

<h3>VALVE SYMBOLS</h3>	<h3>GENERAL SYMBOLS</h3>	<h3>GENERAL SYMBOLS</h3>	<h3>GENERAL SYMBOLS</h3>	<h3>GENERAL SYMBOLS</h3>	<h3>INSTRUMENT IDENTIFICATION</h3> <table border="0"> <tr> <td>A ANALYSIS</td> <td>A ALARM</td> </tr> <tr> <td>B BURNER, COMBUSTION</td> <td>C CONTROLLER</td> </tr> <tr> <td>C REFLECTIVITY</td> <td>D DIFFERENTIAL</td> </tr> <tr> <td>D THICKNESS</td> <td>E PRIMARY ELEMENT</td> </tr> <tr> <td>E VOLTAGE (EMF)</td> <td>FFC FEED FORWARD</td> </tr> <tr> <td>F FLOW</td> <td>G GAGE</td> </tr> <tr> <td>G GAUGING</td> <td>H HIGH</td> </tr> <tr> <td>H HAND</td> <td>I INDICATOR</td> </tr> <tr> <td>I CURRENT, INTERLOCK</td> <td>J SCANNING</td> </tr> <tr> <td>J POWER</td> <td>L LOW</td> </tr> <tr> <td>K TIME OR TIME SCHEDULE</td> <td>D DRIFICE (RESTRICTION)</td> </tr> <tr> <td>L LEVEL</td> <td>R RECORD OR PRINT</td> </tr> <tr> <td>M MOISTURE</td> <td>S SWITCH SAFETY OR SHUTDOWN</td> </tr> <tr> <td>N USERS CHOICE</td> <td>T TRANSMITTER</td> </tr> <tr> <td>P PRESSURE OR VACUUM</td> <td>V VALVE DAMPER OR LOUVER</td> </tr> <tr> <td>Q QUANTITY OR EVENT</td> <td>W WELL</td> </tr> <tr> <td>S SPEED OR FREQUENCY</td> <td>X UNCLASSIFIED</td> </tr> <tr> <td>T TEMPERATURE</td> <td>Y RELAY</td> </tr> <tr> <td>U UNCLASSIFIED/MULTI-VARIABLE</td> <td></td> </tr> <tr> <td>V VISCOSITY</td> <td></td> </tr> <tr> <td>W WEIGHT</td> <td></td> </tr> <tr> <td>X UNCLASSIFIED</td> <td></td> </tr> <tr> <td>Z POSITION</td> <td></td> </tr> </table>	A ANALYSIS	A ALARM	B BURNER, COMBUSTION	C CONTROLLER	C REFLECTIVITY	D DIFFERENTIAL	D THICKNESS	E PRIMARY ELEMENT	E VOLTAGE (EMF)	FFC FEED FORWARD	F FLOW	G GAGE	G GAUGING	H HIGH	H HAND	I INDICATOR	I CURRENT, INTERLOCK	J SCANNING	J POWER	L LOW	K TIME OR TIME SCHEDULE	D DRIFICE (RESTRICTION)	L LEVEL	R RECORD OR PRINT	M MOISTURE	S SWITCH SAFETY OR SHUTDOWN	N USERS CHOICE	T TRANSMITTER	P PRESSURE OR VACUUM	V VALVE DAMPER OR LOUVER	Q QUANTITY OR EVENT	W WELL	S SPEED OR FREQUENCY	X UNCLASSIFIED	T TEMPERATURE	Y RELAY	U UNCLASSIFIED/MULTI-VARIABLE		V VISCOSITY		W WEIGHT		X UNCLASSIFIED		Z POSITION		<h3>GENERAL ABBREVIATIONS</h3> <table border="0"> <tr> <td>C CONVECTION (VACUUM GAUGE)</td> </tr> <tr> <td>CC COLD CATHODE</td> </tr> <tr> <td>CM CAPACITANCE MANDRIVER</td> </tr> <tr> <td>FC FAIL CLOSED</td> </tr> <tr> <td>FL FAIL LAST</td> </tr> <tr> <td>FO FAIL OPEN</td> </tr> <tr> <td>F&P FURNISHED & PIPED</td> </tr> <tr> <td>GR GRADE</td> </tr> <tr> <td>IA INSTRUMENT AIR</td> </tr> <tr> <td>IG INSTRUMENT GAS</td> </tr> <tr> <td>LC LOCKED CLOSED</td> </tr> <tr> <td>LO LOCKED OPEN</td> </tr> <tr> <td>NC NORMALLY CLOSED</td> </tr> <tr> <td>NO NORMALLY OPEN</td> </tr> <tr> <td>PO PUMP OUT CONN.</td> </tr> <tr> <td>SS START/STOP SWITCH</td> </tr> </table>	C CONVECTION (VACUUM GAUGE)	CC COLD CATHODE	CM CAPACITANCE MANDRIVER	FC FAIL CLOSED	FL FAIL LAST	FO FAIL OPEN	F&P FURNISHED & PIPED	GR GRADE	IA INSTRUMENT AIR	IG INSTRUMENT GAS	LC LOCKED CLOSED	LO LOCKED OPEN	NC NORMALLY CLOSED	NO NORMALLY OPEN	PO PUMP OUT CONN.	SS START/STOP SWITCH
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TYPICAL LINE NUMBER

4-4-GN2-01-1B1-4-HC-FP4

LINE SIZE
SEQUENTIAL NO.
INSULATION THICKNESS
INSULATION MATERIAL CODE
INSULATION CODE
PIPING SPEC. DESIGNATION
FLUID SERVICE

*** IF NO INSULATION MATERIAL CODE APPEARS IN THE LINE NUMBER THEN IT SHALL BE UNDERSTOOD THAT NO INSULATION IS REQUIRED.

FLUID SERVICE CODES

CA CLASS 100 CLEAN AIR	PG PROCESS GAS
CVD COOLING WATER DRAIN	PL PROCESS LIQUID
CVR COOLING WATER RETURN	PV PROCESS VACUUM
CWS COOLING WATER SUPPLY	PX PROCESS TWO-PHASE (LIQ/VAP)
DB DRAIN TO/FROM BLOWDOWN SYSTEM	SVR SEAL WATER RETURN
DC DRAIN CLOSED	SVS SEAL WATER SUPPLY
DM DRAIN TO MANIFOLD	VA VENT AND RELIEF TO ATMOSPHERE
DO DRAIN OPEN	VM VENT TO MANIFOLD
GN2 GASEOUS NITROGEN	VR VENT AND RELIEF TO RECOVERY
LN2 LIQUID NITROGEN	WT WATER
N NITROGEN	

DETAIL D
TYPICAL ELECTRONIC MOTOR OPERATED GATE VALVE CONTROL (EV)

PIPING SPECIFICATION DESIGNATION

1ST FIRST DIGIT IDENTIFIERS
1 = 150# ANSI

2ND SECOND DIGIT IDENTIFIERS
A = CARBON STEEL GENERAL MATERIAL
B = 304 STAINLESS STEEL GENERAL MATERIAL
C = TYPE L COPPER TUBING
T = STAINLESS STEEL TUBING

3RD THIRD DIGIT IDENTIFIERS
1 = CRYOGENIC
2 = GENERAL PROCESS
3 = PROCESS VACUUM
4 = ULTRA HIGH VACUUM
5 = CLASS 100 CLEAN AIR

INSULATION CODES

HC HOT AND COLD
C COLD CONSERVATION
PC PERSONNEL PROTECTION COLD
PH PERSONNEL PROTECTION HOT
VJ VACUUM JACKETED

INSULATION MATERIAL CODES

F15' 1.5' FIBERGLASS
P POLYISOCYANURATE
FP3' 1' FIBERGLASS INNER 2' POLYISOCYANURATE OUTER
FP3.5' 1' FIBERGLASS INNER 2.5' POLYISOCYANURATE OUTER
FP4' 1' FIBERGLASS INNER 3' POLYISOCYANURATE OUTER
PC3' 3' POLYISOCYANURATE

ION PUMP CONTROLS (TYP.)

DETAIL E
TYPICAL LARGE ION PUMP CONTROLS (2500 L/S)

DETAIL F
TYPICAL SMALL ION PUMP CONTROLS (70 L/S & 25 L/S)

SELF-ACTUATED DEVICES

TEMPERATURE REGULATOR
PRESSURE SAFETY RELIEF VALVE

VALVE ACTUATOR SYMBOLS

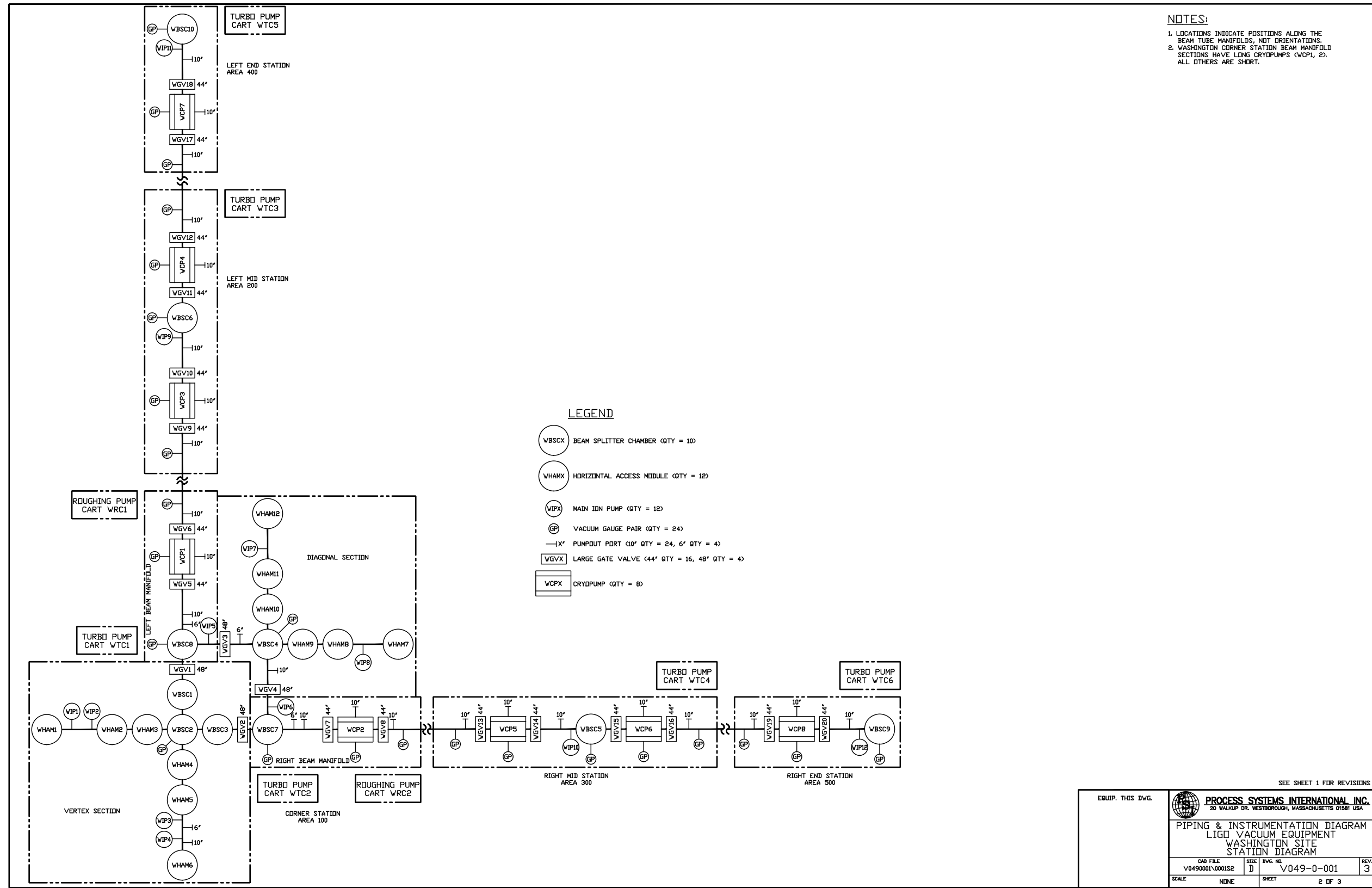
DIAPHRAGM
ELECTRONIC MOTOR
SOLENOID W/ MANUAL RESET
PISTON

DETAIL A
TYPICAL ON/OFF ACTUATED VALVE (XV) INSTRUMENTATION SCHEME

DETAIL B
TYPICAL CONTROL VALVE (XCV) INSTRUMENTATION SCHEME

DETAIL C
TYPICAL MANUAL VALVE INSTRUMENTATION SCHEME

<p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: ANGULAR: 45°-90° BEND: 45° TWO PLACE DECIMAL: ±.005 FINISHED SURFACE: RING BREAK: CONES: IN REMOVE ALL BURRS</p>				<p>3 AS-BUILT</p>		<p>LD 08.25.98 0628</p>		<p>PROCESS SYSTEMS INTERNATIONAL, INC. 20 WALKUP DR. WESTBOROUGH, MASSACHUSETTS 01581 USA</p>	
<p>DO NOT SCALE THIS DRAWING</p>				<p>P1 PRELIMINARY DESIGN UPDATE</p>		<p>REB TS RT SM DMcV R/JW 10.25.96 0309</p>		<p>PIPING & INSTRUMENTATION DIAGRAM LIGD VACUUM EQUIPMENT LEGEND</p>	
<p>USED ON</p>				<p>REV DESCRIPTION</p>		<p>CHKD DRWN DATE DECN</p>		<p>CAD FILE: V0490001.0001S1 SCALE: NONE</p>	
<p>NEXT ASS'Y</p>				<p>REV DESCRIPTION</p>		<p>CHKD DRWN DATE DECN</p>		<p>SHEET: 1 OF 3</p>	



NOTES:
 1. LOCATIONS INDICATE POSITIONS ALONG THE BEAM TUBE MANIFOLDS, NOT ORIENTATIONS.
 2. WASHINGTON CORNER STATION BEAM MANIFOLD SECTIONS HAVE LONG CRYOPUMPS (WCP1, 2). ALL OTHERS ARE SHORT.

LEGEND

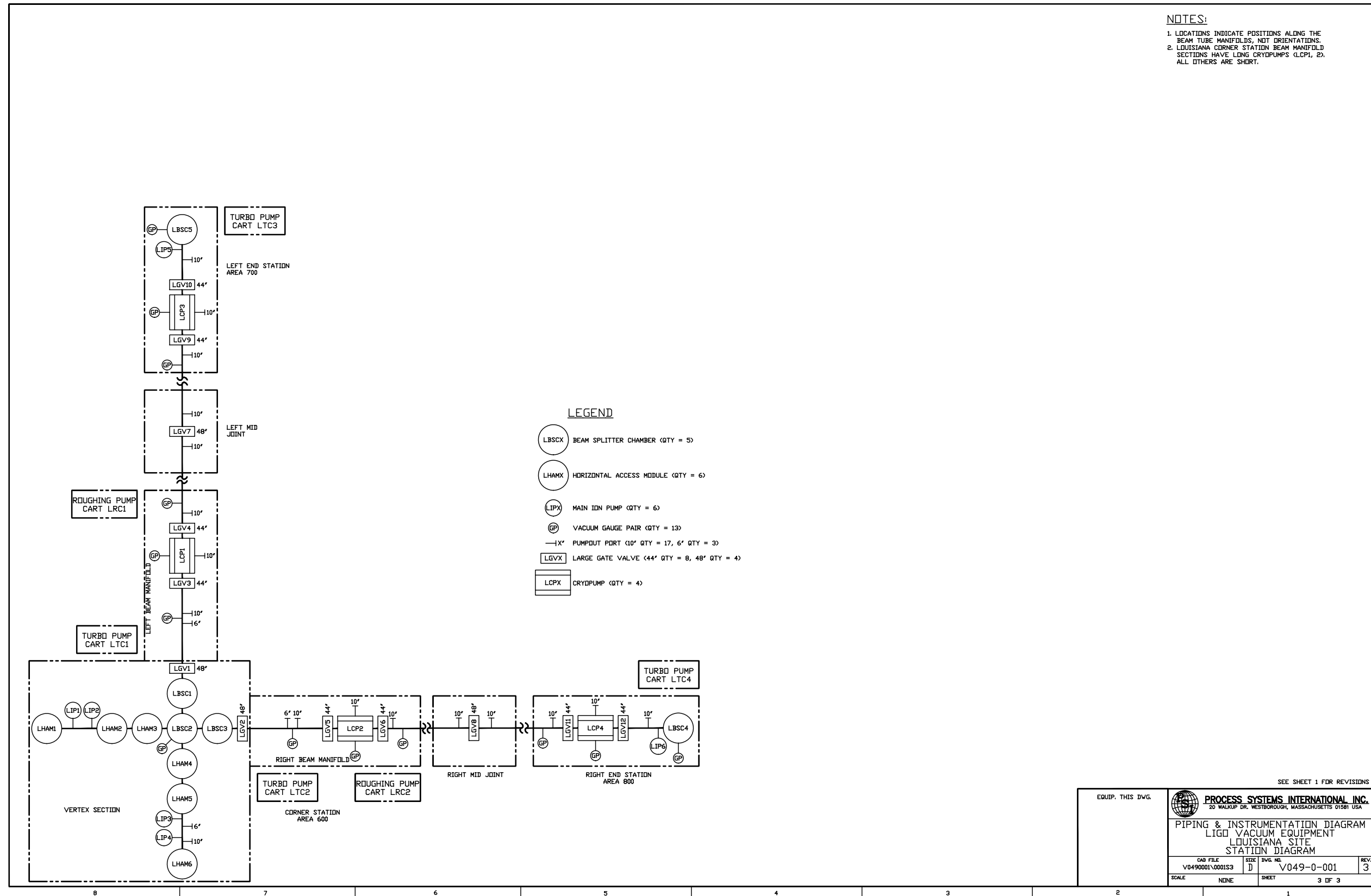
- WBSCX BEAM SPLITTER CHAMBER (QTY = 10)
- WHAMX HORIZONTAL ACCESS MODULE (QTY = 12)
- VIPX MAIN ION PUMP (QTY = 12)
- VGP VACUUM GAUGE PAIR (QTY = 24)
- X' PUMP/OUT PORT (10' QTY = 24, 6' QTY = 4)
- WGVX LARGE GATE VALVE (44' QTY = 16, 48' QTY = 4)
- WCPX CRYOPUMP (QTY = 8)

SEE SHEET 1 FOR REVISIONS

EQUIP. THIS DWG.		PROCESS SYSTEMS INTERNATIONAL INC. <small>20 WALKUP DR. WESTBOROUGH, MASSACHUSETTS 01581 USA</small>	
PIPING & INSTRUMENTATION DIAGRAM LIGO VACUUM EQUIPMENT WASHINGTON SITE STATION DIAGRAM			
CAD FILE	SIZE	DWG. NO.	REV.
V0490001.0001S2	D	V049-0-001	3
SCALE	NONE	SHEET	2 OF 3

NOTES:

1. LOCATIONS INDICATE POSITIONS ALONG THE BEAM TUBE MANIFOLDS, NOT ORIENTATIONS.
2. LOUISIANA CORNER STATION BEAM MANIFOLD SECTIONS HAVE LONG CRYOPUMPS (LCP1, 2). ALL OTHERS ARE SHORT.



LEGEND

- LBSCX BEAM SPLITTER CHAMBER (QTY = 5)
- LHAMX HORIZONTAL ACCESS MODULE (QTY = 6)
- LIPX MAIN ION PUMP (QTY = 6)
- GP VACUUM GAUGE PAIR (QTY = 13)
- X PUMPOUT PORT (10" QTY = 17, 6" QTY = 3)
- LGVX LARGE GATE VALVE (44" QTY = 8, 48" QTY = 4)
- LCPX CRYOPUMP (QTY = 4)

SEE SHEET 1 FOR REVISIONS

EQUIP. THIS DVG.		PROCESS SYSTEMS INTERNATIONAL INC. 20 WALKUP DR. WESTBOROUGH, MASSACHUSETTS 01581 USA	
PIPING & INSTRUMENTATION DIAGRAM LIGO VACUUM EQUIPMENT LOUISIANA SITE STATION DIAGRAM			
CAD FILE	SIZE	DWG. NO.	REV.
V0490001\0001S3	D	V049-0-001	3
SCALE	NONE	SHEET	3 OF 3