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**INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS**

**MODEL T2001 & T2003**

**SKOTCH<sup>®</sup> TRIFECTA<sup>®</sup> OIL VALVE SYSTEMS**

**WARNING**

**Valves and valve actuators supplied by ITT Engineered Valves, LLC are designed and manufactured using good workmanship and materials, and they meet the applicable industry standards. These valves are available with components of various materials, and they should be used only in services recommended herein or by a company valve engineer. Misapplication of the product may result in injuries or property damage. A selection of valve components of the proper material consistent with the particular performance requirement, is important for proper application.**

**Examples of the misapplication or misuse of a valve or valve actuator includes use in an application that exceeds the pressure/temperature rating, or failure to maintain the equipment as recommended.**

## Record of Revisions

Revision	Description	Date
-	First Issue	09/10/99
A	Revised IV.A.4, IV.C.4, format and text.	08/31/18

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## DRAWINGS

03-005	Valve Assembly - Model T2000 Systems
03-017	Valve Assembly - Model T2001, T2003
57-007	Dimensions - Model T2001, T2003
60-001	Wiring Diagram - Model T2001
60-005	Wiring Diagram - Model T2003

## **I. DESCRIPTION**

The Model T2001 and T2003 Oil Valves are an integral valve system with all components housed within a single valve body. It is typically used on all oil-fired burners and igniters where steam or air atomization is required. The Skotch Trifecta's unique two-stem three-seat design enables it to perform all key functions, including fuel sequencing and purging of downstream piping by providing three distinct valve positions.

1. Closed - Both oil and purge media off
2. Fire - Oil flowing while purge is off
3. Purge - Purge media flowing while oil flow is off

The Model T2001 utilizes an electro-hydraulic actuator and requires electric power to open, purge and close. The system fails in the last position upon loss of electrical power.

The Model T2003 valve system, which is Fail Closed model, utilizes an electro-hydraulic actuator and requires electric power to open and purge. The system goes to the 'Closed' position on loss of electric power.

A single Skotch oil valve is typically installed in place of a multiple valve arrangement.

Consult order specification for detailed specifications of equipment supplied on each project.

## **II. OPERATION**

Refer to Purchase Order Specification or solenoid valve assembly nameplate to determine proper line voltage. Operation is in accordance with reference drawings.

Check specific order options and wiring diagrams (60-001 for Fail-in-Last or 60-005 for Fail-Closed) for electrical terminals inside the main terminal board and in auxiliary switch box assembly.

### **A. *Closed: Oil Flow Off and Purge Media Flow Off***

In this position the main valve plug is held against the main or upper seat by the actuator return spring, blocking flow of the purge media. The oil valve plug is held in the oil seat by the oil valve return spring, blocking oil flow. The oil valve proof of closure (POC) switch is made. The valve closed limit switch is actuated and the valve open limit switch is deactuated.

Model T2001: Applying line voltage to terminal points 2 and 3 moves the system to the closed position.

Model T2003: Delete line voltage from all terminal points (1, 2, 3, and 7) to moves the system to the closed position.

### **B. *Fire: Oil Flowing and Purge Off***

Commanding the actuator to the Fire position causes the main stem to move downward towards the oil stem. As the main stem contacts the oil stem, it forces the oil plug out of its seat ring initiating oil flow while simultaneously seating in the purge seat. Prior to any oil flowing the oil valve POC switch changes contact states. The valve open and close limit switches change states from the valve closed position (Valve open actuated & valve closed deactuated).

Model T2001: Applying line voltage across terminal points 1 and 3 moves the system to the fire position.

Model T2003: Applying line voltage across terminal points 1, 2, and 3 moves the system to the fire position.

***C. Purge: Purge Media Flowing and Oil Off***

Commanding the Actuator to the Purge position moves the main stem to the purge position. In this position the main plug is positioned between, but not in contact with the upper and purge seats. Accordingly, the main stem is not in contact with the oil plug, therefore the oil valve remains in the closed position. The purge media flows from the purge inlet to the oil outlet, purging or clearing any oil which, remains in the downstream oil piping. There is no oil flow in the purge position and the oil valve POC switch is made. Both the valve open and valve closed limit switches are deactuated.

Model T2001: Applying line voltage across terminal points 3 and 7 moves the system to the purge position.

Model T2003: Applying line voltage across terminal points 1 and 7 moves the system to the purge position.

***D. Notes***

Some installations may require tip warm up prior to light-off. This can be accomplished by commanding the valve to "Purge" for a period before commanding to "Fire". Purge steam then passes down the fuel line, warming up the tip in preparation for ignition.

### III. INSTALLATION

#### **WARNING**

*Prior to installation and/or start-up, inlet piping should be verified as being free of dirt, grit, welding slag, or other particulate contamination. Failure to do so may result in damage to valve internals.*

#### **A. Unpacking**

Do not remove protective plugs from valve and solenoid until ready to install.

If plastic protective caps are missing, verify no debris or foreign objects are inside valve.

Transporting - Use proper hoisting procedures to avoid damage to valve. Do not lift by conduit, switches, etc.

#### **B. Valve Installation**

The oil valve installation should be in accordance with standard practices for end connection selected. Valves with weld end connections are supplied with end connections of sufficient length to prevent thermal damage to valve internals. As a safety precaution, methods to thermally block the transfer of heat to the valve body should be employed during welding. ***The end connections should not be modified to a shorter length.*** The weight of the valve must be properly supported to prevent excessive piping stresses. The valve must be installed vertically with the actuator upright. ***Adequate clearance should be provided for valve maintenance and repair.***

#### **CAUTION**

**Valve must be installed in proper flow direction, per valve flow tag. Improper installation will result in fuel contamination of purge piping, and improper valve operation.**

***CAUTION***

**Ensure piping upstream of fuel inlet DOES NOT include a check valve since this will cause hydraulic locking of the oil valve in the closed position.**

***CAUTION***

**The valve must be installed with the actuator in the vertical upright position *ONLY*.**

***C. Electrical Hook Up***

Electrical power is required to operate the oil valve system. Wiring should be in accordance with referenced drawings and all applicable codes. All wiring connections are on the main terminal board located inside the terminal board compartment, to limit switches inside the limit switch compartment and to the oil valve POC switch.

***Warning***

**Make certain electrical supply is isolated and tagged out before proceeding with electrical connections.**



***D. Start-Up***

When valve is placed in service, stroke the main stem and oil stem two or three times (Fire cycles) and then check for packing leaks. If leakage is present, tighten adjusting nut 1/8 turn, stroke valve several times to ensure proper setting of packing and recheck. Repeat until leakage is stopped. This should occur before nut is completely tight. If leakage is present when nut is completely tight, packing must be replaced and the stem inspected for wear. Refer to instructions in Section V.

***CAUTION***

**DO NOT OVER-TIGHTEN PACKING. Over-tightened packing may cause excessive stem friction, inhibiting stem movement.**

**IV. MAINTENANCE AND DISASSEMBLY INSTRUCTIONS**

***A. Maintenance***

The Scotch Trifecta Valve Systems requires periodic maintenance and adjustments in order to function properly. The following is a list of items which, must be inspected on a regular basis.

**1. Testing Oil Valve Seal**

Periodic leak testing should be performed per all applicable codes to verify proper operation of oil valve seal. See Section V for leak testing procedures.

**2. POC Verification**

Periodic testing should be performed per all applicable codes to verify proper operation of the oil valve POC switch. See Section VI for POC switch setting procedures.

**3. Packing Inspection**

Both the oil valve and the main packing should be inspected regularly for leakage. If any leakage is noted the packing should be adjusted until the leakage has stopped. See Section III.D for instructions.

**4. Actuator Maintenance and Adjustment.**

The electrohydraulic actuators supplied with the T2001 & T2003 systems require very little preventative maintenance. The reference actuator assembly drawing identifies and shows location of those parts that may require corrective maintenance over the service life of the system and are field repairable. The actuator cannot be disassembled in the field due to internal spring preload.

***NOTICE***

**Do not remove actuator nameplate to access actuator internals.  
There are no field replaceable parts below the nameplate.**

To repair or replace field serviceable items other than Auxiliary Limit Switches, refer to ASCO General Controls Bulletin contained in the reference information at the end of this publication.

To repair, replace or adjust Auxiliary Limit Switches, refer to ASCO General Controls Bulletin contained in the reference section and the following. Switches LS-6 and LS-5 are factory set and should not require adjustment during normal operation. If it becomes necessary to adjust these switches, the following procedure should be used:

- a) Ensure the actuator is in the fully closed position.
- b) Adjust the cam on LS-6 so that the normally open contacts of the switch are made when the valve is closed. Adjust the cam so the normally open contacts break when it is rotated 40° to 45°.

- c) Set the cam on LS-5 such that the Switch Arm just falls off the cam when rotated counterclockwise two teeth further than switch LS-6.
- d) Verify proper switch setting by verifying no oil stem movement when the system is stroked to the purge position. If the oil stem moves, rotate the cam for switch LS-6 counterclockwise two teeth. Switch LS-5 should also be rotated counterclockwise two teeth.
- e) Repeat test per (d) above. Switch setting is satisfactory when no oil stem movement occurs when the valve is stroked to the purge position.

**WARNING**

**If LS-5 normally open contacts change state prior to the normally open contacts of LS-6, the actuators pump unit will run continuously, cycling between LS-6 normally open contacts make and break point. This will cause the pump unit to fail prematurely. Ensure the normally open contacts of LS-6 break before the normally open contacts of LS-5.**

**5. Body to End Flange Joint Inspection**

Body end flange joints should be inspected regularly for leakage. Any leakage should be repaired immediately. See following Section for instructions.

**CAUTION**

**Failure to repair steam side end flange joint on steam purge systems may result in steam cutting of valve body, end flange assembly or both. This may result in serious damage to the valve.**

***B. Disassembly***

All T2000 series Skotch Trifecta Valve Systems may be disassembled without removal from piping. It is recommended the work area be as clean as possible. Ensure all manual isolation valves are closed and tagged out and all electrical circuits are de-energized. BE SAFE!

The following instructions describe how to fully disassemble the valve system. Individual corrective tasks may not require complete disassembly. The user should judge what steps are appropriate for each task.

Special tools are needed to remove the valve seats. The following tools are available:

ITT P/N: 44425, T1000/T2000 oil seat ring tool. This tool will remove all three seats (main, purge and oil) from the oil valve body and is needed when servicing the purge side of the valve.

**NOTE:** Customers that do not feel comfortable with rebuilding and testing Skotch valves can have them rebuilt by the factory. Call the number located on the front cover or (800) 366-1111 and ask to speak to Skotch, Customer Service for quotation and instructions.

**1. Actuator Removal**

Note: Electrical power is required for actuator removal.

***CAUTION***

**Valve system MUST be stroked to purge position prior to decoupling stem connector for actuator removal. Failure to do so may result in damage to upper seat ring and/or main stem subassembly.**

Reference Drawing 03-017. Commence actuator removal by stroking the system to the purge position in accordance with Section II.B. Loosen screw on actuator's wrench arm and carefully slide up. Ensure the Switch Cam driven by the Wrench Arm does not move. Loosen setscrew on Union Nut (Item 5). Unscrew Union Nut. Close (retract) the actuator. Unscrew Yoke Lock Nut (Item 4). Carefully lift Actuator off of the valve

making sure not to hit the valve stem. Loosen Stem Nut SetScrew and unscrew Stem Nut (Item 7) from valve stem. Remove Union Nut (Item 5).

**2. Main/Purge Valve Disassembly**

After completing Paragraph IV.B.1, unscrew Socket Head Cap Screws (Item 6) which retain End Flange (Item 2) to Body (Item 1). Remove End Flange and Body Gasket (Item 7). Be sure to thoroughly clean mating gasket surface, but do not damage it. Insert Seat Ring Wrench (P/N: 44425) into lugs on Upper Seat Ring (Item 9). Unscrew and remove Seat Ring (Item 9), Seat Ring Gasket (Item 21), and Main Stem (Item 8). Insert other end of wrench into holes in Purge Seat Ring (Item 10) and remove.

**3. Oil Valve Disassembly**

Remove Hex Nuts (Item 29) holding Limit Switch Box (Item 13) to End Flange (Item 39). Note: These two nuts must be removed uniformly. Remove Limit Switch Box (Item 13) and Oil Valve Return Spring (Item 19). Loosen Set Screw (Item 18) and unscrew Spring Seat (Item 17) from Oil Stem (Item 12). Remove the Socket Head Cap Screws (Item 6) securing End Flange (Item 39) to Body (Item 1), then remove End Flange (Item 39), Oil Stem (Item 12) and Body Gasket (Item 7). Insert Seat Ring Wrench in lugs of Oil Seat Ring (Item 11), and remove Oil Seat Ring and Seat Ring Gasket (Item 21).

***CAUTION***

**To properly unload the Oil Valve Return Spring, make certain the nuts (Item 29) unthread from the studs. A hex wrench can be used to keep the studs from rotating.**

**4. Packing Removal**

After removing end flanges in Paragraphs IV.B.2 and IV.B.3 above, unscrew Packing Nut (Item 3) and remove Packing (Item 4) and Packing Spring (Item 5).

**5. Inspection**

After disassembly, inspect all sealing and bearing surfaces on valve and actuator parts for physical damage including nicks, scratches or corrosion. Be sure all gasket surfaces are thoroughly cleaned and free of old gasket material. Replace packing. Inspect main, oil and purge seat ring and the oil and main stem/plugs. If any visual damage is apparent, replace part. Check electro-hydraulic actuator for hydraulic fluid leakage. Any component found to be faulty should be repaired or replace.

**C. Reassembly**

**1. Packing/End Flange Reassembly**

Place Packing Spring (Item 5) in stuffing box. Lubricate each individual packing component (Item 4) with KRYTOX<sup>®</sup> lubricant from DuPont. Individually install the components into the End Flange. The assembly order is male ring first, then chevrons, then female ring. Screw packing nut (Item 3) into end flange (Item 2 or 39) and snug up by hand. Do not tighten at this time. Take special precaution not to damage the packing when sliding over the stem threads. Some means of protecting the packing from damage during installation should be employed.

**WARNING**

**Assure packing is installed in the correct orientation. See Drawing 03-005 for proper orientation. Failure to do so will cause the valve to leak severely from packing gland.**

## 2. Oil Valve Reassembly

Lubricate the Oil Seat Ring (Item 11) soft seal sealing surface located on the inside diameter with Magnalube<sup>®</sup>-G from the Carleton-Stuart Corporation. Clean the body oil seat threads and gasket area. Apply Grafoil<sup>®</sup> GTS<sup>®</sup> sealant to both the Body (Item 1) and Oil Valve Seat Ring threads (Item 11), place the Seat Ring Gasket (Item 21) on the Oil Valve Seat Ring (Item 11) and thread into Body (Item 1). Torque to 130 Ft-Lbs (176.3 Nm). Lubricate the oil stem plug with Magnalube<sup>®</sup>-G and the shaft with antiseize lubricant. Carefully slide the oil stem (Item 12) into the End Flange (Item 39), making sure not to damage the Packing (Item 4). Slide the Body Gasket (Item 7) over the End Flange subassembly (Item 39). Lubricate the 4 end flange Screws (Item 6) with antiseize compound and fasten the End Flange assembly (Item 39) onto the Valve Body (Item 1), ensuring the limit switch box Studs (Item 14) are properly oriented (In line with piping). Torque the end flange Screws (Item 6) in two uniform increments. Torque screws initially in a crisscross pattern to 40 Ft-Lbs (54.2 Nm), repeat using 65-70 Ft-Lbs (88.1 - 94.9 Nm) and recheck. Push the Oil Stem (Item 12) up into the Valve Body (Item 1) until it seats in the Oil Valve Seat Ring (Item 11). This may require that the Oil Stem (Item 12) be lightly struck with a mallet until it is fully seated. Screw Spring Seat (Item 17) onto the Valve Stem (Item 12). Hold the Limit Switch Box (Item 13) in place, while adjusting the spring seat position to 2.05" (52.1 mm). This is measured from the inside surface of the Switch Box (Item 13) on which the spring rest to the spring seating surface on the Spring Seat (Item 17). Tighten the Set Screw (Item 18) so the spring seat is secure. Remove the Limit Switch Box (Item 13). Place Oil Valve Return Spring (Item 19) into the Spring Seat (Item 17) and mount the Limit Switch Box (Item 13) using the 2 mounting Nuts (Item 29) with Lock Washers (Item 28). Tighten these fasteners in a uniform manner, so the box is not cocked during assembly. Item 29 should be torqued to approximately 150 In-Lbs (14.1 Nm). Mount the Oil Valve POC Switch (Item 20) to the Limit Switch Box (Item 13) using Washer (Item 23), Lock Washer (Item 24) and Screw (Item 22). Verify the Spring Seat (Item 17) dimension is set correctly. The Oil Valve POC Switch must be set per section VI.

### 3. Main/Purge Valve Reassembly

Clean the thread/surface area in the Body (Item 1) of both the Purge Seat (Item 10) and Seat Ring (Item 9). Apply Grafoil® GTS® sealant to both the Purge Seat (Item 10) and Body (Item 1) threads, and screw into the Valve Body (Item 1). Torque to 100 Ft-Lbs (135.6 Nm). Insert the Main Stem (Item 8) into the Valve Body (Item 1). Place the Seat Ring Gasket (Item 21) over the Seat Ring (Item 9), apply Grafoil® GTS® sealant to both the Seat Ring (Item 9) threads and body threads and screw into Valve Body (Item 1). Torque to 130 Ft-Lbs (176.3 Nm). Place Body Gasket (Item 7) on End Flange (Item 2). Carefully slide End Flange (Item 2) and Body Gasket (Item 7) over the Main Stem (Item 8) making sure not to damage the Packing (Item 4). Lubricate the 4 end flange Screws (Item 6) with antiseize compound and fasten the End Flange assembly (Item 2) onto the Valve Body (Item 1). Torque the end flange Screws (Item 6) in two uniform increments. Torque screws initially in a crisscross pattern to 40 Ft-Lbs (54.2 Nm), repeat using 65-70 Ft-Lbs (88.1 - 94.9 Nm) and recheck. Screw the stem connector onto the Main Stem (Item 8) and tighten set screws.

### 4. Actuator Reinstallation

Place actuator onto the valve. Ensure main valve stem is in the fully closed position. Screw on Yoke Lock Nut, but do not securely fasten at this time. Align the ears of Stem Nut with Actuator Shaft.

#### a) For model T2001 (Fail-in-Last)

Energize actuator to “FIRE”, when the Actuator Shaft touches the Stem Nut. Engage the nut into the shaft, then de-energize the actuator. This will cause the actuator to stop moving. Thread the Union Nut on the Actuator Shaft and tighten. Energize actuator to “CLOSED”. Tighten the Yoke Lock Nut. Slide Wrench Arm over the Union Nut until it is fully seated and then tightened.

#### b) For model T2003 (Fail-Closed)

Open the Auxiliary Switch Box on the Actuator. Grasp the Shaft Arm and push so the limit switch cam moves to the actuator fully retracted position. Hold the Shaft Arm, set the cam for LS-6 so that the normally open contacts are made and will break upon initial Shaft Arm movement. Set the cam for LS-5 so the normally open contacts break after the normally open contacts of LS-6 break.



Energize the actuator to the “PURGE” position. When the Actuator Shaft touches the Stem Nut, engage the ears of the nut into the shaft, then move the Shaft Arm slightly so the normally open contacts of LS-6 break. This will cause the actuator to stop moving. Thread the Union Nut on the Actuator Shaft and Tighten. De-energize all circuits to actuator, closing the valve. Tighten the Yoke Lock Nut. Slide Wrench Arm over the Union Nut until it is fully seated and then tightened.

Reset Limit Switch LS-6 and LS-5 per Section IV.A.4. Adjust LS-1 through LS-4 if required. Replace the lens on the Actuator Yoke. The valve is now ready for testing.

**5. Test**

Conduct the following tests to assure system performance is satisfactory after rebuild.

a) Valve Stroke

Verify no oil stem movement occurs when the valve strokes from the Closed to Purge position. If the oil stem moves, reset LS-6 and LS-5 per Section IV.A.4. and retest. Continue until no movement occurs.

b) Oil Valve Proof of Closure

The oil valve Proof of Closure switch must be adjusted in accordance to Section VI.

**V. Leak Testing**

After assembly, the Scotch Trifecta Valve should be leak tested to verify proper operation as follows:

**A. Upper Seat Ring**

1. Place the valve in the Closed position.
2. The fuel inlet port must be plugged so that test media cannot escape for this port.
3. Pressurize the purge inlet to 50 PSIG (344.7 KPa) air while monitoring the

leakage rate from the fuel outlet. The leakage rate should not exceed ANSI Class IV limits or 1254 cc/min.

4. If leakage is excessive, stroke the valve 10 to 20 times to allow the metal seat to wear in with the metal plug and retest the valve. If valve leakage is still excessive, the main stem and seat should be replaced and the valve retested.

Note: If the actuator was removed anytime prior to testing, the actuator/valve coupling nut should be checked for proper installation. The main stem closure force is due to the return spring located inside the actuator. If the coupling nut is not adjusted correctly it is possible for the actuator to reach its home position without the main plug contacting the seat. If this occurs main seat leakage will take place regardless of the plug and seat condition. The main seat and plug should limit the actuator travel in the Closed position.

**B. Purge Seat**

1. Stroke the valve to the Fire position.
2. The fuel inlet should be plugged to keep the test media from escaping from this port.
3. Pressurize the purge inlet to 50 PSIG (344.7 KPa) air while monitoring the fuel outlet port for leakage. The allowable leakage rate per ANSI Class IV is 439 cc/min.
4. If leakage is excessive, stroke the valve 10 to 20 times to allow the metal seat to wear in with the metal plug and retest the valve. If valve leakage is still excessive, the main stem and purge seat should be replaced and the valve retested.

**C. Oil Seat**

1. The valve should be in fully closed position.
2. The purge inlet should be plugged.
3. Pressurize the fuel inlet port to 50 PSIG (344.7 KPa) air while measuring the leakage rate from the fuel outlet. The allowable leakage rate is one bubble per minute or Class VI.
4. If leakage is excessive, stroke the valve 10 to 20 times to allow the soft seal in the oil seat to wear in with the metal plug and retest the valve. If valve leakage is still excessive the oil seat and/or stem should be replaced and the valve retested.

**VI. PROOF OF CLOSURE (POC) SWITCH TESTING**

The POC switches should be tested after the valve has been leak tested.

The intent of the Proof of Closure (POC) switch is to prove the valve is in the closed position. To accomplish this, the oil valve is designed with valve seal over-travel. That is, the seal will stop the flow of oil and continue to move in the valve seat bore until the metal seat is made. During this portion of valve stroke the oil valve is effectively sealed, the POC switch contacts must change state. That is, the POC Switch changes state before oil flows regardless of whether the valve moves from the Closed position to Fire or Fire to Closed (Purge).

1. Ensure the valve is in the closed position.
2. Wire the switch to a test device.
3. Loosen switch and push it towards the end flange (up - orientation assumes the valve actuator is on top) to edge of slot or until switch boot hits the edge of the hole. This will typically move the switch roller actuator past the tripping device.
4. Move the switch away from the end flange (down) until it trips. Try and keep the switch level.

5. Mark the limit switch box 0.14" (3.6 mm) from the switch surface opposite the end flange (bottom surface), for the entire length of the switch. This can be accomplished by placing a 0.14" (3.6 mm) thick metal plate on the switch and marking along the edge. Caution with how close the mark is to the plate. If the marking device is always 0.03" (0.8 mm) higher, the plate should then be 0.11" (2.8 mm), so the end result is always 0.14" (3.6 mm).
6. Move switch to the line and tighten the two screws to prevent movement.
7. Plug the purge inlet pipe.
8. With the oil valve fully closed, pressurize the oil inlet to 10 to 20 PSIG (68.9 - 137.9 KPa). While monitoring the outlet for leakage, slowly open the valve. The normally open contacts of the switch should change state before flow commences ( $> 24 \text{ in}^3/\text{Hr}$  or  $400 \text{ cc}/\text{Hr}$ ). If it does not, loosen the screws, securing the switch and move the switch downward 0.015" (0.4 mm). Tighten retaining screws and repeat test.
9. Pressurize the oil valve inlet between 10 and 20 PSIG (68.9 - 137.9 KPa) while monitoring the outlet for leakage. Stroke the valve to open position. Slowly close the valve while monitoring the normally open switch contacts. Flow should cease ( $< 24 \text{ in}^3/\text{Hr}$  or  $\text{cc cc}/\text{Hr}$ ) before contacts change state. If it does not, loosen the screws, securing the switch and move the switch upward 0.015" (0.4 mm). Tighten retaining screws and repeat test. If any adjustments are made during this step, step 8 must be repeated.
10. Switches are properly set when both conditions in Step 8 and 9 are satisfied.

## **VII. MISCELLANEOUS INSTRUCTIONS FOR SPECIAL OPTIONS**

Due to customer requirements, some T2000 Systems incorporate special options. Any special procedures not covered in the above material can be found in the Reference Section of this manual as addenda.

## **VIII. SPARE PARTS ORDERING INFORMATION**

Orders for T2000 Systems Spare Parts should be placed with

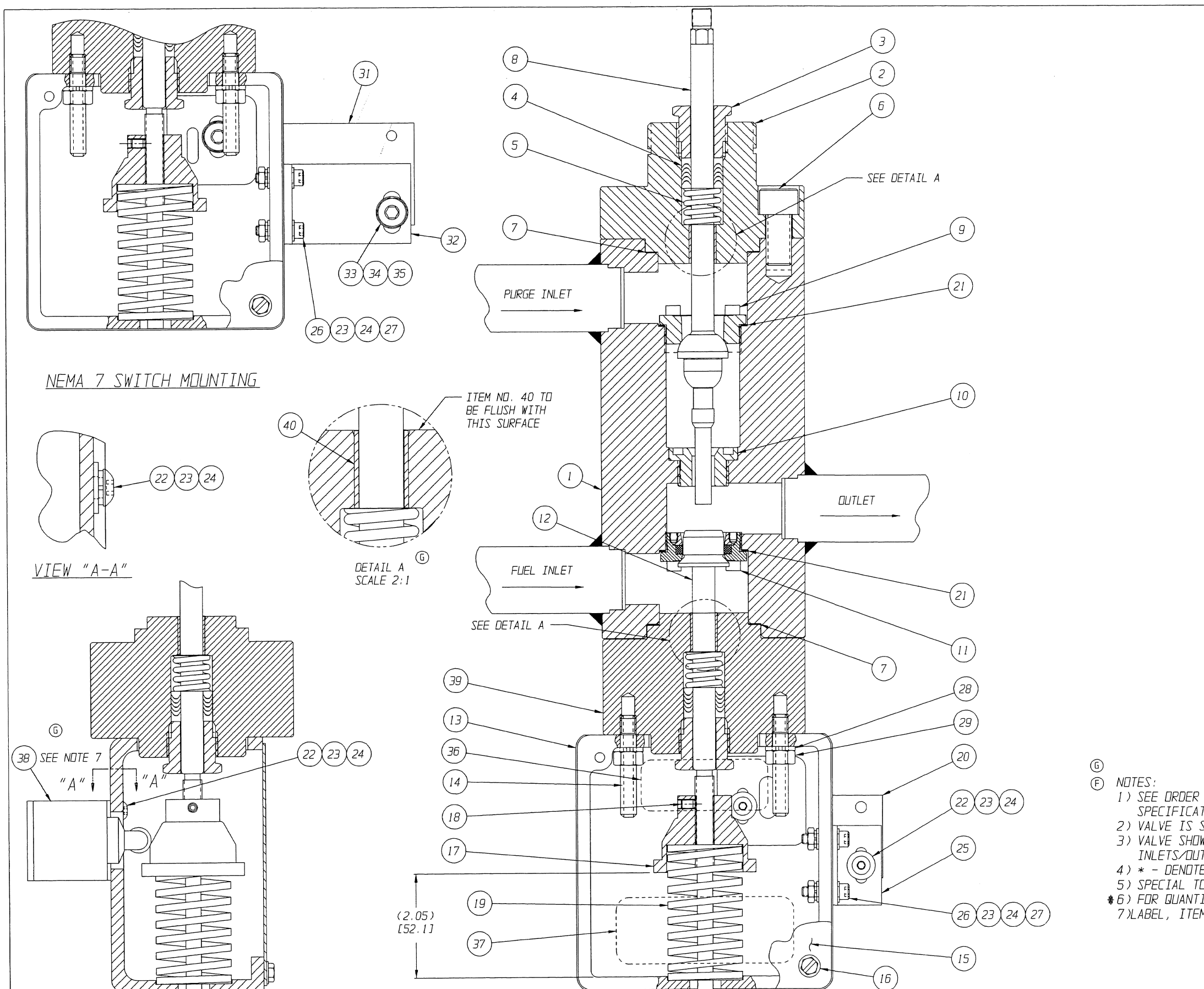
*ITT Engineered Valves, LLC  
33 Centerville Road  
Lancaster, PA 17603-2064*

*Phone: 717-509-2200  
Fax: 800-348-9000*

Please be advised that spare parts should be ordered directly from ITT Engineered Valves, as such materials are specially designed for Scotch Trifecta Valve Systems. Other replacement parts, although they may be similar in function, will void the FM rating. To maintain FM Approval, FM also requires technicians servicing/repairing the Scotch Trifecta Valve Systems to be trained by ITT Engineered Valves.

## **IX. REFERENCE INFORMATION**

The following pages contain drawings and reference information alluded to in above sections.



LIST OF PARTS			
ITEM	DWG. NO.	QTY.	DESCRIPTION
1	02-011	1	VALVE BODY SUBASSEMBLY
G 2	118060	1	END FLANGE STEAM SIDE
3	01-012	2	PACKING NUT
* 4	39-001	2	PACKING SET
F * 5	-	2	PACKING SPRING
F 6	-	8	0.50-13 X 1.00 LG. SOCKET HEAD CAP SCREW
* 7	40-001	2	BODY GASKET
* 8	116633	1	MAIN STEM
* 9	01-013	1	UPPER SEAT RING
* 10	01-011	1	PURGE SEAT RING
* 11	02-110	1	OIL VALVE SEAT RING ASSEMBLY
F * 12	02-107	1	OIL STEM
13	01-218	1	LIMIT SWITCH BOX
G 14	-	2	STUD (0.31-18 UNC)
15	01-016	1	LIMIT SWITCH BOX COVER
16	-	2	12-24 X 0.50 LG. HEX WASHER HEAD SCREW
17	01-224	1	SPRING SEAT
18	-	1	10-32 X 0.25 LG. SOCKET HEAD SET SCREW
* 19	-	1	OIL VALVE RETURN SPRING
* 20	25-007	1	OIL VALVE PROOF OF CLOSURE SWITCH NEMA 4
* 21	40-026	2	SEAT RING GASKET
# 22	-	-	10-32 X 0.50 LG. HEX SOC BTNHD CAP SCR
# 23	-	-	#10 FLAT WASHER
# 24	-	-	#10 LOCK WASHER
# 25	01-234	-	SWITCH MOUNTING BRACKET (NEMA 4)
26	-	2	#10-32 X 0.75 LG. HEX SOCKET HD CAP SCREW
27	-	2	#10-32 HEX NUT
G 28	-	2	0.31 LOCK WASHER
G 29	-	2	0.31-18 HEX NUT
G 30	-	-	-
* 31	25-017	1	OIL VALVE PROOF OF CLOSURE SWITCH NEMA 7
# 32	01-235	-	SWITCH MOUNTING BRACKET (NEMA 7)
# 33	-	-	0.31 FLAT WASHER
# 34	-	-	0.31 LOCK WASHER
# 35	-	-	0.31-18 X 0.75 LG. HEX SOC BTNHD CAP SCR
F 36	117504	1	LABEL - CAUTION STEM PACKING
F 37	90-018	1	LABEL - CAUTION SPRING
F 38	117500	1	LABEL - PROOF OF CLOSURE
G 39	118059	1	END FLANGE OIL SIDE
G 40	-	2	BEARING

ITEM NO.	QUANTITY	
	NEMA 4	NEMA 7
22	2	-
23	6	4
24	4	2
25	1	-
32	-	1
33	-	2
34	-	2
35	-	2

- NOTES:
- SEE ORDER SPECIFICATION FOR MAIN VALVE AND ACCESSORY/OPTIONS SPECIFICATIONS.
  - VALVE IS SHOWN IN CLOSED POSITION.
  - VALVE SHOWN IS LEFT TO RIGHT FLOW. FOR RIGHT TO LEFT FLOW, INLETS/OUTLETS ARE REVERSED.
  - \* - DENOTES RECOMMENDED SPARE PART.
  - SPECIAL TOOL IS REQUIRED TO REMOVE SEATS. CONSULT FACTORY.
  - FOR QUANTITY SEE TABLE 1
  - LABEL, ITEM 38, TO BE PLACED ON TOP OF SWITCH HEAD

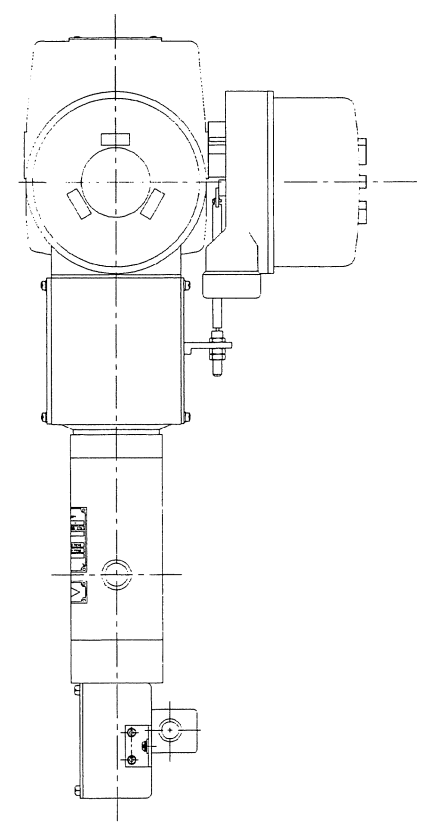
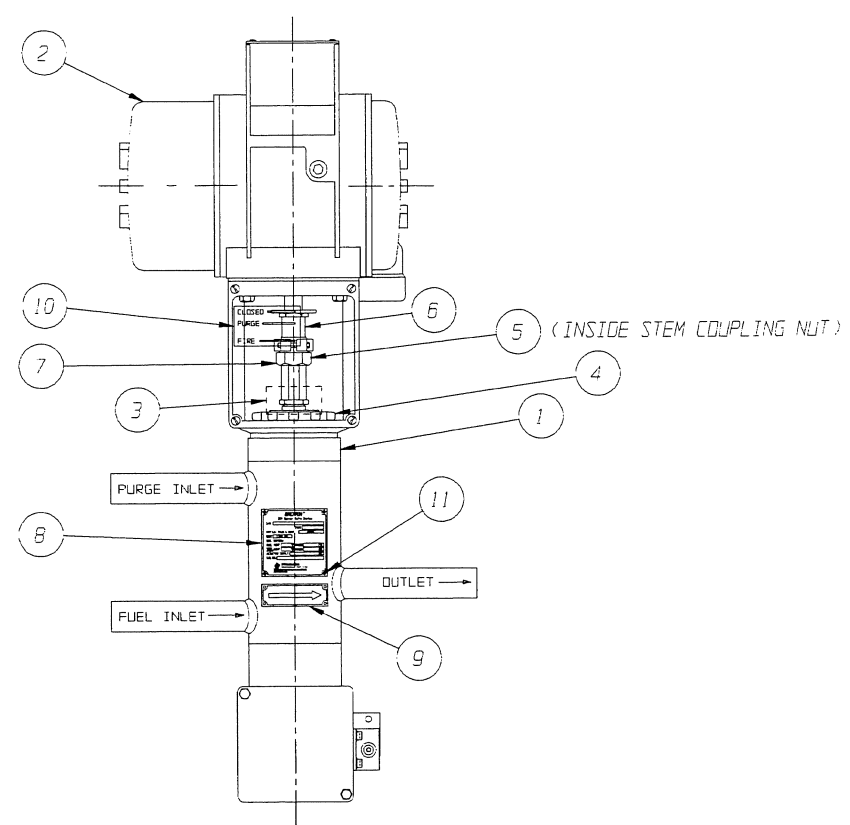
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TOLERANCES EXCEPT AS NOTED		WEIGHT	SCALE	MAIN VALVE ASSEMBLY		ITT Engineered Valves ITT Fluid Technology Corporation Lancaster, Pa.
EXCEPT AS NOTED			1:1	OIL BURNER VALVE SYSTEM		
XX 1.00		DATE	BY	T2000		SHEET 1 OF 1
XXX 0.005		DWN	JON			
ANGLES 10.50°		REV				DRAWING NUMBER 03-005
REMOVE ALL BURRS AND SHARP EDGES ALL DIMENSIONS TO BE SURFACES TO BE UNLESS EXCEPT AS NOTED		12/10/97				
G	7/24/99	4975	JON	MJD	MJD	REV G
F	12/10/97	3158	JON	HJO	MJD	
REV	DATE	ECN NBR	BY	CHKD	APVD	
		APVD	1/21/98	MJD		SUPERSEDES: -

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LIST OF PARTS				
ITEM	DWG. NO.	PART NO.	QTY.	DESCRIPTION
(A) 1	03-005	-	1	VALVE BODY SUBASSEMBLY
2	-	12-001-01	1	ACTUATOR ELECTROHYDRAULIC FAIL CLOSED 100/120V 50/60 HZ
	-	12-001-02		ACTUATOR ELECTROHYDRAULIC FAIL CLOSED 200/220V 50/60 HZ
	-	12-002-01		ACTUATOR ELECTROHYDRAULIC LAST POSITION 100/120V 50/60HZ
	-	12-002-02		ACTUATOR ELECTROHYDRAULIC LAST POSITION 200/220V 50/60HZ
(A) 3	117504	37200	1	VALVE PACKING TAG
4	36-013	36-013	1	YOKE LOCKNUT
5	-	11-041	1	ACTUATOR UNION NUT
(A) * 6	-	-	1	STEM CONNECTOR
(A) * 7	-	-	1	STEM COUPLING NUT
8	90-012	90-012-02	1	VALVE TAG S.S.
9	90-005	90-005-02	1	FLOW TAG S.S.
10	90-002	90-002	1	POSITION DECAL
11	-	36-161	8	RIVET

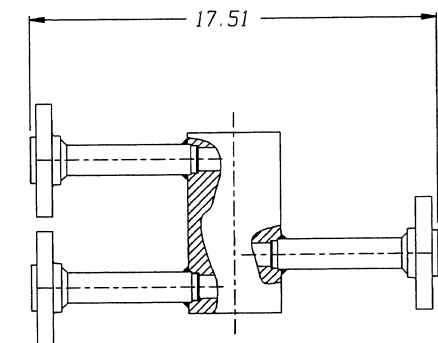
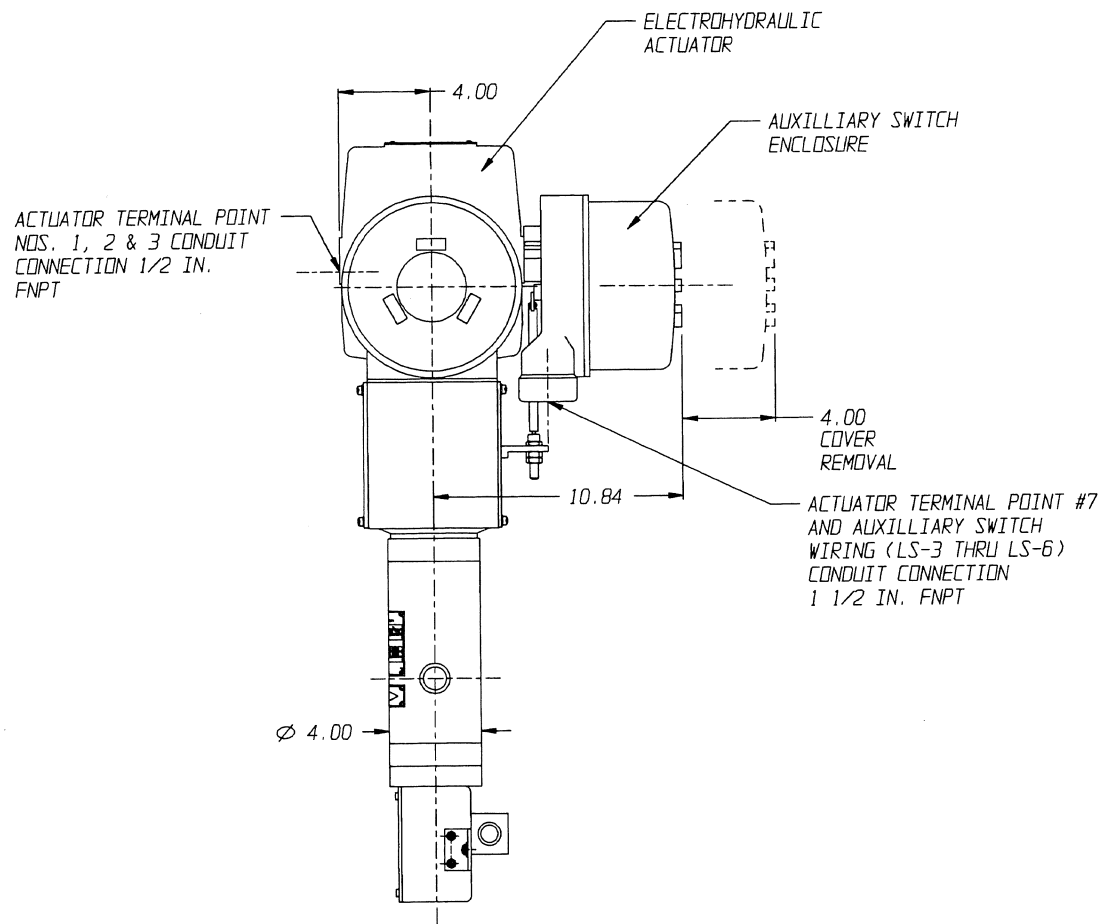
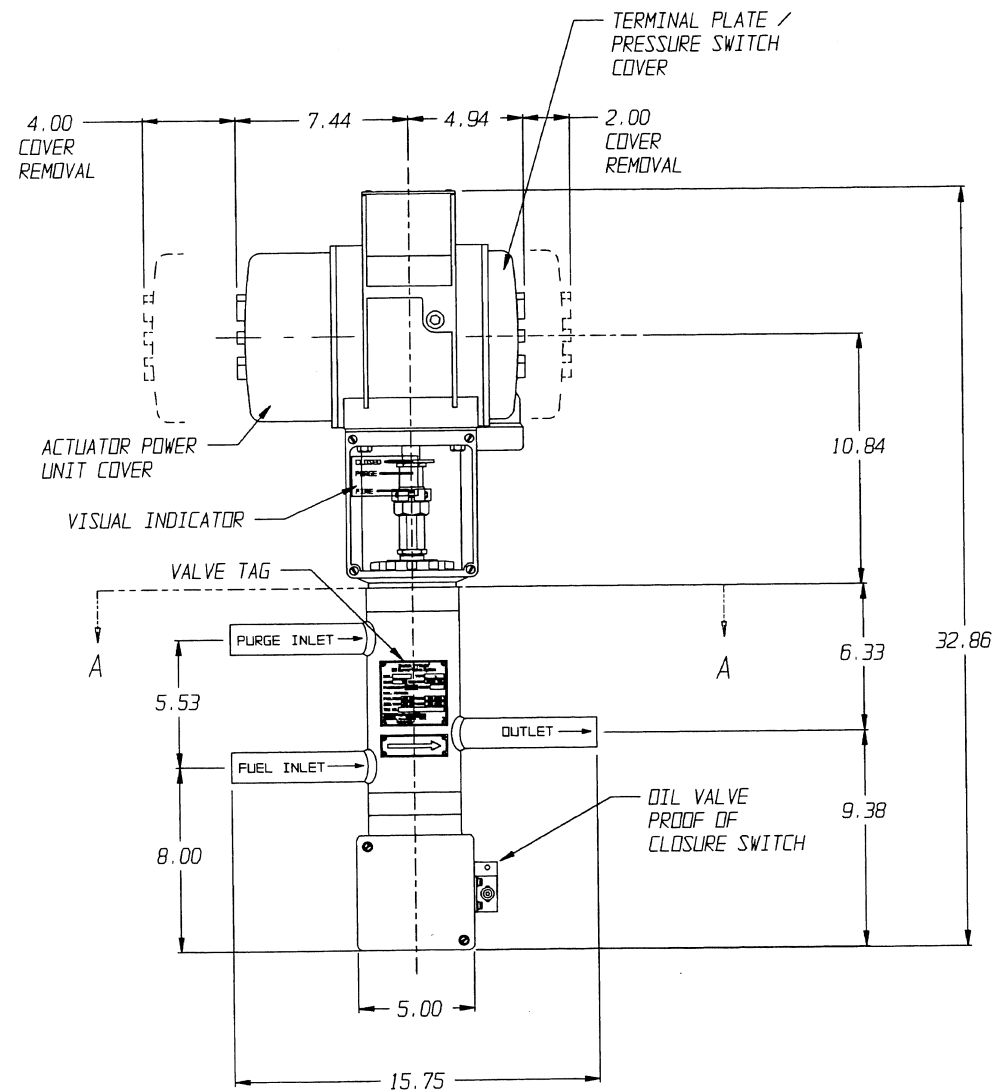


- (A) NOTES:  
 1) CUSTOMER TO WIRE DIRECTLY TO OIL VALVE PROOF OF CLOSURE SWITCH TERMINALS  
 \* 2) LENGTH MUST BE 1.640/1.625 IF NOT MACHINED FROM HEX END

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PART NO. -		PATTERN NO. -	
TOLERANCES EXCEPT AS NOTED DECIMALS .XX ± .02 .XXX ± .005 ANGLES 90° 50° REMOVE ALL BURRS AND SHARP EDGES ALL MACHINED SURFACES TO BE 125° EXCEPT AS NOTED		WEIGHT -	SCALE 1:4
ASSEMBLY T2001 & T2003 TRIFECTA OIL BURNER VALVE SYSTEM	DATE 5/1/95	BY JON	CHKD 5/5/95
APVD 5/5/95	MJD		
REV A	DATE 4/27/95	ELN HDR	BY JON
CHKD	APVD		
SIZE D	DRAWING NUMBER 03-017	SHEET 1	REV A
SUPERSEDES: -		ITT Engineered Valves ITT Fluid Technology Corporation Lancaster, Pa	



FLANGE ASSEMBLY SECTION "A"-A"

- (A) NOTES:
- 1) SEE INSTRUCTION AND OPERATION MANUAL IOT2003 OR IOT2001 FOR OPERATING AND MAINTENANCE INSTRUCTIONS.
  - 2) DIMENSIONS ARE FOR REFERENCE ONLY.
  - 3) ALLOW 6.00 INCHES MINIMUM CLEARANCE AT TOP AND BOTTOM OF VALVE SURFACES FOR DISASSEMBLY.
  - 4) VALVE SHOWN IS CONFIGURED FOR LEFT TO RIGHT FLOW. FOR RIGHT TO LEFT FLOW ROTATE THE INLET AND OUTLET PORTS 180° ABOUT VALVE CENTERLINE.
  - 5) END CONNECTIONS SHOWN ARE SPIGOT. DIMENSIONS ARE THE SAME FOR BUTTWELD AND SCREWED CONNECTIONS. SEE ORDER SPECIFICATION FOR END CONNECTIONS SUPPLIED.

WR# -

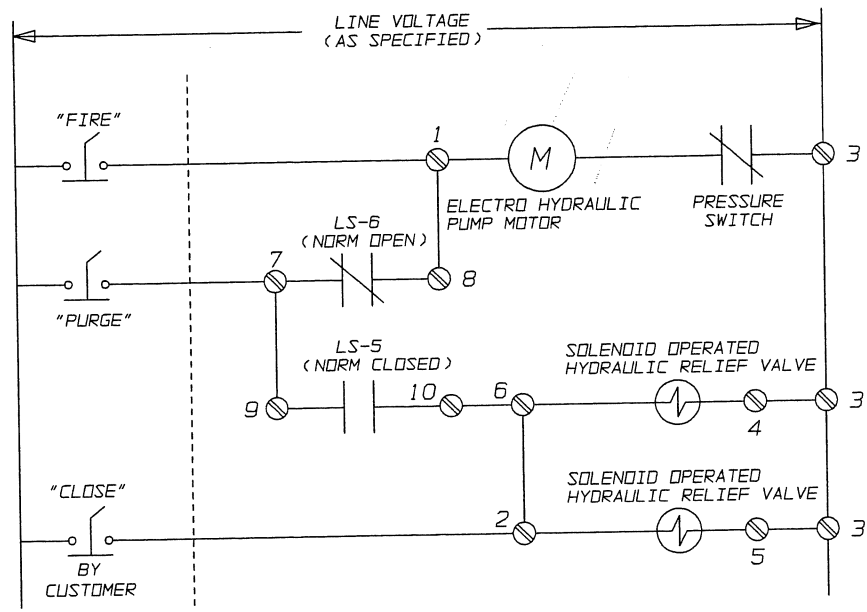
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TOLERANCES EXCEPT AS NOTED DECIMALS .XX ± .02 .XXX ± .005 ANGLES 90 50° REMOVE ALL BURRS AND SHARP EDGES ALL MACHINED SURFACES TO BE 125 UNLESS OTHERWISE NOTED		WEIGHT	SCALE 1:4	DIMENSIONS-MODELS T2001 & T2003 TRIFECTA OIL BURNER VALVE SYSTEMS		PART NO. -		PATTERN NO. -	
DATE	BY	DATE	BY	GCS		ITTEngineered Valves		ITT Fluid Technology Corporation	
11/92	GCS	11/92	JRB	Lancaster, Pa		SHEET 1 OF 1		REV A	
CHKD	APVD	CHKD	APVD	SUPERSEDES:-		DRAWING NUMBER		REV	
A	4/8/95	JBN	APVD	D		57-007		A	

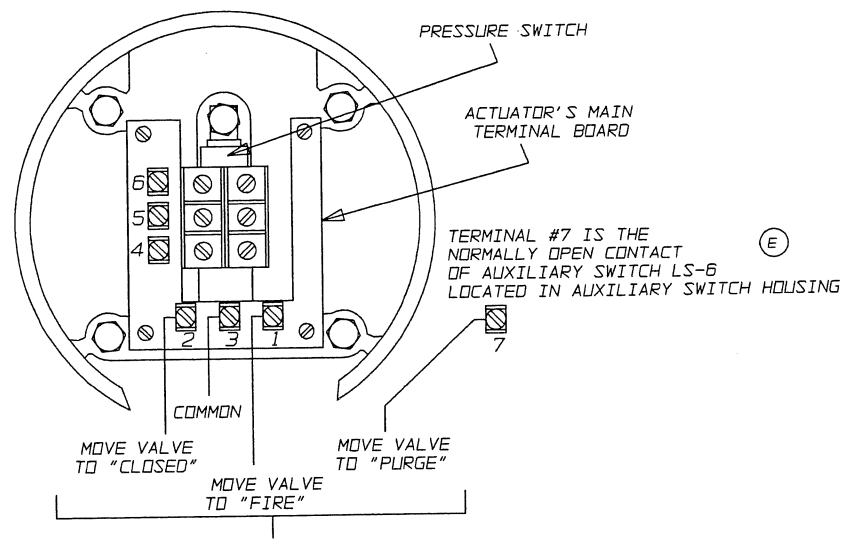


NOTE:  
1. SEE ORDER SPECIFICATION FOR MAIN VALVE, ACTUATOR AND ACCESSORIES/OPTIONS SPECIFICATIONS, AND CONTRACT DATA.



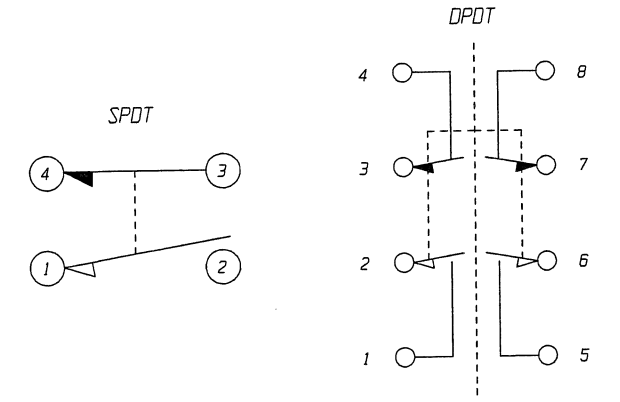
(E) NOTE: ALL SWITCHES SHOWN WITH MAIN VALVE IN FULLY CLOSED POSITION. TERMINALS 1-6 ARE LOCATED ON ACTUATOR'S MAIN TERMINAL BOARD. TERMINALS 7-10 ARE LOCATED ON SWITCHES LS-6 & LS-5 IN AUXILIARY SWITCH HOUSING.

**ELECTRICAL SCHEMATIC**



CUSTOMER WIRING: THREE HOT LEADS, ONE COMMON.

**ACTUATOR WIRING**



NOTE:  
1) OIL VALVE PROOF OF CLOSURE SWITCH IS LOCATED ON THE BOTTOM OF THE MAIN VALVE ASSEMBLY AND OPERATES DIRECTLY FROM VALVES OIL STEM.  
2) PROOF OF CLOSURE SWITCH CHANGES STATE PRIOR TO OIL VALVE OPENING OR CLOSING.  
3) CONTACTS SHOWN WITH OIL VALVE IN CLOSED POSITION.

**OIL VALVE PROOF OF CLOSURE SWITCH WIRING**

SWITCH NO.	VALVE POSITION		
	CLOSED	PURGE	FIRE
LS-1			■
LS-2		■	
LS-3	■		
LS-4	■		
LS-5 *	■		
LS-6 *	■		

■ - DEPICTS SWITCH ACTUATED BY CAM (SWITCHES NORMALLY OPEN CONTACTS ARE MADE)

NOTE: GRAPH SHOWS SETTINGS FOR CAM-OPERATED SPDT AUXILIARY SWITCHES LS-1 THRU LS-6. SWITCHES ARE LOCATED IN AUXILIARY SWITCH HOUSING. SEE DIMENSIONAL DRAWING FOR LOCATION.  
\*LS-6 AND LS-5 ARE FOR ACTUATION SYSTEM USE ONLY - NOT FOR CUSTOMER USE.

**AUXILIARY SWITCH CAM SETTINGS**

SWITCH NO. TERMINALS	LS-1	LS-2	LS-3	LS-4	LS-5*	LS-6*	LS-7 PROOF OF CLOSURE SWITCH					
							SPDT		DPDT			
							1-2	3-4	1-2	3-4	5-6	7-8
VALVE IN CLOSED	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.						
VALVE IN PURGE	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.						
VALVE IN FIRE	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.						

\*LS-6 AND LS-5 ARE FOR ACTUATION SYSTEM USE ONLY.

(E) NOTE: FOR "PURGE" INDICATION, WIRE NORMALLY OPEN CONTACTS OF LS-2 AND LS-3 IN SERIES.

**SWITCH CONTACT LOGIC**

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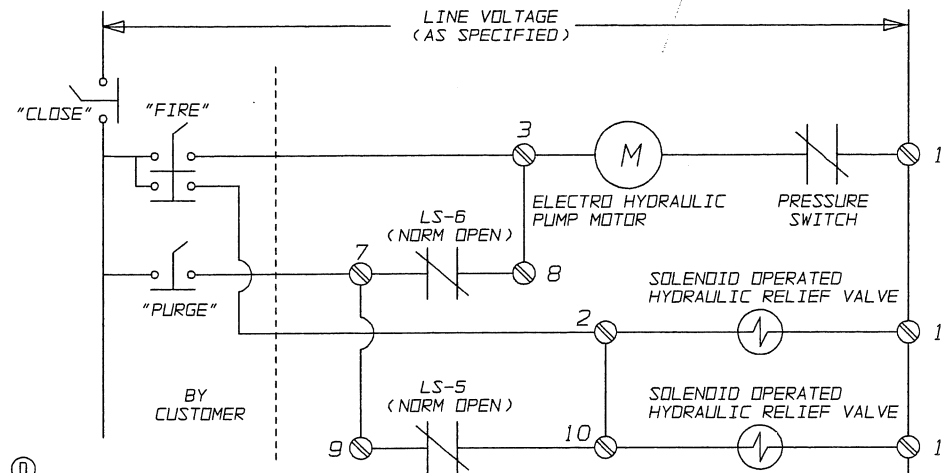
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THIRD ANGLE PROJECTION	UNLESS OTHERWISE NOTED X ± .06 (1.5mm) .XX ± .03 (.76mm) .XXX ± .005 (.12mm) XX ± 1/16 (1.5mm) X ± .5 X ± 1	WEIGHT	SCALE	WIRING SCHEMATIC ELECTRICAL SCHEMATIC SERIES T1001 AND T2001	<b>ITT Industries</b> Engineered Valves Lancaster, PA USA		
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES EXCEPT AS NOTED	REMOVE ALL BURRS AND SHARP EDGES ALL MACHINED SURFACES TO BE FINISHED EXCEPT AS NOTED	DATE	BY	SIZE		DRAWING NUMBER	SHEET
		8-15-02	AS	D	60-001	1 OF 1	E

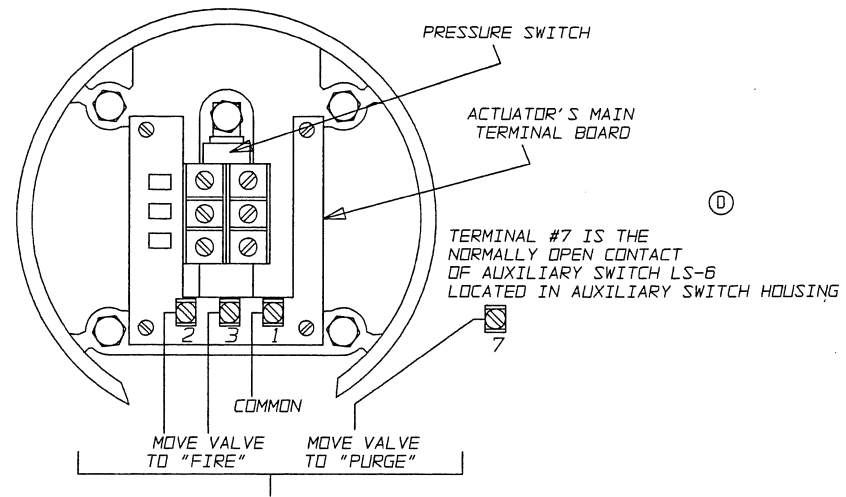
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NOTE:  
1. SEE ORDER SPECIFICATION FOR MAIN VALVE, ACTUATOR AND ACCESSORIES/OPTIONS SPECIFICATIONS, AND CONTRACT DATA.



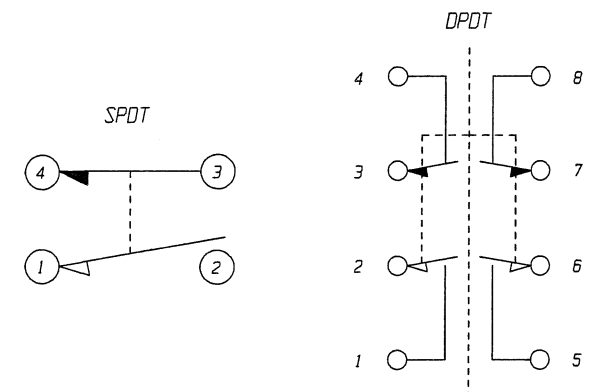
NOTE: ALL SWITCHES SHOWN WITH MAIN VALVE IN FULLY CLOSED POSITION. TERMINALS 1-3 ARE LOCATED ON ACTUATOR'S MAIN TERMINAL BOARD. TERMINALS 7-10 ARE LOCATED ON SWITCHES LS-6 & LS-5 IN AUXILIARY SWITCH HOUSING.

**ELECTRICAL SCHEMATIC**



CUSTOMER WIRING: THREE HOT LEADS, ONE COMMON. DE-ENERGIZE ALL CIRCUITS TO CLOSE VALVE. WIRE SIZE: #14 AWG MINIMUM.

**ACTUATOR WIRING**



NOTE:  
1) OIL VALVE PROOF OF CLOSURE SWITCH IS LOCATED ON THE BOTTOM OF THE MAIN VALVE ASSEMBLY AND OPERATES DIRECTLY FROM VALVES OIL STEM.  
2) PROOF OF CLOSURE SWITCH CHANGES STATE PRIOR TO OIL VALVE OPENING OR CLOSING.  
3) CONTACTS SHOWN WITH OIL VALVE IN CLOSED POSITION.

**OIL VALVE PROOF OF CLOSURE SWITCH WIRING**

SWITCH NO.	VALVE POSITION		
	CLOSED	PURGE	FIRE
LS-1			■
LS-2		■	
LS-3	■		
LS-4	■		
LS-5*	■		
LS-6*	■		

■ - DEPICTS SWITCH ACTUATED BY CAM (SWITCHES NORMALLY OPEN CONTACTS ARE MADE)

NOTE: GRAPH SHOWS SETTINGS FOR CAM-OPERATED SPDT AUXILIARY SWITCHES LS-1 THRU LS-6. SWITCHES ARE LOCATED IN AUXILIARY SWITCH HOUSING. SEE DIMENSIONAL DRAWING FOR LOCATION. \*LS-6 AND LS-5 ARE FOR ACTUATION SYSTEM USE ONLY - NOT FOR CUSTOMER USE.

**AUXILIARY SWITCH CAM SETTINGS**

SWITCH NO. TERMINALS	LS-1	LS-2	LS-3	LS-4	LS-5*	LS-6*	LS-7 PROOF OF CLOSURE SWITCH					
							SPDT		DPDT			
	1-2	3-4	1-2	3-4	5-6	7-8						
VALVE IN CLOSED	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.						
VALVE IN PURGE	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.						
VALVE IN FIRE	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.	COM N.O. N.C.						

\*LS-6 AND LS-5 ARE FOR ACTUATION SYSTEM USE ONLY.

NOTE: FOR "PURGE" INDICATION, WIRE NORMALLY OPEN CONTACTS OF LS-2 AND LS-3 IN SERIES.

**SWITCH CONTACT LOGIC**

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THIRD ANGLE PROJECTION	UNLESS OTHERWISE NOTED: X ± .06 (1.5mm) .X ± .03 (.75mm) .XX ± .02 (.5mm) .XXX ± .005 (.12mm) X/X ± 1/16 (1.5mm) X ± .5 X ± .25	WEIGHT	SCALE	WIRING SCHEMATIC ELECTRICAL SCHEMATIC SERIES T1003 AND T2003	<p>Engineered Valves Lancaster, PA USA</p>
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES	REMOVE ALL BARRS AND SHARP EDGES ALL MACHINED SURFACES TO BE .25 EXCEPT AS NOTED	DATE	BY	SIZE	
		DWN	8/15/02	LS	DRAWING NUMBER
		CHKD	9/15/02	AKC	60-005
		APVD	8/15/02	AKC	SHEET
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