





Plant 300 MTPD Caustic Soda Expansion	Client PACL	Contract Code PACL- 300 TPD EXPN	Document Number 0215-INS-00-EC-0044	Contract No. 66- 0215-700
	INSTRUMENT SPECIFICATION FOR CL2 LIQUEFACTION UNIT			 PACL LIMITED
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1 GENERAL

This specification covers the general requirements of instrumentation control and interlocking system to be supplied along with Chlorine liquefaction unit.

This specification is a general guideline. The instruments for measurement, control and interlocking shall be as per the frozen P&ID for the project under consideration. Vendor is fully responsible to ensure that the instrumentation is designed to meet the requirements of the process as well as safety of the package offered.



2 SCOPE OF WORK

2.1 Scope of work is as given in following table:

DESCRIPTION	E	S	I	ER	COM
Field instruments	V	V	V	C/V*	C/V
Panel mounted instruments	V	V	V	C/V*	C/V
PLC Control panel with accessories	V	V	V/C	C/V*	C/V
Interlock and shutdown system	V	V	V	C/V*	C/V
Cables between instruments and Control Panel	V	V	V	C/V*	C/V
Cables between J.B. / control panel & Control room	C	C	C	C	C
Tubes for impulse lines, pneumatic tubing, Air manifold	V	V	V	C/V*	C/V
Tube fittings, cable glands and other erection hardware	V	V	V	C/V*	C/V
Structural steel for erection work	V	V	V	C/V*	C/V
Cable trays/tube trays	V	V	V	C/V*	C/V
Canopies for JB's & control panel	V	V	V	C/V*	C/V
Any other items required, however not included	V	V	V	C/V*	C/V

Abbreviations:

- E** : Engineering
- S** : Supply, packing, forwarding
- I** : Inspection
- ER** : Erection at site / Supervision
- COM** : Testing, calibration & commissioning at site

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- V** : By vendor
- C** : By clients
- T** : By tkIS-India
- NA** : Not applicable
- C/V*** : Erection by Client and Supervision by Vendor.

2.2 It shall be the vendor's responsibility to ensure that the quality as specified is met prior to dispatch of instrument items. Clients/tkIS-India shall participate only in those inspections indicated in the above table. All such inspections shall be carried out in the presence of vendor's representative and dispatch clearance shall be given only after all requirements are met with. Items for which clients/tkIS-India is not involved in inspection, no individual or cumulative inspection waiver or dispatch clearance shall be given by the clients/tkIS-India. The vendor may inspect such items without any intimation to the clients/tkIS-India and dispatch the same to site.

3 ENVIRONMENTAL SPECIFICATION

3.1 Field

a.	Temperature	:	Normal °C. ; Maximum 50°C.
b.	Humidity	:	Normal Rh ; Maximum 100 Rh
c.	Area classification	:	Hazardous <input type="checkbox"/> Non-hazardous <input checked="" type="checkbox"/>
			IEC, Zone Group <input type="checkbox"/>
			NEC, Class Group Div. <input type="checkbox"/>

4 BATTERY LIMITS

4.1 Power Supply

Main incoming power supply at one voltage level and frequency as per specifications given below shall be provided by the owner at the incoming terminals of the control panel.

a.	Voltage	:	110V AC ±1% <input checked="" type="checkbox"/> 230V AC±1% <input checked="" type="checkbox"/>
		:	<input type="checkbox"/>
b.	Frequency	:	50 Hz ± 5%



All further distribution of the same and generation of any other voltage level required for meeting requirements of section 5.0 shall be done within the panel by the vendor. This shall include providing a suitable transformer, voltage stabiliser, rectifiers etc.

4.2 Air Supply

Air supply at one pressure level as per specifications given below shall be made available at one point within battery limit by the owner.

a.	Pressure	:	Maximum 7 kg/cm ² g
			Minimum 4 kg/cm ² g
b.	Dew point	:	-40°C at atmospheric pressure

Further distribution of the same and pressure reduction if required shall be done by the vendor.



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5 POWER SUPPLY DISTRIBUTION PHILOSOPHY FOR INSTRUMENTS

a.	Panel instruments, 4 wire transmitters, interlock / shutdown system, printers, operator interfaces etc.	:	110V AC ±1% <input checked="" type="checkbox"/>	230V AC±1% <input type="checkbox"/>
b.	Interrogation for interlocks and alarm	:	24V DC	
c.	Solenoid valves	:	110V AC ±1% <input checked="" type="checkbox"/> 24V DC <input type="checkbox"/>	230V AC±1% <input type="checkbox"/>
d.	Two wire transmitters	:	24V DC	
e.	Auxiliaries like panel lighting, socket outlets etc.	:	110V AC ±1% <input type="checkbox"/>	230V AC±1% <input checked="" type="checkbox"/>

6 GENERAL DESIGN CONSIDERATIONS

- 6.1** All measuring units shall be in metric system.
- 6.2** All electronic instruments shall work satisfactorily for voltage and frequency variation specified in 4.1. Pneumatic instruments shall be designed to work satisfactorily even if pressure drops to 4 kg/cm²g.
- 6.3** All field mounted electrical/electronic instruments shall be weatherproof to IP65 and suitable for area classification given in clause 3.1, c.
- 6.4** Material of wetted parts for all instruments shall be suitable for the service under consideration. Only minimum requirements are indicated.
- 6.5** All pressure and DP transmitters shall have integral local indication in Engg unit and shall be of SMART type with HART protocol. All temperature transmitters shall be head mounted HART type and blind.
- 6.6** Pressure and temperature ratings of all instruments shall be as per the piping class applicable.
- 6.7** All temperature instruments shall have thermowells. These shall be installed in minimum line size of 3" and lines less than 3" shall be expanded to this size.
- 6.8** All instruments (except those measuring temperature, pH and conductivity etc.) shall have individual isolation valves.
- 6.9** For flow measurements orifice plate with DP gauge/transmitter shall be used. By pass variable area flowmeter are not preferred.
- 6.10** Filled system (Hg or gas filled) type temperature switches are not acceptable. These shall be RTD or T/C input type with head mounted temperature transmitter.
- 6.11** Local pressure/temperature gauges with contact shall not be used for alarming or interlocking.
- 6.12** Different types of signals shall be grouped in separate junction boxes (JBs). There shall be separate JB's for 4~20mA analog input and output, digital inputs, RTD or thermocouple inputs and digital outputs. In general signals of different voltage levels shall not be grouped together into a common JB.
- 6.13** All instruments shall be tagged prior to dispatch. The tag numbers shall be the same as those in the frozen P&IDs. Tag numbering philosophy shall be provided by TKIS-India, after award of contract.
- 6.14** System design shall follow fail safe philosophy. On failure of any instrument or hardware/software the interlocking system shall ensure safe shutdown of the process. Annunciator shall be "contact open to alarm" type and relay/switch contacts shall open on fault.

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- 6.15** Level gauge chamber shall be machined from forged bars only. Chamber fabricated from plates is not acceptable. In case the chamber is made from pipes (if specified), only seamless pipes shall be used.
- 6.16** All instruments flanges shall be forged weld neck type.
- 6.17** Level switches and flow switches are not acceptable. Transmitters shall be used instead.
- 6.18** Orifice bore calculation shall be done as per ISO5167.

7 GENERAL CONTROL PHILOSOPHY

7.1 Interlocking system shall be DCS based PLC based
All instruments shall be connected to PLC in local control panel for control and interlocks.

7.2 For operation, interlocking and control of the refrigeration compressor and liquefier , vendor shall supply PLC with LCD monitor as HMI operator station located in local control room near to compressor. For alarms, electronic hooter shall be provided with monitor.

7.2.1 PLC specifications

7.2.1.1 PLC shall be mounted inside local control panel and supplied fully wired for all inputs and outputs. The panel will be located inside local control room near to liquefier. All cable entries shall be from bottom of panel. All digital inputs and outputs (I/Os) shall be through potential free contacts. CPU card and IO cards shall be provided with conformal coating.
PLC Hardware shall be as follows:



1) Rockwell Control-Logix 1756-L7 series controllers with conformal coating.
HMI shall be Panel View Plus 6 with extended features, Keypad and Touch, Color, Ethernet.

2) Siemens Siplus S7 300 series CPU (for extreme conditions)
HMI shall be Simatic Comfort Outdoor Panel TP series, Touch, Colour.
Power supply unit for 24V DC in PLC panel shall be of Phoenix Quint make (with conformal coating) or Siemens Siplus (with conformal coating)

7.2.1.2 All inputs/outputs to/from PLC shall be optically/galvanically isolated.

7.2.1.3 The redundancy requirements are as follows:

a.	CPU	:	Required	<input checked="" type="checkbox"/>	Not -required	<input type="checkbox"/>
b.	Communication between CPU and I/Os	:	Required	<input checked="" type="checkbox"/>	Not -required	<input type="checkbox"/>
c.	Power supply	:	Required	<input checked="" type="checkbox"/>	Not -required	<input type="checkbox"/>
d.	Inputs/outputs	:	Required	<input type="checkbox"/>	Not -required	<input checked="" type="checkbox"/>

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7.2.1.4 Outputs from PLC shall be through fused terminals. The load requirements are as follows:

a.	Outputs to field solenoids	:	110V AC/1A <input checked="" type="checkbox"/>	24VDC <input type="checkbox"/>
b.	Outputs to MCC/Switchgear	:	100V DC/2A <input type="checkbox"/>	230 VAC <input checked="" type="checkbox"/>

7.2.1.5 Separate terminal strips shall be considered for different types of signals.

1.0	<u>TERMINALS</u>			
a.	Make	:	Elmex <input checked="" type="checkbox"/>	Phoenix <input type="checkbox"/>
		:	Weidmuller <input type="checkbox"/>	Wago <input type="checkbox"/>
b.	Material	:	PVC <input type="checkbox"/>	Melamine <input type="checkbox"/>
		:	Polyamide <input checked="" type="checkbox"/>	
c.	Size	:	2.5 mm ² <input checked="" type="checkbox"/>	4 mm ² <input checked="" type="checkbox"/>

7.2.1.6 Inputs to PLC from MCC/HV switchgear shall be through link type terminals

7.3 Vendor shall provide local control panel for local operation. Following indications are required on panel as a minimum:

- ◆ Power on.
- ◆ Running indications of all compressors & pumps
- ◆ Loading / unloading status of the compressors.
- ◆ Lamps for critical alarms



7.4 Following selector switches/pushbuttons are required as minimum on control panel:

- ◆ Load/Unload
- ◆ On/off
- ◆ Local/remote

7.5 Vendr shall provide repeat indication for following signals

- ◆ Chlorine liquefier Level
(This shall be used in DCS for Level control of Liquefier)
- ◆ Chlorine liquefier Pressure
- ◆ Running indication of Refrigeration Compressor

Vendor shall consider required signal repeaters and multiplying relays in PLC panel

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8 GENERAL SPECIFICATIONS FOR INSTRUMENTATION

8.1 Field Instruments

8.1.1 Transmitters (Pressure and Differential Pressure)

8.1.1.1 These shall be two wire type, with integral local indicator and with following specifications:

a.	Type	:	Standard <input type="checkbox"/> Smart HART <input checked="" type="checkbox"/>
b.	Wetted parts	:	SS316 minimum; superior if required by process

8.1.1.2 DP transmitters for flow measurement shall have integrally mounted 3 valve manifolds.

8.1.1.3 Level transmitters shall be guided wave Radar type for Chlorine liquefier. Pressure transmitter on Chlorine liquefier shall be 3" Flanged diaphragm seal type, with capillary of 3 meters. Flange rating for these transmitters shall be 300# .

8.1.2 Temperature Transmitters

8.1.2.1 These shall be standard smart type, 4 ~ 20mA O/P, head mounted RTD/TC input. These shall be blind type.

8.1.3 pH and Conductivity Analysers



a.	Type	:	Standard <input type="checkbox"/> Smart <input checked="" type="checkbox"/>
b.	Wetted parts	:	SS316 minimum
c.	Sensor	:	Fully encapsulated with flow through chamber.

8.1.4 Dial Thermometers

a.	Type	:	Gas filled <input type="checkbox"/> Bimetallic <input checked="" type="checkbox"/>
b.	Dial size	:	100 mm <input type="checkbox"/> 150 mm <input checked="" type="checkbox"/>
c.	Capillary (if required)	:	Material SS304/SS316, armoured, with maximum length restricted to 3 m.
d.	Thermowells	:	Material SS316(min.), superior material if required by the process.
			Dial Thermometer shall be every angle type.

8.1.5 Resistance Temperature Detectors

a.	Type	:	Pt 100, 3 wire, calibration as per IEC 584-2,
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			mineral insulated
b.	Sheath	:	SS304 / SS316
c.	Thermowells	:	Material SS316(min.), superior material if required by the process.

8.1.6 Thermocouples

a.	Type	:	K type, mineral insulated, Calibration as per ANSI MC96.1, Ungrounded
b.	Sheath	:	SS304 / SS316
c.	Thermowells	:	Material SS316(min.), superior material if required by the process.

8.1.7 Pressure Gauges/Differential Pressure Gauges

a.	Type	:	Bourdon/ Capsule/ Diaphragm as required. Material of wetted parts SS316(min.) Superior material to be used if required by the process.
b.	Dial size	:	100 mm <input type="checkbox"/> 150 mm <input checked="" type="checkbox"/>

8.1.8 Variable area flowmeters

Variable area flowmeters shall be normally selected for line sizes less than or equal to 3" and shall be with flanged end connections.

a.	Type	:	Metal tube <input checked="" type="checkbox"/> Glass tube <input type="checkbox"/>
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8.1.9 Level Gauges

Local level indicators with all metallic construction with magnetic coupling and follower magnets is generally preferred for corrosive and toxic fluids like hydrochloric acid/sulphuric acid. Gauge glasses shall be reflex or transparent type with flanged connections. All level gauges shall be provided with drain valve.



However Level gauges shall be Reflex type with Anti frost which are mounted on Chlorine liquefier and cryogenic services.

8.1.10 Level Switches

Vibrating fork type level switch shall be selected for solids and liquid service OR Level switches shall be flanged external float type (with chamber) with IP65 enclosure.

8.1.11 Control/On-Off Valves

Butterfly valves shall be used on/off service for line sizes > 3". Globe/diaphragm valves can be used for on/off service for line sizes ≤ 3". Diaphragm valves shall not be used for control applications. Globe valves shall be used for control service. Butterfly valve can be used for non-critical control service for line size ≥ 6".

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Control valves shall be of flanged design. For Freon service, Valves with **double gland packing and anti-cavitation trim** shall be selected

All control valves shall be considered with Smart HART E/P positioners with gauges for signal and output indications and one air filter regulator with output gauge mounted and tubed. For special cases, volume boosters shall be considered for control valve positioners to get fast operation as per process requirement. Quick exhaust shall be considered where quick closing is required. All accessories shall be mounted on control valve and tubed. In addition, following specifications shall apply :

a.	Limit switches for closed/open position	:	Inductive type {P & F make}	<input checked="" type="checkbox"/>
		:	Microswitch	<input type="checkbox"/>
b.	Handwheel, where applicable	:	Required	<input checked="" type="checkbox"/>
			Not -required	<input type="checkbox"/>

E/P Positioners

All control valves shall be considered with electro-pneumatic positioner with gauges for input and output indications and one air filter regulator with output gauge mounted and tubed. Electro-pneumatic positioners shall be SMART HART type. For special cases, volume boosters shall be considered for control valve positioners to get fast operation as per process requirement.

8.1.12 Solenoid Valves

3/2 way; coil voltage as per clause 5.0.c, with integrally mounted termination box, pneumatic connection 1/4" NPT(F), SS body. Vent port shall be with SS bug screen.

9 SPECIFICATIONS OF OTHER ITEMS

9.1 Signal Cables

Single pair (1P) and multipair (6P, 12P), multistranded copper conductor 0.75 mm², PVC insulated, type "C", screened, PVC sheathed, armoured and overall PVC sheathed, for signals from instruments to junction boxes (single pair) and from junction boxes to panel (multipair). Thermocouple extension cables shall have the same material of conductors as thermocouples.

Applicable standards : EN 50288 Part 7 : 2005.

9.2 Power Supply Cables For Instruments & Solenoid Valves



3C/12C/24C x 2.5 mm² multistranded copper conductor, PVC insulated, type "C", PVC sheathed, armoured and overall PVC sheathed as per EN 50288 Part 7 : 2005.

9.3 Impulse Tubing

a.	Material	:	SS 304	<input type="checkbox"/>	SS 316	<input checked="" type="checkbox"/>
b.	Size	:	1/2" OD x 0.049" thk	<input checked="" type="checkbox"/>	12 mmOD x 1mm thk	<input type="checkbox"/>
c.	Applicable standard	:	ASTM A269			

9.4 Air Supply/Signal Tubing

a.	Material	:	Cu, PVC sheathed	<input checked="" type="checkbox"/>	SS 316	<input type="checkbox"/>
b.	Size	:	8mm ODx1mm thk	<input checked="" type="checkbox"/>		<input type="checkbox"/>
c.	Applicable standard	:	ASTM A269			

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9.5 Fitting for Impulse Tubing/Signal Tubing

Compression type fittings of double ferrule “Swagelok” type of following material:

a.	Impulse lines	:	SS 304 <input type="checkbox"/> SS 316 <input checked="" type="checkbox"/>
b.	Pneumatic lines	:	Brass Ni-plated with brass ferrules <input type="checkbox"/>
		:	SS 316 <input checked="" type="checkbox"/>
c.	Impulse lines for corrosive service	:	PTFE material 8mmOD/6mm ID of EM Technik / Swagelok/ Parker make.

9.6 Junction Boxes

Junction boxes shall be made of FRP in general and shall be weatherproof to IP 55. Junction boxes shall be machine molded. In general, all cable entries shall be at bottom. Canopies for field transmitter & junction boxes shall be made of FRP. Thickness of FRP shall be 4 mm.

9.7 Cable Glands

Cable glands shall be double compression type with PVC hood of following specifications:

a.	Material	:	Brass Ni-plated <input checked="" type="checkbox"/> SS 316 <input type="checkbox"/>
b.	Size	:	To suit cable dimensions and instruments.

9.8 Air Headers



Air distribution pot shall be made out of 2” SS 316 pipe with 10 tappings. Each outlet of air header shall be provided with a ball valve of material SS 316, size ¼ “ NPT(F).

9.9 Cable Trays

These shall be FRP perforated, 4 mm thick up to 300mm width and 5 mm thick FRP ladder type for widths greater than 300mm.

10 PAINTING

All the cable trays, structurals etc. shall be cleaned with wire brush or by chemical treatment followed by 2 coats of epoxy primer and 2 coats of final paint. Painting requirements for Instruments shall be governed by the Project specific painting requirements.

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11 INSTRUMENT TAPPING CONNECTION DETAILS

Tapping sizes are as given below:

Instrument Tapping Sizes			
Instrument type			
	Instrument Connection	Piping Connection	Equipment Connection
Pressure			
Pressure Gauge / Switch Bourdon	½" NPT(M)	1" nozzle	1" nozzle
Pressure Gauge / Switch Diaphragm	2" flanged	2" nozzle	2" nozzle 2)
Shafer Diaphragm Pressure Gauge	2" flanged	2" nozzle	2" nozzle
Pressure Gauge - Manometer	¼" NPT	1" nozzle	
Pressure Transmitter	½" NPT(F)	1" nozzle	1" nozzle
Flanged Type Press. Transm.	3" flanged	3" nozzle	3" nozzle
Remote Seal Type Press. Transm.	3" flanged	3" nozzle	3" nozzle
Temperature			
Temperature Gauge / RTD / Thermocouple Thermowell			
Liquid	1 1/2" flanged 1)	1 1/2" nozzle	1 1/2" nozzle 2)
Gas	1 1/2" flanged / M33 X 2	M33 X 2	1 1/2" nozzle 2)
Level			
Level Gauges Magnetic Level Indicator	1" flanged	-	1" nozzle 2)
Level Switch (External Float Switch, side-mounted))	2" flanged	-	2" nozzle 2)
DP Level Transmitter	½" NPT(F)	-	1" nozzle 2)
Flanged Level Transmitter	3" flanged	-	3" nozzle
Remote Seal Level Transmitter	3" flanged	-	3" nozzle
Displacer Level Transmitter	2" flanged	-	2" nozzle
Purge Level Transmitter	½" NPT(F)	-	1" nozzle 2)
Capacitive Level Switch	1 1/2" flanged	-	1 1/2" nozzle 2)
Radar Level Transmitter	4" flanged	-	4" nozzle
Vibrating fork type Level Switch	2" flanged		2" nozzle

Remarks:

1. Special conditions (high pressure, high fluid velocity, high corrosive fluid) may require special thermowells and nozzles.
2. Special equipment/pipe design like rubber/PTFE lining, enamel lining, plastic pipes or vessels etc. may require different nozzle design and size.

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12 TAGGING PHILOSOPHY

Following tagging philosophy shall be followed for all tags.

AAAAA	99	99	BB
Functional description (Max of 5 characters)	P&ID number	Serial number for a parameter (e.g. pressure, level, etc.)	Suffix for tag number

e.g. PT-2311A.

Serial nos. for all tags shall start from 11 onwards.

Local gauges shall be tagged as PI, LI, TI, FI etc.

On-Off Valve Limit switch shall be tagged as XZSH for Open indication and XZSL for Closed indication.

Control Valve Limit switch, if applicable shall be tagged as FZSH, FZSL, PZSH, PZSL and so on.



Pump run signals shall be tagged as YA-2305A

Pump Trip signals shall be tagged as YS-2305ATRP

where 05A indicates Pump no. 23P005A.

13 SPECIAL REQUIREMENTS

- 13.1** All on/off valves shall be supplied with solenoid valve and open & close limit switches wired in a common box.

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14 DOCUMENTATION REQUIREMENTS

SR. NO.	DOCUMENT	TO BE SUBMITTED ALONGWITH BID		FOR INFORMATION AFTER PO / LOI			FOR APPROVAL AFTER PO / LOI			FINAL	
		COPIES (PRINTS)		TIME SCH. WEEKS	COPIES (PRINTS)		TIME SCH. WEEKS	COPIES (PRINTS)		COPIES	
		C	tkIS-India		C	tkIS-India		C	tkIS-India	S (1)	P (1)
1.	Instrument index	---	---	---	---	---	4	3	2	1	8
2.	PLC I/O list	---	---	---	---	---	4	3	2	1	8
3.	Inst. specs. & data sheets	---	---	---	---	---	6	3	2	1	8
4.	Control philosophy	---	---	---	---	---	4	3	2	1	8
5.	Interlock & shutdown logic diagram / Ladder diagram / Write up	---	---	---	---	---	8	3	2	1	8
6.	Alarm & shutdown list with set points	---	---	---	---	---	10	3	2	1	8
7.	Panel specification	---	---	---	---	---	8	3	2	1	8
8.	Wiring diagram for panel/loop wiring drawings	---	---	---	---	---	8	3	2	1	8
9.	JB termination drawing, cable list	---	---	---	---	---	8	3	2	1	8
10.	Hookup drawings	---	---	---	---	---	8	3	2	1	8
11.	Instrument plot plan	---	---	---	---	---	16	3	2	1	8
12.	Test cert. & certificates from statutory authorities	---	---	---	---	---	---	---	---	1	8
13.	Complete catalogues with parts list for all insts.	---	---	---	---	---	---	---	---	1	8
14.	Installation, operation & maintenance manual for all insts.	---	---	---	---	---	---	---	---	1	8

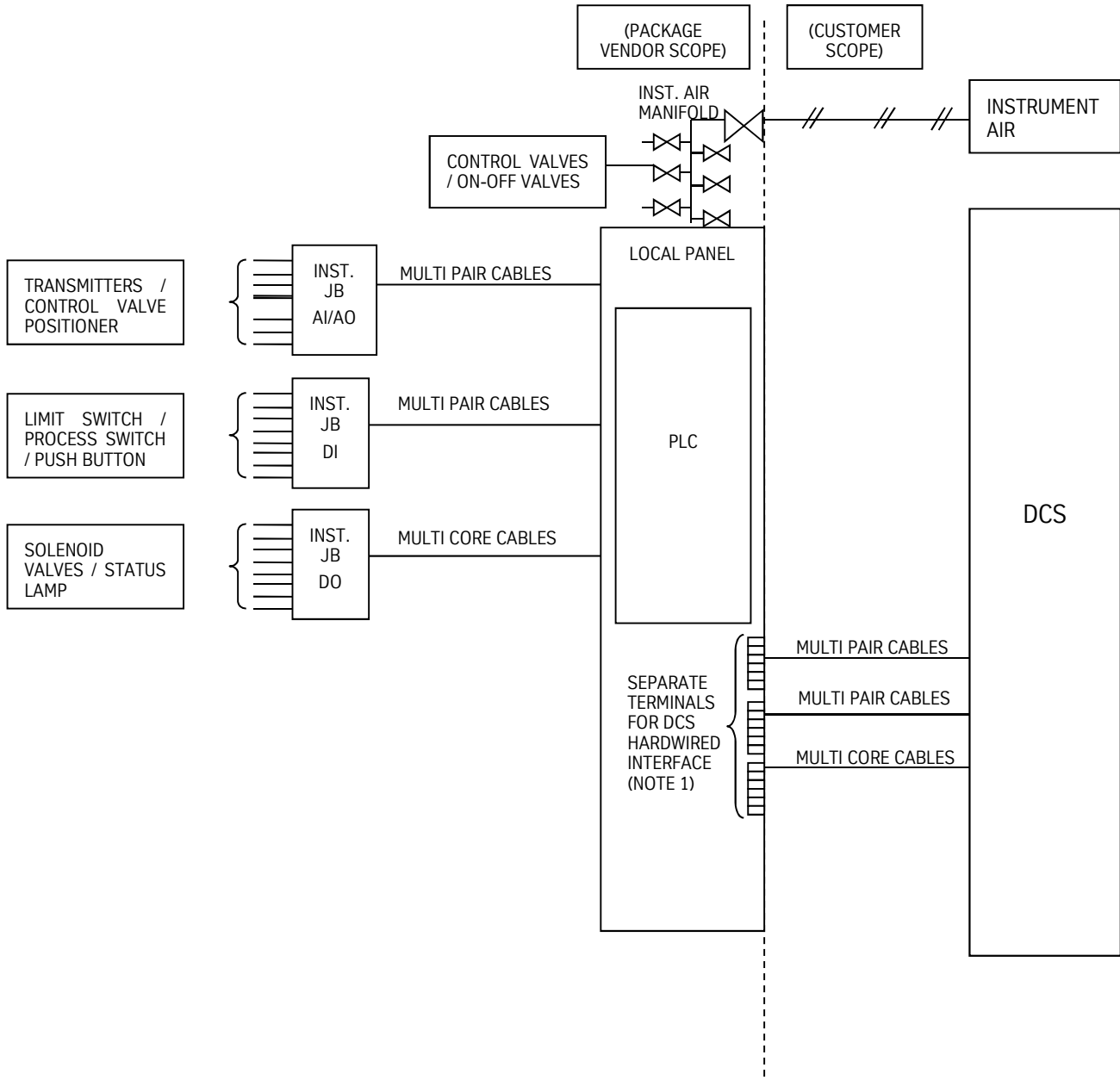
1. Abbreviations:

S : Soft copies (.pdf files)

P : Prints



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15 INSTRUMENTATION CONNECTION CONCEPT





NOTES:

- 1) SIGNAL GROUPING SHALL BE 1) AI/AO , 2) DI AND 3) DO SIGNALS. SIGNALS FROM/TO DCS SHALL BE BROUGHT TO SEPARATE TERMINAL BLOCK (TB) . SEPARATE TBs TO BE PROVIDE FOR EACH SIGNAL GROUP.



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16 APPROVED VENDOR LIST FOR IMPORTANT ITEMS

SR. NO.	ITEM	VENDOR NAME	REMARKS
1.	PROGRAMMABLE LOGIC CONTROLLERS	M/S. ROCKWELL AUTOMATION M/S. SIEMENS LTD.	
2.	ELECTRONIC TRANSMITTERS (PRESS. / DIFF. PRESSURE)	M/S. YOKOGAWA INDIA LTD. M/S. EMERSON PROCESS MANAGEMENT M/S. SIEMENS LIMITED, M/S. HONEYWELL AUTOMATION INDIA LTD. M/S. ENDRESS & HAUSER	
3.	TEMPERATURE ELEMENTS WITH TEMPERATURE TRANSMITTERS	M/S. THERMAL INSTRUMENTS INDIA M/S. PYROELECTRIC INSTS. PVT. LTD. M/S. GOA INSTRUMENTS INDUSTRIES M/S. GAUGES BOURDON INDIA	TRANSMITTERS FROM: 1) YOKOGAWA 2) EMERSON 3) E & H
4.	RADAR TYPE LEVEL TRANSMITTERS	M/S. EMERSON PROCESS MANAGEMENT (INDIA) PVT. LTD. M/S. ENDRESS+ HAUSER (INDIA) PVT LTD. M/S. VEGA INDIA LTD.	
5.	ON-OFF / CONTROL VALVES - BUTTERFLY	M/S. PENTAIR VALVES & CONTROLS M/S. IDEX INDIA PVT. LTD. M/S. BRAY CONTROLS M/S. FLOWSERVE	
6.	CONTROL VALVES -GLOBE UNLINED	M/S. EMERSON PROCESS MGMT CHENNAI LTD. M/S. MIL CONTROLS LTD. M/S. SAMSON CONTROLS PVT. LTD. M/S. UNIFLOW CONTROLS INSTRUMENTS PVT. LTD. M/S. FORBES MARSHALL	
7.	CONTROL VALVES SELF REGULATING	M/S. NIRMAL INDUSTRIAL CONTROLS PVT. LTD M/S. EMERSON PROCESS MANAGEMENT CHENNAI LTD M/S. SAMSON CONTROLS PVT. LTD.	
8.	AIR FILTER REGULATORS	M/S. MIDLAND M/S. PLACKA INSTS. & CONTROLS M/S. SHAVO NORGREN (I) PVT. LTD.	
9.	ELECTROPNEUMATIC POSITIONER	M/S. SIEMENS LTD. M/S. SAMSON CONTROLS PVT. LTD M/S. EMERSON PROCESS MGMT (INDIA) PVT. LTD. M/S. YTC	
10.	SOLENOID VALVES	M/S. ASCO NUMATICS (INDIA) PVT. LTD. M/S. IMI NORGREN HERION PRIVATE LIMITED M/S. ROTEX	

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SR. NO.	ITEM	VENDOR NAME	REMARKS
11.	pH / REDOX & CONDUCTIVITY ANALYSERS	M/S. ABB LTD. M/S. FORBES MARSHALL PVT LTD. M/S. YOKOGAWA INDIA LTD. M/S. EMERSON PROCESS MGMT (I) PVT. LTD.	
12.	VARIABLE AREA FLOWMETER/ WITH TX / WITH CONTACT	M/S. KROHNE MARSHALL PVT. LTD. M/S. TANSO EQUIPMENTS PVT. LTD. M/S. EURAKA INDUSTRIAL EQUIPMENTS M/S. CHEMTROLS INDUSTRIES LIMITED	
13.	ORIFICE PLATES / ASSEMBLIES	M/S. MINCO INDIA PVT LTD. M/S. HYDROPNEUMATICS (PYROELECTRIC) M/S. MINCO INDIA FLOW ELEMENTS M/S. BALIGA LIGHTING EQPT PVT. LTD. M/S. STARMECH	
14.	LEVEL GAUGES TRANSPARENT / REFLEX TYPE	M/S. CHEMTROLS SAMIL INDIA M/S. BLISS ANAND M/S. GAUGES BOURDON INDIA	
15.	LEVEL GAUGES (MAGNETIC TYPE)	M/S. CHEMTROLS SAMIL INDIA M/S. BLISS ANAND M/S. GAUGES BOURDON INDIA	
16.	LEVEL SWITCHES VIBRATING FORK TYPE	M/S. ENDRESS & HAUSER INDIA LTD. M/S. VEGA INDIA LEVEL M/S. NIVO CONTROLS M/S. PUNE TECHTROL	
17.	PRESSURE GAUGES – BOURDON / DIAPHRAGM SEAL	M/S. BAUMER TECHNOLOGIES INDIA M/S. GAUGES BOURDON INDIA M/S. WIKA INSTRUMENTATION M/S. GOA THERMOSTATIC M/S. PRECISION MASS PRODUCTS	
18.	PRESSURE & DIFF. PRESSURE SWITCHES	M/S. KAUSTUBH UDYOG(ORION) M/S. GAUGES BOURDON INDIA M/S. PRECISION MASS PRODUCTS	
19.	TEMPERATURE GAUGES	M/S. BAUMER TECHNOLOGIES INDIA M/S. GAUGES BOURDON INDIA M/S. GOA THERMOSTATIC M/S. PRECISION MASS PRODUCTS	
20.	JUNCTION BOX (FRP)	M/S. SHRENIK & CO. M/S. EX-PROTECTA M/S. PHOENIX MECANO INDIA M/S. DEVI POLYMERS	
21.	INSTRUMENT CABLES	M/S. TC COMMUNICATION M/S. ASSOCIATED CABLE LTD. M/S. THERMOCABLE LTD. M/S. CORDS CABLES M/S. SUYOG ELECTRICAL LTD	

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SR. NO.	ITEM	VENDOR NAME	REMARKS
22.	CABLE GLANDS	M/S. COMET BRASS PRODUCTS M/S. EX-PROTECTA M/S. FLAMEPROOF EQPTS. PVT. LTD. M/S. PRIME INDUSTRIES	
23.	SS TUBES	M/S. TRUEWAY ENGINEERING INDUSTRIES M/S. V.S. METAL, M/S. RAJENDRA MECH IND.(REMI) M/S. SHRIRAM METAL	
24.	COPPER TUBES (PVC SHEATHED)	M/S. RAJCO METAL INDUSTRIES. M/S. V.S. METAL M/S. EXCEL HYDROPNEUMATICS PVT. LTD	
25.	TUBE FITTINGS , ISOLATION VALVES, & MANIFOLDS	M/S. TRUEWAY ENGINEERING INDUSTRIES M/S. EXCEL HYDROPNEUMATICS PVT. LTD. M/S. WESMEC ENGINEERING M/S. COMFIT & VALVES PVT. LTD.	
26.	PTFE/PFA TUBES & FITTINGS	M/S. EM-TECHNIK M/S. SWAGELOK M/S. PARKER	
27.	CABLE TRAYS - FRP	REFER ELECTRICAL VENDOR LIST	
28.	DISPLACER LEVEL TRANSMITTERS	M/S. CHEMTROLS SAMIL INDIA M/S. V-AUTOMAT INSTRUMENTS PVT LTD M/S. EMERSON PROCESS MGMT (I) PVT. LTD.	