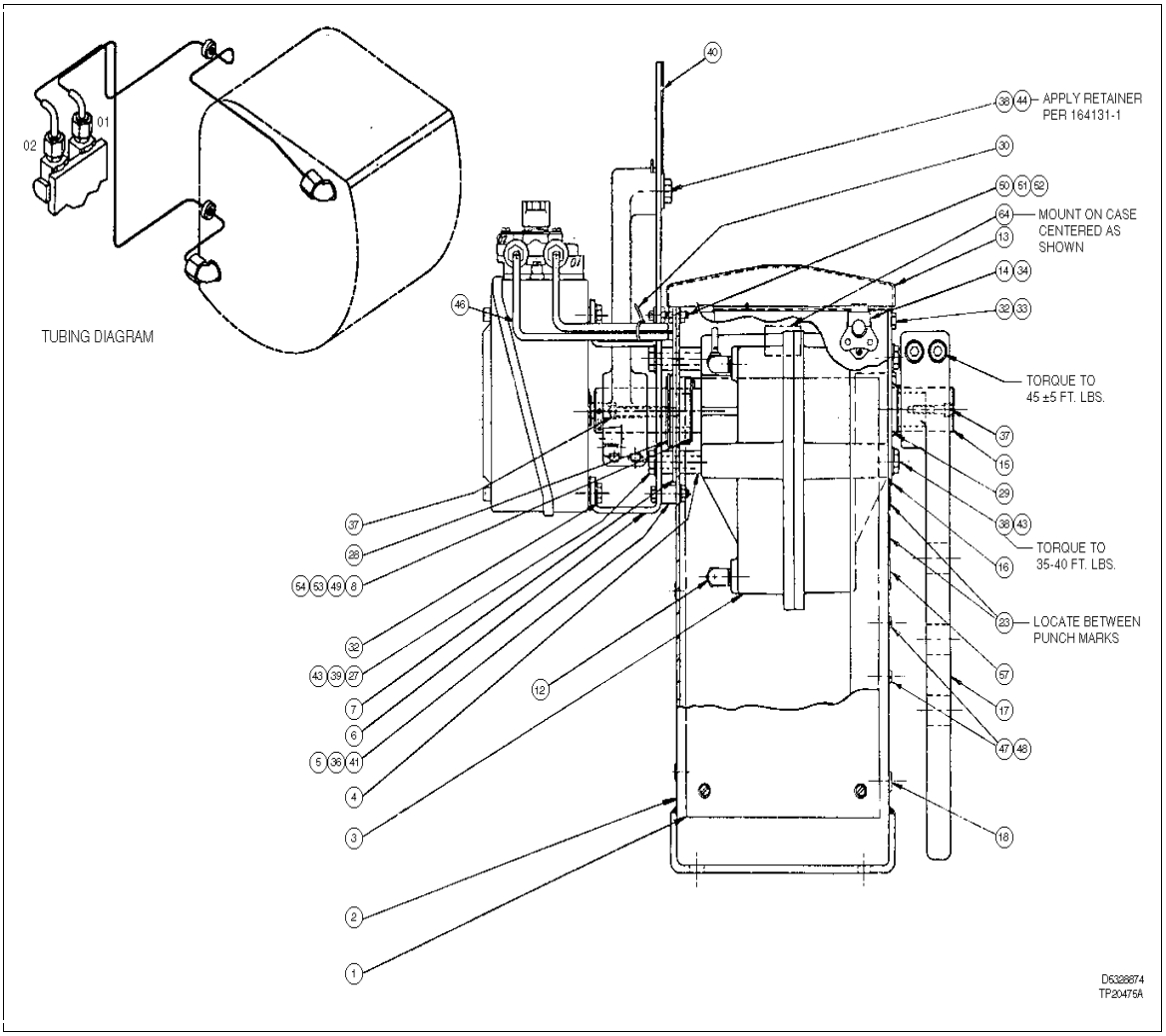


Figure A-5. UP2 with Positioner, Tables A-8 and A-9 (Sheet 1 of 3)

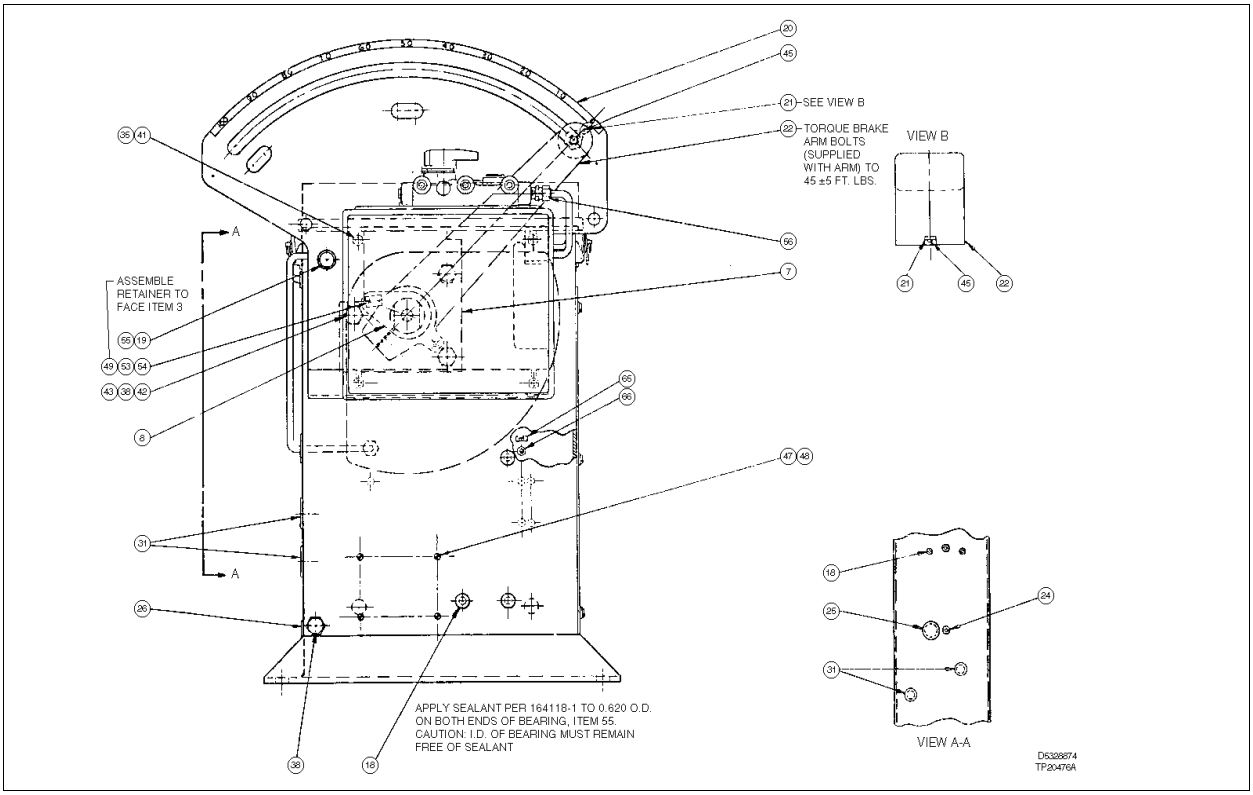


Figure A-5. UP2 with Positioner, Tables A-8 and A-9 (Sheet 2 of 3)

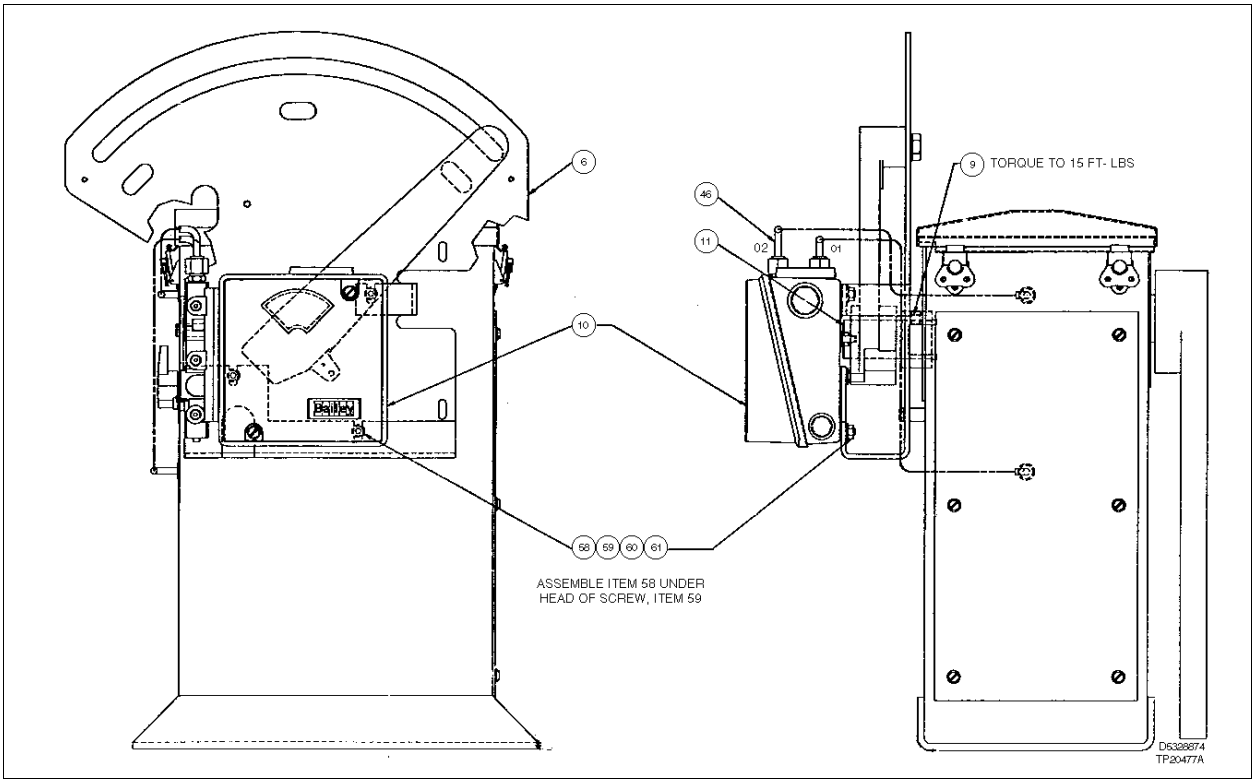


Figure A-5. UP2 with Positioner, Tables A-8 and A-9 (Sheet 3 of 3)

Table A-10. UP2 with Solenoid Valve,
Figure A-6 (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-11	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
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)

Table A-10. UP2 with Solenoid Valve, Figure A-6 (Drawing No. 5328891) (continued)

Item	Qty	Part No.	Description
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)
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.

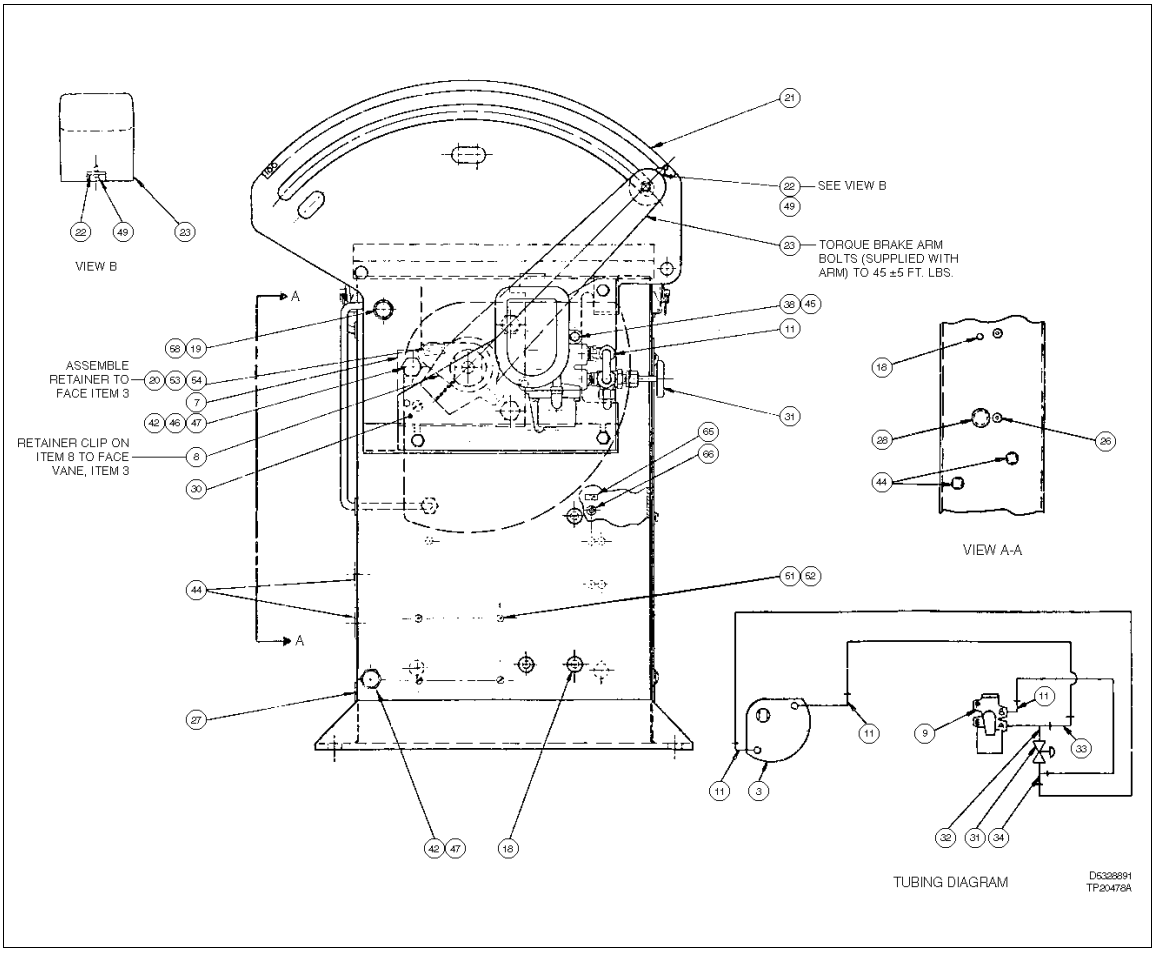


Figure A-6. UP2 with Solenoid Valve, Tables A-10 and A-11 (Sheet 1 of 2)

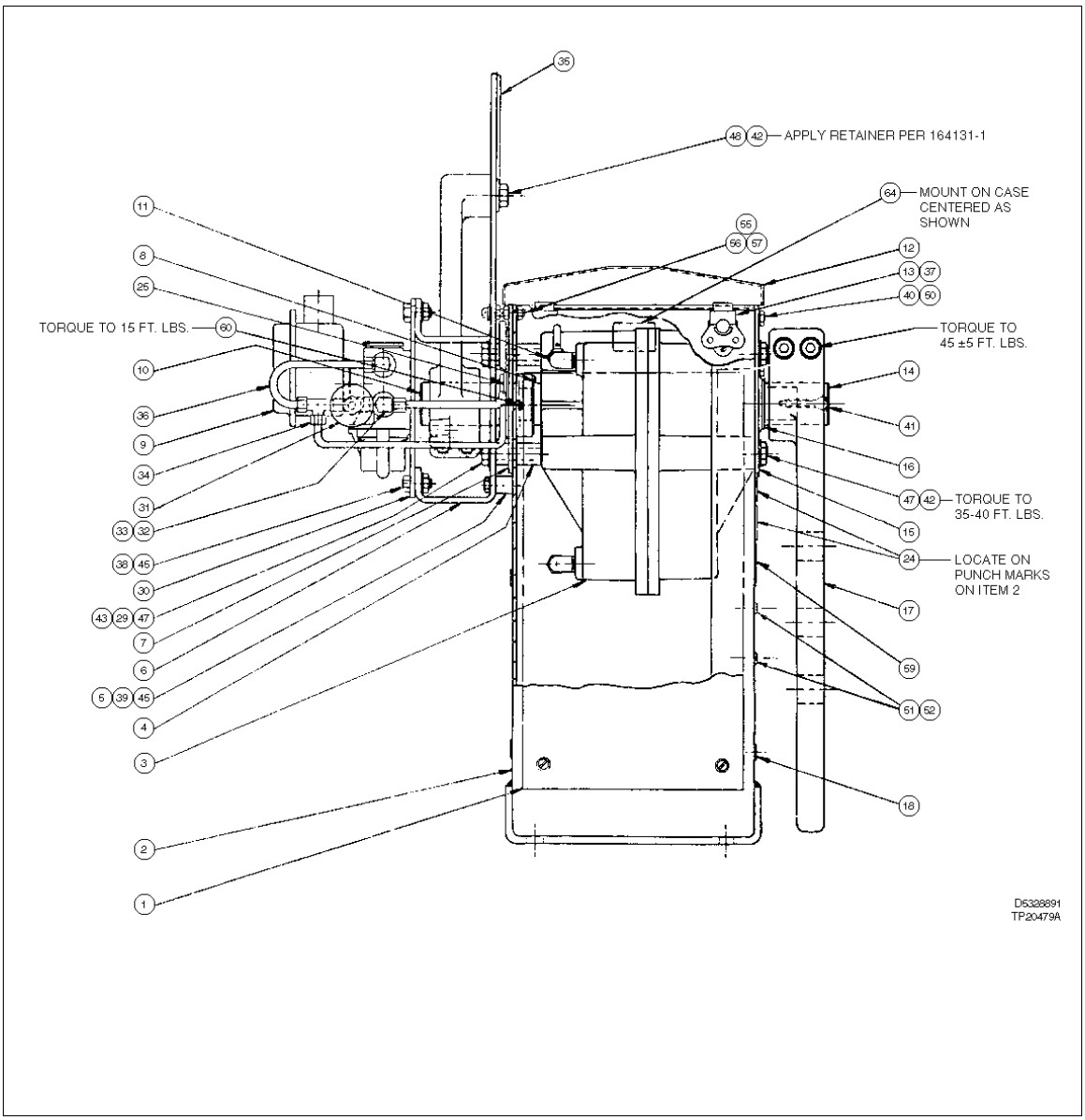


Figure A-6. UP2 with Solenoid Valve, Tables A-10 and A-11 (Sheet 2 of 2)

Table A-11. UP2 Solenoid Valves, Figure A-6

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-12. UP2 Alarm/Travel Switch Kit, Figure A-7 (Kit No. 5328932_1)

Item	Qty	Part No.	Description
1	1	5328596A1	Arm, drive
2	1	5328931A1	Linkage assembly
3	1	1963318A10	Nameplate
4	1	NHSAC16010	SEM SLT PAN INT 10-32 x 5/8
5	1	008H008T10	SOC HD SCR 6-32 x 1/2
6	1	DWGE5328932	Alarm unit dwg
7	1	155C003U01	Alarm/travel SW-UP1,2,5,6-4SW
8	4	040D010T10	5/16-18 x 5/8 SCR CAP HEX HD
9	4	085D516T10	5/16 Spring lock washer
10	1	172A049U01	Conduit plug recessed HD 3/4
11	1	150A164U01	Conduit nipple #502
12	1	114B026U01	1/2” Protection cap

Table A-13. UP2 Pneumatic Shaft Position Transmitter Kit, Figure A-8 (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
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
25	3	NTMHA21000	Int sems lockwasher (0.250)

Table A-13. UP2 Pneumatic Shaft Position Transmitter Kit, Figure A-8 (Kit No. 5328936 _2/3)

Item	Qty	Part No.	Description
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)

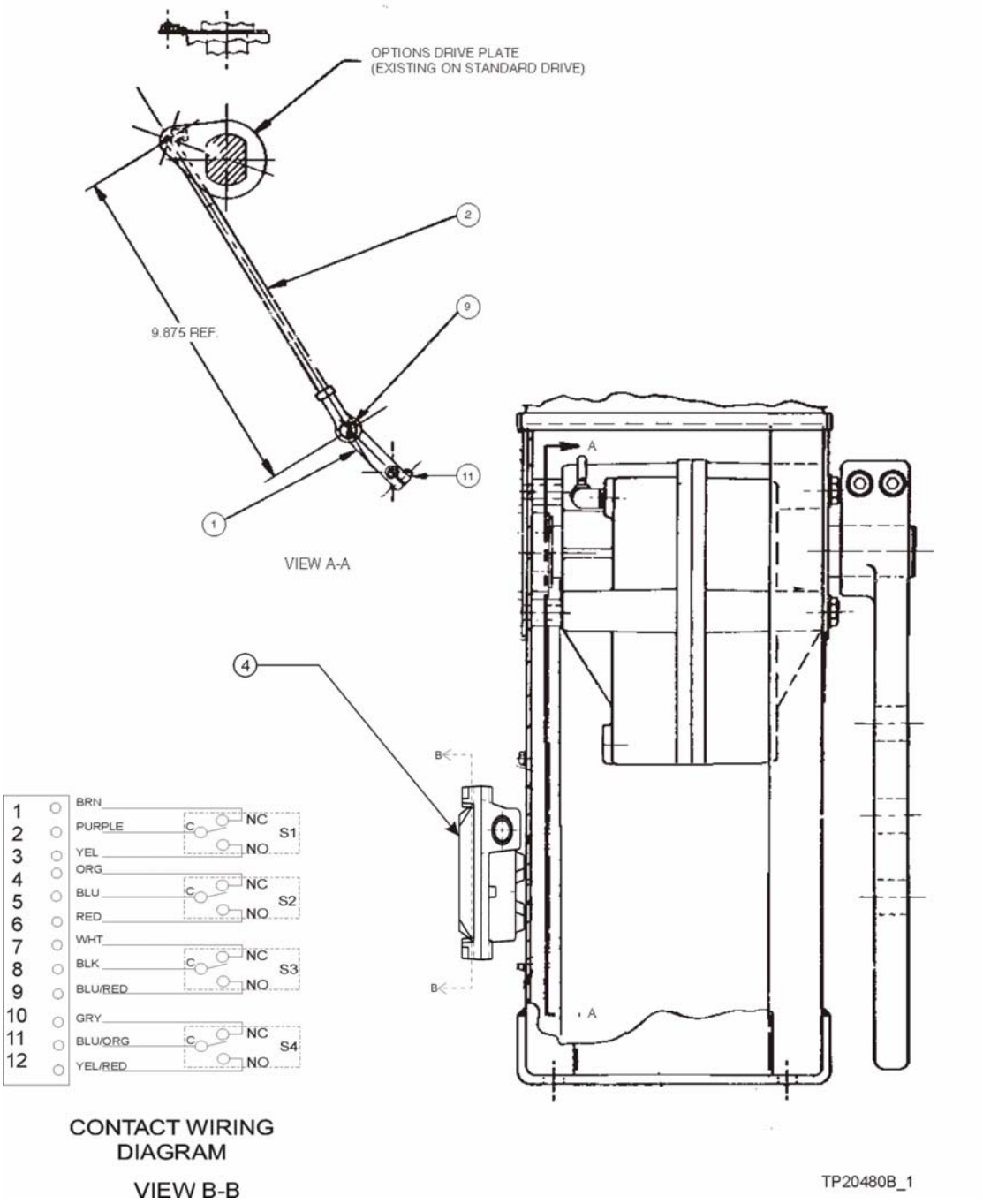


Figure A-7. UP2 with Alarm/Travel Switches Table A-12 (Sheet 1 of 2)

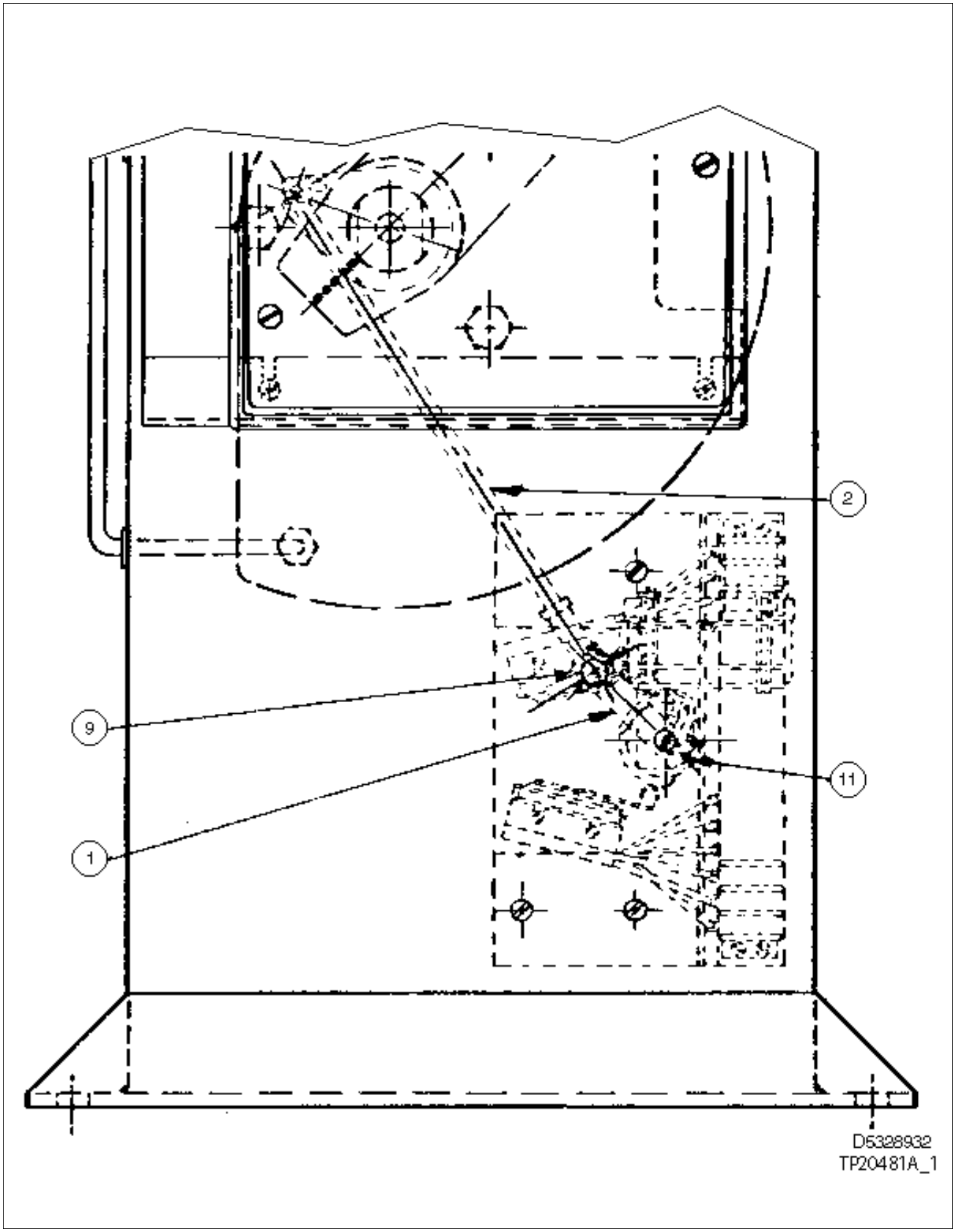


Figure A-7. UP2 with Alarm/Travel Switches, Tables A-12 (Sheet 2 of 2)

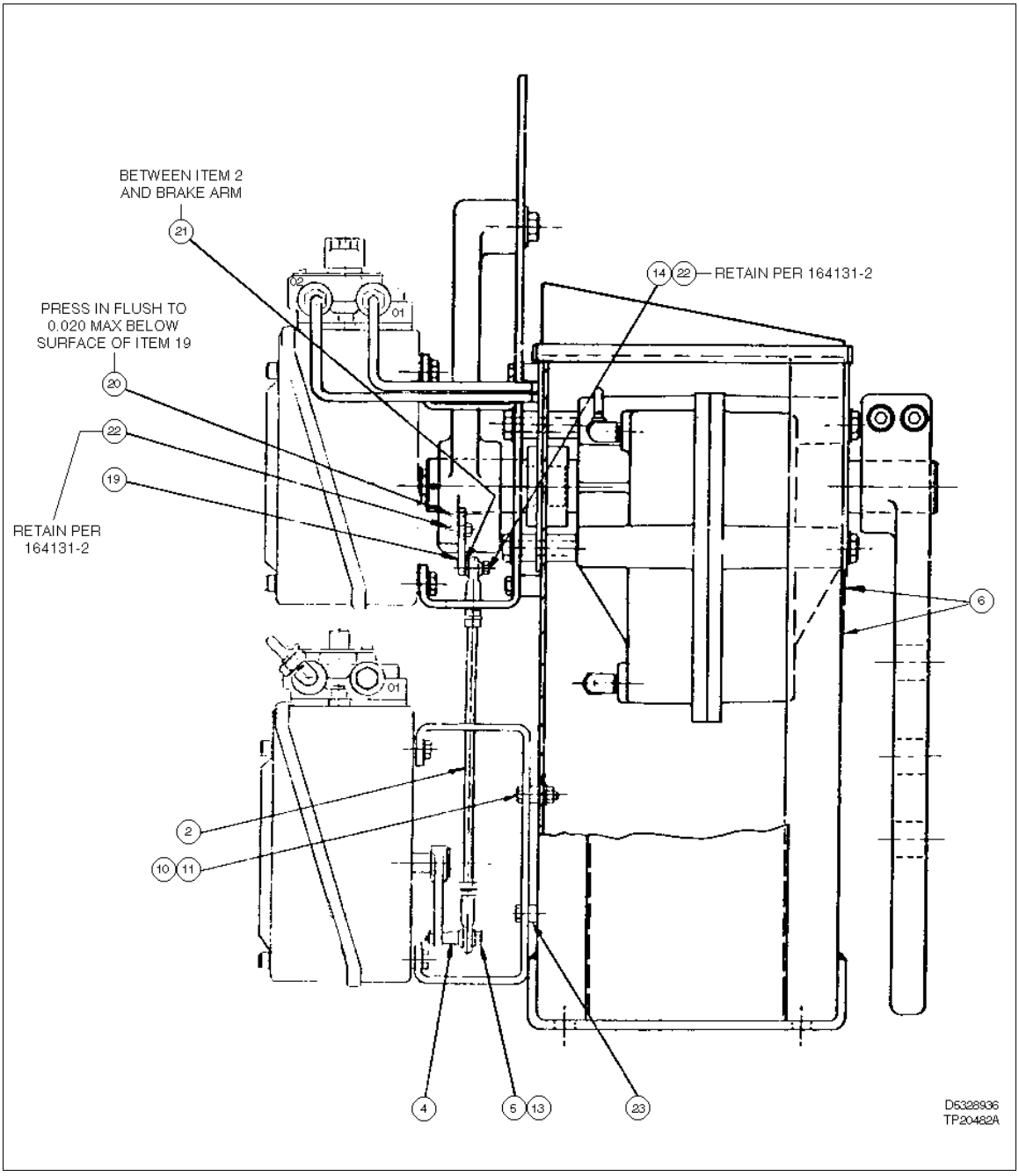


Figure A-8. UP2 with Pneumatic Shaft Position Transmitter, Table A-13 (Sheet 1 of 2)

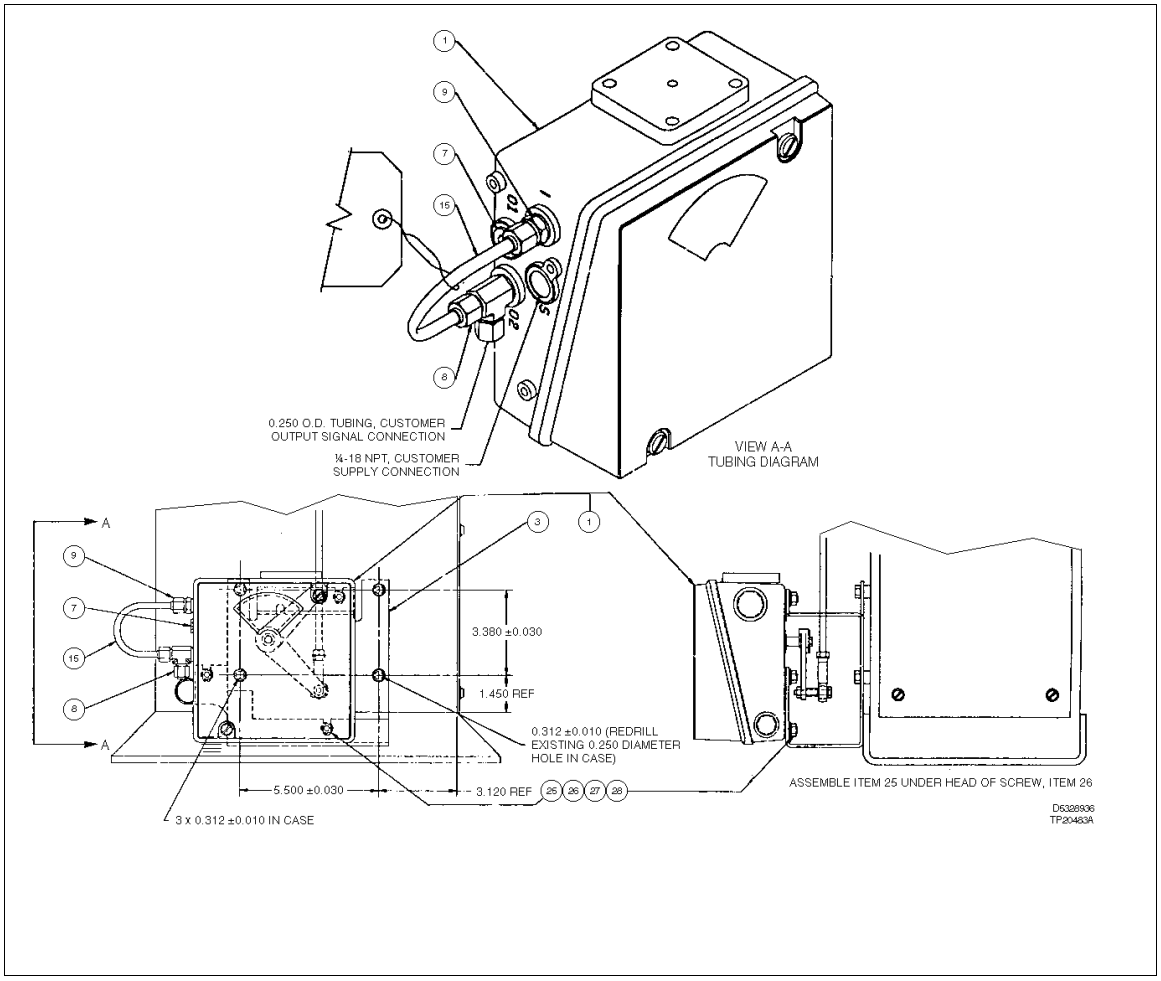


Figure A-8. UP2 with Pneumatic Shaft Position Transmitter, Table A-13 (Sheet 2 of 2)

Table A-14. UP2 Air Failure Lock Kit, Figure A-9 (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

Table A-14. UP2 Air Failure Lock Kit, Figure A-9 (Kit No. 5328925 _1) (continued)

Item	Qty	Part No.	Description
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
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	—	$\frac{1}{8}$ 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)

Table A-14. UP2 Air Failure Lock Kit, Figure A-9 (Kit No. 5328925 _1) (continued)

Item	Qty	Part No.	Description
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	—	1/8 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)

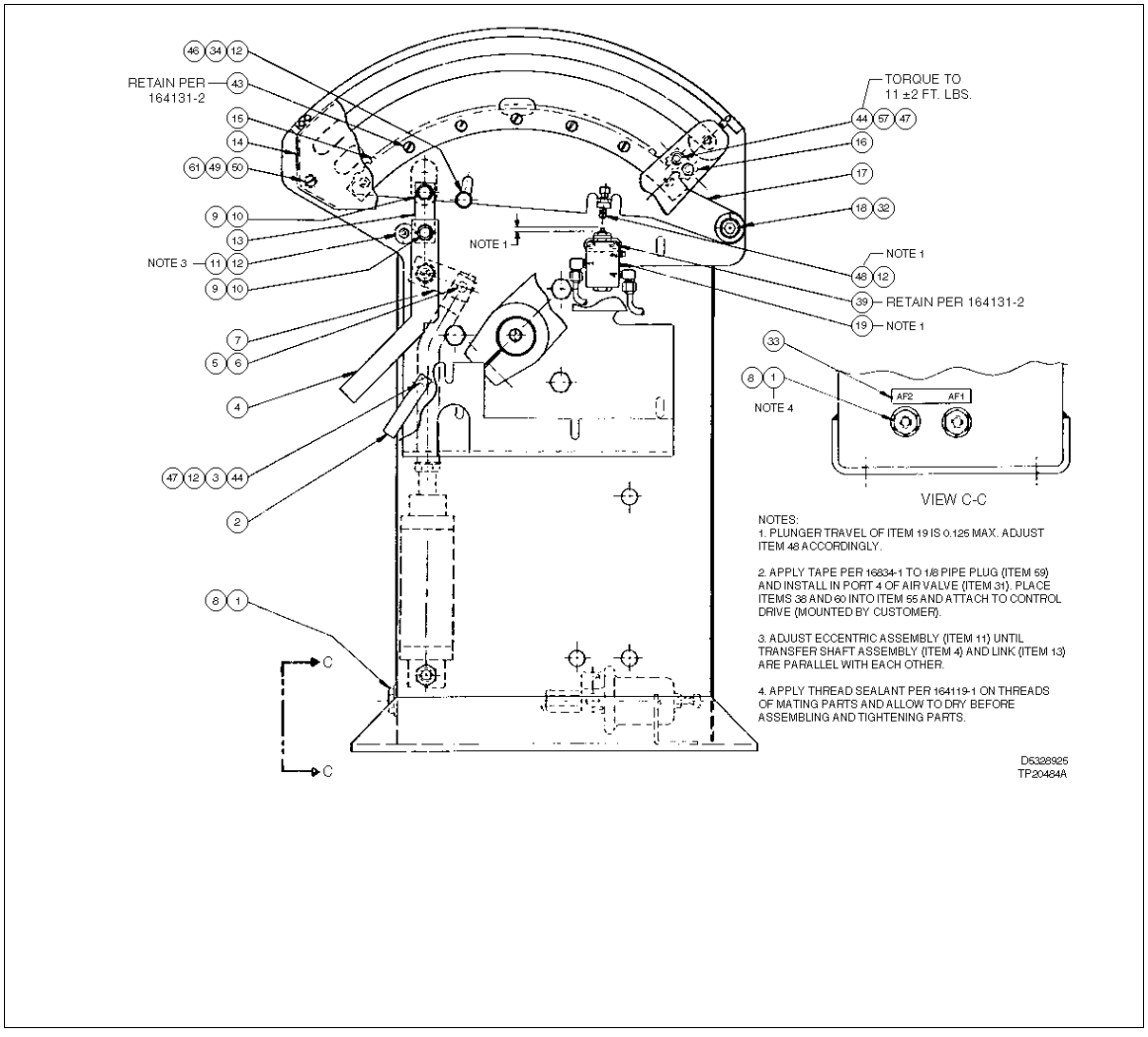


Figure A-9. UP2 with Air Failure Lock, Table A-14 (Sheet 1 of 2)

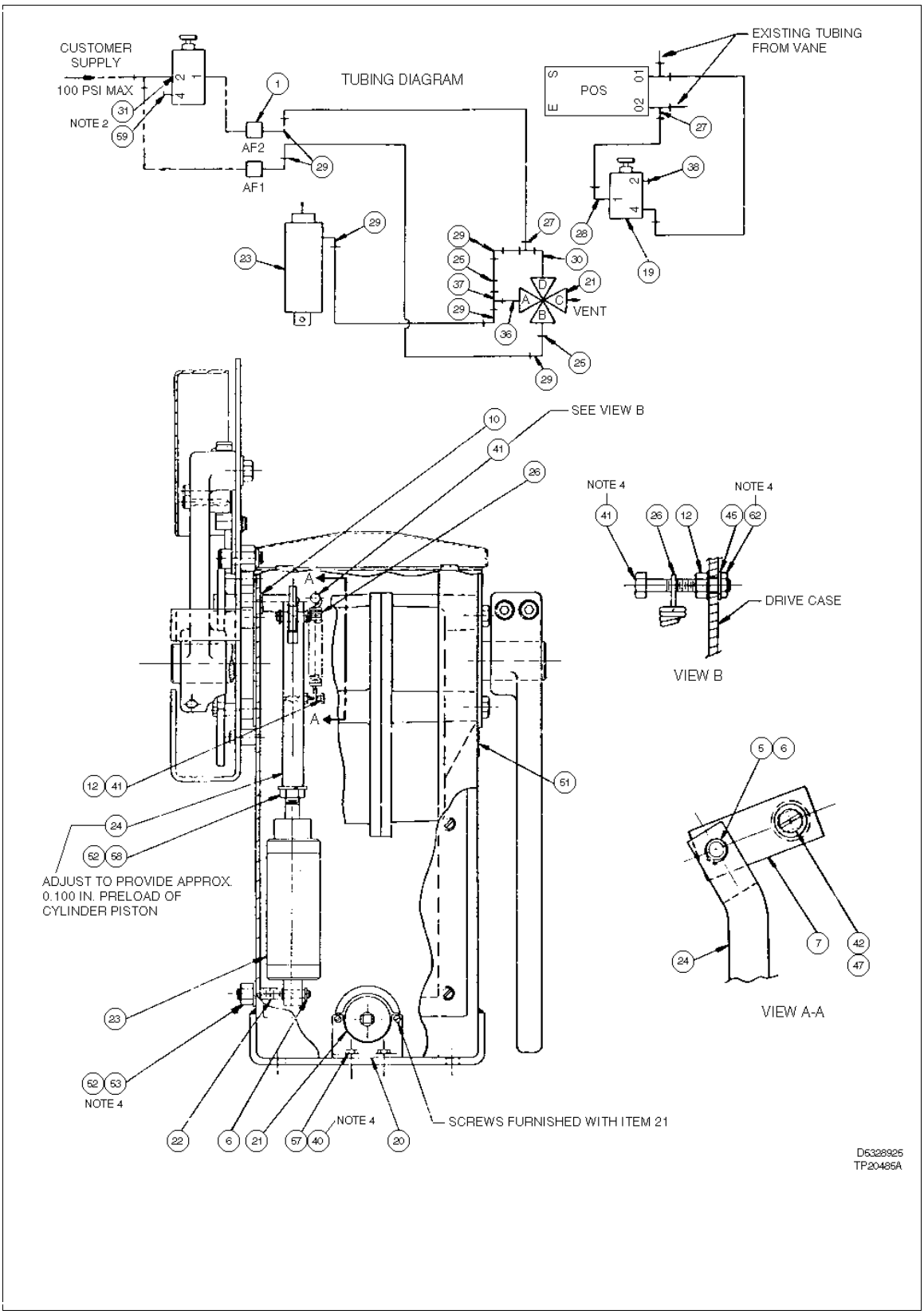


Figure A-9. UP2 with Air Failure Lock, Table A-14 (Sheet 2 of 2)

Table A-15. UP2 Reserve Air Tank Kit, Figure A-10 (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

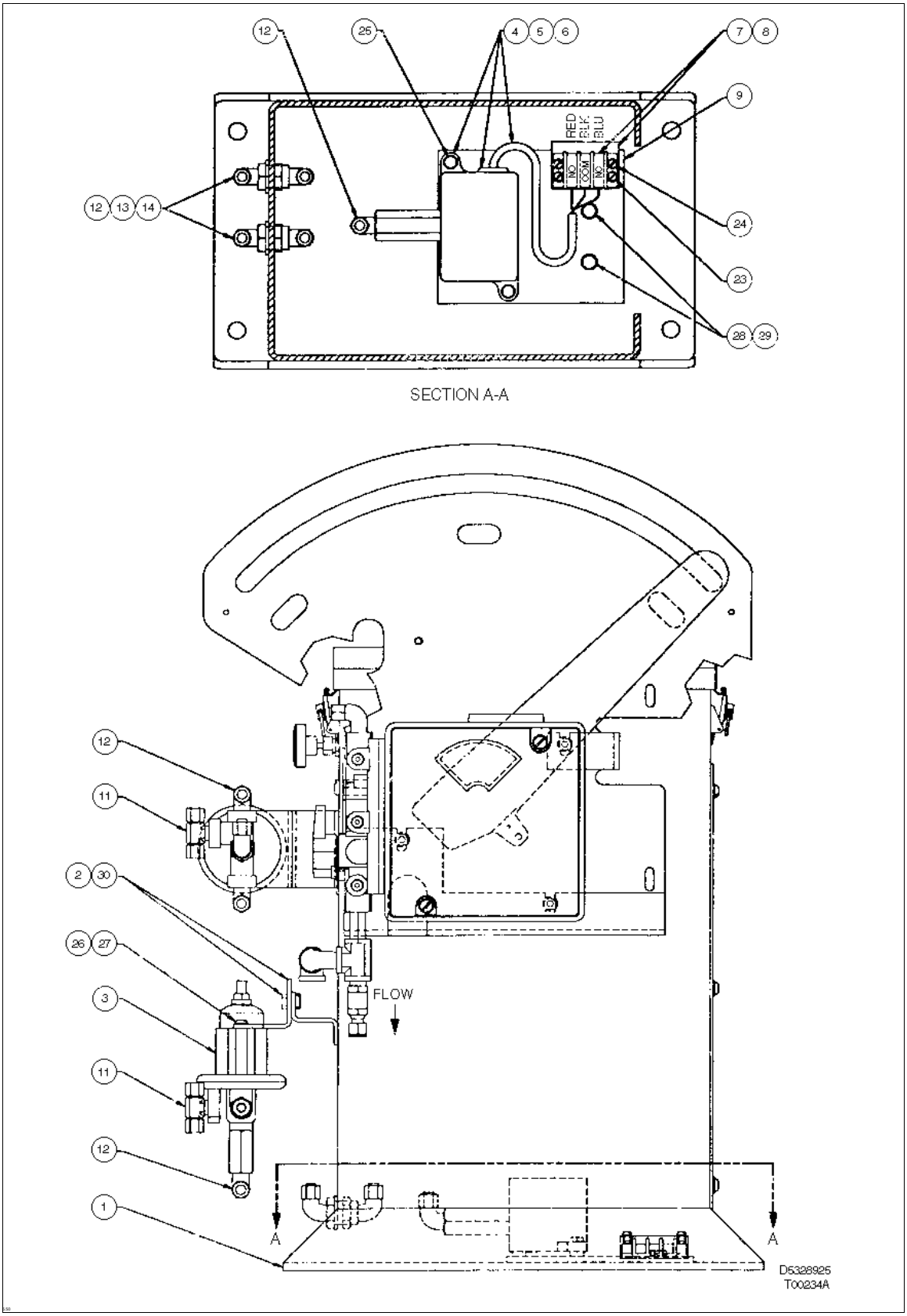


Figure A-10. UP2 Reserve Air Tank Kit, Table A-15 (Sheet 1 of 2)

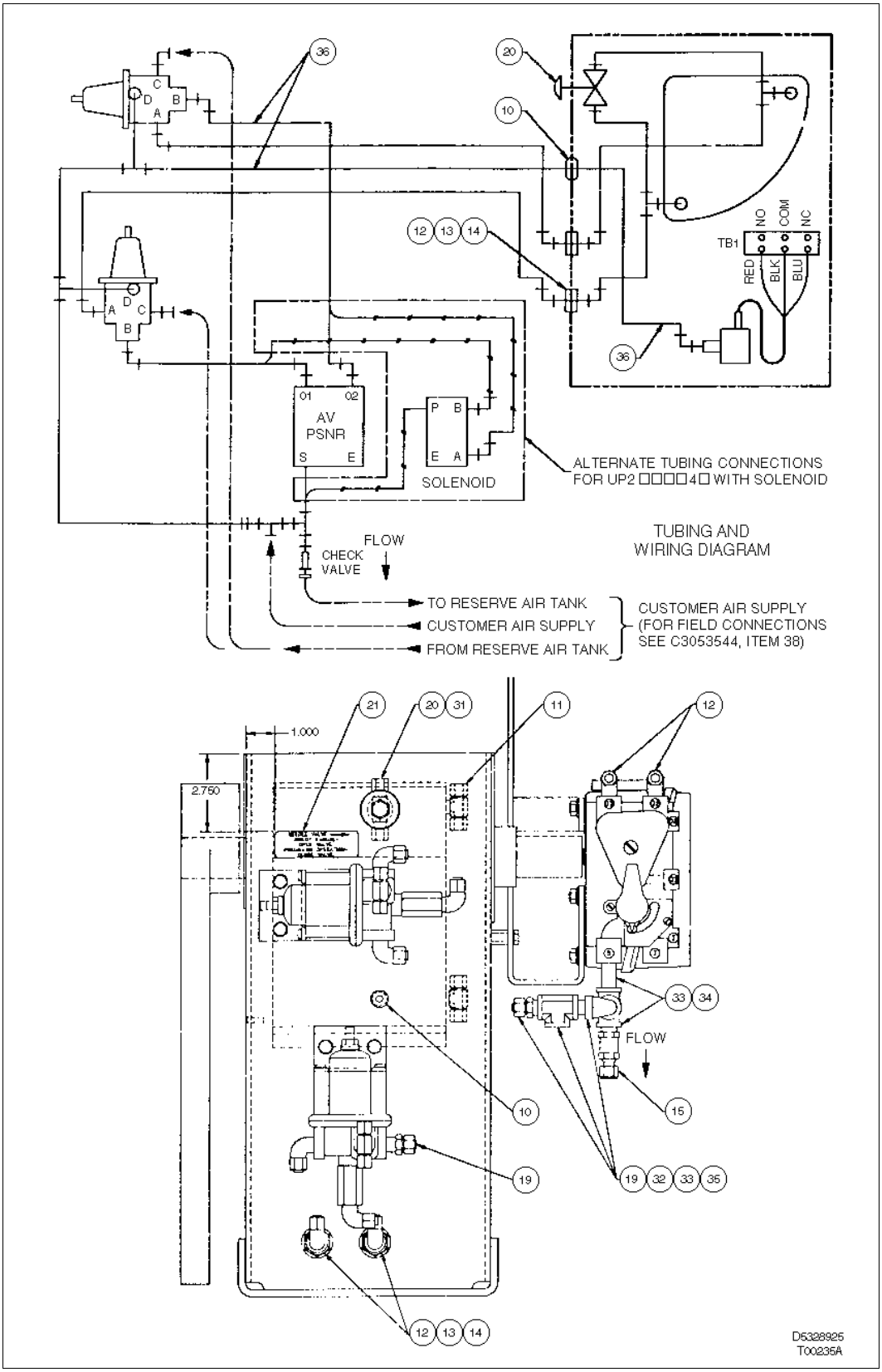


Figure A-10. UP2 Reserve Air Tank Kit, Table A-15 (Sheet 2 of 2)

Table A-16. 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-17. UP2 Heater Kits, Figure A-11 (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

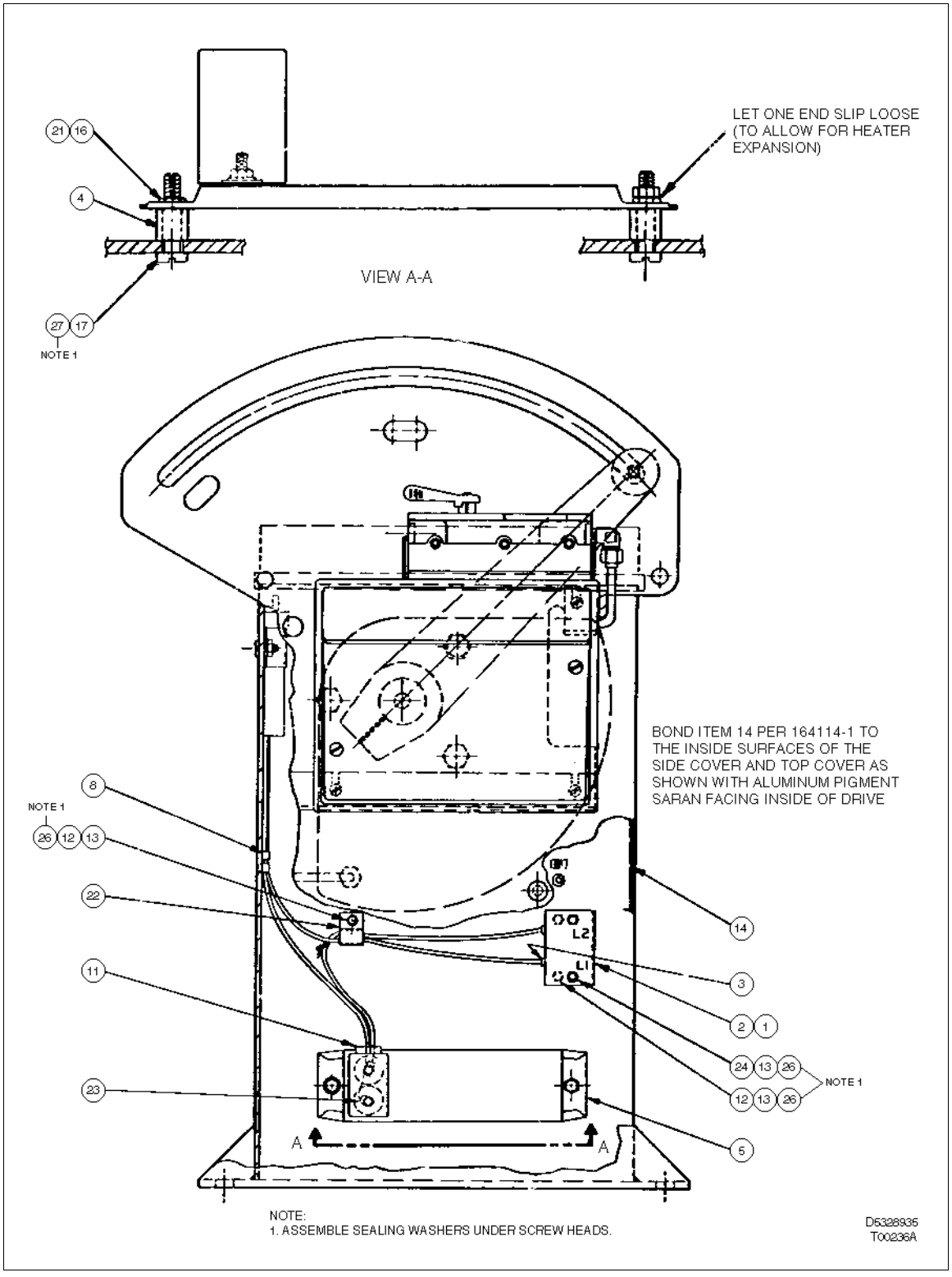


Figure A-11. UP2 with Heater, Table A-17 (Sheet 1 of 2)

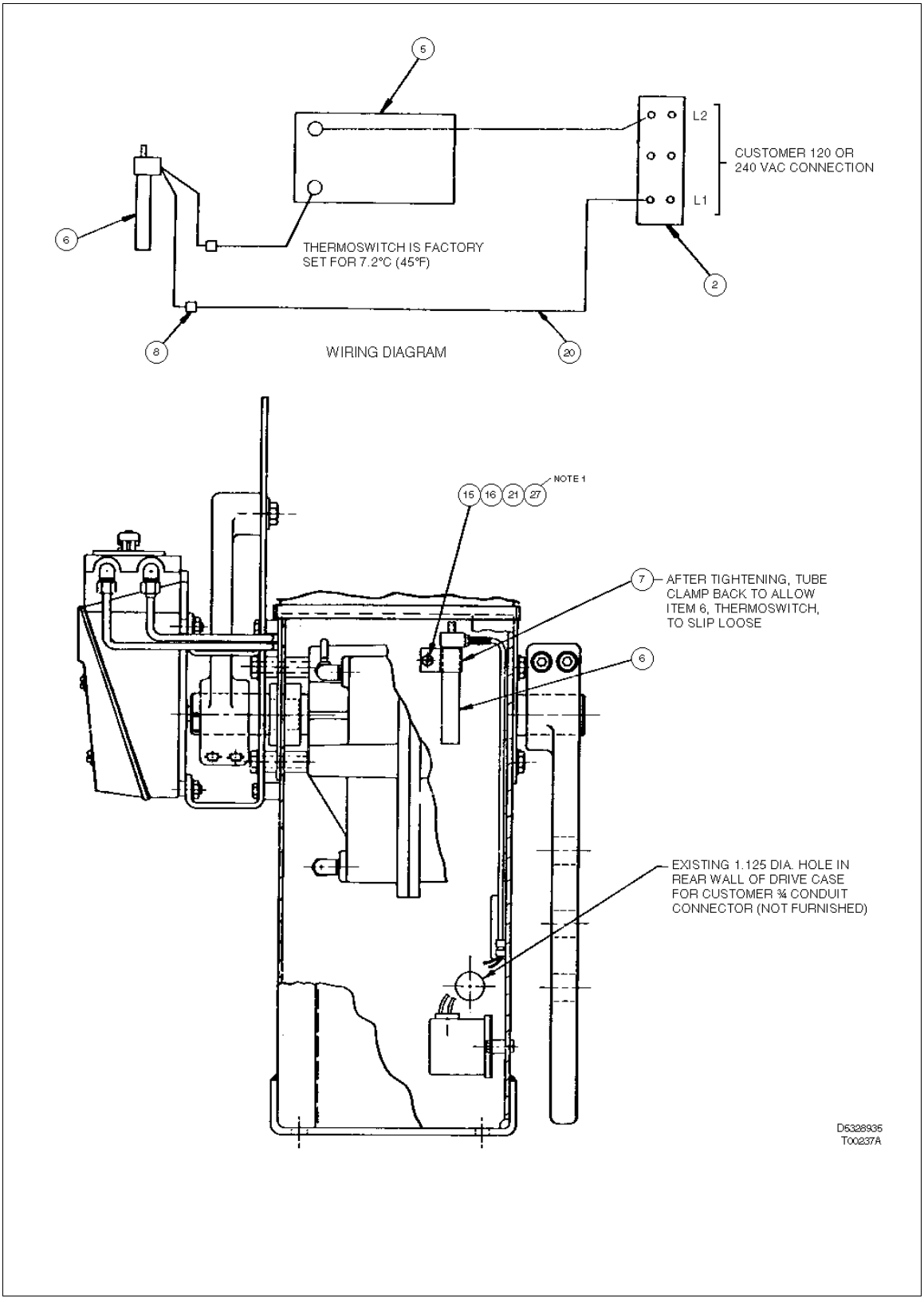


Figure A-11. Figure A-11. UP2 with Heater, Table A-17 (Sheet 2 of 2)

Types UP3 AND UP4 Actuators

Refer to Tables A-18 through A-31. Figures A-12 through A-19, for spare parts information for Types UP3 and UP4 actuators.

Table A-18. UP3 and UP4 with Positioner, Figure A-12 (Drawing No. 5328749)

Item	Qty	Part No.	Description
Refer to sheets 1 and 2 of Figure A-12.			
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-19, A-20, 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-19, A-20	Positioner
24	1	Refer to Table A-19	Desig plate
25	1	194956_7	Terminal block
26	2	5328770_1	Clevis pin
27	Refer to Table A-19	1951407_1	Male connector
28	1	5328718_1	Bearing support
29	1	5328771_1	Clevis
30	1	5328765_2	Gasket
31	5	5313297_1	Washer
32	2	5313299_1	Thrust bearing

Table A-18. UP3 and UP4 with Positioner, Figure A-12 (Drawing No. 5328749) (continued)

Item	Qty	Part No.	Description
33	2	5311759_1	Ball joint
34	1	5400311_1	Connecting link (AV)
35	Refer to Table A-19	1951609_1	Bulkhead fitting
36	Refer to Table A-19	19981_31	Plug button
37	1	197676_1	Ground screw
38	1	197675_1	Washer
39	Refer to Table A-19	4-4CBI2-B	Male elbow
40	Refer to Table A-19	4CBI2-B	Male elbow
41	Refer to Table A-19	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-19	—	¼ NPT brass street elbow
48	Refer to Table A-19	—	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-19	1943825_1	Terminal lug
55	1	—	Hex jam nut (1.000-14)
56	1	—	Hex nut (0.750-16)
57	Refer to Table A-19	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-18. UP3 and UP4 with Positioner, Figure A-12 (Drawing No. 5328749) (continued)

Item	Qty	Part No.	Description
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-19	R2041-0030	18 AWG white leadwire
76	Refer to Table A-19	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-19	4VBI2-B	45° male elbow
81	Refer to Table A-19	—	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-19	1943825_3	Terminal lug
92	A/R	1963353_ _ 01	Label, universal, CSA
93	Refer to Table A-19	1951408_1	Male elbow
94	Refer to Table A-19	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-19	1941147_1	Bushing
99	Refer to Table A-19	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
110	76.2 cm (30.0 in.)	R2041-1581	22 AWG blue leadwire

Table A-18. UP3 and UP4 with Positioner, Figure A-12 (Drawing No. 5328749) (continued)

Item	Qty	Part No.	Description
111	76.2 cm (30.0 in.)	R2041-1700	22 AWG green leadwire
112	1	Refer to Table A-20, A-12 Sheet 4	TZIDC Mtg. Kit
120	1	5313297_2	Washer
Refer to sheet 3 of Figure A-12 .			
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-19. UP3 and UP4 _Positioners and Unique Items, Figure A-12

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_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_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_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
UP3_DA	5328775_1	AV332110	1947271_8	Omit	1	5	3	1
UP3_DB	5328775_1	AV332120	1947271_8	Omit	1	5	3	1

Table A-19. UP3 and UP4 _Positioners and Unique Items, Figure A-12 (continued)

Type	Item 7	Item 23	Item 24	Item 27	Item 35	Item 36	Item 39	Items 40,80
UP3_E0	5328775_1	AV442100	1947271_9	Omit	1	5	3	1
UP4_A0	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_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_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_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

Table A-19. UP3 and UP4 Positioners and Unique Items, Figure A-12

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_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_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_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_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
UP4_A0	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_BA	1	1	2	7	0.3 m (1.0 ft)	Omit	1	4

Table A-19. UP3 and UP4 Positioners and Unique Items, Figure A-12 (continued)

Type	Item 41	Items 47, 81	Item 48	Item 54	Item 57	Items 75, 76	Items 91, 98	Item 93
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_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_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

Table A-19. UP3 and UP4 Positioners and Unique Items, Figure A-12

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_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_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)
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_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_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)
UP4_A0	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_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_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_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)

Table A-19. UP3 and UP4 Positioners and Unique Items, Figure A-12 (continued)

Type	Item 94	Item 99	Item 107	Item 108	Item 109	Item 110	Item 111
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)

Table A-20. UP3 and UP4 TZIDC Positioners, Figure A-12 (continued)

Drive Type	Cylinder Item 7	Positioner Item 23	Mounting Kit Item 112	Mounting Plate Item 58	Remaining Variable Items Same As:
UP3_U0	5328775_1	V18345-2022420001	258656_1	Omit	UP3_ _0
UP3_UB	5328775_1	V18345-2022421001	258656_1	Omit	UP3_ _0
UP3_W0	5328775_1	V18345-2022520001	258656_1	Omit	UP3_ _0
UP3_WB	5328775_1	V18345-2022521001	258656_1	Omit	UP3_ _0
UP3_Y0	5328775_1	V18348-201233000110	258656_1	Omit	UP3_ _0
UP3_YB	5328775_1	V18348-201233100110	258656_1	Omit	UP3_ _0
UP3_Z0	5328775_1	V18348-201243000110	258656_1	Omit	UP3_ _0
UP3_ZB	5328775_1	V18348-201243100110	258656_1	Omit	UP3_ _0
UP4_U0	5328769_1	V18345-2022420001	258656_1	Omit	UP4_ _0
UP4_UB	5328769_1	V18345-2022421001	258656_1	Omit	UP4_ _0
UP4_W0	5328769_1	V18345-2022520001	258656_1	Omit	UP4_ _0
UP4_WB	5328769_1	V18345-2022521001	258656_1	Omit	UP4_ _0
UP4_Y0	5328769_1	V18348-201233000110	258656_1	Omit	UP4_ _0
UP4_YB	5328769_1	V18348-201233100110	258656_1	Omit	UP4_ _0
UP4_Z0	5328769_1	V18348-201243000110	258656_1	Omit	UP4_ _0
UP4_ZB	5328769_1	V18348-201243100110	258656_1	Omit	UP4_ _0

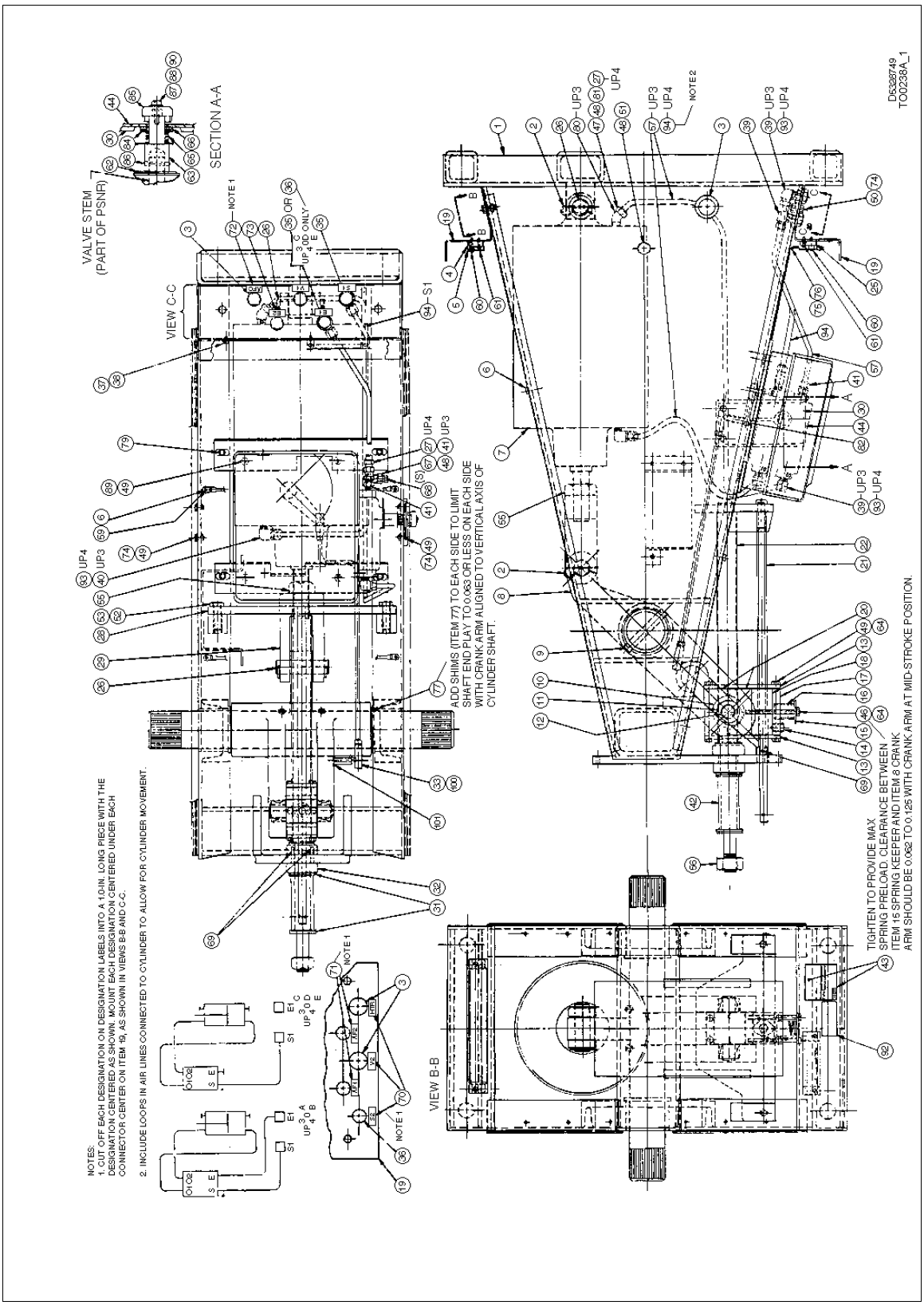


Figure A-12. UP3 and UP4 with Positioner, Tables A-18 and A-19 (Sheet 1 of 4)
(Type AV Positioner shown)

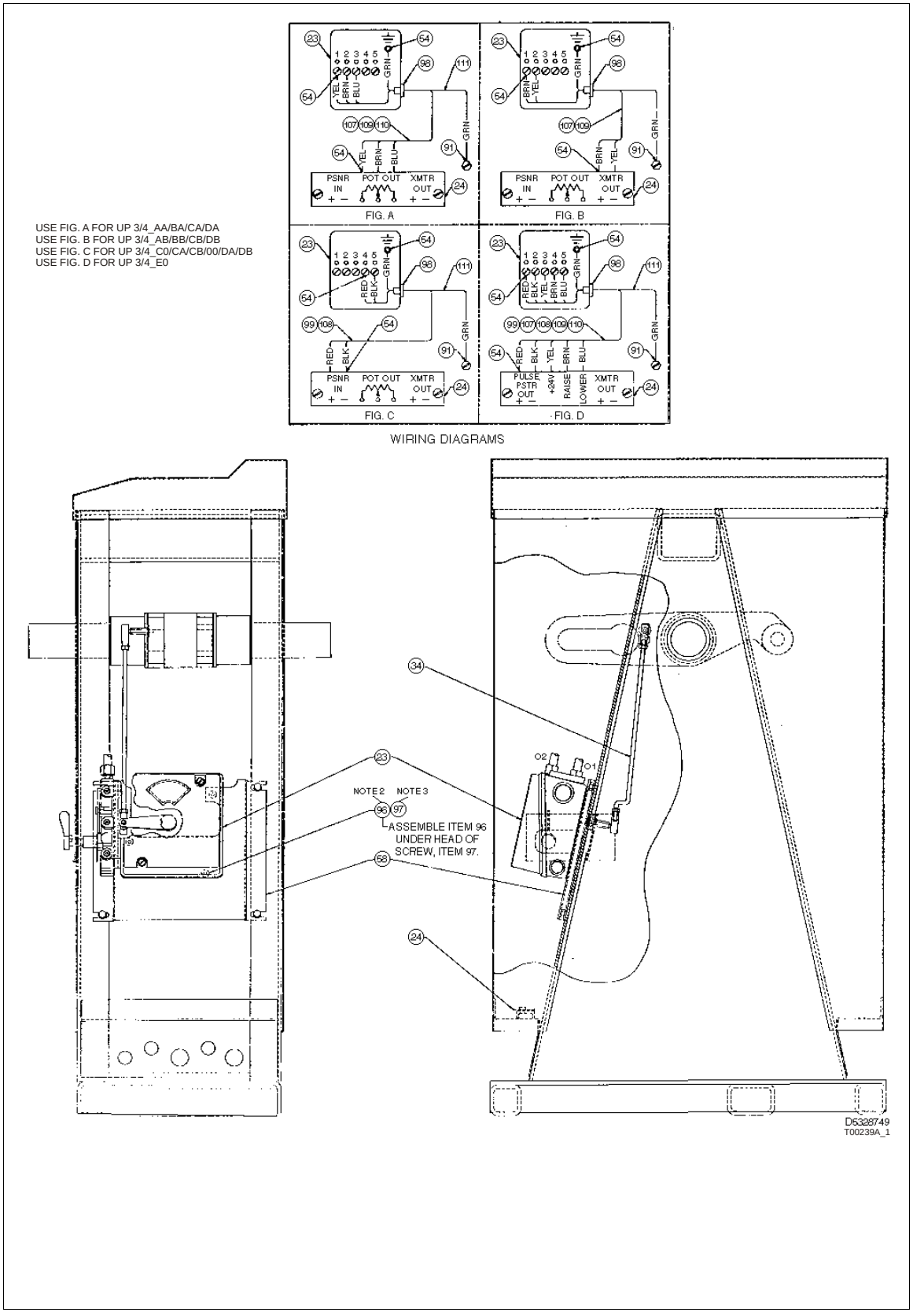


Figure A-12. UP3 and UP4 with Positioner, Tables A-18 and A-19 (Sheet 2 of 4)
(Type AV Positioner shown)

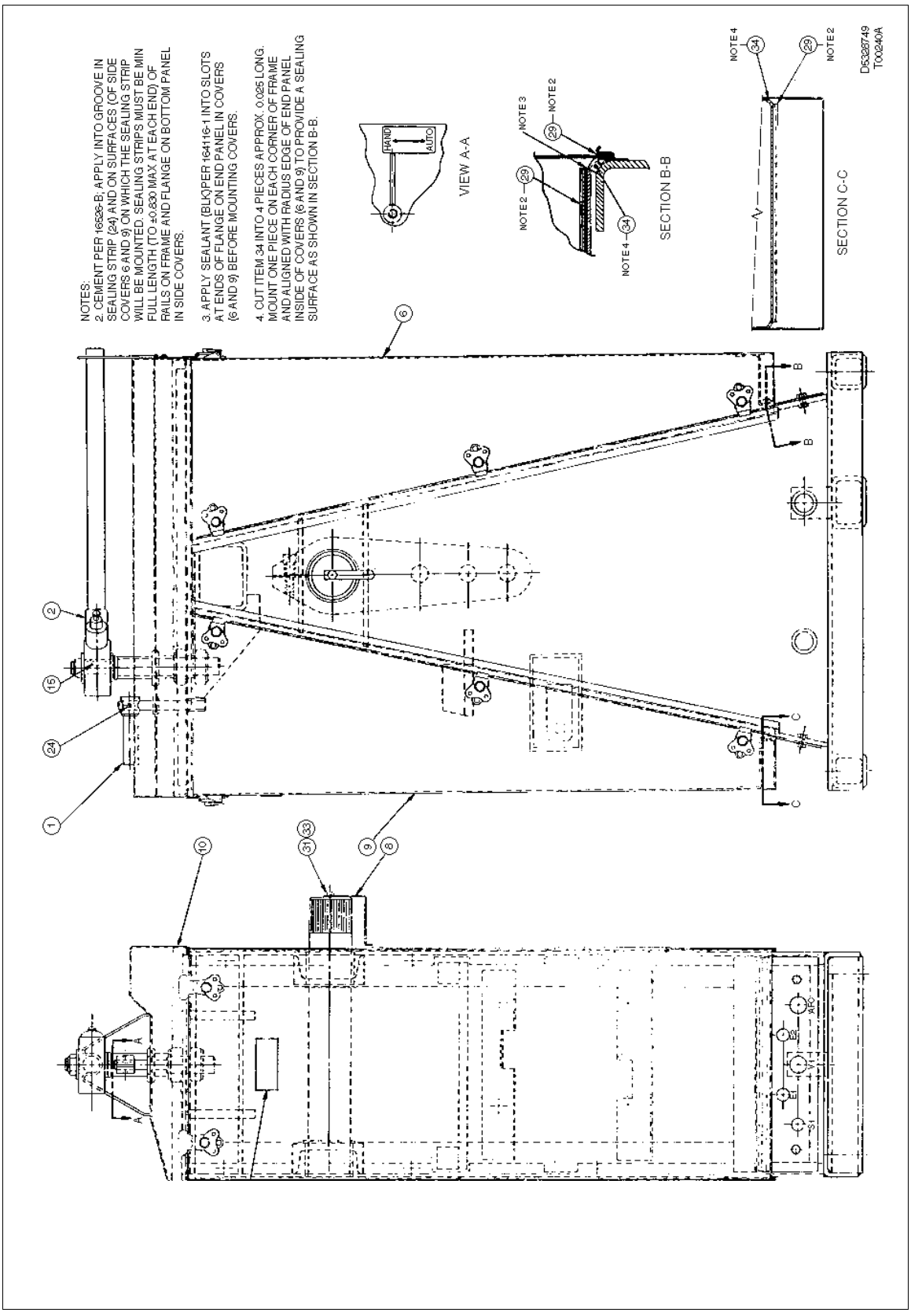
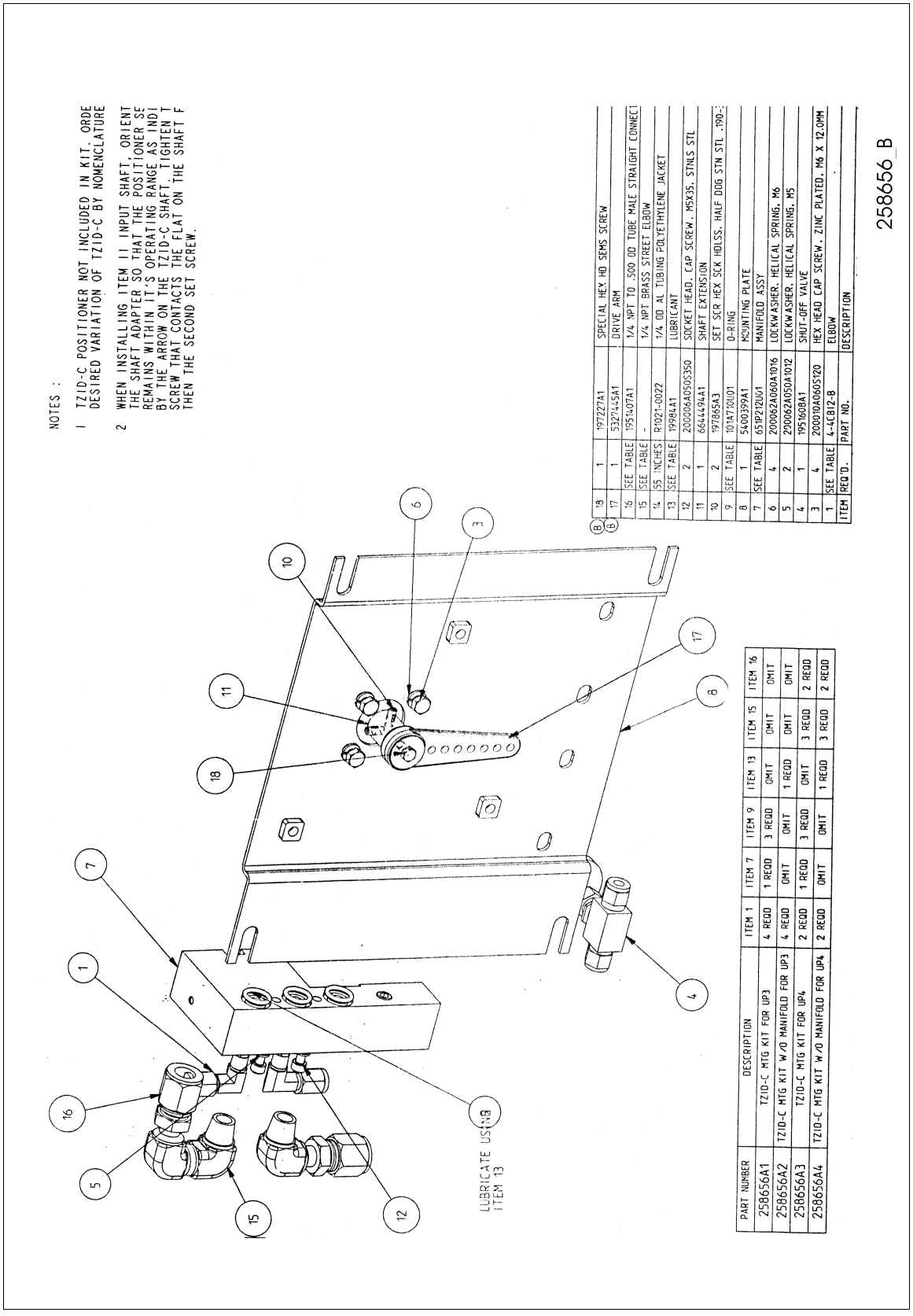


Figure A-12. UP3 and UP4 with Positioner, Tables A-18 and A-19 (Sheet 3 of 4)
(Type AV Positioner shown)



ITEM	REQ'D.	PART NO.	DESCRIPTION
18	1	197227A1	SPECIAL HEX HD SEMS SCREW
17	1	532744-5A1	DRIVE ARM
16	SEE TABLE	195140-7A1	1/4 NPT TO .500 OD TUBE MALE STRAIGHT CONNECT
15	SEE TABLE	-	1/4 NPT BRASS STREET ELBOW
14	55 INCHES	R021-0022	1/4 OD AL TUBING POLYETHYLENE JACKET
13	SEE TABLE	199844A1	LUBRICANT
12	2	200006A050S350	SOCKET HEAD. CAP SCREW. MSX35. STNLS STL
11	1	664449-4A1	SHAFT EXTENSION
10	2	197865A3	SET SCR HEX SCK HDLSS. HALF DOG STN STL .190-3
9	SEE TABLE	101A7101001	O-RING
8	1	540039-9A1	MOUNTING PLATE
7	SEE TABLE	651P212001	MANIFOLD ASSY
6	4	200062A060A1016	LOCKWASHER. HELICAL SPRING. M6
5	2	200062A050A1012	LOCKWASHER. HELICAL SPRING. M5
4	1	195160-8A1	SHUT-OFF VALVE
3	4	200010A060S120	HEX HEAD CAP SCREW. ZINC PLATED. M6 X 12.0MM
1	SEE TABLE	4-4CB12-B	ELBOW

PART NUMBER	DESCRIPTION	ITEM 1	ITEM 7	ITEM 9	ITEM 13	ITEM 15	ITEM 16
258656A1	TZID-C MTG KIT FOR UP3	4 REQD	1 REQD	3 REQD	OMIT	OMIT	OMIT
258656A2	TZID-C MTG KIT W/O MANIFOLD FOR UP3	4 REQD	OMIT	OMIT	1 REQD	OMIT	OMIT
258656A3	TZID-C MTG KIT FOR UP4	2 REQD	1 REQD	3 REQD	OMIT	3 REQD	2 REQD
258656A4	TZID-C MTG KIT W/O MANIFOLD FOR UP4	2 REQD	OMIT	OMIT	1 REQD	3 REQD	2 REQD

Figure A-12. UP3 and UP4 with Positioner, Table A-20 (Sheet 4 of 4)
(Item 112)

Table A-21. UP3 and UP4 with Solenoid Valve
Figure A-13 (Drawing No. 5328799)

Item	Qty	Part No.	Description
Refer to sheet 1 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-19,A-20,8-1,8-2 and Figs 8-2,8-3,	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-22	Solenoid valve
24	1	Refer to Table A-22	Design plate
25	1	194956_7	Terminal block
26	2	5328770_1	Clevis pin
27	Refer to Table A-22	1951407_1	Male connector
28	1	5328718_1	Bearing support
29	1	5328771_1	Clevis
30	1	5328800_1	Cover plate
31	5	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-21. UP3 and UP4 with Solenoid Valve
Figure A-13 (Drawing No. 5328799) (continued)

Item	Qty	Part No.	Description
39	Refer to Table A-22	4CBI2-B	Male elbow
40	Refer to Table A-22	4-4CBI2-B	Male elbow
41	Refer to Table A-22	4FBI2-B	Male connector
42	Refer to Table A-22	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-22	—	¼ NPT x 1.250 brass nipple
48	Refer to Table A-22	—	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-22	—	¼ NPT brass elbow
59	Refer to Table A-22	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-22	R2041-1594	14 AWG black leadwire
64	1	195273_¼	¼ NPT brass tee
65	Refer to Table A-22	1943825_7	Terminal lug
66	Refer to Table A-22	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
78	Refer to Table A-22	4VBI2-B	45° male elbow

Table A-21. UP3 and UP4 with Solenoid Valve
Figure A-13 (Drawing No. 5328799) *(continued)*

Item	Qty	Part No.	Description
79	Refer to Table A-22	1951408_1	Male elbow
80	Refer to Table A-22	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-22	R9021-0050	0.500 OD x 0.062 wall nylon with polyester tubing
120	1	5313297_2	Washer
85	Refer to Table A-22	—	(⅜ x ¼) brass reducing bushing
Refer to sheet 2 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	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).

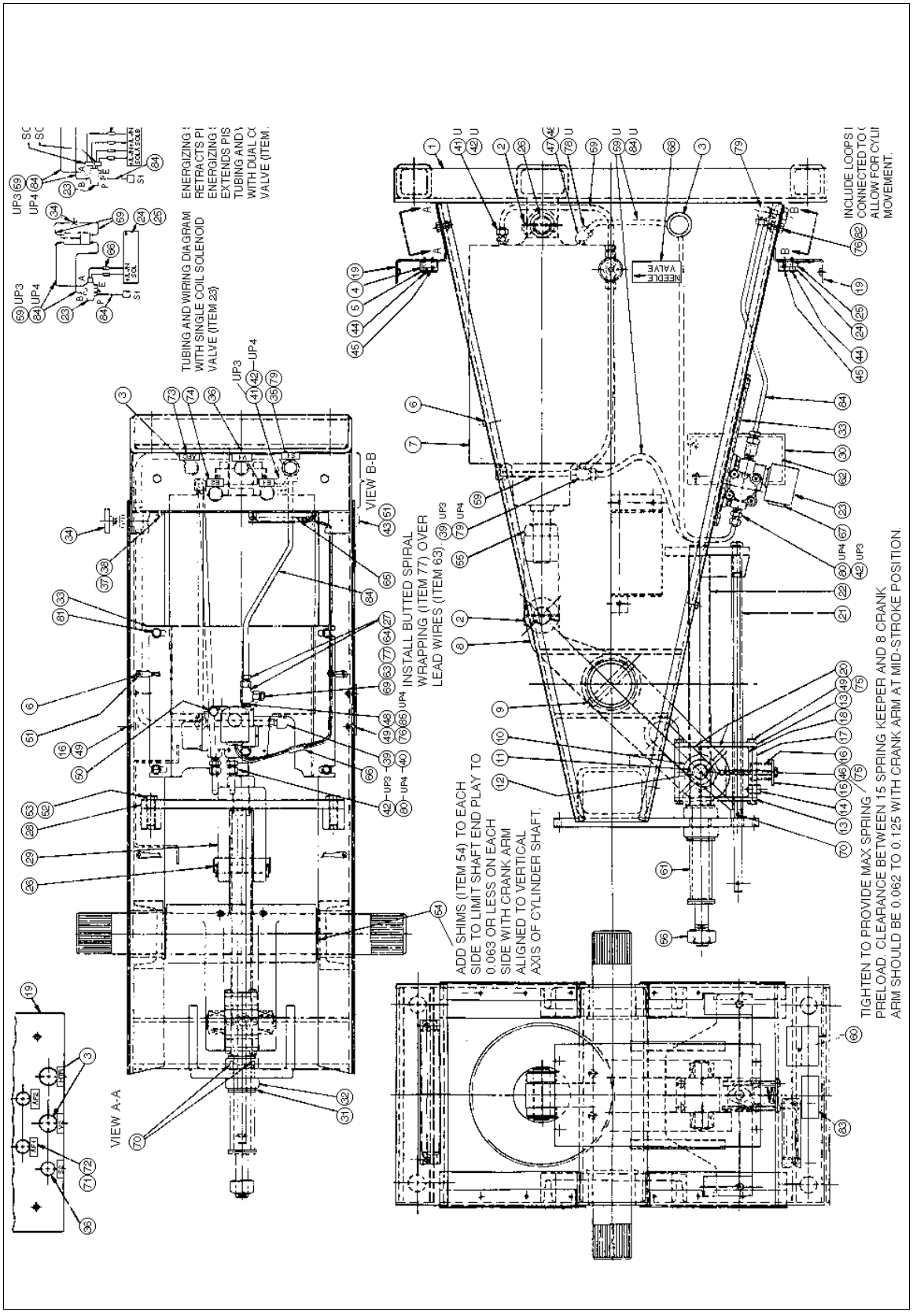


Figure A-13. UP3 and UP4 with Solenoid Valve, Tables A-21 and A-22 (Sheet 1 of 2)

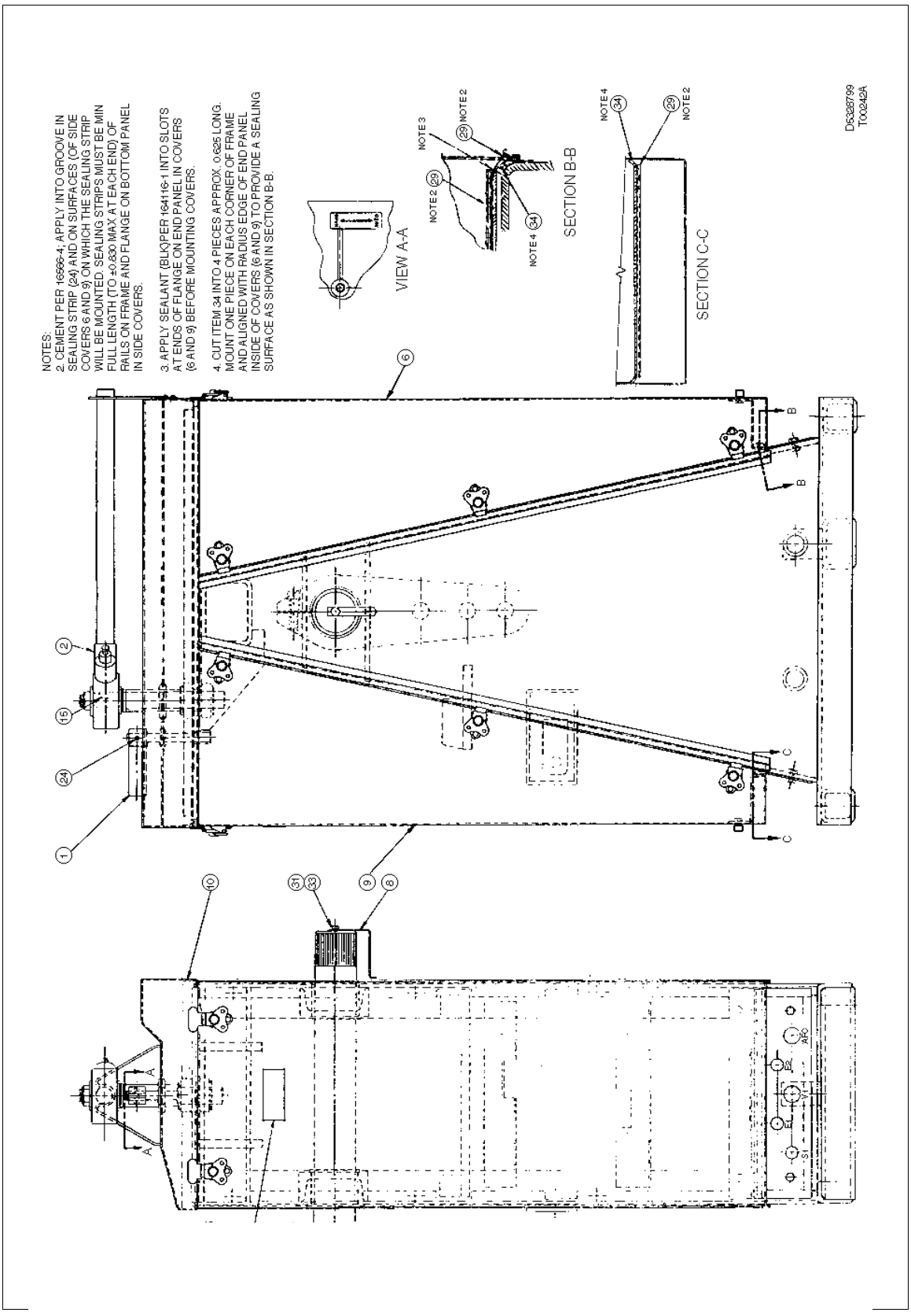


Figure A-13. UP3 and UP4 with Solenoid Valve, Tables A-21 and A-22 (Sheet 2 of 2)

Table A-22. UP3 and UP4 with Solenoid Valves and Unique Items, Figure A-13

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)

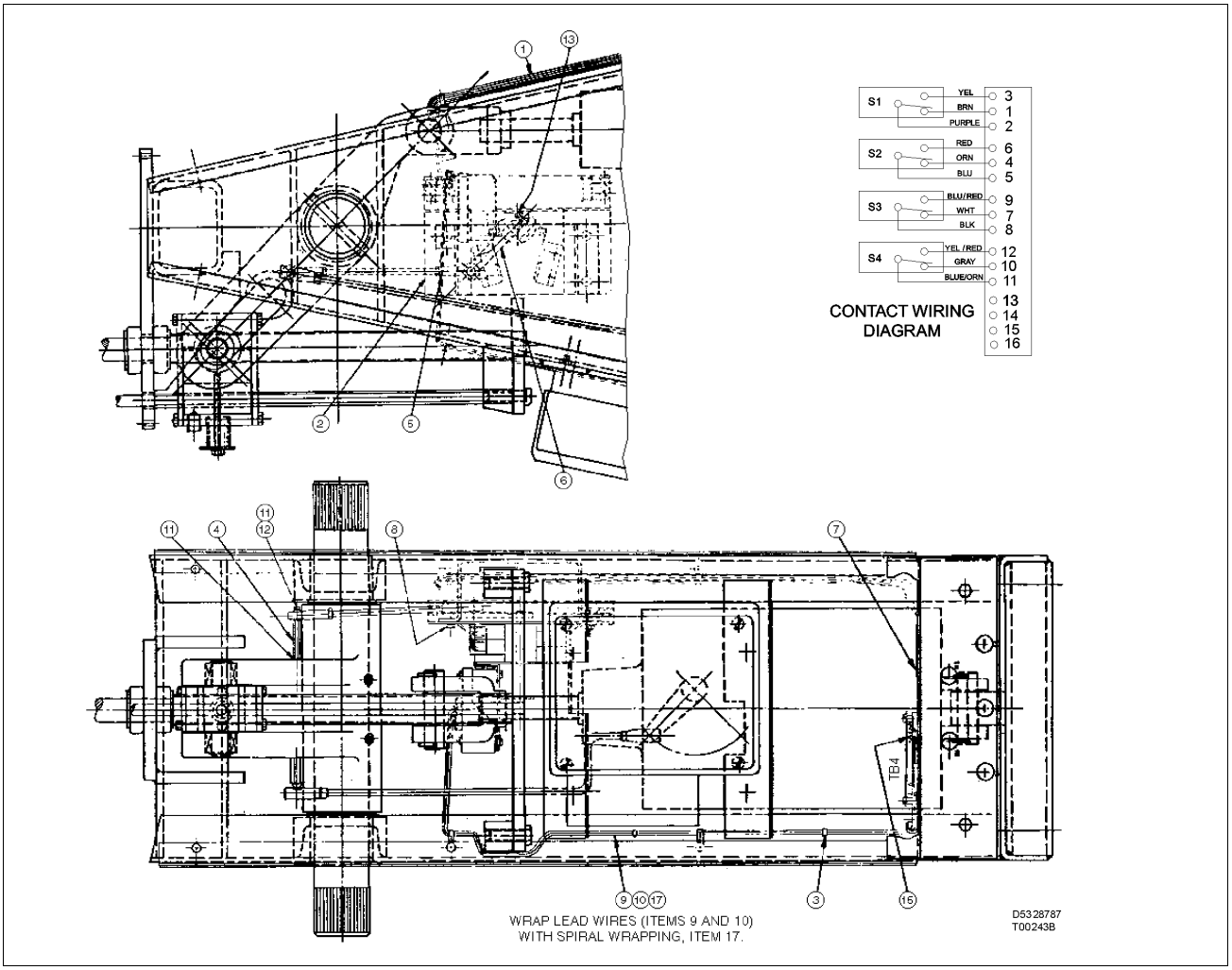


Figure A-14. UP3 and UP4 with Alarm/Travel Switches, Table A-23

Table A-23. UP3 and UP4 Alarm/Travel Switch Kit, Figure A-14

Item	Qty	Part No.	Description
1	1	5328786B1	Wiring Harness
2	1	154C003U01	Alarm Unit
4	1	19934A208	Spacer
5	1	5312449A13	Connecting Link
6	1	5328596A2	Arm
7	0	DWGE5328787	Kit, xmtr SWS
8	3	NIEAC16008	Sem Hex Hd Ext 10-32 x 1/2
11	2	085f010S31	#10 Int Tooth Washer
12	2	NBMAC16012	Hex Ind Mach Scr 10-32 x 3/4
13	1	NBAAC13008	Hex Soc Hd Cap Scr 6-32 x 1/2
14	1	150A164U01	Conduit nipple #502
18	1	355C647U03	Mtg. plate travel SW UP3/UP4

Table A-23. UP3 and UP4 Alarm/Travel Switch Kit, Figure A-14

Item	Qty	Part No.	Description
19	1	355C647U04	Mtg. plate travel SW UP3/4
20	4	040D010T10	5/16-18 x 5/8 SCR CAP HEX HD
21	4	085D516T10	5/16 Spring lock washer
22	2	NNBAC21000	NUT HEX-EXT WSHR 1/4-20
23	2	NAUAC21010	Bolt, HEX HD FIN

Table A-24. UP3 and UP4 Pneumatic Shaft Position Transmitter Kits, Figure A-15 (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)

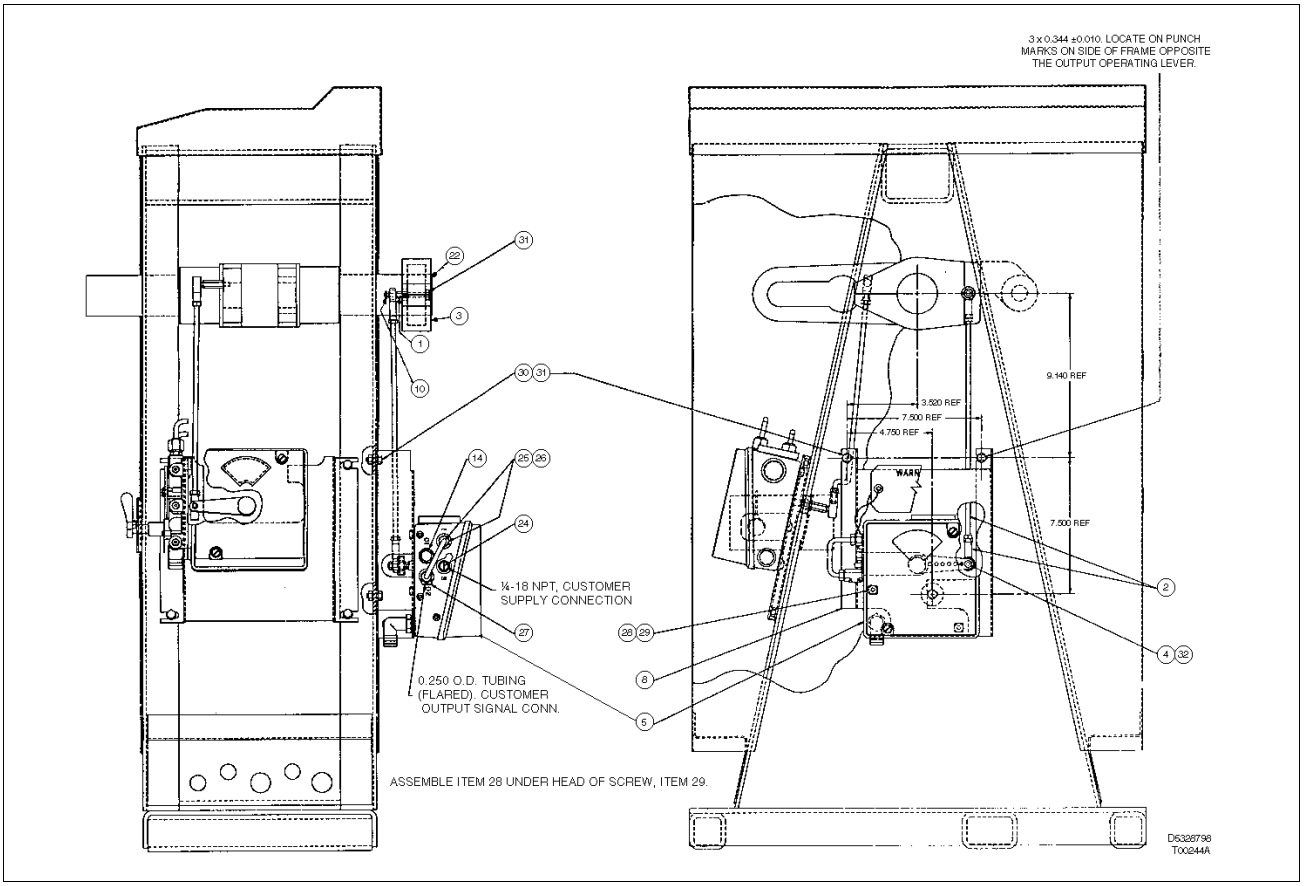


Figure A-15. UP3 and UP4 Pneumatic Shaft Position Transmitter, Table A-24

Table A-25. UP3 Air Failure Lock Kits, Figure A-16 (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)
13	6	4CBI2-B	Male elbow
14	1	1951609_1	Bulkhead fitting

Table A-25. UP3 Air Failure Lock Kits, Figure A-16 (Kit Nos. 5328781 _1/2) (continued)

Item	Qty	Part No.	Description
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

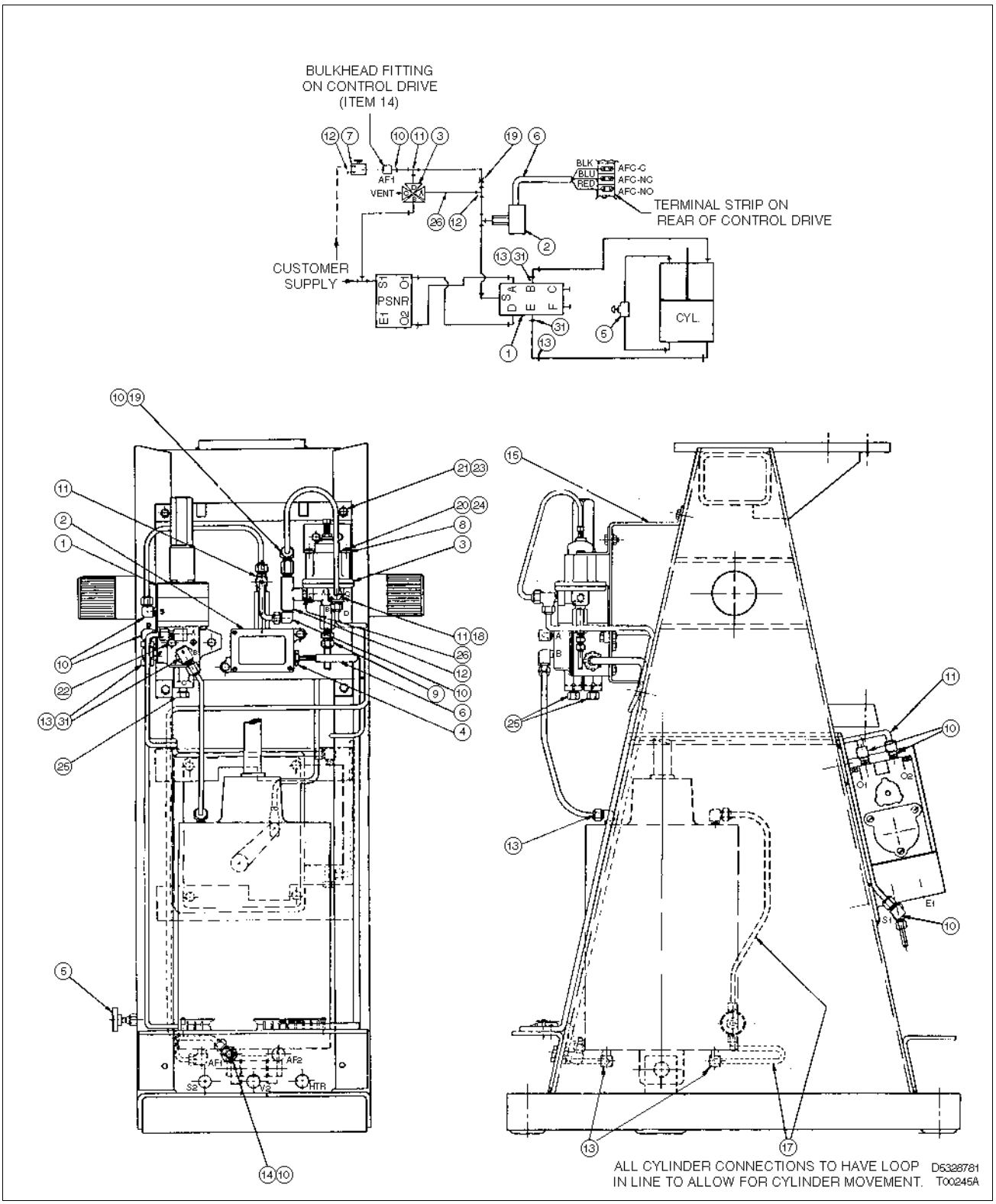


Figure A-16. UP3 with Air Failure Lock, Table A-25

Table A-26. UP4 Air Failure Lock Kits, Figure A-17 (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 ($\frac{1}{8}$ 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

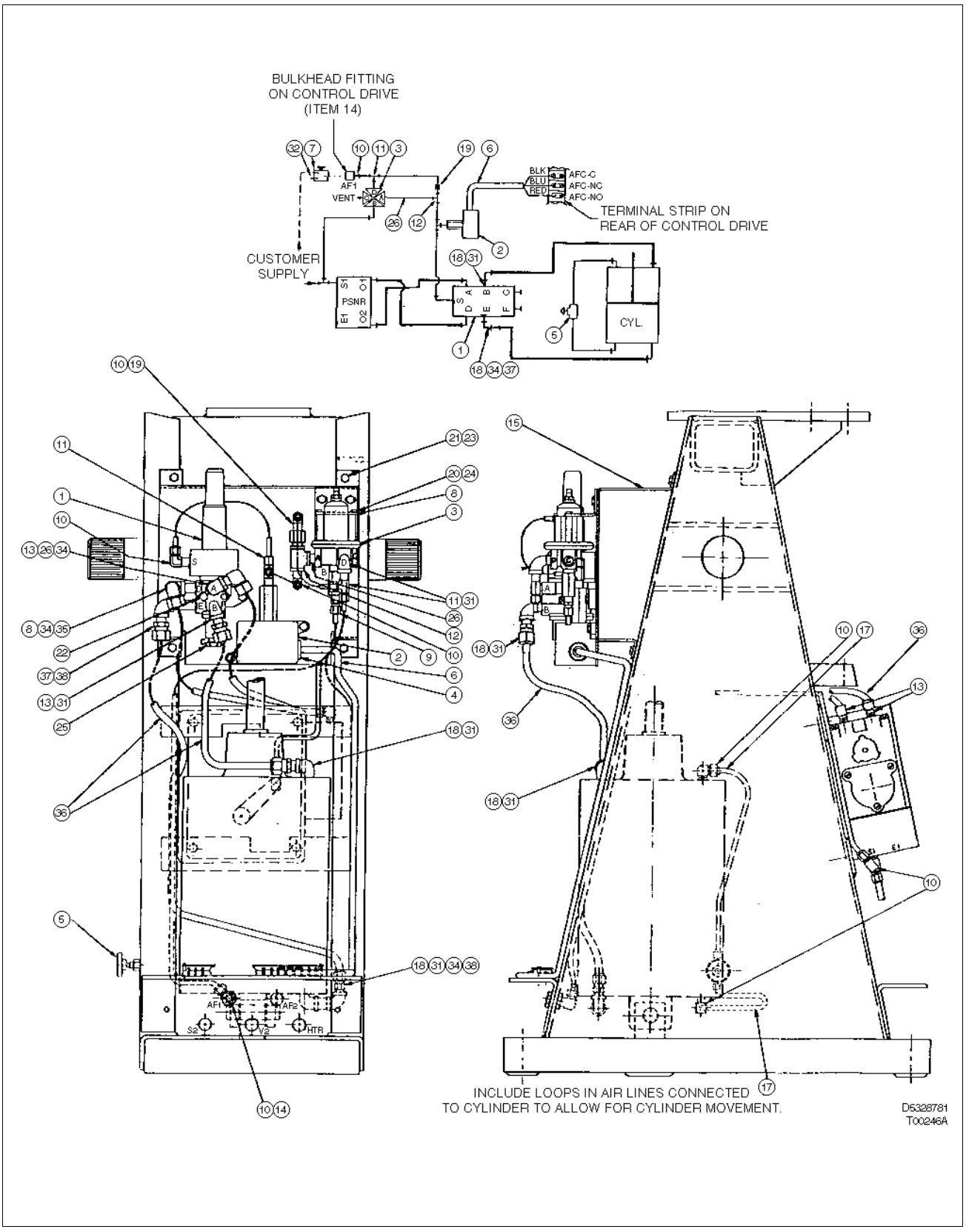


Figure A-17. UP4 with Air Failure Lock, Table A-26

Table A-27. UP3 Reserve Air Tank Kits, Figure A-18 (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)

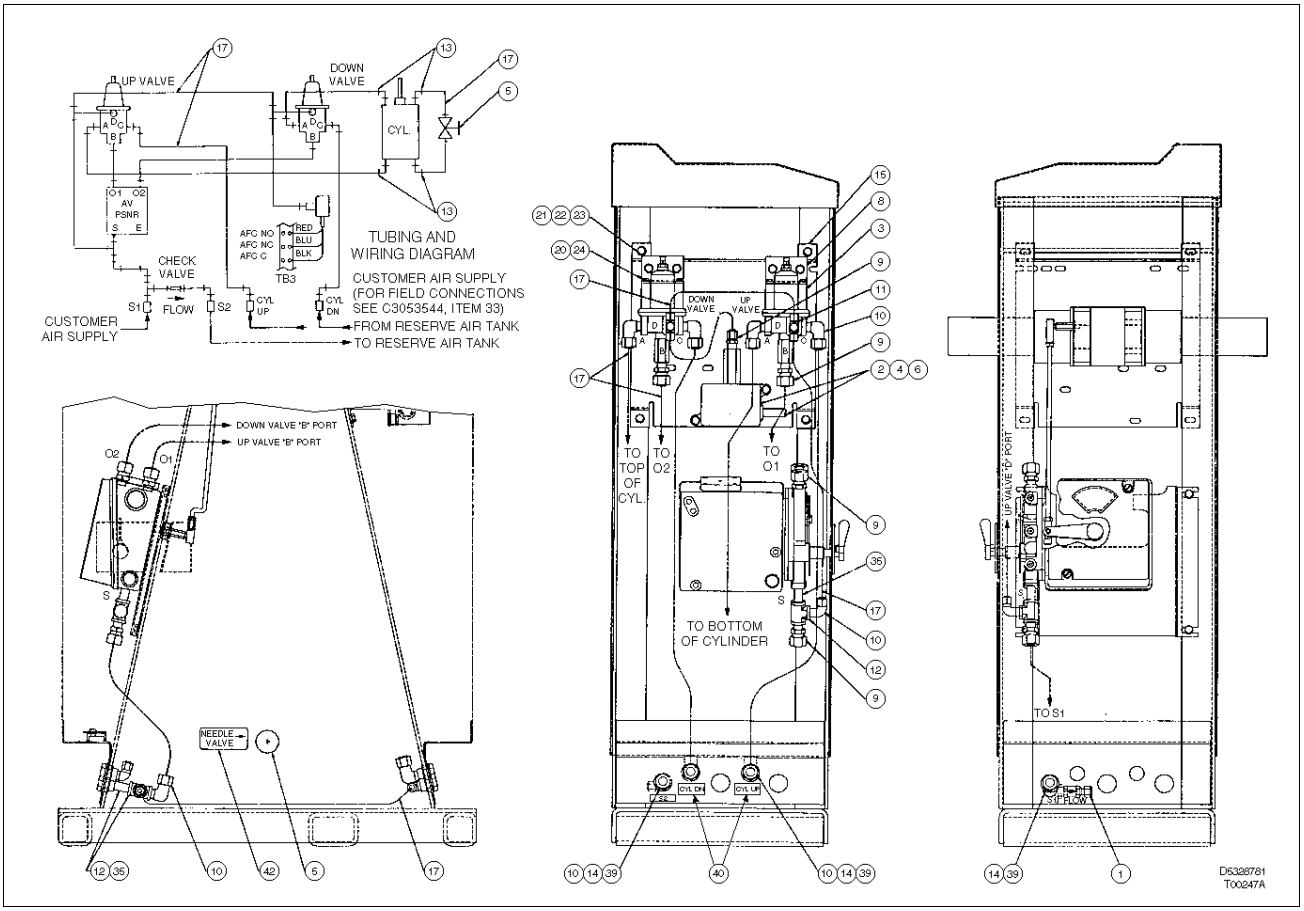


Figure A-18. UP3 with Reserve Air Tank, Table A-27

Table A-28. UP4 Reserve Air Tank Kits, Figure A-19 (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-28. UP4 Reserve Air Tank Kits, Figure A-19 (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)

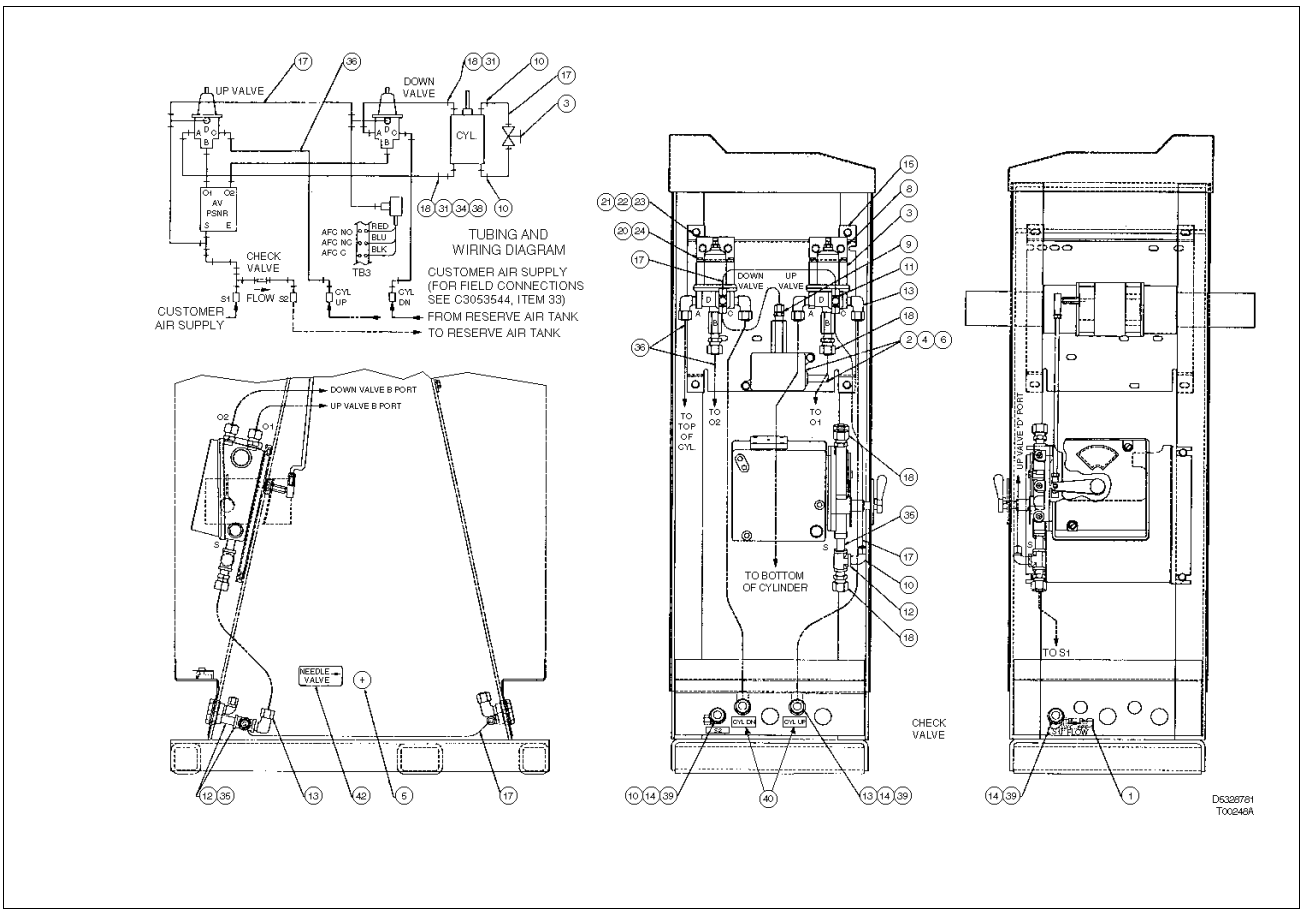


Figure A-19. UP4 with Reserve Air Tank, Table A-28

Table A-29. UP3 and UP4 Heater Kits, Figure A-20

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
17	4	—	Pan head Zn plated steel sems int (0.190-32 x 0.375)
18	4	NTKAC19000	Shakeproof lockwasher (0.190)

Table A-29. UP3 and UP4 Heater Kits, Figure A-20 (continued)

Item	Qty	Part No.	Description
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

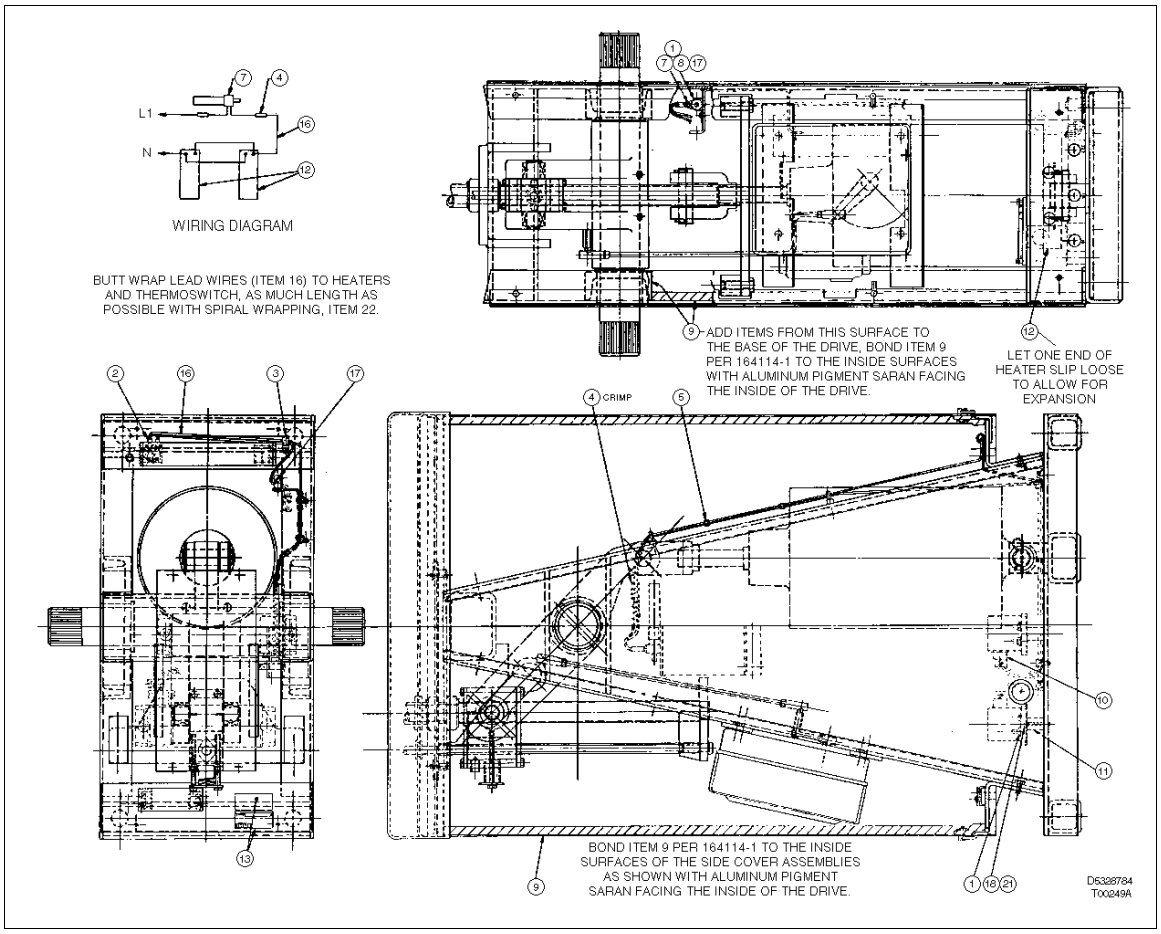


Figure A-20. UP3 and UP4 with Heater, Table A-29

Table A-30. 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-31. 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

Types UP5 and UP6 Actuators

Refer to Tables A-32 through A-46, and Figures A-21 through A-28 for spare parts information for Types UP5 and UP6 actuators.

Table A-32. UP5 and UP6 with Positioner, Figure A-21 (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-32&A-33	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-32&A-33	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-32&A-33	R2041-0030	18 AWG white leadwire
24[1]	1	5329162_1	Top cover assembly
25	1	5329067_1	Stop plate

Table A-32. UP5 and UP6 with Positioner, Figure A-21 (Drawing No. 5328960) (continued)

Item	Qty	Part No.	Description
26	1	5329010_1	Roller chain
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-33, 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 Tables A-32 & A-33	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)

Table A-32. UP5 and UP6 with Positioner, Figure A-21 (Drawing No. 5328960) *(continued)*

Item	Qty	Part No.	Description
66	8	—	Pan head Zn plated steel machine screw (0.138-32 x 1.000)
67	8	SSP-68	Zn plated steel rivet
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 Tables A-32 & A-33	8-8CBI2-B	Elbow
80	Refer to Tables A-32 & A-33	5323705_1	Elbow

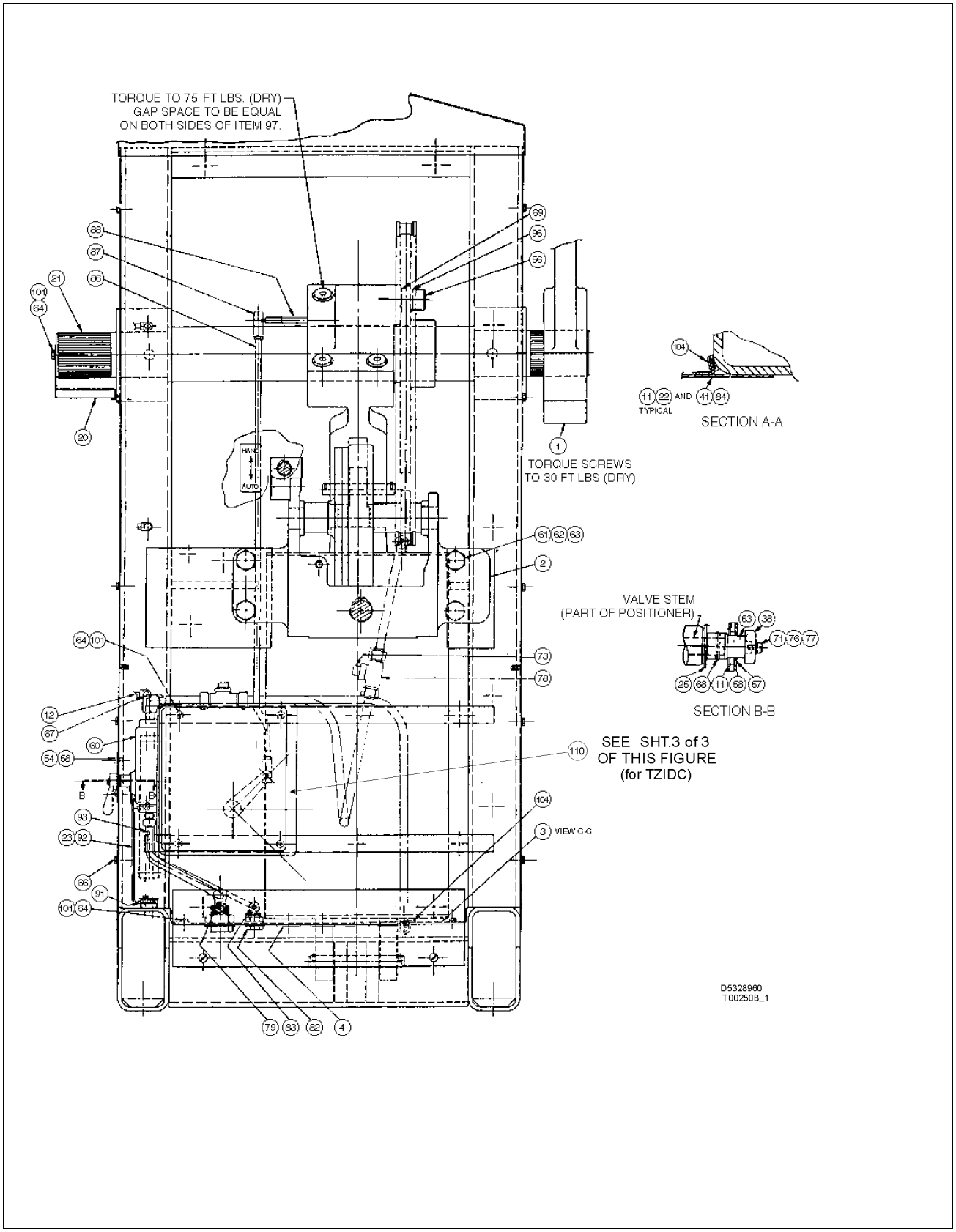


Figure A-21. UP5 and UP6 with Positioner, Tables A-32, A-32 and A-33 (Sheet 1 of 3)

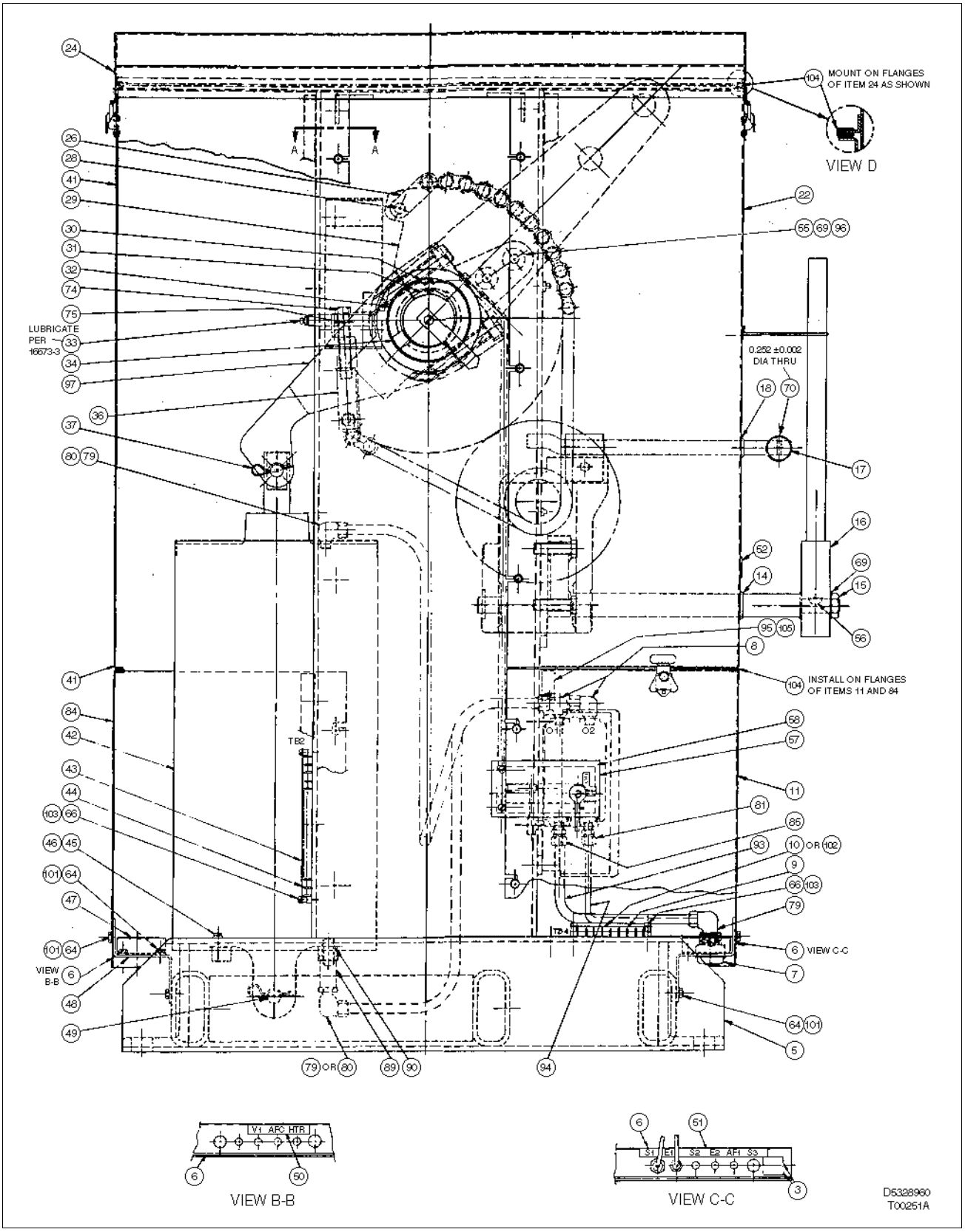
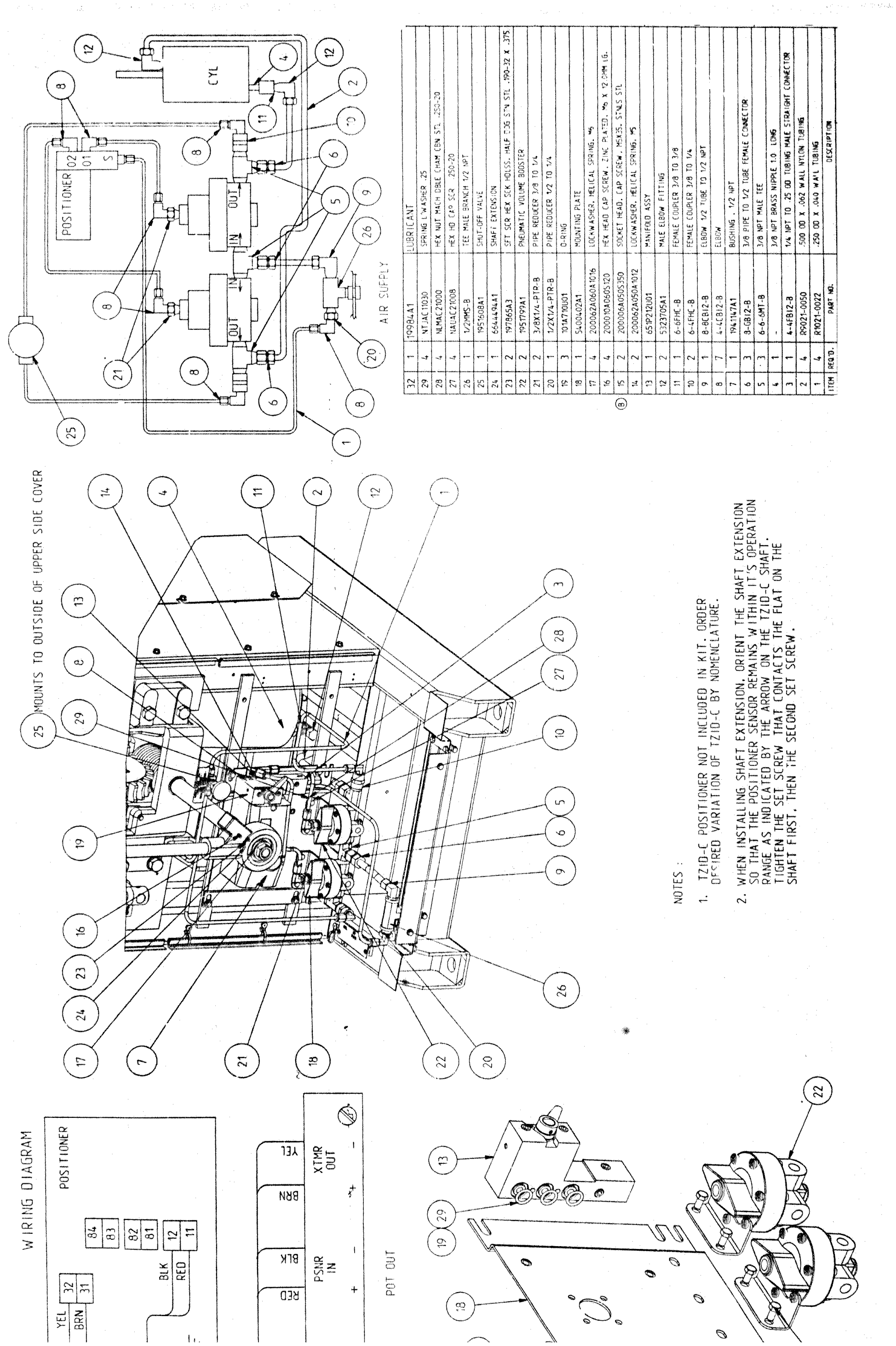


Figure A-21. UP5 and UP6 with Positioner, Tables A-32, A-32 and A-33 (Sheet 2 of 3)



NOTES :

1. TZID-C POSITIONER NOT INCLUDED IN KIT. ORDER DESIRED VARIATION OF TZID-C BY NOMENCLATURE.
2. WHEN INSTALLING SHAFT EXTENSION, ORIENT THE SHAFT EXTENSION SO THAT THE POSITIONER SENSOR REMAINS WITHIN IT'S OPERATION RANGE AS INDICATED BY THE ARROW ON THE TZID-C SHAFT. TIGHTEN THE SET SCREW THAT CONTACTS THE FLAT ON THE SHAFT FIRST, THEN THE SECOND SET SCREW.

ITEM	REQ'D.	PART NO.	DESCRIPTION
32	1	19984A1	LUBRICANT
29	4	NTJAC11030	SPRING L'WASHER .25
28	4	NLMAC21000	HEX NUT MACH DBLE CHAM CBN STL .250-20
27	4	NAUAC21008	HEX HD CAP SCR .250-20
26	1	1/2MMS-B	TEE MALE BRANCH 1/2 NPT
25	1	1951608A1	SHUT-OFF VALVE
24	1	6644494A1	SHAFT EXTENSION
23	2	197865A3	SFT SCR HEX SCK HDLSS. HALF DOG STN STL .190-32 X .375
22	2	1951799A1	PNEUMATIC VOLUME BOOSTER
21	2	3/8X1/4-PTR-B	PIPE REDUCER 3/8 TO 1/4
20	1	1/2X1/4-PTR-B	PIPE REDUCER 1/2 TO 1/4
19	3	101A710U01	O-RING
18	1	5400402A1	MOUNTING PLATE
17	4	200062A060A1016	LOCKWASHER, HELICAL SPRING, M6
16	4	200010A060S120	HEX HEAD CAP SCREW, ZINC PLATED, M6 X 12.0MM LG.
(8) 15	2	200006A050S350	SOCKET HEAD, CAP SCREW, M5X35, STNLS STL
14	2	200062A050A1012	LOCKWASHER, HELICAL SPRING, M5
13	1	651P212U01	MANIFOLD ASSY
12	2	5323705A1	MALE ELBOW FITTING
11	1	6-6FHC-B	FEMALE COUPLER 3/8 TO 3/8
10	2	6-4FHC-B	FEMALE COUPLER 3/8 TO 1/4
9	1	8-8CBI2-B	ELBOW 1/2 TUBE TO 1/2 NPT
8	7	4-4CBI2-B	ELBOW
7	1	1941147A1	BUSHING , 1/2 NPT
6	3	8-GBI2-B	3/8 PIPE TO 1/2 TUBE FEMALE CONNECTOR
5	3	6-6-6MT-B	3/8 NPT MALE TEE
4	1	-	3/8 NPT BRASS NIPPLE 1.0 LONG
3	1	4-4FBI2-B	1/4 NPT TO .25 OD TUBING MALE STRAIGHT CONNECTOR
2	4	R9021-0050	.500 OD X .062 WALL NYLON TUBING
1	4	R1021-0022	.250 OD X .040 WALL TUBING

Figure A-21. Kit Adding TZIDC Positioner & Boosters to UP5/UP6 (Kit Item 110, P/N 258657-1 (Sheet 3 of 3)

Table A-32. UP5 and UP6 with Positioner, Figure A-21 (Drawing No. 5328960) (continued)

Item	Qty	Part No.	Description
81	Refer to Tables A-32 & A-32	4-4FBI2-B	Male connector
82	Refer to Tables A-32 & A-32	1951609_1	Bulkhead fitting
83	Refer to Tables A-32 & A-32	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 Tables A-32 & A-32	—	Brass coupling (3⁄8)
90	Refer to Tables A-32 & A-32	—	Brass close nipple (3⁄8)
91	Refer to Tables A-32 & A-32	1943825_1	Terminal lug
92	Refer to Tables A-32 & A-32	R2041-0010	18 AWG black leadwire
93	183 cm (72 in.)	R9021-0050	0.500 OD nylon tubing
94	Refer to Tables A-32 & A-32	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-32 A-32	1943825_3	Terminal lug
101	21	1114-00	Zn plated steel shakeproof int lockwasher
102	Refer to Table A-32	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
110	1	258657-1	TZIDC Mounting Kti with Boosters and Manifold

NOTE:

1. Older models have plastic top covers. To order a plastic top cover, use Part No. 5329053_1.

Table A-33. UP5 and UP6 Positioners and Unique Items, Figure A-21

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

Table A-33. UP5 and UP6 Positioners and Unique Items, Figure A-21 (continued)

Type	Item 82	Item 83	Items 89,90	Item 91	Item 92	Item 94	Item 100	Item 102
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
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	1 req	5 req	137 cm (54 in.)	Omit	5 req	1 req

Table A-34. UP5/UP6 With TZIDC Positioners and Unique Items, ref. Figure A-21, Sheets. 1-3)

Drive Type	Cylinder Item 42	Positioner Item 60	Mounting Kit Item 110	Remaining Variable Items Same As:
UP5_U0	5328952_1	V18345-2022420001	258657_1	UP5_ _A
UP5_UB	5328952_1	V18345-2022421001	258657_1	UP5_ _A
UP5_W0	5328952_1	V18345-2022520001	258657_1	UP5_ _A
UP5_WB	5328952_1	V18345-2022521001	258657_1	UP5_ _A
UP5_Y0	5328952_1	V18348-201233000110	258657_1	UP5_ _A
UP5_YB	5328952_1	V18348-201233100110	258657_1	UP5_ _A
UP5_Z0	5328952_1	V18348-201243000110	258657_1	UP5_ _A
UP5_ZB	5328952_1	V18348-201243100110	258657_1	UP5_ _A
UP6_U0	5328945_1	V18345-2022420001	258657_1	UP6_ _A
UP6_UB	5328945_1	V18345-2022421001	258657_1	UP6_ _A
UP6_W0	5328945_1	V18345-2022520001	258657_1	UP6_ _A
UP6_WB	5328945_1	V18345-2022521001	258657_1	UP6_ _A
UP6_Y0	5328945_1	V18348-201233000110	258657_1	UP6_ _A
UP6_YB	5328945_1	V18348-201233100110	258657_1	UP6_ _A
UP6_Z0	5328945_1	V18348-201243000110	258657_1	UP6_ _A
UP6_ZB	5328945_1	V18348-201243100110	258657_1	UP6_ _A

Table A-35. UP5 and UP6 with Solenoid Valve, Figure A-22 (Drawing No. 5328961)

Item	Qty	Part No.	Description
1	1	6631317_1	Operating lever

Table A-35. UP5 and UP6 with Solenoid Valve, Figure A-22 (Drawing No. 5328961) (continued)

Item	Qty	Part No.	Description
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-36	8-8CBI2-B	Elbow
9	1	194956_8	Terminal block
10	1	Refer to Table A-36	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
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-36, 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

Table A-35. UP5 and UP6 with Solenoid Valve, Figure A-22 (Drawing No. 5328961) (continued)

Item	Qty	Part No.	Description
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-36	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-36	Solenoid valve
58	Refer to Table A-36	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)
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-36	—	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-36	488907_9	Grommet
80	2	4-4FBI2-B	Male connector
81	Refer to Table A-36	—	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

Table A-35. UP5 and UP6 with Solenoid Valve, Figure A-22 (Drawing No. 5328961) (continued)

Item	Qty	Part No.	Description
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-36. UP5 and UP6 Solenoid Valves and Unique Items, Figure A-22

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

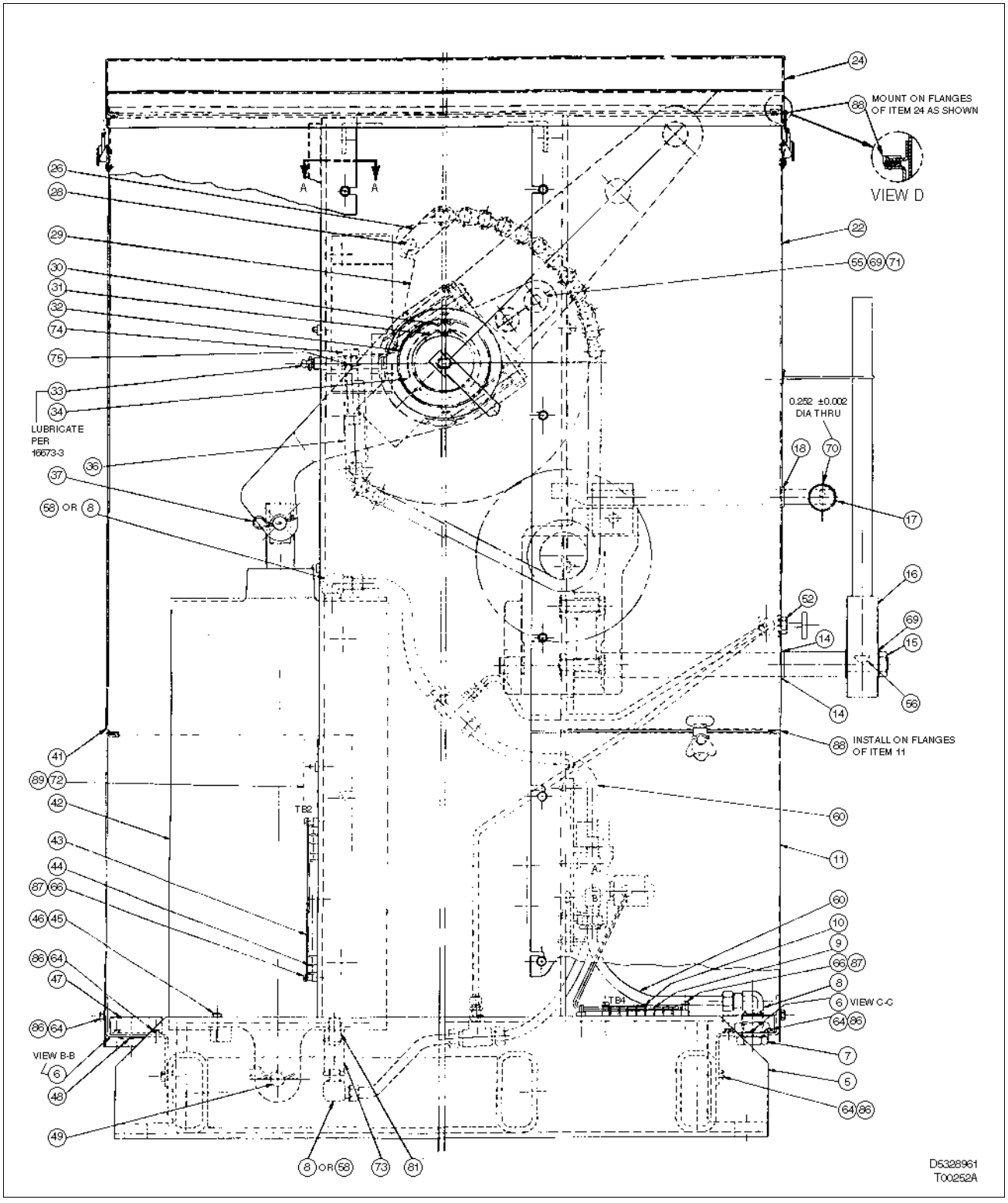


Figure A-22. UP5 and UP6 with Solenoid Valve, Tables A-35 and A-36 (Sheet 1 of 2)

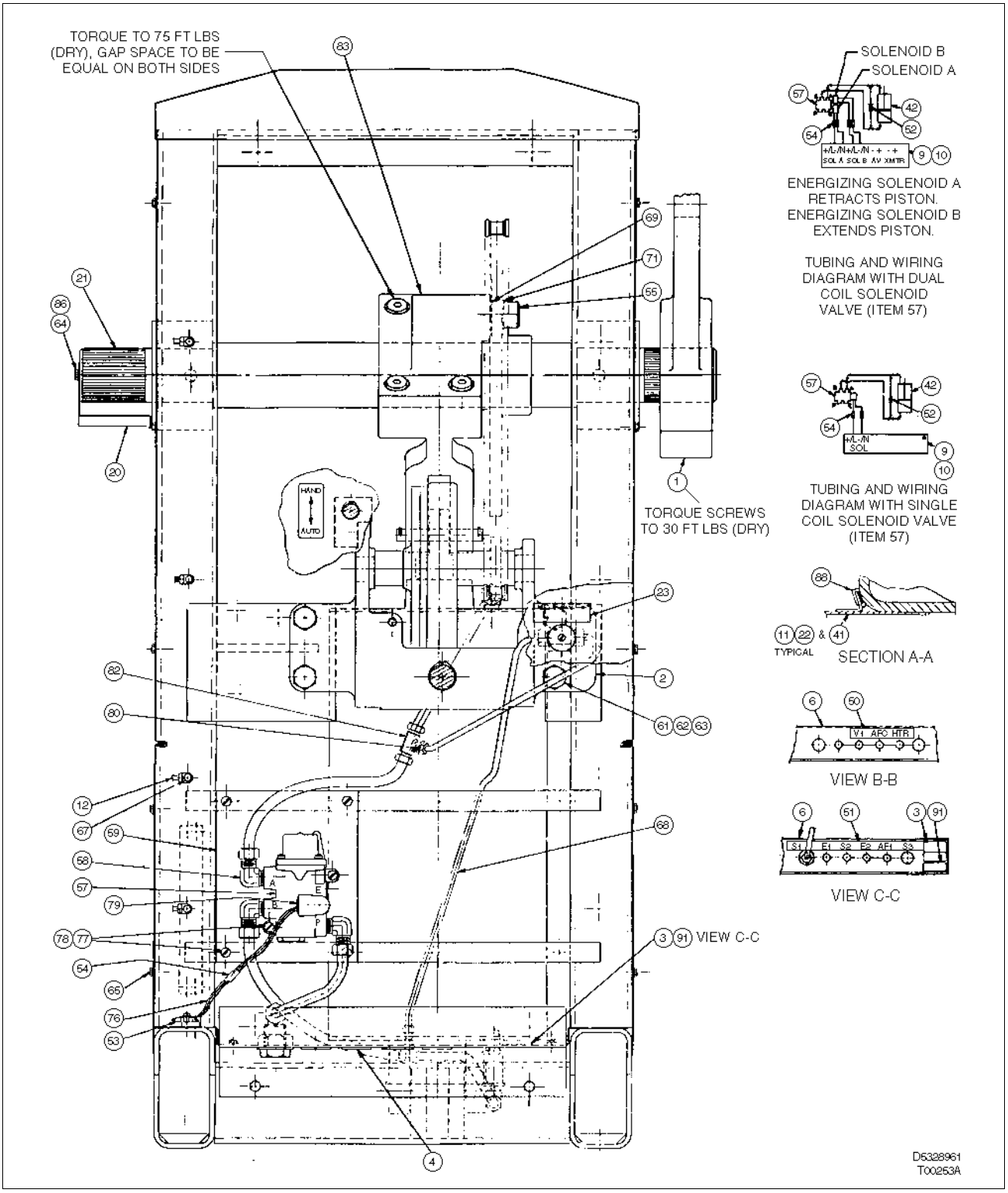


Figure A-22. UP5 and UP6 with Solenoid Valve, Tables A-35 and A-36 (Sheet 2 of 2)

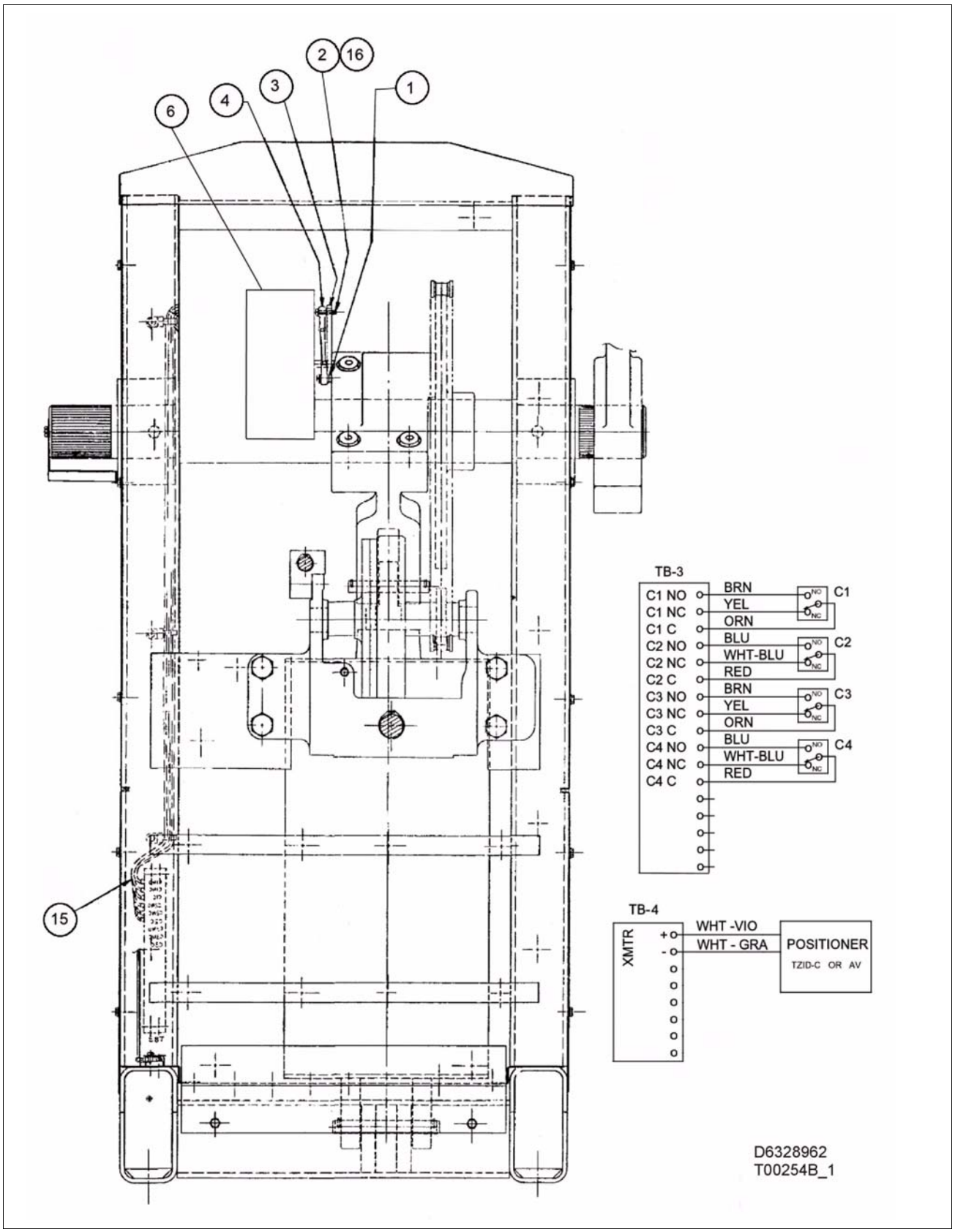


Figure A-23. UP5 and UP6 with Alarm/Travel Switches, Table A-38 (sheet 1 of 2)

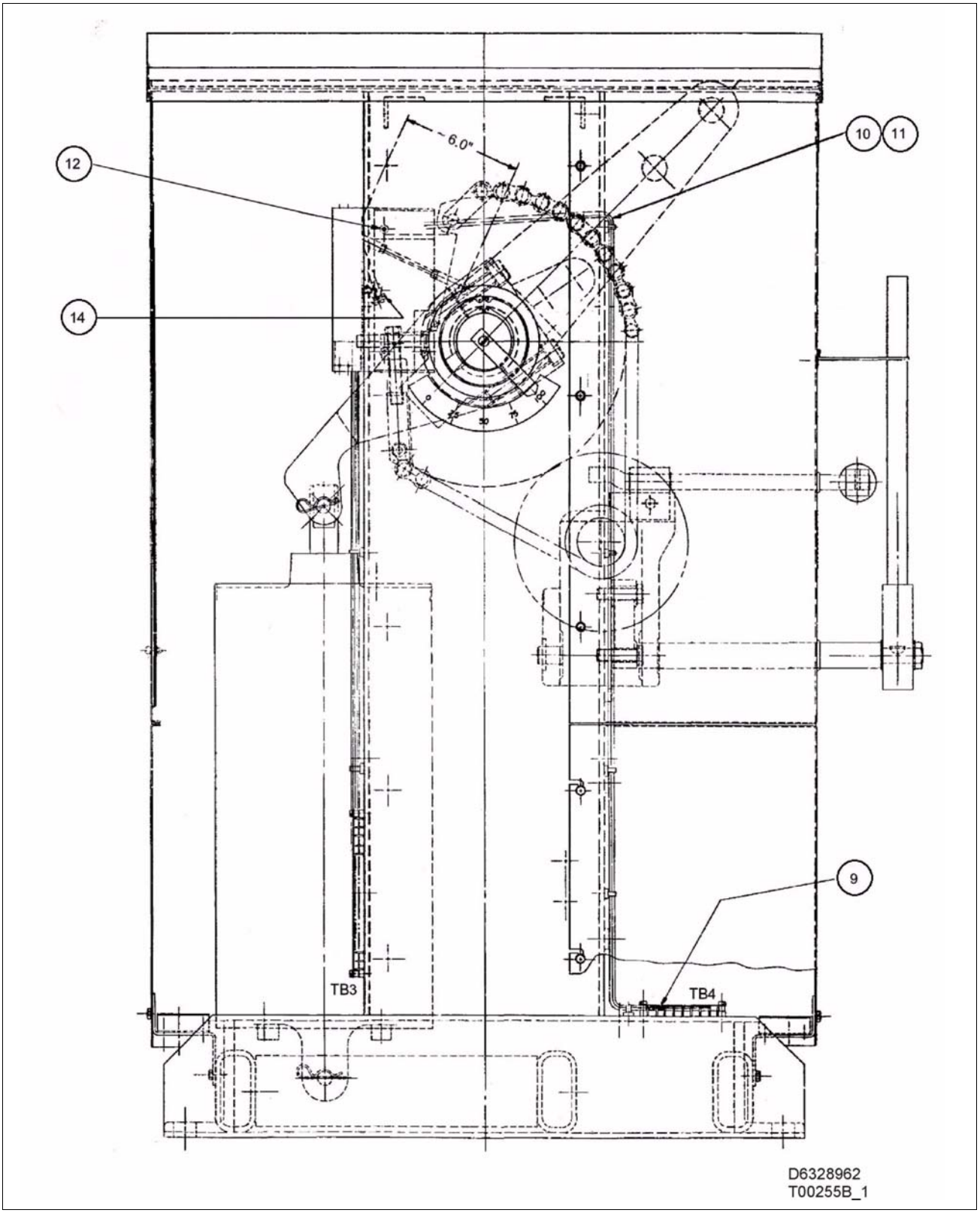


Figure A-23. *UP5 and UP6 with Alarm/Travel Switches, Table A-38 (Sheet 2 of 2)*

Table A-37. UP5 and UP6 Pneumatic Shaft Position Transmitter Kit, Figure A-24 (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

Table A-38. UP5 and UP6 Alarm/Travel Switch Kit, Figure A-23 (Kit No. 5328962_1)

Item	Qty	Part No.	Description
1	1	19934A208	Spacer
2	2	NBZAC16016	Screw, SLT PAN HD 10-32 x 1
3	1	5328596A2	Arm
4	1	5312449A12	Connecting Link
6	1	155C003U01	Alarm/Travel SW-UP1.2.5.6-4SW
12	3	NIEAC16008	SEM HEX HD EXT 10-32 x 1/2
14	1	NBAAC13008	HEX SOC HD CAP SCR 6-32 x 1/2
15	1	5328933A1	Wiring Harness
16	2	085F020S31	#10 INT tooth washer
17	1	1963318A10	Nameplate
	4	085D516T10	5/16 Spring lock washer
	1	150A164U01	Conduit nipple #502
	1	355C647U01	Mtg. plate travel SW UP3-6
	4	040D010T10	5/16-18 screw CAP HEX HD
	1	DWGE5328962	UP5/6 drive

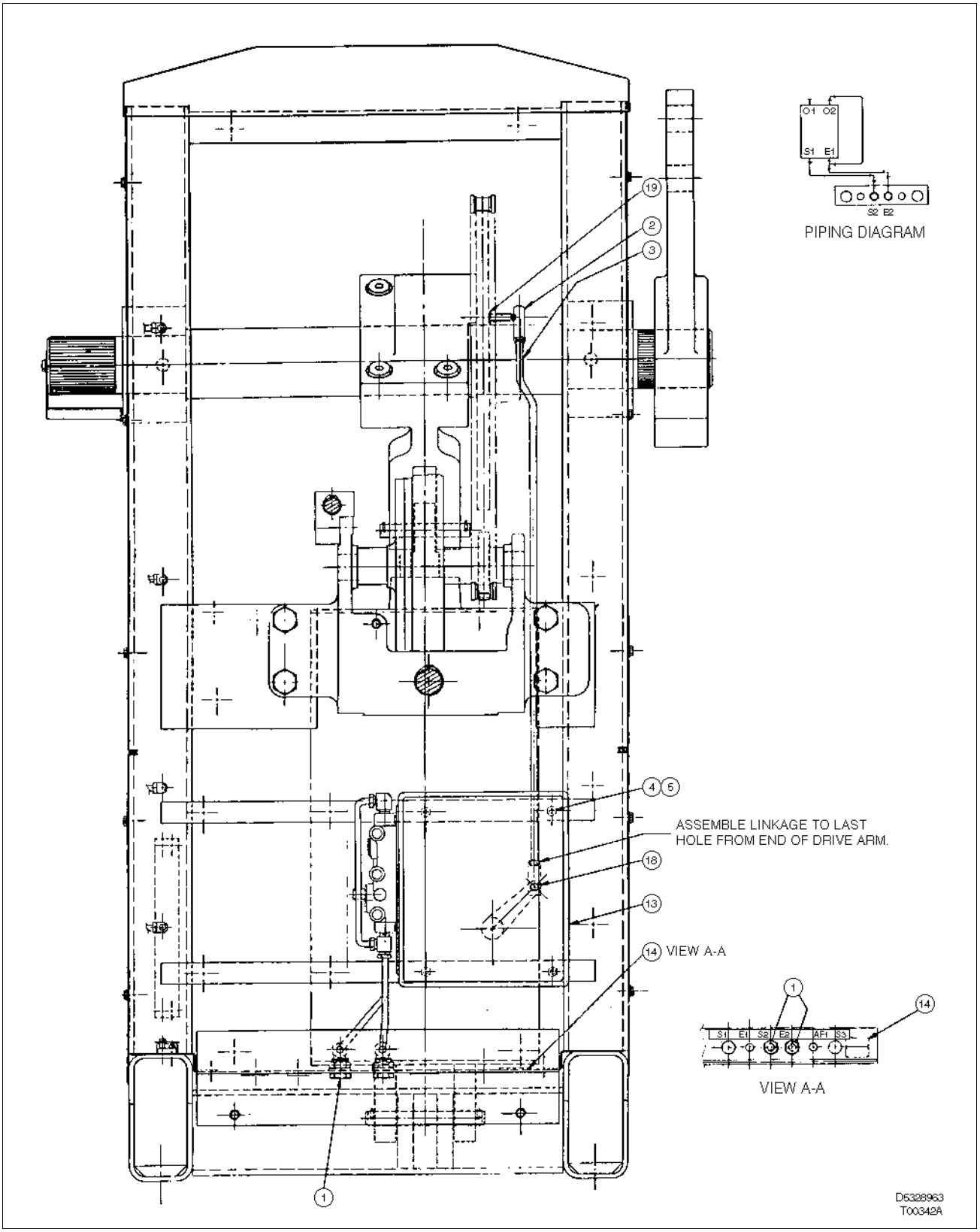


Figure A-24. UP5 and UP6 with Pneumatic Shaft Position Transmitter, Table A-37 (Sheet 1 of 2)

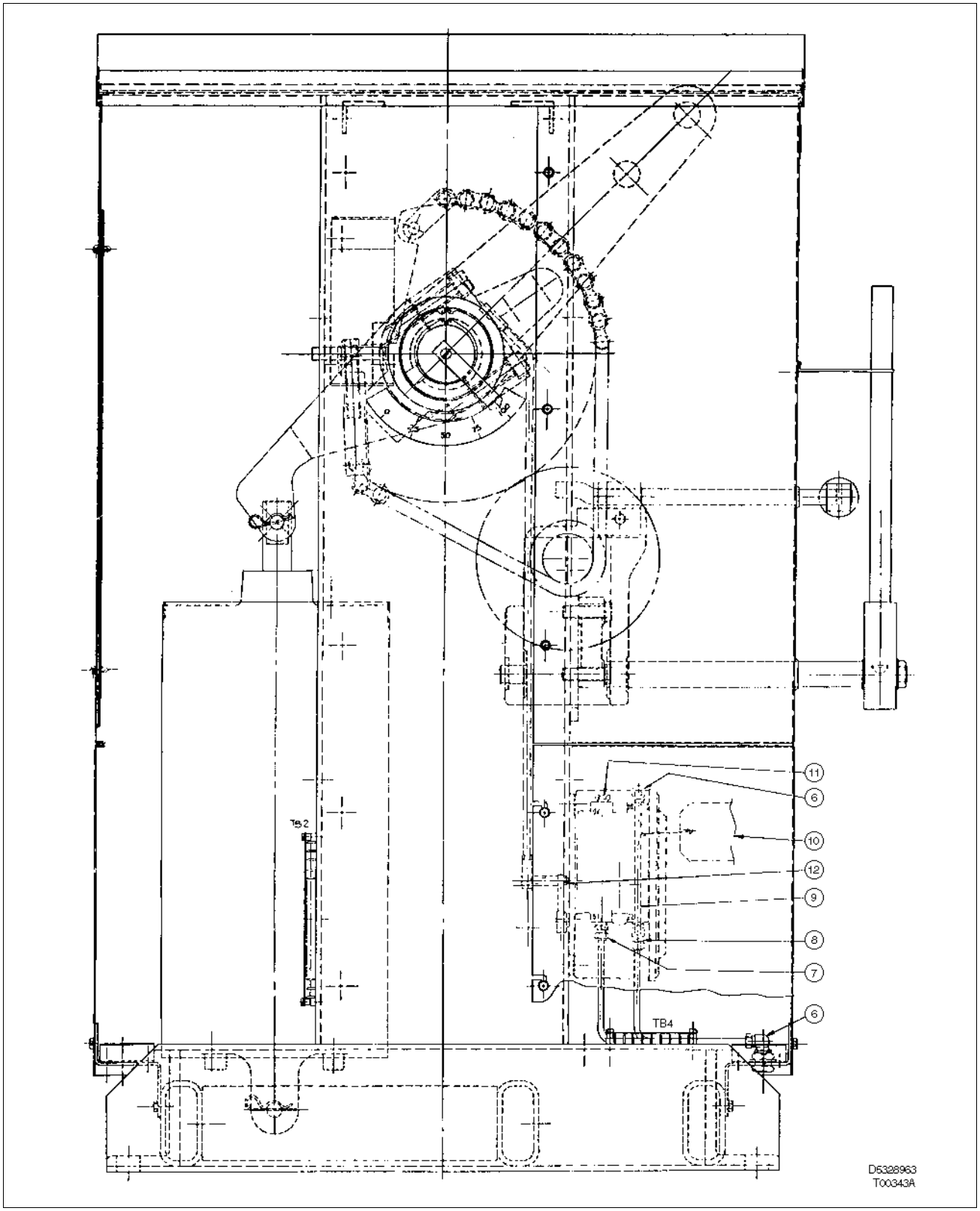


Figure 24. UP5 and UP6 with Pneumatic Shaft Position Transmitter, Table A-37 (Sheet 2 of 2)

Table A-39. UP5 and UP6 with Positioner Air Failure Lock Kit, Figure A-25 (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-40. UP5 and UP6 with Solenoid Valve Air Failure Lock Kit, Figure A-25 (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

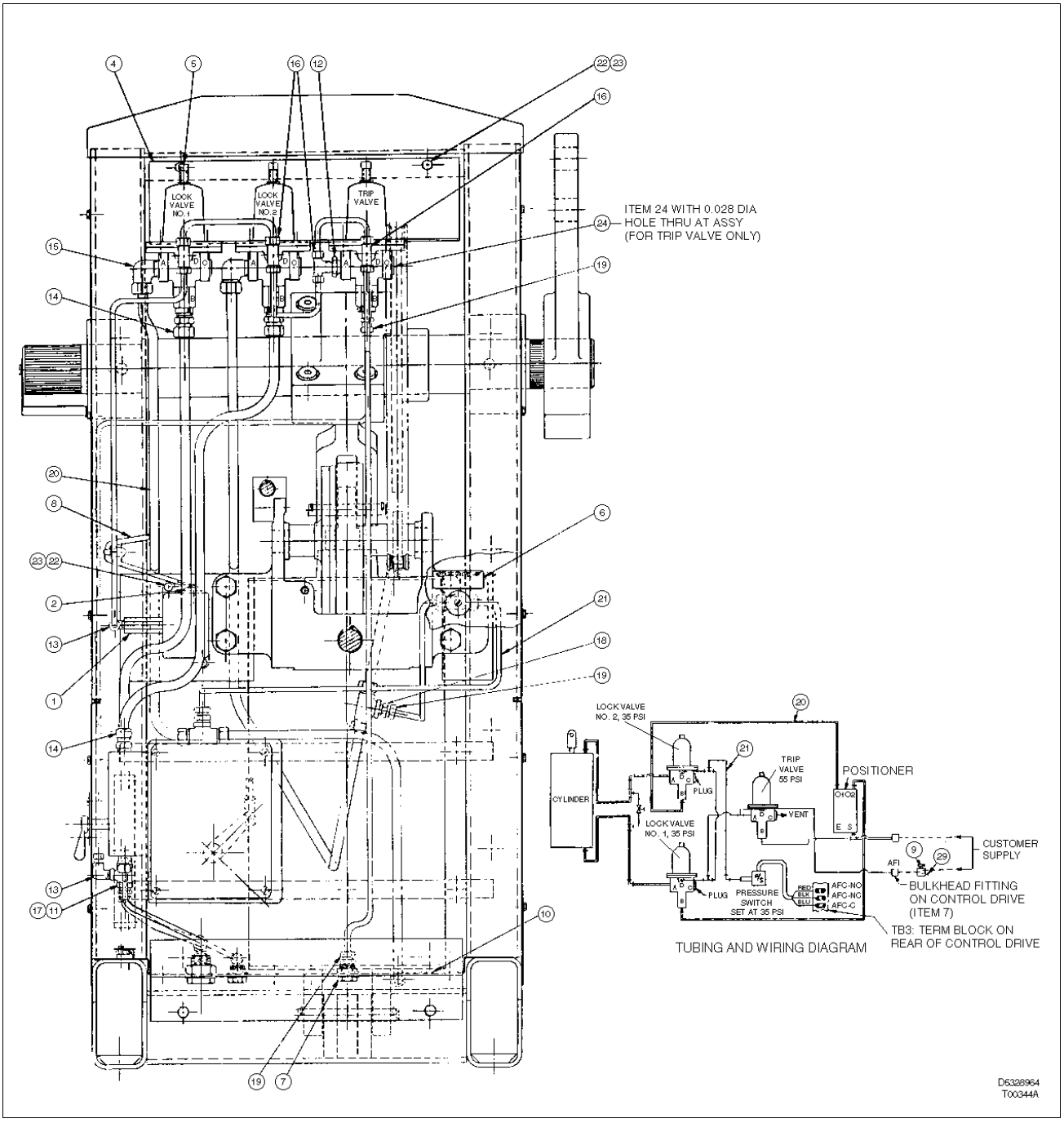


Figure A-25. UP5 and UP6 with Air Failure Lock, Tables A-39 and A-40 (Sheet 1 of 2)

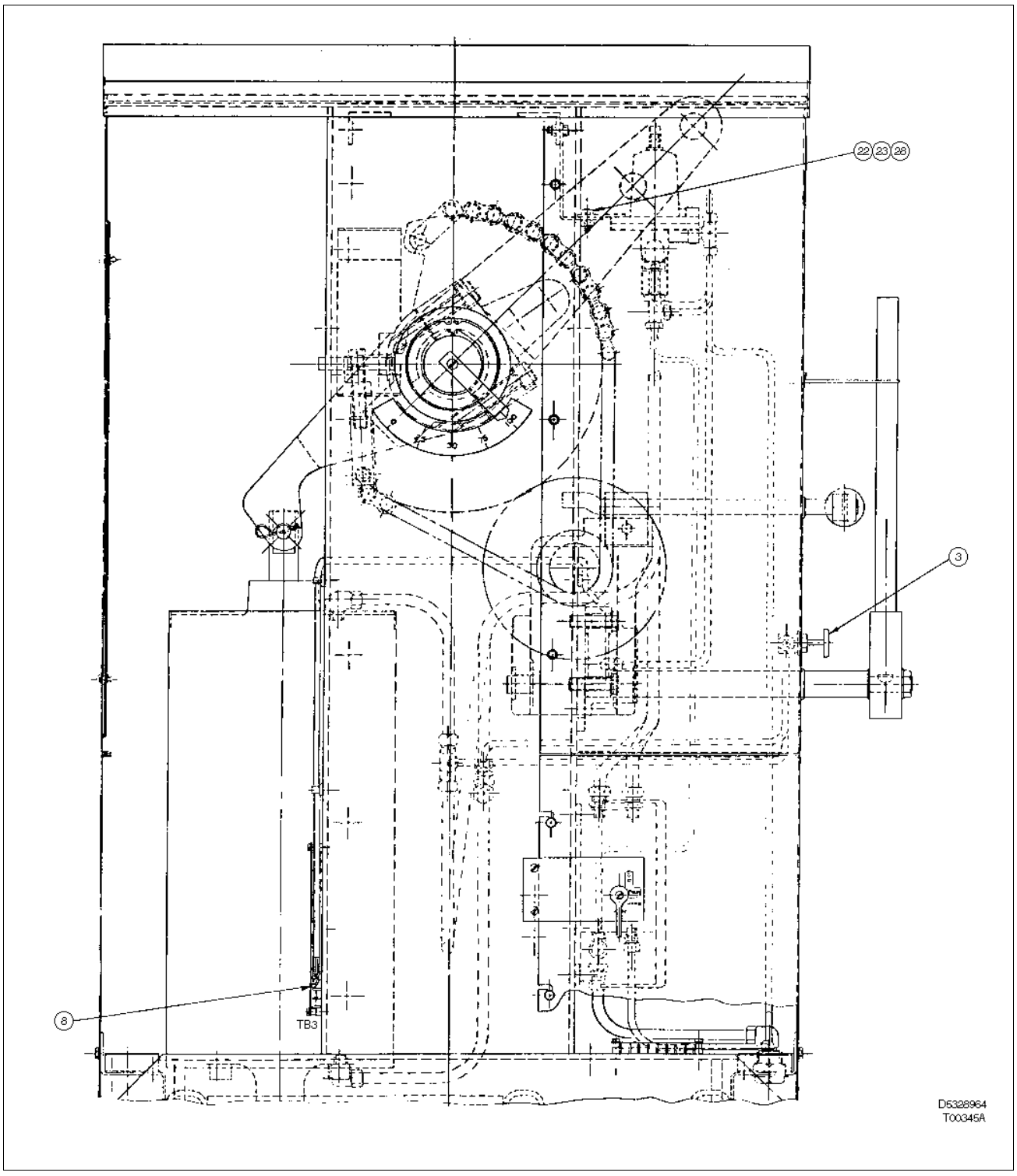


Figure A-25. UP5 and UP6 with Air Failure Lock, Tables A-39 and A-40 (Sheet 2 of 2)

Table A-41. UP5 and UP6 Reserve Air Tank Kits, Figure A-26 (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

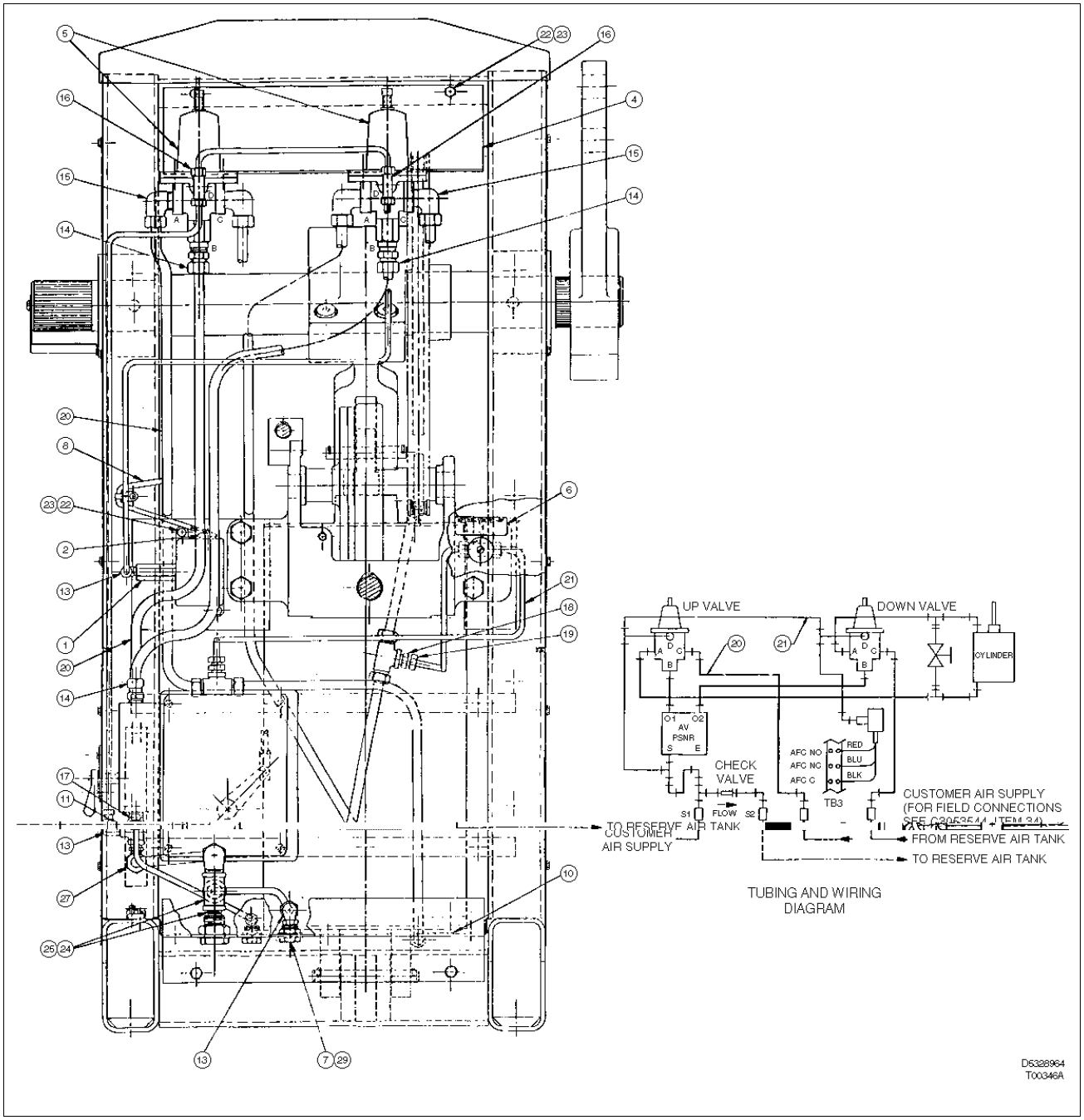


Figure A-26. UP5 and UP6 with Reserve Air Tank, Table A-41 (Sheet 1 of 2)

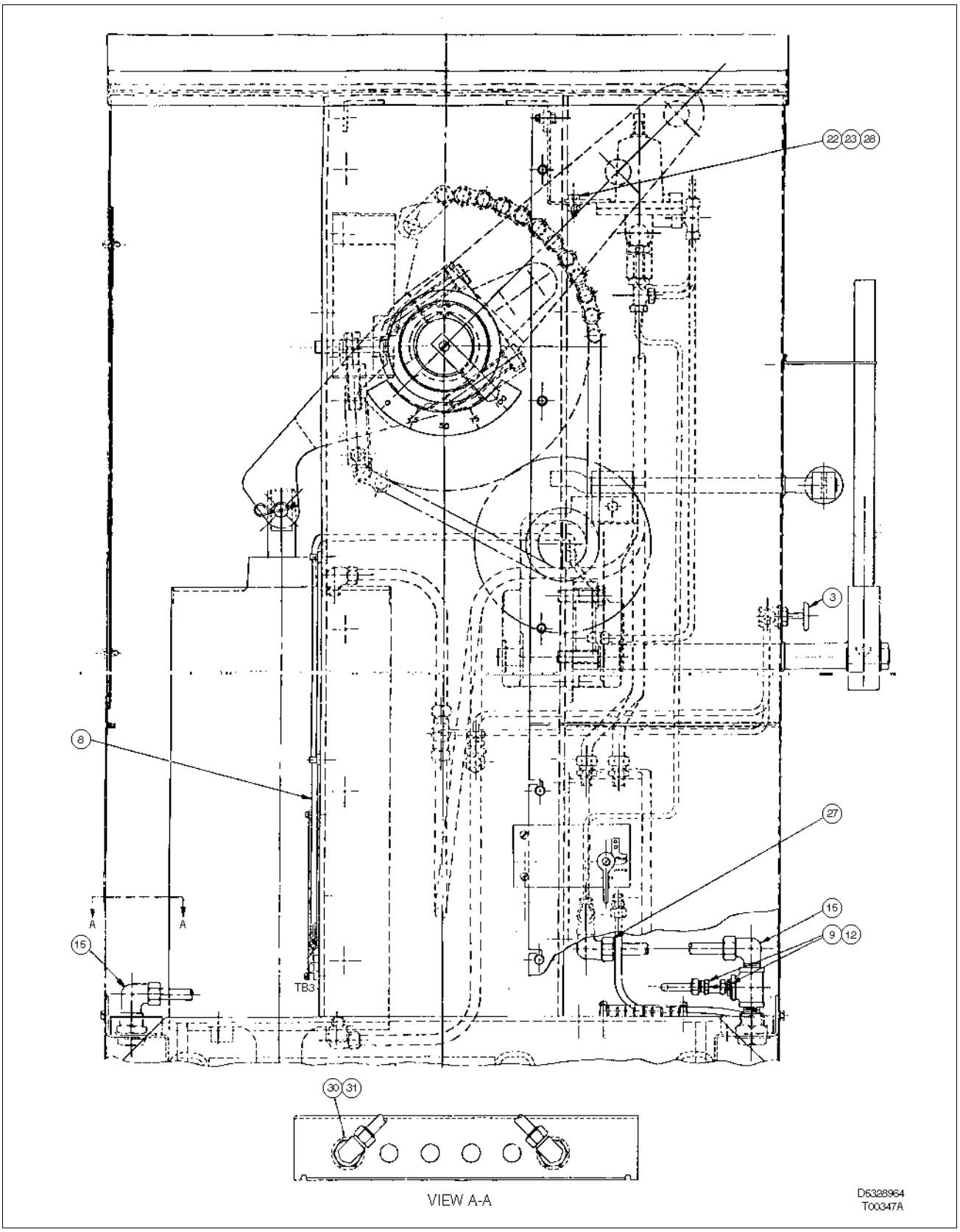


Figure A-26. UP5 and UP6 with Reserve Air Tank, Table A-41 (Sheet 2 of 2)

Table A-42. 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-43. 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-44. UP5 and UP6 Heater Kits, Figure A-27 (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

Table A-45. UP6 Volume Boosters Kit, Figure A-28 (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

Table A-45. UP6 Volume Boosters Kit, Figure A-28 (Kit No. 5329155) (continued)

Item	Qty	Part No.	Description
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

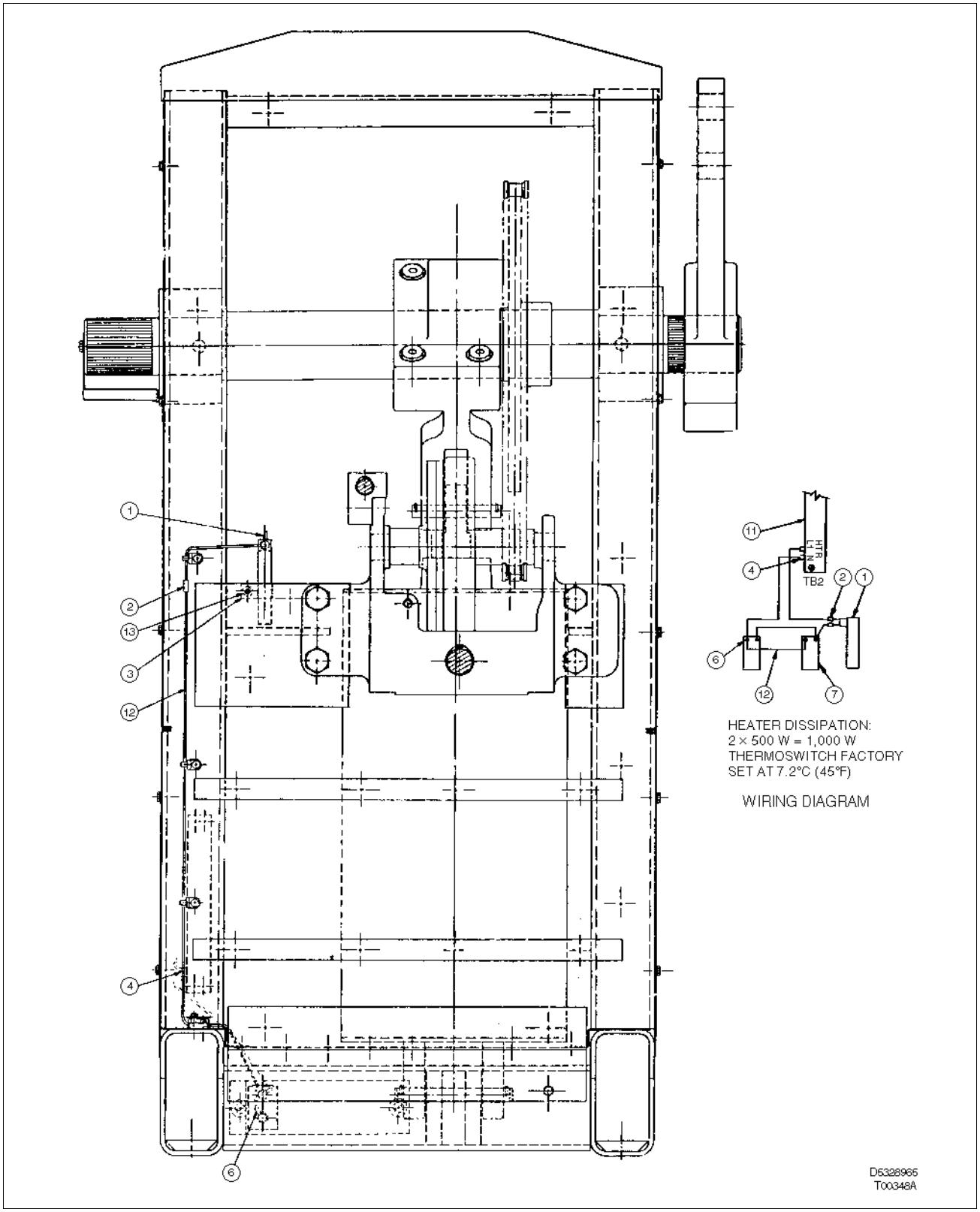


Figure A-27. UP5 and UP6 Actuators with Heater, Table A-44 (Sheet 1 of 2)

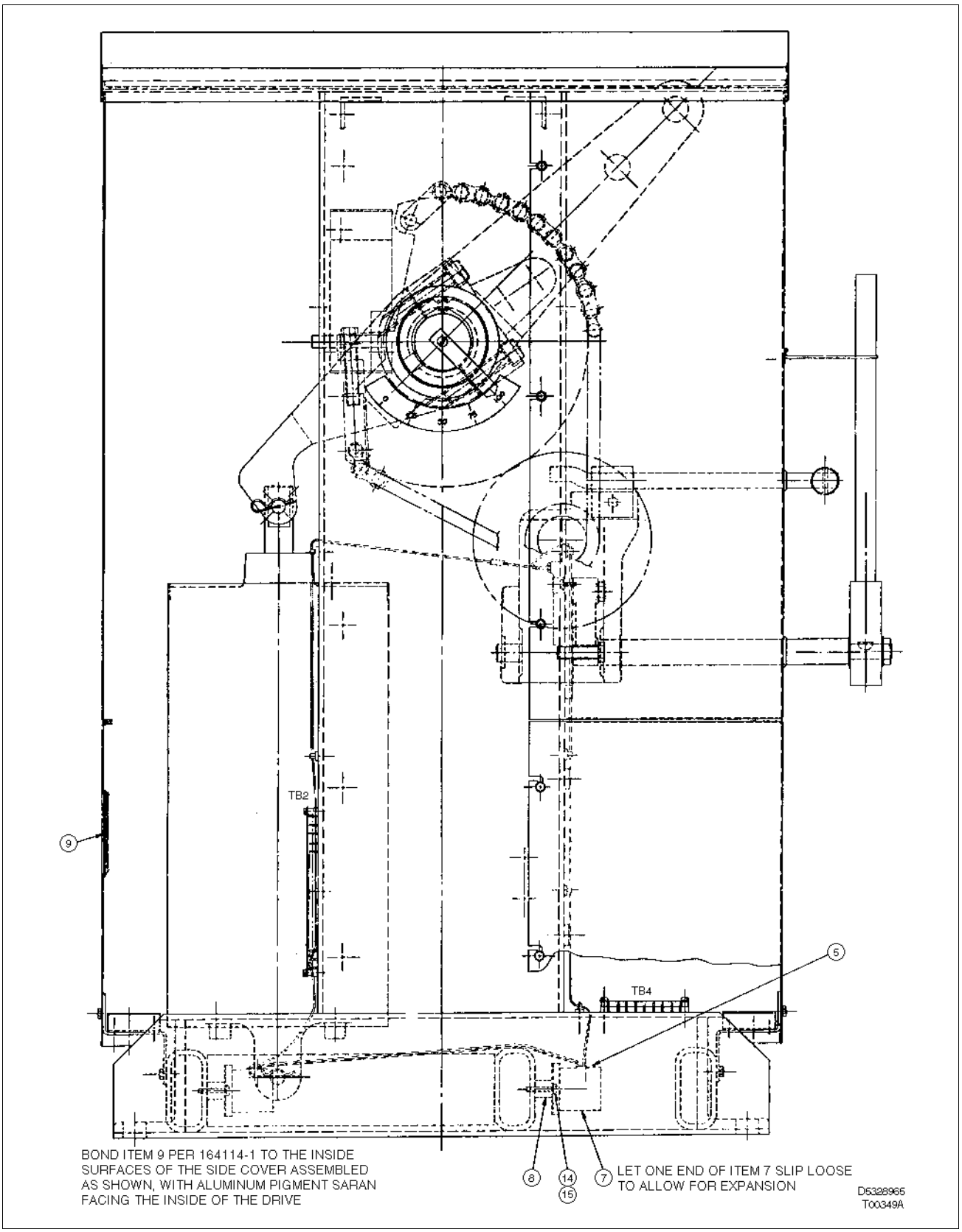


Figure A-27. UP5 and UP6 Actuators with Heater, Table A-44 (Sheet 2 of 2)

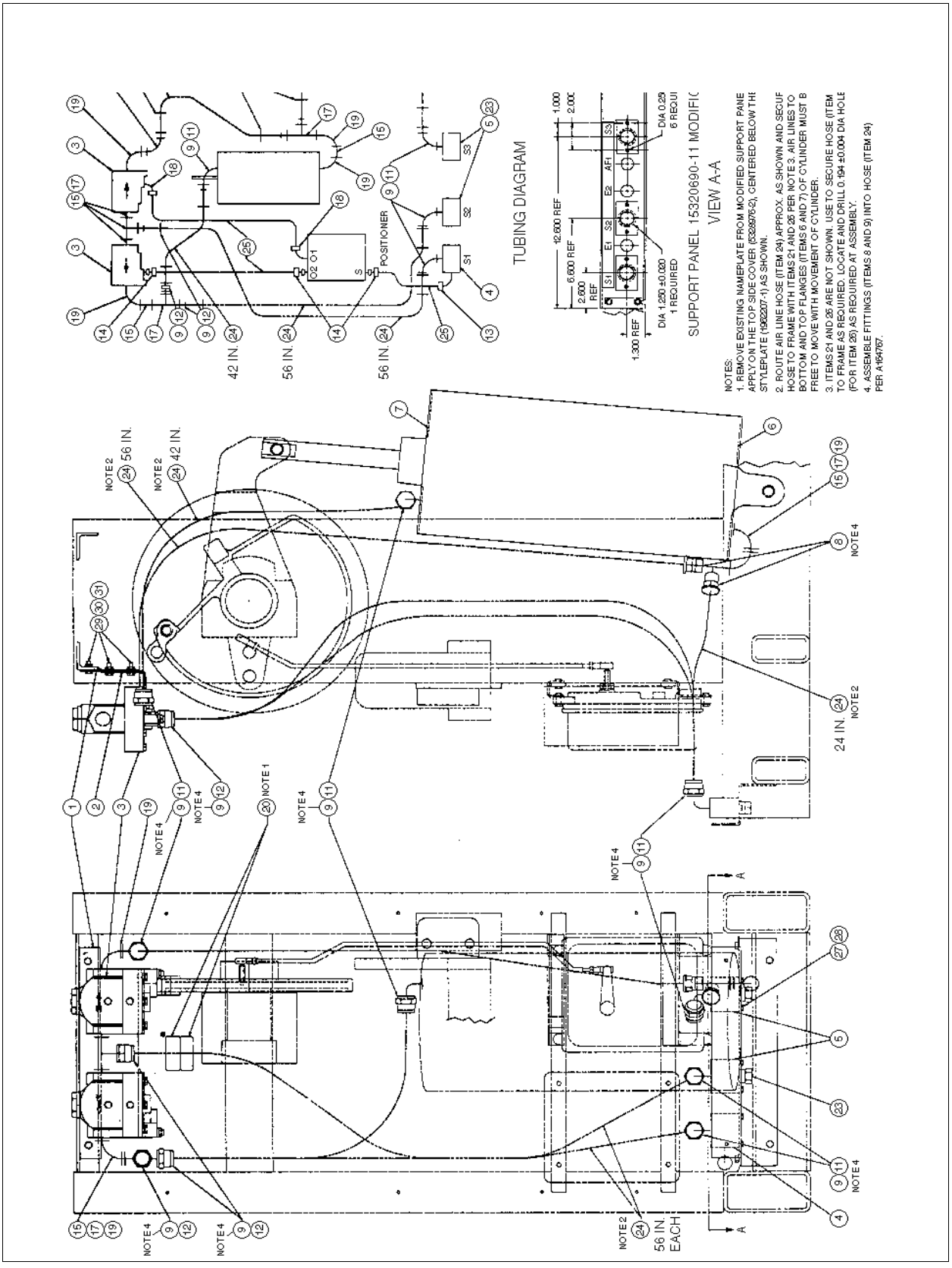


Figure A-28. UP6 Actuators with Volume Boosters, Table A-45

PARTS KITS FOR ALL Actuators

Alarm/Travel Switch Kits.

The UP alarm/switch travel design changed in April 2004. Repair of the pre-2004 switch is by replacement; use the replacement switch kit part number appropriate to the UP actuator size listed in the following table.

If adding a new limit switch to a UP actuator, use the Add-On switch kit part number appropriate for the actuator size listed in the following table. The Add-On switch kits include the linkage necessary to connect the UP lever to the switch.

Table A-46. Alarm/Travel Switch Kits for UP Actuators

UP Size	Replacement Switch Kit Part Number
UP1	5328745A3
UP2	5328932L3
UP3/4	5328787A2
UP5/6	5328962A3
UP Size	**Add-On Switch Kit Part Number**
UP1	5328745A2
UP2	5328932L4
UP3/4	5328787A1
UP5/6	5328962A1

APPENDIX B - DIMENSION DRAWINGS

DIMENSION DRAWINGS

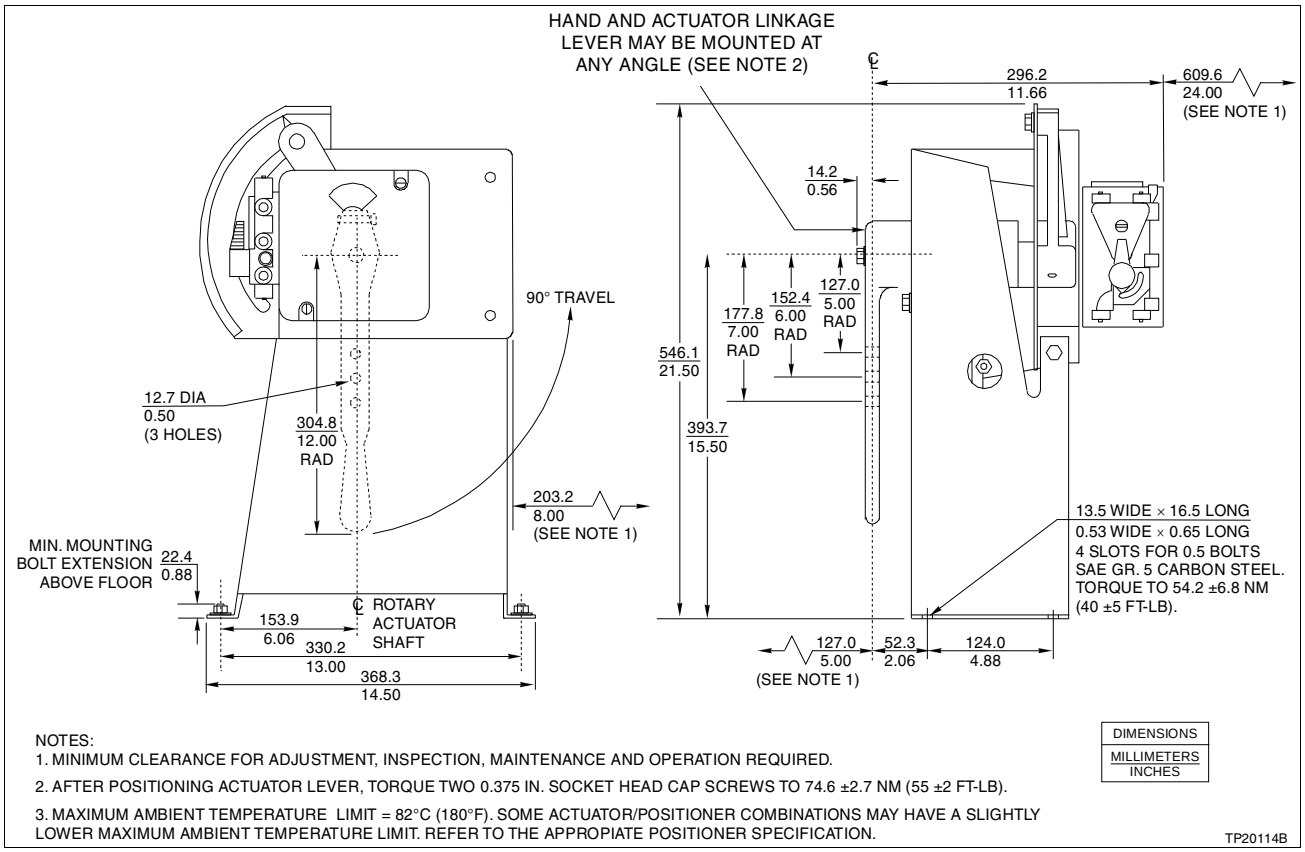
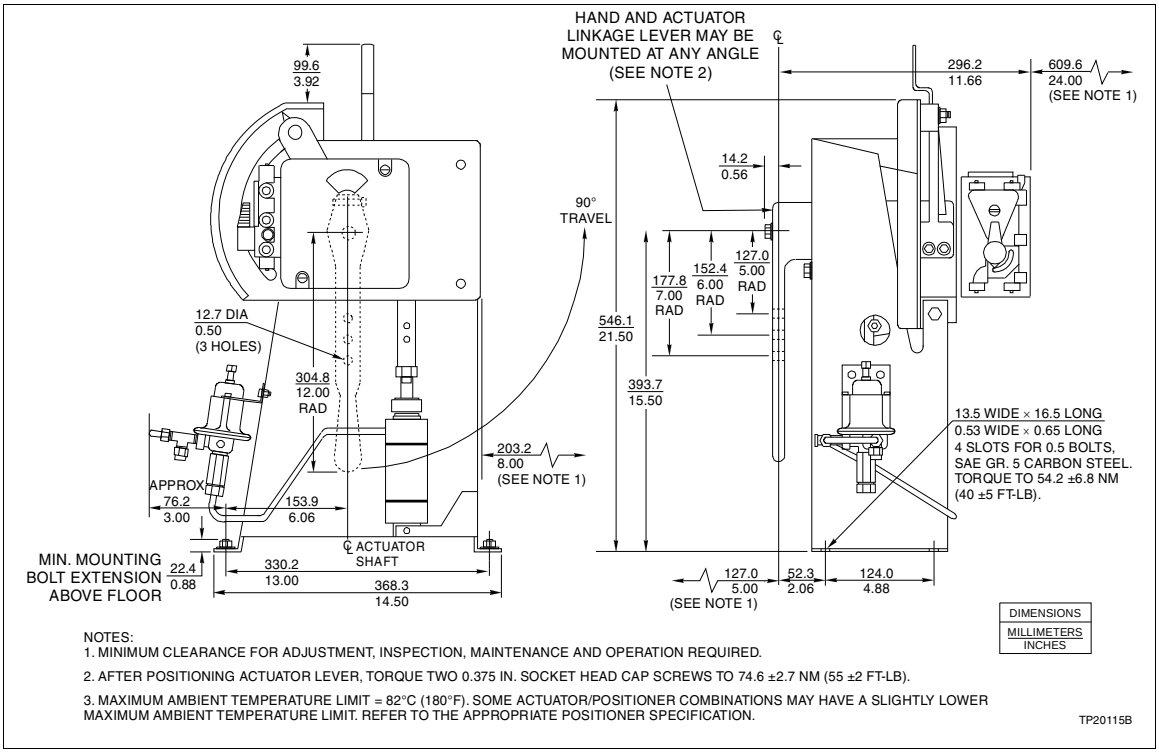


Figure B-1. Type UP1 Actuator with 'Positioner



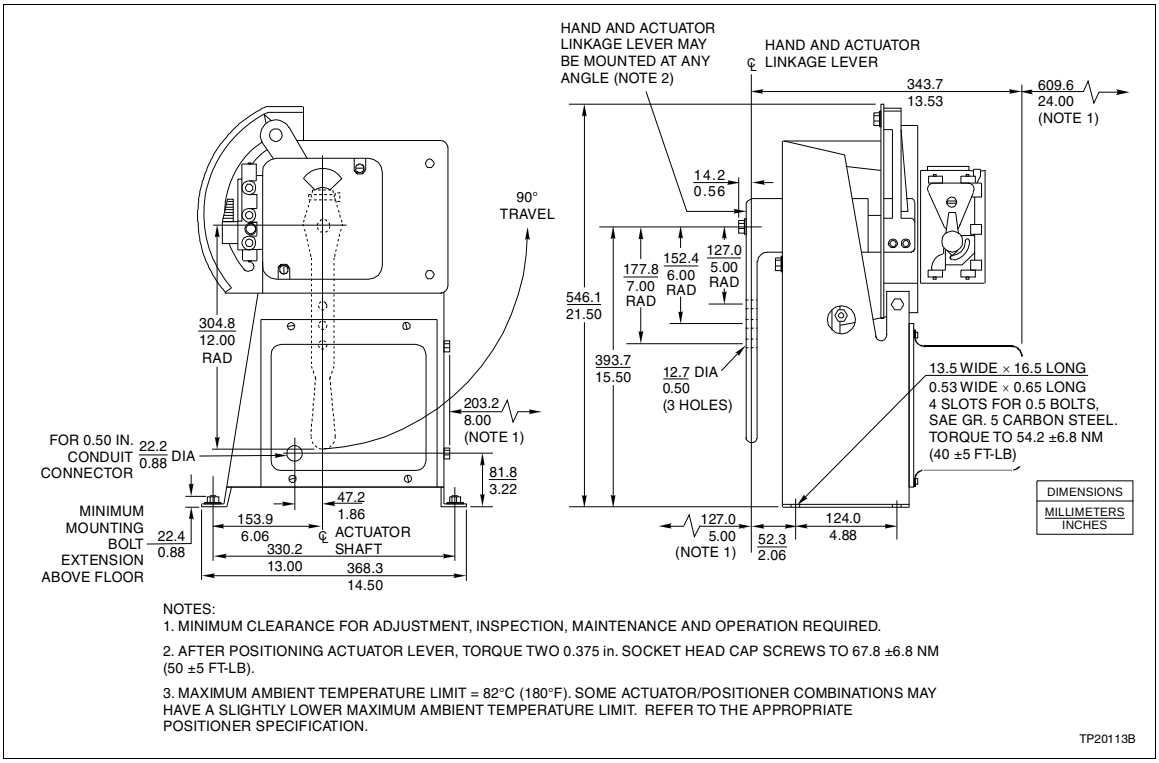
NOTES:
1. MINIMUM CLEARANCE FOR ADJUSTMENT, INSPECTION, MAINTENANCE AND OPERATION REQUIRED.

2. AFTER POSITIONING ACTUATOR LEVER, TORQUE TWO 0.375 IN. SOCKET HEAD CAP SCREWS TO 74.6 ±2.7 NM (55 ±2 FT-LB).

3. 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.

TP20115B

Figure B-2. Type UP1 Actuator with Positioner and Air Failure Lock



NOTES:
1. MINIMUM CLEARANCE FOR ADJUSTMENT, INSPECTION, MAINTENANCE AND OPERATION REQUIRED.

2. AFTER POSITIONING ACTUATOR LEVER, TORQUE TWO 0.375 in. SOCKET HEAD CAP SCREWS TO 67.8 ±6.8 NM (50 ±5 FT-LB).

3. 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.

TP20113B

Figure B-3. Type UP1 Actuator with Positioner and/or Alarm/Travel Switches

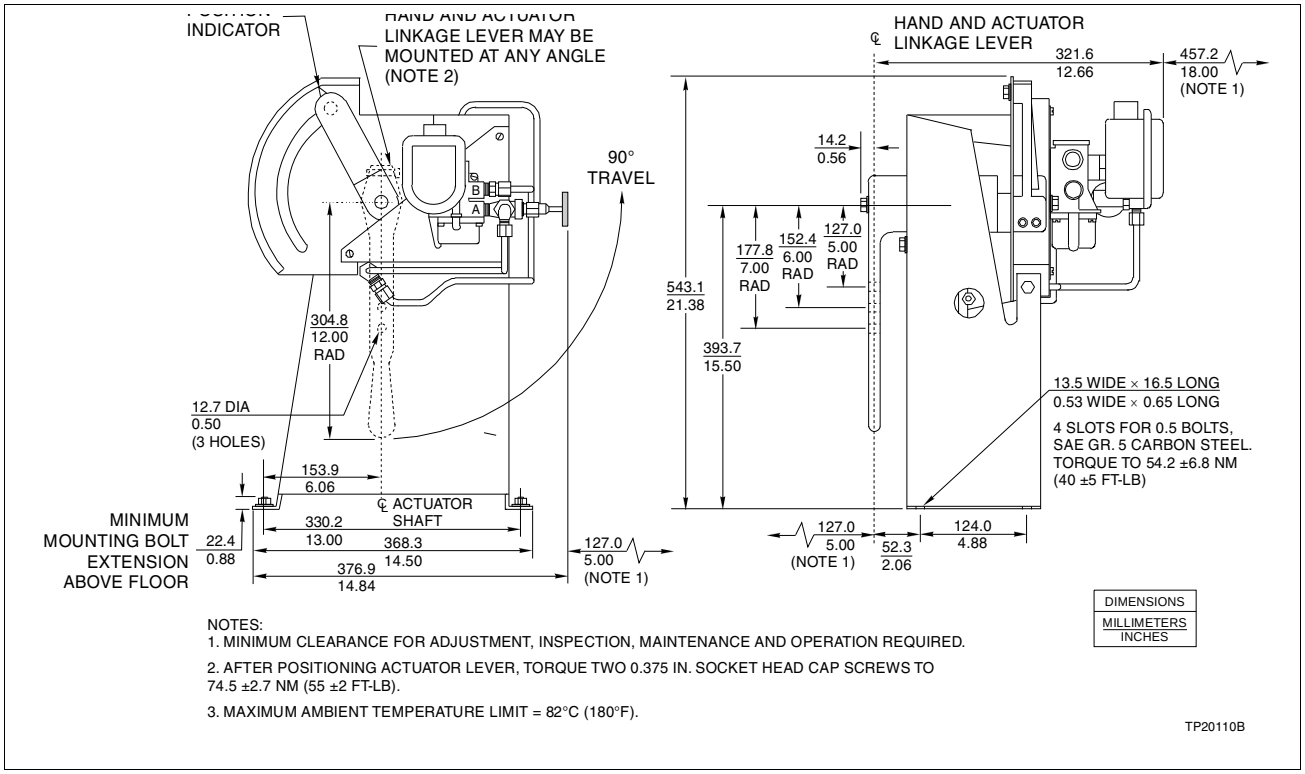


Figure B-4. Type UP1 Actuator with Solenoid Valve

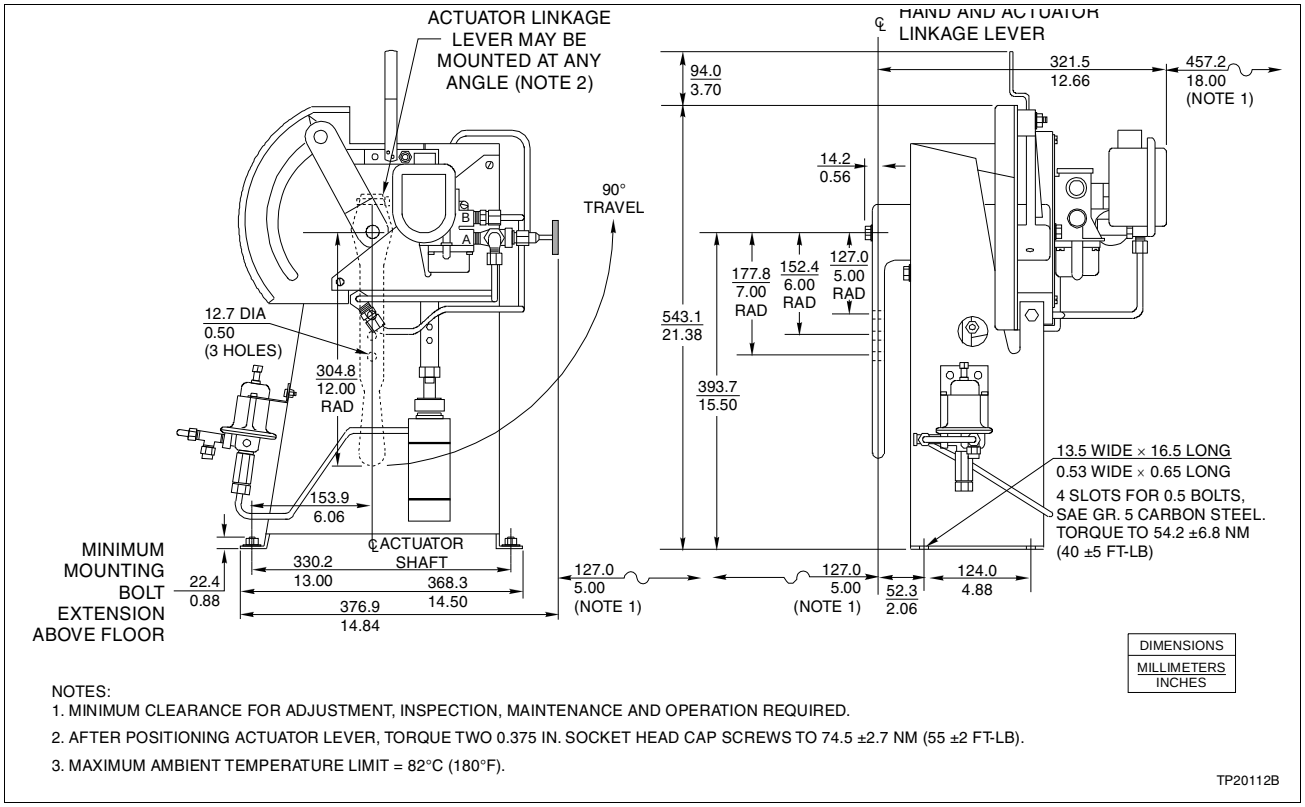


Figure B-5. Type UP1 Actuator with Solenoid Valve and Air Failure Lock

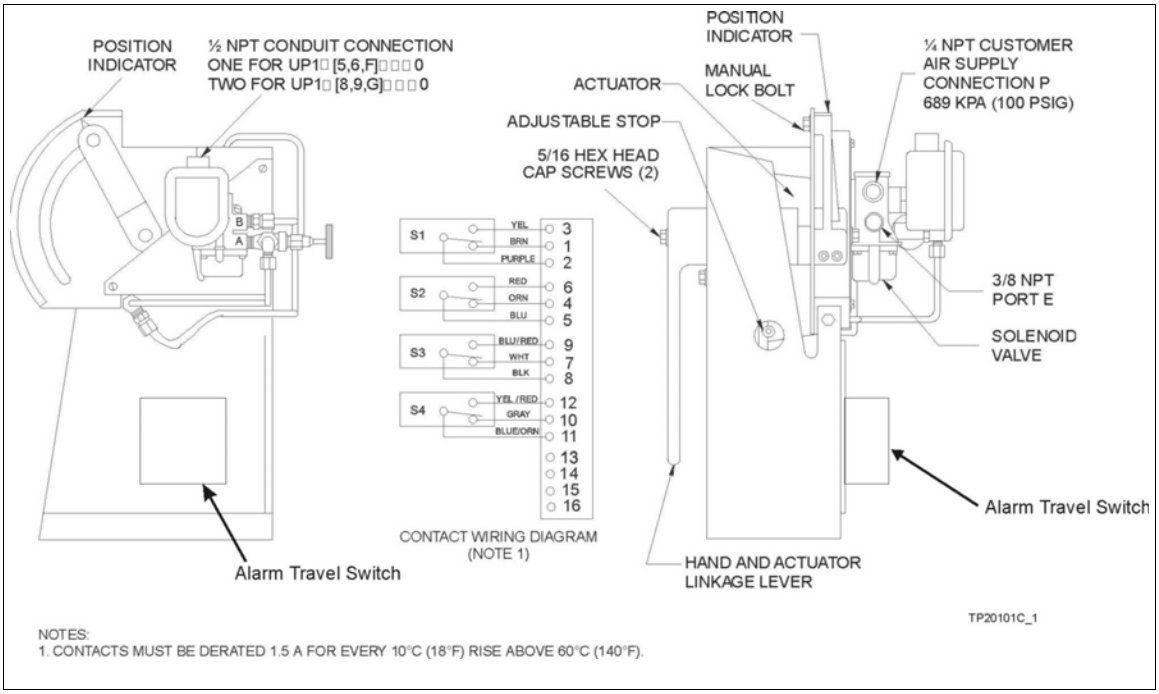


Figure B-6. Type UP1 Actuator with Solenoid Valve and/or Alarm/Travel Switches

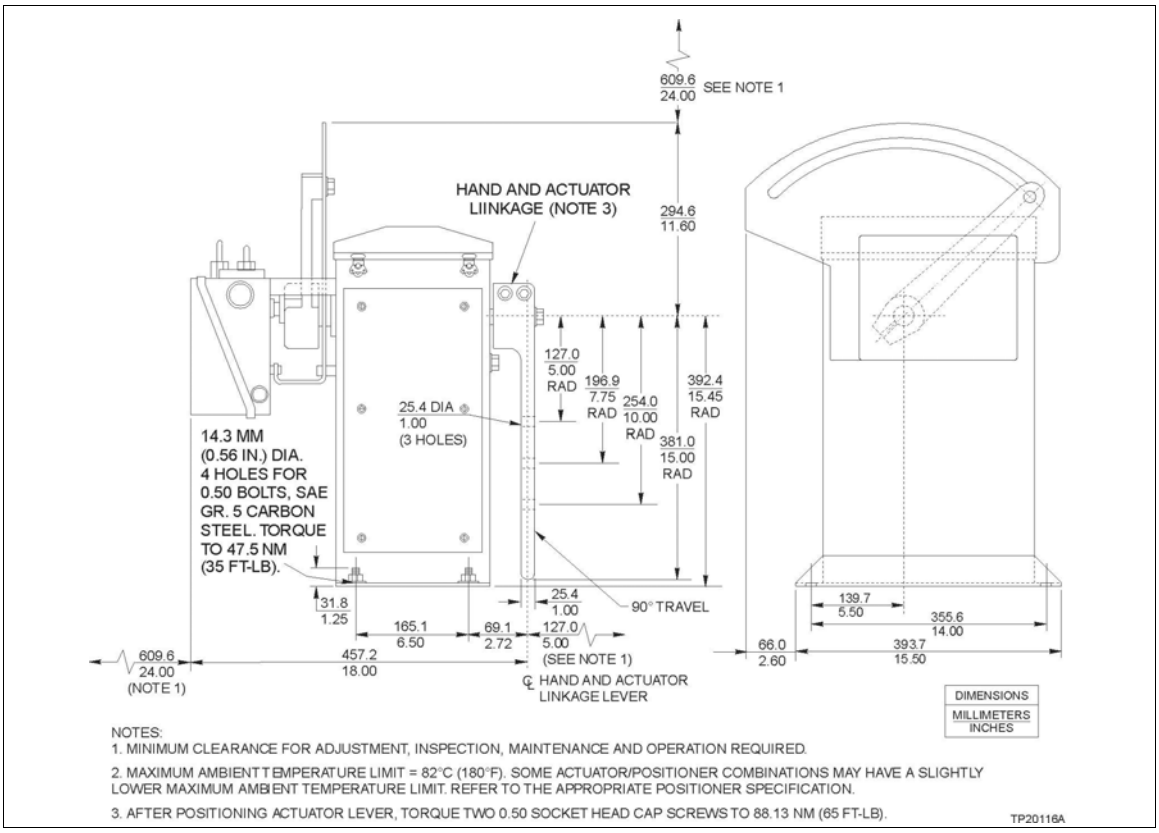
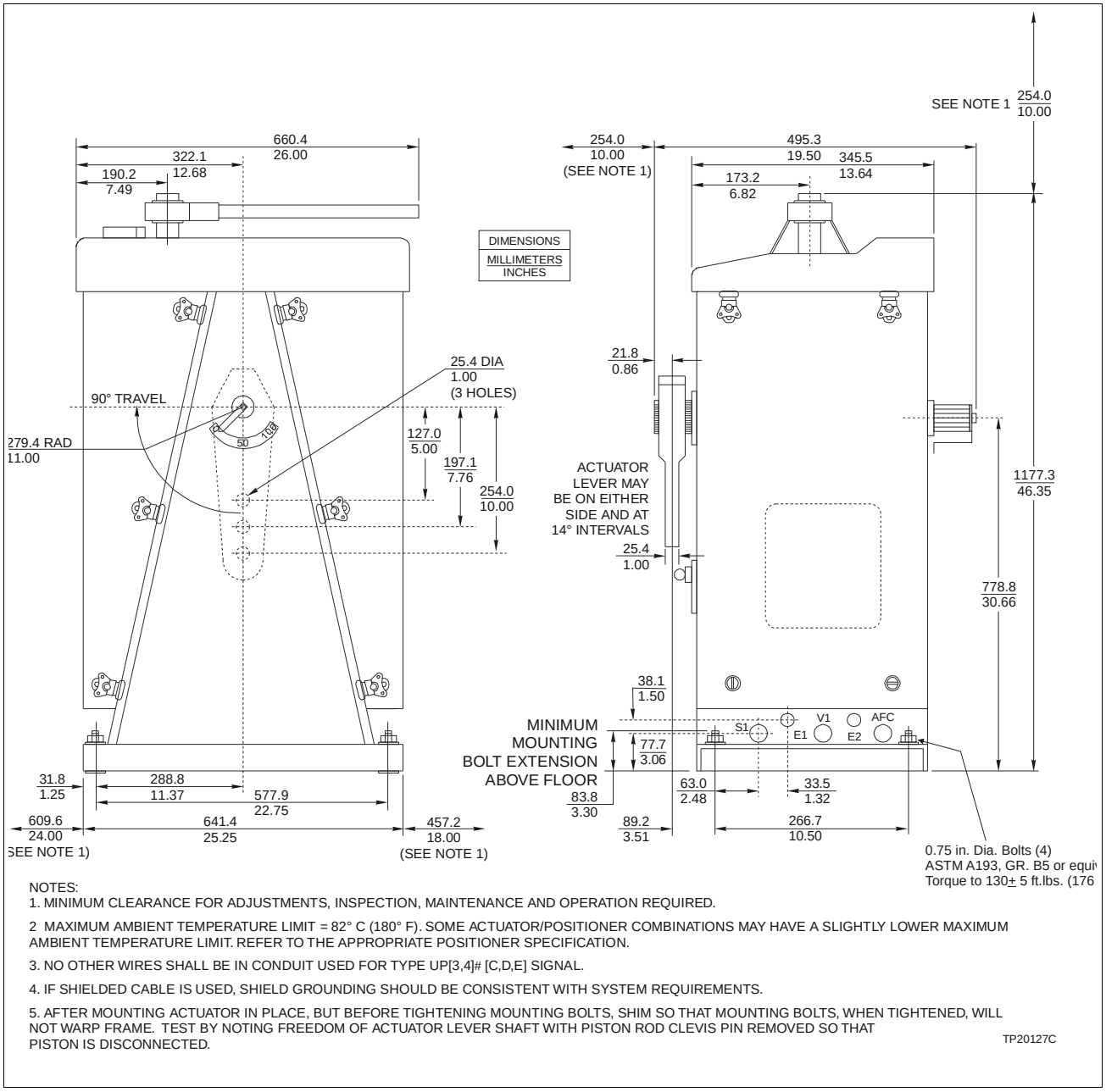


Figure B-7. Type UP2 Actuator with Type AV Positioner or Solenoid Valve



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.

TP20127C

Figure B-8. Types UP3 and UP4 Actuators (Page 1 of 2)

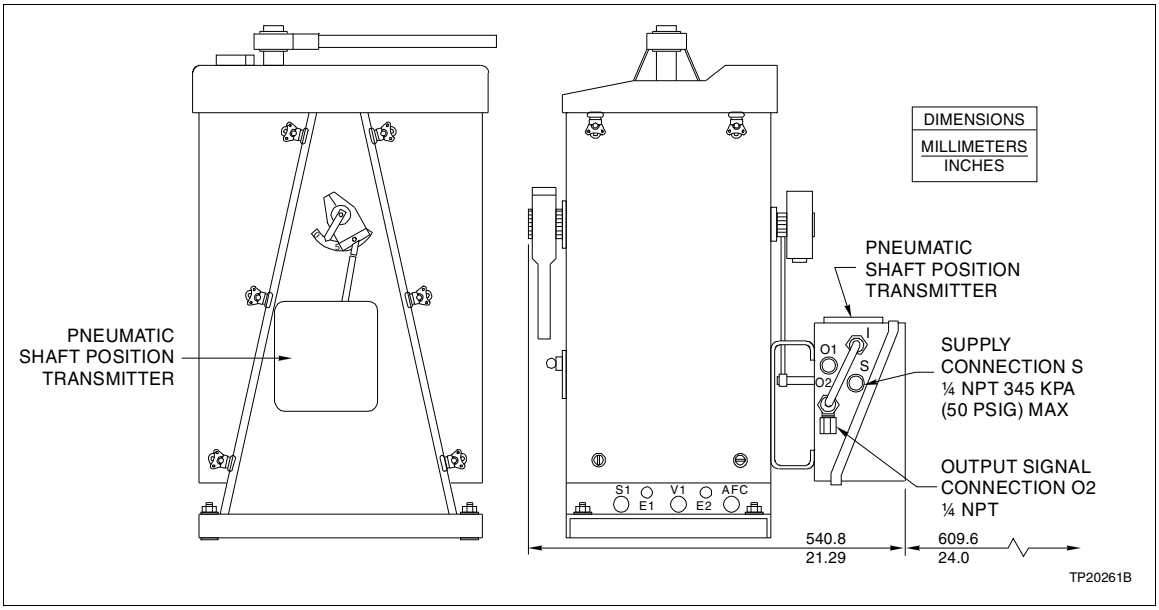


Figure B-9. Types UP3 and UP4 Actuators (Page 2 of 2)

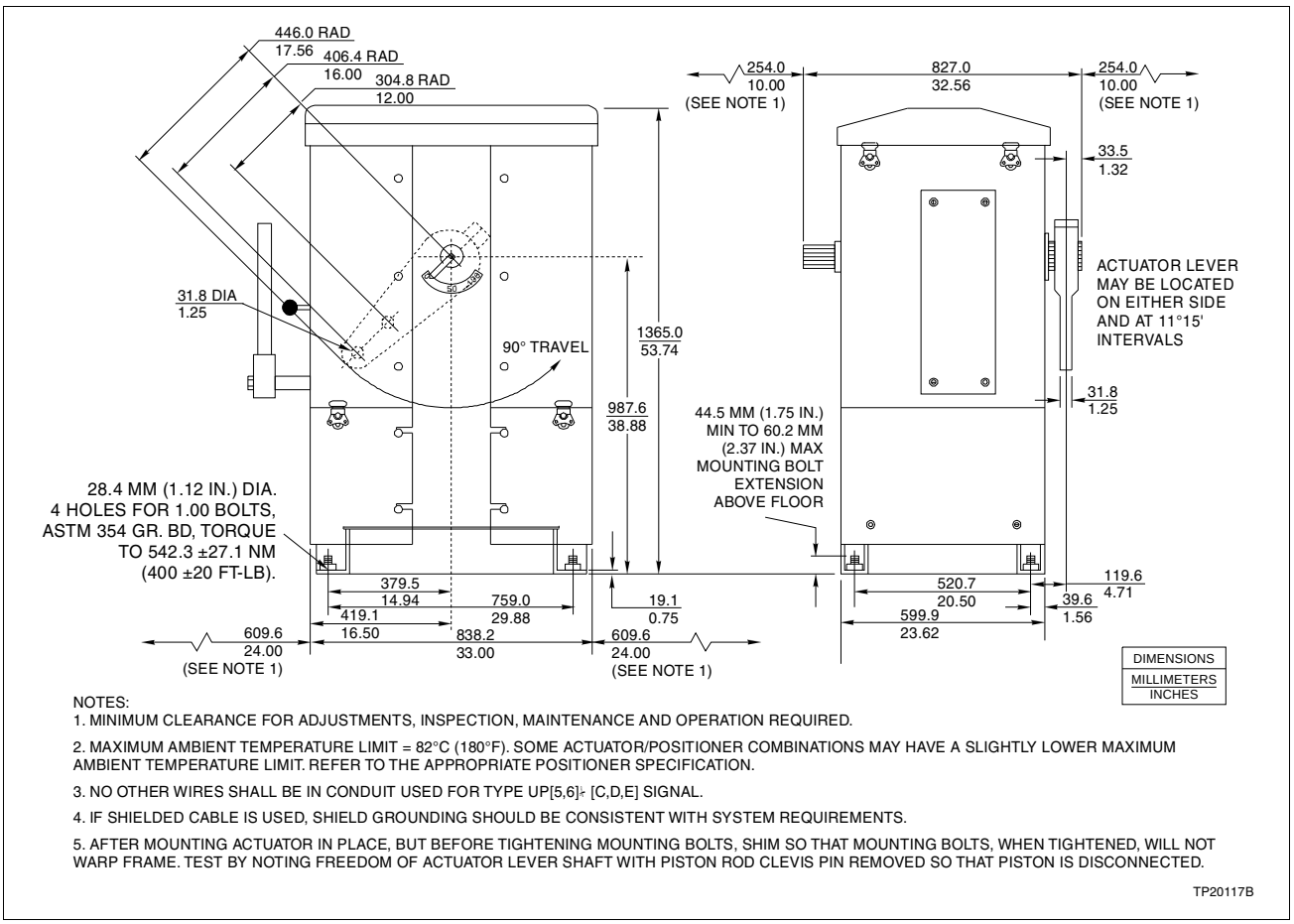


Figure B-10. Types UP5 and UP6 Actuators

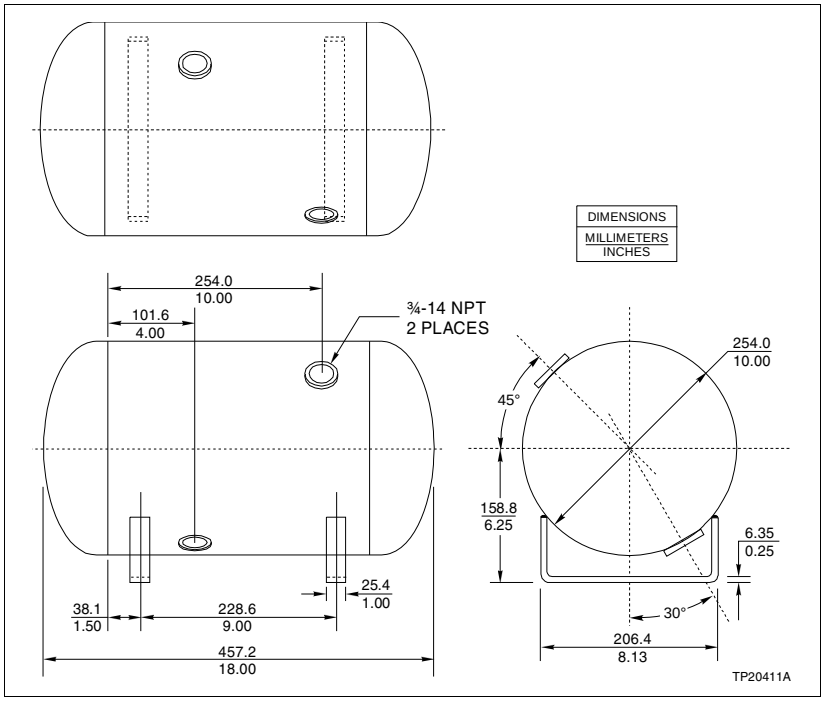


Figure B-11. 20.8 LIter (5.5 Gallon) Reserve Air Tank Option for Type UP2 Actuators

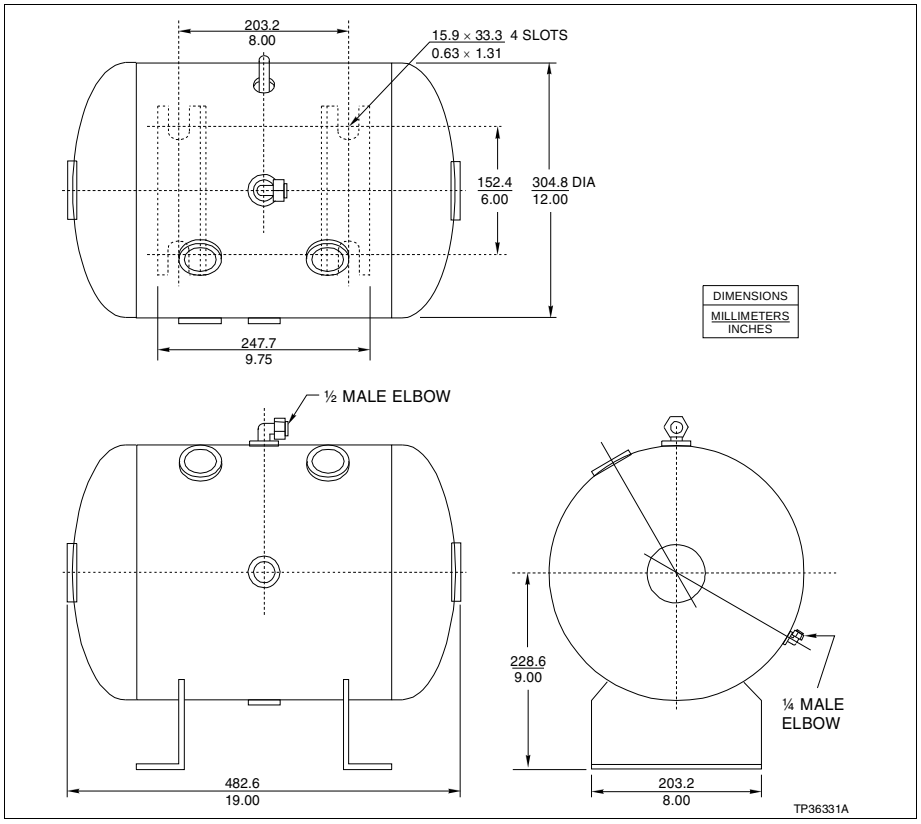


Figure B-12. 30.3 Liter (8.0 Gallon) Reserve Air Tank Option for Types UP3, UP4 and UP5 Actuators

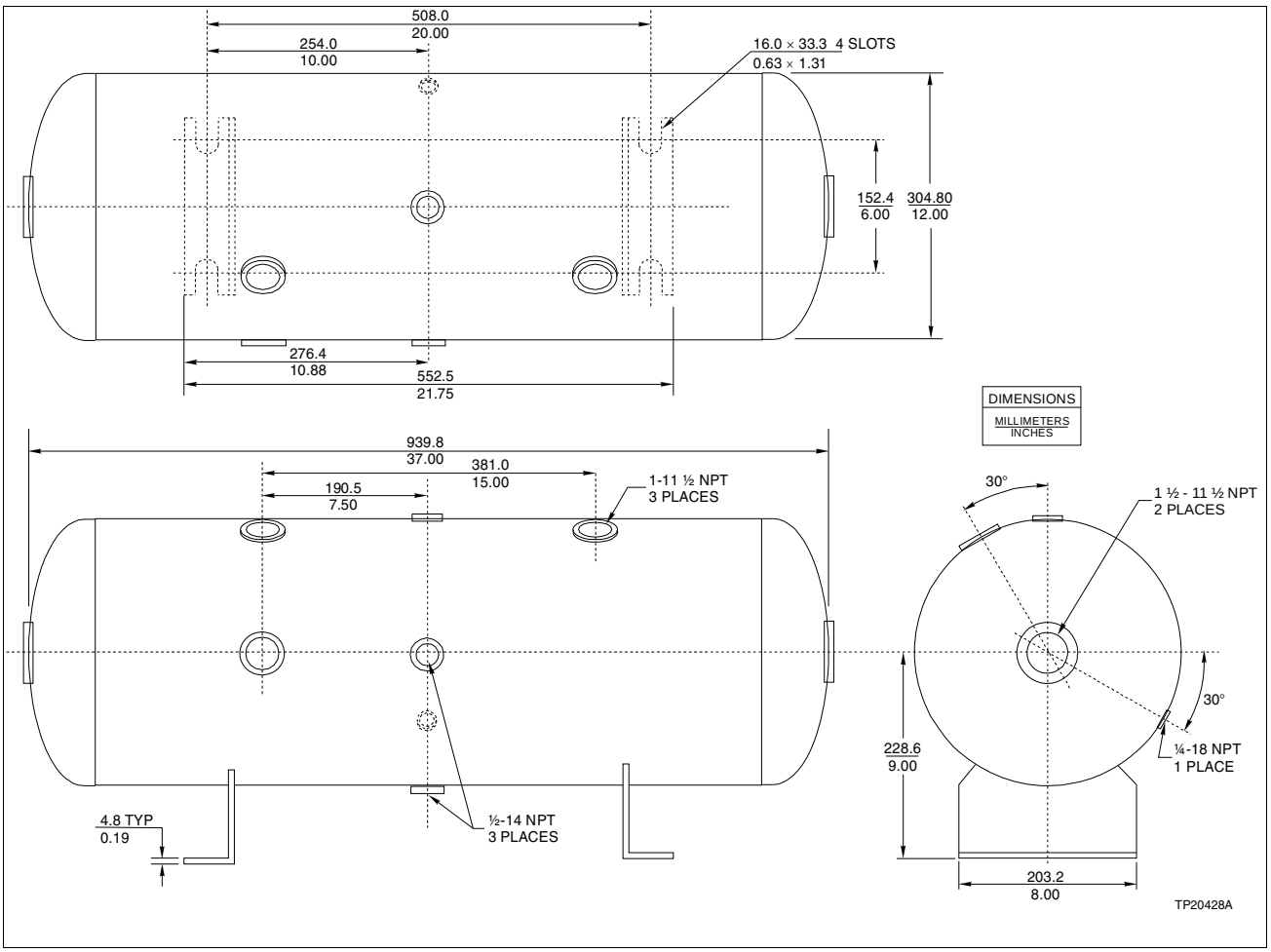


Figure B-13. 64.4 Liter (17.0 Gallon) Reserve Air Tank for Type UP6 Actuators

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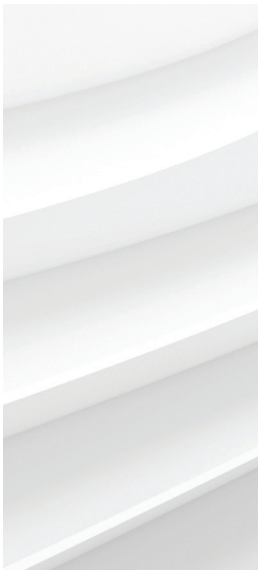

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