

	COMPLIANCE STATEMENT / QUERY	BIDDER'S CONFIRMATION / ANSWER
	Please note that it is mandatory to furnish replies to the technical queries listed below, without which bidder's offer will be considered as incomplete and is liable for rejection.	
1	Please confirm that deviation, if any, against the applicable specifications and codes/ standards shall be duly consolidated at one place (under Exceptions / deviations list). In case no deviations are furnished, it will be presumed that all requirements are fully met and complied with, by the bidder. Any deviations/ deletions/ corrections made by the bidder elsewhere will not be taken cognizance of and all such deviations shall deem to have been withdrawn by the bidder.	
2	Please confirm categorical compliance to the scope of work, various technical specifications, drawings and documents for Instrumentation & control system in the bid package. Also, confirm that all other equipment, materials and work not explicitly mentioned but nevertheless required to fulfill the functional requirements shall be deemed to be included in the scope of bidder with no additional cost and time implication to the owner.	
3	Confirm that the all instrumentation items their accessories, items for relay based control system including their accessories, etc. supplied shall be of one of the approved makes given in the APPROVED VENDOR LIST attached with bid package.	
4	Please confirm compliance to Drawings/ Documents requirements.	

Notes: -

1. The Bidder shall indicate his reply in the space provided in the Technical Questionnaire. In case space provided is not adequate, the reply may be furnished separately under suitably numbered annexure / attachments duly referred against the comment / query.
2. The Compliance Statements / Queries are required to be categorically confirmed / answered by the bidder and the completely filled in Tech questionnaire shall be submitted together with the Bid.

Moisture Analyser

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General	1.	Tag Number				
	2.	Service				Food Grain
	3.	SILO Size				
	4.	Area Classification				Zone 22 (dust) Zone 2 (gas)
	5.	Measurement Type				Equilibrium moisture content
Probe/ Cable	6.	Cable for measurement				Required
	7.	SILO Isolation Valve				Not required
	8.	Cable housing material				
	9.	Cable insertion				
		SILO Height 1	SILO Height 2	mm	*	*
SILO Height 3		SILO Height 4	mm			
SILO Height 5		SILO Height 6	mm			
10.	Cable Connection size / Rating / Flange material (all streams)					
Evaluation Unit/ Transmitter	11.	Flow rate/ pressure /purity				*
	12.	Flow meter				Not Required
	13.	Items Required				RH/Moisture, Evaluation unit/Transmitter
	14.	Interface				RS232, RS485
	15.	Enclosure				IP 65 according to EN 60529/10.91
	16.	Interconnection tubing/ fittings between Probe and Sample Cell				Required, to be supplied by vendor.
	17.	Principle				Equilibrium moisture content
	18.	Location				To be mounted in a self-standing cabinet in the Control room.
	19.	Power Supply				110 V AC ±10%, 50 Hz / 24 V DC (Bidder shall furnish filled-up utility consumption table along with offer)
	20.	Scale Range				*
	21.	Accuracy	Repeatability		*	*
	22.	Response Time	Sensitivity		*	*
	23.	Auto-calibration				Required (For analyser)
	24.	Analyser Type				Microprocessor based with RAM memory with battery back-up
	25.	Outputs				Isolated 4-20mA DC, current output for each stream.
26.	Enclosure				General Purpose.	
Service Conditions	27.	Process Conditions				
	28.	Fluid	State		Food Grain	Solid
	29.	Pressure: Normal	Design	Kg/cm2g		
	30.	Temperature: Normal	Design	°C		
	31.	Operating Density	Molecular weight			
	32.	Measurement range	Concentration			
	33.	Cp / Cv	Comp. Factor			
	34.	Vapour Press.	Critical Press.	Kg/cm2a		
	35.	Stream Composition				
Certifications	36.	Statutory				CCOE
	37.	Others				
Others	38.	Manufacturer				*

0	22.11.16	RCK	NBG	NBG	REQ. NO. :	LEGEND : * - By Vendor ^ - data Revised
REV	DATE	BY	CHKD	APPD	VENDOR. :	



ENGINEERS INDIA LIMITED
NEW DELHI

PLANT : FOOD GRAIN STORAGE SILO PROJECT AT NABHA
CLIENT : M/s. CWC

SPECIFICATION	REV
A951-000-YA-DS-0001	0

703

Moisture Analyser

45.	Model No		*
-----	----------	--	---

Notes:-

*- By Vendor

1. Power supply feeders shall be provided in Control room / Sub- station, further distribution with all accessories such as power supply pack, etc. shall be in vendor's scope of supply.
2. Minimum 4 numbers of probes/nodes shall be provided by contractor. However, the exact quantity shall be decided by contractor during detail engineering.
3. Any special cables shall be included by contractor from field to control room in their scope of supply.
4. Any statutory requirement/certificate shall be complied by contractor.

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0	22.11.16	RCK	NBG	NBG	REQ. NO. :	LEGEND * - By Vendor ^ - data Revised
REV	DATE	BY	CHKD	APPD.	VENDOR :	



ENGINEERS INDIA LIMITED
NEW DELHI

PLANT : FOOD GRAIN STORAGE SILO
PROJECT AT NABHA
CLIENT : M/s. CWC

SPECIFICATION	REV
A951-000-YA-DS-0001	0

704

Breather Valve, Flame Arrester, Vents

GENERAL	1	Tag Number				
	2	Service			Diesel	
	3	Tank No./ Line No.			Diesel Day Tank	
BREATHER VALVE	4	Type				
	5	Sizing				
	6	Setting	Pressure		Kg/cm2	
			Vacuum		Mm H2O	
	7	Over Pressure				
		Full Open Pressure			Kg/cm2	
	8	Capacity (equivalent air) at				
		Set Pressure			M3/h	
		Set Vacuum			M3/h	
	9	End Connections, Inlet				
		Size	Rating			
		Facing and finish				
	End Connections, Outlet					
	Size	Rating				
	Facing and finish					
10	Type of Seating					
11	Material	Body	Seat/Pallet			
		Diaphragm	O Ring			
12	Test Connection Below Pallet					
13	Type	Mounting				
	Sizing Delta P			Deflagration	In Line	
14	End Connection Size			HOLD		
	Rating			2' (HOLD)	150#	
	Facing and Finish			RF 125AARH		
16	Material Body and Flanges			ASTM A350 Gr LF2		
	Shell	Bank		316 SS (Note-6)	316 SS	
17	Bank Type			Retractable		
18	Capacity (equivalent air) at					
	Design Pressure		Kg/h	*		
	Design Vacuum		M3/h	*		
19	Type					
	End Connection	Rating				
	Facing and Finish					
21	Material	Body	Cover			
		Mesh	Diaphragm			
22	Capacity (equivalent air) at					
	Design Pressure					
	Design Vacuum					
23	Set Pressure					
	Vacuum					
24	Over Pressure %					
	Full Open Pressure					
25	Fluid	Fluid Gas Group		Diesel		
	Flash Point		Deg			
27	Insert Gas Blanket			NA	NA	
28	Capacity (equivalent air) at					
	In Breathing	Out Breathing	M3/h			
29	Tank	Design Pressure	Kg/cm2			
		Design Vacuum	Mm H2O			
30	Discharge To					
	Manufacturer			Atmosphere		
OTHERS	32 Model Number Breather Valve			*		
	Flame Arrester					
	Vent/Emer. Vent/Free Vent			*		

NOTES:

1. SI No. 25: Hazardous area classification is Zone 1, Gas Gr. IIA/IIB, T3
2. SI No. 29: Design Pressure= Atmosphere and operating & design temperature 20-25 & 65 deg C.
3. Certified capacity curves for supplied models shall be furnished.
4. This Flame Arrestor is to be mounted on the tank top to atmosphere. Flame arrester to be sized considering the vent.
5. Flame arrester shall be provided with bolted cover & cover basket.
6. SS316Ti is also acceptable.

[] Deviation [] No Deviation Vendor's Signature

					Requisition No.	
0	22-11-16	RCK	NBG	NBG	Order No.	
Rev	Date	By	Chkd	Appd	Vendor	

Legend:
* By Vendor

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ENGINEERS INDIA LIMITED NEW DELHI	PLANT : FOOD GRAIN STORAGE SILO PROJECT CLIENT : M/s CWC	SPECIFICATION A951-000-YB-DS-0001 (1/1)	REV 0
---	--	--	-----------------

7050

Gage Glasses & Cocks

UNITS: Flow->Liquid- Gas- Steam- Pressure-> Temperature->°C Level / Length-> mm

1. Vendor's Scope of Supply:-

GAUGE GLASSES

2. Type:-

3. Chamber Conn.:-

Size & Type :-

Location :-

Vent & Drain :-

4. Material :

Chamber :-

Cover Plate :-

Studs :-

Nuts :-

Gaskets :-

5. Options:

a) Mica Shield

b) Illuminator

c) Heating Jacket

d) Calibrated Scale

e) No-Frost Extn.

f) I.B.R. certificate

g)

h)

6. Illuminator:

Power Supply :-

Area Class :-

Enclosure :-

Cable Entry :-

7. Heating Jacket:

Medium :-

Max. Temp / Press. :-

Connections :-

Inlet :-

Outlet :-

COCKS

8. Type:-

9. Type of Connection:

Vessel

Gauge

Vent

Drain

10. Material:

Body :-

Trim :-

11. Closing :-

12. Bonnet Type :-


13. Ball Checks :-

14. Renewable Seats :-

Tag Number	VISIBLE LENGTH	C TO C LENGTH	Max. Operating		FLUID	LOCATION	VESSEL CONNECTION	OPTIONS	NOTES
			TEMP.	PRESS.					

NOTES:-

Sheet 3/10

VENDOR DRAWING NO:-	ORDER NO:-			
FILE:	REQUISITION NO :	31.10.16		
 ENGINEERS INDIA LIMITED NEW DELHI	CLIENT :	IM/s CWC	DATE	BY
	PLANT :	NABHA SILO PROJECT	DATA SHEET NO.	
	VENDOR :		A951-000-YL-DS--0001	APPD
				0

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Pressure Instruments


UNITS: Flow->Liq- Gas- Steam- Pressure->Kg/cm2g Temperature->°C Level / Length-> mm

1. Function:-	GENERAL		MEASURING UNIT
2. Type:-	Transmitting & Indicating		23. Service:-
3. Case:-	Electronic, SMART		24. Element:-
4. Mounting:-	YOKE		25. Body Material:-
5. Electrical Area Classification			26. Element Material:-
6. Enclosure:-			27. Process Connection.
Enclosure Class:-			28. Process Connection Location
7. Intrinsically Safe:-			29. Diaphragm Seal:
8. Air Supply:-			Wetted Parts Material
9. Power Supply:-			Other Material:-
10. Cable Entry:-	1/2" NPTF		Process Conn.:
11. Accuracy:-			Size & Rating:-
12. Repeatability:-			Facing & Finish:-
	TRANSMITTER		Capillary Material:-
13. Output	4-20 mA (2 wire with HART protocol)		Armour Flexible:-
14. Trans.Power Supply:-	24 V DC		Armour Flexible Material:-
	CONTROLLER		Capillary Length:-
15. Output:-			Flush./Fill. Conn. With Plug:-
16. A/M Switch:-			MISCELLANEOUS
No. of Positions:-			30. Over Range Protection:-
17. Set Point Adjustment:-			Max. Pressure
18. Manual Regulator:-			31. Options:-
19. Mode:-	RECORDER		a) IS Output meter:-
			b) Test jack
20. Chart & Chart Drive:-			c) Mounting brackets for 2" NB Pipe
21. Moving Parts Material			32. Load driving capability:-
22. Chart Speed:-			

Tag Number	Operating Pressure	Maximum Pressure	Maximum Temp.	Range		Control Action	Service	Options
				Span	Set			

NOTES:-

Sheet 10/10

VENDOR DRAWING NO:-	ORDER NO:-				
FILE:	REQUISITION NO :				
 ENGINEERS INDIA LIMITED NEW DELHI	CLIENT : M/s CWC	DATE	BY	CHKD	APPD
	PLANT : FOOD GRAIN STORAGE SILO	DATA SHEET NO.		REV	
	VENDOR :	A951-000-YI-DS-1001		0	

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707

Differential Pressure Instrument

GENERAL	1.	Function	Transmit Indicate	MEASURING UNIT	23.	Service	Flow
	2.	Type	Electronic SMART		24.	Element Type	Diaphragm
	3.	Case	MFR STD		25.	Body Material	Carbon Steel
	4.	Mounting	Yoke,NOTE		26.	Element Material	316 SS
	5.	Enclosure	Weather+Flame Proof		27.	Body Rating kg/cm ²	160
	6.	Electric Area Class	NOTE-4		28.	Overrange Protection	NOTE-5
	7.	Intrinsic Safety	Yes		29.	Instrument Connection	1/2" NPTF
	8.	Air Supply			30.	Connection Location	MFR STD
	9.	Power Supply	24V D.C. Two Wire		31.	Diaphragm Seal	Not Required
	10.	Cable Entry	1/2" NPTF			Type	
	11.	Accuracy	+/-0.075%			Wetted Part Material	
	12.	Output Type	Electronic Smart			Other Material	
	13.	Driving Voltage	24 V (On Two Wire)			Process Connection (LP):	
	14.	Protocol	HART			Size & Rating	
TRANS MITTER	15.	Auto Manual Switch			Facing & Finish		
	16.	Set Point Adjustment			Process Connection (HP):		
	17.	Manual Regulator			Size & Rating		
	18.	Output Type			Facing & Finish		
CONTROLLER	19.	Protocol			Capillary Material		
	20.	Chart			Armour Type		
	21.	Chart Drive			Armour Material		
RECORDER	22.	Chart Speed			Capillary length m		
					Flushing/Filling Conn. with plug		
				MODEL	32.	MFR & Model No.	* *

- Options :
- | | | |
|-------------------------|---|--|
| a) Air Filter Regulator | b) Integral Output Meter (Intrinsically safe) | c) Manifold 5 Valve |
| d) Manifold 3 Valve | e) Condensate Pots | f) Adjustable Dampener |
| g) Integral Sq.Rt. Ext | h) Test Jack, Calibrating | i) Mounting Accessories for 2" NB pipe |
| j) CCOE Approval | | |

- Notes :
- Output 4-20mA shall be superimposed on digital signal with HART protocol.
 - Digital communication shall be possible with hand held communicator.
 - Vendor shall supply U bolts and nuts suitable for 2" pipe mounting.
 - Electrical area classification shall be IEC Zone -I, Gr. IIA/IB, T3
 - Over range protection shall be suitable for maximum pressure or 130% of range, whichever is higher.
 - All instruments shall be as per std. spec. no.6-52-0032.

Sheet 1 Of 2

	REQUISITION NO.:	LEGEND :	= Hold * By Vendor / Data Revised
REV. DATE	BY	CHKD.	APPVD.
			VENDOR
ENGINEERS INDIA LIMITED NEW DELHI		PLANT :	SPECIFICATION
		UNIT :	REV
		CLIENT :	A951 000-YI-DS-3000

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708

Differential Pressure Instrument

Rev.	Tag No	Diff. Range		Scale Factor	Zero Elev. / Stopp.	Pressure Max.	Temp. Max.	Control Mode / Action	Service	Options
		Span	Set							

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Sheet 2 Of 2

REV	DATE	BY	CHKD	APVD	REQUISITION NO:	LEGEND	B Hold * By Vendor ^ Data Revised
ENGINEERS INDIA LIMITED NEW DELHI					ORDER NO:	SPECIFICATION	
					VENDOR:	REV	
					PLANT:	A951-000-YI-DS-3000	
					UNIT:		
					CLIENT:		



709

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Radar Level Instruments (Non-contact type)

			UNITS	Non-contact type	
Sensor	1	Wave Guide Type		*	
	2	Response Time		*	
	3	Linearity		<0.1% of probe length (Note-2)	
	4	Repeatability		±1 (Note-2)	
	5	Operating Temp. effect		*	
	6	Connection	Orientation		Ref. Continuation sheets
	7	Accuracy			Top mounted
	8	Chamber Material	Flange Material		± 3(Note-2)
Transmitter	10	Function – Indicating/ Trans.		SS316	
	11	Output		Indicate & Transmit	
	12	Electrical Cable Entry -Signal	Power		4-20 mA HART
	13	Power Supply			½" NPTF
	14	Enclosure			24 V DC, Two wire
	15	Electrical Area Classification			IP-65
	16	Intrinsic Safety			*
	17	Gauge Head Material			*
	18				Manufacturer's standard
	19	Type			Digital with LCD display
Local Indicator	20	Location		Grade Level	
	21	Graduations		0 – 100%	
	22	Enclosure			WP IP 65
	23				
Temperature Element	24	Vent Connections		-	
	25	Drain Connections		-	
	26	Interface Devices:		-	
	27	- Temperature Element			Not Required
	28	- Water Cut Probe			Not Required
	29	Type			-
	30	Element Type No. of Elements			-
	31	Connection Size & Rating			-
Water cut Probe	32	Element Anchoring			
	33	Sheath Material			
	34	Type			Not Required
	35	Dedicated With Temp. Probe			-
Options	36				
	37	Calibration Pin			
	38	Still Well			
	39	Power Switch			
	40	Mounting Brackets			
	41	Built-in Alarm contacts			
	42	Inter connecting cables between			
		- Tank side Indicator & Gauge head			
		- Gauge and temperature element			
		- Tank Gauge & Water Probe			
Service Conditions		- Power cable between gauge head & Indicator			
	43	Fluid			
	44	Pressure –Oper.	Max		
	45	Temp. –Oper.	Max		
	46	Fluid Density			
	47	Viscosity Corrosive Constituent			
	48	Statutory			
Certification	49	Others			
	50	Manufacturer			
Others	51	Model Number			

Note-

- Accuracy shall be ±3 mm. The accuracy of instrument is inclusive of linearity, repeatability and hysteresis.

Deviation

No Deviation

Vendor's Signature

						Requisition No.		Legend: * By Vendor
0	31.10.16					Order No.		
Rev	Date	By	Chkd	Appd	Vendor			



ENGINEERS INDIA LIMITED
NEW DELHI

PLANT : FOOD GRAIN STORAGE
SILO PROJECT
CLIENT : M/s CWC

SPECIFICATION	REV
A951-000-YL-DS-1001 (1/2)	0

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Tag No.	Service	Inst. Range	Process Connection		Process Condition			Remarks
			Size	Flange Class	Temperature °C	Pressure Kg/cm ² (g)	Viscosity Cst	
			3"	150# RF 125 AARH				

Deviation

No Deviation

Vendor's Signature

					Requisition No.		Legend: * By Vendor
0	31.10.16				Order No.		
Rev	Date	By	Chkd	Appd	Vendor		



**ENGINEERS INDIA
LIMITED
NEW DELHI**

**PLANT : FOOD GRAIN STORAGE
SILO PROJECT
CLIENT : M/s CWC**


SPECIFICATION	REV
A951-000-YL-DS-1001 (2/2)	0

TEMPERATURE MONITORING SYSTEM								
ELEMENT/CABLE	1	Scope of Supply	Note-1	HEAD	9	Head Cover Type	*	
	2	Electric Area Class	Zone 22 (dust) Zone 2 (gas)		10	Material	*	
	3	No. of Elements	*		11	Cable Entry	1/2" NPTF	
	4	Calibration	IEC 60584-2		12	No. of Entries	*	
	5	O.D. mm			13	Terminals	Spring Loaded	
		Material	*		14	Enclosure	IP65	
	6	Junction	*		THERMOWELL	15	Thermowell	*
	7	Retractable	Required			16	Material	*
		Size inch/Material	*			17	Construction	*
	8	Packed Connector	No			18	Process Connection	*
			19	Instrument Connection		*		
				20	Thermowell Length	*		
				21	MFR and Model No.	*		

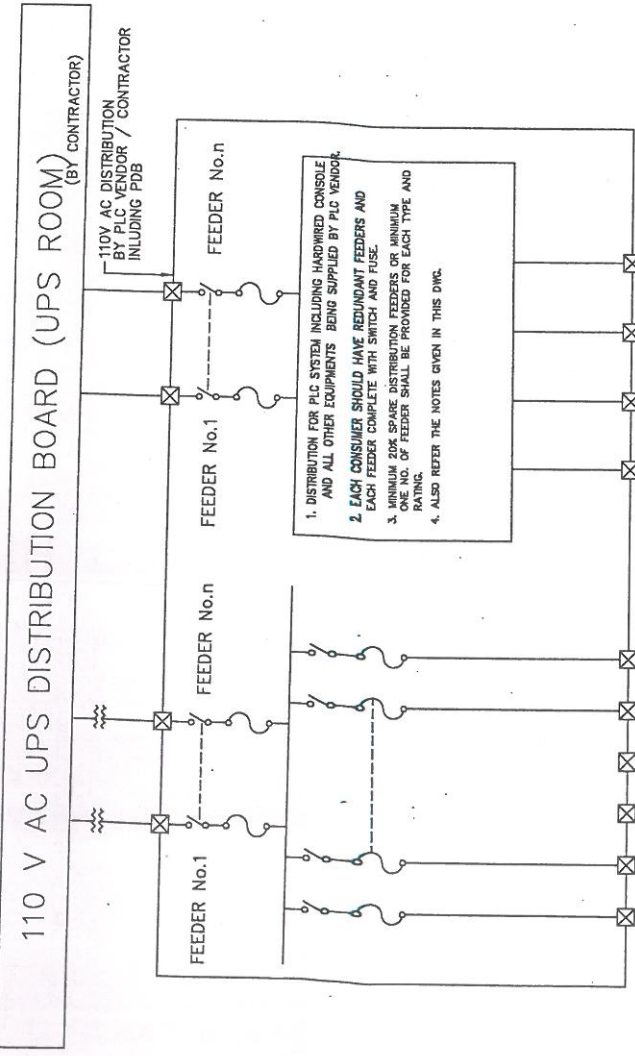
Options: a) Extra Nipple Extension b) Conformance on NACE
c) IBR Certification d) CCOE Approval (if ex. T/c used)

Notes:

- *- Vendor to furnish the details.
- 1) Temperature cable with sensor along with complete control system and monitoring including Junction box, panel, intermediate cable shall be in contractor's scope of supply.
- 2) Vendor shall furnish the complete drawings indicating the temperature elements with transmitter and monitoring system.
- 3) Vendor shall provide RS232/RS485 port to transfer all data to plant PLC system.
- 4) Any statutory requirement/certificate shall be supplied by contractor.

						PROJECT: FOOD GRAIN STORAGE SILO PROJECT AT NABHA	
						INSTRUMENT SPECIFICATION TEMPERATURE MONITORING SYSTEM	
							
0	RCK	NBG	NBG	22.11.16	Issued for Tender	EIL No. A951-000-YT-D5-0001	Sheet 1 of 1
No.	By	Chk	Appr	Date	Description	Code: 23	Rev: 0

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1. DISTRIBUTION FOR PLC SYSTEM INCLUDING HARDWARE CONSOLE AND ALL OTHER EQUIPMENTS BEING SUPPLIED BY PLC VENDOR.
 2. EACH CONSUMER SHOULD HAVE REDUNDANT FEEDERS AND EACH FEEDER COMPLETE WITH SWITCH AND FUSE.
 3. MINIMUM 20% SPARE DISTRIBUTION FEEDERS OR MINIMUM ONE NO. OF FEEDER SHALL BE PROVIDED FOR EACH TYPE AND RATING.
 4. ALSO REFER THE NOTES GIVEN IN THIS DWG.

- REFER NOTE-10
- FEEDER No.1
- FEEDER No.2
- FEEDER No.3
- FEEDER No.4
- FEEDER No.n-1
- FEEDER No.n
- FEEDER No.1
- FEEDER No.2
- FEEDER No.1
- FEEDER No.1
- FEEDER No.1

(NOTE-9)

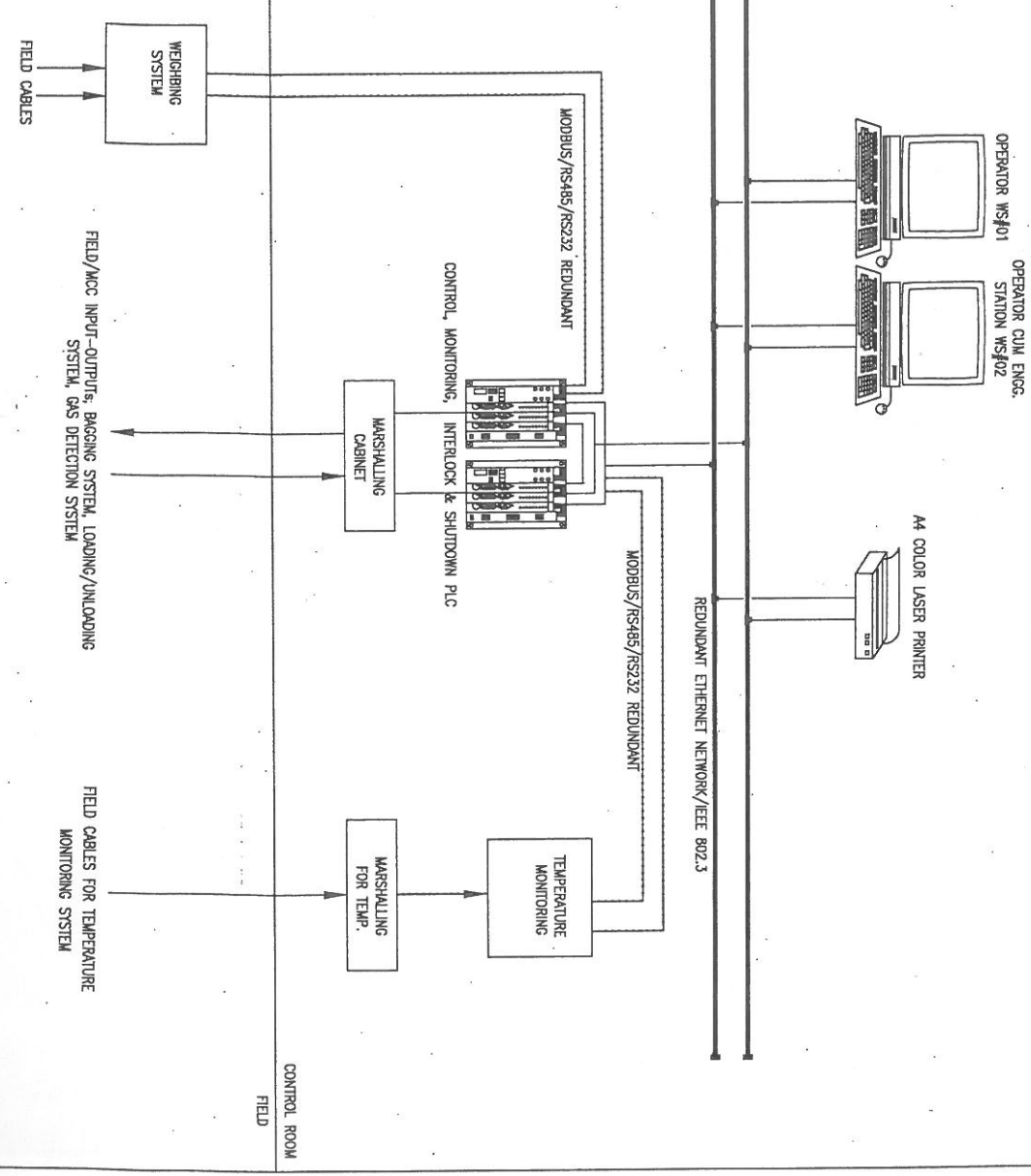
(NOTE-5 & 9)

FOR INSTRUMENTS, PACKAGE PLC, LCP ETC.

- NOTES**
- 1) POWER CONSUMPTION, WHEREVER INDICATED, IS TENTATIVE ONLY. ACTUAL LOAD SHALL BE CALCULATED DURING DETAIL ENGINEERING.
 - 2) FOR PLC SYSTEM VENDOR SHALL ADEQUATELY SIZE FEEDERS, ISOLATORS AND FUSE BASED ON ACTUAL LOAD ON EACH FEEDER.
 - 3) MAIN ISOLATOR SHALL BE DPST TYPE TO ISOLATE AC LINE AND NEUTRAL. LIKEWISE, INDIVIDUAL DISTRIBUTION FEEDERS TO HAVE ISOLATORS OF DPST TYPE TO ISOLATE LINE AND NEUTRAL.
 - 4) CABLE GLANDS SHALL BE PROVIDED BY VENDOR.
 - 5) COMPLETELY ISOLATED FEEDERS SHALL BE PROVIDED FOR PLC LOADS AND NON PLC LOADS IN FIELD. ISOLATION TRANSFORMERS SHALL BE PROVIDED FOR ISOLATION.
 - 6) IN ORDER TO OBTAIN PROPER FUSE CO-ORDINATION, FOLLOWING MUST BE TAKEN INTO CONSIDERATION:
 - a) ALL FEEDERS FOR PLC SHALL FEED TO SEPARATE SETS OF BUS BARS (LINE & NEUTRAL).
 - b) ALL SETS OF FEEDERS SHALL BE FULLY INDEPENDENT AND SHALL NOT BE JOINED TOGETHER AT ANY POINT.
 - 7) PROVIDE VOLTMETER AND AMPMETER IN EACH MAIN POWER FEEDER ENTRY POINT INSIDE THE POWER DISTRIBUTION BOARD.
 - 8) CONTRACTOR SHALL PROVIDE 20% (MINIMUM ONE NUMBER) SPARE POWER DISTRIBUTION OUTLETS, COMPLETE WITH ISOLATOR AND FUSE FOR EACH TYPE AND QUANTITY USED FOR EACH CATEGORY WITH MINIMUM OF ONE NO. FOR EACH TYPE & RATING.
 - 9) FEEDERS TO INDIVIDUAL END USER SHALL ALSO BE REDUNDANT.
 - 10) CONTRACTOR SHALL PROVIDE FEEDER DETAILS IN TABLE FORM INDICATING S. NO, FEEDER DESCRIPTION LOAD ETC.
 - 11) ISOLATION TRANSFORMERS SHALL BE PROVIDED FOR COMPLETE ISOLATION OF FEEDERS FOR PLC AND NON PLC LOAD.

- LEGEND:**
- ISOLATOR
 - HRG FUSE
 - FEEDER OUTLET WITH CABLE GLAND
 - ISOLATION TRANSFORMER

ENGINEERS INDIA LIMITED NEW DELHI		DWG. NO.	REF. DRAWING	ISSUED FOR TENDERING		BIBBAL	RCK	DRAWING NO.		SHEET 1 OF 1
				NO.	DATE	BY	CH'D	A951-000-16-51-3301		REV.
				REVISION				110 V AC POWER DISTRIBUTION (TYPICAL)		A



OPERATOR WS#01
STATION WS#02

A4 COLOR LASER PRINTER

REDUNDANT ETHERNET NETWORK/IEEE 802.3

MODBUS/RS485/RS232 REDUNDANT

CONTROL, MONITORING,
INTERLOCK & SHUTDOWN PLC

MARSHALLING
FOR TEMP.

TEMPERATURE
MONITORING

CONTROL ROOM

FIELD

WEIGHING
SYSTEM

FIELD CABLES

FIELD/MCC INPUT-OUTPUTS, BAGGING SYSTEM, LOADING/UNLOADING
SYSTEM, GAS DETECTION SYSTEM

FIELD CABLES FOR TEMPERATURE
MONITORING SYSTEM

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BIBHAL ROK NBS

CONTROL ROOM SYSTEM

A951-000-16-51-3302

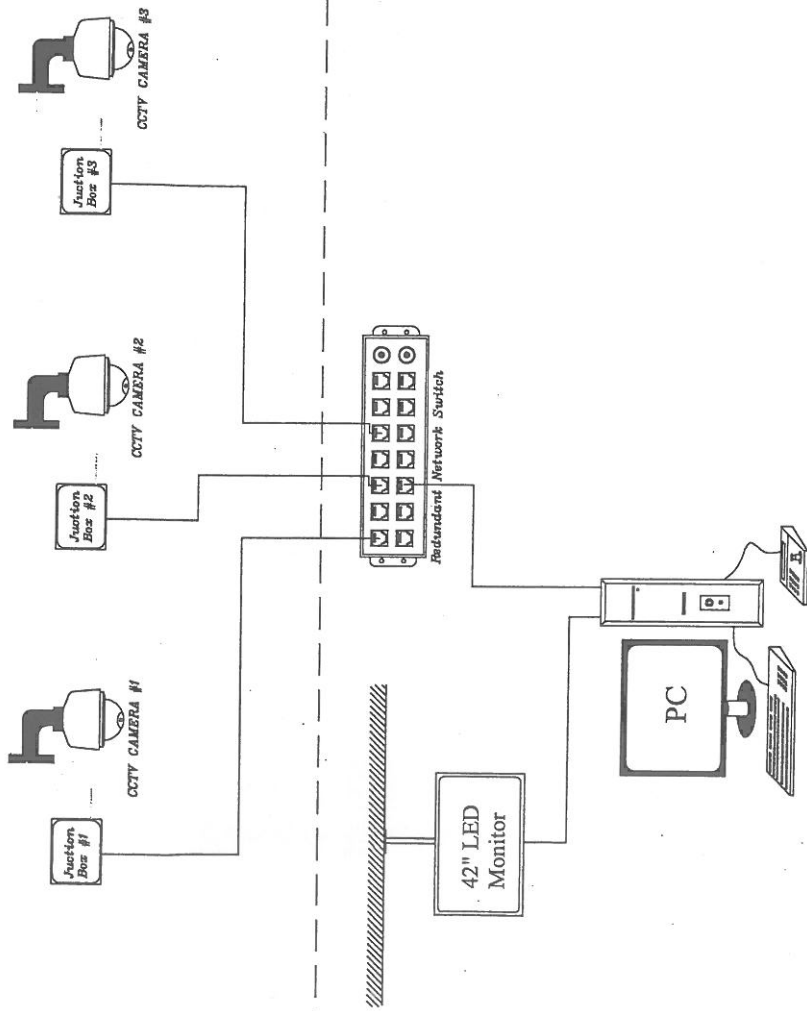
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SHEET 1 OF 1

1-1641-0508 REV/D 03-2002/2017

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1. THE CCTV SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE FOLLOWING REQUIREMENTS AND SHALL BE SUBJECT TO THE APPROVAL OF THE PROJECT ARCHITECT.
2. THE SYSTEM SHALL BE A CLOSED CIRCUIT TELEVISION SYSTEM WITH A CONTROL ROOM AND A MONITOR ROOM.
3. ALL EQUIPMENT SHALL BE INSTALLED AS PER THE MANUFACTURER'S RECOMMENDATIONS.
4. ALL WORK SHALL BE COMPLETED WITHIN THE SPECIFIED TIME FRAME.
5. THE SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE FOLLOWING REQUIREMENTS AND SHALL BE SUBJECT TO THE APPROVAL OF THE PROJECT ARCHITECT.



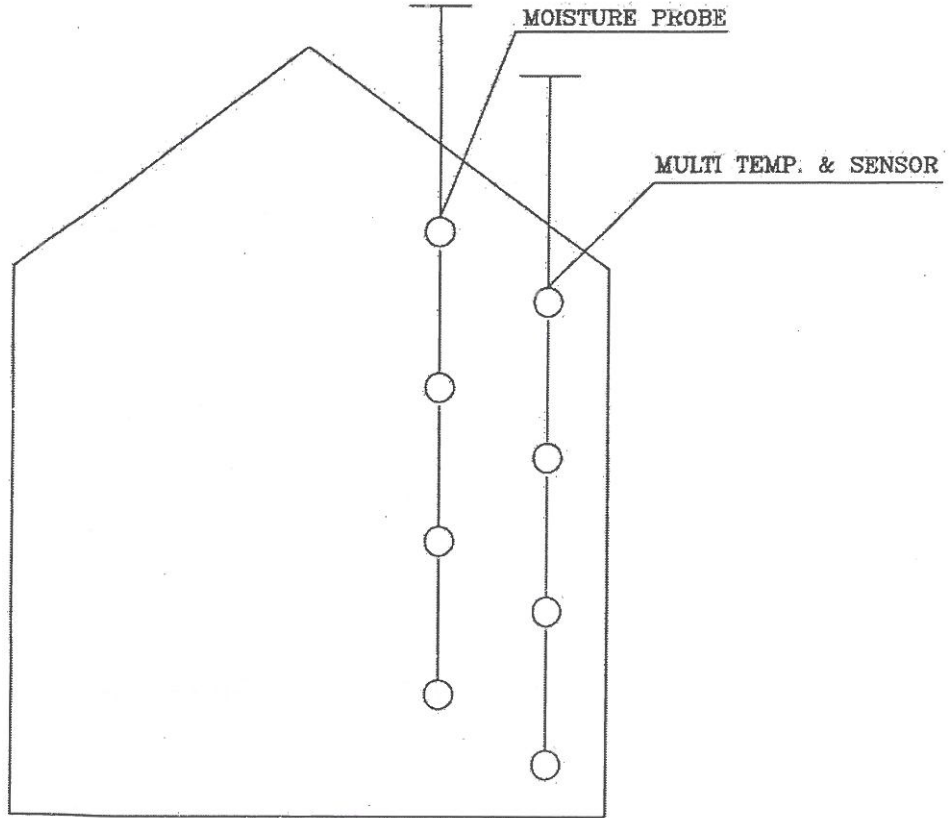
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Plant:					
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Client:					



SILO



ENGINEERS INDIA LIMITED
NEW DELHI

TYPICAL SCHEMATIC DIAGRAM FOR
MOISTURE & TEMP. MONITORING SYSTEM

DRAWING NO.	REV.
A951-000-15-51-SK-0001	0
SHT. 1 OF 1	

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1.0 VENDOR DRAWING/DOCUMENT REQUIREMENT

1.1 This section defines the requirement for Drawing / Document / Data for instrumentation & and control to be furnished by Contractor, during and after execution of the project. This shall include all-

- (i) Basic Engineering Documents
- (ii) Detailed Engineering Documents (system related) .
- (iii) Documents for Procurement
- (iv) Study, Schematic and Construction drawings.
- (v) All Manufacturer/Supplier/Sub-Vendor related Drawings, Manuals and other Technical Literature.
- (vi) All as built Drawing/Documents
- (vii) Any other Drawing/Document/Deliverable not specifically covered but generated by contractor as part of project execution.

1.2 Contractor shall submit all Drawings/ Documents generated by them to Owner /PMC for /Review/ Records. These categories are as defined below:

Review Category :Drawing /Documents for which Owner/PMC shall review and comment.
Records :Drawing /Documents essentially retained by Owner/PMC for Information/Records.

However Contractor shall note that Review of any drawing by Owner/ PMC does not absolve the contractor from the responsibility of ensuring complete compliance to the Tender requirements. Non compliance to the tender requirement observed at any stage of Project execution shall be rectified by Contractor without any implication.

1.3 Contractor shall note that Language of all documents during Engineering, execution stage, all final documents and as-built documents shall be English.

1.4 Contractor shall on award of Contract prepare and submit for Owner/PMC review a detailed drawing document schedule. The schedule shall ensure sequential and logical sequence of document submission. Contractor shall ensure that subsequent documents are submitted only after the basic documents have been reviewed /approved. Haphazard and en-Bulk submission of documents shall not be entertained.

VENDOR DATA REQUIREMENT

INSTRUMENTATION:

Sl. No.	Description	Review	Records	Remarks
1.	Drawing and Document Schedule	√		
2.	Vendor List for Instruments and accessories	√		
3.	Power consumption list including sub vendor packages		√	
4.	Purchase Requisition for all instruments/PLC based system	√	√	Note - 2
5.	Logic Diagram for PLC based control system	√	√	
6.	Instrument Loop Drawings		√	
7.	Instrument details for data base generation from vendor		√	
8.	Panel internal arrangement drawing r	√		
9.	Power Supply Distribution dwg		√	
10.	Wiring diagram for panels		√	
11.	Bill of Material for PLC based system panel etc.		√	
12.	Bill of Material for Temperature control system etc.		√	
13.	Special test equipment / tool requirement for maintenance PLC vendor		√	
14.	Start up and commissioning Spare list		√	
15.	Test / calibration / inspection certificates for all instruments		√	
16.	Inspection and test (FAT/SAT) procedures for PLC based system	√		
17.	Complete catalogues with part list for all contractor supplied instruments, control system etc.		√	
18.	Details of special test equipments/tool requirement for maintenance.		√	
19.	As Built drawings & documents		√	

Notes:

1. Only critical documents as identified by Owner/PMC from contractor's drawing schedule shall be reviewed. Documents other than those identified for review by Owner/PMC shall be submitted for record.
2. Purchase Requisition (PR) for PLC based control system oriented items and critical items like, level transmitter etc. shall be submitted for review. PR for all the other items shall be submitted for record.
3. Bidder shall prepare & submit the as built drawings / documents after commissioning. All the drawings/ documents listed shall be converted into "As Built" after commissioning of Project. "As Built" shall include documents generated by bidder & documents generated/ submitted by various Sub-vendors.
5. All post-order instrument documents/ drawings shall be submitted after issue of P&IDs. The submission of document / drawing is sequenced in such a way that submitted document/ drawing is neither dependant nor changed due to drawing / document yet to be submitted. Document/ drawing submission schedule shall be made accordingly.

6. All the above documents, as applicable, are also required for the package units sub-ordered by the bidder. Package unit drawings/ documents shall be first reviewed by bidder before submission to OWSSB/ PMC.
7. Catalogue for all instruments shall be submitted with respective PR (with first submission) & along with supply.
8. Review and Records as marked has to be strictly followed.
9. As built drawings / documents shall be provided for all items.

Abbreviations:

AARH	Arithmetic Average Roughness Height
EDDL	Electronics Device Description Language
FISCO	Fieldbus Intrinsic Safety Concept
FDT/DTM	Field Device Tool/ Device Type Manager
FF	Fieldbus Foundation
HART	Highway Addressable Remote Transducer
LAS	Link Active Scheduler
LCD	Liquid Crystal Display
NPS	Nominal Pipe Size
NPT	National Pipe Thread
RAM	Random Access Memory
WC	Water Column

Instrumentation Standards Committee

Convener: Ms. R. Priyamvada

Members: Mr.P.K. Sahay
Mr.S. Bhowal
Mr. M. Nandi
Ms. R. Shanti Devi
Mr. M.P Jain (Proj.)

1.0 GENERAL

1.1 Scope

1.1.1 This specification, together with the data sheets attached herewith describes the requirements for the design, materials, nameplate marking, inspection, testing and shipping of electronic/pneumatic instruments.

1.1.2 The related standards referred to herein and mentioned below shall be of the latest edition prior to the date of the purchaser's enquiry:-

ASME American Society of Mechanical Engineers
B 1.20.1 Pipe Threads General Purpose (Inch)
B 16.5 Pipe Flanges and Flanged Fittings
B 16.20 Metallic Gaskets for Pipe Flanges, Ring Joint, Spiral wound and Jacketed.

EN European Standards
10204 Inspection Documents For Metallic Products

IS/IEC Indian Standards/ International Electrotechnical Commission
IS/IEC 60079 Electrical Apparatus for Explosive Gas Atmospheres.
IS/IEC 60529 Degree of Protection Provided by Enclosures (IP Code).
IEC 61000-4 Electromagnetic Compatibility (EMC) for Industrial Process Measurement and Control Equipment
IEC 61158 Fieldbus Standard for use in Industrial Control System
IEC 61158-2 Physical Layer Specification and service definition for Fieldbus
IEC 61508 Functional Safety of Electrical/Electronic/Programmable Electronic Safety related Systems.
IEC 61511 Functional safety instrumented system for the process industry sector
IEC 61804 Function blocks (FB) for process control – Electronic Device Description
IEC 61518 Mating dimensions between differential pressure (type) measuring instruments and flanged-onshut-off devices up to 413 bar (41,3 MPa)

ISA International Society of Automation
S 7.3 Quality Standard for Instrument Air
S 50.1 Compatibility of Analog Signals for Electronic Industrial Process Instruments.

ITK Interoperability Test Kit (latest version)

1.1.3 In the event of any conflict between this standard specification, job specification/data sheets, statutory regulations, related standards, codes etc. the following order of priority shall govern:

- a) Statutory Regulations
- b) Job Specifications / Data Sheets
- c) Standard Specification
- d) Codes and Standards

1.1.4 In addition to compliance to purchaser's specifications in totality, vendor's extent of responsibility shall include the following:

- a) Purchaser's data sheets specify the minimum acceptable material of construction of body, measuring element and accessories. Alternate superior material of construction shall also be acceptable provided vendor assumes complete

responsibility for the selected materials for their compatibility with the process fluid and its operating conditions.

- b) Selection of suitable sealant liquid for diaphragm seal instruments compatible with the process fluid and its operating temperature.

1.2 Bids

1.2.1 Vendor's quotation shall be strictly as per the bidding instructions to the vendor attached with the material requisition.

1.2.2 Whenever a detailed technical offer is required, vendor's quotation shall include the following:

- a) Compliance to the specifications.
- b) Whenever the requirement of a detailed specification sheet for electronic/pneumatic instruments is specifically indicated, a detailed specification sheet for each item shall be furnished, which shall provide information regarding type, material of construction, performance specification, model number etc. of the offered electronic / pneumatic instruments. The material specification and the units of measurement for various parts in vendor's specification sheets shall be to the same standards as those indicated in purchaser's data sheets.
- c) Proven references for each offered model number inline with clause 1.2.3 of this specification.
- d) A copy of approval from local statutory authority, as applicable such as Petroleum & Explosives Safety Organisation (PESO) / Chief Controller of Explosives (CCE), Nagpur or Director General of Mines Safety (DGMS) in India, for the electronic instruments installed in electrically hazardous area along with:
 - i) Test certificate from recognised test house like Central Institute of Mining and Fuel Research (CIMFR) / Electronics Regional Testing Laboratory (ERTL) etc. for flameproof enclosure/intrinsic safety, as specified in the data sheet, as per relevant standard for all Indian manufactured equipments or for items requiring Director General of Mines Safety DGMS approval.
 - ii) Certificate of conformity from agencies like Laboratoire Central Des Industries Electriques (LCIE), British Approval Service for Electrical Equipment in Flammable Atmospheres (Baseefa), Factory Mutual (FM), Physikalisch-Technische Bundesanstalt (PTB), Canadian Standards Association (CSA), Underwriters Laboratories (UL) etc. for compliance to ATEX directives or other equivalent standards for all equipments manufactured outside India.
- e) Deviations on technical requirements shall not be entertained. In case vendor has any valid technical reason, they must include a list of deviations tag number wise, summing up all the deviations from the purchaser's data sheets and other technical specifications along with the technical reasons for each of these deviations.
- f) Catalogues giving detailed technical specifications, model decoding details and other related information for each type of electronic/pneumatic instruments covered in the bid. Information shall include, but not limited to product certifications, dimensional drawings, Transient Protection, range limits, power supply, Current draw, vibration effect, power supply effect, Electromagnetic compatibility. For Field bus instruments, Field bus parameters like available standard function blocks/Advanced function blocks and their execution time for each block, Device type, number of link objects, virtual communication Relationships, Basic and advanced diagnostic features, transmitter failure mode, physical profile type etc.

1.2.3 All items, as offered, shall be field proven and should have completed trouble free satisfactory operation for a period of minimum 4000 hours on the bid due date in the similar

application with the process conditions similar to those as specified in the purchaser's data sheets. Items with proto-type design or items not meeting provenness criteria specified above shall not be offered.

- 1.2.4 Wherever specified vendor must furnish certified values of failure rates, probability of failure on demand (PFD) and test intervals for offered items for Safety Integrity Level (SIL) analysis.
- 1.2.5 All documentation submitted by the vendor including their quotation, catalogues, drawings, installation, operation and maintenance manuals, etc shall be in English language only.
- 1.2.6 Vendor shall also quote for the following:
- Universal hand held configurator / terminal for the configuration and maintenance of instruments with HART output.
 - Field bus configurator with hardware and software for configuration and maintenance of field bus devices and also to perform diagnostics and trouble shooting of fieldbus segments wherever specified.
 - Two-year operational spares for each model of instruments offered in the bid, which shall include sensor, electronic module, local indicator, o-ring/gasket set etc. based on vendor's recommendations.
 - Any special tool other than those covered under 1.2.6 (a) and (b). In case any special tools are needed for maintenance of offered instruments, vendor must certify in their offer.

1.3 Drawing and Data

- 1.3.1 Detailed drawings, data, catalogues and manuals required from the vendor are indicated by the purchaser in vendor data requirement sheets. The required number of prints and soft copies should be dispatched to the address mentioned, adhering to the time limits indicated.
- 1.3.2 Final documentation consisting of design data, installation manual, operation and maintenance manual, etc submitted by the vendor after placement of purchase order shall include the following, as a minimum;
- Specification sheet for each electronic/pneumatic instrument and their accessories.
 - Certified drawing for each instrument, which shall provide dimensional detail, internal construction and part list, material of construction etc.
 - Calculations for integral orifice
 - Copy of type test certificates.
 - Copy of the test certificates of all the tests indicated in clause 4.0 of this specification.
 - Installation procedure for electronic/pneumatic instrument and its accessories.
 - Calibration, Configuration and Maintenance procedures including replacement of its internal parts.
 - Device Descriptor (DD) Files for configuring the device parameters (Soft Copy)
 - Common File Format (CFF) files for integrating the device into the system (Soft Copy).

2.0 DESIGN AND CONSTRUCTION

2.1 General Requirements

- 2.1.1 The type and material of construction of electronic/pneumatic instruments shall be as specified in the purchaser's data sheet.

- 2.1.2 The range of instruments shall be selected by vendor based on the set range indicated in the purchaser's data sheet. Where no set range is indicated, vendor may select the same as per the following guidelines;
- The set range shall be 1.1 times the maximum process value or 1.4 times the operating process value whichever is higher rounded to the nearest ten.
 - The set range shall preferably be in the middle third of the selected instrument range.
- 2.1.3 Measuring element in vacuum service shall have under range protection down to full vacuum, without undergoing a change in calibration or permanent set.
- 2.1.4 Unless otherwise specified, diaphragm seal instrument shall meet the following requirements;
- Instruments shall have its diaphragm seal (flanged type) integral with the instrument. In case wafer type diaphragm seal is provided, it shall be supplied with companion flange.
 - When purchaser data sheets specify wafer seal type of instrument, vendor shall include supply of studs, nuts and gasket as per the materials specified in the purchaser's data sheet. Refer Annexure – 1 attached with this specification for stud – bolts, nuts and gasket material requirement.
 - The sealant shall be an inert liquid, compatible with the process fluid and process temperature indicated in the purchaser's data sheets. In general, sealant shall be;
 - DC 704 or equivalent for all diaphragm seal instruments except for oxygen and chlorine.
 - Flouro-lube or equivalent for all diaphragm seal instruments in oxygen and chlorine.
 - The requirement of spacer ring shall be as specified in purchaser's data sheet. The material of construction of spacer ring shall be 316 Stainless Steel, as a minimum unless otherwise specified in the purchaser's data sheets.
 - The span of the offered model shall be selected to ensure zero elevation/zero suppression equal to the head created by the fill fluid for the specified capillary length in the data sheet.
- 2.1.5 Wherever purchaser data sheet specifies integral flow transmitter, vendor shall supply complete assembly consisting of integral orifice, upstream and downstream meter runs with end flanges, meeting the following requirements:
- Three nos. of integral orifice plates shall be supplied i.e. one is installed and two are spares.
 - Unless otherwise specified, material of construction shall be 316 Stainless Steel for integral orifice and meter run with flanges.
- 2.1.6 The instrument enclosure shall be suitable for the area classification indicated in the purchaser's data sheets. Unless otherwise specified, the enclosure shall meet the following standards;
- | | |
|----------------------|--|
| Weatherproof housing | IP-65 to IS/IEC-60529. |
| Flameproof housing | Flameproof/ Ex (d) as per IS/IEC-60079 |
- Flameproof housing shall also be made weatherproof.
- 2.1.7 Unless otherwise mentioned, end connection details shall be as below:-
- Threaded end connections shall be to NPT as per ASME B 1.20.1.
 - Flanged end connections shall be as per ASME B 16.5.

- c) Grooves of ring type joint flanges shall be octagonal as per ASME B16.20.
- d) Flanged face finish shall be as per ANSI B 16.5. The face finish shall be as follows:
- | | | |
|----------|---|---------------------------|
| 125 AARH | : | 125 to 250 microinch AARH |
| 63 AARH | : | 32 to 63 microinch AARH |
- 2.1.8 All electronic / pneumatic instruments in oxygen and chlorine service shall be thoroughly degreased using reagents like trichloro-ethylene or carbon tetrachloride. End connection shall be blinded / plugged after the degreasing process in order to avoid entrance of grease or oil particles.
- 2.1.9 Electronic Instruments
- 2.1.9.1 All instruments shall be of state-of-the-art technology and shall be in compliance with the electromagnetic compatibility requirements specified in IEC-61000-4 standard.
- 2.1.9.2 Plug-in circuit boards shall be designed and manufactured such that reverse insertion or insertion of the wrong card is prevented.
- 2.1.9.3 Electronic instruments shall generally operate on nominal voltage of 24 V DC and shall be protected against short circuit and reverse voltage. Transmission and output signal shall generally be 4 to 20 mA DC for analog and smart transmitters. The display of integral output meter shall be in engineering units for pressure, differential pressure, flow & Temperature and 100% linear for level.
- 2.1.9.4 Electronic transmitters with two-wire system shall be suitable for delivering rated current to an external loop resistance of at least 600ohm when powered with 24 V DC.
- 2.1.9.5 Terminals for electrical connections shall be clearly identified, and polarity shall be permanently marked.
- 2.1.9.6 Peak to peak ripple and total noise level in the analog output signal shall not exceed 0.25% of the maximum signal.
- 2.1.9.7 Electrical cable entries shall have internal 1/2" NPT threads.
- 2.1.9.8 Zero elevation/zero suppression shall be equal to minimum of 100% of the span of the offered transmitter.
- 2.1.10 Pneumatic Instruments.
- 2.1.10.1 All pneumatic connections shall be 1/4" NPT, unless otherwise specified.
- 2.1.10.2 All threaded connections shall be internal, unless otherwise specified.
- 2.1.10.3 The process input connections and pneumatic output and air supply connections etc. shall be permanently stamped on the body at a suitable place.
- 2.1.10.4 Unless otherwise specified, pneumatic instruments shall operate on air supply of 1.4 kg/cm²g and shall have transmission and output signal of 0.2 to 1.0 kg/cm²g.
- 2.1.10.5 Instrument air quality shall be as per ISA-S7.3 and shall be free from all corrosive, hazardous, flammable and toxic contaminants.
- 2.2 Transmitters
- 2.2.1 Pneumatic Transmitters
- 2.2.1.1 Pneumatic blind transmitters shall be of the force-balance type and pneumatic indicating transmitters of the motion balance type.
- 2.2.1.2 Transmitters shall have an accuracy of 0.5 % of span.
- 2.2.1.3 Transmitters shall be supplied with external zero and span adjustments.
- 2.2.2 Electronic Analog Transmitters

- 2.2.2.1 Electronic transmitters shall be of the two-wire DC current regulating type. They shall be provided with integral output indicator. When specified, field mounted external output meters shall be provided.
- 2.2.2.2 Electronic analog transmitters shall have an accuracy of $\pm 0.25\%$ of span.
- 2.2.2.3 Transmitters shall be supplied with external zero and span adjustments. Flameproof transmitters shall also have their calibration adjustment from outside, without any need to remove the cover.
- 2.2.2.4 Unless otherwise specified, the electronic transmitters shall be certified intrinsically safe.
- 2.2.3 Smart and Field bus based Transmitters
- 2.2.3.1 Smart and field bus based transmitters shall be two wire microprocessor based type. These shall have a non-volatile memory, storing, complete sensor characterisation and configuration data of the transmitter. All necessary signal conversions and output generation with the required protocol shall be carried out in the transmitter electronics. Integral output meter with LCD display shall be provided for all transmitters.
- 2.2.3.2 Transmitter shall also run complete diagnostic subroutines and shall provide diagnostic alarm messages for sensor as well as transmitter healthiness. Field bus based transmitter in addition shall have facility to detect plugged impulse lines, whenever specifically indicated in purchaser's data sheets. In the event of detection failure, the output shall be driven to a predefined value, which shall be field configurable.
- 2.2.3.3 The transmitters with field bus connectivity shall have built in control algorithm like proportional, proportional-integral and proportional-integral-differential.
- 2.2.3.4 Whenever specifically indicated in purchaser's data sheets, the meter electronics shall be provided with in-built lightning and power supply surges. The transient protection shall meet the requirements specified in IEC-61000-4.
- 2.2.3.5 The configurational data of the instruments shall be stored in a non-volatile memory such that this remains unchanged because of power fluctuations or power off condition. In case vendor standard instrument has battery backed RAM, vendor to ensure that battery drain alarm is provided as diagnostic maintenance message.
- 2.2.3.6 Accuracy of transmitters, smart as well as field bus based, shall be as follows:

Type of Transmitter	Range of Transmitter	Accuracy
Direct	760 mm WC and above	Equal to or better than $\pm 0.075\%$
Direct	Less than 760 mm WC	Equal to or better than $\pm 0.15\%$
Diaphragm seal	500 mm WC and above	Equal to or better than $\pm 0.25\%$
Diaphragm seal	Less than 500 mm WC	Equal to or better than $\pm 0.5\%$

The accuracy is defined as the combined effect of repeatability, linearity and hysteresis.

- 2.2.3.7 The stability of the transmitters shall be equal to or better than $\pm 0.1\%$ of span for a period of minimum 6 months, as a minimum.
- 2.2.3.8 Transmitter shall update the output at least 8 times a second unless otherwise specified.
- 2.2.3.9 Unless specified otherwise in purchaser's specification, transmitter response time shall be as follows:
- For transmitter range of 760 mm WC and above, the response time shall be equal to or better than 500 milliseconds.
 - For transmitter range below 760mm WC, the response shall be equal to or better than 1 second.

The response time of the transmitter shall be considered as the sum of dead time and 63.2% step response time of the transmitter.

- 2.2.3.10 Unless specified otherwise, the over-range/static pressure protection of the transmitter shall be as follows:

Range of Transmitter ®	OVERRANGE / STATIC PRESSURE (*)	
	Pressure Transmitter Kg/Cm2	Differential Pressure Transmitter Kg/Cm2
0 < ® < 250 mmWC	20	20
250 < ® < 1000 mmWC	45	52
1000 < ® < 5000 mmWC	45	70
5000 < ® < 10000 mmWC	45	160
1 < ® < 10 Kg/cm2	52	160
10 < ® < 100 Kg/cm2	160	210
® > 100 Kg/cm2	210	210

(*) However, if the overrange/static pressure valve specified above is less than the maximum/design pressure of service conditions specified in the datasheets, offered instrument shall be suitable for the maximum/design pressure as per datasheet.

- 2.2.3.11 In the transmitter, the 'WRITE' option shall be protected through password.

- 2.2.3.12 Temperature transmitters shall meet the following requirements as a minimum:

- Temperature transmitter shall be universal type and shall be able to accept input from resistance temperature detector (RTD) or thermocouple (T/C) of any type and range.
- Temperature transmitters shall be freely programmable i.e. element type and range shall be programmable without any change in hardware / software.
- Temperature transmitter shall be remote mounted type, in general. Head mounted transmitters shall be supplied when specifically indicated in purchaser's data sheets.
- The accuracy of the temperature transmitter with RTD element shall be as follows:
 - For temperature range above 350° C, the accuracy shall be equal to or better than $\pm 0.075\%$ of range.
 - For temperature range with ranges between 350° C to 150° C, the accuracy shall be equal to or better than $\pm 0.15\%$ of range.
 - For temperature range below 150° C, the accuracy shall be equal to or better than $\pm 0.25\%$ of range.
- The accuracy of temperature transmitter with cold junction compensation for Thermocouple element shall be as follows;
 - For temperature above 350° C, accuracy shall be $\pm 0.25\%$ of range.
 - For temperature between 150°C to 350°C. accuracy shall be $\pm 0.5\%$ of range.
 - For temperature below 150°C, accuracy shall be $\pm 0.75\%$ of range.

2.2.3.13 When HART protocol is specified, the following features must be ensured;

- a) It shall allow multi masters (two for example, primary and secondary) for configuration, calibration, diagnostics and maintenance. The primary could be the control system or host computer and the secondary could be the hand-held communicator.
- b) It shall be capable of implementing universal commands from either of these locations.

2.2.3.14 In addition to the requirements specified above, field bus based transmitter shall meet the following requirements;

- a) All instruments must satisfy the requirements of the field bus registration laboratory with applicable checkmark like foundation field bus, profibus NutZerorganisation e.v (PNO), or as specified in the purchaser's data sheets.
- b) All instruments shall be polarity insensitive. Also transmitter shall be LAS capable and provided with line plugging detection, whenever specified in data sheet.
- c) All instruments shall have one no. of Analog Input (AI) block and One no. of Proportional, Integration and Differential (PID) control block, as a minimum.
- d) All instruments must be interoperable and shall have valid interoperability test clearance like ITK latest version for foundation field bus or equivalent for profibus PA, as applicable.
- e) The field bus instruments shall support peer to peer communication.
- f) The field bus instruments in hazardous area shall be certified as per entity concept or shall be FISCO approved as per the requirements specified in the purchaser's specification.
- g) All instruments shall support EDDL or FDT/DTM requirements, as specified in data sheets.
- h) Internal Software shall be configured by the vendor including the following information.
 - Serial Number
 - Device Tag (Tag No.)
 - Process Description
- i) All instruments shall be capable of supporting incremental Device Descriptor (DD) for extra functionality and/or software revisions in Device Memory.

2.3 Receivers

2.3.1 Pneumatic/electrical cables shall be such that they permit the instrument internals to be drawn from its normal mounting position without affecting operation. Pneumatic connection points shall seal automatically upon disconnection.

2.3.2 Electronic receivers shall be suitable for standard voltage inputs of 0.25 to 1.25 V, 1 to 5 V, 0 to 10 V dc. Any voltage receiver shall not alter the voltage drop across the conditioning resistor by more than $\pm 0.1\%$ of input range of maximum input voltage.

2.3.3 Recorder pens shall be easily replaceable.

2.3.4 Each recorder shall be supplied with chart-rolls and ink for six months continuous operation.

2.4 Controllers

2.4.1 Automatic control stations including dedicated cascade control stations shall have switches to transfer control from automatic to manual mode and vice-versa. The transfer shall be

procedure less and shall not produce any bump in the process under control during such a transfer, the output signal shall not change by more than 1% of span.

- 2.4.2 Cascade control stations shall have a switch to select local or remote set point.
- 2.4.3 The control settings of the controller shall be readily adjustable from the front.
- 2.4.4 Controller action shall be easily reversible.
- 2.4.5 Pneumatic automatic controller shall be easily removable, without disturbing the manual control mechanism.
- 2.4.6 Electronic controller shall be easily removable, with the aid of a service station.
- 2.4.7 Local mounted pneumatic controllers shall be supplied with gauges for air supply pressure and control signal. The gauges shall be integral with the instrument.

2.5 Accessories

2.5.1 Field Universal Communicator:

2.5.1.1 It shall be possible to perform routine configuration, calibration, display process variable, diagnostics etc. from a hand held portable communicator, which can be connected at any location in the transmitter loop. It shall be possible to perform all the above functions on-line and the loop function shall remain unaffected.

2.5.1.2 There should be no interruption on the output while communicating with the transmitter.

2.5.1.3 Field communicator shall meet the following requirements:

- a) Hand Held communicator shall be universal type and shall be compatible with all make and models of HART transmitters and Smart positioners, with all engineering capability like calibration, diagnostics, configuration, inhibition of HART signal, etc. Similarly Field bus Hand Held communicator shall also be universal type and shall be suitable for all make and models of FF transmitters and Positioner.
- b) It shall be possible to connect the communicator at any of the following locations for purpose of digital communication;
 - i) Marshalling cabinet serving the transmitter, in safe area.
 - ii) Junction box serving the transmitter, in hazardous area.
 - iii) Directly at the transmitter, in hazardous area.

Plug-in type connections shall be provided with field communicator. Necessary interconnection accessories shall be supplied by the vendor.

- c) Offered communicator shall be dust-proof, certified intrinsically safe and suitable for outdoor location. Carrying case shall be supplied with each communicator.
 - d) When specified in data sheets, the software shall also be capable of configuring other makes of transmitters.
 - e) They shall be battery powered with replaceable and rechargeable batteries, suitable for recharging with 240 V, 50 Hz . In case vendor's standard design does not make use of rechargeable batteries, then vendor to provide 2 sets of spare batteries.
- 2.5.2 Remote output meter
- 2.5.2.1 Remote output meter shall be electronic with LCD display. The display shall be in actual engineering units.
 - 2.5.2.2 The indicator electronics shall be able to perform square root extraction for flow measurement
 - 2.5.2.3 Offered indicators shall be certified Intrinsically safe/FISCO, when used in hazardous area as specified in Data sheet.

2.5.2.4 This Field Bus based field indicator shall be 2 wire segment powered and shall be able to indicate minimum of 8 signals available in the fieldbus segment, selectively.

2.5.3 Yoke mounted instruments shall be supplied with universal mounting bracket , U-bolt and nuts suitable for mounting the instruments on a 50 mm (nominal bore) pipe stanchion (horizontal or vertical)

2.5.4 Air set

Air set, where provided, shall be a combination air filter regulator set with 5-micron filter cartridge. It shall have a 50 mm diameter pressure gauge to indicate the regulated pressure. Each air set shall be supplied with mounting bracket and bolts with nuts for surface mounting.

2.5.5 Battery charger

Battery charger shall be supplied with all necessary accessories and shall be suitable for 240V $\pm 10\%$, 50Hz $\pm 3\text{Hz}$, unless otherwise specified.

3.0 NAMEPLATE

3.1 Each flush panel mounted instrument shall have the following information identified in the front:-

- a) Tag number as per purchaser's data sheet.
- b) Reading coefficient, if any
- c) Pen colour, tag number-wise in the case of recorders.

Each flush panel mounted instrument shall have a back nameplate permanently fixed to it at a visible place reporting the following information:

- a) Instrument tag number.
- b) Manufacturer's serial number or model number.
- c) Manufacturer's name/trade mark.

3.2 Surface mounted instruments shall be provided with only one nameplate.

Local mounted instruments shall have a stainless steel nameplate attached firmly to it at a visible place, furnishing the following information:

- a) Tag number as per purchaser's data sheets.
- b) Manufacturer's serial number and /or model number
- c) Manufacturer's name/trade mark.
- d) Body material.
- e) Measuring element material.
- f) Range of measurement.
- j) Area classification in which the equipment can be used, this shall be to the same code as per purchaser's data sheets.

4.0 INSPECTION AND TESTING

Purchaser reserves the right to inspect and witness testing all the items at the vendor's works in line with the inspection test plan for electronic/pneumatic instruments and approved quality documents. All these tests shall be completed by the vendor and test reports shall be submitted to purchaser for scrutiny.

5.0 SHIPPING

- 5.1 All threaded and flanged openings shall be suitably protected to prevent entry of foreign material.
- 5.2 Instruments shall be supplied individually, in suitably sealed packing.
- 5.3 Proper care shall be taken in shipping instruments with diaphragm seals to ensure safety of the diaphragm seals, extensions, capillaries, where specified.
- 5.4 All pneumatic / electronic instruments in oxygen and chlorine service shall be separately packed along with a certificate indicating 'CERTIFIED FOR OXYGEN / CHLORINE SERVICE', as applicable.
- 5.5 Proper care shall be taken in shipping instrument accessories clearly indicating the instrument tag numbers.

6.0 REJECTION

- 6.1 Vendor shall prepare their offer strictly as per clause 1.2 of this specification and shall attach only those documents and information, which are specifically indicated in the material requisition.
- 6.2 Any offer not conforming to the above requirements, shall be summarily rejected.

Abbreviations:

AC	:	Alternating Current
Baseefa	:	British Approval Service for Electrical Equipment in Flammable Atmospheres
CPU	:	Central Processing Unit
CSA	:	Canadian Standards Association
DC	:	Direct Current
DCS	:	Distributed Control System
DMR	:	Dual Modular Redundant
DVD	:	Digital Versatile Disc
EMI	:	Electromagnetic Interference
ESD	:	Emergency Shutdown System
EXIDA	:	Excellence in Dependable Automation
FAT	:	Factory Acceptance Test
FMEDA	:	Failure Modes, Effects and Diagnostic Analysis
HART	:	Highway Addressable Remote Transducer
HW	:	Hardware
HWC	:	Hardwired Console
IEEE	:	Institute of Electrical and Electronic Engineers
I/O	:	Input / Output
LAN	:	Local Area Network
LCD	:	Liquid Crystal Display
LCIE	:	Laboratoire Central Industries Electriques
LED	:	Light Emitting Diode
MIS	:	Management Information System
MTBF	:	Mean Time Between Failure
MTTR	:	Mean Time to Repair
OPC	:	OLE for Process Control
PC	:	Personal Computer
P&ID	:	Piping and Instrumentation Diagram
PID	:	Proportional, Integral and Derivative
PLC	:	Programmable Logic Controller
PTB	:	Physikalisch Technische Bundesanstalt
PLC	:	Programmable Logic Controller
RFI	:	Radio Frequency Interference
SIL	:	Safety Integrity Level
TCP / IP	:	Transmission Control Protocol / Internet Protocol
TMR	:	Triple Modular Redundant
TUV	:	Technische Überwachungs Vereine
UHF	:	Ultra High Frequency
UPS	:	Uninterrupted Power Supply
UL	:	Underwriter's Laboratories
VDU	:	Video Display Unit
VHF	:	Very High Frequency

Instrumentation Standards Committee

Convener : Mr. Rajiv Gupta

Members : Mr. S Bhowal
Mr. M Nandi
Mr. R K Gupta
Ms. Rima Kundu
Mr. S Mahesh Kumar
Ms. N P Guha (Proj.)

1.0 GENERAL

1.1 Scope

1.1.1 This specification, defines the minimum functional requirements for the design, hardware, software and firmware specifications, nameplate marking, testing and shipping of Programmable Logic Controllers (PLC) designed for reliable, effective and optimum control and monitoring of a process plant (hydrocarbon and non-hydrocarbon) and captive power plant.

1.1.2 The related standards referred to herein and mentioned below shall be of the latest editions, unless otherwise specified: -

API American Petroleum Institute

RP 552 Transmission Systems

EEMUA Engineering Equipment & Material User Association

191 Alarm System - A Guide to Design, Management and Procurement

BS British Standards

EN 10204 Inspection Document for Metallic Products

IS/IEC Indian Standards / International Electrotechnical Commission

IS/IEC60079 Electrical Apparatus for Explosive atmospheres

IS/IEC60529 Classification of Degree of protection provided by enclosures (IP Code).

IEC 60584-2 Thermocouples. Part 2: Tolerances

IEC 60617 Graphical Symbols for Diagram

IEC 60751 Industrial platinum resistance thermometers and platinum temperature sensors

IEC 61000-4-3 Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test.

IEC 61000-4-4 Electromagnetic Compatibility (EMC) -Part 4-4: Testing and Measurement Techniques - Electrical Fast Transients / Burst Immunity Test

IEC 61000-4-5 Electromagnetic Compatibility (EMC) -Part 4-5: Testing and Measurement Techniques - Surge Immunity Test

IEC 61000-6-2 Electromagnetic Compatibility (EMC) -Part-6-2: Generic Standards - Immunity for Industrial environments.

IEC 61508 Functional Safety of Electrical / Electronic / Programmable Electronic Safety-related Systems.

	IEC 61131	Programmable Logic Controllers
	IEC 61511	Functional Safety – Safety Instrumented Systems for the Process Industry Sector
	IEC 61643-21	Low voltage surge protective devices - Part 21: Surge protective devices connected to telecommunications and signaling networks - Performance requirements and testing methods
	IEC 62561-3	Lightning protection system components (LPSC) - Part 3: Requirements for isolating spark gaps (ISG)
IEEE 802.3		Telecommunication and Information Exchange between Systems – Local and Metropolitan Area Networks – Specific Requirements – Part 3: Carrier Sense Multiple Access with Collisions Detection (CSMA / CD) Access Method and Physical Layer Specifications
IS		Indian Standards
	3043	Code of Practice for Earthing
ISA		International Society of Automation
	5.1	Instrumentation Symbols and Identification
	5.2	Binary Logic Diagrams for Process Operations
	5.3	Graphic Symbols for Distributed Control / Shared Display Instrumentation, Logic and Computer System.
	5.4	Instrument Loop Diagrams
	5.5	Graphic Symbols for Process Displays
	18.1	Annunciator Sequences and Specifications
	71.01	Environmental Conditions for Process Management and Control Systems: Temperature and Humidity
	71.04	Environmental Conditions for Process Measurement and control Systems: Airborne Contaminants
ANSI/ISA		American National Standards Institute / International Society of Automation
	TR 99.00.01	Security technologies for Industrial Automation and Control Systems
ISO		International Organization of Standardization
	216	Writing Paper and Certain Classes of Printed matter-Trimmed Sizes- A & B Series and indication of machine direction
	9241-5	Ergonomic requirements for office work with visual display terminals (VDTs) – Part 5: Workstation layout and postural requirements

9241-302 Ergonomics of human-system interaction -- Part 302:
Terminology for electronic visual displays

1.1.3 In the event of any conflict between this specification, data sheets, statutory regulations, related standards, codes etc., the following order of priority shall govern:

- a) Statutory regulations
- b) Job Specifications/ Data Sheets
- c) Standard Specifications
- d) Codes and Standards

1.1.4 In addition to meeting purchaser's specifications in totality, vendor's extent of responsibility shall also include the following:

- a) Purchaser's data sheets specify the minimum acceptable functional requirements for the programmable logic controllers. It shall be vendor's responsibility to select proper hardware, software and firmware to meet the specified functional requirements, keeping the integrity of functional blocks specified in the configuration diagram attached with the Requisition.
- b) Purchaser's data sheets specify the scan time / cycle time and loading requirements. Vendor shall be responsible for sizing and selecting their standard product i.e. hardware, software and firmware to meet the requirements specified in the purchaser's data sheets.
- c) Adequacy of Bill of Material selected to meet purchaser's requirements including spares. Vendor to note that bill of material shall not be verified by the purchaser during evaluation stage. Any hardware, software and firmware required to meet the purchaser's specified requirements shall be provided by the vendor without any implication.

1.2 Bids

1.2.1 Vendor's quotation shall be strictly as per the bidding instructions to vendor attached with the Requisition. Vendor's quotation shall enumerate and include the detailed specification of each subsystem and each module of programmable logic controller, detailed system configuration, hardware and software capabilities, programming aids, display facilities and other relevant information.

1.2.2 Whenever a detailed technical offer is required, vendor's quotation shall include the following:

- a) Compliance to the specifications.
- b) Detailed specification sheet for each sub-system. The specification sheet shall provide information regarding hardware specifications, software specifications, redundancy requirements, capacity, power consumption etc. of the programmable logic controllers and its accessories. The material specifications and unit of measurement for various items in vendor's specification sheets shall be to the same standards as those indicated in purchaser's data sheets.
- c) System security features and design details.



- d) Proven references for each offered model in line with clause 1.2.4 of this specification whenever specifically indicated in the purchaser's specifications.
- e) A copy of approval for flameproof enclosure, intrinsic safety etc whenever specified, from local statutory authority, as applicable, like Petroleum and Explosives Safety Organisation (PESO) / Chief Controller of Explosives (CCE), Nagpur or Director General of Mines Safety (DGMS) in India along with:
- i) Test certificate from recognised house CIMFR (Central Institute of Mines & Fuel Research) / ERTL (Electronics Research and Test Laboratory) etc. for specified protection class as per relevant Indian Standard for all Indian manufactured equipments or for equipments requiring DGMS approval.
- ii) Certificate of conformity from agencies like LCIE, Baseefa, PTB, CSA, UL etc., for compliance to ATEX or other recognised standards for all equipments manufactured outside India.
- f) Deviations on technical requirements shall not be entertained. In case vendor has any valid technical reason to deviate from the specified requirement, they must include a list of deviations item wise, summing up all the deviations from the purchaser's data sheets and other technical specification along with the technical reasons for each of these deviations.
- g) Certificate for specified SIL requirement (e.g. SIL-3) from Independent Testing Agency (e.g. TUV/EXIDA).
- h) Catalogues giving detailed technical specifications, model decoding details and other related information for each item / sub-system covered in the bid.
- 1.2.3 The equipment being offered / supplied shall be of latest proven version available in the current manufacturing range.
- 1.2.4 The system hardware, software and firmware as offered, shall be field proven and should have been operating satisfactorily for a period of minimum 6 months continuously on the bid due date in the validly similar size and application specified in the purchaser's data sheet. Items with prototype design shall not be offered or supplied.
- 1.2.5 The detailed scope of work, specific job requirements, exclusions, deviations, additions etc. shall be indicated in the job specifications which shall be part of Requisition
- 1.2.6 Whenever specified, vendor shall furnish tested values of failure rates, probability of failure on demand and test intervals for safety integrity level analysis.
- 1.2.7 All documentation submitted by the vendor including their quotation, catalogues, drawings, installation, operation and maintenance manuals shall be in English language only.
- 1.2.8 Vendor shall also quote for the following:
- a) Two year's operational spares for each sub-system and their accessories which shall include the following as a minimum:
- i) All type of electronic modules e.g. I/O modules, processor modules, communication modules, power supply modules etc.
- ii) All type of auxiliary items e.g. barriers / isolators, hardwired instruments, annunciator modules, receiver switches, trip amplifiers, temperature element converters etc.

- iii) Switches, lamps, fuses, connectors, terminals, pre-fabricated cables, circuit breakers, relays etc.
- iv) Video display units, keyboards, disc drives, PC's, network items (e.g. switches, hubs etc.) etc.
- b) Any special tools and test equipments needed for the maintenance of PLCs and other items being offered by vendor. Vendor must confirm in their offer if no special tools or test equipments are needed for maintenance other than those specifically indicated in purchaser's data sheet.

1.3 Drawings and Data

1.3.1 Detailed drawings, data, catalogues and manuals required from the vendor are indicated by the purchaser in vendor data requirement sheets. The required number of prints and soft copies shall be dispatched to the address mentioned, adhering to the time limits indicated.

1.3.2 Final documentation consisting of design manuals, installation manual, operation and maintenance manual etc., submitted by the vendor after placement of purchase order shall include the following, as a minimum:

- a) Specification sheet for each sub-system, auxiliary instrument and bought out item.
- b) Certified drawings for complete system including the following:
 - i) System Configuration Diagram
 - ii) General Arrangement drawings for panels, cabinets, marshalling racks, hardwired consoles, operator console, programming terminal etc with complete dimensional details, internal construction and weight in kilograms.
 - iii) Control room layouts e.g. console room, rack room and engineering room layout with all dimensions in millimeters.
 - iv) Channel base frame drawings for console room, rack room and engineering room.
 - v) Input/ output assignment.
 - vi) Logic/ Ladder diagrams.
 - vii) Loop wiring diagram for all tags.
 - viii) Power supply distribution diagram.
 - ix) Memory loading calculations/ Scan time calculations.
 - x) Modbus address mapping/ Protocol/ Pin Detail wherever required as per requisition.
 - xi) Dynamic graphic diagrams.
 - xii) System grounding drawing.
- c) Design manuals and functional design specifications which shall include hardware design manual, software design manual and special software specifications.

- d) Copy of type test certificates.
- e) Copy of test certificates for all tests indicated in this specification.
- f) Installation manual containing installation procedure for programmable logic controllers and other items covered in the Requisition.
- g) Power-on, start-up and internal testing procedures.
- h) Software debugging and system configuration procedures.
- i) Calibration and maintenance manual containing maintenance procedures including replacement of parts, application modification etc.
- j) Any other drawings and documents specifically indicated in vendor data requirement enclosed with the Requisition.

2.0 DEFINITIONS

The various terms used in this specification are defined as follows:

2.1 Programmable Logic Controller

The class of control systems which can be programmed to execute plant shutdown and / or interlock / sequence logics to the specified safety integrity levels and also regulatory control functions in specific applications.

2.2 Accessible

A system feature that is viewable by and interactive with the operator and allows the operator to perform user permissible control action e.g. set point change, auto-manual transfers or on-off actions.

2.3 Assignable

A system feature that permits an operator to direct a signal from one device to another without the need for change in wiring, either by means of switches or via other data entry devices like keyboard commands to the system.

2.4 Configurable

The capability to select and connect standard hardware modules to create a system or the capability to change functionality or sizing of software functions by changing parameters without having to modify or regenerate software.

2.5 I/O

Input / Output with respect to process / operator.

2.6 PLC Console (Operator)

PLC console (Operator) is the operator's main plant interface device through which operator can view, monitor and control the plant and can give instructions to peripherals to execute commands, and shall have protective access to configure and maintain the system.

2.7 PLC Engineering Console (Programming)

PLC Engineering console (Programming) shall be the engineer's main interface device through which engineer can configure / program and maintain the system, and shall have protective access to monitor and control the plant, give instructions to peripherals to execute commands.

2.8 Local Level

All those sub-systems, which directly interface with field devices shall be referred to as local level.

2.9 Central Level

Operator Console and Programming Terminal, which present data acquired from local level devices, shall be referred as Central Level.

2.10 Database

Database shall be defined as the information stored temporarily or permanently in the system which can be accessed by various programs to meet all its functional requirements.

2.11 Loop Integrity

A system shall be said to have loop integrity if the failure of one component in the system/sub-system does not affect more than one loop.

2.12 System Loading

System loading for a sub-system is defined as the percentage of time a sub-system spends in carrying out various activities referred to the use of memory, CPU time and communication capacity in the worst case of high sub-system operation out of the designed / designated cycle time of the sub-system.

2.13 Redundancy

A system component shall be termed as redundant if it takes over automatically the operation in the event of the failure of the main component without causing any interruption in the system and upsetting the process. The repaired or replaced device shall be brought in-line only through operator action without upsetting system operation.

2.14 Switchover Time

Time required for a back up instrument / system to come on-line automatically in case of the failure of the main instrument / system.

2.15 Processor Cycle Time (t_{pc})

Processor cycle time is the measure of the processing speed of a processor. Processor cycle time for a sub-system of the programmable logic controller shall be defined as follows:—

Processor cycle time for programmable logic controller shall be defined as the total time taken by the processor to read input supplied by input module, execute all computations (analog as well as logic as configured) and write the outputs for the output module.

2.16 Scan Time (t_s)

Scan time of a logic loops is the end-to-end response time of a sub-system and shall be defined as follows:

The scan time for a logic loop shall be defined as the total time taken by a sub-system e.g. programmable logic controller to read input from the input terminal, process input, execute logic, updating logic output and write output at the output terminal for all the logics configured within the subsystem.

2.17 User's Memory

Free memory space available after utilisation of memory required for system operation, configuration and implementation of application and other system related functions for implementation of user defined specific programs such as plant calculations, process optimization or MIS (like free formatting of certain logs). The programs shall either be written in high level language or system specific language.

2.18 Event

An event shall be defined as any action taken by the operator via operator keyboard or switches on hardwired console like change of set point, change of control mode, start/stop of motor, open/close of shut down valves, alarm acknowledge, etc.

2.19 Sequence of Event (SOE)

Arranging events in the sequence of their occurrence in time with a specified time resolution by a program is defined as sequence of event.

2.20 Sequence of Event Recorder (SER)

Sequence of event recorder, when specified, shall identify, store and print alarms with the specified time resolution between two events. SER shall also transfer data to operator sub system over communication sub system.

2.21 Real Time Trend

Real time trend shall be defined as a continuously progressing graphical record showing updated parameter with most recent value and a past record of minimum of 10 minutes without pressing any additional key for moving backward in time.

2.22 Plant Information Network

High-level communication network which serves various users within a plant and transfer information for the purpose of unit / plant monitoring. This network is different than control network and is generally realised using open communication protocol network e.g. OPC etc.

2.23 Tag

A Tag is a collection of attributes that specify either a control loop or a process variable, or a measured input, or a calculated value, or some combination of these, and all associated control and output algorithms. Each tag is unique.