

OPERATION & MAINTENANCE MANUAL



GENERAL VALVE COMPANY

**800 KOOMEY ROAD
BROOKSHIRE, TEXAS 77423
PHONE: (281) 934-6013
(800) 926-2288
FAX: (281) 934-6058
(800) 765-2266**

**HINDLE COCKBURNS, LTD
P. O. #. P62934**

**GENERAL VALVE COMPANY
S. O.# 98GF0956**

**16" B4711 FOUR WAY DIVERTER VALVE
HYDRAULIC CONTROL MOD. 4W-110A
HYDRAULIC CONTROL MOD 4W110A-20
ELECTRICAL MODULE, 4W110A, 24VDC
HYD.CONMTROLS MODULE 4W110A-20
ACTUATOR MASTER, 16" 4W110A HYD.**

**EHPU
HYDRAULIC POWER UNIT, BASIC S/A
AUTO ELECTRICAL CONTROL MODULE
ELETRO-HYDRAULIC POWER UNIT
PUMP, MOTOR RESERVOIR ASSY, EHPU
DATA SHEET 1474**

Data Sheet for
Electro-Hydraulic Power Units

BY: **GV**
CHK'D:

Job Data:

Customer: HINDLE ORI / ITALY
Project: _____
Purchase order no./Contract no.: _____
RFQ no.: _____
GV sales order no.: 98GF0956

Item Data:

Item no.: 1
Description: EHPU FOR 16" B4711 W / 4W-110A ACTUATOR
Tag no.: _____

PRE START-UP FLUID LEVEL (GAL REQD TO FILL)
RECHECK FLUID LEVEL AT 0 PSI HYDRAULIC PRESSURE

GENERAL VALVE COMPANY
800 KOOMEY ROAD
BROOKSHIRE, TEXAS 77423

ELECTRICAL DATA

MOTOR	HP	7 ½
	FL AMPS	22
	VOLTAGE	400 VAC
	PH/Hz	3 / 50
	RPM	1800
UL APPROVED FOR HAZARDOUS LOCATIONS	VOLTAGE	
	PH/Hz	
CONTROLS B/M NO.	400-2093	
SCHEMATIC NO.	290-128	

HYDRAULIC DATA

A C C U M U L A T O R	OPERATING RANGE	900 / 2400	PSI
	PRECHARGE	810	PSI
	MIN STORED VOLUME	1.8	GAL
	NOMINAL VOLUME	10	GAL
	MIN RECHG TIME (STORED VOL)	28	SEC
	SKID B/M NO.	400-1689	
	MAX WORKING PRESSURE	3000 PSI	
	MAX OPERATING TEMPERATURE	185° F	
	B/M NO.	400-1473	
	SCHEMATIC NO.	290-083	

SYSTEM DATA

PUMP/RECHARGE RATE	4.37	GPM AT	1740	RPM
MAX FLOW RATE			45	GPM
MAX RESERVOIR VOLUME			20	GAL
CONNECTIONS: ELEC	1 ½	:HYD SAE-16 ST THD O-RING		
B/M NO.	400-1690			
SCHEMATIC NO.	290-088			
SALES ORDER NO.	98GF0956			



**ELECTRO-HYDRAULIC
POWER UNIT**

FOR SERVICE CALL GENERAL VALVE SERVICE COMPANY PHONE: (281) 934-6013 OR (800) 926-2288 FAX: (281) 934-6058

Additional Data:

SET RELIEF VALVE (PORT 2F) TO 3000 PSI CRACK
SET PRESSURE SWITCH TO STOP MOTOR @ 2400 PSI INCREASING.

1473

Data Sheet for
4W110A Electro-Hydraulic Operator

BY: **GV**
 CHK'D:

Job Data:

Customer: **HINDLE ORI / ITALY**
 Project: _____
 Purchase order no./Contract no.: _____
 RFQ no.: _____
 GV sales order no.: **98GF0956**

Item Data:

Item no.: **1**
 Description: **4W-110A HYDRAULIC OPERATOR F/16" B4711 4-WAY**
 Tag no.: _____

4W110A ELECTRO-HYDRAULIC OPERATOR

HYDRAULIC DATA

SEAT / UNSEAT	MIN FLOW REQD	24.0	GPM
	MIN PRESS REQD	900	PSI
FLOW CONTROL SETTING	PORT 4B	24	GPM
	PORT 5B	N/A	GPM
VOL TO SEAT OR UNSEAT		.6	GAL

1 / 4 TURN	MIN FLOW REQD	12.5	GPM
	MIN PRESS REQD	900	PSI
FLOW CONTROL SETTING	PORT 3B	6.5	GPM
	PORT 4D	6.0	GPM
VOL TO 1/4 TURN		0.6	GAL

MAX WORKING PRESSURE		3000	PSI
VOLUME / ACTUATION		1.8	GAL
CONNECTIONS		SAE-16 ST THD O-RING	
B/M NO.		400-1438	
SCHEMATIC NO.		290-104	

ELECTRICAL DATA

SOLENOID VOLTS/AMPS	24 VDC / .75
HEATER VOLTS/AMPS	24 VDC / .42
CONDUIT CONNECTIONS	3/4 FNPT
B/M NO.	400-1539
SCHEMATIC NO.	290-103



GENERAL VALVE COMPANY
 800 KOOMEY ROAD
 BROOKSHIRE, TX 77423

OPERATOR DATA

APPROX ACTUATION TIME	8	SEC.
SEAT/UNSEAT TIME	1	SEC.
1/4 TURN TIME	6	SEC.
OPERATOR MODEL NO.	4W-110A	
B/M NO.	400-1526	

FOR SERVICE: PHONE (281) 934-6013 OR (800) 926-2288 FAX: (281) 934-6058

Additional Data:

SET "UNSEAT" & "SEAT" TO CRACK AT 900 PSI
SET "CCW" & "CW" TO MAX @ 1400 PSI
SET SEQUENCE TO SHIFT @ 700 PSI



OPERATION & MAINTENANCE INSTRUCTIONS

FOUR-WAY DIVERTER VALVE

OPERATION

The General Four-Way Diverter Valve is a non-lubricated, resilient seal valve which has mechanical means of retracting the seating slips before it is cycled from one seated position to opposite position. In opening the valve, the plug is raised, thus retracting the seating slips through their tapered dovetail connections. Only after the seating slips are fully retracted perpendicularly from the body seat is the plug (which is mounted on trunnions) rotated to the other seating position.

Conversely, in closing the valve, the plug and seating slips cycle freely, with no plug-to-body contact, until the seating segments are positioned over the ports. Then the plug is driven down between the slips and the tapered surfaces wedge out the seating slips for a positive seal.

Position indicator through the upper stem shows the flow direction. The gear operator position may be changed as follows:

- (A) Place valve in unseated position. (B) Remove gear housing cap screws. (C) Turn handwheel to further open the valve; this will turn gear housing. Continue until handwheel comes to desired position and gear housing mounting holes are aligned. (D) Replace gear housing mounting cap screws. Be sure short cap screw is inserted below worm shaft.

MAINTENANCE

The Four-Way Diverter Valve requires no day-to-day maintenance. There are some services which may be needed occasionally.

1. In cold climates, before freezing weather sets in, any possible collection of water below valve plug should be drained out through bottom access plate drain plug.

If at any time the pressure gauge system should indicate a leak which cannot be stopped with ordinary force on hand-wheel, this may be stopped by one of the following:

- A) Operate valve through open-close cycle while fluid is flowing to try to flush out valve body. If pressure gauge system still indicates valve leak, seating segments should be inspected.

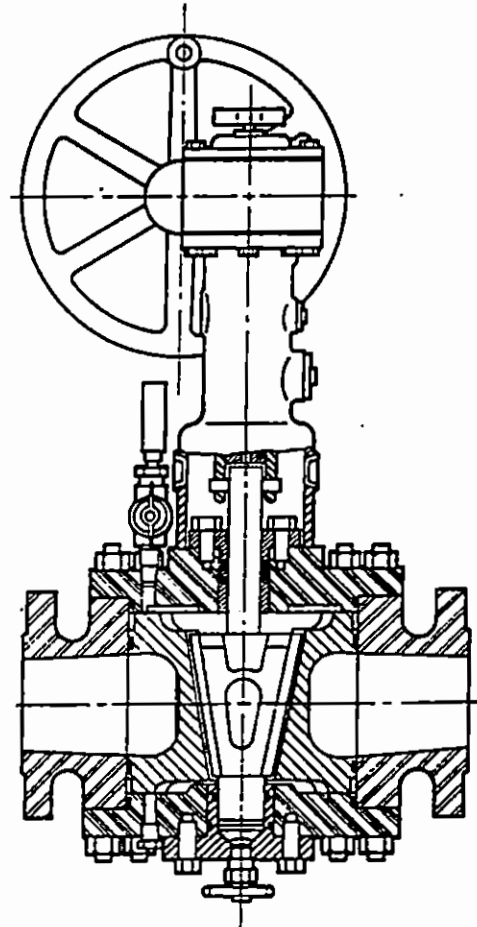
- B) To inspect seating segments line must be drained. Place 4-way valve in unseated position (check pressure gauge system for zero pressure) and open the body bleed. Then remove lower plate. Seating slips can be pulled off dovetails and inspected and replaced if necessary. It is usually best to replace lower plate O-ring any time lower plate is removed. Be sure to save old slips for return to General Valve Service Company for exchange credit.

3. To change gear operator:

- A) Close 4-way valve as tight as possible.
- B) Drive out coupling pin (toward guide pin boss).
- C) Remove housing mounting bolts and lift operator off.
- D) Replace new operator in reverse order (insert coupling pin from same side as guide pin boss).
- E) After inserting coupling pin, tap plug trunnion in opposite direction to center.
- F) Check operation of valve.

4. To order seating slips, give figure number, size, series, serial number, part number on slip and type of resilient seal material.

5. Keep the valve operator filled with lubricant to displace and prevent moisture from accumulating and freezing. The operator is provided with a grease fitting in the gear head. Lubricant should be injected with operator in the OPEN position ONLY. Under ordinary conditions, a few pumps of the grease gun semi-annually is sufficient. Use lithium 12 hydroxy stearate or lithium base moly-disulfide grease.



GENERAL
FOUR-WAY DIVERTER VALVES



General Valve Company

**4W-110A Hydraulic Operator
and
Valve Control System**

Installation and Start-up Instructions

1.0 GENERAL SYSTEM DESCRIPTION (See "Master Drawing List" for numbers of drawings referenced in this manual).

- 1.1 The General Valve Company 4W-110A (and 4W-100A-20) is an electrically controlled and hydraulically powered valve operator (see "Operator Assembly" drawing).
 - 1.1.1 The 4W-110A-20 operator is used exclusively with the General Valve Company 20-inch 4-Way Diverter Valve.
 - 1.1.2 The 4W-110A operator is used with the General Valve Company 12-inch and 16-inch 4-Way Diverter Valves.
- 1.2 The "unseat quarter-turn reseal" motion required to operate all general Valve 4-Way Diverter Valves is not defined mechanically as in other operators (i.e., no gears, rollers, slots, followers, etc.). Rather, during normal operation, electro-hydraulic logic, reacting to a command signal, monitors and commands the valve when to "unseat", when to "quarter-turn" and when to "reseal." Strict attention to electrical and hydraulic adjustments are essential and must be performed rigorously. Routine field adjustments shall *not* be required.
- 1.3 The electrical controls (see "Electrical Module Assembly" drawing) are housed in rugged, watertight, submersible switch housings which have been designed for use in hazardous-duty locations.
- 1.4 The hydraulic controls assembly (see "Hydraulic Controls Assembly" drawing) is separated into two interconnected, state-of-the-art cartridge-type hydraulic control modules; the "Quarter-Turn Module" and the "Seat/Unseat Module".
 - 1.4.1 The "Quarter-Turn Module" (see "Quarter-Turn Hydraulic Module Assembly" drawing) reacts to both an electrical signal monitored by the Electrical Module and a hydraulic command monitored by the "Seat/Unseat Module" (during normal operation). When called on to cause rotation of the 4-Way Valve it will do so only when the electrical signal and hydraulic command are in agreement.
 - 1.4.2 The "Seat/Unseat Module" (see "Seat/Unseat Hydraulic Control Module Assembly" drawing) reacts to an electrical signal monitored by the Electrical Module and provides hydraulic logic to prevent premature 4-Way Valve rotation. When called on to unseat the 4-Way Valve it will do so; at the completion of the unseat travel the "Seat/Unseat Module" will provide hydraulic power to the "Quarter-Turn Module".
- 1.5 These two hydraulic modules provide hydraulic power to two distinctively different hydro-mechanical devices which convert this hydraulic power into mechanical force and movement.
 - 1.5.1 Referring to the "Operator Assembly" drawing, the "seat/unseat" motion and thrust is provided by the lower "Vertical Cylinder" closest to the "Extension Housing" which, in turn, attaches directly to the 4-Way Valve "Bonnet" (see "Valve Assembly" drawing or "Valve Installation" drawing). This "Vertical Cylinder" is provided hydraulic power by the "Seat/Unseat Module" which is hydraulically interconnected by the two "Vertical Cylinder Tube Assemblies".
 - 1.5.2 Likewise, the "Rotary Actuator" just above the "Vertical Cylinder" provides the 4-Way Valve with "quarter-turn" motion and torque. The "Rotary Actuator" is provided hydraulic power via the "Quarter-Turn Module" interconnected only by the two "Rotary Tube Assemblies".
- 1.6 Both of these hydro-mechanical devices are semi-connected to one piston rod in such a way as to provide linear travel and thrust along with rotary movement and torque to the 4-Way Valve via a bolted coupling (see "Operator Assembly" drawing).

2.0 GENERAL SYSTEM FEATURES, REQUIREMENTS AND LIMITATIONS.

2.1 Hydraulic data

- 2.1.1 The 4W-110A operator utilizes "zero leak" (maximum five drops/min/valve @ 3000 psi) 4-Way, 3-Position "blocked centers" directional control valves to minimize power unit* cycling and maintain valve position (see "Hydraulic Schematic").
- 2.1.2 Also the 4W-110A operator is pressure-protected ("torque and thrust limited") with four integral factory preset and field-adjustable relief valves. This eliminates the need for the power unit to be pressure-regulated and therefore assures maximum use of hydraulic accumulators which are required when smaller horsepower power units are used.
- 2.1.3 Integral factory preset and field adjustable pressure-compensated flow regulators are used to control the flow of hydraulic fluid to the Vertical Cylinder and Rotary Actuator thereby controlling independently the rate of vertical travel "seat/unseat" and rotary travel "quarter-turn". The ability of the flow regulator to "pressure compensate" assures repeatable operating time regardless of hydraulic pressure or 4-Way Diverter flow rates. (Minimum hydraulic pressure and flow conditions must be maintained at "supply" port of Hydraulic Control Module; see "Data Sheet").
- 2.1.4 Integral 10 micron filter elements are included in both hydraulic modules to minimize downtime due to dirty hydraulic systems.
- 2.1.5 Integral hydraulic manual overrides, infinitely adjustable, are provided to ease startup, switch adjustment, trouble shooting, etc.
- 2.1.6 Hydraulic control limitations are:

Hydraulic pressure (maximum working @ controls	3000 psi
Maximum leakage (@ 3000 psi through controls)	10 drops/minimum
Maximum flow (Seat/Unseat Module)	30 gpm
Maximum flow (Quarter-Turn Module)	8 gpm

- 2.1.7 Hydraulic limitations protected by integral pressure relief valves:

Vertical Cylinder maximum pressure	2500 psi
Rotary Cylinder maximum differential pressure	1400 psid

Never readjust pressure-relief valves to exceed these values. Operator and valve damage will occur should these pressures be exceeded.

- 2.1.8 Consult the Data Sheet by item for the *minimum* operating conditions for the valves in question.

*A suitable Hydraulic Power Unit is required to provide hydraulic flow and pressure for proper valve operation. These power units may be provided by General Valve Company or by others. In any case, the power units *must* be sized and designed properly to accommodate the minimum requirements of the 4W-110A operator as stated in the "Data Sheet" located in this manual. Frequency and duration of operation must also be considered with regard to each installation.

2.2 Electrical Data:

2.2.1 Most typical AC or DC control and space heater voltages are available. Power consumption for solenoids is approximately 17 watts (during quarter-turn two solenoids will be energized). Space heater is approximately 10 watts and should be constantly energized. Standard voltages and their current draws are:

VOLTAGE	SOLENOID AMPS	SPACE HEATER AMPS
12 VDC	1.5	.83
24 VDC	.75	.42
36 VDC	.5	.28
48 VDC	.38	.21
110 VDC	.16	.09
24 VAC	.75	.42
115 VAC	.16	.08
230 VAC	.08	.05

AC solenoids and heaters are internally AC/DC rectified and therefore are functional at 50 or 60 Hz and require no inrush current considerations. All solenoids are continuous-duty.

2.2.2 DPDT limit switches are provided in each of the fully seated positions (two switches total) for remote position indication. The switches have fine silver contacts and are rated 10 amps at 115/250 VAC, 75-80% PF, 1/3 HP at 125 VAC, 3/4 HP at 250 VAC. The switches are UL listed (file no. E27957).

2.2.3 Switch actuation adjustment is simple and repeatable with individual switch actuators which are flexible and forgiving. Thus related over-travel problems and resultant switch damage are minimized.

2.3 Recommended minimum 4W-110A cycle time:

OPERATING DATA BY VALVE SIZE

VALVE SIZE/MODEL	ANSI RATING	MIN PRESS PSI	VOL/ACT GAL	VERT GPM	90° GPM	CYCLE TIME (SEC)		
						TOTAL	VERT	90° (Surge Limi
12 C4741	600	800	1.8	24	9	7	1.5	4
16 B4711	150	800	1.8	24	6	9	1.5	6
16 B4721	300	800	1.8	24	6	9	1.5	6
16 C4721	300	1200	1.9	26	6	10	2.0	6
16 C4741	600	1200	1.9	26	6	10	2.0	6
20 C4711	150	1700	2.2	24	4.5	12	2.0	8
20 C4721	300	1700	2.2	24	4.5	12	2.0	8

3.0 INSTALLATION PROCEDURE

- 3.1 Remove strapping and other shipping materials; however, do not remove the protective port plugs until ready to install the related plumbing. Visually check the valve and operator thoroughly and report any shipping damage to the General Valve Company Service Department at (713) 934-6013 or (800)926-2288
- 3.2 Install the 4-Way Valve in the piping system. Be sure that the ports, bleed system and other accessories are properly oriented with respect to flow and accessory access.
- 3.3 Fully turn all four hydraulic manual override knobs toward the "stop" direction (see "Hydraulic Controls Assembly" drawings).

- 3.4 From the "supply" port (stamped "SUPPLY") of the Seat/Unseat Hydraulic Module, run suitable tubing to the "supply" or "pressure" port of the associated power unit (see "Hydraulic Controls Assembly" drawing). The "supply" port of the Seat/Unseat Hydraulic Module is an SAE-16, 1-5/16"-12 UNC straight-threaded O-ring boss. The "supply" tubing must be capable of withstanding 3000 psi working pressure and sized to maintain flow velocities less than 30 ft./sec., i.e., for flows:

GPM	RECOMMENDED MINIMUM TUBING SIZE
Up to 6	3/8"
Up to 12	1/2"
Up to 18	5/8"
Up to 25	3/4"
Up to 45	1"

See Data Sheets for specific individual valve actuator flow demands.

If more than one valve actuator is supplied by this power unit, a summation of simultaneous flows must be considered for tubing size; for example, two actuators each with a flow demand of 12 gpm, would require a 1/2-inch tube if not actuated simultaneously, or a 3/4-inch tube if actuated simultaneously.

- 3.5 From the "tank" port (stamped "TANK") of the Seat/Unseat Hydraulic Module, run suitable tubing to the "tank" or "reservoir" port of the associated power unit (see "Hydraulic Controls Assembly" drawing). The "tank" port of the Seat/Unseat Hydraulic Module is an SAE-16, 1-5/16"-12 UNC straight-threaded O-ring boss. The "tank" tubing must be no smaller than the "supply" tubing, without reservations, and should be capable of handling 1000 psi working pressure.
- 3.6 The following fittings are available from General Valve Company and are recommended for use in leak-proof applications:

AEROQUIP O-RING FITTING COMPONENTS

	For 1" Tube	For 3/4" Tube
Braze ring	GV #76-1204	GV #76-1205
Nut	GV #76-1175	GV #76-1179
Tail piece	GV #76-1176	GV #76-1180
Straight adapter	GV #76-1258	GV #76-1169

The following is a list of available fittings which may be used to connect the SAE-16, 1-5/16"-12 UNC straight-threaded O-ring boss to various tube and pipe sizes:

FITTING	TUBE OR PIPE SIZE
Flodar RBA 1000-16	1" Tube
Flodar R1100-16	1" Pipe
Parker Ferulock 16-16-F5BU	1" Tube
Parker CPI 16-16-ZHBA	1" Tube
Swagelok 16-16-1OST	1" Tube
Weatherhead 7315-16	1" Tube
Imperial 1968-FS-16	1" Tube
Imperial 720-FSO-16-16	1" Pipe
Lenz O-ring Seal A-100-16	1" Tube
SAE 37' Flare MV-MJ-16	1" Tube
SAE 37' Flare MB-MJ-16-12	3/4" Tube
SAE 37' Flare MB-MJ-16-10	5/8" Tube
Generic MB-FP-16	1" Pipe
Generic MP-FP-16-12	3/4" Pipe
Generic MB-FP-16-8	1/2" Pipe

Note: General Valve Company does not recommend pipe thread joints.

- 3.7 Check the available power unit hydraulic oil supply and make sure it is properly filled with a good grade of suitable hydraulic operating media compatible with Buna-N seals. Use a general purpose, extreme-pressure hydraulic fluid conforming to MIL-H-5606. The oil viscosity rating should be 50-200 SSU at 100°F. Use hydraulic fluid equivalent to:

Union	UNAX AW-WR 150 VG 32
Standard of California	No. 9, 10 or 11 E.P. Hyd. Oil
Texaco	Rando H.D. "A"
Shell	Tellus No. 927 or 929
Mobil	DTE-24

- 3.8 Remove the indicator flag and the switch housing cover (see "Operator Assembly" and "Electrical Module Assembly" drawings). Determine which of the two conduit connections is to be used and install the suitable conduit. Plug the unused conduit hole with a 3/4" NPT pipe plug.
- 3.9 Connect the wiring as shown on the "Actuator Electrical Schematic" drawing. Check to ensure the voltage supplied is the same as specified in the Data Sheets (see Section 2.2.1). If the voltage differs, correct this problem before continuing.
- 3.10 On valves with factory installed operators, the switch actuators are tightly secured to the indicator rod (see "Electrical Module Assembly" drawing). If the valve you are installing has such a factory installed operator, you are ready to begin start-up procedures. However, if the switch actuators require adjustment, follow these steps to avoid switch damage:
- 3.10.1 Use a 1/8-inch Allen wrench to loosen both set screws on each switch actuator cube. Note: at some positions of valve travel, these set screws may not be accessible. If this is the case, proceed to the start-up phase and notice at what point the screws become accessible when the valve is being actuated. Then stop the valve actuation, loosen the screws and perform step 3.10.2.
- 3.10.2 Slide all the switch actuators down the indicator rod until they rest atop one another on the hydraulic manifold.
- 3.10.3 Proceed with start-up instructions.

4.0 START-UP INSTRUCTIONS

- 4.1 Allow the associated hydraulic power unit to build up pressure to the supply port of the Seat/Unseat Hydraulic Module (see "Hydraulic Controls Assembly" drawing). Check for leaks (maximum working pressure is 3000 psi; see Data Sheets for minimum working pressure). If leaks occur, bleed pressure off via the hydraulic dump valve in the power unit and retighten or repair; then repressurize and prepare to operate the 4-Way Valve.
- 4.2 Temporarily reinstall the indicator flag *without* the switch housing.
- 4.3 To avoid confusion, never simultaneously open any two or more manual override valves except for the unseat valve and either one of the L-R/CCW or R-L/CW valves.
- 4.4 Referring to the "Electrical Module Assembly" drawing sheet two of two showing various switch actuator positions, determine the position of your valve and familiarize yourself with this drawing and how it relates to the assembly.
- 4.5 To avoid confusion at this point of start-up:
- 4.5.1 *All* four manual override valves (henceforth referred to as "knobs") must be turned fully in the clockwise "stop" direction.
- 4.5.2 *No* electrical power is to be provided to the directional solenoid valves.
- 4.5.3 **IMPORTANT:** If valve position is not known *always* unseat the valve *fully* before quarter turning and *always* quarter turn the valve *fully* before seating.

- 4.6 Locate the knob marked "unseat" in port 4E of the "Seat/Unseat" Module (henceforth referred to as the "larger manifold"). Turn this knob open slowly no more than one counterclockwise revolution. The valve, if not already fully unseated, will slowly move to the fully unseated position.
- 4.7 Leaving the unseat knob open one revolution, also slowly turn the knob marked "divert L-R" in port 3D of the Quarter-turn Module ("small manifold") open no more than two counterclockwise revolutions. The valve, if not already fully diverted L-R/CCW, will slowly move to the "unseated-diverted L-R" position. At the end of quarter-turn travel, close the clockwise "divert L-R" just opened by fully turning it clockwise.
- 4.8 Leaving the unseat knob open one revolution, also slowly turn the divert R-L knob found in port 4B of the "small manifold" open no more than two counterclockwise revolutions. The valve will slowly move to the "unseated-diverted R-L" position. At the end of quarter-turn travel, close the knob marked "divert R-L" just opened by fully turning it clockwise.
- 4.9 As steps 4.7 and 4.8 are repeated, it can be seen that the "rolling switch actuator" (see pages one and two of the "Electrical Module Assembly" drawings) should contact the "unseat switch roller lever actuator". The contact made should maintain the actuated position of the unseat switch during the entire quarter turn. If adjustment to this rolling switch actuator is necessary, do so as follows:
 - 4.9.1 Use a 1/8-inch Allen wrench to loosen both set screws in the cube portion of the rolling switch actuator (if the set screws cannot be accessed, temporarily change the position of the valve). Move the cube up, down, right or left as necessary, until a "click" is heard indicating that the switch has actuated. Be sure it maintains this actuated status during the entire quarter turn. Grasp the cube portion and Allen wrench. *Do not* grasp or press the flexible blade (doing so will cause inaccurate switch adjustment).
 - 4.9.2 Retighten both set screws and repeat 4.7 and 4.8 to assure that switch actuation is maintained during quarter turn.
 - 4.9.3 Proper adjustment should assure that the contact point of the roller mechanism is about 3/8-inch inboard of each edge of the rolling switch actuator.
- 4.10 With the "unseat" knob open as before, divert the valve "R-L/CW" by opening the "divert R-L" knob (no other knobs may be open). When the valve is in the "unseated-diverted R-L" position close both knobs by turning them fully clockwise. All knobs should now be closed.
- 4.11 Locate the knob marked "seat" in port 3C of the larger manifold. Slowly turn this knob open no more than one counterclockwise revolution. The valve will now move to the "seated R-L" position. When fully seated, close the "seat" knob by fully turning the knob clockwise.
- 4.12 The lowest switch on the entire switch bracket ("R-L/CW seated switch") should now be actuated by the "R-L/CW switch actuator". If adjustment is necessary do so as follows:
 - 4.12.1 Use a 1/8-inch Allen wrench to loosen both set screws in the cube portion of the "R-L/CW switch actuator". If the set screws cannot be accessed, temporarily change the position of the valve). Move the cube up, down, right or left as necessary until a "click" is heard indicating that the switch has actuated. Grasp the cube portion and Allen wrench. *Do not* grasp or press the flexible blade (doing so will cause inaccurate switch adjustment).
 - 4.12.2 Retighten both set screws and repeat steps 4.6 and 4.11 to assure that the switch is being actuated properly.

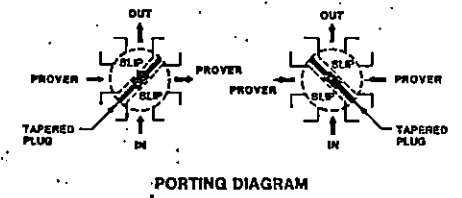
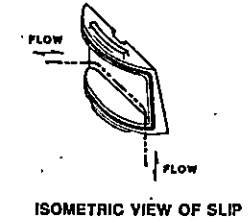
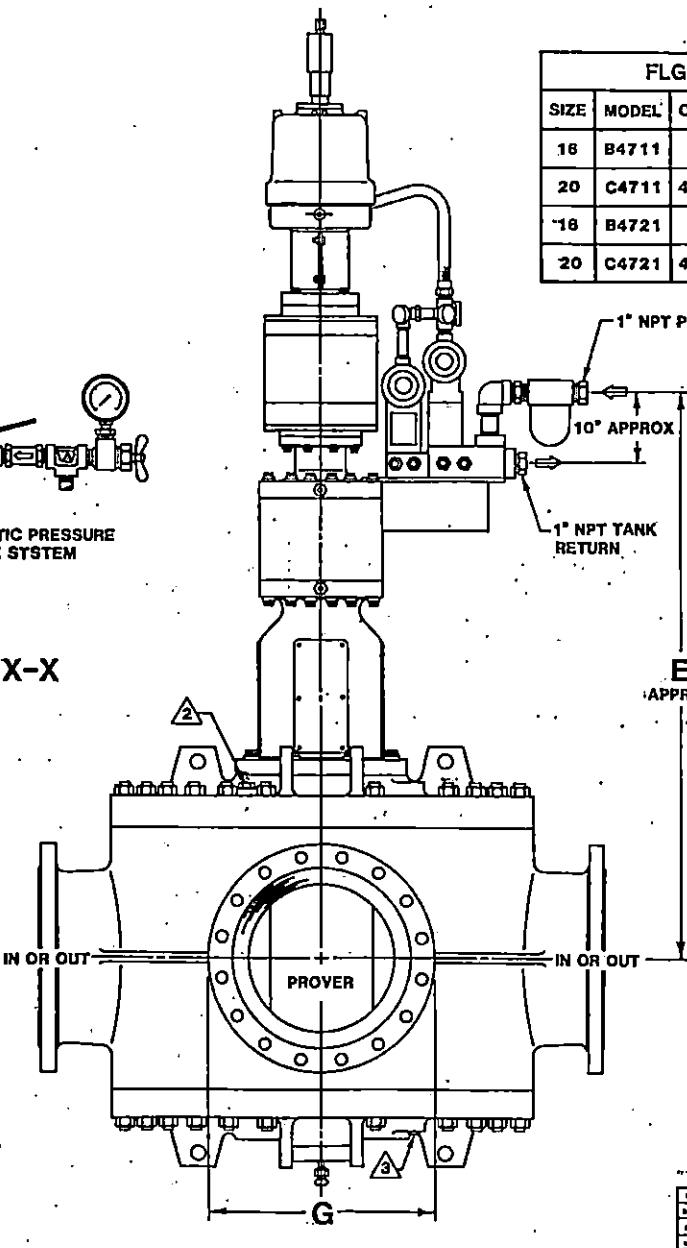
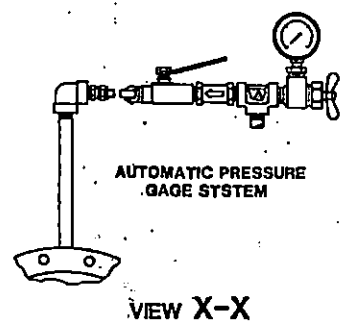
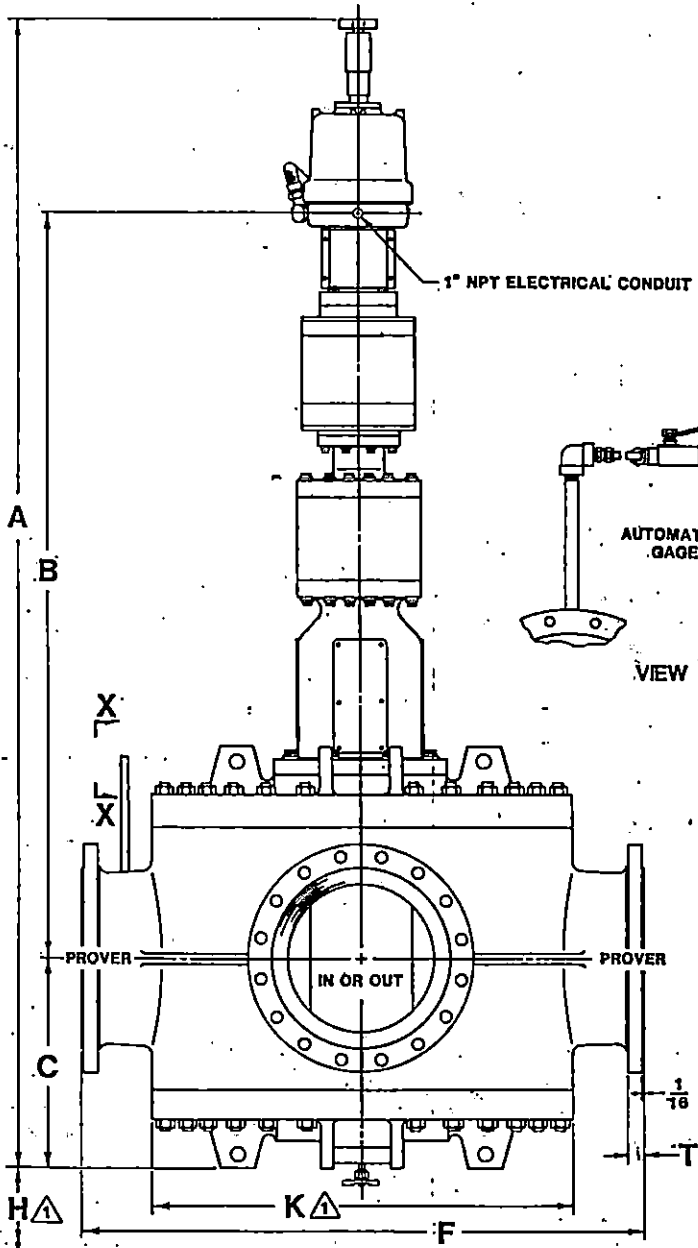
- 4.12.3 Proper adjustment should assure that when the valve is in the "seated L-R/CCW" position, the "R-L/CW actuator" is between the seat coil and "L-R/CCW seated switch" with about 3/32-inch clearance per side (see "Electrical Module Assembly" drawing, sheet two of two, upper right hand view).
- 4.12.4 Proper adjustment should also assure that when the valve is in the "seated R-L/CW" position the lower side of the "R-L/CW switch actuator" cube rests as shown above the manifold. If not, *slightly* bend the actuator and readjust accordingly.
- 4.13 Repeat step 4.6 to unseat the valve. Repeat step 4.7 to divert the valve L-R/CW. Close all knobs.
- 4.14 Slowly open the "seat" knob one revolution counterclockwise to move the valve to the "seated L-R" position. When fully seated, close the "seat" knob by fully turning the knob clockwise.
- 4.15 The "L-R/CW seated switch" should now be actuated by the "L-R/CCW switch actuator" which is located immediately above the "seated R-L/CW switch actuator". If adjustment is necessary, do so as follows:
 - 4.15.1 Use a 1/8-inch Allen wrench to loosen both set screws in the cube portion of the "L-R/CCW switch actuator". (If the set screws cannot be accessed, temporarily change the position of the valve). Move the cube up, down, right or left as necessary until a "click" is heard indicating that the switch has actuated. Grasp the cube portion and Allen wrench. *Do not* grasp or press the flexible blade (doing so will cause inaccurate switch adjustment).
 - 4.15.2 Retighten both set screws and repeat steps 4.6 and 4.14 to assure that the switch is being actuated properly.
 - 4.15.3 When properly adjusted, the "L-R/CCW switch actuator" should clear the unseat coil when the valve is in the "seated R-L/CW" position (see "Electrical Module Assembly" drawing, sheet two of two, upper left hand view).
 - 4.15.4 If the lower two cubes are too close together to allow proper switch actuation (see "Electrical Module Assembly" drawing, sheet two of two, lower left hand view) *slightly* bend the upper actuator down. Readjust accordingly.
- 4.16 Repeat step 4.6 to unseat the valve. Repeat step 4.8 to divert the valve R-L/CW. Close all knobs.
- 4.17 Slowly open the "seat" knob one revolution counterclockwise to move the valve to the "seated R-L" position. When fully seated, close the "seat" knob by fully turning the knob clockwise.
- 4.18 The "R-L/CW switch" which is the lowest switch with a roller mechanism attached, should have been actuated and remain actuated during the entire "seat/unseat R-L/CW vertical travel". If adjustment is necessary do so as follows:
 - 4.18.1 Use a 1/8-inch Allen wrench to loosen both set screws in the cube portion of the "R-L/CW actuator" (if the set screws cannot be accessed, temporarily change the position of the valve). Move the cube right or left as necessary until a "click" is heard, indicating that the switch has actuated. The switch should remain actuated during the entire vertical travel. Grasp the cube portion and Allen wrench. *Do not* grasp the flexible blade (doing so will cause inaccurate switch adjustment).
 - 4.18.2 Retighten both set screws. Unseat the valve by slowly opening the "unseat" knob one turn until fully unseated to assure that switch actuation is maintained during the entire vertical travel. Repeat steps 4.7 and 4.8 and assure that the "R-L/CW switch" is actuated. Close all knobs.

- 4.18.3 Proper adjustment will provide a net fit between the lower "L-R/CCW seated switch actuator cube" and this "R-L/CW switch actuator cube" (see "Electrical Module Assembly" drawing, sheet two of two, lower left hand view).
- 4.18.4 Proper adjustment will also allow about 3/16-inch to upper edge of switch actuator when fully seated. The lower edge distance when fully unseated will vary with valve travel.
- 4.19 Repeat step 4.6 to unseat the valve. Repeat step 4.7 to divert the valve L-R/CCW. Close all knobs.
- 4.20 Slowly open the "seat" knob one revolution counterclockwise to move the valve to the seated L-R position. When fully seated, close the "seat" knob by fully turning the knob clockwise.
- 4.21 The "L-R/CCW switch", the last of the five switches to be discussed, should have been actuated and remained actuated during the entire "seat/unseat L-R/CCW vertical travel". If adjustment is necessary, do so as follows:
- 4.21.1 Use a 1/8-inch Allen wrench to loosen both set screws in the cube portion of the "L-R/CCW actuator" (if the set screws are inaccessible, temporarily change the valve position). Move the cube right or left as necessary until a "click" is heard, indicating that the switch has actuated. The switch should remain actuated during the entire vertical travel. Grasp the cube portion and Allen wrench. *Do not* grasp the flexible blade (doing so will cause inaccurate switch adjustment).
- 4.21.2 Retighten both set screws. Unseat the valve by slowly opening the "unseat" knob one turn until fully unseated to assure that switch actuation is maintained during the entire vertical travel. Repeat steps 4.7 and 4.8 and assure that the "L-R/CW switch is actuated. Close all knobs.
- 4.21.3 Proper adjustment will provide a net fit between the lower "R-L/CW switch actuator cube and this "L-R/CCW switch actuator cube" (see "Electrical Module Assembly" drawing, sheet two of two, lower left hand view).
- 4.21.4 Proper adjustment will also allow about 3/16-inch to upper edge of switch actuator when fully seated. The lower edge distance when fully unseated will vary with valve travel.
- 4.22 Remove the indicator flag and check the explosion-proof switch housing base and mating surface for cleanliness. Insure that the switch housing O-ring is in place and reinstall the housing and indicator flag.
- 4.23 Make sure all four knobs are closed by fully turning them clockwise. After electrically signalling the 4-Way valve to "divert L-R" or "divert R-L", it should now function properly. Start-up is now complete.

4-WAY VALVE W/HYD OPERATOR

FLGD ANSI 150 LB (4711) & 300 LB (4721)

SIZE	MODEL	OPERATOR	A	B	C	E	F	G	H	K	T
18	B4711	4W110	111 $\frac{1}{2}$	72	18 $\frac{1}{2}$	57 $\frac{1}{2}$	60	23 $\frac{1}{2}$	22	35	1 $\frac{1}{2}$
20	C4711	4W110-20	130 $\frac{1}{2}$	79 $\frac{1}{2}$	29 $\frac{1}{2}$	65 $\frac{1}{2}$	62	27 $\frac{1}{2}$	20	60	1 $\frac{3}{4}$
18	B4721	4W110	111 $\frac{1}{2}$	72	18 $\frac{1}{2}$	57 $\frac{1}{2}$	60	25 $\frac{1}{2}$	22	35	2 $\frac{5}{16}$
20	C4721	4W110-20	130 $\frac{1}{2}$	78 $\frac{1}{2}$	29 $\frac{1}{2}$	65 $\frac{1}{2}$	62	30 $\frac{1}{2}$	20	60	2 $\frac{9}{16}$



230-026

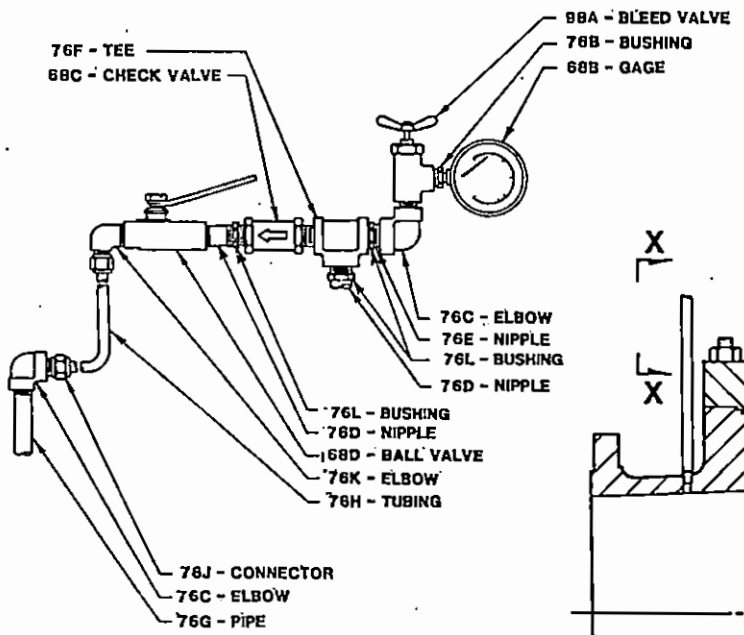
NOTES:

- ▲ MINIMUM CLEARANCE REQUIRED TO REPLACE SLIPS
- ▲ 1" NPT HOLES 90° APART FOR SLIP REMOVAL (20" VALVE ONLY)
- ▲ 1/2" NPT DRAIN HOLE

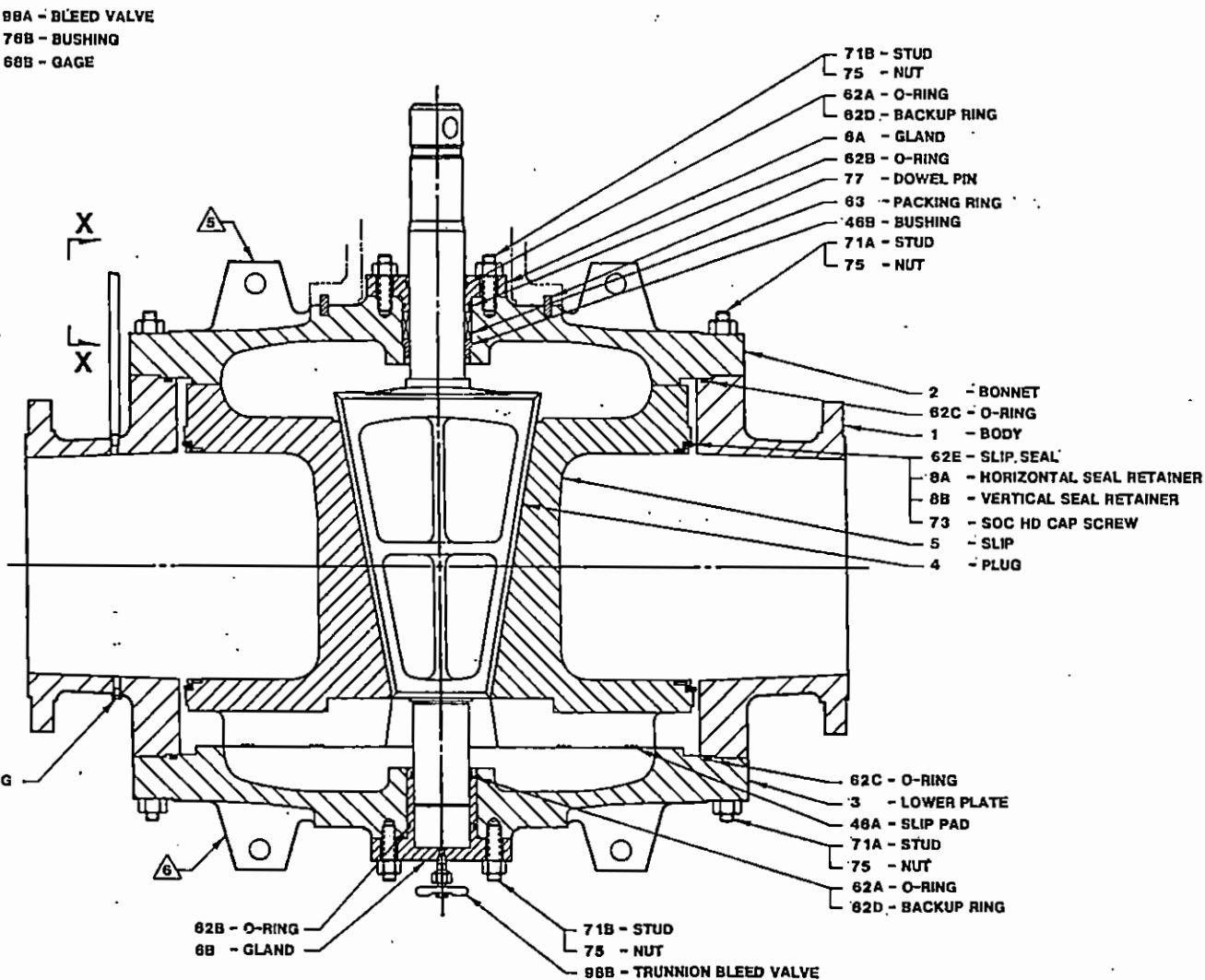
DATE	LD	10-15-70	ALL DIMENSIONS ARE IN INCHES
DATE	GM	10-19-70	
DATE			DO NOT SCALE DWG.

GENERAL VALVE COMPANY 871 SO. PLACENTIA AVE. FULLERTON, CALIFORNIA 92708			
TITLE	20	C4721	KO-095
	18	B4721	KO-110
	20	C4711	KO-211
	18	B4711	KO-117
DATE	BY	UNLESS	NOTED
230-026			

REV	DATE	BY
N/C	1/13/83	CO 8438
A	1-28-81	CO 884m
B	4-2-81	CO 8403



VIEW X-X



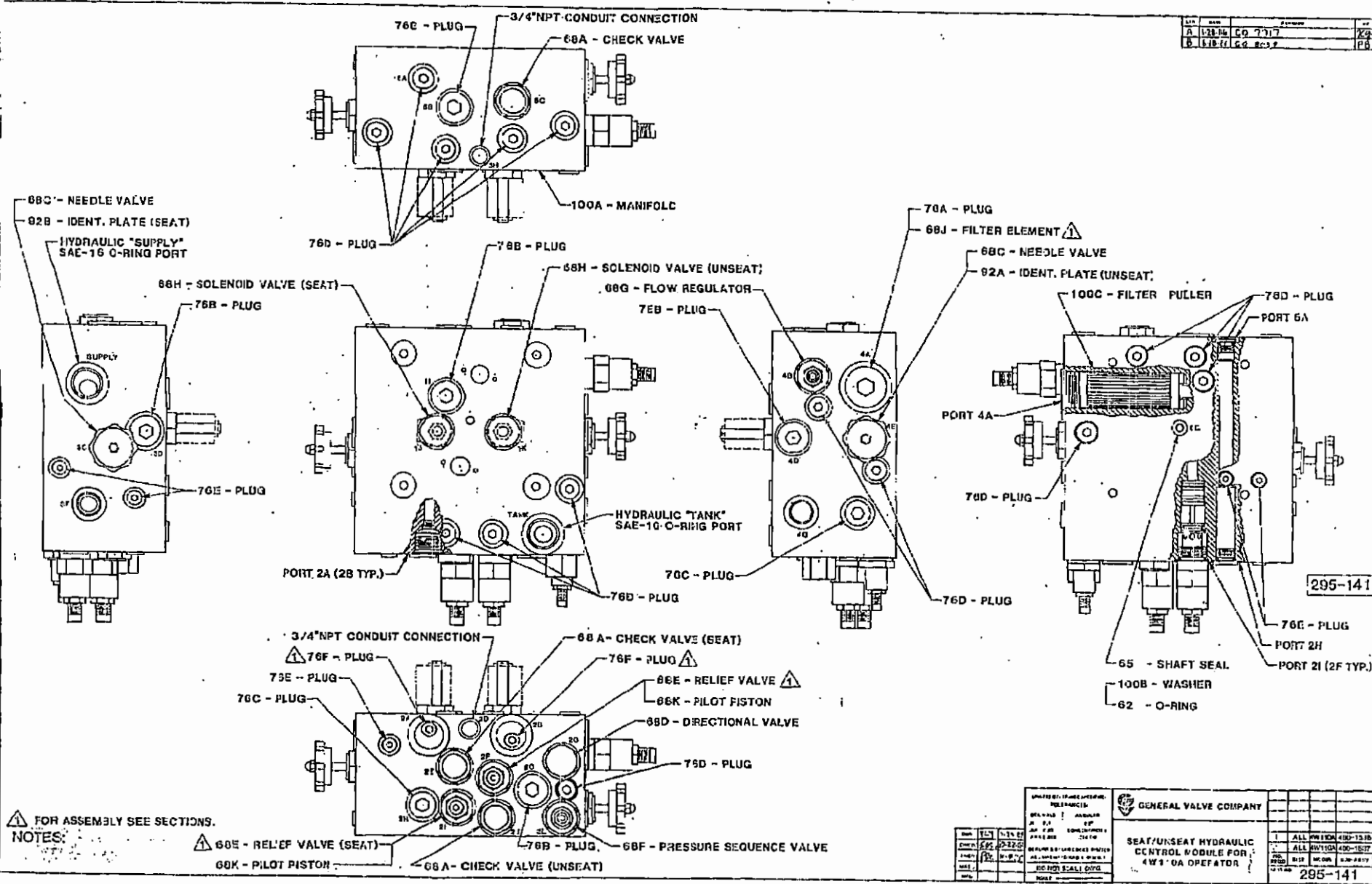
225-006

NOTES:

1. ASSEMBLY & TEST PROCEDURES PER GVP 105
 2. TORQUE ALL THREADED FASTENERS PER GVS 223
 3. APPLY LUBRICATION PER GVMP5 4003
 4. FOR VALVE TRAVEL & CLEARANCES SEE GVS 123
- ⚠ FOR BONNET MADE FROM PLATE, 95A - LIFTING LUG, 71C - STUD & 75 - NUT ARE REQUIRED
- ⚠ FOR LOWER PLATE MADE FROM PLATE, 95B - SUPPORT, 71D - STUD & 75 - NUT ARE REQUIRED

DATE: 1-13-83 DRAWN: CM CHECKED: [blank] APPROVED: [blank]		TITLE: ASSEMBLY DRAWING 4-WAY DIVERTER VALVE FLOW ANSI 150 LB (4711) & 300 LB (4721)	GENERAL VALVE COMPANY 16 84721 400-1121 16 84711 400-1124 225-006
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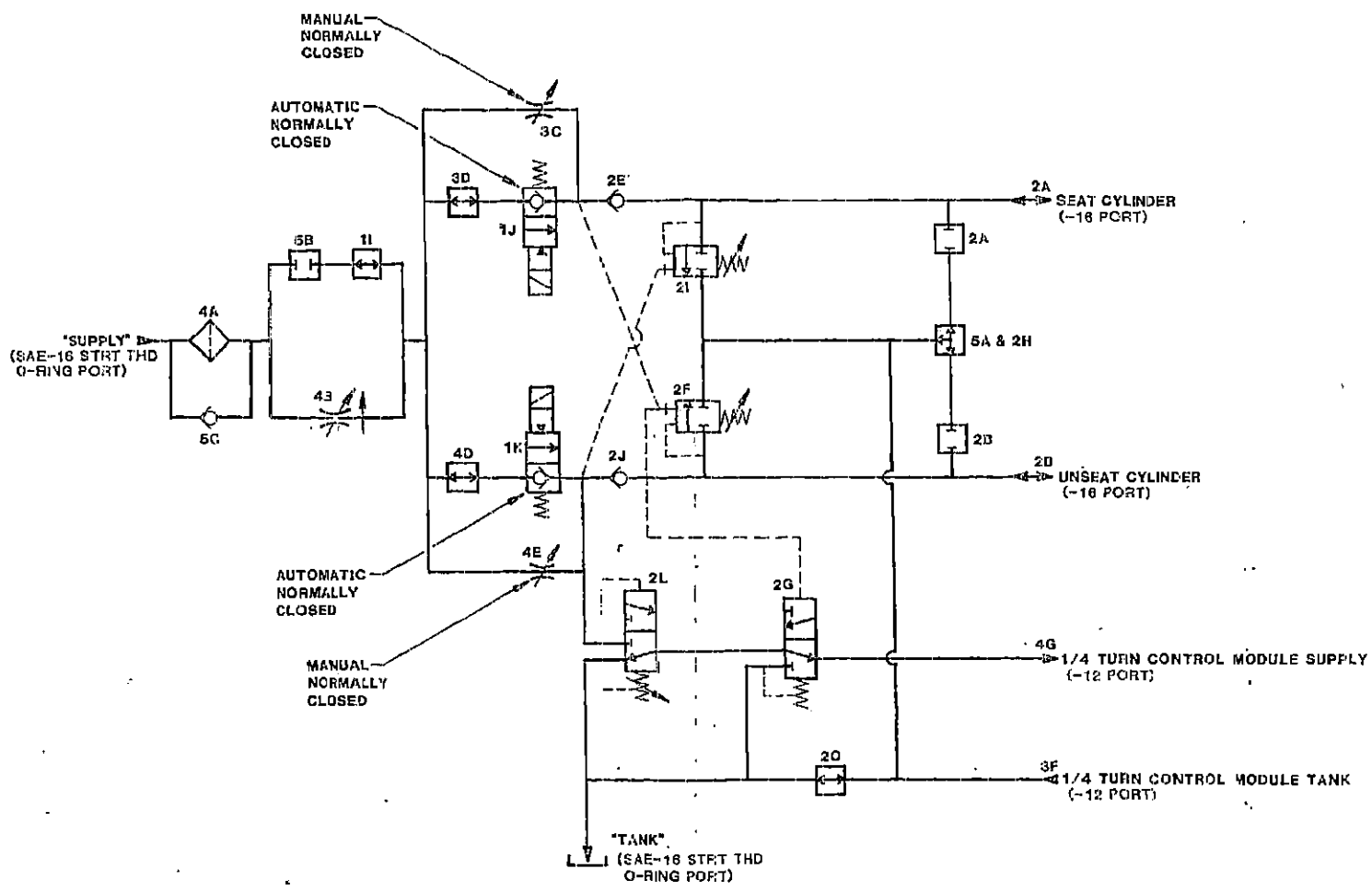
REV.	DATE	DESCRIPTION	BY
A	12/8/46	CD 7317	PG
B	5/18/47	EG 8037	PG



FOR ASSEMBLY SEE SECTIONS.
NOTES:

- ▲ 68E - RELIEF VALVE (SEAT)
- 68K - PILOT PISTON
- ▲ 68F - RELIEF VALVE (UNSEAT)
- 68A - CHECK VALVE (UNSEAT)

GENERAL VALVE COMPANY			295-141
SEAT/UNSEAT HYDRAULIC CONTROL MODULE FOR 4W10A OPERATOR			295-141



290-104

2 NEAR EACH HYDRAULIC SYMBOL APPEARS A NUMBER & LETTER WHICH CORRESPONDS TO PORTS STAMPED SIMILARLY ON THE HYDRAULIC MANFOLD 100-869.

1. DEFINITIONS OF NON-STANDARD HYDRAULIC SYMBOLS:

- CAVITY PLUG (HALT FLOW)
- OR PORT PLUG (FREE FLOW)

NOTES: UNLESS OTHERWISE SPECIFIED.

DWN:	TCY	4-18-85
CHKD:	GAIS	11-22-85
ENGR:	RLC	11-4-85
MATL:		
MFG:		

UNLESS OTHERWISE SPECIFIED TOLERANCES:

DECIMALS: ANGULAR

X .01 1/16"

XX .005 1/32"

XXX .002 1/64"

OR BURR & BREAK EDGES STRENGTHEN

ALL MACHINED RADII .0150"

DO NOT SCALE DW'G.

SCALE: _____

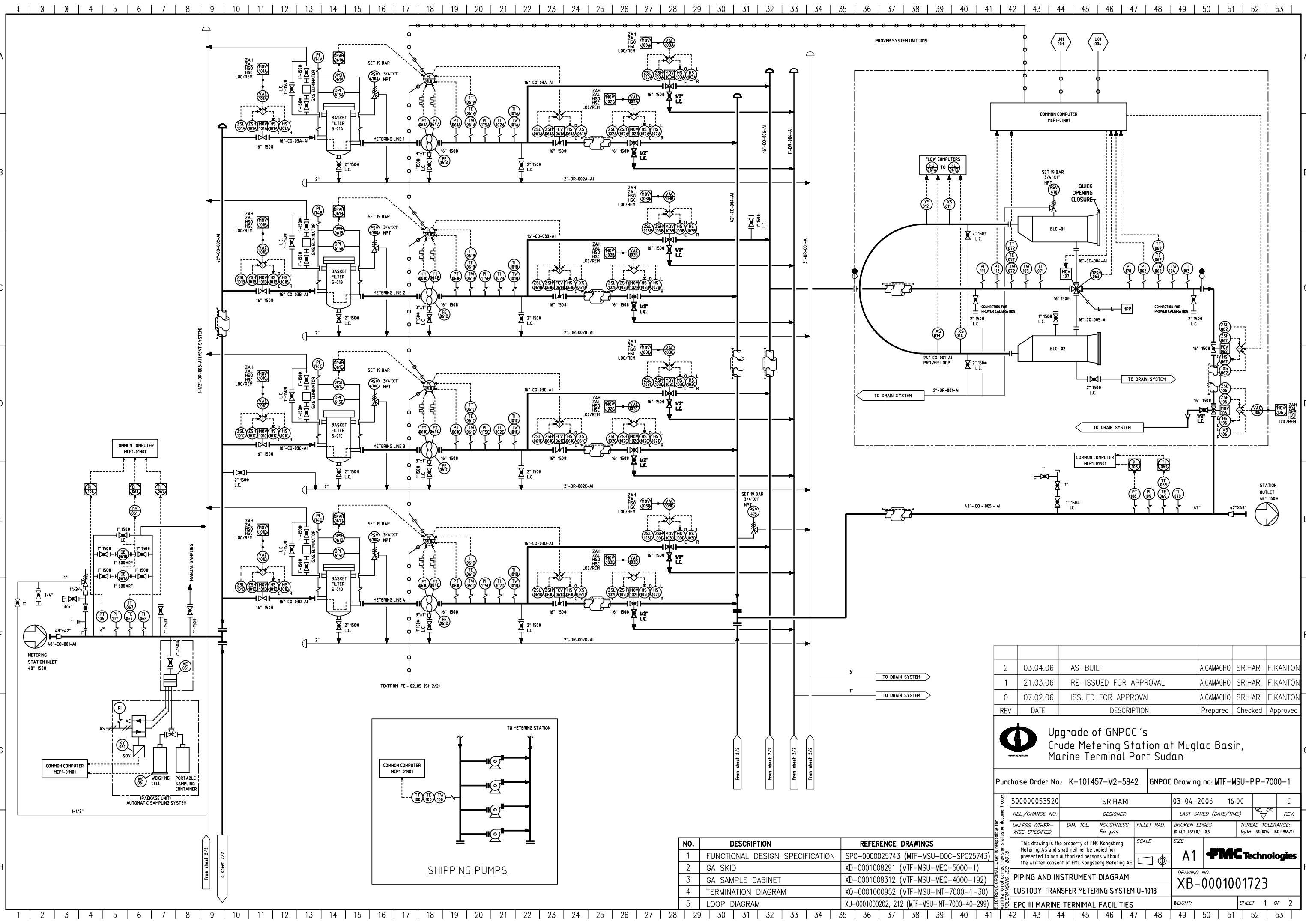
GENERAL VALVE COMPANY

SCHEMATIC:

VERTICAL ACTUATOR, HYDRAULIC

FAIL AS IS, 1 SPD, 1 PR-A, HMD.

NO.	1	19	HW10A	
SIZE				
MODEL				
QUD-ASSY				
PART NO.	290-104			



REV	DATE	DESCRIPTION	Prepared	Checked	Approved
2	03.04.06	AS-BUILT	A.CAMACHO	SRIHARI	F.KANTON
1	21.03.06	RE-ISSUED FOR APPROVAL	A.CAMACHO	SRIHARI	F.KANTON
0	07.02.06	ISSUED FOR APPROVAL	A.CAMACHO	SRIHARI	F.KANTON

Upgrade of GNPOC's Crude Metering Station at Muglad Basin, Marine Terminal Port Sudan

Purchase Order No.: K-101457-M2-5842 GNPOC Drawing no: MTF-MSU-PIP-7000-1

500000053520	SRIHARI	03-04-2006	16:00	C	
REL./CHANGE NO.	DESIGNER	LAST SAVED (DATE/TIME)		NO. OF REV.	
UNLESS OTHERWISE SPECIFIED	DIM. TOL.	ROUGHNESS Ra μm:	FILLET RAD.	BROKEN EDGES (R ALT. 45° 0.1 - 0.5)	THREAD TOLERANCE: 6g/6H (NS 1874 - ISO 9965/1)
This drawing is the property of FMC Kongsberg Metering AS and shall neither be copied nor presented to non authorized persons without the written consent of FMC Kongsberg Metering AS			SCALE	SIZE	
PIPING AND INSTRUMENT DIAGRAM			A1	FMC Technologies	
CUSTODY TRANSFER METERING SYSTEM U-1018			DRAWING NO. XB-0001001723		
EPC III MARINE TERMINAL FACILITIES			WEIGHT:	SHEET 1 OF 2	

NO.	DESCRIPTION	REFERENCE DRAWINGS
1	FUNCTIONAL DESIGN SPECIFICATION	SPC-0000025743 (MTF-MSU-DOC-SPC25743)
2	GA SKID	XD-0001008291 (MTF-MSU-MEQ-5000-1)
3	GA SAMPLE CABINET	XD-0001008312 (MTF-MSU-MEQ-4000-192)
4	TERMINATION DIAGRAM	XQ-0001000952 (MTF-MSU-INT-7000-1-30)
5	LOOP DIAGRAM	XU-0001000202, 212 (MTF-MSU-INT-7000-40-299)

