Standby SRU(525TPD) Train of IOCL Paradip Refinery

Gas Detection Systems

(Document No : B366-999-YD-MR-2650)

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MATERIAL REQUISITION (TOP SHEET)

ITEM DESCRIPTION: Gas Detection Systems

GROUP ITEM CODE 15IA	**DESTINATION :** IOCL PARADIP REFINERY
ITEM CATEGORY II	**DELIVERY PERIOD :**

DOCUMENT NUMBER

(Always quote the Document Number given below as reference)

B366	999	YD	MR	2650	A
JOB NO	UNIT/	MAIN COST	DOC. CODE	SR.NO.	REV

07/01/2022	16	51
DATE	DIVN.	DEPT.
	ORIGINATOR	

Notes:

1. This page is a record of all Revisions of this Requisition
2. The nature of the Revision is briefly stated in the "Details" column below, the Requisition in its entirety shall be considered for contractual pupose.
3. Vendor shall note the MR category and shall submit his offer in line with the requirements included in attached 'Instructions to Bidders'

REV	DATE	BY	CHK	APPD	DETAILS
A	07/01/2022	AK	JJ	AR	Issued for Bids

This is a system generated approved document and does not require signature.

S.NO	TAG NO . / ITEM CODE	DESCRIPTION	QUANTITY	GROUP
1		**Design ,engineering,manufacture,procurement of materials and bought out components, assembly at shop,inspection,testing at manufacturer's works, supply of mandatory spares, packing, delivery, documentation as per the enclosed Job specifications, instructions to vendors, data sheets etc**		
GROUP:	01	Gas Detectors & Portable Gas Calibrators with Accessories		
1.0001	088-AAH-0001	Hooter	1 Nos	01
1.0002	088-AAH-1001A	Stroboscopic Beacon-RED	1 Nos	01
1.0003	088-AAH-1001B	Stroboscopic Beacon-YELLOW	1 Nos	01
1.0004	088-AAH-1001C	Stroboscopic Beacon-BLUE	1 Nos	01
1.0005	088-AT -0127	HC Detector (Open Path)	1 Nos	01
1.0006	088-AT -0128	HC Detector (Open Path)	1 Nos	01
1.0007	088-AT -OS1	H2S Gas Detector HVAC Duct	1 Nos	01
1.0008	088-AT -OS2	HC Gas Detector HVAC Duct	1 Nos	01
1.0009	088-AT-0100	H2S DETECTOR	1 Nos	01
1.0010	088-AT-0105	H2S DETECTOR	1 Nos	01
1.0011	088-AT-0106	H2S DETECTOR	1 Nos	01
1.0012	088-AT-0107	H2S DETECTOR	1 Nos	01
1.0013	088-AT-0108	H2S DETECTOR	1 Nos	01
1.0014	088-AT-0112	H2S DETECTOR	1 Nos	01
1.0015	088-AT-0113	H2S DETECTOR	1 Nos	01
1.0016	088-AT-0120	SO2 DETECTOR	1 Nos	01
1.0017	088-AT-0121	SO2 DETECTOR	1 Nos	01
1.0018	088-AT-0122	SO2 DETECTOR	1 Nos	01
1.0019	088-AT-0123	SO2 DETECTOR	1 Nos	01
1.0020	088-AT-0124	SO2 DETECTOR	1 Nos	01
1.0021	088-AT-0125	NH3 DETECTOR	1 Nos	01
1.0022	088-AT-0129	H2S DETECTOR	1 Nos	01
1.0023	088-AT-0130	H2S DETECTOR	1 Nos	01
1.0024	088-AT-0131	H2S DETECTOR	1 Nos	01
1.0025	088-AT-0132	H2S DETECTOR	1 Nos	01
1.0026	088-AT-0133	H2S DETECTOR	1 Nos	01
1.0027	088-AT-0134	H2S DETECTOR	1 Nos	01
1.0028	088-AT-0136	H2S DETECTOR	1 Nos	01
1.0029	088-AT-0137	H2S DETECTOR	1 Nos	01
1.0030	088-AT-0138	H2S DETECTOR	1 Nos	01
1.0031	088-AT-0139	H2S DETECTOR	1 Nos	01
1.0032	088-AT-0142	Fire Detector	1 Nos	01
1.0033	088-AT-0143	Fire Detector	1 Nos	01
1.0034	088-AT-0144	Fire Detector	1 Nos	01
1.0035	088-AT-0145	Fire Detector	1 Nos	01
1.0036	088-AT-0146	Fire Detector	1 Nos	01

S.NO	TAG NO . / ITEM CODE	DESCRIPTION	QUANTITY	GROUP
1.0037	088-AT-0147	Fire Detector	1 Nos	01
1.0038	088-PHCD-0001	Multigas Portable Detector	1 Nos	01
1.0039	088-PHCD-0002	Multigas Portable Detector	1 Nos	01
1.0040	090-AAH-0002	Hooter	1 Nos	01
1.0041	090-AAH-1002A	Stroboscopic Beacon-RED	1 Nos	01
1.0042	090-AAH-1002B	Stroboscopic Beacon-YELLOW	1 Nos	01
1.0043	090-AAH-1002C	Stroboscopic Beacon-BLUE	1 Nos	01
1.0044	090-AT-0111	HC DETECTOR	1 Nos	01
1.0045	090-AT-0126	HC DETECTOR	1 Nos	01
1.0046	090-AT-0141	H2S DETECTOR	1 Nos	01
1.0047	090-AT-0148	Fire Detector	1 Nos	01
1.0048	090-AT-0149	Fire Detector	1 Nos	01
5		**Supply of two years operation and Maintenance Spares,as per enclosed instructions to vendor**		
7		**Training of Owner Personnel as per SIV**		
7.0007	GRP 01	For Group 01	1 Nos	01
8		**Supervision of erection,testing and commissioning of items specified at item 1.00 above as per enclosed instructions to vendor**		
8.0007	GRP 01	For Group 01	1 Nos	01

- Vendors shall quote prices against these items in their price schedule
  Vendor to note that the numbers given in square '[]' and curly '{}' brackets are not for their use and meant for store purpose only.Items shall be tagged as per equipment Tag No. only.

LIST OF ATTACHMENTS

S. No.	DOCUMENT TITLE	DOCUMENT NO.	REV	DATE	SHEETS
1	Vendor Data Requirement	B366-999-YD-VD-2650	0	07/01/2022	3
2	Special Instruction to Vendor	B366-999-YD-SI-2650	0	02/08/2021	8
3	Datasheet Index with Datasheets	B366-999-16-51-ID-2650	0	02/08/2021	20
4	SCHEMATIC FOR DUCT, HOOTER, BEACON & ASPIRATOR	B366-999-16-51-SK-2650	0	02/08/2021	1
5	Compliance Statement	B366-999-YD-CF-2650	0	02/08/2021	1
6	Job Specification for Gas Detection System	080557C-000-JSS-1511-003	0	14/09/2021	36
7	Job Specification for Fire Detectors	080557C-000-JSS-1511-004	C	12/03/2020	51
8	Inspection & Test Plan for Fire and Gas Detectors	080557C-000-ITP-1566-001	A	18/05/2020	5
9	Proven Track Record	B366-999-16-51-PTR-2650	0	05/11/2021	2

In case of any subsequent revision of MR or PR,only revised sheets of the attachments listed above shall be issued alongwith the revision.

GENERAL NOTES:

Engineers India Limited	Vendor Drawing/ Document Submission Schedule		
Client/ Project:IOCL/ IOCL Paradip SRU	**Vendor's Name :**	**Contact Person (Name/ Tel/ Fax/ email) :**	**Status Date:**
Item Description:Gas Detection Systems	**PR No.:** **Date of LOI:** **PO No.:** **Date of PO:**	**Review Status Code:** 1. No Comments 2. Proceed with manufacture/ fabrication as per commented document. Revised document required. 3. Document does not conform to basic requirements as marked. Resubmit for Review. R: Retained for Reference V: Void	
EIL Originating Department :Instrumentation	**Contact Person(EIL):**		

S.No.	Drg/ Doc. Nomenclature as per EIL Vendor Data Requirement	Vendor Drg/ Doc No. / Title	Category Review(R)/ Records(I)	Schedule Date of 1st Submission (Rev. 0)	Anticipated (Ant) / Actual (Act) Date of submission by vendor; Date of Return (Rew) by EIL; Review Status (Code)	Rev. 0	Rev. 1	Rev. 2	Rev. 3	Form Electronic (E)/ Print (P)	Remarks
					Ant						
					Act						
					Rew						
					Code						
					Ant						
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VENDOR DATA REQUIRMENT

Description	With Proposal (Prints)	AFTER PURCHASE ORDER		Final Documentation / As Built
		Prints	Date Needed	
1. Dimensional details with mounting details and model number		X(i)	2W	X
2. Wiring diagrams		X(i)	4W	X
3. Parts list				X
4. Recommended spare parts list(for two years operation)	X			
5. Installation, Operation and maintenance manual				X
6. Test certificates				X
7. Certificate from statutory body	X			X
8. Assembly details				X
9. Catalogues in english	X			
10. Compliance Statement	X			
11. Filled in datasheets	X	X(i)	1W	
12. Final Document in soft copy (CD)				X
13. Calibration Gas Cylinder Calculation		X(a)	4W	
14. SIL Certificate for Gas Detectors	X			X

REV	DATE	BY	CHKD	APPVD
0	07/01/2022	AK	JJ	AR

REQ. NO. : B366-999-YD-MR-2650

ORDER NO. :

VENDOR :

ENGINEERS INDIA LIMITED
NEW DELHI

PLANT : IOCL Paradip SRU
UNIT : 999
CLIENT IOCL

SPECIFICATION	REV
B366-999-YD-VD-2650	0

NOTES :

1. Fold all drawings to 216mm X 279mm and roll transparencies.

2. Vendor to provide all printed matter to ENGINEERS INDIA LIMITED (EIL).
ATTENTION -

Vendor Drawing Control
1, Bhikaji Cama Place, New Delhi-110066.

LEGEND:

Categories preceeded with * will be approved for fabrication by Engineers India Limited.
The remaining drawings are needed for information only.

A/C = As compiled A/R = As required W/S = With shipment W = Weeks

IMPORTANT

While submittimg drawings and documents for review as indicated in vendor data requirement, vendor must ensure the following :

1. A blank space measuring 75 mm W x 38 mm H shall be provided on all vendor drawings (on the front side) for marking review codes etc. by ENGINEERS INDIA LIMITED.

2. The review of the drawings shall be done as applicable, under the following review codes :
   a) Review Code 1 : No Comments.
   b) Review Code 2 : Proceed with manufacture / fabrication as per commented drawing. Revised drawing required.
   c) Review Code 3 : Document does not conform to the basic requirements as marked. Resubmit for review.

3. Review of the vendor drawings by EIL would be only to check compatibility with basic design and concepts and would in no way absolve the manufacturer / fabricator of his responsibility to meet the applicable codes, specifications and statutory rules and regulations.

4. For drawings / documents indicated as FOR INFORMATION in the vendor data requirement, vendor must clearly mark FOR INFORMATION ONLY on the submitted drawings / documents.

5. Any drawing/document not indicated in the list above but required during erection, commissioning or for reconfiguration of the system shall also be supplied by the Vendor on demand.
6. X indicates required. Suffix Codes mean the following:
- (i) For Information
- (a) For Approval
7. The soft copy of documentation shall be in editable form (CAD. Excel, Database etc).
8. Note-1 & 2 above is not applicable as document shall be submitted as soft copies through eDMS/ equivalent document exchange system.
9. Refer elsewhere in the RFQ for FINAL DOCUMENTATION procdeure.

10. DCI shall be prepared by vendor based on the VDR attached with PR and submitted within 15 days from the date of FOA.
11. Vendor shall submit the record/information category documents to Engineer In-charge with one copy through eDMS portal/ equivalent document exchange system to EIL/ BHEL and vendor shall proceed further without waiting for comments from EIL/ BHEL.
12. All inspection related document (QA/QC/ITP) shall be submitted to TPIA.
13. No of copies to be submitted to the site and owner shall be 6 hard copies along with 2 Nos CDs/DVD/Pendrive etc.

SPECIAL INSTRUCTION TO VENDORS

(B366-999-YD-MR-2650)

JOB NO : B366

PROJECT : BS VI REFINERY

CLIENT : INDIAN OIL CORPORATION LTD.

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
A	05.01.22	Issued for Bids	AK	JJ	AR

Part A:

I. BIDDING INSTRUCTIONS

A1. Bidders must follow the following guidelines while submitting their offer. Offers not complying to these guidelines shall be rejected summarily without any intimation to the Bidder.

a. Furnish quotations only for those items that bidder can supply strictly as per MR specifications.

b. In case of any contradiction between these bidding instructions and any other documents attached with the MR, this bidding instruction shall govern.

In case of contradiction, however, Bidders shall bring the same to the notice of Purchaser and Purchaser's decision will be final and binding without any implication

A2. Bidder is responsible to meet all technical requirements in Material Requisition including Instrument Data sheet. If at any stage, till the completion of order, the offered instruments and its accessories are found unsuitable to meet the specification, Bidder shall replace the same with suitable items, without any time/Cost implication.

A3. In addition to the requirements specified above, Bidder must follow the following guidelines while submitting their offer.

Offers not complying with these guidelines shall be rejected summarily without any intimation to the bidder.

a) The Material Requisition (MR) specifications (i.e. data sheets, Job specifications and other attachments to this MR) shall be fully complied with. No deviations of any type are acceptable. Bidder to offer only std. product out of their manufacturing range as listed in their product catalogue including model no.

b) Bidder shall submit the Lumpsum price for Group-01 separately as mentioned in MR elsewhere, covering all the items, accessories, mandatory spares, testing requirements and applicable statutory certification requirements as specified in this MR. If any change at a later date is required in the any item or accessories due to wrong selection, the same shall be borne by the vendor without any time or cost implication.

c) All documentation submitted by the bidder including their quotation, catalogues, drawings, installation, operation and maintenance manuals etc., shall be in English language only.

A4. During Offer as per VDR, Vendor shall furnish the filled in datasheets for inclusion in the PR.

A5. Bidder to note that prior to the submission of bids, bidder can seek any clarification/ confirmation if required as part of pre-bid clarification. Bidder shall ensure that MR is throroghly scrutinized and both technical and commercial clarifications are resolved.

A6. The Bidder shall submit the required drawings/ documents as per the Vendor Data Requirements (VDR) enclosed with the MR

A7. MUST COMPLY REQUIREMENTS

Offer must be complete in all respects complying fully with the MR requirements without exception. No price change, whatsoever, shall be allowed to the bidder after submission of bid.

A8. Special tools and tackles ,if any, required for maintenance of the Gas Detectors shall be included

in the lump-sum price of the Group-01 indicated in the offer and list of same shall be furnished by Bidder.

PART-B
SPECIFIC JOB REQUIREMENTS

B1. This MR consists of Gas Detectors, Fire Detectors, Hooters & Beacons for the following units:

Refinery	Job Number	Unit Name	Unit Number	Licensed/ Engineered By
IOCL- Paradip	B366	SRU III	088	BLACK& VEATCH
		TGTU II	090	BLACK& VEATCH

The following definition shall apply in this requisition:

Owner: M/s Indian Oil Corporation Ltd (IOCL)

Consultant/ PMC: M/s Technip Energies

Purchaser/ LSTK Contractor: M/s Bharat Heavy Electricals limited (BHEL)

Engineering Sub Contractor: M/s Engineers India Ltd (EIL)

B2. Bidder to note the following with regard to ordering of the instruments mentioned in the requisition. Gas Detectors covered in this MR are clubbed under one group as detailed below:

Group-01

HC Gas Detector :- 03 Nos.
H2S Detector :- 19 Nos.
NH3 Detector :- 01 No
SO2 Detector :- 05 Nos
Fire Detector :- 08 Nos
Hooters & beacons :- 08 Nos
Open Path Detector :- 02 Nos
Multi Gas Portable Detector :- 02 Nos

Bidder to note that the evaluation shall be carried out on bottom line basis (lump sum basis) for all the tags in Group 01 as mentioned above including mandatory spares, accessories, testing, special tools and tackles and all other requirements of MR. Bidder shall note that all instruments in Group 01 will be ordered together on one vendor. Bidder to ensure their offering accordingly.

Vendor List

Vendor list for the Fire Detectors, Gas Detectors & Hooter/ Beacons as per the Project Vendor List is as below. Bidder shall ensure the items are sourced from these Project Vendor List only.

a) Vendor List for Gas Detectors :

S.No.	SUPPLIER NAME	COUNTRY
1.	CROWCON DETECTION INSTRUMENTS LTD	International
2.	DETECTOR ELECTRONICS CORP. (KIDDE CO.)	India
3.	DRAGER SAFETY AG & CO KGAA	India
4.	EMERSON PROCESS MANAGEMENT INDIA PVT LTD	India
5.	HONEYWELL ANALYTICS	India

6.	INDUSTRIAL SCIENTIFIC OLDHAM	India
7.	MINE SAFETY APPLIANCES COMPANY	India
8.	NET SAFETY MONITORING INC	India
9.	RESPO PRODUCTS	India
10.	RIKEN KEIKI CO LTD	India

b) Vendor List for Fire Detectors:

S.No.	SUPPLIER NAME	COUNTRY
1.	DETCON INC	International
2.	DETECTOR ELECTRONICS CORP. (KIDDE CO.)	India
3.	EMERSON PROCESS MANAGEMENT INDIA PVT LTD	India
4.	HONEYWELL AUTOMATION INDIA LTD	India
5.	MINE SAFETY APPLIANCES COMPANY	India
6.	NET SAFETY MONITORING INC	India

c) Vendor List for Hooters & Beacons

S.No.	SUPPLIER NAME	COUNTRY
1.	BALIGA LIGHTING EQUIPMENT PVT LTD	India
2.	CAEG FCG	India
3.	EX PROTECTA	India
4.	FLAMEPROOF EQUIPMENT PVT LTD	India
5.	FLEXPRO ELECTRICALS	India

B3. Each tag in the datasheet is provided with notes specific to that tag no. Bidder shall read the same together with these notes given.

B4. Offered Model Nos for fire and gas detectors, portable gas detectors and its accessories shall be field proven in the similar refinery applications for a period of minimum 8000 hours from the bid opening within duration of five years.

ITEMS WITH PROTOTYPE DESIGNS OR ITEMS NOT MEETING PROVENNESS CRITERIA SPECIFIED ABOVE SHALL NOT BE CONSDIERED BY THE BIDDER.

Fire & Gas Detectors, portable gas detectors and its accessories not having proven references in similar applications shall not be acceptable.

B5. All gas detectors (including open path gas detectors) & fire detectors shall be directly connected to the Purchaser's Gas Detection and Alarm System (FDAS) respectively located in Rack Room SRR-811. No fire and gas detector panel is applicable. The cable between the detectors and PLC shall be in Purchaser's Scope. Vendor to indicate distance limitations for cable between detector / transmitter and Rack Room SRR-811, if any, considering 2.5 sq.mm Twisted triad, PE coated, 7 stranded copper conductor, 100% aluminum Mylar shielding with 25% overlap, armored, 600V/1000V rated, DC resistance of 7.41 ohm/km at 20° C, mutual capacitance between the pair of 100 pF/ m at 1k Hz.., capacitance between any core and screen of 400 pf/m at 1k Hz., L/R ratio of adjacent cores of 60 microH/ohm .Vendor to confirm the suitability of these cables for the offered gas detectors.

In case above cable considered by Purchaser is not suitable for the maximum distance of 500 mtrs (Between field and Rack room SRR-811), bidder shall clearly furnish in the offer

(i) The maximum distance upto which the above cable size is suitable for the offered detectors
(ii) Suitable cable size to be considered by Purchaser for distances mentioned above for the offered fire & gas detectors.

B6. Field Warning System:

Vendor's scope shall also include the supply of hooters & beacons as indicated in the datasheet which shall be installed in the field to warn the field operators on occurrence of gas leakage/ fire detected. These hooters & beacons shall be direcly connected to the Purchaser's Gas Detection PLC/ Fire Detection and Alarm System (FDAS). For the annunciation sequence & details, bidder shall refer to 080557C-000-JSS-1511-003 & 080557C-000-JSS-1511-004 attached with MR.

B7. All fire and gas detectors shall be suitable for outdoor installation certified for use in electrically hazardous area. The detectors shall be weather proof to IP 66 in accordance as a minimum and certified flameproof (Exd) for the area classification specified in Purchaser's datasheets.

B8. Unless otherwise specified , all fire and gas detectors shall be provided with dust guard and splash guard.

B9. Mounting accessories like mounting bracket (Stainless Steel) required for the installation of fire and gas detectors for 2"pipe mounting shall be supplied by vendor. However, open path detectors shall be suitable for 4" pipe mounting.

B10. All fire and gas detectors shall be provided with terminal box for terminating incoming cabling. Flying leads shall not be acceptable. The cable entry in the terminal box shall be ¾" NPTF

B11. All the fire and gas transmitters shall be SIL 2 certified (with Hardware Fault Tolerance HFT 0 configuration) SMART type with 4 -20 mA DC analog output with superimposed HART Protocol for interfacing with Gas Detection PLC/ Fire Detection and Alarm System (FDAS) PLC. Third party SIL certificate/ FMEDA report shall be provided. Also, the transmitters shall be HART 7 certified.

B12. Transmitter with integral LCD display shall be supplied as specified in the individual datasheet

B13. (a) Lamp in Infrared detectors shall be replaceable type

(b) Offered IR detectors shall be compensated for lamp intensity variation due to dust, variation in humidity, sunlight etc

(c) The gas detectors shall have an over range protection in case of sudden exposure to large quantity of Hydrocarbon gases.

B14. IR sensor shall be 'Dual beam with heated optics' or other suitable arrangement to overcome environmental effects of fogging/fouling. Diagnostic alarm shall be provided for detector failure/dirty sensor & Detector shall have option to clean the dirt and remove alarm.

B15. CALIBRATION

i. Vendor shall indicate time period after which recalibration of HC, H2S, NH3 and SO2 detectors is required along with offer. Vendor to indicate drift in the calibration of offered detectors.

ii. HC Detectors shall be calibrated for gas that they are least sensitive. Vendor shall indicate the gas with which the gas detectors shall be calibrated.

iii. Gas detector sensors shall be capable of non intrusive calibration initiated through Purchaser's Universal HART HHC.

iv. All detectors shall be supplied pre-calibrated at vendor's works by the vendor either with the gas to be sensed or by applying cross sensitivity factors.

v. Vendor to furnish calibration procedure for HC, H2S, SO2, NH3 fixed as well as portable detectors along with make/model no. with catalogue/technical details of calibration kit.

vi. Vendor to furnish quantity of calibration gas required for calibration of detector. Volume of calibration gas cylinder and no. of calibration gas cylinders shall be based on the requirements specified for below for a period of 1 year. Price for the same shall be included in the base price of Group 01.

a) Sufficient quantity of calibration gas cylinders shall be supplied to enable calibration of all sensing heads at least thrice considering minimum 3 minutes for each detector. Vendor to ensure that the composition and stability of the calibration gas provided in the gas cylinders shall be suitable for minimum six months periods.
b) In case vendor's standard product requires higher calibration time, vendor to indicate the same and calculate the gas quantity accordingly. Gas cylinders, self regulating valves, pressure gauges, hose, interconnecting tubing, fittings etc. shall be supplied by the vendor. The delivery of gas cylinders shall be staggered in such way that the composition and stability of gas do not deteriorate. Date of supply shall be intimated to the bidder and shall be prior to commissioning.

   Valid PESO certificate must be provided along with calibration gas cylinders and certificates shall be in the name of IOCL.

B16. Portable Gas Detectors:

Portable Gas Detecrors shall be small size and light weight. Also these items should be very Compact, Durable and easy to use having rapid response & recovery and fast

A. Bidder shall comply with following Display Requirements:
   i) Standard Graphic Large LCD Display with backlight and Power Save.
   ii) With continuous display (alphanumeric) of Real Time Gas Concentration with Backlight in Low Light (auto and on demand) and Alarm Condition (auto).
   iii) Graphic symbols for battery Healthiness.
   iv) Display of Healthy Operation and Fault Warning.

B. Bidder shall comply with following Alarm Requirements:
   i. Gas Channel with Two Instantaneous Alarm Levels Set (Low and High) For Multi Gas Portable Detectors, EACH Gas Channel shall be accompanied with Two Alarm Levels Set, Field adjustable set points for alarms required.
   ii. High Output Clear Audible Alarms and Multiple Alarm Sounds at Preset Values.
   iii. Visual and Internal Vibrator Alarms in Gas hazard.
   iv. Vibrator in sync with Audio/ Visual Alarms
   v. Alert for Low Battery, OFF Warning and Sensor Fail
   vi. Confidence Beep (Field Selectable ON/OFF)
   vii. Multigas Detecors shall have Low, High, TWA and STEL Alarms with field adjustable set points.

Portable detectors shall be provided with rechargeable batteries and battery charger suitable for 230V AC non UPS. Carrying case, Calibration kit and Maintenance kit shall be provided with portable detectors. Portable detectors shall be preferably IS type.

B17. For Flameproof (Ex'd') detectors, intrinsically safe port shall be provided for connecting HHC. Vendor to ensure that the gas detectors offered shall be able to communicate with universal hand held configurator (configurator is not in vendor's scope). In case vendor's gas detector is not able to accept commands from universal HHC and vendor has his own proprietary communicator, the same shall be supplied by vendor as part of their offer. HHC quantity shall be minimum 1 no. with 1 no. of portable charger. Price for the same shall be included in the lump-sum price.

B18. HC Open Path Gas Detector

Vendor to note that open path gas detectors shall be provided with transmitters & receivers. For each set of transmitter and receiver, range as per datasheets shall be considered. Suitable accessories for mounting the transmitter & receiver including special tools & tackles shall be provided. All JB, interconnecting cables (if required) between transmitter & receiver shall be supplied by vendor.

Alignment kit along with test filters for detectors shall be provided.

B19. Vendor must forward type-test certificates validated by third party test laboratory (TPIA), indicating the procedures followed for checking the sensitivity of the quoted detector including fluid used, time for which the detector is exposed to this fluid and the related loss in sensitivity.

B20. Vendor shall provide the installation elevation of the detectors considering the gas composition which shall be furnished after placement of order. Vendor to furnish the installation drawings for the offered detectors.

B21. Any special tool required for the maintenance of the offered detectors and its accessories shall be supplied by the vendor and details of the same shall be furnished along with the offer. Bidder must confirm in their offer if no special tools are needed for maintenance of offered detectors & its accessories. The maintenance on any detector should not necessitate shutdown of total/partial detection system except those that are being maintained.

B22. Vendor shall include separate list of spares for two (2) years normal operation as per vendor's recommendation. However, the same shall include the detectors, transmitters, monitors, electronic modules, power supply modules etc. of each type as a minimum. Price for the same shall not be included in the lumpsum price.

B23. Training Requirements:

Training for owner's personnel shall be provided for supplied fire and gas detectors of each make as indicated below.

i. The training shall be at OEM's premises, where proper facility and infrastructure for training shall be available
ii. "On the job traning" to owner's personnel at site shall also be included in training schedule. Training course shall include detail configuration, modification, operation, troubleshoot, calibration, maintenance (preventive/ breakdown) etc as a minimum. The cost of lodging and boarding attending the same shall be by owner.
iii. The cost of training shall be considered for evaluation.

At OEM's Work	At SITE
5 days/ 5 personnel	5 days/ 5 personnel

B24. Bidder shall supply the following mandatory spares. Price for the same shall be included in the lumpsum price of Group 01:

i. Sensors as part of Fire & Gas Detectors including portable detectors: 20% or minimum 2 sets of each type whichever is higher.
ii. Electronic cards/ modules/ display as part of Fire & Gas Detectors including portable detectors: 10% or minimum of 1 set of each type whichever is higher
iii. Hooter: 10% (subject to minimum of 1, whichever is higher) for each type
iv. Beacon: 10% (subject to minimum of 1, whichever is higher) for each type

B25. Purchaser may require the service of bidder's specialist during commissioning for supervision of erection, testing and commissioning of the Fire & Gas Detector, Beacon/ hooter and Portable Gas Detector. Hence vendor must quote per diem rate for the visit of their specialist to IOCL Paradip Refinery, for supervision of erection, testing and commissioning of Fire & Gas Detector, Beacon/ Hooter and Portable Gas Detector at site. Three (3) day of visit shall be considered in their offer for evaluation purpose based on the per diem rate to be quoted by vendor. This is exclusively for commissioning assistance and does not include any visit by vendor/ manufacturer's visit is found necessary because of non functional behavior or Fire & Gas Detector, Beacon/ Hooter, Portable Gas Detector not meeting agreed specification during warranty period, this shall be considered as per warranty agreement.

B26. SITE CONDITIONS:

The instruments and accessories covered in the MR shall be suitable for unprotected installation in Hot, Humid and Corrosive environment having following ambient condition. The site environmental conditions are as follows:

IOCL- Paradip Refinery	
Maximum ambient temperature	42.4 º C
Minimum ambient temperature	11.3 º C
Relative humidity	95% (max) @ 42.4 °C
Maximum recoded rainfall	335 mm in 24 hour

Group 1
Gas Detectors with Accessories (Qty: 48 Nos.)

Sl. No.	Tag No.	Description	Datasheet No
1.	090-AT -0126	HC Detector	B366-999-YD-DS-2600
2.	090-AT -0111	HC Detector	
3.	088-AT -OS2	HC Gas Detector HVAC Duct	
4.	088-AT -0100	H2S Detector	B366-999-YD-DS-2602
5.	088-AT -0105	H2S Detector	
6.	088-AT -0106	H2S Detector	
7.	088-AT -0107	H2S Detector	
8.	088-AT -0108	H2S Detector	
9.	088-AT -0112	H2S Detector	
10.	088-AT -0113	H2S Detector	
11.	088-AT -0129	H2S Detector	
12.	088-AT -0130	H2S Detector	
13.	088-AT -0131	H2S Detector	
14.	088-AT -0132	H2S Detector	
15.	088-AT -0133	H2S Detector	
16.	088-AT -0134	H2S Detector	
17.	088-AT -0136	H2S Detector	
18.	088-AT -0137	H2S Detector	
19.	088-AT -0138	H2S Detector	
20.	088-AT -0139	H2S Detector	
21.	090-AT -0141	H2S Detector	
22.	088-AT -OS1	H2S Gas Detector HVAC Duct	
23.	088-AAH -0001	Hooter	B366-999-YD-DS-2603
24.	090-AAH -0002	Hooter	
25.	088-AAH -1001A	Red Beacon	
26.	088-AAH -1001B	Yellow Beacon	
27.	088-AAH -1001C	Blue Beacon	
28.	090-AAH -1002A	Red Beacon	
29.	090-AAH -1002B	Yellow Beacon	
30.	090-AAH -1002C	Blue Beacon	
31.	088-AT -0125	NH3 Detector	B366-999-YD-DS-2604
32.	088-AT -0127	HC Detection (Open path)	B366-999-YD-DS-2605
33.	088-AT -0128	HC Detection (Open path)	B366-999-YD-DS-2606
34.	088-AT -0120	SO2 Detector	B366-999-YD-DS-2607
35.	088-AT -0121	SO2 Detector	
36.	088-AT -0122	SO2 Detector	
37.	088-AT -0123	SO2 Detector	

38.	088-AT -0124	SO2 Detector	
39.	088-AT -0142	Fire Detector	B366-999-YD-DS-2608
40.	088-AT -0143	Fire Detector	
41.	088-AT -0144	Fire Detector	
42.	088-AT -0145	Fire Detector	
43.	088-AT -0146	Fire Detector	
44.	088-AT -0147	Fire Detector	
45.	090-AT -0148	Fire Detector	
46.	090-AT -0149	Fire Detector	
47.	088-PHCD -0001	Multi-Gas Portable Detectors	B366-999-YD-DS-2609
48.	088-PHCD -0002	Multi-Gas Portable Detectors	

GENERAL	1	Tag Number			SEE LIST	
	2	Service			HC/LEL Detection	
	3	Location/ Equipment No.			SEE LIST	
	4				Flame Proof (Ex'd) and Weather Proof to IP-66	
	5	Protective Cap for Dust/ Rain Cover			Required	
	6	Electrical Area Classification			IEC Zone-1,Gas Gr.IIA/IIB, T3	
	7	LEL (% v/v in Air)			SEE LIST	
	8	Mol Wt.	Major Constituents		SEE LIST	SEE LIST
LEL/HC GAS DETECTOR	9	Detetor Type			Infra Red(IR)	
	10	IR Detector Type			Point	
	11	IR Source (Lamp) Life			Minimum 5 Years(*)	
	12	Material of Construction				
	a	Body			SS	
	b	Cap			Manufacturer standard	
	c	Filter			Manufacturer standard	
	13	Response Time (T90)			Less than 30 seconds with Splash guard and Dust guard	
	14	Range			0-100% LEL	
	15	Detector Output			*	
	16	Alarm At			SEE LIST	
TRANSMITTER	17	Location			Integral to Detector	
	18	Enclosure Type			FlameProof (Ex'd) & WP to IP-66 (Note-ii)	
	19	Type			SMART, HART	
	20	No. of detectors per transmitter			1	
	21	Output				
	a	Analogue			4-20 mA DC, HART, 3 wire(Note-iii)	
	b	Serial				
	22	Display			LCD, Integral to Transmitter	
	23	Power Supply			24VDC±10%	3 wire(Note-iii)
	24	Min Operating Voltage			*	
	25	Cable b/w Detecor & Transmitter			Not Required	
	a	Power			-	
	b	Signal			-	
	26	Cable b/w Transmitter & Remote reciever			Not Required	
	27	Power				
	28	Signal				
	29	Cable Glands and Accessories			Required	
	30	Cable Entry			3/4"NPT(F)(Note-iii,iv)	
	31	Mounting			2" pipe mounting	
	32	Mounting Accessories			Required	
	33					
ACCESSORIES	34	Portable Calibration Kit			Required (Note-v)	
	35	Type				
	36	Service			HYDROCARBON	
	37	Carrying Case			Required	
	38	Calibration Gas Cylinders			Required	
OPTIONS	39	Aspirator assembly			Required as per LIST	
	40	Notes			SEE LIST	
CERTIFICATION	41	Statutory			Required	
	42	Others			PESO	
PURCHASE	43	Manufacturer			*	
	44	Model			*	
	45	Requisition Number			B366-999-YD-MR-2650	
	46	Price	Item Number			
	47	Purchase Order Number				

Notes:

				INSTRUMENTION SPECIFICATION			
				LEL/HC Detector			
				Project :SRU 3, IOCL-PARADIP			
				Job No. : B366			
				Unit No.:			
0	AK	05.01.2022	Issued with MR				
No.	A	Date	Revision	Code:	114	Dwg. No.: B366-999-YD-DS-2600	Rev.: 0

Tag Number : SEE LIST

GENERAL NOTES :
i. All sensor/ transmitter , Portable calibrators shall be suitable for specified Area classification(Sl. No. 6)
ii. Transmitter enclosure material shall be SS 316.
iii. Three Wire system is considered. Triad cable will be provided by purchaser.
iv. In case Vendor's standard connection is other than 3/4" , vendor shall provide suitable adaptor to meet the 3/4" NPTF connection specified for purchasers use.
v. Portable calibration kit shall include portable calibrator, tubing, pressure regulator, gas cylinder etc. as required by vendor for calibration. The number of gas cylinders should be sufficient to calibrate gas detectors of units SRU (088) and TGTU (090).
vi. ' * ' indicates to be furnished by vendor.
vii. Offered gas detector transmitters shall be SIL-2 certified.
viii. All gas detectors shall be provided with dust guard and splashguard.
ix. Refer SIV Clause No B14: Heated optics shall be used to avoid signal loss/ false alarms due to condensation.
x. Repeatability: +/- 2% Full Scale

TAG SPECIFIC NOTES
1. These gas detectors are to be installed on duct. Suitable mounting accessories for installation on duct shall be provided by vendor. Refer drawing no. B366-999-16-51-SK-2650.

Sr. No.	Tag Number	Location	Mol Wt.	LEL (% V/V in Air)	Major Constituents	Alarm	Notes
1	090-AT -0126	Near 090-F-001 (Incinerator Burner)	16 -86	1.2	C1- C6	20% LEL, 40% LEL	
2	090-AT -0111	Near 090-V-008 (Fuel Gas KOD)	16 -86	1.2	C1- C6	20% LEL, 40% LEL	
3	088-AT-OS2	HC Gas Detector HVAC Duct					Note -1

GENERAL	1	Tag Number	SEE LIST		
	2	Service	TOXIC (H2S) Detection		
	3	Location/ Equipment No.	SEE LIST		
	4	Enclosure Type	FlameProof (Ex'd) and WeatherProof to IP-66		
	5	Protective Cap for Dust/ Rain Cover	Required		
	6	Electrical Area Classification	IEC zone-1, Gas Gr. IIA/IIB, T3		
	7	Detector Output	*		
	8	Alarm at			
TOXIC GAS DETECTOR	9	Detetor Type	Electrochemical		
	10	Detector Output	*		
	11	Alarm At	SEE LIST		
	12	Material of			
	a	Body	Manufacturer's Standard		
		Cap	Manufacturer's Standard		
		Filter	Manufacturer's Standard		
	13	Response Time	T90 (Less than 60 sec with splash guard & dust guard)		
	14	Range	0-20 PPMV		
	15	Mol Wt	SEE LIST		
	16				
TRANSMITTER	17	Location	Integral to Detector		
	18	Enclosure Type	FlameProof (Ex'd) and WP to IP-66(Note-ii)		
	19	Type	SMART,HART		
	20	No. of detectors per transmitter	1		
	21	Output			
		Analogue	4-20 mA DC, HART, 3 wire (Note-iii)		
		Serial	-		
	22	Display	LCD, Integral to Transmitter		
	23	Power Supply	24VDC±10%	3 wire(Note-iii)	
	24	Min Operating Voltage	*		
	25	Cable b/w Detecor & Transmitter	Not Required		
		Power	-		
		Signal	-		
	26	Cable b/w Transmitter & Remote	Not Required		
	27	Power			
	28	Signal			
	29	Cable Glands and Accessories	Required		
	30	Cable Entry	3/4" NPT(F)(Note-iii,iv)		
	31	Mounting	2" pipe mounting		
	32	Mounting Accessories			
	33				
ACCESSORIES	34	Portable Calibration Kit	Required (Note-v)		
	35	Type			
	36	Service	H2S/Toxic		
	37	Carrying Case	Required		
	38	Calibration Gas Cylinders	Required		
OPTIONS	39	Notes	SEE LIST		
	40				
CERTIFICATION	41	Statutory	Required		
	42	Others	PESO		
PURCHASE	43	Manufacturer	*		
	44	Model	*		
	45	Requisition Number	B366-999-YD-MR-2650		
	46	Price	Item Number		
	47	Purchase Order Number			

Notes:

				INSTRUMENTION SPECIFICATION	TechnipFMC / IndianOil
				Toxic Detector (H2S)	
				Project : SRU 3, IOCL-PARADIP	
				Job No. : B366	
				Unit No.:	
0	AK	05.1.2022	Issued with MR		Sheet 1 of 3
No	A	Date	Revision	Code: 115	Dwg. No.: B366-999-YD-DS-2602 Rev. 0

Tag Number : SEE LIST

GENERAL NOTES:

i. All sensor/transmitter , Portable calibrators shall be suitable for specified area classification(Sl. No. 6)
ii. Transmitter enclosure material shall be SS316.
iii. Three Wire system is considered. Triad cable will be provided by purchaser.
iv. In case Vendor's standard connection is other than 3/4", vendor shall provide suitable adaptor to meet the 3/4" NPTF connection specified for purchasers use.
v. Portable calibration kit shall include portable calibrator, tubing, pressure regulator, gas cylinder etc. as required by vendor for calibration. The No. of gas cylinders should be sufficient to calibrate gas detectors of units SRU (088), TGTU (090).
vi. All gas detectors shall be provided with dust guard and splashguard.
vii. ' * ' indicates to be furnished by vendor.
viii. Offered gas detector trasnmitters shall be SIL-2 certified.
ix. The field life of electrochemical type of sensor shall be 2 years as a minimum. The cell shall be able to be replaced in-situ.
x. S. No 9: The semiconductor type sensor is also acceptable. The same shall be the thin film MOS type with life expectancy of minimum of 5 years and Zero and span adjustment shall be automatic.
xi. Repeatability: +/- 2 PPM

Tag Specific Notes

1. These gas detectors are to be installed on duct. Suitable mounting accessories for installation on duct shall be provided by vendor. Refer Drawing No B366-999-16-51-SK-2650.

Sr. No.	Tag Number	Location	Mol Wt.	Major Constituents	LEL (% V/V in Air)	Alarm	Notes
1	088-AT -0100	NEAR 088-V-001 BOTTOM	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
2	088-AT -0105	NEAR 088-P-001A SEAL	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
3	088-AT -0106	NEAR 088-P-001B SEAL	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
4	088-AT -0107	NEAR 088-P-002A SEAL	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
5	088-AT -0108	NEAR 088-P-002B SEAL	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
6	088-AT -0112	NEAR 088-V-002 BOTTOM	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
7	088-AT -0113	NEAR 088-F-002 REACTION FURNACE	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
8	088-AT -0129	NEAR 088-F-002 REACTION FURNACE	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
9	088-AT -0130	NEAR 088-A-002 TSP DOSING PACKAGE	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
10	088-AT -0131	NEAR 088-WHB-002	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
11	088-AT -0132	NEAR 088-V-005	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
12	088-AT -0133	NEAR 088-V-007	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
13	088-AT -0134	NEAR 088-V-008	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
14	088-AT -0136	NEAR 088-SU-001 SULPHUR PIT	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
15	088-AT -0137	NEAR 088-SU-001 SULPHUR PIT	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
16	088-AT -0138	NEAR BATTERY LIMIT VALVE STATION PLATFORM	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
17	088-AT -0139	NEAR BATTERY LIMIT VALVE STATION PLATFORM	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
18	090-AT -0141	NEAR 090-A-001	34	H2S	10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	
19	088-AT -OS1	HVAC Duct of Operator Shelter			10 ppmv	Prealarm at 5 ppmv and alarm at 10 ppmv	Note 1

GENERAL	1	Tag Number		SEE LIST
	2	Service		SEE LIST
	3	Location/ Equipment No.		SEE LIST
	4	Enclosure Type		Flameproof (Ex'd) and Weather proof to IP-66
	5	Protective Cap for Dust/ Rain Cover		
	6	Electrical Area Classification		IEC Zone-1,Gas Gr.IIA/IIB, T3
	7	Type		SEE LIST
	8			
BEACON	9	Type		Continuous flashing
	10	Beacon Color		Refer Notes
	11	Luminous Intensity		*
	12	Flashing Frequency		*
	13	Lamp Type		Xenon Strobe Tube Technology
	14	Dome Material for flashing tube		Transparent toughened glass
	15	Lens gaurd / Cage		Yes,Required
	16	Power Supply		24 V DC
	17	Cable Entry		3/4" NPTF with cable glands
	18	Mounting		Surface mounting on either walls or poles with mounting accessories
	19	Body Material		Metallic
	20	Wiring System		2 wire
	21			
HOOTER	22	Type		Electronic
	23	Mode of Operation		Three tone
	24	Frequency		*
	25	Sound Level		115 dBA minimum @ 1 Mtr
	26	Body Material		Metallic
	27	Power Supply		24 V DC
	28	Wiring System		2 wire for each tone
	29	Cable Entry		3/4" NPTF, 2 nos. with cable glands
	30	Mounting		Surface mounting on either walls or poles with mounting accessories
FIELD MOUNTED PUSH BUTTON	31	Number of Contacts		
	32	Rating of Contacts		
	33	Type		
	34			
	35	Cable Entry		
	36	Cable Glands and Accessories		
	37	Mounting		
	38	Mounting Accessories		
	39			
	40			
PORTABLE GAS DETECTOR	41	Type		
	42	Battery Type		
	43	Carrying Case		
	44	Battery Charger		
	45	Battery Charger Voltage		
OPTIONS	46	Notes		SEE LIST
	47			
CERTIFICATION	48	Statutory		Required
	49	Others		PESO
PURCHASE	50	Manufacturer		*
	51	Model		*
	52	Requisition Number		
	53	Price	Item Number	
	54	Purchase Order Number		

Notes:

				INSTRUMENT SPECIFICATION		
				BEACON / HOOTER / MISC		
				Project :IOCL-PARADIP		
				Job No. :		
				Unit No.: SRU		
	AK	05.1.22	Issued with MR		Sheet 1 of 3	
No	By	Date	Revision	Code:	Dwg. No.: B366-999-YD-DS-2603	Rev.:0

Tag Number : SEE LIST

GENERAL NOTES:
i. Hooter and Beacon shall be suitable for operating with galvanic isolator (P&F / MTL) make at Gas Detection/ FDAS PLC. This isolator is in Purchaser's scope and exact make/ model of the isolator will be informed as part of detailed engineering.
ii. In case Vendor's standard connection is other than 3/4" for hooter/beacon , vendor shall provide suitable adaptor to meet the 3/4" NPTF connection specified for purchasers use.

				INSTRUMENT SPECIFICATION BEACON/ HOOTER/ MISC	TechnipFMC IndianOil	
	AK	05.1.22	Issued with MR		Sheet 2	of 3
No.	By	Date	Revision	Code: 117	Dwg. No.: B366-999-YD-DS-2603	Rev 0

Sr. No.	Tag Number	Location	Service	Type	Notes
1	088-AAH-0001	Hooter for SRU Block		Hooter	
2	090-AAH-0002	Hooter for TGTU Block		Hooter	
3	088-AAH-1001A	Red Beacon for Fire Alarm for SRU Block		Stroboscopic Beacon	RED COLOR
4	088-AAH-1001B	Yellow Beacon for Toxic Gas Alarm for SRU Block		Stroboscopic Beacon	YELLOW COLOR
5	088-AAH-1001C	Blue Beacon for Combustible Gas Alarm for SRU Block		Stroboscopic Beacon	BLUE COLOR
6	090-AAH-1002A	Red Beacon for Fire Alarm for TGTU Block		Stroboscopic Beacon	RED COLOR
7	090-AAH-1002B	Yellow Beacon for Toxic Gas Alarm for TGTU Block		Stroboscopic Beacon	YELLOW COLOR
8	090-AAH-1002C	Blue Beacon for Combustible Gas Alarm for TGTU Block		Stroboscopic Beacon	BLUE COLOR

GENERAL	1	Tag Number	SEE LIST		
	2	Service	Ammonia Gas Detection		
	3	Location/ Equipment No.	SEE LIST		
	4	Enclosure Type	FlameProof (Ex'd) and WeatherProof to IP-66		
	5	Protective Cap for Dust/ Rain Cover	Required		
	6	Electrical Area Classification	IEC zone-1, Gas Gr. IIA/B, Temp. Class T3		
	7				
	8	Alarm at			
NH3 GAS DETECTOR	9	Detetor Type	Electrochemical		
	10	Detector Output	*		
	11	Alarm At	SEE LIST		
	12	Material of			
	a	Body	SS		
		Cap	Manufacturer's Standard		
		Filter	Manufacturer's Standard		
	13	Response Time	T90: Less than 60 seconds with Splash guard and Dust guard		
	14	Range	0-40 PPM		
	15	Mol Wt			
	16				
TRANSMITTER	17	Location	Integral to Detector		
	18	Enclosure Type	FlameProof (Ex'd) and WP to IP-66 (Note-ii)		
	19	Type	SMART, HART		
	20	No. of detectors per transmitter	1		
	21	Output			
		Analogue	4-20 mA DC, HART, 3 wire (Note-iii)		
		Serial	-		
	22	Display	LCD, Integral to Transmitter		
	23	Power Supply	24VDC±10%	3 wire (Note-iii)	
	24	Min Operating Voltage	*		
	25	Cable b/w Detecor & Transmitter	Not Required		
		Power	-		
		Signal	-		
	26	Cable b/w Transmitter & Remote	Not Required		
	27	Power			
	28	Signal			
	29	Cable Glands and Accessories	Required		
	30	Cable Entry	3/4"NPT(F) (Note-iii,iv)		
	31	Mounting	2" pipe mounting		
	32	Mounting Accessories			
	33				
ACCESSORIES	34	Portable Calibration Kit	Required (Note-vi)		
	35	Type	As per SIV		
	36	Service	NH3		
	37	Carrying Case	Required		
	38	Calibration Gas Cylinders	Required		
OPTIONS	39	Notes	SEE LIST		
	40				
CERTIFICATION	41	Statutory	Required		
	42	Others	PESO		
PURCHASE	43	Manufacturer	*		
	44	Model	*		
	45	Requisition Number	B366-999-YA-MR-2650		
	46	Price	Item Number		
	47	Purchase Order Number			

Notes:

				INSTRUMENTION SPECIFICATION	
				Toxic Detector (NH3)	
				Project :SRU 3, IOCL-PARADIP	
				Job No. : B366	
				Unit No.:	
0	AK	05.1.2022	Issued with MR		Sheet 1 of 3
No	A	Date	Revision	Code: 92	Dwg. No.: B366-999-YD-DS-2604 Rev. 0

Tag Number : SEE LIST

GENERAL NOTES:
i. All sensor/transmitter, Portable calibrators shall be suitable for specified area classification(Sl. No. 6)
ii. Transmitter enclosure material shall be SS 316.
iii. Three Wire system is considered. Triad cable will be provided by Purchaser.
iv. In case Vendor's standard connection is other than 3/4", vendor shall provide suitable adaptor to meet the 3/4" NPTF connection specified for Purchaser's use.
v. Offered gas detector transmitters shall be SIL-2 certified.
vi. Portable calibration kit shall include portable calibrator, tubing, pressure regulator, gas cylinder etc. as required by vendor for calibration. The number of gas cylinders should be sufficient to calibrate gas detectors as mentioned in notes for individual calibrator.
vii. All gas detectors shall be provided with dust guard and splashguard.
viii. ' * ' indicates to be furnished by vendor.
ix. The field life of electrochemical type of sensor shall be 2 years as a minimum. The cell shall be able to be replaced in situ.
x. Repeatability: +/- 2% Full Scale
xi. S. No 9: The semiconductor type sensor is also acceptable. The same shal be the thin film MOS type with life expectancy of minimum of 5 years and Zero and span adjustment shal lbe automatic.

Sr. No.	Tag Number	Location	Mol Wt.	Major Constituents	LEL (% V/V in Air)	Alarm	Notes
1	088-AT-0125	Near 088-V-002	17	NH3	25 ppmv	Alarm at 10PPMV and 25PPMV	

GENERAL	1	Tag Number		090-AT-0127		
	2	Service		HC Detection (Open path)		
	3	Location/ Equipment No.		NORTH SIDE OF UNIT STARTING FROM STAIR CASE OF 088-TS-001 TO 088-C-001		
	4	Enclosure Type		Flame Proof (Ex'd) and Weather Proof to IP-66		
	5	Protective Cap for Dust/ Rain Cover		Required		
	6	Electrical Area Classification		IEC Zone-1, Gas Gr.IIA/B, Temp. Class T3		
	7					
	8	Mol Wt.	Major Constituents	16 - 86	C1-C6	
HC GAS DETECTOR	9	Detector Type		Infra Red (IR) (Open Path)		
	10	Detector Ouput		4-20 mA DC		
	11	Low Explosive Limite (LEL)		1.2 (%V/V IN AIR)		
	12	Material of Construction				
	a	Body		SS 316		
	b	Cap		Manufacturer standard		
	c	Filter		Manufacturer standard		
	13	Response Time		T90:- Less than 30 seconds with splash guard and dust guard.		
	14	Range		0 - 4 LEL Meter		
		Path Length		50 Meter		
	15	Pre Alarm		1 LEL Meter		
	16	High Alarm		3 LEL Meter		
TRANSMITTER & RECEIVER	17	Location		Integral to Detector		
	18	Enclosure Type		FlameProof (Ex'd) & WP to IP-66 (Note-ii)		
	19	Type		SMART, HART		
	20	No. of detectors per transmitter		1		
	21	Output				
	a	Analogue		4-20 mA DC, HART, 3 wire (Note-iii)		
	b	Serial				
	22	Display		LCD, Integral to Transmitter		
	23	Power Supply		24 V DC±10% (Note-iii)	3 wire (Note-iii)	
	24	Min Operating Voltage		*		
	25	Cable b/w Detecor & Transmitter		Not Required		
	a	Power		-		
	b	Signal		-		
	26	Cable b/w Transmitter & Remote reciever		-		
	27	Power		-		
	28	Signal		Manufacturer standard (Note-vii)		
	29	Cable Glands and Accessories		Required (Both at Transmitter and Recevier)		
	30	Cable Entry		3/4"NPT(F) (Note-iii,iv)		
	31	Mounting		4" pipe mounting (Transmitter and Recevier)		
	32	Mounting Accessories		Required (Transmitter and Recevier)		
	33					
ACCESSORIES	34	Portable Calibration Kit				
	35	Type				
	36	Service				
	37	Carrying Case		Required		
	38	Calibration Gas Cylinders		Required		
OPTIONS	39	Aspirator assembly				
	40	Notes				
CERTIFICATION	41	Statutory		Required		
	42	Others		PESO		
PURCHASE	43	Manufacturer		*		
	44	Model		*		
	45	Requisition Number		B366-999-YD-MR-2650		
	46	Price	Item Number			
	47	Purchase Order Number				

Notes:

				INSTRUMENTION SPECIFICATION	TechnipFMC / IndianOil
				Open Path Gas Detector (HC)	
				Project : SRU 3 IOCL PARADIP	
				Job No. : B366	
				Unit No.:	Sheet 1 of 2
0	AK	05.1.2022	Issued with MR	Code: 114	Dwg. No.: B366-999-YD-DS-2605 Rev.: 0
No.	BY	Date	Revision		

Tag Number : 088-AT-0127

GENERAL NOTES :

i. All Sensor/ Transmitters / Receivers shall be suitable for specified Area classification (Sl. No. 6).
ii. Transmitter / Receiver enclosure material shall be SS 3316
iii. Three Wire system is considered. Triad cable will be provided by Purchaser for further interface with F&G PLC. 24 V DC power supply shall be separately provided to Sensor.
iv. In case Vendor's standard connection is other than 3/4", vendor shall provide suitable adaptor to meet the 3/4" NPTF connection specified for Purchaser's use.
v. Repeatability and Response time shall be as per manufacturer standard. Vendor shall indiacte the same in the offer.
vi. All gas detectors Transmitters / Receivers shall be provided with dust guard and splash guard.
vii. Any communication cable required for intial setup between Transmitter and Receiver, the same shall be supplied by bidder.
viii. The open path Gas Detector shall cover the total Path length of 50 meter. If single open path gas detector is not sufficient to cover the entire range, vendor shall supply addtional open path gas detector to cover the entire path length and the same shall be clearly indicated in the offer. Price for additional open path gas detector in case required shall be included in the base price of the main tag itself.
ix. Offered gas detector trasnmitters shall be SIL-2 certified.
x. Refer SIV Clause No 14: iHeated optics shall be used to avoid signal loss /false alarms due to condensation.

				INSTRUMENT SPECIFICATION Open Path Gas Detector (HC)	TechnipFMC / IndianOil	
0	AK	05.1.2022	Issued with MR		Sheet 2	of 2
No	By	Date	Revision	Code:	Dwg. No.: B366-999-YD-DS-2605	Rev 0

GENERAL	1	Tag Number		090-AT-0128		
	2	Service		HC Detection (Open path)		
	3	Location/ Equipment No.		SOUTH SIDE OF UNIT STARTING FROM UNIT PERIPHERY NEAR 088-SU-002 TO 088-V-010		
	4	Enclosure Type		Flame Proof (Ex'd) and Weather Proof to IP-66		
	5	Protective Cap for Dust/ Rain Cover		Required		
	6	Electrical Area Classification		IEC Zone-1, Gas Gr.IIA/B, Temp. Class T3		
	7					
	8	Mol Wt.	Major Constituents	16 - 86	C1-C6	
HC GAS DETECTOR	9	Detector Type		Infra Red (IR) (Open Path)		
	10	Detector Ouput		4-20 mA DC		
	11	Low Explosive Limite (LEL)		1.2 (%V/V IN AIR)		
	12	Material of Construction				
	a	Body		SS 316		
	b	Cap		Manufacturer standard		
	c	Filter		Manufacturer standard		
	13	Response Time		T90:- Less than 30 seconds with splash guard and dust guard.		
	14	Range		0 - 4 LEL Meter		
		Path Length		50 Meter		
	15	Pre Alarm		1 LEL Meter		
	16	High Alarm		3 LEL Meter		
TRANSMITTER & RECEIVER	17	Location		Integral to Detector		
	18	Enclosure Type		FlameProof (Ex'd) & WP to IP-66 (Note-ii)		
	19	Type		SMART, HART		
	20	No. of detectors per transmitter		1		
	21	Output				
	a	Analogue		4-20 mA DC, HART, 3 wire (Note-iii)		
	b	Serial				
	22	Display		LCD, Integral to Transmitter		
	23	Power Supply		24 V DC±10% (Note-iii)	3 wire (Note-iii)	
	24	Min Operating Voltage		*		
	25	Cable b/w Detecor & Transmitter		Not Required		
	a	Power		-		
	b	Signal		-		
	26	Cable b/w Transmitter & Remote reciever		-		
	27	Power		-		
	28	Signal		Manufacturer standard (Note-vii)		
	29	Cable Glands and Accessories		Required (Both at Transmitter and Recevier)		
	30	Cable Entry		3/4"NPT(F) (Note-iii,iv)		
	31	Mounting		4" pipe mounting (Transmitter and Recevier)		
	32	Mounting Accessories		Required (Transmitter and Recevier)		
	33					
ACCESSORIES	34	Portable Calibration Kit				
	35	Type				
	36	Service				
	37	Carrying Case		Required		
	38	Calibration Gas Cylinders		Required		
OPTIONS	39	Aspirator assembly				
	40	Notes				
CERTIFICATION	41	Statutory		Required		
	42	Others		PESO		
PURCHASE	43	Manufacturer		*		
	44	Model		*		
	45	Requisition Number		B366-999-YD-MR-2650		
	46	Price	Item Number			
	47	Purchase Order Number				

Notes:

				INSTRUMENTION SPECIFICATION	TechnipFMC / IndianOil
				Open Path Gas Detector (HC)	
				Project : SRU 3 IOCL PARADIP	
				Job No. : B366	
				Unit No.:	
0	AK	05.1.2022	Issued with MR	Sheet 1 of 2	
No.	BY	Date	Revision	Code: 114 Dwg. No.: B366-999-YD-DS-2606	Rev.: 0

Tag Number : 088-AT-0128

GENERAL NOTES :

i. All Sensor/ Transmitters / Receivers shall be suitable for specified Area classification (Sl. No. 6).
ii. Transmitter / Receiver enclosure material shall be SS 3316
iii. Three Wire system is considered. Triad cable will be provided by Purchaser for further interface with F&G PLC. 24 V DC power supply shall be separately provided to Transmitter.
iv. In case Vendor's standard connection is other than 3/4", vendor shall provide suitable adaptor to meet the 3/4" NPTF connection specified for Purchaser's use.
v. Repeatability and Response time shall be as per manufacturer standard. Vendor shall indiacte the same in the offer.
vi. All gas detectors Transmitters / Receivers shall be provided with dust guard and splash guard.
vii. Any communication cable required for intial setup between Transmitter and Receiver, the same shall be supplied by bidder.
viii. The open path Gas Detector shall cover the total Path length of 50 meter. If single open path gas detector is not sufficient to cover the entire range, vendor shall supply addtional open path gas detector to cover the entire path length and the same shall be clearly indicated in the offer. Price for additional open path gas detector in case required shall be included in the base price of the main tag itself.
ix. Offered gas detector trasnmitters shall be SIL-2 certified.
x. Heated optics shall be used to avoid signal loss /false alarms due to condensation.

				INSTRUMENT SPECIFICATION Open Path Gas Detector (HC)	TechnipFMC / IndianOil	
					Sheet 2	of 2
0	AK	05.1.2020	Issued with MR			
No	By	Date	Revision	Code:	Dwg. No.:B366-999-YD-DS-2606	Rev 0

GENERAL	1	Tag Number	SEE LIST		
	2	Service	Sulphur dioxide Gas Detection		
	3	Location/ Equipment No.	SEE LIST		
	4	Enclosure Type	FlameProof (Ex'd) and WeatherProof to IP-66		
	5	Protective Cap for Dust/ Rain Cover	Required		
	6	Electrical Area Classification	IEC zone-1, Gas Gr. IIA/B, T3		
	7				
	8	Alarm at			
SO2 GAS DETECTOR	9	Detector Type	Electrochemical Type		
	10	Detector Output	*		
	11	Alarm At	SEE LIST		
	12	Material of			
	a	Body	SS		
	b	Cap	Manufacturer's Standard		
	c	Filter	Manufacturer's Standard		
	13	Response Time	T90: Less than 60 seconds with Splash guard and Dust guard		
	14	Range	0-20 ppm		
	15	Mol Wt			
	16				
TRANSMITTER	17	Location	Integral to Detector		
	18	Enclosure Type	FlameProof (Ex'd) and WP to IP-66 (Note-ii)		
	19	Type	SMART, HART		
	20	No. of detectors per transmitter	1		
	21	Output			
		Analogue	4-20 mA DC, HART, 3 wire (Note-iii)		
		Serial	-		
	22	Display	LCD, Integral to Transmitter		
	23	Power Supply	24VDC±10%	3 wire (Note-iii)	
	24	Min Operating Voltage	*		
	25	Cable b/w Detecor & Transmitter	Not Required		
		Power	-		
		Signal	-		
	26	Cable b/w Transmitter & Remote	Not Required		
	27	Power			
	28	Signal			
	29	Cable Glands and Accessories	Required		
	30	Cable Entry	3/4"NPT(F) (Note-iii,iv)		
	31	Mounting	2" pipe mounting		
	32	Mounting Accessories			
	33				
ACCESSORIES	34	Portable Calibration Kit	Required (Note-vi)		
	35	Type	As per SIV		
	36	Service	SO2		
	37	Carrying Case	Required		
	38	Calibration Gas Cylinders	Required		
OPTIONS	39	Notes	SEE LIST		
	40				
CERTIFICATION	41	Statutory	Required		
	42	Others			
PURCHASE	43	Manufacturer	*		
	44	Model	*		
	45	Requisition Number	B366-999-YD-MR-2650		
	46	Price	Item Number		
	47	Purchase Order Number			

Notes:

				INSTRUMENTION SPECIFICATION		
				Toxic Detector (SO2)		
				Project :SRU 3, IOCL-PARADIP		
				Job No. : B366		
				Unit No.:		
0	AK	05.1.22	Issued with MR		Sheet 1	of 3
No	A	Date	Revision	Code: 92	Dwg. No.: B366-999-YD-DS-2607	Rev. 0

Tag Number : SEE LIST

GENERAL NOTES:
i. All Sensor/transmitter, Portable calibrators shall be suitable for specified area classification (Sl. No. 6)
ii. Transmitter enclosure material shall be SS 316.
iii. Three Wire system is considered. Triad cable will be provided by Purchaser.
iv. In case Vendor's standard connection is other than 3/4", vendor shall provide suitable adaptor to meet the 3/4" NPTF connection specified for Purchasers use.
v. Offered gas detector transmitters shall be SIL-2 certified.
vi. Portable calibration kit shall include portable calibrator, tubing, pressure regulator, gas cylinder etc. as required by vendor for calibration. The number of gas cylinders should be sufficient to calibrate gas detectors of units.
vii. All gas detectors shall be provided with dust guard and splash guard.
viii. ' * ' indicates to be furnished by vendor.
ix. Repeatability: +/- 2% Full Scale
x. S. No 9: The semiconductor type sensor is also acceptable . The same shall be thin film MOS type with life expectancy of minimum of 5 years and Zero and span adjustment shall be automatic.

Sr. No.	Tag Number	Location	Mol Wt.	Major Constituents	Alarm	Notes
1	088-AT-0120	NEAR 088-V-007	64	SO2	High Alarm at 1PPMV & High High Alarm 2 PPMV	
2	088-AT-0121	NEAR 088-V-008	64	SO2	High Alarm at 1PPMV & High High Alarm 2 PPMV	
3	088-AT-0122	NEAR SULPHUR PIT 088-SU-001	64	SO2	High Alarm at 1PPMV & High High Alarm 2 PPMV	
4	088-AT-0123	NEAR SULPHUR PIT 088-SU-001	64	SO2	High Alarm at 1PPMV & High High Alarm 2 PPMV	
5	088-AT-0124	NEAR REACTION FURNACE 088-F-002	64	SO2	High Alarm at 1PPMV & High High Alarm 2 PPMV	

GENERAL	1	Tag Number		SEE LIST
	2	Service		Flame Detector
	3	Location/ Equipment No.		SEE LIST
	4	Enclosure Type		Flame Proof (Ex'd) and Weather Proof to IP-66
	5	Protective Cap for Dust/ Rain Cover		Required
	6	Electrical Area Classification		IEC Zone-1, Gas Gr.IIA/B, T3
	7	LEL (% v/v in Air)		SEE LIST
	8	Mol Wt.	Major Constituents	SEE LIST / SEE LIST
FLAME DETECTOR	9	Detetor Type		Multi Spectrum IR Detector
	10	IR Detector Type		*
	11	IR Source (Lamp) Life		Minimum 5 years (*)
	12	Material of Construction		
	a	Body		SS
	b	Cap		Manufacturer standard
	c	Filter		Manufacturer standard
	13	Response Time		<=5 sec
	14	Detector Range		1 sq ft gasoline fire for atleast 45 metres
	15	Field of view		90°
	16	Alarm At		SEE LIST
TRANSMITTER	17	Location		Integral to Detector
	18	Enclosure Type		FlameProof (Ex'd) & WP to IP-66 (Note-ii)
	19	Type		SMART, HART
	20	No. of detectors per transmitter		1
	21	Output		
	a	Analogue		4-20 mA DC, HART, 3 Wire (Note-iii)
	b	Digital		Required (Note viii)
	22	Display		LCD, Integral to Transmitter
	23	Power Supply		24VDC±10% / 3 Wire (Note-iii)
	24	Min Operating Voltage		*
	25	Cable b/w Detecor & Transmitter		Not Required
	a	Power		-
	b	Signal		-
	26	Cable b/w Transmitter & Remote reciever		Not Required
	27	Power		
	28	Signal		
	29	Cable Glands and Accessories		Required
	30	Cable Entry		3/4" NPT(F) (Note-iii,iv)
	31	Mounting		2" pipe mounting
	32	Mounting Accessories		Required
	33			
ACCESSORIES	34	Portable Calibration Kit		
	35	Type		
	36	Service		
	37	Carrying Case		
	38	Calibration Gas Cylinders		
OPTIONS	39	Aspirator assembly		
	40	Notes		
CERTIFICATION	41	Statutory		PESO
	42	Others		
PURCHASE	43	Manufacturer		*
	44	Model		*
	45	Requisition Number		B366-999-YD-MR-2650
	46	Price	Item Number	
	47	Purchase Order Number		

Notes:

				INSTRUMENTION SPECIFICATION	TechnipFMC / IndianOil
				FLAME Detector	
				Project : SRU 3, IOCL-PARADIP	
				Job No. : B366	
0	AK	05.1.22	Issued with MR	Unit No.:	Sheet 1 of 3
No.	BY	Date	Revision	Code:	Dwg. No.: B366-999-YD-DS-2608 Rev.: 0

Tag Number : SEE LIST

GENERAL NOTES :
i. All Sensors shall be suitable for specified Area classification(Sl. No. 6)
ii. Detector enclosure material shall be SS 316.
iii. Three Wire system is considered. Triad cable will be provided by Purchaser.
iv. In case Vendor's standard connection is other than 3/4", vendor shall provide suitable adaptor to meet the 3/4" NPTF connection specified for Purchaser's use.
v. ' * ' indicates to be furnished by vendor.
vi. All detectors shall be provided with dust guard and splash guard.
vii. If any additional Barrier/converter module are required for offered Flame detector, the same shall be included for each tag and the price for the same shall be included in base price of the tag. These module shall be supplied loose for purchaser's use in FDAS system.
viii. Flame Detector shall provide the 4-20 mA signals along with 2 potential free contact output for transmitter failure and Flame detected signal.
ix. The device shall not be sensitive to arc welding, X-rays or hot surfaces.
x. The detector shall have modular design that allows IR sensor module to be easily replaced in the field without the use of special tools.
xi Detector shall have a swivel mounting bracket to provide a means for easily sighting the detector.
xii. Detector shall be provided with Auto Check facility.
xiii. Offered Flame detector shall be SIL-2 certified.

Sr. No.	Tag Number	Location
1	088-AT-0142	Near Acid Gas KOD Pumps
2	088-AT-0143	Near Acid Gas KOD Pumps
3	088-AT-0144	Near Reaction Furnace West Side
4	088-AT-0145	Near 088-F-001
5	088-AT-0146	Near Sulphur Pit
6	088-AT-0147	Near Sulphur Pit
7	090-AT-0148	Near 090-V-009
8	090-AT-0149	Near 090-V-009

GENERAL	1	Tag Number	SEE LIST
	2	Service	SEE LIST
	3	Location/ Equipment No.	SEE LIST
	4	Enclosure Type	WP to IP-66, Intrinsically Safe Design
	5	Protective Cap for Dust/ Rain Cover	
	6	Electrical Area Classification	IEC Zone-1,Gas Gr.IIC, T3
	7	Type	SEE LIST
	8		
BEACON	9	Type	
	10	Beacon Color	
	11	Luminous Intensity	
	12	Flashing Frequency	
	13	Lamp Type	
	14	Dome Material for flashing tube	
	15	Lens gaurd / Cage	
	16	Power Supply	
	17	Cable Entry	
	18	Mounting	
	19	Body Material	
	20	Wiring System	
	21		
HOOTER	22	Type	
	23	Mode of Operation	
	24	Frequency	
	25	Sound Level	
	26	Body Material	
	27	Power Supply	
	28	Wiring System	
	29	Cable Entry	
	30	Mounting	
FIELD MOUNTED PUSH BUTTON	31	Number of Contacts	
	32	Rating of Contacts	
	33	Type	
	34		
	35	Cable Entry	
	36	Cable Glands and Accessories	
	37	Mounting	
	38	Mounting Accessories	
	39		
	40		
PORTABLE GAS DETECTOR	41	Type	Multigas (CO, O2, CH4, H2S) : Refer Note-4
	42	Battery Type	Rechargeable Type
	43	Carrying Case	Required
	44	Battery Charger	Required
	45	Battery Charger Voltage	240V AC
OPTIONS	46	Notes	SEE LIST
	47		
CERTIFICATION	48	Statutory	Required
	49	Others	PESO
PURCHASE	50	Manufacturer	*
	51	Model	*
	52	Requisition Number	B366-999-YD-MR-2650
	53	Price / Item Number	
	54	Purchase Order Number	

Notes:

				INSTRUMENT SPECIFICATION		
				Multi Gas Portable Gas Detector Project : SRU 3 IOCL PARADIP Job No. : B366 Unit No.:		
0	AK	05.1.22	Issued with MR		Sheet 1 of 3	
No.	BY	Date	Revision	Code:	Dwg. No.: B366-999-YD-DS-2609	Rev.:0

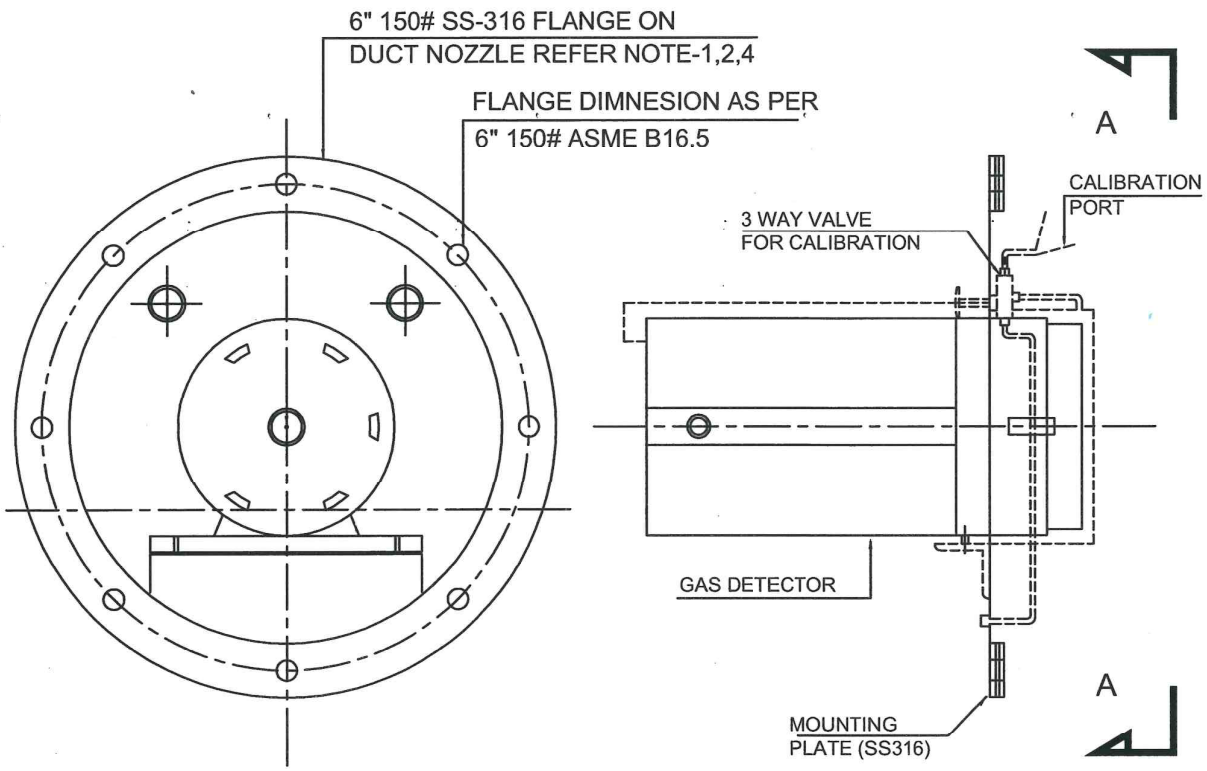
Tag Number : SEE LIST

GENERAL NOTES:

1. Portable calibration kit for portable Gas Detectors shall provided which includes portable calibrator, tubing, pressure regulator, gas cylinder etc. as required for calibration.
2. Detectors shall be Microprocessor Based with Plug In Replaceable Sensors.
3. Type and Gas Measurements reqd:
(i) CH4 (Catalytic-With Heat Reaction and Thermal Conductivity Sensor): 0-100% LEL
(ii) CO (Electrochemical): 0-500 ppm
(iii) H2S (Electrochemical): 0-20 ppm
(iv) O2 (Electrochemical): 0-25%
4. Standard Graphic Large LCD Display with Peak Value Display on Demand (in ppm) is required. For further detailed display requirements, refer SIV.
5. Accessories required with each detector:
(i) Rechargeable Batteries suitable for minimum 12 Hr. Continuous Operation (with Charging time < 4 Hrs)
(ii) Ni-Cd, Ni-Mh or Li-Ion Rechargeable Batteries
(iii) Battery Charger suitable for charging above supplied Batteries
(iv) Charging PS Adaptor with Indian Style 3 Pin, 240 Volt AC Input
(v) Stainless Steel Allegator Clip
(vi) Manual Aspirator Assembly with 15 Feet Tube
(vii) Shoulder Strap, Carry Case, Chest harness
(viii) Impact Resistant ABS Casing
(ix) Calibration/ Sample Shield
6. Additional Requirements:
(i) With Auto Set Points Display on activation and after calibration
(ii) TWA, STEL alarms
(iii) Peak Hold Display
(iv) With Lock Alarm Feature That Latches Alarm When Level Exceeds 100%LEL

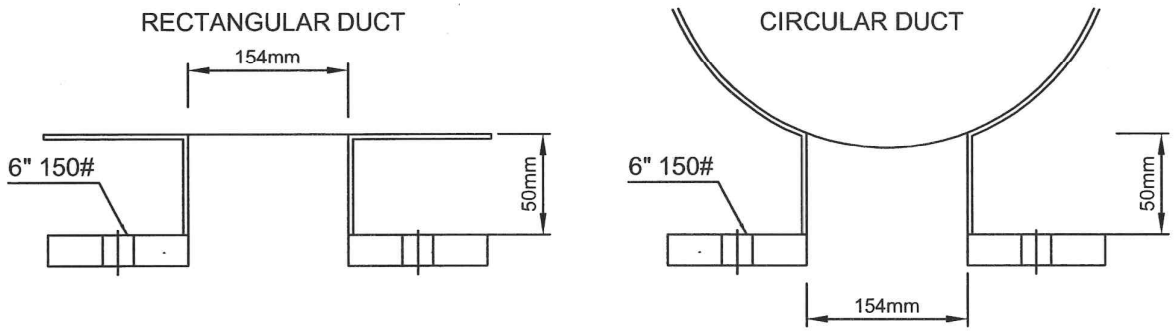
Tag Number	Service	Location	Type	Notes
088-PHCD-0001	Multi Gas Detection	Portable Gas Detector	Electrochemical	
088-PHCD-0002	Multi Gas Detection	Portable Gas Detector	Electrochemical	

INSTRUMENTATION	REV.	DATE	REVISION	BY	CHECKED	APPD.	APPD.
	0	05-11-2021	ISSUED AS STANDARD	Manoj	AK	JJ	AR



SECTION A-A

DETAIL-A



NOZZLE DETAIL FOR RECTANGULAR DUCT

NOZZLE DETAIL FOR CIRCULAR DUCT

NOTES:-

1 BACKUP FLANGE (SS316) ALONG WITH GASKET & NUTS/BOLTS SHALL BE IN VENDORS SCOPE.

2 GAS DETECTOR VENDOR TO SELECT THE EXACT DIMENSION OF FLANGE AND SENSOR ALONG WITH TUBING TO MATCH WITH PURCHASERS NOZZLE AS SHOWN IN DETAIL-A.

3. GAS DETECTOR SHALL BE WITH INSITU CALIBRATION FACILITY WITH ALL INTERCONNECTING TUBING.

4 HC IR SENSOR WILL BE MOUNTED HORIZONTALLY IN DUCT WHERE AS H2S / TOXIC DETECTOR ELECTROCHEMICAL SENSOR WILL BE MOUNTED VERTICALLY IN DUCT.

ENGINEERS INDIA LIMITED NEW DELHI	GAS DETECTOR ASSEMBLY FOR DUCT MOUNTING	STANDARD	REV.
		B366-99916-51-SK-2650	0
		SHT. 01 OF 01	

TECHNICAL COMPLIANCE STATEMENT

(TO BE SIGNED BY VENDOR'S PRINCIPAL CORPORATE LEVEL SIGNATORY ON COMPANY LETTERHEAD)

I, ON BEHALF OF M/s_____ CONFIRM THAT THE PROPOSAL OF ----------

----------QUOTED BY M/s_____ ***FOR SRU STANDBY TRAIN, IOCL PROJECT AT PARADIP OF M/S INDIAN OIL COPORATION LIMITED*** AGAINST MATERIAL REQUISITION /TENDER/PACKAGE No. ----------

---------- IS IN TOTAL COMPLIANCE TO THE FOLLOWING

A. SCOPE OF SUPPLY AND WORK

B. TECHNICAL AMENDMENT IF APPLICABLE

C. ANY OTHER DOCUMENT ATTACHED AS PART OF MR

AS WELL AS ALL THE TECHNICAL SPECIFICATION AND NO DEVIATION, VARIATION OR RESERVATION WHATSOEVER HAS BEEN MENTIONED IN THE TECHNICAL OFFER. IT IS FURTHER AGREED THAT THE TECHNICAL DETAILS FURNISHED IN OUR OFFER WILL BE REVIEWED BY BHEL/EIL/IOCL DURING DETAILED ENGINEERING STAGE AFTER ORDER AND ANY CHANGE REQUIRED TO MEET THE REQUIREMENTS OF ENQUIRY SCOPE AND SPECIFICATION INCLUDING AMENDMENT(S) (IF ANY) WILL BE INCORPORATED BY US WITHOUT ANY PRICE AND TIME IMPLICATION.

(SIGNATURE WITH SEAL)

JOB SPECIFICATION FOR GAS DETECTION SYSTEM

(AMENDMENT TO PDRP GAS DETECTION SYSTEM NO. PDRP4200-8550-FS-1003)

			Written By	Checked By	Approved By	Authorized By
A	02.12.2019	ISSUED FOR DESIGN	CRK	KRS	SS	JMC
REV.	**DATE**	**DESCRIPTION**	**PREPARED**	**CHECKED**	**APPROVED**	**AUTHORIZED**

TABLE OF CONTENTS

1. INTRODUCTION

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

2. GENERAL ABBREVIATIONS

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them.
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related
SRU	Sulphur Recovery Unit

3. CONFLICTS AND DEVIATIONS

If conflicting statements exist within this document or between this document and Design Basis, other applicable specifications, Standard Drawings, Industry standards, codes, etc., it shall be brought to Owner's / PMC notice for clarification and proper approval shall be obtained before implementation. Decision of Owner / PMC shall be final.

In case of contradiction between licensor specification, design basis and JSS, it has to be brought to the notice of Owner/PMC and Decision of Owner/PMC shall be binding on Contractor/Vendor.

In general, order of priority of the documents shall be as follows,

- Local regulatory and statutory requirement.
- Licensor Requirements (as applicable)
- Project specification and datasheets, wherever applicable.
- This specification and relevant equipment/system specification.
- Codes and standard.

4. SCOPE

Gas detection system shall be designed in accordance with gas detection system doc. no. PDRP4200-8550-FS-1003, Rev.F3 which is attached as Annexure-1 with this document and addendum requirement covered in this document.

5. ADDENDUM TO GAS DETECTION SYSTEM

This addendum shall be read in conjunction with Gas detection system document PDRP4200-8550-FS-1003, Rev.F3

The following amendments and additions shall apply to Gas detection system document PDRP4200-8550-FS-1003, Rev.F3. The clauses of PDRP4200-8550-FS-1003, Rev.F3 that are not amended in this Addendum remain applicable without change.

5.1. Amendment to section 2.2 Page 8 of 29

- "MAC" shall be read as "Contractor"
- Paradip Refinery Project shall be referred as Standby SRU and Additional tanks Project
- EPCM shall be read as EPCM/LSTK

5.2. Addition of clause to 1.1.3 page 4 of 29

- **1.1.3** The GDS shall be a sub-system of the main ESD system as per clause No. 1.1.3 of PDRP4200-8550-FS-1003 GDS Functional Spec, but shall have segregation of Marshalling and I/O, but can share the same processor

5.3. Amendment to section 3.1 Page 9 of 29

The section is modified and the same are to be read as given below on all applicable section

- 080557C-000-JSS-1511-002 - Emergency Shutdown System Functional Specification

5.4. Amendment to section 6.1.5 Page 13 of 29

The section is modified and the same are to be read as given below

- Relative Humidity (non-condensing) 99.7% i.e. The control room shall be air-conditioned. Under normal operating conditions, the temperature may range from 20-30 Deg. C, with 35 to 65% RH. In case of AC failure, the temperature may range from 10-50 Deg. C, with relative humidity in the range of 25% to 100%.

5.5. Amendment to clause 7.1.4 Page 14 of 29

This section is modified and the same is to be read as given below

- Toxic and combustible gas detectors inclusive all ancillary equipment in the detection loop shall be suitable for SIL 3 applications If SIL 3 certified detectors are not available with the IOCL approved vendors it shall be minimum SIL-2 certified.

5.6. Amendment to section 13 Page 18 of 29

This section is modified and the same is to be read as given below

- Training for owner's personnel shall be provided for supplied Gas Detection System. The training shall be at OEM's premises, where proper facility and infrastructure for training shall be available.
- 'On the job training' to owner's personnel at site shall also be included in training schedule. Training course shall include detail configuration, modification, operation, troubleshooting, calibration, maintenance (preventive / breakdown) etc. as minimum. The cost of travel, lodging & boarding for personnel attending training shall be by owner.

	AT OEM's WORK	AT SITE	REMARK
GDS	5 Days 5 Personnel	5 Days 5 Personnel	For each make of Gas Detector

5.7. Amendment to Section 15.2.1 in page 20 of 29

15.2 Hazardous area Classification

This section is modified and the same is to be read as given below

- 15.2.1. Notwithstanding the hazard classification assigned to the area in which an instrument is located, which is generally Zone 2 for hazardous areas subject to flammable gas / vapours, all instruments shall be:

- Instrument Electrical certification to be as per design Basis - Instrumentation 080557C-088-JSD-1540-002 section 7.2
- The certification listed above, shall be provided by the Chief Controller of Explosives (CCOE), Nagpur, India, and an Internationally recognised authorities

5.8. Amendment to below listed Section

Following sections are modified and the same are to be read as given below

- **15.3.9** Toxic Gas Detectors shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.4.9** Chlorine Gas Detectors shall be provided with ½" NPT cable entries suitable for accepting cable glands
- **15.5.9** Combustible Gas detectors shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.6.12** Open path Combustible Gas detectors shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.7.9** Oxygen Depletion detectors shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.8.9** Hydrogen Gas detectors shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.13.9** Audible devices shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.14.8** Audible devices shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.15.9** Visual alarm devices shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.16.6** Visual alarm devices shall be provided with ½" NPT cable entries suitable for accepting cable glands

5.9. Amendment to clause 15.2.3 page 20 of 29

This section is modified and the same is to be read as given below

- Gas Detection field devices shall be Underwriters Laboratories, Inc. Listed under the appropriate UL/FM/CENELEC testing standard

5.10. Amendment to section listed

Following section is modified and the same is to be read as given below

- **15.5.7** Combustible Gas detectors shall include an integral LCD/LED display to provide live status of gas concentration and device status to assist with fault identification and calibration
- **15.6.10** Open path Combustible Gas detectors shall include an integral LCD/LED display to provide live status of gas concentration and device status to assist with fault identification and calibration

5.11. Amendment to clause 15.13.2 page 20 of 29

This section is modified and the same is to be read as given below

- **15.13.2** Audible alarm devices shall be certified for use in a hazardous area. Refer to paragraph 15.2 for specific requirements.

5.12. Amendment to clause 15.14.3 page 27 of 29

This section is modified and the same is to be read as given below

- Sound output power level shall be 65dB(A) at 1 metre from the device at least with facility to adjust output such that volume exceeds background ambient noise by at least 10 dB(A)

6. ANNEXURE

1. GAS DETECTION SYSTEM- PDRP4200-8550-FS-1003, Rev F3

IndianOil	PARADIP REFINERY PROJECT PROJECT SPECIFICATION GAS DETECTION SYSTEM	PDRP4200-8550-FS-1003 PAGE 1 OF 29 REV F1

Contract:	1-14-4200/4399
Client's Name:	Indian Oil Corporation Limited (IOCL)
Project Title:	Paradip Refinery Project (PDRP) – EPCM-1
Project Location:	Paradip, Orissa State, India
Document Category	Class 1

REVISION	F1	Signature
DATE	AUG 09	
ORIG. BY	G. W .Smith	
CHK. BY	G. Cassap	
APP. BY	D. Ball	

REVISION HISTORY			
Revision	Date	Reason for Issue	Originator
A1	08 May 09	Issued for Use	G. Cassap
F1	27 Aug 09	Issued Final	G. W .Smith

Rev. No. F2	**Date :** 24/12/14	**Description:** ISSUED FOR TENDER AFTER INCORPORATING IOCL COMMENTS
Prepared by : SUJ	**Checked by :** VSP	**Approved by :** UMS

Rev. F3	03-04.2017	Updated by TEIPL	KPJ

DSN 1916

CONTENTS

1.0 INTRODUCTION

1.1.1 This specification covers the technical and functional requirements of the Gas Detection System (GDS) for the Paradip Refinery Project, which consists of the installation of an integrated grassroots 15 MMTPA (300,000 BPSD) refinery complex at a site located 5 Km south of the Port of Paradip in the state of Orissa, India.

1.1.2 The main function of the Gas Detection System (GDS) in the Paradip Refinery is to detect the concentration of toxic and/or combustible gases and initiate an alarm or shutdown functions at a predetermined level at a stage sufficiently early to protect lives and assets.

1.1.3 As the GDS is a sub-system of the main ESD system, many references to the Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 shall be made.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions - Technical

Alarm: An audible or visible means of indicating to the operator equipment or process malfunction or abnormal condition.

Alarm System: The collection of hardware and software that an alarm state, transmits the message to be displayed to the operator, records the message, and generate alarm metrics report.

Auto-ignition temperature: Lowest temperature at which there is enough heat energy to ignite vapours spontaneously

Flammable Gas: A flammable gas is one than can burn when brought in contact with heat or flame

Flammable Liquid: A flammable liquid is defined as one having a flash point below 100°F (37.8°C) with a vapour pressure not exceeding 40 psi (276kPa).

They are volatile in nature, constantly giving off heavier than air vapours that can not be seen with the naked eye.

Combustible Liquids:	Combustible liquids have a flash point at or above 100° F (37.8°C).When heated above their flash points; these liquids take on many of the characteristics of flammable liquids
Explosive Range:	Range of gas or vapour-mixture with air between the explosive limits (LEL and UEL)
Lower Explosive Limit (LEL):	This is the minimum concentration of flammable gas or vapour mixture that will propagate flame when exposed to a source of ignition. Commonly abbreviated LEL or LFL (Low Flammable Limit), a mixture below this concentration level is considered “to lean” to burn. An increase in atmospheric temperature or pressure wills a decrease the LEL of gas or vapour.
Upper Explosive Limit (UEL):	The maximum concentration of gas in air that will produce a flash of fire when an ignition source is present Any higher percentage of combustible gas or lower oxygen in the mixture of the two, and the mixture will be too “rich” to sustain combustion.
Flash Point:	This is the lowest temperature in which a liquid give off sufficient vapour at its surface to form a combustible or explosive mixture. Many hazardous liquids have their flash points at or below room temperature and are covered by a layer of flammable vapours that will ignite rapidly if exposed to an ignition source.
PPM:	Parts per Million, a unit of concentration.10,000 parts per million equals 1% (one percent)
Vapour Density:	This is the relative density of the vapour as compared with air. It is calculated as the ratio of the molecular weight of the vapour to the molecular weight of air. A vapour density less than one indicates a substance lighter than air; conversely densities greater than one indicates a substance heavier than air. All flammable liquid vapours are heavier than air and can travel along a gradient for considerable distances to an ignition source.

Threshold Limit Value (TLV): This refers to airborne concentrations of substances, and represents conditions under which workers may be repeatedly exposed day after day without adverse health effects.

There are three categories of TLV's:

TLV-Time Weighted Average (TLV-TWA): This refers to a time weighted AVERAGE concentration for a normal 8 Hour day, in a 40 hour work week in which MOST workers can be exposed REPEATEDLY without adverse effect.

TLV-Short Term Exposure Limit (STEL): This is the concentration in which most workers can be exposed **CONTINUOSLY** for a **SHORT** period of time without suffering from irritation, chronic or irreversible tissue damage, or narcosis to the degree which would impair self rescue, work efficiency or cause accidents, **PROVIDED** that the TWA has not been exceeded any time during a normal work day even if the worker is within the 8 hour **TWA.** Exposures **ABOVE** the **TWA** and UP TO the **STEL** should not be longer than 15 minutes and should not exceed 4 times a day.

TLV-Ceiling (C): This is a concentration which should not be exceeded during any part of the working exposure.

Gas Detection Instruments: An assembly of electrical, mechanical, and (possibly) chemical components that senses and responds with visual or acoustic alarms to the presence of gas in air mixtures.

Gas Sensing Element: The particular subassembly or element in the gas-detection instrument that, in the presence of gas, produces, a change in its electrical, chemical or physical characteristic.

Hazardous (Classified) Location: A location, in which fire or explosion hazards may exist due to an explosive atmosphere of flammable gases or vapours, flammable liquids, combustible dust, or easy ignitable fibers or flyings. Three different zones are to be differentiated:

Zone 0:	Area in which an explosive gas-air mixture is continuously present or present for long periods.
Zone1:	Combustible or conductive dusts are present. Area in which an explosive gas-air mixture is likely to occur in normal operation.
Zone 2:	Area in which an explosive gas-air mixture is not likely to occur, and if occurs it will be only for a short period.

Note: A complete area classification should include the protection type of the device to be installed, temperature code (T1 to T6), and the exact flammable nature of the material (gas, dust, liquid, flyings fibres) indicated in Groups. Groups for gases and vapours typical in the Oil & Gas Industry are classified as follow:

Group IIA:	Ethane,Propane,Butane,Hexane,Methane,Heptane,Octane,Nonane,Decane,Acetic acid, Acetone, methanol, toluene, ethyl acetate.
Group IIB:	Ethylene, coke oven gas, dimethyl ether, diethylene, ethylene oxide.
Group IIC:	Hydrogen, Carbon disulphide, Acetylene, Ethyl nitrate
Non Hazardous (Unclassified) Location:	A location in which fire or explosion hazards are not expected to exist specifically due to the presence of flammable gases or vapours, flammable liquids, combustible dusts, or ignitable fibers or flyings. Such location may also be referred to as a safe area.

2.2 Definitions - Contractual

Contract:	Means the contract between the **MAC** and **IOCL** for the supply of the **Equipment/ Services**, which comprises the general terms and conditions of Contract/Purchase (together with any special terms and conditions), the attachments, requisitions, drawings, specifications, and other documents included and or referred to in the **Contract,** together with the **MAC's** unconditional written acceptance of the **Contract** and any subsequent written amendments to the original **Contract**
MAC:	Main Automation Contractor. Means the Firm, Company or other corporate entity (including its successors and/or permitted assigns) contracted to supply the **Equipment/Services** to **IOCL**
EPCm	Engineering, Procurement & Construction Management Contractor.
Equipment/Services:	Means the Equipment and or Services including but not limited to materials, equipment, fabricated products, software, drawings, certification and other documentation to be supplied under the **Contract.**
Plant:	Means the **IOCL's** Paradip Refinery Project, Paradip Orissa , India in connection with the construction and/or operation of which the **Equipment/Services** are to be supplied
Vendor:	Shall mean any person, firm or company having a purchase order for the Supply of the Gas Detection System or part of it to IOCL.
Shall:	Refers to a mandatory requirement
Should:	Refers to a recommendation
May:	Refers to an acceptable course of action

2.3 Abbreviations

C & E	Cause and Effect
CPU	Central Processing Unit
DCS	Distributed Control System
EFD	Engineering Flow Diagram
ESD	Emergency Shutdown
FAT	Factory Acceptance Test
FDAS	Fire Detection Alarm System
FSCR	Fire Station Control Room
IOCL	Indian Oil Corporation Limited
GDS	Gas Detection System
FM	Factory Mutual
HMI	Human Machine Interface
HVAC	Heating Ventilation and Air Conditioning
I/E	Instrument Electrical Interface
IFAT	Integrated Factory Acceptance Test
I/O	Input/Output
IR	Infrared
IS	Intrinsically Safe
MCB	Main Control Building
MCR	Main Control Room
MTBF	Mean Time Between Failure
MTTR	Mean Time to Repair
PLC	Programmable Logic Controller
SRR	Satellite Rack Room
SIL	Safety Integrity level
TÜV	Technischer Überwachungs Verein
UL	Underwriters Laboratories Inc.
UPS	Uninterruptible Power Supply
VDU	Visual Display Unit

3.0 CODES AND STANDARDS

This specification shall be read in conjunction with following standards:

3.1 Project Standards

PDRP4200-8550-FS-1002	Emergency Shutdown System Functional Specification
PDRP4200-8550-FS-1005	Fire Detection Specification
3210-8140-PD-240-0001	Fire Protection System

3210-8550-SP-0011	Inspection and Testing of Electronic Control Systems

3.2 International Standards and Codes

API RP505	Recommended Practice for Classification of Locations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1 and Zone 2.
BS.5345	Code of practice in Selection and Maintenance of Electrical Apparatus for use in Potentially Explosive Atmosphere (other Than Mining Applications for explosive Processing and Manufacture) Part 1-9
IEC 61000	Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Parts 1,2, 3,4,5,6
IEC 61508	Functional safety of electrical/electronic/programmable electronic safety – related systems.
IEC 61511	Functional Safety- Safety instrumented systems for the process industry sector
MIL-HDBK217	Reliability Prediction of Electronic Equipment
OISD-STD-116	Fire Protection Facilities for Petroleum Refineries and Oil/Gas Processing Plants
OISD-STD-152	Safety Instrumentation for Process System in Hydrocarbon Industry
OISD-STD-173	Fire Protection System for Electrical Installation
ISA RP92.0.02	Part II: Installation, Operation and Maintenance of Toxic Gas Instruments, Hydrogen Sulphide
ISA RP12.13	Part II: Installation, Operation and Maintenance of Combustible Gas Detection Instruments

4.0 SYSTEM DESCRIPTION AND FUNCTION

4.1.1 The Gas Detection System shall form a separate node on the SRR ESD System for each plant. As such, many references to the Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 shall be made.

4.1.2 However, it shall reside in a separate cabinet to the main ESD dedicated to process protection.

4.1.3 The GDS shall be an open architecture, modular system, with fault tolerant network capabilities.

4.1.4 As part of the plant ESD system the GDS shall be capable of logic solving and issuing executive actions to effect shutdown of process equipment and activate visual and audible alarming.

4.1.5 The system shall be capable of reflecting logic arrived at by Cause and Effect charts for each Zone in a simple graphical manner. Pages of logic shall be directly associable with corresponding Zone limits.

4.1.6 The GDS shall be based on high availability, fault tolerant redundant ESD technology, SIL3 rated ESD with an availability of 99.99% or greater.

4.1.7 The GDS shall be capable of interfacing with its associated SRR DCS node via fault tolerant industrial standard communication methods such as MODBUS RTU, Ethernet, and/or Control Net.

4.1.8 Operator displays of Gas detectors for GDS nodes shall be through the plant wide DCS network and Main Control building DCS HMI's.

F3

4.1.9 The DCS HMI shall display GDS Alarms at both FSCRs.

SRR ~~802~~

4.1.10 ~~Each SRR~~ shall constitute a GDS node with one or more logic solvers. The number of cabinets required shall be determined by I/O count. GDS nodes shall be housed in separate cabinets the GDS nodes are based on the geographic distribution/collection of signals within the Fire zones assigned to the GDS node, not per single process unit e.g. AVU and SR/LPG units are combined as one GDS node. Interconnection to the ~~refinery~~ wide safety system and to the ~~refinery~~ DCS shall be via redundant communication networks.

XXX

Plant

Plant

4.1.11 The GDS shall be designed as a ESD based Fault Tolerant System; certified SIL 3. At least "voting" of two channels is required for all trip initiating inputs and trip devices.

4.1.12 The GDS shall allow direct connection of 4-20 mA input signals from gas detectors either combustible or toxic. Action on failure of an input circuit or detector will be determinable (i.e. Fail Safe).

4.1.13 Gas detection devices should appear to the DCS as any other instrument with display of analogue value and alarm settings..

4.1.14 Detectors covering an area or hazard should be arranged in a 2oo3 (two out of three) or greater voting logic configuration. This is to increase reliability of gas detection and avoidance of false executive actions due to transmitter failure.

4.1.15 GDS nodes shall carry at least a 25% growth capability.

4.1.16 In addition to DCS graphics, all resets and any other interaction with GDS system shall be via ESD HMI.

5.0 SCOPE OF SUPPLY

5.1.1 The Scope of this Specification covers but is not limited to the following:

5.1.2 The design, manufacture, supply, assembly and testing of logic components, marshalling and system cabinets, junction, outlet and mounting boxes, power supplies, batteries and distribution, terminations, labels and any other associated hardware necessary to form the complete system described in this specification including gas detectors, field alarms like beacons and horns, auxiliary devices, etc. and all other accessories and miscellaneous items required , even though each item is not specifically mentioned or described.

5.1.3 The development and implementation of special dedicated displays for the GDS showing overall plot plan, process areas, units, equipments, buildings, etc.

5.1.4 The supply of all system maintenance and operation manuals, documentation, software packages, software licences, programming devices for on- and off line configuration, software instructions and references manuals, and application programming required to configure the protective system functions described in this specification.

5.1.5 Developing a detailed Functional Design Specification for the GDS system

5.1.6 The GDS should be supplied, engineered, integrated and tested from a vendor facility where such a system has been supplied, engineered, integrated and tested previously. Engineering, manufacturing and testing shall meet the criteria as described in Section 6 of this specification.

5.1.7 The engineering for the GDS system shall be carried out by the manufacturer on whose name the GDS TÜV SIL 3 AK6 certification has been issued.

6.0 GENERAL REQUIREMENTS

6.1 System Environment

6.1.1 The GDS shall form an integrated part of the ESD consisting of independent stand alone panels installed in air conditioned, non-hazardous environment, within the main control building, SRR's, Analyzer Shelters, etc.

6.1.2 The system shall be designed to operate under following ambient conditions:

6.1.3 Outside ambient temperature (max) 42.4 °C

6.1.4 Design Temperature (for air cooled areas) 25 °C

6.1.5 Relative Humidity (non-condensing) 99.7%

6.1.6 Field devices (gas detectors, horns, beacons etc.,) shall be suitable for operation outdoors in a salt laden corrosive environment as applicable. All field mounted devices shall be certified, suitable to be installed according to the electrical hazardous area classification as shown on the associated Instrument data sheet.

6.2 System Availability

Please refer to “Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 “

6.3 System Redundancy

Please refer to “Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 “

6.4 Electrical Requirements

Please refer to “Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 “

6.5 System Spare Capacity, Loading and Expansion Requirements

Please refer to “Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 “

6.6 Standard Hardware and Software

Please refer to “Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 “

6.7 Time Synchronization

Please refer to “Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 “

7.0 HARDWARE REQUIREMENTS

7.1.1 General requirements as per "Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 "

7.1.2 The MAC shall demonstrate the following:

7.1.3 Detectors as being offered /supplied should have been proven to operate satisfactorily in the hydrocarbon industry like Refinery, Petrochemical and Gas processing plants under similar process conditions for at least 12 months.

7.1.4 Toxic and combustible gas detectors inclusive all ancillary equipment in the detection loop shall be suitable for SIL 3 applications

7.2 Fault Tolerant GDS nodes

Please refer to "Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 "

7.3 Cabinet Equipment

Please refer to "Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 "

7.4 System Wiring Requirements

For wiring in cabinets refer to PDRP-8550-SP-0005 Control & Marshalling Cabinet Specification

7.5 System Cables

Please refer to "Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 "

7.6 Field Input/Output - General

Please refer to "Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 "

7.7 Earth Leakage on field signal lines.

Please refer to "Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 "

8.0 FUNCTIONAL REQUIREMENTS

8.1 General

8.1.1 The functional design of the GDS will be based on the requirements of this specification and the following EPCm documents:

8.1.2 Hazard Process Analysis (HAZOP) studies.

8.1.3 Development of Fire and Gas Zone limits.

8.1.4 Gas detector layout within Zones.

8.1.5 Cause and Effect Charts (by EPCm)

8.1.6 GDS detection logic shall be implemented as Energised for normal – De energised for abnormal alarm conditions.

8.1.7 GDS executive outputs shall be implemented as Energised/Closed for normal permission – De energised/Open for executive action.

8.1.8 Alarms should be displayed at HMI of the DCS identifying the detector and the corresponding process area or related equipment

8.1.9 Alarm resets for SRR GDS process nodes shall be made from the DCS GDS graphics, follow normal DCS reset sequences.

8.1.10 See also Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002

8.2 I/O Functionality

8.2.1 Please refer to “Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 “

8.2.2 Analogue input signals with the HART signal superimposed shall be used by the Instrument Asset Management System and shall display the following information.

- Gas Detector Integrity
- Detector and transmitter failure alarm
- Detector drift
- Remote Calibration
- IR source deterioration
- Detector Failure .

8.3 Voted Inputs

Please refer to “Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 “

8.4 Manual Shutdown Activation

Please refer to “Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 “

8.5 Maintenance Overrides

Please refer to "Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 "

8.6 Start Up Override Switches

Start up override switches are not permissible in the GDS

8.7 Operational Override Switches

No operational override switches are permissible in the GDS

8.8 Trip Resets

Please refer to "Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 "

8.9 I/O segregation

8.9.1 I/O wiring and I/O module distribution specific to GDS shall be segregated on the following basis:

- Fire and Gas Zone
- Separate Input cards for individual signals used in voted e.g. 2ooN circuits

See also: Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002

8.10 Communication Links

Please refer to "Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 "

8.11 Sub-system Interfaces

Please refer to "Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 "

8.12 Diagnostics

Please refer to "Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 "

9.0 GDS HUMAN MACHINE INTERFACE (HMI)

9.1.1 Please refer to “Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 “

9.1.2 Specific Fire and Gas Zone graphics shall be designed such that the operator, by using the touch screen or equivalent interface shall be able to display an overall plot plan, followed by process area plans, process unit equipments, F&G zones and finally indication of sensors and detectors. Live status devices shall be displayed.

9.1.3 The Fire and Gas Zone graphics shall incorporate wind direction and velocity information.

9.1.4 All GDS Graphics information will be made available via the DCS HMI.

9.2 Sequence of Event Recording

Please refer to “Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 “

9.3 Printers

Please refer to “Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 “

10.0 SIL IMPLEMETATION

Please refer to “Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 “

11.0 GAS DETECTION AND ALARM DEVICES

11.1.1 Refer to Appendix 1 for detailed specification of GDS devices.

11.1.2 Gas detectors shall be have a range of 4-20mA and shall be set to go over-range (>20mA) or under-range (<4mA) in case of transmitter fault (i.e. full range is 0 - 22mA). Alarm settings shall be as detailed on the associated Gas detector data sheet.

11.1.3 For Toxic Gas Detectors

11.1.4 The first alarm should initiate a visual and audible local alarm in the corresponding process area and repeated in the DCS and GDS.

11.1.5 The second alarm for evacuating of the corresponding affected area should activate visual (strobes lights) and voice alarm for evacuation in the corresponding process area and repeated in the DCS and GDS.

11.2 Audible Alarms

11.2.1 Sounders and Speakers shall be provided in each process area near to the location of toxic gas detectors. These audible alarms should be activated under detection of toxic gas in the corresponding process area.

11.2.2 Sounder shall be provided to alarm within each process area. These shall be sited to ensure full coverage of the area. The sounder must also be redundant when an A and B path configuration is being used for multiple detectors.

11.2.3 Please refer to Appendix 1 for specific Alarm tone generation.

11.2.4 The sound level from the sirens should be a minimum of 5 dB above the local environment sound. Devices located in the plant and/or within hazardous areas should be properly certified and approved.

11.2.5 It is preferred that the required sound level is obtained by using multiple small sounders (e.g. 115 dB (A)) within each alarm area rather than using a single or a small number of large power output (>130 dB (A)) sounders for each alarm area.

11.3 Visible Alarms

11.3.1 Flashing beacons shall be provided for gas alarms in the field. These shall be supplied with Blue lenses for flammable gas and yellow lenses for toxic gas and provide enough light output to be visible in all normal situations. Xenon type strobe tubes shall be used.

11.3.2 Devices located in the plant and/or within hazardous areas shall be suitable for the environment and certified as required. Alarms shall be located so that they are clearly visible, and local to clusters of gas detectors.

12.0 ENGINEERING EQUIPMENT AND BUILDER SOFTWARE

Please refer to “Emergency Shutdown System Functional Specification PDRP4200-8550-FS-1002 “

13.0 TRAINING AND INSTRUCTION

Requirements for training are detailed in the material requisition for ‘Main Automation Contractor’ PDRP-RQ-4301-1617A-001

14.0 SUBMITTALS

Detailed requirements for documentation are detailed in the material requisition for 'Main Automation Contractor' PDRP-RQ-4301-1617A-001

15.0 APPENDIX 1

15.1 Detailed requirements field mounted equipment

15.2 Hazardous area Classification

15.2.1 Not withstanding the hazard classification assigned to the area in which an instrument is located, which is generally Zone 2 for hazardous areas subject to flammable gas / vapours, all instruments shall be:

- Certified as a minimum EEx'ia'.
- The certification listed above, shall be provided by the Chief Controller of Explosives (CCOE), Nagpur, India, and an Internationally recognised authority,

15.2.2 Not withstanding the hazard classification assigned to the area in which an instrument is located, for hazardous areas subject to flammable dust / fibres, all instruments, except the drive section of motorised valves, shall be;

- Certified, as a minimum, EEx'iaD'.
- The certification listed above, shall be provided by the Chief Controller of Explosives (CCOE), Nagpur, India, and an internationally recognised authority.

15.2.3 Gas Detection field devices shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard.

15.3 Toxic gas detector (H2S)

15.3.1 Toxic Gas Detectors shall be fully tropicalised and all atmospheric vents fitted with bug screens where applicable.

15.3.2 Toxic Gas detectors shall be certified in accordance with IEC 60529, as IP 66. The housing shall be of an Industrial grade with a painted finish to the manufacturer's standard suitable for sulphurous, salt laden environmental conditions.

15.3.3 Toxic Gas detectors shall employ an electrochemical sensor which shall be ranged 0-100PPM.

15.3.4 Toxic Gas detector shall include an integral LCD display to provide live status of gas concentration and device status to assist with fault identification and calibration.

15.3.5 Sensor outer casing material shall be AISI 316 stainless steel.

15.3.6 Toxic gas detectors shall produce a 4-20mA analogue output from a 2 or 3 wire configuration at a nominal supply of 24VDC. The device shall support HART technology in transmitting operational data for plant asset management system.

15.3.7 Toxic Gas detectors shall be monitored via their analogue circuits at the I/O module in the GDS system for over (22mA) and under range (2mA) alarms.

15.3.8 Supplier shall indicate any transmission distance limits base on minimum voltage required at the device and preferred cable type.

15.3.9 Toxic Gas Detectors shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.3.10 Terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.3.11 Toxic Gas detectors shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved.

15.3.12 Mounting Kits shall be included in supplier's scope suitable for 2" pipe mounting

15.3.13 Toxic Gas detectors mounted in HVAC ducts shall be supplied complete with required duct mounting accessories as identified on the relevant detector data sheet.

15.4 Toxic gas detector Chlorine

15.4.1 Chlorine Gas Detectors shall be fully tropicalised and all atmospheric vents fitted with bug screens where applicable.

15.4.2 Chlorine Gas detectors shall be certified in accordance with IEC 60529, as IP 66. The housing shall be of an Industrial grade with a painted finish to the manufacturer's standard suitable for sulphurous, salt laden environmental conditions.

15.4.3 Chlorine Gas detectors shall employ an electrochemical sensor which shall be ranged 0-30PPM.

15.4.4 Chlorine Gas detector shall include an integral LCD display to provide live status of gas concentration and device status to assist with fault identification and calibration.

15.4.5 Sensor outer casing material shall be AISI 316 stainless steel.

15.4.6 Chlorine gas detectors shall produce a 4-20mA analogue output from a 2 or 3 wire configuration at a nominal supply of 24VDC. The device shall support HART technology in transmitting operational data for plant asset management system.

15.4.7 Chlorine Gas detectors shall be monitored via their analogue circuits at the I/O module in the GDS system for over (22mA) and under range (2mA) alarms.

15.4.8 Supplier shall indicate any transmission distance limits base on minimum voltage required at the device and preferred cable type.

15.4.9 Chlorine Gas Detectors shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.4.10 Terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.4.11 Chlorine Gas detectors shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved.

15.4.12 Mounting Kits shall be included in supplier's scope suitable for 2" pipe mounting

15.4.13 Chlorine Gas detectors mounted in HVAC ducts shall be supplied complete with required duct mounting accessories as identified on the relevant detector data shee

15.5 Point Type Combustible Gas detector (%LEL)

15.5.1 Combustible Gas Detectors shall be fully tropicalised and all atmospheric vents fitted with bug screens where applicable.

15.5.2 Combustible Gas detectors shall be certified in accordance with IEC 60529, as IP 66. The housing shall be of an Industrial grade with a painted finish to the manufacturer's standard suitable for sulphurous, salt laden environmental conditions.

15.5.3 Combustible Gas detectors shall utilise Infra red technology. Heated optics shall be used to avoid signal loss /false alarms due to condensation.

15.5.4 Combustible Gas detectors shall be ranged 0-100%LEL.Calibration gas shall be as detailed on associated individual device specification sheets.

15.5.5 Combustible Gas detectors shall produce a 4-20mA analogue output from a 2 or 3 wire configuration at a nominal supply of 24VDC. The device shall support HART technology in transmitting operational data for plant asset management system.

15.5.6 Supplier shall indicate any transmission distance limits base on minimum voltage required at the device and preferred cable type

15.5.7 Combustible Gas detectors shall include an integral LCD display to provide live status of gas concentration and device status to assist with fault identification and calibration

15.5.8 Combustible Gas detectors Transmitter body material shall be AISI 316 stainless steel.

15.5.9 Combustible Gas detectors shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.5.10 Terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.5.11 Combustible Gas detectors shall be provided with the vendor's proprietary nameplate with the instrument tag number clearly engraved suitably affixed.

15.5.12 Mounting Kits shall be included in supplier's scope suitable for 2" pipe mounting

15.5.13 Combustible Gas detectors mounted in HVAC ducts shall be supplied complete with required duct mounting accessories as identified on the relevant detector data sheet.

15.6 Open Path Combustible Gas detector (%LEL)

15.6.1 Open path Combustible Gas Detectors shall be fully tropicalised and all atmospheric vents fitted with bug screens where applicable.

15.6.2 Open path Combustible Gas detectors shall be certified in accordance with IEC 60529, as IP 66. The housing shall be of an Industrial grade with a painted finish to the manufacturer's standard suitable for sulphurous, salt laden environmental conditions.

15.6.3 Open path Combustible Gas detectors comprise a transmitter and receiver unit both powered at 24VDC and utilise Infra red technology. Heated optics shall be used to avoid signal loss /false alarms due to condensation.

15.6.4 Fault diagnostics shall include a continuous optical path check and fault alarms will occur if the optics are dirty .Automatic gain control shall adjust for loss of signal due to dirty optics or if the IR signal is weak or blocked or if an instrument malfunction

occurs. Faults shall be reported via the 4-20ma loop without recourse to additional relays.

15.6.5 Open path Combustible Gas detectors shall provide an average measurement over the path length and expressed in ppm meters or LEL meters. Calibrated range shall be based on anticipated path length and gas concentration as detailed on the instrument specification sheet.

15.6.6 Lamp unit shall be replaceable type without requirement for special maintenance tools and have an operational life of 5 years minimum.

15.6.7 Open path Combustible Gas detectors shall produce a 4-20mA 2 wire analogue output at a nominal supply of 24VDC. The device shall support HART technology in transmitting operational data for plant asset management system.

15.6.8 Supplier shall indicate any transmission distance limits base on minimum voltage required at the device and preferred cable type

15.6.9 Supplier shall advise on any special reset requirements which may require additional digital outputs from the GDS node to reset the device.

15.6.10 Open path Combustible Gas detectors shall include an integral LCD display to provide live status of gas concentration and device status to assist with fault identification and calibration

15.6.11 Open path Combustible Gas detectors Transmitter/Receiver body material shall be AISI 316 stainless steel.

15.6.12 Open path Combustible Gas detectors shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.6.13 Terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.6.14 Open path Combustible Gas detectors shall be provided with the vendor's proprietary nameplate with the instrument tag number clearly engraved suitably affixed.

15.6.15 Mounting Kits shall be included in supplier's scope suitable for 2" pipe mounting

15.7 Oxygen Depletion detector (%O2)

15.7.1 Oxygen Depletion Gas Detectors shall be fully tropicalised and all atmospheric vents fitted with bug screens where applicable.

15.7.2 Oxygen Depletion Gas Detectors shall be certified in accordance with IEC 60529, as IP 66. The housing shall be of an Industrial grade with a painted finish to the manufacturer's standard suitable for sulphurous, salt laden environmental conditions.

15.7.3 Oxygen Depletion detectors shall utilise electrochemical sensor technology.

15.7.4 Oxygen Depletion detectors shall be located in Analyser shelters. The detector shall be calibrated to 0-25% O2 with an alarm generated at 19 % falling to protect personnel within the shelter.

15.7.5 Oxygen Depletion detectors shall produce a 4-20mA analogue output from a 2 or 3 wire configuration at a nominal supply of 24VDC. The device shall support HART technology in transmitting operational data for plant asset management system.

15.7.6 Supplier shall indicate any transmission distance limits base on minimum voltage required at the device and preferred cable type

15.7.7 Oxygen Depletion detectors shall include an integral LCD display to provide live status of gas concentration and device status to assist with fault identification and calibration

15.7.8 Oxygen Depletion detectors Transmitter body material shall be AISI 316 stainless steel.

15.7.9 Oxygen Depletion detectors shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.7.10 Terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.7.11 Oxygen Depletion detectors shall be provided with the vendor's proprietary nameplate with the instrument tag number clearly engraved suitably affixed.

15.7.12 Mounting Kits shall be included in supplier's scope suitable for 2" pipe mounting/surface mounting dependant on application.

15.8 Hydrogen Gas Detector (%LEL)

15.8.1 Hydrogen Gas Detectors shall be fully tropicalised and all atmospheric vents fitted with bug screens where applicable.

15.8.2 Hydrogen Gas Detectors shall be certified in accordance with IEC 60529, as IP 66. The housing shall be of an Industrial grade with a painted finish to the manufacturer's standard suitable for sulphurous, salt laden environmental conditions.

15.8.3 Hydrogen Gas detectors shall utilise a poison resistant Catalytic sensor.

15.8.4 Hydrogen Gas detectors shall be located indoors battery rooms or externally wherever the risk of Hydrogen release exists. The calibrated range shall be determined on the basis of the application e.g. slow leakage rates associated with battery rooms 0-10%LEL versus 0-100%LEL for process area equipment containment failure. This shall be clearly detailed on the data sheet.

15.8.5 Hydrogen Gas detectors shall produce a 4-20mA analogue output from a 2 or 3 wire configuration at a nominal supply of 24VDC.The device shall support HART technology in transmitting operational data for plant asset management system.

15.8.6 Supplier shall indicate any transmission distance limits base on minimum voltage required at the device and preferred cable type

15.8.7 Hydrogen Gas detectors shall include an integral LCD display to provide live status of gas concentration and device status to assist with fault identification and calibration

15.8.8 Hydrogen Gas detectors Transmitter body material shall be AISI 316 stainless steel.

15.8.9 Hydrogen Gas detectors shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.8.10 Terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.8.11 Hydrogen Gas detectors shall be provided with the vendor's proprietary nameplate with the instrument tag number clearly engraved suitably affixed.

15.8.12 Mounting Kits shall be included in supplier's scope suitable for 2" pipe mounting.

15.9 Aspirator Cabinet mounted Combustible detectors

15.10 Cooling Tower Top platform

15.10.1 The supplier shall include for Combustible Gas detectors mounted in a 2OO3 configuration with all ancillary tubing and Instrument air driven sample pump/ eductor units to facilitate the sampling of exhaust air from cooling towers top platform refer to OISD-STD-116.

15.10.2 All detectors sample pumps and catch pots etc shall be mounted in a general purpose weatherproof enclosure

15.10.3 The sample will be conditioned via knock out /catch pots to allow any moisture in the sample to be periodically drained away

15.10.4 Combustible gas detectors in this service shall be point type as stated above with the sample routed through the detectors prior to venting.

15.10.5 The system shall include low flow alarms to inform operations of a loss of sample.

15.10.6 Instrument air connection shall be made at the bottom of the cabinet via 1/2" NPT F connector stainless steel tube and fittings shall be used throughout.

15.10.7 The system shall incorporate facilities for test and calibration

15.10.8 All detection and alarm signals shall be wired out to externally mounted Junction boxes to allow for ease of installation.

15.10.9 Cabinet shall be manufactured from AISI 316 stainless steel rated certified in accordance with IEC 60529, as IP 66 suitable for plate mounting on a suitable stand. All internal electronics components shall be suitable for an electrical area classified as Zone 1 EEx ia.

15.10.10 Vents and drains shall be fitted with bug screens where applicable.

15.11 General requirements gas detectors

15.11.1 Calibration accessories

All gas detectors shall be supplied complete with Gassing adaptors, anti draught calibration head covers and all required regulator/calibration bottle adaptors and manifolds as required by detector type. Provision shall be included to introduce calibration gas to duct mounted detectors appropriate kits shall be included for this purpose.

15.12 Calibration gases

Supplier shall advise on calibration requirements and include within his scope calibration gas cylinders based on the following:

- Minimum of 5 calibrations per detector each lasting a nominal 3 minutes as calibration time for gas quantity calculations. If supplier's product has more onerous requirements then this shall be stated and calculations on this basis shall prevail.
- Supplier shall state recommended calibration interval.
- Gas cylinders shall be quoted unit wise (i.e. based on the number of detectors of unit) Calculation shall be submitted by supplier for validation prior to order.
- Devices shall be supplied pre-calibrated with calibration shall be as stated on the data sheet or calibrated against a base line calibration gas and supplied with cross sensitivity scale factors for particular gases.

15.12.1 Mounting

Supplier shall advise on best elevation for mounting detector based on information detailed on individual device data sheets to avoid potential for mis–application associated with incorrect installation.

15.12.2 Special tools

Supplier shall advise on any special tools requirements within his proposal.

15.13 Audible Alarm Devices (Hazardous area)

15.13.1 Audible alarm devices shall be certified in accordance with IEC 60529, as IP 66. The termination housing shall be of an Industrial grade with a painted finish to the manufacturer's standard suitable for sulphurous, salt laden environmental conditions.

15.13.2 Audible alarm devices shall be certified for use in a hazardous area. Refer to paragraph ~~3.3~~ 15.2 for specific requirements.

15.13.3 Audible alarm devices for Gas alarm annunciation shall be provided with facility to generate an alarm tone of 1000 Hz signifying a Gas released event. There are three alarm requirements for gas detection.

- Level 1.Toxic gas detection: Sounder will be activated for 2 minutes sounded three times for 30 seconds.@ 1000 Hz. with an interval of 15 seconds in between.
- Level 2 Combustible gas Detection: Sounder will be activated for 2 minutes sounded three times for 30 seconds.@ 1000 Hz. with an interval of 15 seconds in between.
- Level 2 Toxic gas detection: Voice announcement via PA system to evacuate the corresponding process area.

15.13.4 Sound output power level shall be 115dB at 1 metre from the device

15.13.5 Audible alarm devices shall be driven from the GDS in the associated SRR at 24VDC.

15.13.6 Audible alarm devices shall be painted manufacturer's standard.

15.13.7 Interface terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.13.8 Audible devices shall be Line monitored from the associated supervised digital output within the GDS in the associated SRR.

15.13.9 Audible devices shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.13.10 Audible devices shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved.

15.14 Audible Alarm Devices Sounders (Buildings)

15.14.1 When combustible or toxic gas is detected the HVAC ducts or Hydrogen Gas is detected in the Battery rooms, audible alarm devices shall annunciate the gas Alarm Tonal Pattern via sounders located throughout the building.

15.14.2 Audible alarm devices for Gas alarm annunciation shall be provided with facility to generate a variable alarm tone 1000 Hz signifying a Gas released event. There are three alarm requirements for gas detection.

- Level 1.Toxic gas detection: Sounder will be activated for 2 minutes sounded three times for 30 seconds.@ 1000 Hz. with an interval of 15 seconds in between.
- Level 2 Combustible gas Detection: Sounder will be activated for 2 minutes sounded three times for 30 seconds.@ 1000 Hz. with an interval of 15 seconds in between.
- Level 2 Toxic gas detection: Voice announcement via PA system to evacuate the corresponding process area.

15.14.3 Sound output power level shall be 65dB(A) at 1 metre from the device at least with facility to adjust output such that volume exceeds background ambient noise by at least 5 dB(A).

15.14.4 Audible alarm devices shall be driven from the GDS in the associated SRR at 24VDC.

15.14.5 Audible alarm devices shall be painted manufacturer's.

15.14.6 Interface terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.14.7 Audible devices shall be Line monitored from the associated supervised digital output within the GDS in the associated SRR.

15.14.8 Audible devices shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.14.9 Audible devices shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved.

15.15 Visual Alarm Devices (Hazardous area)

15.15.1 Visual alarm devices (Beacons) shall be certified in accordance with IEC 60529, as IP 66. The termination housing shall be of an Industrial grade with a painted finish to the manufacturer's standard suitable for sulphurous, salt laden environmental conditions.

15.15.2 Visual alarm devices (Beacons) shall make use of Xenon Strobe tube technology with a suitably affixed optical guard.

15.15.3 Visual alarm devices shall be certified for use in a hazardous area. Refer to paragraph 3.3 for specific requirements.

15.15.4 Visual alarm devices shall be driven from the GDS in the associated SRR at 24VDC.

15.15.5 Visual alarm devices for Toxic Gas /Oxygen depletion detected shall have a Yellow coloured lens. The terminal housing shall be painted manufacturers standard.

15.15.6 Visual alarm devices for Combustible Gas detected shall have a Blue coloured lens. The terminal housing shall be painted manufacturers standard.

15.15.7 Cable terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.15.8 Visual alarm devices shall be Line monitored from the associated supervised digital output within the GDS in the associated SRR.

15.15.9 Visual alarm devices shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.15.10 Visual alarm devices shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved.

15.15.11 Visual alarm devices shall be provided with all required mounting brackets and accessories.

15.16 Visual Alarm Devices (Buildings).

15.16.1 Visual alarm devices located in Buildings shall be classified as general purpose. The termination housing shall be of an Industrial grade flame retardant GRP with a painted finish to the manufacturer's standard suitable for an indoor location.

15.16.2 Visual alarm devices shall be Line monitored from the associated supervised digital output within the GDS in the associated SRR.

15.16.3 Visual alarm devices shall operate at 24VDC.

15.16.4 Visual alarm devices for Toxic Gas detected shall have a Yellow coloured lens. The terminal housing shall be painted manufacturers standard.

15.16.5 Visual alarm devices for Combustible Gas detected shall have a Blue coloured lens. The terminal housing shall be painted manufacturers standard.

15.16.6 Visual alarm devices shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.16.7 Cable terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.16.8 Visual alarm devices shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved.

15.16.9 Visual alarm devices shall be provided with all required mounting brackets and accessories.

JOB SPECIFICATION FOR FIRE DETECTION SYSTEM

(AMENDMENT TO PDRP FIRE DETECTION SYSTEM NO. PDRP4200-8550-FS-1005)

REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED
C	12.03.2020	ISSUED FOR DESIGN	CRK	KRS	SS	JMC
B	14.02.2020	ISSUED FOR DESIGN	CRK	KRS	SS	JMC
A	03.12.2019	ISSUED FOR DESIGN	CRK	KRS	SS	JMC

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1. INTRODUCTION

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

2. GENERAL ABBREVIATIONS

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them.
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related
SRU	Sulphur Recovery Unit

3. CONFLICTS AND DEVIATIONS

If conflicting statements exist within this document or between this document and Design Basis, other applicable specifications, Standard Drawings, Industry standards, codes, etc., it shall be brought to Owner's / PMC notice for clarification and proper approval shall be obtained before implementation. Decision of Owner / PMC shall be final.

In case of contradiction between licensor specification, design basis and JSS, it has to be brought to the notice of Owner/PMC and Decision of Owner/PMC shall be binding on Contractor/Vendor.

In general, order of priority of the documents shall be as follows,

- Local regulatory and statutory requirement.
- Licensor Requirements (as applicable)
- Project specification and datasheets, wherever applicable.
- This specification and relevant equipment/system specification.
- Codes and standard.

4. SCOPE

Fire detection system shall be designed in accordance with Fire detection system doc. no. PDRP4200-8550-FS-1005, Rev.F1 which is attached as Annexure-1 with this document and addendum requirement covered in this document.

5. ADDENDUM TO FIRE DETECTION SYSTEM

This addendum shall be read in conjunction with Fire detection system document PDRP4200-8550-FS-1005, Rev.F1

The following amendments and additions shall apply to Fire detection system document PDRP4200-8550-FS-1005, Rev.F1. The clauses of PDRP4200-8550-FS-1005, Rev.F1 that are not amended in this Addendum remain applicable without change.

5.1. Amendment to section 2.1 Page 5 of 29

- "MAC" shall be read as "Contractor"
- Paradip Refinery Project shall be referred as Standby SRU and Additional tanks Project
- EPCM or EPCM-7 or shall be read as EPCM/LSTK

5.2. Addition to section 4.1 Page 10 of 41

- Segregation rules for FDAS architecture shall be as follows-

  FDAS Nodes/Controllers/networks shall be segregated as a minimum basis per SRR. For larger units or groups of units in each SRR, further segregation of nodes/controllers shall be made to maximise availability for each unit or group of units. Common networks per SRR can be maintained, including common EWS.

5.3. Amendment to section 4.1.9 Page 11 of 41

The section is modified and the same are to be read as given below

- Each SRR FDAS node shall interface with its associated SRR DCS node via a dedicated fault tolerant MODBUS communications link. This interface shall be used to transfer status information from the FDAS to the DCS and shall not be used to pass data from the DCS to the FDAS

5.4. Amendment to section 4.1.10 Page 11 of 41

The section is modified and the same are to be read as given below

- Centralised fire monitoring alarming and associated information, of all plant areas across the refinery shall be possible from the Engineering Room in the Main Control Building (MCB) through the FDAS engineering workstation which shall be connected to the FDAS network. FDAS EWS and HMI stations shall be separate and not combined

5.5. Amendment to section 4.2.2 Page 11 of 41

The section is modified and the same are to be read as given below

- In order to ensure that the system complies with the requirements of SIL 3, flame detectors, shall be if possible certified SIL 3 and should be arranged in a voting logic 2oo2 for alarm release. If SIL 3 certified detectors are not available with the IOCL approved vendors it shall be minimum SIL-2 certified.

5.6. Amendment to section 5.2.3 Page 13 of 41

The section is modified and the same are to be read as given below

- Relative Humidity (non-condensing) 99.7% i.e. The control room shall be air-conditioned. Under normal operating conditions, the temperature may range from 20-30 Deg. C, with 35 to 75% RH. In case of AC failure, the temperature may range from 10-50 Deg. C, with relative humidity in the range of 25% to 100%.

5.7. Addition to section 5.6 Page 14 of 41

- Power distribution cabinets shall include all required Fault isolation/ transfer switches for all UPS power distribution cabinets
  Bulk power supplies shall be supplied in a distributed manner, generally they shall be installed in the same cabinets as the power users. Common bulk power supplies providing power to many users located in other cabinets is not acceptable. Bulk power supplies shall always be provided in a redundant configuration (as a minimum) and fed from separate UPS feeders. The above requirements are applicable to all LSTK supplied systems inclusive of all field devices powered by contractor supplied systems.

5.8. Amendment to section 5.6.15 Page 15 of 41

The section is modified and the same are to be read as given below

- The FDAS should be suitably earthed Refer to drawing 080557C001-000-DW-1540-008 Instrument Earthing Philosophy Diagram for system earthing requirements. Any special earthing requirements, for the FDAS system, shall be incorporated into the above drawing

5.9. Amendment to section 5.6.3 Page 14 of 41

The section is modified and the same are to be read as given below

- UPS shall be sized to guarantee operation of the SRR FDAS with dedicated batteries that shall enable the system (s) to remain on line for twenty four (24) hours in the event of failure of the main refinery power systems plus five minutes of alarm. Total UPS time 24 hours and 5 minutes. (per NFPA 72 Section 1-5.2.5)

5.10. Amendment to section 5.6.4 Page 14 of 41

The section is modified and the same are to be read as given below

- Battery shall be composed of sealed Lead-acid cells, maintenance free, 24 VDC nominal

5.11. Addition to section 5.6.17 Page 15 of 41

- UPS and DC power supply failure alarms and fault alarms shall be available in the DCS. Signals shall be allocated based on required unit/plant segregation, for common areas such as control building areas where process unit DCS nodes may not be available, alternative means shall be considered provided segregation requirement are maintained

5.12. Addition to section 6.2 Page 17 of 41

- The Visual Display Units (VDU's) for FDAS Workstation/Server PCs shall be 24" or larger LED colour IPS screen with high-resolution graphics, capable of displaying alpha-numeric & graphic displays and shall be flicker-free and glare-free.

5.13. Amendment to clause 6.4.1 Page 18 of 41

This section is modified and the same is to be read as given below

- System Cabinets and Marshalling Cabinets shall be provided in accordance with specification 080557C-000-JSS-1511-005 “Control/Marshalling Cabinet Specification”.

5.14. Addition to clause 6.5 Page 19 of 41 .

The section 6.5.12 is newly added and same is to be read as given below

- Sequence of Event recording shall be First in First Out type with availability of SOE data preferably in PLC processor for maximum number of SOE points configurable in the installed PLC system (Preferably 10000 process alarms & 5000 Diagnostic alarms). This will ensure that even if the communication with SOE PC is not healthy in any particular time, the latest SOE data can be retrieved by establishing communication with PLC

5.15. Addition of clause 7.3.13 Page 23 of 41

- Network health shall be continuously diagnosed and automatically alarmed for all network malfunctions (including but not limited to, reduction in performance, hardware and cabling faults).

5.16. Amendment to clause 10 Page 26 of 41

This section is modified and the same is to be read as given below

- Documentation requirements for the FDAS will be provided in Material Requisition from Contractor

5.17.Amendment to clause 11.1.2 Page 26 of 41

This section is modified and the same is to be read as given below

- Project Execution requirements will be detailed in the Material Requisition from Contractor

5.18. Amendment to clause 12.1.2 Page 26 of 41

This section is modified and the same is to be read as given below

- A Factory Acceptance Test (FAT) of the FDAS shall be carried out, at the MAC’s works. This FAT shall be carried out in accordance with specification 080557C-000-ITP-1500-002 “Inspection and Testing of Electronic Control Systems”

5.19. Amendment to clause 12.1.4 Page 26 of 41

This section is modified and the same is to be read as given below

- The SAT shall be carried out in accordance with the specification 080557C-000-ITP-1500-002

5.20. Amendment to section 13 Page 27 of 41

This section is modified and the same is to be read as given below

- Training for owner's personnel shall be provided for supplied Fire Detection System. The training shall be at OEM's premises, where proper facility and infrastructure for training shall be available.
- 'On the job training' to owner's personnel at site shall also be included in training schedule. Training course shall include detail configuration, modification, operation, troubleshooting, calibration, maintenance (preventive / breakdown) etc. as minimum. The cost of travel, lodging & boarding for personnel attending training shall be by owner.

	AT OEM's WORK	AT SITE	REMARK
GDS	5 Days 5 Personnel	5 Days 5 Personnel	For each make of Detector

5.21. Amendment to section 13 Page 27 of 41

This section is modified and the same is to be read as given below

- Spare parts requirements are detailed in 11.3-Spares Philosophy Mandatory Spare List-Instrumentation, attached along with tender.

5.22. Amendment to Section 15.2.1 in page 28 of 41

This section is modified and the same is to be read as given below

- 15.2.1. Notwithstanding the hazard classification assigned to the area in which an instrument is located, which is generally Zone 2 for hazardous areas subject to flammable gas / vapours, all instruments shall be:
  - Instrument Electrical certification to be as per design Basis - Instrumentation 080557C-088-JSD-1540-002 section 7.2
  - The certification listed above, shall be provided by the Chief Controller of Explosives (CCOE), Nagpur, India, and an Internationally recognised authorities

5.23. Amendment to Section 15.5.2 in page 29 of 41

This section is modified and the same is to be read as given below

- Application in buildings shall be executed using a combined Photo Optical/Fixed heat detector.

5.24. Amendment to Section 15.5.4 in page 30 of 41

- Delete clause 15.5.4 as this repetition of clause 15.5.2

5.25. Addition to Section 15.5.13 in page 30 of 41

This section is modified and the same is to be read as given below

- Smoke Detectors located in floor, ceiling voids or HVAC ducts shall have their associated LED status indicator wired and surface mounted remotely from the detector with the device Tag Number mounted alongside .HVAC duct mounted devices shall be supplied with suitable mounting kits to simplify connection to the duct.Where increased sensitivity would normally require an Ionisation smoke detector this shall be replaced with an Addressable Combined Optical Smoke/ Fixed heat detector. The device will react to both smoke and heat independently.

5.26. Amendment to below listed Section

Following sections are modified and the same are to be read as given below

- **15.4.4** Manual call points shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.5.10** Smoke Detectors shall be provided with ½" NPT cable entries suitable for accepting cable glands
- **15.6.5** Transmitter/receiver detectors shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.8.4** Heat detectors shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.10.13** Controller/Interface module shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.11.9** Flame detector shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.12.11** Audible devices shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.13.8** Audible devices shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.14.4** Fire bells shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.15.9** Visual alarm devices shall be provided with ½" NPT cable entries suitable for accepting cable glands.
- **15.16.6** Visual alarm devices shall be provided with ½" NPT cable entries suitable for accepting cable glands

5.27. Amendment to clause 15.11.4 page 34 of 41

This section is modified and the same is to be read as given below

- Flame detector shall provide the 4-20 mA signals along with potential free contact output

5.28. Amendment to clause 15.12.4 page 35 of 41

This section is modified and the same is to be read as given below

- Audible alarm devices shall be certified for use in a hazardous area. Refer to paragraph 15.2 for specific requirements.

5.29. Amendment to clause 15.13.11 page 36 of 41

This section is modified and the same is to be read as given below

- Bell sounder should exceeds background ambient noise by at least 10 dB(A)

5.30. Amendment to section 5.7.7 Page 16 of 41

This section is modified and the same shall be read as given below.

- Scan time of input signals for control loop shall be 250 msec or better, and for monitoring & digital points shall be 1 sec or better. The controller loading shall not exceed 50 % (worst case) when configured for scan time mentioned above and maximum control loops in one controller shall not exceed 100 nos. These requirements shall be inclusive of installed spares.

5.31. Amendment to section 5.3.1 Page 13 of 52

This section is modified and the same is to be read as given below

- The FDAS shall be designed to achieve an availability of 99.999%. with an assumed Mean Time To Repair (MTTR) of 8.0 hours or less and a Mean Time Between Failure (MTBF) of 80,000 hours or more.

6. ANNEXURE

1. FIRE DETECTION SYSTEM- PDRP4200-8550-FS-1005, Rev F1

IndianOil	PARADIP REFINERY PROJECT PROJECT SPECIFICATION	PDRP4200-8550-FS-1005 PAGE 1 OF 41 REV F1
	FIRE DETECTION SPECIFICATION	

Contract:	1-14-4200/4399
Client's Name:	Indian Oil Corporation Limited (IOCL)
Project Title:	Paradip Refinery Project (PDRP) – EPCm-1
Project Location:	Paradip, Orissa State, India
Document Category	Class 1

REVISION	F1	Signature
DATE	Aug 09	
ORIG. BY	G.W.Smith	
CHK. BY	G.Cassap	
APP. BY	D. Ball	

REVISION HISTORY			
Revision	**Date**	**Reason for Issue**	**Originator**
A1	08 May 09	Issued for Use	G. Cassap
F1	27 Aug 09	Issued Final	G.W. Smith

CONTENTS

1.0 INTRODUCTION

1.1.1 This specification covers the technical and functional requirements of the Fire Detection and Alarm System (FDAS) for the Paradip Refinery Project, which consists of the installation of an integrated grassroots 15 MMTPA (300,000 BPSD) refinery complex at a site located 5 Km south of the Port of Paradip in the state of Orissa, India.

1.1.2 The main function of the Fire Detection and Alarm System (FDAS) in the Paradip Refinery is to detect fires at a stage sufficiently early to allow an effective response by alerting the operator, who should activate the appropriate protective responses based on the characteristics of the incident.

1.1.3 Except for specific cases no executive action shall be taken on detection of fire. Such cases should be based upon the result of a plant risk analysis and according to the corresponding OISD standards (OISD-Std.144), such cases for instance are the protection of LPG spheres with thermal fuses/quartz bulbs or electro-pneumatic heat detectors, which after actuation cause trip of LPG pumps and compressors via plant ESD system and the deluge valves on fire water sprinkler system will be actuated from the FDAS system.

1.1.4 The Fire Detection and Alarm System works by monitoring throughout the installation by means of fire detectors and providing a continuous display of process plant areas conditions to the control room operator. In the event of an incident being detected (fire in early stage) it is alarmed to the operator in the control room who should be provided with facilities to take the corresponding action. Repeated indication through a FDAS monitor station with graphics of all fire alarms shall be provided in the Fire and Safety Control Room (FSCR) located in the Fire station.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

Alarm:	An audible or visible means of indicating to the operator equipment or process malfunction or abnormal condition.
Alarm System:	The collection of hardware and software that an alarm state, transmits the message to be displayed to the operator, records the message, and generate alarm metrics report.
MAC:	Main Automation Contractor. Shall mean the firm, company or other corporate entity (including its successors and/or permitted assigns) contracted to supply the **Equipment/ Services** to **IOCL.**
EPCm	Engineering Procurement & Construction Management Contractor.
Equipment/ Services:	Means the equipment and/or services including but not limited to materials, equipment, fabricated products, software, drawings, certification and other documentation, to be supplied under the **Contract. Plant**: Means the **IOCL's** Paradip Refinery Project, Paradip, Orissa, India in connection with the construction and/or operation of which the **Equipment/ Services** are to be supplied.
Shall:	Refers to a mandatory requirement
Should:	Refers to a recommendation
May:	Refers to an acceptable course of action
Hazardous (Classified) Location:	A location, in which fire or explosion hazards may exist due to an explosive atmosphere of flammable gases or vapours, flammable liquids, combustible dust, or easy ignitable fibers or flyings. Three different zones are to be differentiated:
Zone 0:	Area in which an explosive gas-air mixture is continuously present or present for long periods.
Zone1:	Combustible or conductive dusts are present. Area in which an explosive gas-air mixture is likely to occur in normal operation.
Zone 2:	Area in which an explosive gas-air mixture is not likely to occur, and if occurs it will be only for a short period.

Note: A complete area classification should include the protection type of the device to be installed, temperature code (T1 to T6), and the exact flammable nature of the material (gas, dust, liquid, flyings fibres) indicated in Groups.

Groups for gases and vapours typical in the Oil & Gas Industry are classified as follow:

Group IIA:	Ethane,Propane,Butane,Hexane,Methane,Heptane, Octane,Nonane,Decane,Acetic acid, Acetone, methanol, toluene, ethyl acetate.
Group IIB:	Ethylene, coke oven gas, dimethyl ether, diethylene, ethylene oxide.
Group IIC:	Hydrogen, Carbon disulphide, Acetylene, Ethyl nitrate.
Non Hazardous (Unclassified) Location:	A location in which fire or explosion hazards are not expected to exist specifically due to the presence of flammable gases or vapours, flammable liquids, combustible dusts, or ignitable fibers or flyings. Such location may also be referred to as a safe area.
Flame Detectors:	Flame detectors are line-of-sight devices that look for specific types of light radiation (infrared, visible, ultraviolet) emitted by flames during combustion. When the detector recognizes this light from fire, it sends a signal to activate and alarm.
Smoke Detectors:	Smoke detectors detect the visible or invisible smoke particles from combustion. The two main types are ionization detectors and photoelectric detectors.
Heat Detectors:	Heat detectors react to a broad temperature change (Rate of Rise) or a predetermined fixed temperature and temperature compensated Heat detectors are normally used in dirty environments or where dense smoke is produced, they are less sensitive, but are more appropriate than a smoke detector in these environments.

2.2 Abbreviations

C & E	Cause and Effect
CPU	Central Processing Unit
DCS	Distributed Control System
EFD	Engineering Flow Diagram
ESD	Emergency Shutdown
FAT	Factory Acceptance Test
FM	Factory Mutual
FDAS	Fire Detection and Alarm System
FSCR	Fire and Safety Control Room
FACP	Fire Alarm Control Panel
GDS	Gas Detection System
HMI	Human Machine Interface
HVAC	Heating Ventilation and Air Conditioning
I/E	Instrument Electrical Interface
IFAT	Integrated Factory Acceptance Test
I/O	Input/Output
IR	Infrared
IS	Intrinsically Safe
MCB	Main Control Building
MCP	Manual Call Point
MCR	Main Control Room
MTBF	Mean Time Between Failure
MTTR	Mean Time to Repair

PLC	Programmable Logic Controller
QMR	Quadruple Modular Redundant
SIB	Satellite Instrument Building
TMR	Triple Modular Redundant
TÜV	Technischer Überwachungs Verein
UL	Underwriters Laboratories Inc.
UPS	Uninterruptible Power Supply
VDU	Visual Display Unit

3.0 CODES AND STANDARDS

This specification shall be read in conjunction with the following standards:

3.1 Project Standards

3210 -8140-SP-0001	Fire Protection
3210-8550-63-0001	Instrument Earthing Philosophy
PDRP -8550-SP-0002	Instrument Cable Standard
PDRP -8550-SP-0005	Control Marshalling Cabinet Specification
PDRP -8550-SP-0007	Instrument Installation Standard
PDRP -8550-SP-0010	Protection of Instruments
PDRP -8550-SP-0011	Inspection and Testing of Electronic Control Systems
PDRP4200-8550-FS-1003	Gas Detection Specification
PDRP4240-8820-IN-1002	Buildings list

3.2 International Standards And Codes

API RP 550	API Recommended Practices on Installation of Refinery Instruments
BS-5445	Components for automatic fire detection systems.
BS- 5839-1/6	Fire Detection and Fire Alarm Systems for Buildings

BS-6266	Code of Practice for Fire Protection of Electronic Data Processing Installations
ISA S84.01	Application of Safety Instrumented Systems for the Process Industry, 1996
IEC 61000	Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Parts 1, 2, 3.
IEC 61508	Functional Safety of Electrical/Electronic programmable electronic Safety related Systems
MIL-HDBK217	Reliability Prediction of Electronic Equipment
NFPA 13	Standard for the installation of Sprinkler Systems
NFPA 72	National Fire Alarm Code, 2007
NFPA 72E	Automatic Fire Detectors
NFPA 101	Life Safety Code
OISD-116	Fire Protection Facilities for Petroleum Refineries and Oil/Gas Processing Plants, 2002
OISD-144	Liquefied Petroleum Gas (LPG) Installations
OISD-150	Design and Safety Requirements for Liquefied Petroleum Gas mounded Storage Facility
OISD-152	Safety Instrumentation for Process System in Hydrocarbon Industry
OISD-173	Fire Prevention and Protection System for Electrical Installations, 2003

4.0 SYSTEM DESCRIPTION AND FUNCTION

4.1 System

4.1.1 The FDAS architecture shall consist of distributed logic solving unit nodes, located in Satellite Rack Rooms (SRR) for each plant area and all manned buildings protected via Building Fire Alarm Control panels.

4.1.2 Each node (SRR or building) shall have its own HMI monitoring capabilities for its associated plant area and shall be capable of independent operation from other refinery systems or in the event of main UPS power failure.

4.1.3 Each SRR HMI shall be in the form of a desk mounted PC, which will be situated in the SRR engineering room.

4.1.4 SRR FDAS logic solving nodes for process areas shall be based on high availability, fault tolerant redundant PLC technology, SIL3 rated, Factory Mutual certified, and NFPA 72 approved. Refer to section 6.0 for details.

4.1.5 SRR FDAS redundancy transfer from controller(s) in service to the stand-by controller(s) shall occur bumpless and automatically.

4.1.6 The SRR FDAS shall communicate with other systems using appropriate industry standard links such as OPC, Modbus/ TCP and Modbus RTU. Chosen communication method will be subject to EPCm/IOCL approval. No proprietary communication system should be used

4.1.7 Building nodes located in each plant building, Service Building, Administration Building and SRRs, shall act as sub systems of the plant area SRR FDAS and communicate with it via fault tolerant industrial standard communication methods. These nodes shall be stand-alone local fire alarm panels with a touch screen operator/tracker ball interface, complete with its own power supply and battery back-up.

4.1.8 Building node Fire Alarm Panels shall be capable of using addressable detection and alarming devices.

4.1.9 Each SRR FDAS node shall interface with its associated SRR DCS node via fault tolerant industrial standard communication methods. Plant wide communication with SRR FDAS nodes shall be through the plant wide DCS network and DCS HMIs.

4.1.10 Centralised fire monitoring alarming and associated information, of all plant areas across the refinery shall be possible from the Engineering Room in the Main Control Building (MCB) through the FDAS engineering workstation which shall also act as an FDAS HMI which shall be connected to the FDAS network.

4.1.11 Fire monitoring alarming and associated information, of all plant areas across the refinery shall also be possible at the through the HMIs of the plant wide DCS.

4.1.12 There are two Fire stations each with its own Fire station control room (FSCR) one located in the northern part of the complex the second located in the south each will have identical HMI functionality via the Plant wide FDAS network.

4.1.13 Supply of Power to SRR FDAS shall be from a dedicated FDAS UPS with independent battery back up for an additional 24 hours of operation plus five minutes of alarm after power failure per NFPA-72.

4.1.14 Supply of power to building nodes FDAS shall be from a dedicated FDAS UPS with independent battery back up for an additional 24 hours of operation plus five minutes of alarm after power failure per NFPA-72

4.1.15 MAC shall ensure that UPS units are supplied form the same manufacturer if possible to standardise on Spare parts etc. MAC shall consult with EPCM-7 to determine UPS vendor.

4.2 Devices and Signalling

4.2.1 The system devices (initiating devices, notification appliance circuits and signalling circuits) shall be a Class “A” wiring system according to NFPA 72.

4.2.2 In order to ensure that the system complies with the requirements of SIL 3, flame detectors, shall be if possible certified SIL 3 and should be arranged in a voting logic 2oo2 for alarm release.

4.2.3 The FDAS should be able to monitor power supply performance, field devices for open circuits, short-to-ground and wire to wire short circuit.

4.2.4 The FDAS shall provide Ground Fault Detection.

4.2.5 FDAS nodes (SRR or building) shall be of an open modular I/O architecture.

4.2.6 SRR and building nodes shall have the capability of monitoring addressable and non-addressable auxiliary devices (fire detectors, smoke detectors, heat detectors, manual pull stations, beacons, horns, water flow switches, sprinkler systems control valves, etc.)

4.2.7 The sprinkler system supervisory device in each process plant area shall be interconnected with the corresponding FDAS node as a separate zone for alarm and trouble.

4.2.8 Response time between alarm initiation and reporting at the MCB or FSCR of the Refinery shall be less than 10 seconds (<10sec)

4.2.9 The Plant shall be zoned into multiple zones on a level by level basis. Each building and process area in the Plant shall be reviewed individually to establish the applicable zoning.

4.2.10 Common zone alarms from the sub-systems shall be transmitted to the corresponding process area FDAS at the SRR and repeated to the Main FDAS Control Panel and to the DCS.

5.0 SCOPE OF SUPPLY

5.1 General

5.1.1 The FDAS scope of supply is to include the cabinets containing the FDAS processors and modules, marshalling cabinets, IS isolation barriers, cord sets, Batteries, Fire Detectors, Manual Call Points, Audible and Visual Alarms

5.1.2 The scope of supply defined in this specification covers but is not limited to the following:

5.1.3 The design, manufacture, supply, assembly and testing of logic components, marshalling and system cabinets, junction, outlet and mounting boxes, power supplies, batteries and distribution, terminations, labels and any other associated hardware necessary to form the complete system described in this specification including detectors, field alarms , auxiliary devices, interface to deluge and sprinkler systems etc. and all other accessories and miscellaneous items required , even though each item is not specifically mentioned or described.

5.1.4 The development and implementation of special dedicated displays for the FDAS showing overall plot plan, process areas, units, equipments, buildings, the corresponding zoning, etc.

5.1.5 The supply of all system maintenance and operation manuals, documentation, software packages, software licences, programming devices for on- and off line configuration, software instructions and references manuals, and application programming required to configure the protective system functions described in this specification.

5.1.6 Interfacing of SRR and building FDAS nodes with sub and higher level systems. Data to be exchanged shall include, but is not limited to the following:

5.1.7 Indication that a protective action has occurred, display of all inputs points under alarm/first out alarm

5.1.8 Indication that a protective function is bypassed

5.1.9 Indication that automatic action (s) such as degradation of voting and/or fault handling has occurred.

5.1.10 Status of sensors and final control elements

5.1.11 System diagnostic status information such as PSU, CPU, I/O Nest, I/O Card etc.

5.1.12 Failure of cabinet environmental conditioning equipment that is necessary to support operation of FDAS nodes

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5.2 System Environment

5.2.1 The FDAS shall consist of independent, stand-alone panels and/ or cabinets installed in air-conditioned, non-hazardous environments within the main control building, SRRs and the others buildings in the refinery.

5.2.2 FDAS equipment installed in buildings (e.g. Analyser Shelters and Laboratories) where a hazardous environment may exist, Equipment offered shall be certified EEx'ia'.

5.2.3 The system shall be designed to operate under following ambient conditions:

Outside ambient temperature (max) :	42.4 °C (Design temperature for outdoor components)
Design Temperature (for air cooled areas):	25 °C
Relative Humidity (non-condensing)	99.7% (Design relative humidity for outdoor components)

5.2.4 Field devices (manual call points, fire detectors, horns, beacons etc.,) shall be suitable for operation outdoors in a salt laden corrosive environment as applicable. All field mounted devices shall be certified, suitable to be installed according to the electrical hazardous area classification.

5.3 System Availability

5.3.1 The FDAS shall be designed to achieve an availability of 99.99% with an assumed Mean Time to Repair (MTTR) of 8.0 hours. Confirmation of the System Availability shall be part of the design developed by the MAC.

5.3.2 The mean time to spurious alarm shall be greater than 10 years.

5.3.3 The mean time between failures (MTBF) of the system shall be submitted as part of the design documentation

5.3.4 The FDAS availability may be based on both MIL-HDBK217 analysis and historical data for comparable systems.

5.4 System Fault reporting and System Redundancy

5.4.1 In order to meet the required system availability (99.99%), SRR FDAS logic solving nodes for process areas shall be of a Fault Tolerant nature, offering full redundancy of logic solving units and communication links to sub systems and higher level networks. Redundancy of logic solving units shall be

achieved by 2oo3D (TMR with diagnostic) or 2oo4D (QMR with diagnostic) configurations.

5.4.2 All single point failures within the FDAS shall cause a fault alarm and shall not cause the system to produce a false fire alarm. System Alarm and diagnostic information from all FDAS nodes shall be reported and available to higher level supervisory systems across the plant wide DCS network. FDAS System alarms on higher level supervisory systems shall be persistent until acknowledged by operations.

5.4.3 It shall be possible to replace, test or implement configuration changes to FDAS SRR and building nodes without disruption to their functionality or operational capability.

5.5 System Communication

5.5.1 The FDAS shall support fault tolerant (full redundant) communication to the plant wide DCS network via coaxial or fibre optic cable. This network shall allow supervision of the entire FDAS system (SRR and buildings) from MCB and the FSCR of the Refinery.

5.5.2 FDAS nodes shall support sub system communications by means of industry standard protocols such as MODBUS, Ethernet and/or Control Net.

5.6 Electrical Requirements

5.6.1 Power Supplies

5.6.2 Power for SRR FDAS nodes shall be provided through redundant feeders from its associated FDAS UPS.

5.6.3 UPS shall be sized to guarantee an operation of the SRR FDAS for at least 30 minutes upon an ac normal power failure, in addition the FDAS shall be provided with dedicated batteries that shall enable the system (s) to remain on line for twenty four (24) hours (per NFPA 72 Section 1-5.2.5) in the event of failure of the main power supply plus five minutes of alarm followed by expiry of the UPS backup time resulting in plant shutdown. Total UPS time 24 hours and 35 minutes.

5.6.4 Battery shall be composed of sealed Ni-Cad cells, maintenance free, 24 VDC nominal.

5.6.5 Battery racks shall be steel with an alkali resistant finish.

5.6.6 Battery Charger shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions.

5.6.6 Battery Charger shall:

5.6.7 Be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.

5.6.8 Have protection to prevent discharge through the charger.

5.6.9 Have protection for overloads and short circuits on both AC and DC sides.

5.6.10 Actuate a trouble alarm signal in the FDAS.

5.6.11 Have automatic AC line voltage regulation, automatic current-limiting features, and adjustable voltage controls

5.6.12 Fire Detectors shall be supplied power from the corresponding FDAS sub-panel installed in each SRR.

5.6.13 The FDAS should be provided with protection against lightning and voltage or current transients. Lightning surge arrestors shall be installed in all fire detector field loops at the marshalling rack to protect FDAS I/O modules.

5.6.14 FDAS system power supplies shall be suitably protected from lightning induced fault /inrush currents via protective devices at the power distribution frame.

5.6.15 The FDAS should be suitably earthed Refer to drawing 3210-8550-63-0001 Instrument Earthing Philosophy Diagram for system earthing requirements. Any special earthing requirements, for the FDAS system, shall be incorporated into the above drawing

5.6.16 Electromagnetic Compatibility (EMC)

The FDAS shall comply with IEC 61000-4 parts 1 to 6 as follows:

- Part 1 General Introduction
- Part 2 Electrostatic Discharge Requirements
- Part 3 Immunity to Radiated Electromechanical Field
- Part 4 Immunity against Fast Transients/Burst
- Part 5 Surge Immunity Requirements
- Part 6 Immunity to Conductive Radio Frequency Disturbances

5.7 Spare Capacity, Loading and Expansion

5.7.1 Spare Capacity

5.7.2 The system shall be designed so that after commissioning the following evenly distributed spare capacity shall be available (as a minimum per system):

5.7.3 System Cabinet;

I/O Modules	20% installed, wired and fully functional I/O for all types (including Field Termination Assemblies)
I/O Racks	10% fully wired spare rack space (modules not included)
Fibre Optic	100% spare fibres
Space within racks	15% of slots used per system

	Space in Cabinet	20%

5.7.4 Marshalling Cabinet;

Space in Cabinet	Minimum 20% free space for hardware with installed DIN rail.
Cable trunks	shall be sized to have 40% spare capacity after all cabling and wiring has been installed
Power supply	The system power supply units shall include 25% spare capacity over and above the peak load (peak load shall be the maximum rack capacity including any spare rack).

5.7.5 See Cabinet specification PDRP-8550-SP-0005 for more details.

5.7.6 Loading Criteria

5.7.7 FDAS nodes shall be designed so that after commissioning no more than 60% of the processing capacity and/or memory are used.

5.7.8 FDAS inter node communication networks shall also be designed so as not to exceed 60% loading after commissioning.

5.7.9 FDAS node to sub system communications load shall be designed so that after commissioning shall not exceed 40%.

5.7.10 FDAS node power supplies shall be rated 25% over and above the installed loading capacity.

5.8 Standard Hardware and Software

5.8.1 All FDAS hardware, software, design and implementation shall be Factory Mutual Approved and comply with NFPA 72.

5.8.2 The FDAS shall employ standard hardware and software configured to meet the stated requirements.

5.8.3 FDAS system offered by the MAC should be current and of latest specifications.

5.8.4 The system software shall be the latest commercially released version at the time of award.

5.8.5 All necessary software licenses shall be provided enabling the right to exercise the use of all relevant and applicable software.

5.8.6 Supplied software and licenses should not be time bound. Validity of license should be unlimited. Re-licensing of software should not require formatting of computer workstations or changing of hardware.

5.8.7 The Complete FDAS shall be of the same software release version

5.9 Time Synchronization

5.9.1 All FDAS clocks shall be synchronized with the DCS clock, which shall serve as master for all systems in the Plant.

5.9.2 MAC shall advise how this will be implemented within the Building FACPs

6.0 HARDWARE REQUIREMENTS

General requirements as per 4.0 System description and function.

6.1 FDAS nodes for process units - Architecture

6.1.1 FDAS nodes shall consist of rack mountable module nests. All modules in the nest must be exchangeable on-line with no detrimental effect to FDAS operations.

6.1.2 Nodes shall consist of racks with modules as follows:

6.1.3 Redundant Central Processing Units (CPU's).

6.1.4 Redundant Power supplies for CPU's.

6.1.5 Redundant Power supplies for I/O modules.

6.1.6 Redundant Inter node communication cards.

6.1.7 Redundant Networking cards for higher level communications.

6.1.8 Redundant Networking cards for sub system communications.

6.1.9 Redundant Internal and external communication busses.

6.1.10 Galvanically isolating I/O cards with possibility of redundancy where necessary for critical applications.

6.2 Human Interfaces

6.2.1 SRR FDAS for process units

6.2.2 SRR FDAS process nodes shall have a local stand-alone Operator Interface with touch screen plus trackball. In addition, display of FDAS fire status for all process plant areas and information shall be made available via dedicated Fire and Gas Zone graphics on the plant wide DCS in the MCB and FDAS in the FSCR. For each process area and non-process area, FDAS status graphics shall be shown on the relative DCS console.

6.2.3 Fire and Gas alarms shall be treated as critical alarms and as such shall have a dedicated pop up display and audible tone on DCS.

6.2.4 Specific Fire and Gas Zone graphics shall be designed such that the operator, by using the touch screen or equivalent interface shall be able to display an overall plot plan, followed by process area plans, process unit equipments, F&G zones and finally indication of sensors and detectors. Live status devices shall be displayed.

6.2.5 The Fire and Gas Zone graphics shall incorporate wind direction and velocity information. MAC shall interface the FDAS with the wind direction and velocity sensor at the MCB for these signals.

6.2.6 As a minimum requirement there shall be at least two FDAS workstations in the FSCR console suite for redundancy /availability an alarm annunciator and HWC shall be provided at both of the FSCRs. (North and South)

6.2.7 All FDAS Inputs/Outputs displayed on the DCS such as faceplates, loop detail, trending, alarms, etc, shall be implemented in an identical manner to those for the process.

6.2.8 FDAS for Local Buildings

6.2.9 Refer to Appendix 2 for Building Fire Alarm control panel Specification.

6.2.10 Each building (administration, medical services, control rooms, dining rooms etc) being protected shall be provided, in accordance with local fire codes, a summary status/mimic panel located on the wall entrance lobby at the main entrance at the building.

6.2.11 Display panels shall show fire zones with locations of detectors and individual alarms and system status related to the floor plan of the building.

6.2.12 Status of test enable operational overrides and manual alarm initiation enable shall be provided as LEDs on the individual building mimic panels.

6.2.13 Zone alarms shall be provided to the FDAS and subsequently displayed on the appropriate DCS graphic.

6.2.14 The MAC shall adopt a multi layered approach to Building Fire Alarm graphical representation at the HMI. A drill down method from a Primary layer Building outline to individual zones within the building shall be provided with individual detectors shown at the lowest level

6.3 Printers

Dedicated FDAS colour laser printers shall be supplied for SRR and FSCR locations connected to FDAS workstations.

6.4 Cabinet Equipment

6.4.1 System Cabinets and Marshalling Cabinets shall be provided in accordance with specification PDRP-8550-SP-0005 “Control/Marshalling Cabinet Specification”.

6.5 Sequence Of Event Recording

6.5.1 It shall be possible to record, display, report, archive, filter and interrogate Sequence of Events (SOE) for all inputs and outputs of the FDAS through the FDAS HMI which shall also act as an SOE workstation.

6.5.2 A dedicated FDAS SOE system (server) shall be located in each of the Control Buildings (MCB/UCB/ETP).

6.5.3 The FDAS SOE system shall communicate with the DCS SOE using serial communications as defined in section 5.5 above.

6.5.4 The above requirements shall be fully integrated standard features of the SOE software and not accomplished by custom written scripts.

6.5.5 Easy, icon or button driven access to the SOE display must be possible. It should not be necessary to have to manually filter non FDAS alarms from the SOE as this should be viewable on its own pages if required.

6.5.6 However, for post event diagnostics it would also be advantageous to be able to view events from the ESD, DCS, FDAS, MMS and other subsystems together as required.

6.5.7 SOE triggers from any form of FDAS input, output or conditional rule must be easily configurable and use comprehensive descriptions.

6.5.8 Time stamping of events shall be done at source (FDAS nodes) with a resolution of 1ms, this time stamp data shall be used in all displays and reports. Time shall be synchronised across all nodes throughout the refinery through the DCS acting as time master.

6.5.9 It shall be possible to Archive data from SOE to a permanent storage media such as CD or Tape drive.

6.5.10 SOE data should be accessible from higher level plant wide networks.

6.5.11 At least 96 hours history for sequence of events should be available in hard disk with LIFO facility

6.6 System Wiring Requirements

6.6.1 The FDAS cabling shall be fire retardant with a Red outer sheath colour according to IEC331/332 and segregated from other cabling. Refer to PDRP-8550-SP-0002 Instrument Cable standard.

6.6.2 All wires shall be colour coded. Number and sizes of conductor shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for initiating device circuits and 14 AWG for notification device circuits.

6.6.3 Addressable circuits and wiring used for the communications loops shall be twisted and shielded unless a specific exception has been requested by the FDAS manufacturer in writing.

6.6.4 Junction boxes and associated equipment shall be labelled. Lettering shall be a minimum of 3/4 inches

6.7 Input/Output Structure

6.7.1 System I/O modules shall be selected so that the need for separate signal conversion shall be avoided. The use of I/O with signal processing facilities built-in shall be preferred.

6.7.2 I/O counts shall be prepared on an FDAS node basis with separate I/O counts prepared for Buildings.

6.7.3 The FDAS nodes shall have I/O nests assigned on a per Fire-Zone basis. However, this shall be rationalised to make most efficient use of available I/O and reduced cabinet footprint during detailed design. EPCM shall consult with MAC to achieve an optimum design.

6.7.4 End of line monitoring shall be provided for detectors/switches. Alarm device outputs (e.g. beacons, audible sounders) shall be monitored for open or short circuit. Fault alarms shall be raised for open or short circuit conditions.

6.7.5 All Input modules shall provide galvanic isolation from between field and system.

6.7.6 Input Modules

6.7.7 Analogue Inputs Modules

6.7.8 Designed to accept 0-22 mA current signals, with the normal range of operation 4-20 mA. LED indicators are to be provided on the front of the circuit's board, visible, showing the status of the field input circuits. 0-22 mA input cards shall be able to measure both over range (>20mA) and under range (<4 mA) currents and provide a fault alarm as appropriate.

6.7.9 Digital Input Modules

6.7.10 Required for contact inputs from key switches, other subsystems etc. Input modules to be provided with LED indicators on the front, showing the status of the field input circuits. End of line fault monitoring shall be provided for detectors and switches.

6.7.11 Output Modules

6.7.12 Output modules shall provide following output signals:

6.7.13 Alarm Sounders

6.7.14 Alarm Beacons

6.7.15 Lamps

6.7.16 Trip signals

6.7.17 Deluge release solenoid valves

6.7.18 Output modules furthermore shall:

6.7.19 Have LED Displays indicating outputs status

6.7.20 Provide power to the external circuit as required

6.7.21 If potential free contacts be rated 24 VDC, 1.5Amp. , and higher currents are required, then interposing relays shall be used

6.7.22 A line monitoring facility shall be provided for alarm device outputs.

6.7.23 Earth Leakage Detection

6.7.24 Where galvanically isolated I/O modules have been used no reference to ground exists on wiring to the field. Grounding of a signal line should not affect the loops functionality.

6.7.25 Where non-galvanically isolated I/O modules have been used a system of ground leakage detection must be employed. This function consists of a detection/alarm system, which continuously monitors and alarms when one of the connected field circuits has an earth fault. This shall be implemented for each main power supply feeder to each group of field circuits. Upon earth fault detection a local lamp shall be illuminated inside each I/O cabinet and a common alarm shall be transmitted to the DCS.

7.0 FUNCTIONAL REQUIREMENTS

7.1 General

7.1.1 The functional design of the FDAS will be based on the requirements of this specification and the following documents:

- Cause and Effect Chart to be developed by EPCm to determine the detailed operation including fire detectors, manual call points, horns etc in case of a fire incident

7.1.2 FDAS detection logic shall be implemented as de- energised for normal – energised for abnormal alarm conditions. E.g. Contacts inputs are normally open, closing in alarm condition. Outputs are normally de-energised and energised in the Alarm or trip condition. Both input and output circuits shall be line monitored for fault conditions. Monitoring integrity and trouble reporting of signal and notification circuits shall be in accordance with Table 6.6.1 and 6.7 of NFPA-72 respectively.

7.1.3 Fire Alarms should be displayed at the HMI local to the FDAS nodes and repeated at the DCS. Alarms shall identify the type and the location of the sensing device activated.

7.1.4 The DCS operator shall normally initiate the required action from the DCS console manually on receipt of an alarm condition for alarm acknowledgement.

7.1.5 An FDAS HWC shall be provided per area /console this shall be a combined HWC with ESD HWC with Executive actions such as manual Deluge release or manual Firewater pump start commands shall be hardwired from the HWC to the nearest FDAS node.

7.1.6 Automatic executive actions (shutdowns, extinguishant release) will be decided by Hazop study and shall require IOCL approval before implementation (example: fire protection of LPG tanks (OISD Std-144)).

7.1.7 The FDAS shall be capable of:

- The system shall display a running count of all events by tag number within a "zone", which are in alarm This shall include Alarm, Trouble, Security, Supervisory, and Access Control Events
- Counting "zones" which are in alarm
- Differentiating types of addressable detectors such as smoke detectors, fire detectors, heat detectors, manual stations, valve tamper switches, water flow switches. This shall be done by tag number.
- Cross-zoning

7.1.8 All buildings shall be provided with manual call points, smoke and heat detectors and alarm bells in accordance with international building fire codes (NFPA 72).All devices shall be provided with a unique address which will report the device status by tag number to its location (Fire zone) within the building on the Building Fire Panel. Refer to appendix 2 for Building Fire Panel specification.

7.1.9 Actuation of any manual call point will alarm in the control room DCS console and FDAS HMI's, activate the appropriate audio and visual alarm corresponding to the location fire process area, and display in the annunciator panel the corresponding fire zone.

7.1.10 Site wide alarm units operable in individual alarms areas from the MCB and consisting of a dual tone device for alarm or evacuate tones, shall be located across the plant.

7.1.11 Where voting of non-addressable detectors is used for confirming fires, detector signal lines shall be to different input cards.

7.1.12 Manual activation of alarming for each zone and overall unit/ plant shall be possible from FDAS graphics located on the DCS console in the MCB and FDAS HMI's.

7.1.13 Alarm resets for Fire Alarm Panels located in buildings, shall be implemented in accordance with NFPA 72 and local buildings codes.

7.1.14 Alarm resets for SRR FDAS process nodes shall be made from the respective SRR.

7.2 Online System Testing

7.2.1 The FDAS shall be provided with test facilities to enable all inputs and all outputs to be tested.

7.2.2 Each alarm and notification circuit shall be opened/closed to ensure that the trouble signal is activated.

7.2.3 Each alarm and notification circuit shall be grounded to ensure that the trouble signal is activated.

7.3 Diagnostics

7.3.1 FDAS system information shall be displayed on the FDAS HMI.

7.3.2 Extensive diagnostic capability including the diagnosis of hidden failures is required. A diagnostic display shall be provided on the engineering workstation. The detail shown shall be sufficient to locate faulty cards and define the cause.

7.3.3 The system equipment shall monitor its own hardware and all field circuits which are not “self revealing” (normally de-energised), and annunciate system faults at the DCS to protect against unrevealed faults. Where required, end of line monitoring shall be provided for energise-to-trip circuits.

7.3.4 The minimum requirements for system diagnostics shall be as follows:

7.3.5 Analog input diagnostics - Sensor out of range, open or shorted loop, analog-to digital converter check.

7.3.6 Analog output diagnostics - Open or shorted loop

7.3.7 Configuration diagnostics - Checking the compatibility and availability of selected I/O hardware and software.

7.3.8 Memory diagnostics - Checksum, parity check etc.

7.3.9 End-to-End CPU/ memory diagnostics - Processor executes a test control or arithmetic algorithm, then compares results with pre-stored answer.

7.3.10 Peripherals and foreign devices' diagnostics - WDT to confirm proper operation.

7.3.11 Power system diagnostics - monitor the availability of supply voltages.

7.3.12 For any 2 out 3 voting logics, in addition to individual and voted alarm, contractor shall provide a maintenance alarm indicating discrepancy shown by any of inputs.

8.0 FIRE DETECTION ELEMENTS AND CIRCUITS

Refer to Appendix 1 for a comprehensive Fire detection Device specifications.

8.1 Public Address System (PAS) interface

8.1.1 The FDAS should be connected to the PAS and it will generate the appropriate alarm tones and/ or issue pre-recorded announcements.

8.1.2 Upon receipt of an alarm signal from the FDAS the operator will activate the PAS, which will transmit a pre-recorded fire alarm message to the floor in alarm, the floor above and the floor below.

8.2 Supervisory Devices – Fire Water System

8.2.1 All sprinkler system valves switches, sprinkler water flow switches, sprinkler pressure switches shall be supervised by the FDAS to indicate and alarm abnormal conditions in the fire protection system or to indicate the activation of a sprinkler system. They shall be connected to the Building FACP by address reporting interface device. The Building FACP will then transmit the information to the appointed FDAS node.

8.2.2 Firewater Pump signals for both diesel and electric pumps shall include but not be limited to:

- Electric pumps: running status, power failure and phase reversal supervisory alarms.
- Diesel Pumps: running status, failure to start, controller off/ automatic, and trouble (e.g., low oil pressure, high temperature, over speed low fuel level)

8.2.3 These signals shall be interfaced using supervised (line monitored) I/O, at the nearest FDAS node located in the associated SRR. Signal requirements shall be defined during detailed design.

8.3 Address Reporting Interface Devices

8.3.1 Where suitable addressable detectors are not available for a particular application, addressable interface devices may be used under the following conditions:

8.3.2 Shall have unique addresses that reports directly to the local process area corresponding FDAS control panel

8.3.3 Shall be configurable to monitor normally open or normally closed devices for both alarm and trouble conditions.

8.3.4 Shall have terminal designations clearly differentiating between the circuit to which they are reporting from and the device that they are monitoring.

8.3.5 Shall be listed by Underwriters Laboratories Inc (UL) for fire alarm use and compatibility with the main control panel and sub-panels of the FDAS.

8.3.6 Shall be approved by EPCM-1/IOCL

9.0 ENGINEERING EQUIPMENT AND BUILDER SOFTWARE

9.1 General

9.1.1 Application development shall be by means of graphical Logic drawings or Cause and Effect tables.

9.1.2 Standard libraries of Logic functions shall be used at all times.

9.1.3 All logic functions to be easily followed.

9.1.4 Builder function shall also allow for application diagnostics on-line.

9.1.5 Ladder, relay network, low level or high level language programming shall not be used.

9.1.6 SRR FDAS nodes for process shall be configurable via a Central Engineering Workstation dedicated to the SRR FDAS systems, located in the MCB of the Refinery. The Central Engineering Workstation shall communicate with SRR FDAS nodes via a dual redundant digital communication network.

9.1.7 The Central Engineering Workstation for the SRR FDAS nodes shall be the sole repository for the FDAS application database.

9.1.8 Engineering of Building FDAS Fire Alarm Panels shall be by laptop portable workstations or local stand-alone control panels and configurable via front of panel touch screens under access control.

9.1.9 In either SRR or Building FDAS it shall be possible to configure off-line using the Appropriate Engineering Workstation.

9.1.10 Logic testing and logic diagram generation shall be possible using the software supplied with the FDAS.

9.1.11 Configuration Equipment shall:

- Be capable of accessing and configuring an FDAS node without requiring Alarm overrides.
- Provide I/O monitoring, logic modification, relocation of logic blocks within memory, search facilities and faults diagnostics.
- Include passwords or similar access protection prioritized according to operators plant managements level
- Provide I/O forcing facility (Password Protected)

9.1.12 All required software, manuals and licenses shall be included for each workstation.

9.1.13 Soft manuals and documentation for the FDAS system shall be included on CD ROMs for each Workstation (including all required reader software and licenses)

9.2 Configuration Guidelines

9.2.1 Configuration should be organised as follows:

9.2.2 Outputs are always conditional on inputs (not set or reset separately)

9.2.3 Areas/ buildings/ zones order in systematic relationship to the cause & effect diagrams

9.2.4 Configuration shall follow Cause & Effect Diagram.

9.2.5 Logic functions depending on program order shall be avoided.

9.3 Self Documentation

9.3.1 The Engineering workstation should be capable of generating or producing:

9.3.2 Logic diagrams

9.3.3 Inputs/ Outputs List

9.3.4 CD copy of data/ program

10.0 SUBMITTALS

Documentation requirements for the FDAS are detailed in the 'Material Requisition for Main Automation Contractor' PDRP-RQ-4301-1617A-001.

11.0 PROJECT EXECUTION

11.1.1 Installations shall be in accordance with this specification and with OISD- Std. 116, NFPA 72 and NFPA 101 and as recommended by the major equipment manufacturer.

11.1.2 Project Execution requirements are detailed in the 'Material Requisition for Main Automation Contractor' PDRP-RQ-4301-1617A-001

12.0 INSPECTION AND TESTING

12.1.1 The MAC is responsible for ensuring that a full integrated inspection and testing of the FDAS is performed. Prior to testing a MAC's qualified representative shall inspect the whole FDAS for compliance with the manufacturer's requirements and applicable codes and this specification.

12.1.2 A Factory Acceptance Test (FAT) of the FDAS shall be carried out, at the MAC's works. This FAT shall be carried out in accordance with specification PDRP-8550-SP-0011 "Inspection and Testing of Electronic Control Systems"

12.1.3 As a pre –requisite to the commencement of the FAT the MAC shall demonstrate that all FDAS field devices have completed individual type testing to establish interfacing compatibility with the FDAS. Documentation in support of the type tests shall be made available for inspection prior to commencement of FAT.

12.1.4 The SAT shall be carried out in accordance with the specification PDRP - 8550-SP-0011.

13.0 TRAINING AND INSTRUCTION

The MAC shall provide training services for IOCL's operation, engineering and maintenance personnel. Training requirements are detailed in the 'Material Requisition for Main Automation Contractor' PDRP-RQ-4301-1617A-001

14.0 SPARE PARTS

Spare parts requirements are detailed in the 'Material Requisition for Main Automation Contractor' PDRP-RQ-4301-1617A-001 and requirements for spare parts 3210-8820-SP-0008.

15.0 APPENDIX 1: FIRE DETECTION FIELD DEVICES

15.1 Detailed requirements field mounted equipment

All equipment including field devices and associated supervisory systems shall be designed and implemented in accordance with NFPA-72.

15.2 Hazardous area Classification

15.2.1 Not withstanding the hazard classification assigned to the area in which an instrument is located, which is generally Zone 2 for hazardous areas subject to flammable gas / vapours, all instruments shall be:

- Certified as a minimum EEx'ia'.
- The certification listed above, shall be provided by the Chief Controller of Explosives (CCOE), Nagpur, India, and an Internationally recognised authority,

15.2.2 Not withstanding the hazard classification assigned to the area in which an instrument is located, for hazardous areas subject to flammable dust / fibres, all instruments, except the drive section of motorised valves, shall be;

- Certified, as a minimum, EEx'iaD',.
- The certification listed above, shall be provided by the Chief Controller of Explosives (CCOE), Nagpur, India, and an internationally recognised authority.

15.2.3 Field devices located in areas specified as electrically non hazardous shall be classified as general purpose. The Fire Detection and Audible /Visual alert equipment shall be installed in air-conditioned, non-hazardous environments within buildings such as main control building, SRRs and others buildings in the refinery.

15.2.4 Fire Detection and Audible /Visual alert devices shall be Addressable type for connection to the Building Fire Alarm Control Panel via an Addressable network. The termination housing shall be of an Industrial grade flame retardant material with a painted finish to the manufacturer's standard

15.3 Manual Call Points (Process Area)

15.3.1 Field mounted manual call points shall be fully tropicalised and all atmospheric vents fitted with bug screens where applicable.

15.3.2 Manual call points located in areas, not subject to flooding, shall be certified in accordance with IEC 60529, as IP 66. The housing shall be of an Industrial grade with a painted finish to the manufacturer's standard suitable for sulphurous, salt laden environmental conditions.

15.3.3 Manual Call points shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.3.4 Manual Call points shall have 2 sets of contacts 1 NO and 1NC. Contacts are to be rated at 24VDC @ 1A. The enclosure shall have sufficient space to accept both in line and end of line resistors.

15.3.5 Terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.3.6 Manual call points shall be supplied with complete with associated In-line and end of line resistors fitted.

15.3.7 Manual Call points shall be Break Glass. Once activated the internal button will be latched and reset from the system following replacement of the glass insert.

15.3.8 Manual Call points are to be painted red and labelled “FIRE”.

15.3.9 Manual Call points shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved.

15.4 Manual call points (Buildings)

15.4.1 Manual call points located in buildings shall be of the Addressable, type suitable for the assignment of a unique system address. Address identity will be easily configured on the device using DIP switches within the device.

15.4.2 MAC shall ensure device compatibility with the Building Fire Alarm Panel. Device change of status from healthy shall be clearly identified. Fault and Alarm statuses shall be reported to the Building Fire Alarm panel.

15.4.3 Manual call point enclosure for this application shall be certified for use in safe areas classed as general purpose suitable for a clean, dry air conditioned indoor environment.

15.4.4 Manual Call points shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.4.5 Manual Call points shall have 2 sets of contacts 1 NO and 1NC. Contacts are to be rated at 24VDC @ 1A.

15.4.6 Terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.4.7 Manual Call points shall be Break Glass type. Once activated the manual Call point status shall be latched at the Building Fire Alarm panel. Reset shall be carried out after glass replacement and reset from the Building Fire panel.

15.4.8 Manual Call points are to be painted red and labelled “FIRE”.

15.4.9 Manual Call points shall be provided with the vendor’s proprietary nameplate with the instrument tag number clearly engraved suitably affixed.

15.5 Optical /Ionisation Type Smoke Detector (Buildings)

15.5.1 General

15.5.2 Ionisation Smoke detectors detect the presence of smoke by means of a small ionisation chamber and a source of ionising radiation.

15.5.3 Ionisation Smoke detectors are generally better at detecting smaller smoke particles such as that produced by rapidly burning fires but are less sensitive to larger smoke particles generated by smouldering fires

15.5.4 Ionisation Smoke detectors are generally better at detecting smaller smoke particles such as that produced by rapidly burning fires but are less sensitive to larger smoke particles generated by smouldering fires.

15.5.5 Optical Smoke detectors detect the presence of smoke by means of a small light source and a separate photoelectric light sensitive cell housed within a sensing chamber. Smoke particles entering the chamber cause some of the light to be directed toward the photoelectric cell. By measuring the amount of light reaching the photoelectric cell an alarm condition can be generated at the required sensitivity.

15.5.6 Optical Smoke detectors are generally more sensitive to larger smoke particles such as that generated by dense smoke or smouldering fires but are less sensitive to smaller particles associated with rapidly burning fires.

15.5.7 Smoke Detectors located in buildings shall be of the Addressable, type suitable for the assignment of a unique system address. Address identity will be easily configured on the device.

15.5.8 MAC shall ensure device compatibility with the Building Fire Alarm Panel. Device change of status from healthy shall be clearly identified. Fault and Alarm statuses shall be reported to the Building Fire Alarm panel.

15.5.9 Smoke Detectors for this application shall be certified for use in safe areas classed as general purpose suitable for a clean, dry air conditioned indoor environment.

15.5.10 Smoke Detectors shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.5.11 Smoke Detectors shall be provided with the vendor's proprietary nameplate with the instrument tag number clearly engraved suitably affixed to the detector base.

15.5.12 Smoke Detectors shall be provided with an integral LED status indicator which will be illuminated in the event of smoke being detected. The LED shall remain latched until reset from the Building Fire Alarm Panel.

15.5.13 Smoke Detectors located in floor, ceiling voids or HVAC ducts shall have their associated LED status indicator wired and surface mounted remotely from the detector with the device Tag Number mounted alongside .HVAC duct mounted devices shall be supplied with suitable mounting kits to simplify connection to the duct.

15.6 Open path Smoke Detectors

15.6.1 For larger area coverage such as in substations, workshops and large storage areas, open path smoke detection units shall be applied. These are made up of a Transmitter unit projecting a beam of IR light to a receiver unit mounted directly opposite. The beam will be projected above equipment being protected smoke interrupting the beam will set the Receiver into the alarm condition.

15.6.2 Alarm condition shall be latched once smoke is detected and reset from the Building Fire alarm panel.

15.6.3 The Transmitter unit shall maintain beam strength over time by employing suitable gain control features to avoid beam degradation.

15.6.4 Receiver unit shall provide Digital Alarm and Fault outputs. The use of Address reporting Interface units may be required to provide a unique address to interface the Receiver unit Fault and Alarm signals with the Building Fire Alarm Panel.

15.6.5 Transmitter /receiver units shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.6.6 All power supply provision and distribution for both Transmitter and Receiver units shall be included.

15.6.7 Transmitter /receiver units shall be supplied with suitable mounting kits.

15.6.8 Transmitter /receiver units shall be supplied with beam alignment kit if appropriate.

15.6.9 Transmitter/Receiver units shall be provided shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved

15.7 Very Early Smoke Detection Apparatus (VESDA)

15.7.1 Areas requiring continuous monitoring for incipient fire conditions such as room and floor voids in communication facilities, control room, I/O rack room etc may employ a VESDA system.

15.7.2 Sampling tubing arrangement shall be determined by MAC and building supplier to provide the most efficient layout in facilitating the most responsive detection of smoke in the areas covered.

15.7.3 VESDA system shall include all necessary hardware/tubing to furnish a complete system.

15.7.4 VESDA system shall offer multiple channels with multiple alarm settings as a minimum requirement the system shall provide 4 sampling channels with 2 alarm set points per channel to provide a 2 stage alarm.

15.7.5 VESDA unit shall provide comprehensive self diagnostics to report sampling tube/ blocked filter and low sample flow rate as a common fault output to Building Fire Alarm Panel. Individual faults shall be displayed on VESDA display to assist maintenance personnel.

15.7.6 VESDA system shall provide Digital Alarm and Fault outputs.(SPDT volt free contacts) Relay contacts shall be rated at 24VDC 1A The use of Address reporting Interface units may be required to provide a unique address for each signal to interface Fault and Alarm signals with the Building Fire Alarm Panel

15.7.7 Interface terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.7.8 Alarm channels and detection tubing circuits shall be suitably labelled at the connection to the VESDA with permanently affixed tag label.

15.8 Heat Detector (Buildings)

15.8.1 Heat Detectors shall be located in kitchens and canteens shall be of the combined rate of rise with fixed temperature devices, addressable, type suitable for the assignment of a unique system address. Address identity will be easily configured on the device using DIP switches within the device.

15.8.2 MAC shall ensure device compatibility with the Building Fire Alarm Panel. Device change of status from healthy shall be clearly identified. Fault and Alarm statuses shall be reported to the Building Fire Alarm panel.

15.8.3 Heat Detectors for this application shall be certified for use in safe areas classed as general purpose suitable for a clean, dry air conditioned indoor environment.

15.8.4 Heat Detectors shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.8.5 Heat Detectors shall be provided with the vendor's proprietary nameplate with the instrument tag number clearly engraved suitably affixed to the detector base.

15.8.6 Heat Detectors shall be provided with an integral LED status indicator which will be illuminated in the event of smoke being detected. The LED shall remain latched until reset from the Building Fire Alarm Panel.

15.9 Heat Detector (Hazardous area)

15.9.1 Pneumatic tubing circuits shall be routed around critical equipment items to be protected by Firewater Deluge release. The pneumatic line will be connected directly to the deluge valve. A fire will burst the pneumatic tubing and vent the air to atmosphere allowing the Deluge Valve to pass water on to the equipment being protected.

15.9.2 In addition to the automatic release due to fire, provision shall be made for local release via manual operation of a vent valve mounted close to the protected equipment.

15.9.3 Remote operation from HWC mounted pushbutton in the main control room via safety network to FDAS in SRR will energise the Deluge release solenoid valve and release water to protected equipment.

15.10 Linear Heat Detector (Hazardous area)

15.10.1 The linear heat detector shall be of the integrating (averaging) type and consist of four small gauge solid copper conductors each insulated with a negative temperature coefficient material. The conductors shall be twisted sufficient to cancel out potential high voltage inductance.

15.10.2 Cable length and maximum ambient temperature should be carefully considered when configuring the detection circuit to avoid reducing the effectiveness of the circuit.

15.10.3 The conductor insulation shall be colour coded for ease of installation. The sensor cable shall have an outer protective extrusion of high temperature PVC material.

15.10.4 The linear heat detector shall have a field adjustable alarm set-point.

15.10.5 The sensor cable shall be self-restorable to its normal condition after an alarm up to 257°F (125°C).

15.10.6 The sensor cable shall be capable of being spliced in the field.

15.10.7 Linear Heat detector cable shall be connected to a suitable controller/interface module which provides power to the cable and facilitates the interface to the FDAS.

15.10.8 Controller/interface module enclosure shall be certified in accordance with IEC 60529, as IP 66. The housing shall be of an Industrial grade with a painted finish to the manufacturer's standard suitable for sulphurous, salt laden environmental conditions.

15.10.9 Controller/interface module shall be certified for use in a hazardous area. Refer to paragraph 8.1.3 for specific requirements.

15.10.10 Controller/interface module shall be field mounted and provide Digital Relay outputs for Fire and Fault. (2 off SPDT Form C). Relays shall be energised in the alarm condition to close volt free contacts. The module shall be capable of reporting open and short circuit faults. Relay contacts shall be rated at 24VDC 1A.

15.10.11 Interface terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.10.12 Terminals shall provide sufficient space to allow installation of In-line and end of line resistors to facilitate line monitoring of circuits from FDAS.

15.10.13 Controller/interface module shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.10.14 A multi position test switch shall be provided to allow a simple electronic test of the controller/interface module's electronic circuitry. The switch shall simulate Fire and both open and short circuit faults. Facility shall be provided to lock the switch in the normal i.e. non 'Test' mode.

15.10.15 Linear Heat cable shall be supplied with all mounting clamps and installation accessories.

15.10.16 Controller/interface module shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved.

15.11 Flame detection (Hazardous area)

15.11.1 Flame detection shall employ Multi spectrum Infra-red technology to provide the highest level of false alarm rejection and fire detection performance.

15.11.2 Flame detector field of view shall be 90 degrees for at least 45 meters (150 feet) based on a 1 ft x 1 ft Gasoline fire. This is a minimum requirement, positioning of Flame detectors shall be optimised to maximise the device sensitivity.

15.11.3 Flame detectors shall be tuned to respond to Flame within 5 seconds. This is based on a Gasoline fire at 45 meters (150 feet).response time will depend on distance from the source of fire and the type of fuel.

15.11.4 Flame detector shall provide Digital Relay outputs (2 off SPDT Form C) for Fire and Fault alarms. Fault alarms shall be generated as a result of detector internal diagnostics. Relays shall be normally de-energised., contacts closing in alarm condition. Relay contacts shall be rated at 24VDC 1A.

15.11.5 Flame detector enclosure shall be certified in accordance with IEC 60529, as IP 66. The housing shall be of an Industrial grade suitable for sulphurous, salt laden environmental conditions.

15.11.6 Flame detector shall provide local indication of status via LEDs which will illuminate for Flame detected and Fault detected as a minimum requirement.

15.11.7 Interface terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.11.8 Terminals shall provide sufficient space to allow installation of In-line and end of line resistors to facilitate line monitoring of circuits from FDAS.

15.11.9 Flame detector shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.11.10 Flame detector shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved.

15.12 Audible Alarm Devices (Hazardous area)

15.12.1 Audible alarm devices shall be certified in accordance with IEC 60529, as IP 66. The termination housing shall be of an Industrial grade with a painted finish to the manufacturer's standard suitable for sulphurous, salt laden environmental conditions.

15.12.2 Sirens shall be provided to alarm within each process area. These shall be sited to ensure full coverage of the area. MAC shall consult with EPCM/ IOCL to determine quantity and distribution of Sirens.

15.12.3 Fire siren code should be as follows:

- Small fire : No siren

- Major Fire: A wailing siren for two minutes. Sirens will be sounded three times for thirty seconds with an interval of fifteen seconds in between.
- Disaster: Same type of siren as in case of Major Fire but the same will be sounded for three times at the interval of two minutes.
- All Clear: Straight run siren for two minutes
- Test: Straight run siren for two minutes

15.12.4 Audible alarm devices shall be certified for use in a hazardous area. Refer to paragraph 8.1.3 for specific requirements.

15.12.5 Audible alarm devices for Fire alarm annunciation shall be provided with facility to produce two tones, a wailing tone signifying a Fire event and a continuous tone signifying All clear. Refer to paragraph 15.13.5 for specific alarm pattern requirements.

15.12.6 Sound output power level shall be 115dB at 1 metre from the device.

15.12.7 Audible alarm devices shall be driven from the FDAS in the associated SRR as a 24VDC Digital output.

15.12.8 Audible alarm devices shall be painted Red.

15.12.9 Interface terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.12.10 Audible devices shall be Line monitored from the associated supervised digital output within the FDAS in the associated SRR.

15.12.11 Audible devices shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.12.12 Audible devices shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved.

15.13 Audible Alarm Devices Sounders (Buildings)

15.13.1 Audible alarm devices shall be selected for annunciation of a Fire alarm driven from the Building Fire Alarm Panel. Building Fire devices may be a simple fire Bell or sounder capable of generating the wailing tone as defined in paragraph 15.13.5.

15.13.2 The number and location of bells/ sounders installed within buildings shall ensure adequate coverage. All Fire Alarm bells/ sounders within a building should have similar sound characteristics and should be distinctive from the sound for other alarm systems in the building

15.13.3 Additionally the building Fire alarm panel shall also provide an interface with the FDAS to annunciate process area Fire Alarms as directed by the operator. These devices will have the same output functionality as the process area sounders. Audible devices shall be Addressable with each device having its own network address within the building, compatible with the Building Fire Alarm Control Panel. However, conventional devices may be connected using an Address Reporting Interface Devices.

15.13.4 Audible alarm devices shall be classified as general purpose. The termination housing shall be of an Industrial grade flame retardant GRP with a painted finish to the manufacturer's standard suitable for an indoor location.

15.13.5 Audible alarm devices for Fire alarm annunciation for events transmitted via the FDAS into the Building Fire Alarm panel shall be provided with facility to produce multiple tones,

- A wailing tone signifying a Fire event in the building frequency 500Hz to 1000Hz.
- A continuous tone signifying All clear. Sound output power level shall be 65dBA at 1 metre from the device.

15.13.6 Audible alarm devices shall operate at 24VDC.

15.13.7 Audible alarm devices shall be painted Red.

15.13.8 Audible devices shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.13.9 Interface terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.13.10 Bells/ sounders shall have a sound pressure level (SPL) of not less than 65 dB(A) in all occupiable areas

15.13.11 Bells/ sounders should exceed the ambient noise level by at least 5 dB(A) subject to a minimum of 65 dB.

15.13.12 It is preferred that the required sound level is obtained by using multiple small sounders (e.g. 110 dB(A)) within each alarm area rather than using a single or a small number of large power output (>130 dB(A)) sounders for each alarm area

15.13.13 Audible devices shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved.

15.13.14 Audible devices shall be continuously monitored from the Building Fire Panel for operational status. A fault will generate an alarm at the Building Fire Panel.

15.14 Audible Alarm Devices Fire Bells (Buildings)

15.14.1 Motorised Fire Bells shall operate at 24VDC. They will connect to the Building Alarm panel network via Address Reporting Interface Devices.

15.14.2 Fire Bells shall operate at 24VDC.

15.14.3 Fire Bells shall be stove enamelled Red finish with a nominal diameter of 150mm (6 inches).

15.14.4 Fire Bells shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.14.5 Interface terminals shall be polarised and suppressed and capable of accepting 2.5 mm2 stranded cable.

15.14.6 Sound output power level shall be a minimum of 95dBA at 1 metre from the device.

15.14.7 Fire Bells shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved.

15.14.8 Fire Bells shall be provided with all required mounting brackets and accessories.

15.15 Visual Alarm Devices (Hazardous area)

15.15.1 Beacons must be provided where ambient noise levels exceed 90 dB(A) (e.g. compressor houses) or close to confined spaces like Analysers Shelters.

15.15.2 The flash rate should be between 30 and 130 flashes per minute, protected Xenon tube strobe elements shall be used.

15.15.3 Visual alarm devices (Beacons) shall be certified in accordance with IEC 60529, as IP 66. The termination housing shall be of an Industrial grade with a painted finish to the manufacturer's standard suitable for sulphurous, salt laden environmental conditions.

15.15.4 Visual alarm devices shall be certified for use in a hazardous area. Refer to paragraph 8.1.3 for specific requirements.

15.15.5 Visual alarm devices shall be driven from the FDAS in the associated SRR as a 24VDC. Digital output.

15.15.6 Visual alarm devices for Fire shall have a Red coloured lens. The terminal housing shall be painted Red.

15.15.7 Cable terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.15.8 Visual alarm devices shall be Line monitored from the associated supervised digital output within the FDAS in the associated SRR.

15.15.9 Visual alarm devices shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.15.10 Visual alarm devices shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved.

15.15.11 Visual alarm devices shall be provided with all required mounting brackets and accessories.

15.16 Visual Alarm Devices (Buildings)

15.16.1 Visual alarm devices (Beacons) located within buildings shall be Addressable with each device having its own network address within the building, compatible with the Building Fire panel. However, conventional devices may be connected using an Address Reporting Interface Device.

15.16.2 Visual alarm devices located in Buildings shall be classified as general purpose. The termination housing shall be of an Industrial grade flame retardant GRP with a painted finish to the manufacturer's standard suitable for an indoor location.

15.16.3 Audible devices shall be continuously monitored from the Building Fire Panel for operational status. A fault will generate an alarm at the Building Fire Panel.

15.16.4 Visual alarm devices shall operate at 24VDC.

15.16.5 Visual alarm devices for Fire alarms shall have a Red coloured lens. The cable terminal housing shall be painted Red.

15.16.6 Visual alarm devices shall be provided with M20 1.5 ISO cable entries suitable for accepting cable glands.

15.16.7 Cable terminals shall be capable of accepting 2.5 mm2 stranded cable.

15.16.8 Visual alarm devices shall be provided with a wired on Stainless steel tag with the instrument tag number clearly engraved.

15.16.9 Visual alarm devices shall be provided with all required mounting brackets and accessories.

15.16.10 The recommended mounting height is 2.1 metres, but no closer than 150 mm to a ceiling structure

16.0 APPENDIX 2: BUILDING FIRE PANEL SPECIFICATION

16.1 General description

16.1.1 The Building Fire Alarm Control Panel (FACP) shall be a microprocessor based CPU controlled, intelligent fire alarm reporting system. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, manual pull stations addressable interface modules, initiating devices, alarm notification equipment and auxiliary control equipment. FACP shall be subject to EPCm-1/IOCL approval.

16.1.2 The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signalling Systems.

16.1.3 The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard for fire alarm applications.

16.2 Environmental

The Building Fire Alarm Control Panel equipment shall be installed in air-conditioned, non-hazardous environments within buildings such as main control building, SRRs and others buildings in the refinery

16.3 Electrical requirements

16.3.1 Power Supplies

16.3.2 Power for Building FACP shall be provided through redundant feeders at 240 VAC 50 Hz.

16.3.3 The Building FACP shall be provided with an integral UPS and dedicated batteries and charger that shall enable the system to remain on line for twenty four (24) hours (per NFPA 72 Section 1-5.2.5) plus five minutes of alarm in the event of failure of the main AC power supplies.

16.3.4 Battery shall be composed of sealed Lead acid Gel type cells, maintenance free, 24 VDC nominal.

16.3.5 The Building FACP shall provide an auxiliary field power supply to notification devices and field devices that require a regulated 24vdc power supply .This power supply shall also be used to charge the batteries.

16.3.6 The power supply shall continuously monitor all field wires for ground fault conditions and shall report status of front of panel LEDs and shall include System healthy/Ground fault and AC power fail. These conditions shall be reported as a common fault alarm to the main FDAS

16.4 System Capacity and General Requirements

16.4.1 The Building FACP shall be capable of expansion to provide a scalable solution to protect the various Buildings listed in PDRP4240-8820-IN-1002

16.4.2 The control panel shall include Form C alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 VDC.

16.4.3 It shall also include Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notification Appliance Circuits.

16.4.4 Facility shall exist to Synchronise the Notification Appliance Circuits compatible with selected devices as required.

16.4.5 The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual colour coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire alarm system. A track ball or other scroll assist device shall also be included.

16.4.6 An easy to read mimic of the building floor plan showing device locations in the form of LEDs shall be provided these shall be colour coded to reflect device status.

16.4.7 The display shall annunciate status information and custom alpha numeric labels for all intelligent detectors, addressable modules, etc.

16.4.8 The System shall include an integral Piezo electric audible alarm and pushbuttons for Acknowledge/ Alarm Silence/ Alarm Activate (test) and Lamp test switches.

16.4.9 A System Reset switch (key lock protected) shall cause all electronically latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition once the hazard or initiator has been cleared..

16.4.10 The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.

16.4.11 The Building FACP shall be programmed in accordance with Fire detection Cause and Effects and Fire detector layouts which shall be provided to MAC from the Building Supplier. MAC shall liaise closely with the Building supplier to ensure a timely completion consistent with project schedule.

16.4.12 The system shall allow the programming of any input to activate any output or group of outputs.

16.4.13 The FACP shall support logic equations, including "and," "or," and" not," or time delay equations to be used for advanced programming. The system shall be supplied with a software utility designed for programming via Laptop.

16.5 Additional Requirements

The following features shall also be included within The Building FACP:

16.5.1 Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.

16.5.2 Detector sensitivity test to meet the requirements of NFPA 72, Chapter7.

16.5.3 Maintenance alert alarms to warn of excessive smoke detector dirt or dust accumulation.

16.5.4 User selectable sensitivity levels for alarm, selected by detector type.

16.5.5 Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification cycle.

16.5.6 Rapid Manual Pull Station reporting (under 3 seconds) and shall meet NFPA 72 Chapter 1 requirements for activation of notification circuits within 10 seconds of initiating device activation.

16.5.7 Periodic detector test, conducted automatically by the Building FACP software.

16.5.8 Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.

16.5.9 Comprehensive self test and diagnostics to include address conflict checks

16.6 Communications Interfaces

16.6.1 Facility shall exist to enable the network connection of FACPs as across the site using a non proprietary fault tolerant industrial standard communication method standard protocols such as MODBUS, Ethernet etc The MAC shall provide a comprehensive description of networking options in his proposal.

16.6.2 FACPs shall be supplied with redundant serial interface connection RS-485.

INSPECTION AND TEST PLAN FOR FIRE AND GAS DETECTORS

INSPECTION CATEGORY: 3

REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED
A	18.05.2020	ISSUED FOR QUOTATION	SI	GM	SS	JMC

1. SCOPE

This Inspection and Test Plan is an engineering document which defines for each type of equipment:

- the type and extent of VENDOR/CONTRACTOR and OWNER / PMC involvement in each phase of fabrication, control and testing requiring an inspection or a documentation review
- the resulting VENDOR's/CONTRACTOR's contractual obligations, in accordance with applicable Project General Purchase Conditions.

Note: The Inspection and Test Plan may under no circumstances be used as a substitute to the VENDOR's/CONTRACTOR's Fabrication and Quality Control Plan.

2. GENERAL DEFINITIONS

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them.
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
UNIT	Indicates any portion of the project to be built which can be Process related or Utilities/Offsites related
SRU	Sulphur Recovery Unit

Extent of Inspection: The extent of Inspection activities is defined as follows:

H (Hold Point): Mandatory witness of testing or inspection activities by CONTRACTOR /OWNER/CONSULTANT. The VENDOR shall notify at least 2 Weeks (10 Working days) in advance and CONTRACTOR /OWNER/CONSULTANT must be present during the specified activity. The VENDOR cannot deviate from this rule unless written approval has been given by the CONTRACTOR /OWNER/CONSULTANT.

W (Witness): Optional witness of testing or inspection activities by the CONTRACTOR

/OWNER/CONSULTANT. The VENDOR must notify at least 2 Weeks (10 Working days) in advance. If CONTRACTOR /OWNER/CONSULTANT does not elect to be present, the VENDOR may proceed with the intended activity, provided controls and test reports are made available for the inspector's review during his subsequent visit.

R (Review): Review and acceptance of documentation such as reports, procedures and qualification records. Other applicable documents will be reviewed by the CONTRACTOR /OWNER/CONSULTANT.

3. CATEGORY OF INSPECTION

Inspection activities shall be based on hold/witness/review points specified in the Inspection & Test Plan (ITP) and confirmed at the Pre-Inspection Meeting. CONTRACTOR / PMC / OWNER Inspection will be based on critical ratings and corresponding levels of inspection.

Category of inspection are defined as follows:

Category 1: Stage wise and final inspection including monitoring of critical phases of fabrication performed at main supplier and main sub-supplier and Documents review as per ITP by CONTRACTOR / TPIA & Witness of Critical Stage / Test / Final inspections by OWNER wherever felt necessary.

Category 2: Stage wise and final inspection and Documents review as per ITP by CONTRACTOR / TPIA witness of final inspection, by OWNER, if felt necessary.

Category 3: Final inspection and Documents review as per ITP by CONTRACTOR / TPIA.

Category 4: Documents Review as per ITP by CONTRACTOR / TPIA.

4. PRE-INSPECTION MEETING

A Pre-Inspection meeting to be held at VENDOR's Works is a review with VENDOR by CONTRACTOR, prior to the start of manufacturing, to ensure understanding of purchase order requirements, including project specifications, applicable codes/standards and all inspection requirements.

5. VENDOR 'S FABRICATION AND QUALITY CONTROL PLAN (FQCP)

The VENDOR shall issue Fabrication and Quality Control Plan for each equipment. The VENDOR's Fabrication and Quality Control Plan is a document, which defines in a chronological manner, the list of the operations of fabrication, controls and tests in accordance with his own "know-how" and with the requirements specified in the project specifications attached with the Inquiry document and/or relevant codes & standards.

Following information shall be clearly specified against each operation:

- Reference documents (drawings, procedures, etc.)
- Acceptance criteria (code, etc.)
- Recording documents for controls and tests
- Involvement of the Quality Control department of the VENDOR and/or his Sub-VENDOR
- Involvement of VENDOR/ CONTRACTOR / PMC / OWNER

6. RIGHT TO INSPECT

All Equipment shall be subject to inspection by OWNER/ PMC. The Inspector shall have free access to the VENDOR's shop/work site. The VENDOR shall provide all facilities like tools and tackles, instruments and personnel to the inspector and CONTRACTOR shall arrange for such INSPECTION on request from OWNER / PMC.

The CONTRACTOR/OWNER/CONSULTANT shall be entitled to reject at any time any portion of the Equipment which is defective, deficient, not within specifications or otherwise of inferior quality or faulty workmanship and require its re-performance or replacement. Rejected and other defective or deficient workmanship shall be satisfactorily redone. The costs associated with such re-performance or replacements shall be for the account of the VENDOR. After completion of the necessary re-performance or replacements, the Equipment shall be subject to further Inspection and examination by CONTRACTOR/OWNER/CONSULTANT. Applicable repair procedure and VENDOR's repair recommendations shall be submitted to the Inspector for approval. No repair shall be made without the Inspector's acceptance.

7. INSPECTION RELEASE CERTIFICATE

This document will be issued by CONTRACTOR / TPIA permits the VENDOR/ CONTRACTOR to proceed with the packing and to notify the shipment of the Equipment.

- THE «ITP» IS A GUIDELINE DEFINING THE EXTENT OF CONTRACTOR AND OWNER/OWNER REPRESENTATIVE FOR ALL INSPECTION LEVELS
- TYPE AND EXTENT OF TESTS SHALL COMPLY WITH CODES AND/OR ORDER SPECIFICATIONS

CLASS:	TYPE:	
INSTRUMENTS	FIRE AND GAS DETECTORS	

STAGE	ACTIVITIES DESCRIPTION	Vendor	Contractor / TPIA	PMC	Owner	APPLICABLE DOCUMENTS AND REMARKS
BEFORE FABRICATION	Vendor's Fabrication Quality Control Plan	H	R	R		Including Sub-Suppliers, If any
	FAT procedure	H	R	R		
DURING FABRICATION	Manufacturer's test certificates	H	R			
FINAL TEST	Checking of Internal Test and Control Reports	H	R	R		
	Mechanical Inspection - Appearance, Labelling, Wiring, Signal Segregation, Spares,... - Visual Inspection - Dimensional Inspection - Functional checks of all Fire and Gas Detectors/Sensors, Flame Detectors, Manual call points, Beacons, Hooters - Calibration and Testing for Fire and Gas Sensors/ Detectors (Calibration at 2 points - Zero and Mid point) - Conformity to Specifications	H	W - 10%	R		One item per model, type and size
	Performance Test, Insulation Resistance Test	H	W - 10%	R		One item per model, type and size
	Performance Test reports and Functional Test reports for Fire and Gas Sensors/ Detectors, Beacons, Hooters	H	R	R		
	Checking of Calibration certificated for all Fire and Gas Sensors/ Detectors including repeatability, Accuracy and Response time					
	Checking of All fire and Gas sensors/ detectos, Manual call point, Beacons, Hooters etc. - BOM Quantities, Conformity to Datasheets	H	W	R		
	Test Certificate for Calibration Gases	H	R	R		
	Final FAT Reports	H	R	R		
	Final Inspection and Confirmity	H	R	R		
	Statutory certification/SIL certification for gas detector/Degree of Protection etc	H	R	R		
DOCUMENTATION	Manufacturer's Data/Record Book (MDRB)	H	R	R		

SL. NO.	DESCRIPTION	AS OFFERED FOR THIS PROJECT	ITEM AS INSTALLED @ SITE 1	ITEM AS INSTALLED @ SITE 2	ITEM AS INSTALLED @ SITE 3	ITEM AS INSTALLED @ SITE 4
1	Name of Plant					
2	Name, Address, E-Mail, Tel. No. of contact person in plant					
3	Name, Address, E-Mail & Telephone No. of consultant					
4	Month & year of supply					
5	Month & year of commissioning					
6	Any major breakdown till date					
7	**Offered Gas & Fire Detectors:** **a) H2S Detector** **b) SO2 Detector** **c) NH3 Detector** **d) HC Detector** **e) Open Path Detectors** **f) Fire Detector** **g) Multi Portable Gas Detector**					

Bidder Seal & Signature