

## MECHANICAL AND INSTRUMENTATION LIST

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## MODIFICATIONS RECORDING

ISSUE OF MODIF	DATE	WRITTEN BY	CHECKED BY	EVOLUTION OF THE DOCUMENT (Updated pages)	JUSTIFICATION OF THE MODIFICATION
Note: Recording of modifications are included in document					

**Upper Cold Box Mechanical**

Tag	Sheet #	Sheet Location	Fluid Service	Type	Description	Line Size	Device Size	Device Connection	Sizing and Selection Requirements						Manufacturer	Manufacturer Model #	Remarks	
						[NPS]	[NPS]		p (in)	p (out)	T	w	Δp	C <sub>v</sub>				Set Press
									[atm]	[atm]	[K]	[g/s]	[atm]	[Full Open]				[psig]
<b>Warm Proportional Valves</b>																		
PV-22400	6	D10	He	Globe	HX-1B HP inlet valve	6	6	6" CL 300 - 32 RMS	18.50	18.44	310	600	0.06	289.00	Flowsolve	Valtek GS / Globe / Three-Flange		
PV-22402	6	F8	He	Globe	HX-1A HP inlet valve	6	6	6" CL 300 - 32 RMS	18.50	18.44	310	600	0.06	289.00	Flowsolve	Valtek GS / Globe / Three-Flange		
PV-22405	6	J6	He	Globe	Bearing Gas Tank Supply Valve	1 1/2	1 1/2	1-1/2" CL 300 - 32 RMS	18.50	12.00	310	30	6.50	11.6	Flowsolve	Valtek GS / Globe / Three-Flange		
<b>Cryogenic Proportional Valves</b>																		
PV-22110	7	F20	He	Angle	Cooldown valve - 300K stage	4	3	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029						PHPK	HPV-80-E-30-A-B-NON		
PV-22115	7	I19	He	Angle	Cooldown valve - 80K stage	2	2	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029						PHPK	HPV-80-E-20-A-B-NON		
PV-22415A	8	E11	He	Angle	80K adsorber A inlet valve	5	4	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029						PHPK	HPV-80-E-40-A-B-NON		
PV-22415B	8	E14	He	Angle	80K adsorber B inlet valve	5	4	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029						PHPK	HPV-80-E-40-A-B-NON		
PV-22420A	8	L11	He	Angle	80K adsorber A outlet valve	5	4	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029						PHPK	HPV-80-E-40-A-B-NON		
PV-22420B	8	L14	He	Angle	80K adsorber B outlet valve	5	4	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029						PHPK	HPV-80-E-40-A-B-NON		
PV-22421	8	I12	He	Angle	80K adsorbers bypass valve	5	3	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029						PHPK	HPV-80-E-30-A-B-NON		
PV-22520	7	I6	He	Angle	LN2 supply valve	1	1	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029						PHPK	HPV-80-E-10-A-B-NON		
<b>Relief Valves</b>																		
PSV-22104	6	J20	He	Angle	LPL Relief Valve			2" x 3" CL 150					70 PSIG	Flow Safe	S84JE-02RF1-03RF1-SS-SS-TT	"J" Orifice size		
PSV-22204	6	I20	He	Angle	LPR Relief Valve			1-1/2" x 2" CL 150					145 PSIG	Flow Safe	S84FD-15RF1-02RF1-SS-SS-TT	"F" Orifice size		
PSV-22403	6	N4	He	Angle	Bearing Gas Tank Relief Valve			1/2" x 1/2" CL 300					320 PSIG	Flow Safe	S841M-05RF2-05RF2-SS-SS-TT	"1" Orifice size		
PSV-22404	6	H20	He	Angle	HP Relief Valve			1-1/2" x 2" CL 300					320 PSIG	Flow Safe	S846B-15RF2-02RF2-SS-SS-TT	"6" Orifice size		
PSV-22421	8	L6	He	Angle	Cryoduct HP Line Relief Valve			1" x 1" CL 300					320 PSIG	Flow Safe	S848B-01RF2-01RF2-SS-SS-TT	"8" Orifice size		
PSV-22510	7	G3	N2	Angle	LN2 Phase separator Relief Valve			1-1/2" x 2" CL 150					145 PSIG	Flow Safe	S846B-15RF1-02RF1-SS-SS-TT	"6" Orifice size		
PSV-22520	7	H3	N2	Angle	LN2 inlet interface Relief Valve			3/4" x 1" CL 150					145 PSIG	Flow Safe	S842M-34RF1-01RF1-SS-SS-TT	"2" Orifice size		
PSV-23100	21	E10	He	Angle	Valve Rack 1121 Relief Valve			1/2" x 1/2" CL 300					320 PSIG	Flow Safe	S841M-05RF2-05RF2-SS-SS-TT	"1" Orifice size		
PSV-23200	20	F5	He	Angle	Valve Rack 1120 Relief Valve			1/2" x 1/2" CL 300					320 PSIG	Flow Safe	S841M-05RF2-05RF2-SS-SS-TT	"1" Orifice size		
PSV-23717A	8	E7	He	Angle	80K Ads A Relief Valve			1-1/2" x 2" CL 300					320 PSIG	Flow Safe	S846B-15RF2-02RF2-SS-SS-TT	"6" Orifice size		
PSV-23717B	8	E6	He	Angle	80K Ads B Relief Valve			1-1/2" x 2" CL 300					320 PSIG	Flow Safe	S846B-15RF2-02RF2-SS-SS-TT	"6" Orifice size		
<b>Manual Valves</b>																		
MV-22100	6	C15	He	Butterfly	LPL Isolation valve	12	12	12" CL 150 Std Serr	4.76		310			5100	Jamesbury	12" 815LHVC-11-22HBXZ/M10-Q w/ QX33B02SDM Limit Switches High vacuum certified, cleaned, and degreased		
MV-22101	6	H15	He	Ball	LPL Pressurization valve	1	1	1" Soc Weld	4.76		310			44	Jamesbury	4CBV3636XTB1		
MV-22200	6	E12	He	Butterfly	LPR Isolation Valve	8	8	8" CL 150 Std Serr	9.86		310			2200	Jamesbury	8" 815LHVC-11-22HBXZ/M10-Q w/ QX33B02SDM Limit Switches High vacuum certified, cleaned, and degreased		
MV-22201	6	H12	He	Ball	LPR Pressurization valve	1	1	1" Soc Weld	9.86		310			44	Jamesbury	1-4CBV3636XTB2		
MV-22401	6	H10	He	Ball	HP-B Pressurization valve	1	1	1" Soc Weld	21.8		310			44	Jamesbury	1-4CBV3636XTB2		
MV-22407	6	H8	He	Ball	HP-A Pressurization valve	1	1	1" Soc Weld	21.8		310			44	Jamesbury	1-4CBV3636XTB2		
MV-22512	7	M3	N2	Globe	LN2 Drain valve	1	1	1" Butt Weld	9.86		80			14	Rego	SK9408BW	Non Jacketed SST Cryovalve	
MV-22438A	8	L5	He	Globe	80K Adsorber A drying inlet valve	1	1	1" Soc Weld	21.8		80			14	Rego	SK9408BW	Non Jacketed SST Cryovalve	
MV-22438B	8	L5	He	Globe	80K Adsorber B drying inlet valve	1	1	1" Soc Weld	21.8		80			14	Rego	SK9408BW	Non Jacketed SST Cryovalve	
<b>Filters</b>																		
F-22400A	6	F6	He	100 Mesh	HP Inlet - Wye Strainer	8	8	10" CL 300 RF	21.8		310		.1 psid		SPX Flow	Y300 FSB		
F-22400B	6	F6	He	30 Micron	HP Inlet - Wye Strainer	8	8	10" CL 300 RF	21.8		310		.5 psid		SPX Flow	Y300 FSB		
F-22411A	8	G10	He	30 Micron	80K Adsorber A inlet filter	5	5	5" Butt Weld	18.3		80		<10 mbar		Novintec	FI10348-000		
F-22412A	8	G10	He	30 Micron	80K Adsorber A inlet filter	5	5	5" Butt Weld	18.3		80		<10 mbar		Novintec	FI10348-000		
F-22418A	8	J10	He	30 Micron	80K Adsorber A outlet filter	5	5	5" Butt Weld	18.3		80		<10 mbar		Novintec	FI10348-000		
F-22419A	8	J10	He	30 Micron	80K Adsorber A outlet filter	5	5	5" Butt Weld	18.3		80		<10 mbar		Novintec	FI10348-000		

Tag	Sheet #	Sheet Location	Fluid Service	Type	Description	Line Size	Device Size	Device Connection	Sizing and Selection Requirements						Manufacturer	Manufacturer Model #	Remarks	
									p (in)	p (out)	T	w	$\Delta p$	$C_V$				Set Press
						[NPS]	[NPS]		[atm]	[atm]	[K]	[g/s]	[atm]	[Full Open]				[psig]
F-22411B	8	G15	He	30 Micron	80K Adsorber B inlet filter	5	5	5" Butt Weld	18.3		80		<10 mbar			Novintec	FI10348-000	
F-22412B	8	G15	He	30 Micron	80K Adsorber B inlet filter	5	5	5" Butt Weld	18.3		80		<10 mbar			Novintec	FI10348-000	
F-22418B	8	J15	He	30 Micron	80K Adsorber B outlet filter	5	5	5" Butt Weld	18.3		80		<10 mbar			Novintec	FI10348-000	
F-22419B	8	J15	He	30 Micron	80K Adsorber B outlet filter	5	5	5" Butt Weld	18.3		80		<10 mbar			Novintec	FI10348-000	
<b>Check Valves</b>																		
CKV-22501	7	E3	N2		GN2 Exhaust check valve	5"		5" CL 150.32 RMS	9.86		90			483	0.18	Crane	Duo-Chek II, 5" G15CPF-9 Wafer Style	Cold Box external piping



Electrical and Instrumentation Devices									Electrical Requirements						Component Rating				Displayed
Tag	Sheet #	Sheet Location	Device Type	Description	Process Range	Manufacturer	Model	Quantity	Power	Voltage	Phase	Current	Speed	Frame	Range	Accuracy	p	T	Engineering
									[VA]	[volts]	#	[amps]	[rpm]	[nema]		[+/-%FS]	[psig]	[F]	Units
TP-22413-B	7	I9	RTD Temperature sensor	HX2 HP INTLET TEMPERATURE	78-320 K	Lakeshore	PT-102-QL	1											
TP-22415A-A	8	G10	RTD Temperature sensor	80K ADS A INLET TEMPERATURE	78-400 K	Lakeshore	PT-102-QL	1											
TP-22415A-B	8	G10	RTD Temperature sensor	80K ADS A INLET TEMPERATURE	78-400 K	Lakeshore	PT-102-QL	1											
TP-22415B-A	8	G15	RTD Temperature sensor	80K ADS B INLET TEMPERATURE	78-400 K	Lakeshore	PT-102-QL	1											
TP-22415B-B	8	G15	RTD Temperature sensor	80K ADS B INLET TEMPERATURE	78-400 K	Lakeshore	PT-102-QL	1											
TP-22416A-A	8	G8	RTD Temperature sensor	80K ADS A TEMPERATURE	78-400 K	Lakeshore	PT-102-QL	1											
TP-22416A-B	8	G8	RTD Temperature sensor	80K ADS A TEMPERATURE	78-400 K	Lakeshore	PT-102-QL	1											
TP-22416B-A	8	G16	RTD Temperature sensor	80K ADS B TEMPERATURE	78-400 K	Lakeshore	PT-102-QL	1											
TP-22416B-B	8	G16	RTD Temperature sensor	80K ADS B TEMPERATURE	78-400 K	Lakeshore	PT-102-QL	1											
TP-22418A-A-A	8	I11	RTD Temperature sensor	80K ADS A HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418A-A-B	8	I11	RTD Temperature sensor	80K ADS A HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418A-A-C	8	I11	RTD Temperature sensor	80K ADS A HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418A-A-D	8	I11	RTD Temperature sensor	80K ADS A HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418A-B-A	8	I11	RTD Temperature sensor	80K ADS A HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418A-B-B	8	I11	RTD Temperature sensor	80K ADS A HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418A-B-C	8	I11	RTD Temperature sensor	80K ADS A HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418A-B-D	8	I11	RTD Temperature sensor	80K ADS A HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418B-A-A	8	I13	RTD Temperature sensor	80K ADS B HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418B-A-B	8	I13	RTD Temperature sensor	80K ADS B HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418B-A-C	8	I13	RTD Temperature sensor	80K ADS B HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418B-A-D	8	I13	RTD Temperature sensor	80K ADS B HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418B-B-A	8	I13	RTD Temperature sensor	80K ADS B HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418B-B-B	8	I13	RTD Temperature sensor	80K ADS B HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418B-B-C	8	I13	RTD Temperature sensor	80K ADS B HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22418B-B-D	8	I13	RTD Temperature sensor	80K ADS B HEATER TEMPERATURE	78-450 K	Lakeshore	PT-102-QL	1											
TP-22420A-A	8	J10	RTD Temperature sensor	80K ADS A OUTLET TEMPERATURE	78-400 K	Lakeshore	PT-102-QL	1											
TP-22420A-B	8	J10	RTD Temperature sensor	80K ADS A OUTLET TEMPERATURE	78-400 K	Lakeshore	PT-102-QL	1											
TP-22420B-A	8	J15	RTD Temperature sensor	80K ADS B OUTLET TEMPERATURE	78-400 K	Lakeshore	PT-102-QL	1											
TP-22420B-B	8	J15	RTD Temperature sensor	80K ADS B OUTLET TEMPERATURE	78-400 K	Lakeshore	PT-102-QL	1											
TP-22422-A	8	M12	RTD Temperature sensor	80K ADS OUTLET TEMPERATURE	78-320 K	Lakeshore	PT-102-QL	1											
TP-22422-B	8	M12	RTD Temperature sensor	80K ADS OUTLET TEMPERATURE	78-320 K	Lakeshore	PT-102-QL	1											
TP-22505-A	7	E4	RTD Temperature sensor					1											
TP-22505-B	7	E4	RTD Temperature sensor	HX-1A GN2 OUTLET TEMPERATURE	220-320 K	ROSEMOUNT	0078-D-25-N-00-055-W3B-Q8	1											
TP-22511-A	7	F8	RTD Temperature sensor	HX-1A GN2 INLET TEMPERATURE	78-320 K	Lakeshore	PT-102-QL	1											
TP-22511-B	7	F8	RTD Temperature sensor	HX-1A GN2 INLET TEMPERATURE	78-320 K	Lakeshore	PT-102-QL	1											
TP-22520-A	7	I6	RTD Temperature sensor	LN2 INLET TEMPERATURE	78-320 K	Lakeshore	PT-102-QL	1											
TP-22520-B	7	I6	RTD Temperature sensor	LN2 INLET TEMPERATURE	78-320 K	Lakeshore	PT-102-QL	1											
TP-22525-A	7	M8	RTD Temperature sensor	LN2 TANK TEMPERATURE	78-320 K	Lakeshore	PT-102-QL	1											
TP-22525-B	7	M8	RTD Temperature sensor	LN2 TANK TEMPERATURE	78-320 K	Lakeshore	PT-102-QL	1											
<b>Heaters</b>																			
EH-22418A-A	8	H11	Heater wrapping	80K Adsorber A regeneration heater	78-450 K	TBD	Strip - 1-1/2" W x 48" Lg	6	1000	208 VAC	1	4.8 (ea)							
EH-22418A-B	8	H11	Heater wrapping	80K Adsorber A regeneration heater	78-450 K	TBD	Strip - 1-1/2" W x 48" Lg	6	1000	208 VAC	1	4.8 (ea)							
EH-22418B-A	8	H13	Heater wrapping	80K Adsorber B regeneration heater	78-450 K	TBD	Strip - 1-1/2" W x 48" Lg	6	1000	208 VAC	1	4.8 (ea)							
EH-22418B-B	8	H13	Heater wrapping	80K Adsorber B regeneration heater	78-450 K	TBD	Strip - 1-1/2" W x 48" Lg	6	1000	208 VAC	1	4.8 (ea)							

**Lower Cold Box Mechanical**

Tag	Sheet #	Sheet location	Fluid Service	Type	Description	Line Size	Device Size	Device Connection	Sizing and Selection Requirements							Manufacturer	Manufacturer Model #	Remarks
									p (in)	p (out)	T	w	Δp	C <sub>v</sub>	Set Press			
									[atm]	[atm]	[K]	[g/s]	[atm]	[Full Open]	[psig]			
<b>Cryogenic Proportional Valves</b>																		
PV-22135	10	F17	He		CD VALVE - 60K STAGE	2	2	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-20-A-B-NON	
PV-22140	10	J17	He		CD VALVE / SUB-ATMO - 35K STAGE	4	4	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-40-A-B-NON	
PV-22150	10	K17	He		CD VALVE / SUB-ATMO - 30K STAGE	4	4	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-40-A-B-NON	
PV-22160	12	B19	He		CD VALVE - 18K STAGE	2	2	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-20-A-B-NON	
PV-22180	12	D19	He		CD VALVE - 7.5K STAGE	3	2	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-20-A-B-NON	
PV-22190	12	G19	He		CD VALVE - 5K STAGE	3	3	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-30-A-B-NON	
PV-22191	12	I19	He		COLD INTERCEPT RETURN VALVE	2	2	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-10-A-B-NON	
PV-22192	12	H20	He		COLD INTERCEPT COOL DOWN VALVE	2	1-1/2	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-15-A-B-NON	
PV-22193	12	I16	He		LHE SUBCOOLER RETURN VALVE	3	3	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-30-A-B-NON	
PV-22194	12	J7	He		DEWAR VAPOR RETURN VALVE	3	2	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-20-A-B-NON	
PV-22195	12	I6	He		LHE FROM DEWAR	1-1/2	1	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-10-A-B-NON	
PV-22220	10	D7	He		WARM SHIELDS CD VALVE	1	1	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-10-A-B-NON	
PV-22225	10	D8	He		WARM SHIELDS RETURN AT 80K	2	2	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-20-A-B-NON	
PV-22242	10	I6	He		TURBINE 1 OUTLET VALVE (SHIELDS)	3	2	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-20-A-B-NON	
PV-22245	10	J6	He		WARM SHIELDS SUPPLY VALVE (FROM T1)	3	3	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-30-A-B-NON	
PV-22246	10	J13	He		TURBINE 2 OUTLET VALVE (SHIELDS)	4	3	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-30-A-B-NON	
PV-22248	10	J9	He		WARM SHIELDS SUPPLY VALVE (FROM T2)	3	3	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-30-A-B-NON	
PV-22249	10	D9	He		WARM SHIELDS RETURN VALVE	3	3	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-30-A-B-NON	
PV-22358	15	H6	He		TURBINE 2 OUTLET VALVE	4	4	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-70-40-A-B-NON	With Open/Close Limit Switches Ultraswitch XCL/XML / 3/4" NPT (AL) and Metering Valve on Air Outlet
PV-22378	16	H6	He		TURBINE 3 OUTLET VALVE	3	3	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-70-30-A-B-NON	With Open/Close Limit Switches Ultraswitch XCL/XML / 3/4" NPT (AL) and Metering Valve on Air Outlet
PV-22388	17	H6	He		TURBINE 4 OUTLET VALVE	2	2	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-70-20-A-B-NON	With Open/Close Limit Switches Ultraswitch XCL/XML / 3/4" NPT (AL) and Metering Valve on Air Outlet
PV-22389	12	F19	He		COLD END BYPASS VALVE	1-1/2	1	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-10-A-B-NON	
PV-22390	12	J10	He		JT VALVE (SC SUPPLY)	1-1/2	1	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-10-A-B-NON	
PV-22391	12	K20	He		4.5K LOADS SUPPLY VALVE	2	2	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-20-A-B-NON	
PV-22392	12	J21	He		COLD INTERCEPT SUPPLY VALVE	1-1/2	1	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-10-A-B-NON	
PV-22393	12	H5	He		DEWAR SUPPLY VALVE	2	1	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-10-A-B-NON	
PV-22432	14	E5	He		TURBINE 1 INLET VALVE	3	3	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-30-A-B-NON	With Fast Discharge Flow Booster
PV-22441	10	G9	He		WARM SHIELDS SUPPLY (T1 BYPASS)	3	1	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-10-A-B-NON	
PV-22452	15	E5	He		TURBINE 2 INLET VALVE	3	3	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-30-A-B-NON	With Fast Discharge Flow Booster
PV-22460	11	G11	He		20K ADSORBER BYPASS VALVE	3	1.5	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-15-A-B-NON	
PV-22461	11	D8	He		20K ADSORBER INLET VALVE	3	3	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-30-A-B-NON	
PV-22466	11	J8	He		20K ADSORBER OUTLET VALVE	3	3	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-30-A-B-NON	
PV-22472	16	E5	He		TURBINE 3 INLET VALVE	3	2	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-20-A-B-NON	With Fast Discharge Flow Booster
PV-22482	17	E5	He		TURBINE 4 INLET VALVE	2	2	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-20-A-B-NON	With Fast Discharge Flow Booster
PV-22485	12	F9	He		TURBINE 4 BYPASS VALVE	1-1/2	1	Sch 10 Butt Weld	See PHPK Cryo Valve Specification 5032-SP-9029							PHPK	HPV-80-E-10-A-B-NON	
<b>Solenoid Valves</b>																		
EV-22432	14	E6	Air		Turbine 1 Inlet Flow Booster	N/A	N/A	N/A							Humphrey	< 2 Sec Flow Booster - 24 VDC Humphrey Mod QE-3 - 3/8" NPT		
EV-22452	15	E6	Air		Turbine 2 Inlet Flow Booster	N/A	N/A	N/A							Humphrey	< 2 Sec Flow Booster - 24 VDC Humphrey Mod QE-3 - 3/8" NPT		
EV-22472	16	E6	Air		Turbine 3 Inlet Flow Booster	N/A	N/A	N/A							Humphrey	< 2 Sec Flow Booster - 24 VDC Humphrey Mod QE-3 - 3/8" NPT		
EV-22482	17	E6	Air		Turbine 4 Inlet Flow Booster	N/A	N/A	N/A							Humphrey	< 2 Sec Flow Booster - 24 VDC Humphrey Mod QE-3 - 3/8" NPT		
EV-22358	15	H6	Air		Turbine 2 Outlet Valve	N/A	N/A	N/A							Asco	8345G001/1 - 24 VDC		
EV-22378	16	H6	Air		Turbine 3 Outlet Valve	N/A	N/A	N/A							Asco	8345G001/1 - 24 VDC		
EV-22388	17	H6	Air		Turbine 4 Outlet Valve	N/A	N/A	N/A							Asco	8345G001/1 - 24 VDC		
<b>Relief Valves</b>																		

Tag	Sheet #	Sheet location	Fluid Service	Type	Description	Line Size	Device Size	Device Connection	Sizing and Selection Requirements						Manufacturer	Manufacturer Model #	Remarks	
									p (in)	p (out)	T	w	Δp	C <sub>v</sub>				Set Press
									[atm]	[atm]	[K]	[g/s]	[atm]	[Full Open]				[psig]
PSV-22190	10	G21	He		Cool Down Line/Sub-atmo return interface PSV			2" x 3" CI 150						75 PSIG		Flow Safe	S84HE-02RF1-03RF1-SS-SS-TT	"H" Orifice size
PSV-22191	12	E21	He		Cold Intercepts return interface PSV			3/4" x 1" CI 150						145 PSIG		Flow Safe	S844M-34RF1-01RF1-FS-SS-TT	"4" Orifice size
PSV-22193	12	M5	He		Dewar Liq return Interface PSV			1-1/2" x 2" CI 150						145 PSIG		Flow Safe	S846B-15RF1-02RF1-SS-SS-TT	"6" Orifice size
PSV-22194	12	M6	He		Dewar VAP return Interface PSV			1-1/2" x 2" CI 150						145 PSIG		Flow Safe	S846B-15RF1-02RF1-SS-SS-TT	"6" Orifice size
PSV-22195	12	M17	He		LHe Phase separator (Subcooler) PSV			1-1/2" x 3" CI 150						145 PSIG		Flow Safe	S84FD-15RF1-03RF1-SS-SS-TT	"F" Orifice size
PSV-22245	10	G4	He		Warm shields supply Interface PSV			2" x 3" CI 150						145 PSIG		Flow Safe	S84JE-02RF1-03RF1-SS-SS-TT	"J" Orifice size
PSV-22247	10	J20	He		HX-6/7 LPR PSV			1-1/2" x 2" CI 150						145 PSIG		Flow Safe	S846B-15RF1-02RF1-SS-SS-TT	"6" Orifice size
PSV-22248	10	H3	He		Warm shields return Interface PSV			1-1/2" x 2" CI 150						145 PSIG		Flow Safe	S846B-15RF1-02RF1-SS-SS-TT	"6" Orifice size
PSV-22390	12	M17	He		HX-SC PSV			1/2" CI 300 x 1/2" CI 150						320 PSIG		Flow Safe	S843M-05RF2-05RF1-SS-SS-TT	"3" Orifice size
PSV-22391	12	N17	He		4.5K supply interface PSV			1-1/2" x 3" CI 150						145 PSIG		Flow Safe	S84GD-15RF1-03RF1-SS-SS-TT	"G" Orifice size
PSV-22392	12	O17	He		Cold Intercepts supply interface PSV			1-1/2" x 3" CI 150						145 PSIG		Flow Safe	S84GD-15RF1-03RF1-SS-SS-TT	"G" Orifice size
PSV-22393	12	M4	He		Dewar LHe supply Interface PSV			1-1/2" x 3" CI 150						145 PSIG		Flow Safe	S84GD-15RF1-03RF1-SS-SS-TT	"G" Orifice size
PSV-22432	14	B6	He		Turbine 1 PSV			1" x 1" CI 300						320 PSIG		Flow Safe	S842M-01RF2-01RF2-SS-SS-TT	"2" Orifice size
PSV-22452	15	B6	He		Turbine 2 PSV			1" x 1" CI 300						320 PSIG		Flow Safe	S842M-01RF2-01RF2-SS-SS-TT	"2" Orifice size
PSV-22465	11	J15	He		HP Circuit downstream 20K Adsorber PSV			1-1/2" x 2" CI 300						320 PSIG		Flow Safe	S846B-15RF2-02RF2-SS-SS-TT	"6" Orifice size
PSV-22472	16	B6	He		Turbine 3 PSV			1" x 1" CI 300						320 PSIG		Flow Safe	S842M-01RF2-01RF2-SS-SS-TT	"2" Orifice size
PSV-22482	17	B6	He		Turbine 4 PSV			1" x 1" CI 300						320 PSIG		Flow Safe	S842M-01RF2-01RF2-SS-SS-TT	"2" Orifice size
PSV-23760	11	D19	He		20K Adsorber PSV			1-1/2" x 2" CI 300						320 PSIG		Flow Safe	S846B-15RF2-02RF2-SS-SS-TT	"6" Orifice size
<b>Manual Valves</b>																		
MV-22408	6	P5	He	Ball	Bearing Gas Tank Vent	1	1	1" Soc Weld	21.8		310			44		Jamesbury	1-4CBV-3636XT-B2	
MV-22465	11	J18	He	Globe	20K Adsorber drying inlet valve	1	1	Sch 10 Butt Weld	5		400			14		Rego	SK9408BV	Non Jacketed SST Cryovalve
MV-22358	15	H6	Air	Needle	Turbine 2 Outlet Air Exhaust Metering Valve	N/A	N/A	1/4" Swagelok	6.8		300					Swagelok	SS-SS4-VH	VH=Vernier Handle
MV-22378	16	H6	Air	Needle	Turbine 3 Outlet Air Exhaust Metering Valve	N/A	N/A	1/4" Swagelok	6.8		300					Swagelok	SS-SS4-VH	VH=Vernier Handle
MV-22388	17	H6	Air	Needle	Turbine 4 Outlet Air Exhaust Metering Valve	N/A	N/A	1/4" Swagelok	6.8		300					Swagelok	SS-SS4-VH	VH=Vernier Handle
<b>Filter</b>																		
F-22461	11	F9	He		20K Adsorber inlet filter	3	3	Sch 10 Butt Weld	18		20			<.01		Novintec	FI10349-000	
F-22462	11	F9	He		20K Adsorber inlet filter	3	3	Sch 10 Butt Weld	18		20			<.01		Novintec	FI10349-000	
F-22468	11	H9	He		20K Adsorber outlet filter	3	3	Sch 10 Butt Weld	18		20			<.01		Novintec	FI10349-000	
F-22469	11	H9	He		20K Adsorber outlet filter	3	3	Sch 10 Butt Weld	18		20			<.01		Novintec	FI10349-000	
<b>Check Valve</b>																		
CKV-22405	6	J6	He		Turbines Bearings Supply Check Valve	2	2	2" CL 300 32 RMS	21.8		310			75	0.23	Crane	Duo-Check II, 2" H30SPF2-201 Lug Style	Field Piping
CKV-22248	10	J8	He		Warm Shield Supply	3	3	3" NPS Soc Weld	1.2		4.5			89	0.125	Check-All	USMSSMT.125SS	
<b>Flow Element</b>																		
FE-22245	10	E5	He	Venturi	Warm Shields supply flow	3	3	Sch 10 Butt Weld	3.6		35					FlowMaxx	D16-123-1.350 x 16	
FE-22391	12	L19	He	Venturi	4.5K Supply flow	2	2	Sch 10 Butt Weld	3.2		4.5					FlowMaxx	D16-123-0.670 x 12	
FE-22392	12	K20	He	Venturi	Cold intercept Supply flow	1-1/2	1-1/2	Sch 10 Butt Weld	3.23		5.5					FlowMaxx	D16-123-0.325 x 08	
FE-22432	14	F8	He	Venturi	Turbine 1 inlet flow	3	3	Sch 10 Butt Weld	18		32					FlowMaxx	D16-123-1.310 x 16	
FE-22452	15	F7	He	Venturi	Turbine 2 inlet flow	3	3	Sch 10 Butt Weld	18		32					FlowMaxx	D16-123-1.375 x 16	
FE-22472	16	F7	He	Venturi	Turbine 3 inlet flow	3	3	Sch 10 Butt Weld	17.9		17					FlowMaxx	D16-123-1.135 x 16	
FE-22482	17	F8	He	Venturi	Turbine 4 inlet flow	2	2	Sch 10 Butt Weld	17.9		7					FlowMaxx	D16-123-0.860 x 10	
*	See PHPK Cryogenic Valve Specification																	
+	See Relief Valve Specification																	
\$	See Adsorber Filter and Mechanical Strength Report																	











**Vacuum Skid Mechanical**

Tag	Sheet #	Sheet location	Fluid Service	Type	Description	Line Size	Device Size	Device Connection	Manufacturer	Manufacturer Model #	Remarks
						[NPS]	[NPS]				
<b><u>Pneumatic Valves</u></b>											
PV-23611	9	E9	Air		GATE VALVE : VACUUM SHELL ISOLATION		ISO250	ISO250	GNB	GVP-ISOF250T-SOP	
PV-23614	9	L11	Air		DIFFUSION PUMP ISOLATION : BELLOWS SEALED INLINE VALVE (SS) - PNEUMATIC ACTUATION	1-1/2	1-1/2	KF40	KURT J. LESKER	SL0150PVQF	
PV-23616	9	F9	Air		DIFFUSION PUMP BY-PASS : BELLOWS SEALED INLINE VALVE (SS) - PNEUMATIC ACTUATION	2-1/2	2-1/2	ISO63	KURT J. LESKER	SL0250PVIK	
PV-23631	13	E9	Air		GATE VALVE : VACUUM SHELL ISOLATION		ISO250	ISO250	GNB	GVP-ISOF250T-SOP	
PV-23634	13	L11	Air		DIFFUSION PUMP ISOLATION : BELLOWS SEALED INLINE VALVE (SS) - PNEUMATIC ACTUATION	1-1/2	1-1/2	KF40	KURT J. LESKER	SL0150PVQF	
PV-23636	13	F9	Air		DIFFUSION PUMP BY-PASS : BELLOWS SEALED INLINE VALVE (SS) - PNEUMATIC ACTUATION	2-1/2	2-1/2	ISO63	KURT J. LESKER	SL0250PVIK	
<b><u>Relief Valves</u></b>											
PSV-22411	9	K18	Cooling Water		UCB Vacuum System Cooling water supply (150 psi)	1/2"	1/2"	1/2" NPT / 3/4" NPT	McMASTER-CARR	6270T212	
PSV-22431	13	K18	Cooling Water		LCB Vacuum System Cooling water supply (150 psi)	1/2"	1/2"	1/2" NPT / 3/4" NPT	McMASTER-CARR	6270T212	
<b><u>Manual Valves</u></b>											
MV-23409	9	M21	H2O		LOW POINT DRAIN VALVE (COOLING WATER RETURN)	1/2	1/2	1/2" NPT	McMASTER CARR	33325K230	
MV-23410	9	K21	H2O		HIGH POINT VENT VALVE (COOLING WATER SUPPLY)	1/2	1/2	1/2" NPT	McMASTER CARR	33325K230	
MV-23411	9	M20	H2O		COOLING WATER SUPPLY VALVE	1/2	1/2	1/2" NPT	McMASTER CARR	33325K230	
MV-23419	9	K20	H2O		COOLING WATER RETURN SHUT-OFF VALVE	1/2	1/2	1/2" NPT	McMASTER CARR	33325K230	
MV-23612	9	B19	AIR		CONNECTION TO 80K BED VAC CART : BELLOWS SEALED INLINE VALVE (SS) -MANUAL ACTUATION	2-1/2	2-1/2	ISO63	KURT J. LESKER	SA0250MVIK	
MV-23418	9	M18	H2O		COOLING WATER RETURN : NEEDLE VALVE	1/2	1/2	1/2" NPT	McMASTER CARR	46425K14	
MV-23610	9	E6	AIR		VACUUM GAUGE ISOLATION	2-1/2	2-1/2	ISO63	KURT J. LESKER	SA0250MVIK	
MV-23611	9	F6	AIR		VACUUM GAUGE VENT	2-1/2	2-1/2	ISO63	KURT J. LESKER	SA0250MVIK	
MV-23613	9	L12	OIL		DIFFUSION PUMP : OIL ADD			1/2" NPT	McMASTER CARR	4800K64	
MV-23615	9	M4	AIR		ROUGHING PUMP ISOLATION : BELLOWS SEALED INLINE VALVE (SS) -MANUAL ACTUATION	2-1/2	2-1/2	ISO63	KURT J. LESKER	SL0250MVIK	
MV-23616	9	A19	AIR		CONNECTION TO 80K BED VAC CART : BELLOWS SEALED INLINE VALVE (SS) -MANUAL ACTUATION	2-1/2	2-1/2	ISO63	KURT J. LESKER	SA0250MVIK	
MV-23427	13	M21	H2O		LOW POINT DRAIN VALVE (COOLING WATER RETURN)	1/2	1/2	1/2" NPT	McMASTER CARR	33325K230	
MV-23420	13	K21	H2O		HIGH POINT VENT VALVE (COOLING WATER SUPPLY)	1/2	1/2	1/2" NPT	McMASTER CARR	33325K230	
MV-23421	13	K20	H2O		COOLING WATER SUPPLY VALVE	1/2	1/2	1/2" NPT	McMASTER CARR	33325K230	
MV-23429	13	M20	H2O		COOLING WATER RETURN SHUT-OFF VALVE	1/2	1/2	1/2" NPT	McMASTER CARR	33325K230	

MV-23632	13	B19	AIR		CONNECTION TO 80K BED VAC CART : BELLOWS SEALED INLINE VALVE (SS) -MANUAL ACTUATION	2-1/2	2-1/2	ISO63	KURT J. LESKER	SA0250MVIK	
MV-23428	13	M18	H2O		COOLING WATER RETURN : NEEDLE VALVE	1/2	1/2	1/2" NPT	McMASTER CARR	46425K14	
MV-23630	13	E6	AIR		VACUUM GAUGE ISOLATION	2-1/2	2-1/2	ISO63	KURT J. LESKER	SA0250MVIK	
MV-23631	13	F6	AIR		VACUUM GAUGE VENT	2-1/2	2-1/2	ISO63	KURT J. LESKER	SA0250MVIK	
MV-23633	13	L12	OIL		DIFFUSION PUMP : OIL ADD			1/2" NPT	McMASTER CARR	4800K64	
MV-23635	13	M4	AIR		ROUGHING PUMP ISOLATION : BELLOWS SEALED INLINE VALVE (SS) -MANUAL ACTUATION	2-1/2	2-1/2	ISO63	KURT J. LESKER	SL0250MVIK	
MV-23636	13	A19	AIR		CONNECTION TO 80K BED VAC CART : BELLOWS SEALED INLINE VALVE (SS) -MANUAL ACTUATION	2-1/2	2-1/2	ISO63	KURT J. LESKER	SA0250MVIK	
<b>Filters</b>											
FLT-23619	9	L6	AIR		MOLECULAR SIEVE FORELINE TRAP	2-1/2	2-1/2	ISO63	NORCAL PRODUCTS	FTM-8-2502-ISO	
FLT-23615	9	K3	AIR		OIL MIST ELIMINATOR : MF300 MIST FILTER	N/A	N/A	N/A	EDWARDS	A462-04-000	
FLT-23639	13	L6	AIR		MOLECULAR SIEVE FORELINE TRAP	2-1/2	2-1/2	ISO63	NORCAL PRODUCTS	FTM-8-2502-ISO	
FLT-23635	13	K3	AIR		OIL MIST ELIMINATOR : MF300 MIST FILTER	N/A	N/A	N/A	EDWARDS	A462-04-000	
<b>WATER BAFFLE</b>											
WC-23610	9	J14	H2O		COOLANT BAFFLE	1/2" VCR	ISO 250		GNB	MCB-ASA10T-SC (ISO 250)	



### Utilities Mechanical

Tag	Sheet #	Sheet location	Fluid Service	Type	Description	Line Size	Device Size	Manufacturer	Manufacturer Model #	Process Location	Remarks
						[NPS]	[NPS]				
<b>Manual Valves</b>											
MV-23100	21	E12	He	Ball	Pumping valve	2	2	Jamesbury	2-4CBV-3636XT-B2		
MV-23101	21	F12	He	Ball	Vent valve	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23102	21	E12	He	Ball	Pumping valve	1-1/2	1-1/2	Jamesbury	1-1/2-4CBV-3636XT-B2		
MV-22106	21	F7	He	Ball	Pumping valve	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23110	21	G7	He	Ball	Pumping valve	1-1/2	1-1/2	Jamesbury	1-1/2-4CBV-3636XT-B2		
MV-22206	21	E7	He	Ball	Pumping valve	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-22306	21	G8	He	Ball	Pumping valve	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-22405	6	M6	He	Ball	Pumping valve	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-22406	21	E7	He	Ball	Pumping valve	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23200	20	F5	He	Ball	He distribution Main isolation valve	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23206	20	F19	He	Ball	He distribution - HP Line	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23207	20	F20	He	Ball	He distribution - HP Line	1	3/8	Jamesbury	3/8-4CBV-3636XT-B2		
MV-23209	20	F20	He	Needle	He distribution - HP Line	3/8	3/8	McMaster-Carr	46425K13		
MV-23231	20	J20	He	Ball	He distribution - LPR Line	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23232	20	K20	He	Ball	He distribution - LPL Line	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23265	20	K20	He	Ball	He distribution - 20K Ads Line	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23718A	20	F19	He	Ball	He distribution - 80K Ads A Line	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23718B	20	G19	He	Ball	He distribution - 80K Ads B Line	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23500	19	B5	Air	Ball	Upper cold box air instrum isolation valve	1-1/2	1-1/2	Jamesbury	1-1/2-4CBV-3636XT-B2		
MV-23501	19	C9	Air	Ball	Upper cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-43GES6-SHD		
MV-23502	19	C9	Air	Ball	Upper cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-43GES6-SHD		
MV-23503	19	C9	Air	Ball	Upper cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-43GES6-SHD		
MV-23504	19	C9	Air	Ball	Upper cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-43GES6-SHD		
MV-23505	19	C9	Air	Ball	Upper cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-43GES6-SHD		
MV-23506	19	C9	Air	Ball	Upper cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-43GES6-SHD		
MV-23507	19	D9	Air	Ball	Upper cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-43GES6-SHD		
MV-23508	19	D9	Air	Ball	Upper cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-43GES6-SHD		
MV-23509	19	D9	Air	Ball	Upper cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-43GES6-SHD		
MV-23510	19	D9	Air	Ball	Upper cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-43GES6-SHD		
MV-23541	19	E9	Air	Ball	Upper cold box air instrum isolation valve	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23550	19	H5	Air	Ball	Lower cold box air instrum isolation valve	1-1/2	1-1/2	Jamesbury	1-1/2-4CBV-3636XT-B2		
MV-23551	19	H9	Air	Ball	Lower cold box air instrum isolation valve	1/4 OD	1/4	Swagelok	SS-4P6T		
MV-23552	19	H9	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23553	19	H9	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23554	19	H9	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23555	19	I9	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23556	19	I9	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23557	19	I9	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23558	19	I9	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23559	19	K9	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23560	19	K9	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23561	19	H12	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23562	19	H12	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23563	19	I12	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23564	19	I12	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23565	19	I12	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23566	19	I12	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23567	19	J12	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23568	19	J12	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23569	19	J12	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23570	19	J12	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23571	19	H15	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23572	19	H15	Air	Ball	Lower cold box air instrum isolation valve	1/4 OD	1/4	Swagelok	SS-4GS4		
MV-23573	19	I15	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23574	19	I15	Air	Ball	Lower cold box air instrum isolation valve	1/4 OD	1/4	Swagelok	SS-4GS4		

MV-23575	19	I15	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6G64		
MV-23576	19	I15	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6G64		
MV-23577	19	J15	Air	Ball	Lower cold box air instrum isolation valve	1/4 OD	1/4	Swagelok	SS-4GS4		
MV-23578	19	J15	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6G64		
MV-23579	19	J15	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6G64		
MV-23580	19	J15	Air	Ball	Lower cold box air instrum isolation valve	1/4 OD	1/4	Swagelok	SS-4GS4		
MV-23581	19	H18	Air	Ball	Lower cold box air instrum isolation valve	1/4 OD	1/4	Swagelok	SS-4P4T		
MV-23582	19	H18	Air	Ball	Lower cold box air instrum isolation valve	3/8 OD	3/8	Swagelok	SS-6P6T		
MV-23583	19	I18	Air	Ball	Lower cold box air instrum isolation valve	1/4 OD	1/4	Swagelok	SS-4P4T		
MV-23584	19	I18	Air	Ball	Lower cold box air instrum isolation valve	1/4 OD	1/4	Swagelok	SS-4P4T		
MV-23585	19	J18	Air	Ball	Lower cold box air instrum isolation valve	1/4 OD	1/4	Swagelok	SS-4P4T		
MV-23591	19	K9	Air	Ball	Lower cold box air instrum isolation valve	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23592	19	K12	Air	Ball	Lower cold box air instrum isolation valve	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23593	19	K15	Air	Ball	Lower cold box air instrum isolation valve	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23594	19	K18	Air	Ball	Lower cold box air instrum isolation valve	1	1	Jamesbury	1-4CBV-3636XT-B2		
MV-23431	18	D18	Cooling Water	Ball	Lower cold box Cooling water isolation valve	3/4	3/4	McMaster Carr	47865K24		
MV-23438	18	J18	Cooling Water	Needle	Lower cold box Cooling water adjustment valve	3/4	3/4	McMaster Carr	4995K19		
MV-23439	18	J18	Cooling Water	Ball	Lower cold box Cooling water isolation valve	3/4	3/4	McMaster Carr	47865K24		
MV-23451	18	E18	Cooling Water	Ball	Lower cold box Cooling water isolation valve	3/4	3/4	McMaster Carr	47865K24		
MV-23458	18	K18	Cooling Water	Needle	Lower cold box Cooling water adjustment valve	3/4	3/4	McMaster Carr	4995K19		
MV-23459	18	K18	Cooling Water	Ball	Lower cold box Cooling water isolation valve	3/4	3/4	McMaster Carr	47865K24		
MV-23471	18	F18	Cooling Water	Ball	Lower cold box Cooling water isolation valve	3/4	3/4	McMaster Carr	47865K24		
MV-23478	18	L18	Cooling Water	Needle	Lower cold box Cooling water adjustment valve	3/4	3/4	McMaster Carr	4995K19		
MV-23479	18	L18	Cooling Water	Ball	Lower cold box Cooling water isolation valve	3/4	3/4	McMaster Carr	47865K24		
MV-23481	18	G18	Cooling Water	Ball	Lower cold box Cooling water isolation valve	1/2	1/2	McMaster Carr	47865K24		
MV-23488	18	M18	Cooling Water	Needle	Lower cold box Cooling water adjustment valve	1/2	1/2	McMaster Carr	4995K17		
MV-23489	18	M18	Cooling Water	Ball	Lower cold box Cooling water isolation valve	1/2	1/2	McMaster Carr	47865K24		
MV-23499	18	J9	Drain	Ball	Lower cold box Cooling water isolation valve	1	1	McMaster Carr	47865K24		
<b>Filters</b>											
F-23500	19	B6	Air		Upper cold box air instrum inlet filter	1"	1	McMaster Carr	60115K471		
F-23550	19	H6	Air		Lower cold box air instrum inlet filter	1"	1	McMaster Carr	60115K471		
<b>Relief Valve</b>											
PSV-23431	18	D20	Cooling Water		Turbine 1 Cooling water supply PSV	1/2	1/2	McMaster Carr	8088K14		
PSV-23451	18	E20	Cooling Water		Turbine 2 Cooling water supply PSV	1/2	1/2	McMaster Carr	8088K14		
PSV-23471	18	F20	Cooling Water		Turbine 3 Cooling water supply PSV	1/2	1/2	McMaster Carr	8088K14		
PSV-23481	18	G20	Cooling Water		Turbine 4 Cooling water supply PSV	1/2	1/2	McMaster Carr	8088K14		
<b>Check Valve</b>											
CKV-23101	21	G13	He	In-Line	Pumping Panel Vent Check Valve	1	1	Generant	CV-1000-B-T-3		
CKV-23718A	20	J20	He	In-Line	80K ads A He distribution check valve	1	1	Generant	CV-1000-B-T-3		
CKV-23718B	20	K20	He	In-Line	80K ads A He distribution check valve	1	1	Generant	CV-1000-B-T-3		
CKV-23207	20	L20	He	In-Line	80K He distribution check valve	1	1	Generant	CV-1000-B-T-3		
CKV-23766	20	M20	He	In-Line	20K ads He distribution check valve	1	1	Generant	CV-1000-B-T-3		
<b>TEMPERATURE INDICATORS</b>											
TI-23420	18	C14	Cooling Water	Bi-Metal	Cooling water supply temperature	1/2	1/2	McMaster Carr	3948K55		Max 400 psi
TI-23438	18	J20	Cooling Water	Bi-Metal	Turbine 1 Cooling water return temperature	1/2	1/2	McMaster Carr	3948K57		Max 400 psi
TI-23458	18	K20	Cooling Water	Bi-Metal	Turbine 2 Cooling water return temperature	1/2	1/2	McMaster Carr	3948K57		Max 400 psi
TI-23478	18	L20	Cooling Water	Bi-Metal	Turbine 3 Cooling water return temperature	1/2	1/2	McMaster Carr	3948K57		Max 400 psi
TI-23488	18	M20	Cooling Water	Bi-Metal	Turbine 4 Cooling water return temperature	1/2	1/2	McMaster Carr	3948K57		Max 400 psi
<b>FLOW INDICATORS</b>											
FI-23428	18	I21	Cooling Water		Diffusion Pump Cooling water return flow	1/2	1/2	McMaster Carr	4165K111		Reads 0.5 - 5 GPM
FI-23438	18	J21	Cooling Water		Turbine 1 Cooling water return flow	3/4	3/4	McMaster Carr	4165K131		Reads 1.5 - 15 GPM
FI-23458	18	K21	Cooling Water		Turbine 2 Cooling water return flow	3/4	3/4	McMaster Carr	4165K131		Reads 1.5 - 15 GPM
FI-23478	18	L21	Cooling Water		Turbine 3 Cooling water return flow	3/4	3/4	McMaster Carr	4165K131		Reads 1.5 - 15 GPM
FI-23488	18	M21	Cooling Water		Turbine 4 Cooling water return flow	1/2	1/2	McMaster Carr	4165K111		Reads 0.5 - 5 GPM





**Utilities Electrical/Instrumentation**

Electrical and Instrumentation Devices								Electrical Requirements						Component Rating			Displayed		
Tag	Sheet #	Sheet Location	Type	Description:	Process range	Manufacturer	Model	Quantity	Power	Voltage	Phase	Current	Speed	Frame	Range	Accuracy	p	T	Engineering
									[hp]	[volts]	#	[amps]	[rpm]	[nema]		[+/-%fs]	[psig]	[F]	Units
<b>Pressure Transducers</b>																			
PT-23100	21	D11	Pressure transducer	Pumping network pressure	0-2 Atm.	GE UNIK	5000 PTX50C2-TB-A1-CA-HO-PF-500PSIA	1	N/A	24VDC		4-20 mA			0-500 psia				
<b>Pressure gauge</b>																			
PI-23100	21	D12	Pressure gauge	Pumping network pressure	0-2 Atm.	Ashcroft	45-1377-AS-02B-0/100 PSIG	1							0-100 psig	0.50			
PI-23205	20	F6	Pressure gauge	He distribution pressure	0-23 Atm.	Ashcroft	45-1377-AS-02B-0/400 PSIG	1							0-400 psig	0.50			
<b>Pressure switch</b>																			
PSL-23500	19	A6	Pressure switch (low)	Upper Cold box Instrument air pressure	45-550 psi	SOR	5NN-K45-N4-F1A	1							45-550 psi				
PSL-23550	19	G6	Pressure switch (low)	Lower Cold box Instrument air pressure	45-550 psi	SOR	5NN-K45-N4-F1A	1							45-550 psi				