

ANNEXURE-A

Bill of material [for Main Supply + Mandatory
Spares]

	Bill of material [for Main Supply]			Annexure -[A] of PY51873
	Fire Detection & Alarm System			Rev 00
	Project: 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)			
BHEL MATERIAL CODE: PY9751873010				
S. No.	Item Description	Quantity	Unit	Remarks
1	Fire Alarm Panel (Each panel shall have 10 Loops) Floor Mounted	1	No.'s	Refer Note-1,2,3 & 6
2	Fire Alarm Panel (Each panel shall have 8 Loops) Floor Mounted	1	No.'s	Refer Note-1,2,3 & 6
3	Fire Alarm Panel (Each panel shall have 6 Loops) Floor Mounted	1	No.'s	Refer Note-1,2,3 & 6
4	Loop Card	2	No.'s	Refer Note-3
5	Redundant Network Card	1	Sets	Model No: B8-NET2-FX4 Network Module (Schrack Make) or Latest Model as suitable. Refer Cl: 7 of Technical Specifications Spec No: PY51873 Rev-00
6	Multisensor Detectors with detector base and mounting back box (Analogue addressable) along with PVC cable glands	770	No.'s	Refer Note-12
7	Heat Detectors with detector base and mounting back box (Analogue addressable) along with PVC cable glands	90	No.'s	Refer Note-12
8	Rate of Rise cum Fixed Temp (IC type) Heat Detector	7	No.'s	If addressable detector is not available in offered make, then Module (2 Input + 1 Output) with IP-65 enclosure to be provided along with detector. Refer Note-12
9	Beam Detectors (Addressable) along with PVC cable glands (Range-100M)	1	No.'s	If addressable detector is not available in offered make, then Module (2 Input + 1 Output) with IP-65 enclosure to be provided along with detector. Refer Note-12
10	Air Sampling Type Smoke Detection System/Gas Sensing Fire Detectors (including modules for interfacing with fire detection & alarm system)	10	Sets	Engineering and supply of related BOQ along with erection hardware is in Bidder scope.
11	24V DC Back Lit Exit Sign	97	No.'s	
12	Indoor Manual Call Points with mounting back box (Addressable type) along with PVC cable glands	92	No.'s	Refer Note-12
13	Outdoor Manual call points with mounting back box (IP-65 min.) (Addressable type) along with PVC cable glands	63	No.'s	Refer Note-12
14	Indoor Hooter cum Strobe with mounting back box (Addressable type & Loop powered) along with PVC cable glands	104	No.'s	Conventional hooter cum strobe or conventional hooter and conventional strobe with addressable module is not acceptable. Bidder to consider addressable loop powered hooter cum strobe or loop powered hooter and loop powered strobe only. Refer Note-12
15	Response Indicators	100	No.'s	
16	Module for LHS Cable (1 Input) with IP-65 enclosure along with PVC cable glands	110	No.'s	Refer Note-12
17	Module for Deluge Valve (2 Input + 1 Output) with IP-65 enclosure along with PVC cable glands	166	No.'s	Refer Note-12
18	Module for Back Lit EXIT Sign (1 Output) along with PVC cable glands	97	No.'s	Refer Note-12
19	Module for Tripping (1 Output) along with PVC cable glands	23	No.'s	Refer Note-12
20	Module for Monitoring Pumps Status (1 Input) with IP-65 enclosure along with PVC cable glands	8	No.'s	Refer Note-12

	Bill of material [for Main Supply]			Annexure -[A] of PY51873
	Fire Detection & Alarm System			Rev 00
	Project: 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)			
BHEL MATERIAL CODE: PY9751873010				
S. No.	Item Description	Quantity	Unit	Remarks
21	Module for Interface with DCS (1 Output) with IP-65 enclosure along with PVC cable glands	3	No.'s	Refer Note-12
22	Module for Interface with IGES, IR Ember Detectors (1 Input + 1 Output), Dual Wavelength UV-IR Flame Detector with IP-65 enclosure along with PVC cable glands	101	No.'s	Refer Note-12
23	24 V DC Power Supply Modules with Battery Back Up	15	No.'s	5A, 24V DC, min. 7AH batteries with backup time of 30 min. Refer attached specification (Annexure-D) for technical details. IP 20 type - 0 nos IP 66 type - 15 nos. Refer Vendor list Annexure-I
24	6 Fiber Armoured single mode Optical Fiber Cable with 2" rodent proof HDPE conduits (for fire alarm panels and PC networking)	10000	Meter	Refer Note-10, 11 below Refer Annexure-P for technical details
25	Operator Workstation & A4 size color laser Printer along with Commissioning software, Graphic software i.e., (GUI) Software with License /Dongle	3	Sets	Refer Annexure-O for technical details
26	Laptop along with Fire Alarm Panel Commissioning Software with License /Dongle	1	No.'s	Minimum Requirements: i7 Processor or latest 6 GB Ram 500GB Hardisk 15" Screen
27	Furniture for Operator Workstation & Printer	3	Sets	
28	Cable Tags for 2C x 1.5 Sqmm Fire Survival MICA Cable	48	No.'s	
29	Cable Tags for 3C x 2.5 Sqmm Fire Survival MICA Cable	54	No.'s	
30	Cable Saddle + Saddle Bars along with fixing screws and rawl plugs for 2C x 1.5 Sqmm Fire Survival MICA Cable	82700	Sets	These saddles are used for laying BHEL supplied cables.
31	Cable Saddle + Saddle Bars along with fixing screws and rawl plugs for 3C x 2.5 Sqmm Fire Survival MICA Cable	25400	Sets	These saddles are used for laying BHEL supplied cables.
32	50 mm Cable Tray	3000	Meter	
33	Nylon Cable Tie for 2C x 1.5 Sqmm Fire Survival MICA Cable	21000	No.'s	
34	Nylon Cable Tie for 3C x 2.5 Sqmm Fire Survival MICA Cable	1000	No.'s	
35	All mounting Accessories & Erection Hardware Software required for installing above components and establishing the networking between all fire alarm panels, repeater panels, DCS, PCs, Printers, Erection & Termination hardware for Optical Fibre cables etc shall be considered.	1	Lot	Refer Note-7 below
Technical Notes:				
1)	Battery sizing of FDA panels is in the scope of bidder. Bidder to considering the panels as fully loaded for sizing purpose. The standby power source (battery bank to power fire detection and alarm system) should be sized for 48 hours of continuous load + 12 hours in alarm condition (at least 25% devices considered active in alarm condition). Fire alarm panels and repeater panels shall be provided with 1 x 100% battery bank and 1 x 100 % battery charger.			
2)	Power supply to all the detectors/components specified in the BOQ above, should be extended from the Fire alarm Panels Only. Sizing of power supply modules, batteries size for secondary power, calculation of notification appliance circuit voltage drops, selection of internal components of FDA Panels etc. to be carried out by bidder & panel model need to be selected accordingly. Battery & Power supply calculation sheet verified by OEM shall be submitted to BHEL during detailed Engg for approval.			
3)	In case the bidder offered system is having multiple variants of loop cards, bidders are advised to select loop cards which cater to largest/longest distance.			

	Bill of material [for Main Supply]			Annexure -[A] of PY51873
	Fire Detection & Alarm System			Rev 00
	Project: 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)			
BHEL MATERIAL CODE: PY9751873010				
S. No.	Item Description	Quantity	Unit	Remarks
4)	Bidder to note that all the above detectors/devices shall be loop powered. In case loop powered devices are not available in the make offered, bidder shall consider the necessary modules.			
5)	NIL			
6)	Fire alarm panels shall be floor mounted only. All batteries, battery chargers, neworking hardware etc. shall be installed inside the floor mounted panel. Each fire alarm panel shall have required no. of switches/MCBs, sockets, illumination lamps etc.			
7)	Refer Annexure - C for minimum erection BOQ inline with typical erection drawings i.e. Annexure - M. Bidder to supply this minimum erection BOQ (including 10% additional margin). In addition to this BOQ, if any other erection hardware is required for installing the main items listed in the above BOQ shall be supplied by bidder.			
8)	All interface modules shall be provided with enclosure suitable for outdoor application. All output modules shall have relay outputs contacts.			
9)	Unit rates for addition/deletion (+10% to -20%) for Main and mandatory spares shall be applicable			
10)	Also necessary erection hardware (jointing kits, termination kits, LIU, patch card, media converter, pit tails, etc) for FO cable shall be considered in the scope bidder. In addition, splicing and termination of FO cable and it's accessories are in bidder scope. Minimum BOM for meeting this reuirement is: Splicing tool kit=1 Set, LIU (along with pigtails based on FO cable) =2 No's, Patch Cords = 10 No's, Media converters= 2 No's, Network Switch-1 No's bidder to add other items (if any) for completeness of the system.			
11)	Fire alarm panels, repeater panels specified in the specification are to be connected in dual redundant ring topology using single mode fiber optic cable. Supply of Single Mode Optical Fiber cable (for networking of Fire Alarm Panels & Repeater Panels) is by others.			
12)	Inbuilt fault isolators for all addressable devices shall be provided.			
13)	NIL			
14)	LIUs (Fiber Patch Panels / Light interface units) - are to be used for routing, terminating and managing optical cable terminations and should be mounted inside the FAPs & Repeater Panel enclosures			
15)	NIL			
16)	Supply items for which no definite "make/brand" is indicated, shall be procured only from reputed makes & models having proven records of accomplishmet and requires purchaser approval.			
17)	FAP, Repeater panel, Detectors, Devices, Modules etc. shall be under regular manufacturing range of OEM and have proven track record.			
18)	Information/Status of all panels shall be available in all the workstations using GUI Software			
19)	All the network switches shall be of high quality and shall be sized to meet the functional requirements as specified. The common switch to which all networks are connected shall be Layer-III switch/router. All the interconnecting cables between network switches shall be fiber optic only. All fiber optic cables shall be terminated directly to network switches through optical fiber port without using media converters.			

	Bill of material [for Supply of Mandatory Spares]			Annexure -[A] of PY51873
	Fire Detection & Alarm System			Rev 00
	Project: 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)			
BHEL MATERIAL CODE: PY9751873029				
S. No.	Item Description	Quantity	Unit	Remarks
FIRE DETECTION & ALARM SYSTEM COMPONENTS				
1	Fire Alarm Panel (Each panel shall have 10 Loops) Floor Mounted	NA	No.'s	
2	Fire Alarm Panel (Each panel shall have 8 Loops) Floor Mounted	NA	No.'s	
3	Fire Alarm Panel (Each panel shall have 6 Loops) Floor Mounted	NA	No.'s	
4	Loop Card	NA	No.'s	
5	Network Card	NA	No.'s	
6	Multisensor Detectors with detector base and mounting back box (Analogue addressable) along with PVC cable glands	77	No.'s	
7	Heat Detectors with detector base and mounting back box (Analogue addressable) along with PVC cable glands	9	No.'s	
8	Rate of Rise cum Fixed Temp (IC type) Heat Detector	1	No.'s	
9	Beam Detectors (Addressable) along with PVC cable glands	NA	No.'s	
10	Air Sampling Type Smoke Detection System (including modules for interfacing with fire detection & alarm system)	1	Sets	
11	Back Lit Exit Sign	NA	No.'s	
12	Indoor Manual Call Points with mounting back box (Addressable type) along with PVC cable glands	10	No.'s	
13	Outdoor Manual call points with mounting back box (IP-65 min.) (Addressable type) along with PVC cable glands	7	No.'s	
14	Indoor Hooter cum Strobe with mounting back box (Addressable type & Loop powered) along with PVC cable glands	NA	No.'s	
15	Response Indicators	NA	No.'s	
16	Module for LHS Cable (1 Input) with IP-65 enclosure along with PVC cable glands	4	No.'s	
17	Module for Deluge Valve (2 Input + 1 Output) with IP-65 enclosure along with PVC cable glands	4	No.'s	
18	Module for Back Lit EXIT Sign (1 Output) along with PVC cable glands	NA	No.'s	
19	Module for Tripping (1 Output) along with PVC cable glands	4	No.'s	
20	Module for Monitoring Pumps Status (1 Input) with IP-65 enclosure along with PVC cable glands	NA	No.'s	
21	Module for Interface with DCS (1 Output) with IP-65 enclosure along with PVC cable glands	NA	No.'s	
22	Module for Interface with IGES, IR Ember Detectors (1 Input + 1 Output), Dual Wavelength UV-IR Flame Detector with IP-65 enclosure along with PVC cable glands	4	No.'s	

	Bill of material [for Supply of Mandatory Spares]		Annexure -[A] of PY51873	
	Fire Detection & Alarm System		Rev 00	
	Project: 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)			
BHEL MATERIAL CODE: PY9751873029				
S. No.	Item Description	Quantity	Unit	Remarks
23	24 V DC Power Supply Modules with Battery Back Up	NA	No.'s	
24	6 Fiber Armoured single mode Optical Fiber Cable with 2" rodent proof HDPE conduits (for fire alarm panels and PC networking)	NA	Meter	
25	Operator Workstation & A4 size color laser Printer along with Commissioning software, Graphic software i.e., (GUI) Software with License /Dongle	NA	Sets	
26	Laptop along with Fire Alarm Panel Commissioning Software with License /Dongle	NA	No.'s	
27	Furniture for Operator Workstation & Printer	NA	Sets	
28	Cable Tags for 2C x 1.5 Sqmm Fire Survival MICA Cable	NA	No.'s	
29	Cable Tags for 3C x 2.5 Sqmm Fire Survival MICA Cable	NA	No.'s	
30	Cable Saddle + Saddle Bars along with fixing screws and rawl plugs for 2C x 1.5 Sqmm Fire Survival MICA Cable	NA	Sets	
31	Cable Saddle + Saddle Bars along with fixing screws and rawl plugs for 3C x 2.5 Sqmm Fire Survival MICA Cable	NA	Sets	
32	50 mm Cable Tray	NA	Meter	
33	Nylon Cable Tie for 2C x 1.5 Sqmm Fire Survival MICA Cable	NA	No.'s	
34	Nylon Cable Tie for 3C x 2.5 Sqmm Fire Survival MICA Cable	NA	No.'s	
35	All mounting Accessories & Erection Hardware Software required for installing above components and establishing the networking between all fire alarm panels, repeater panels, DCS, PCs, Printers etc	NA	Lot	
FIRE ALARM PANEL ITEMS				
1	Power Supply Module	4	Nos.	Each Type & Rating
2	CPU Card/Main Control Board	4	Nos.	Each Type
3	Network Interface Items	4	Nos.	Each Type
4	Zone Control Card/Module	4	Nos.	Each Type
5	Audio Control Modules	2	Nos.	Each Type
6	Input/Output Control Modules	4	Nos.	Each Type
7	Relay Modules	4	Nos.	Each Type
8	Any Other Electronic Cards/Modules used in the System	2	Nos.	2Nos. for each type
9	Battery	2	Nos.	2Nos. for each type and rating

ANNEXURE-B

Bill of material [for Erection Hardware [for Main
Supply + Mandatory Spares]]

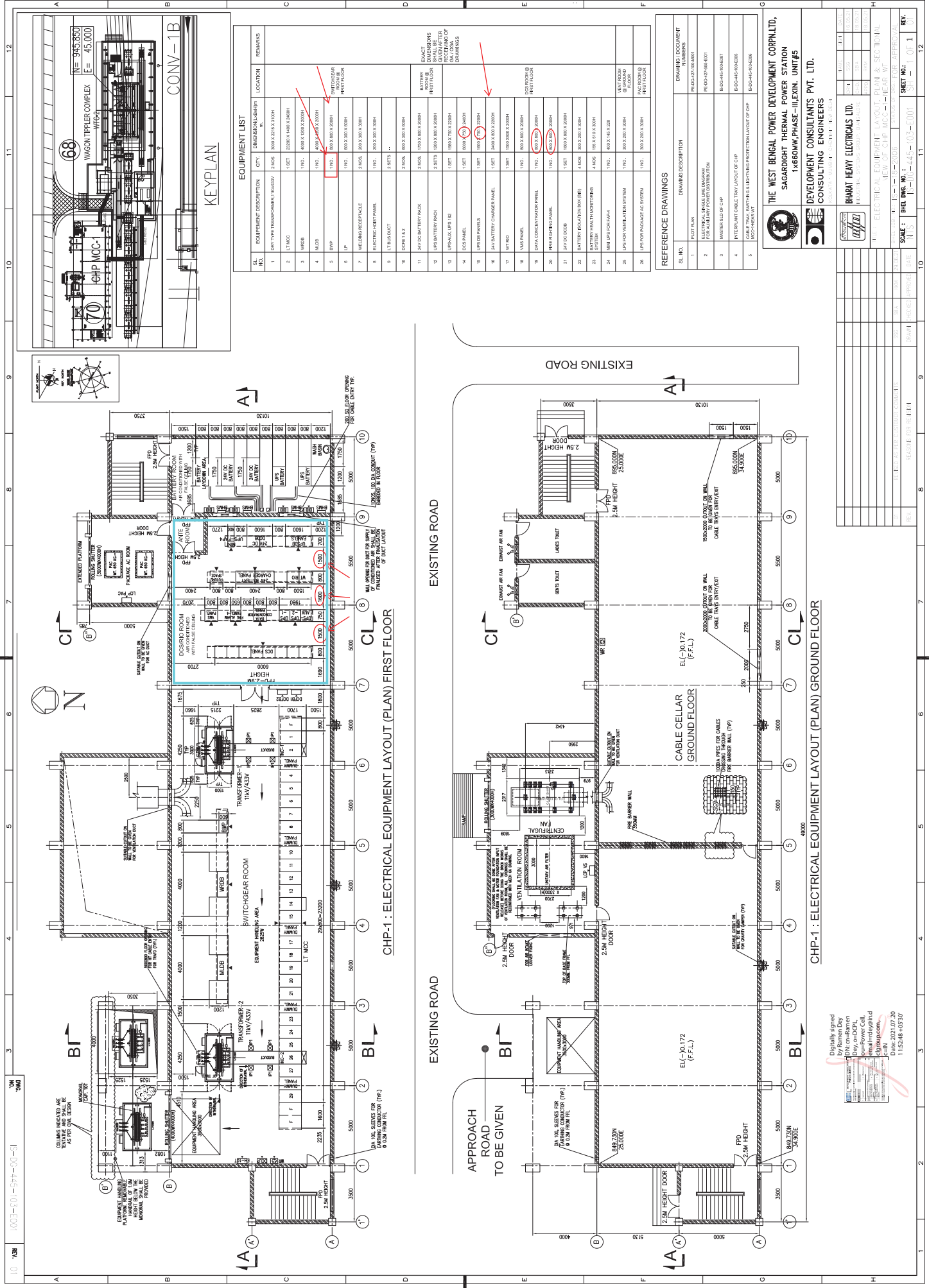
Sl. No.	Main Item	Main Item Quantity	Typical Erection Hardware Bill of Material		Annexure -[B] of PY51873		
			Fire Detection & Alarm System		Rev-00		
			Project: 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)				
			Erection Items Required for Erection of Main Item	Erection Item Quantity	Total Erection Hardware	Total Erection Hardware to be Supplied with 10% Margin	Units
1	Multisensor Detectors on True Ceiling	670	MS Backbox	1	670	737	Nos.
			Rawl Plug for back box fixing	2	1340	1474	Nos.
			Screw for back box fixing	2	1340	1474	Nos.
			Screw for base plate & detector base fixing	2	1340	1474	Nos.
			Cable gland for 1.5 sqmm loop cable in/out	2	1340	1474	Nos.
			1.5 sqmm tinned copper lugs	4	2680	2948	Nos.
2	Multisensor Detectors on False Ceiling	100	Screw for detector base fixing	2	200	220	Nos.
			Cable gland for 1.5 sqmm loop cable in/out	2	200	220	Nos.
			1.5 sqmm tinned copper lugs	4	400	440	Nos.
3	Heat Detectors on True Ceiling	90	MS Backbox	1	90	99	Nos.
			Rawl Plug for back box fixing	2	180	198	Nos.
			Screw for back box fixing	2	180	198	Nos.
			Screw base plate & detector base fixing	2	180	198	Nos.
			Cable gland for loop cable in/out	2	180	198	Nos.
			1.5 sqmm tinned copper lugs	4	360	396	Nos.
4	Heat Detectors on False Ceiling	0	Screw for detector base fixing	2	0	0	Nos.
			Cable gland for 1.5 sqmm loop cable in/out	2	0	0	Nos.
			1.5 sqmm tinned copper lugs	4	0	0	Nos.
5	Response Indicator on False Ceiling	100	Screw for response indicator fixing	2	200	220	Nos.
			Cable gland for 1.5 sqmm loop cable in/out	2	200	220	Nos.
			1.5 sqmm tinned copper lugs	4	400	440	Nos.
6	Probe detector	0	MS Base Plate	2	0	0	Nos.
			Anchor Fastner	8	0	0	Nos.
			Nut Bolt Washer Assembly	4	0	0	Nos.
			Cable Gland for 1.5 sqmm loop cable	2	0	0	Nos.
			1.5 sqmm tinned copper lugs	6	0	0	Nos.
			ISMC 75 (1 meter long)	4	0	0	Nos.
			MS Counter Flange with Hole	1	0	0	Nos.
			Flame Proof Junction Box with provision for mounting probe detector	1	0	0	Nos.
7	Beam Detector	1	Backbox for Beam detector	1	1	2	Nos.
			Backbox for Transmitter	1	1	2	Nos.
			Backbox Remote Indicator	1	1	2	Nos.
			Rawl Plug for beam detector backbox fixing	4	4	5	Nos.
			Rawl Plug for transmitter backbox fixing	4	4	5	Nos.
			Rawl Plug for remote indicator backbox fixing	2	2	3	Nos.
			Screw for beam detector backbox fixing	4	4	5	Nos.
			Screw for transmitter backbox fixing	4	4	5	Nos.
			Screw for remote indicator backbox fixing	2	2	3	Nos.
			Cable gland for loop cable	4	4	5	Nos.
8	Air Sampling Smoke Detector (Refer notes below)	10	1.5 sqmm tinned copper lugs	8	8	9	Nos.
			MS Backbox	0	0	0	Nos.
			Rawl Plug for back box fixing	4	40	44	Nos.
			Screw for back box fixing	4	40	44	Nos.
			Screw for base plate & detector base fixing	4	40	44	Nos.
			Nozzles	-	1	1	Lot
			PVC Pipe & Fittings	-	1	1	Lot
			End Caps	-	1	1	Lot
			Hole Stckers	-	1	1	Lot
			GI Saddles for PVC Pipe	-	1	1	Lot
9	Indoor Manual Call Point	92	Screw for fixing saddle	-	1	1	Lot
			MS Backbox	1	92	102	Nos.
			Rawl Plug for back box fixing	2	184	203	Nos.
			Screw for back box fixing	2	184	203	Nos.
			Screw for base plate & MCP base fixing	2	184	203	Nos.
			Cable gland for loop cable	2	184	203	Nos.
			1.5 sqmm tinned copper lugs	4	368	405	Nos.
10	Outdoor Manual Call Point	63	MS Backbox	1	63	70	Nos.
			Rawl Plug for back box fixing	2	126	139	Nos.
			Screw for back box fixing	2	126	139	Nos.
			Screw for base plate & MCP base fixing	2	126	139	Nos.
			Cable gland for loop cable	2	126	139	Nos.
			1.5 sqmm tinned copper lugs	4	252	278	Nos.
11	Flameproof Manual Call Point	0	MS Base Plate	1	0	0	Nos.
			Anchor Fastners	4	0	0	Nos.
			ISMC 75 (1.5 meter long)	1	0	0	Nos.
			Nut Bolt Washer Assembly	2	0	0	Nos.
			Cable gland for loop cable	2	0	0	Nos.
			1.5 sqmm tinned copper lugs	4	0	0	Nos.
12	Indoor Hooter cum Strobe	104	MS Backbox	1	104	115	Nos.
			Rawl Plug for back box fixing	2	208	229	Nos.
			Screw for back box fixing	2	208	229	Nos.
			Screw for base plate & hooter base fixing	2	208	229	Nos.
			Cable gland	2	208	229	Nos.
			1.5/2.5 sqmm tinned copper lugs	4	416	458	Nos.
13	Siren	0	Anchor FASTER	4	0	0	Nos.
			Cable gland	2	0	0	Nos.
			Tinned Copper Lugs	4	0	0	Nos.
			MS Base Plate	1	0	0	Nos.

	Typical Erection Hardware Bill of Material				Annexure -[B] of PY51873		
	Fire Detection & Alarm System						
	Project: 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)				Rev-00		
Sl. No.	Main Item	Main Item Quantity	Erection Items Required for Erection of Main Item	Erection Item Quantity	Total Erection Hardware	Total Erection Hardware to be Supplied with 10% Margin	Units
14	Siren Control Panel	0	Anchor Faster	4	0	0	Nos.
			Cable gland	3	0	0	Nos.
			Tinned Copper Lugs	6	0	0	Nos.
15	Interface Module	511	Enclosure for Module	1	511	563	Nos.
			Rawl Plug for Enclosure fixing	2	1022	1125	Nos.
			Screw for enclosure fixing	4	2044	2249	Nos.
			Cable gland for loop cable	4	2044	2249	Nos.
			1.5 sqmm tinned copper lugs	8	4088	4497	Nos.
16	Power Supply Module	15	Anchor Faster	4	60	66	Nos.
			Cable gland	5	75	83	Nos.
			Tinned Copper Lugs	10	150	165	Nos.
17	For BHEL Use	-	MS Base Plate (100 x 100 x 5)	-	-	475	Nos.
			MS Angle (25 x 25 x 5) - (1 meter long)	-	-	475	Nos.
NOTES: -							
1. Calculation and supply of erection hardware like PVC pipe, fittings, nozzles etc. for air sampling detectors indicated as 'LOT' above is in bidder scope.							

ANNEXURE-C

List of Control Rooms

1. ESP cum FGD Control Room
2. CW & ACW Pump House
3. TG Building
4. AHP MCC-1 Building
5. CHP MCC-1 Building
6. CHP MCC-2 Building
7. CHP MCC-3 Building
8. Wagon Tippler Control Room Building



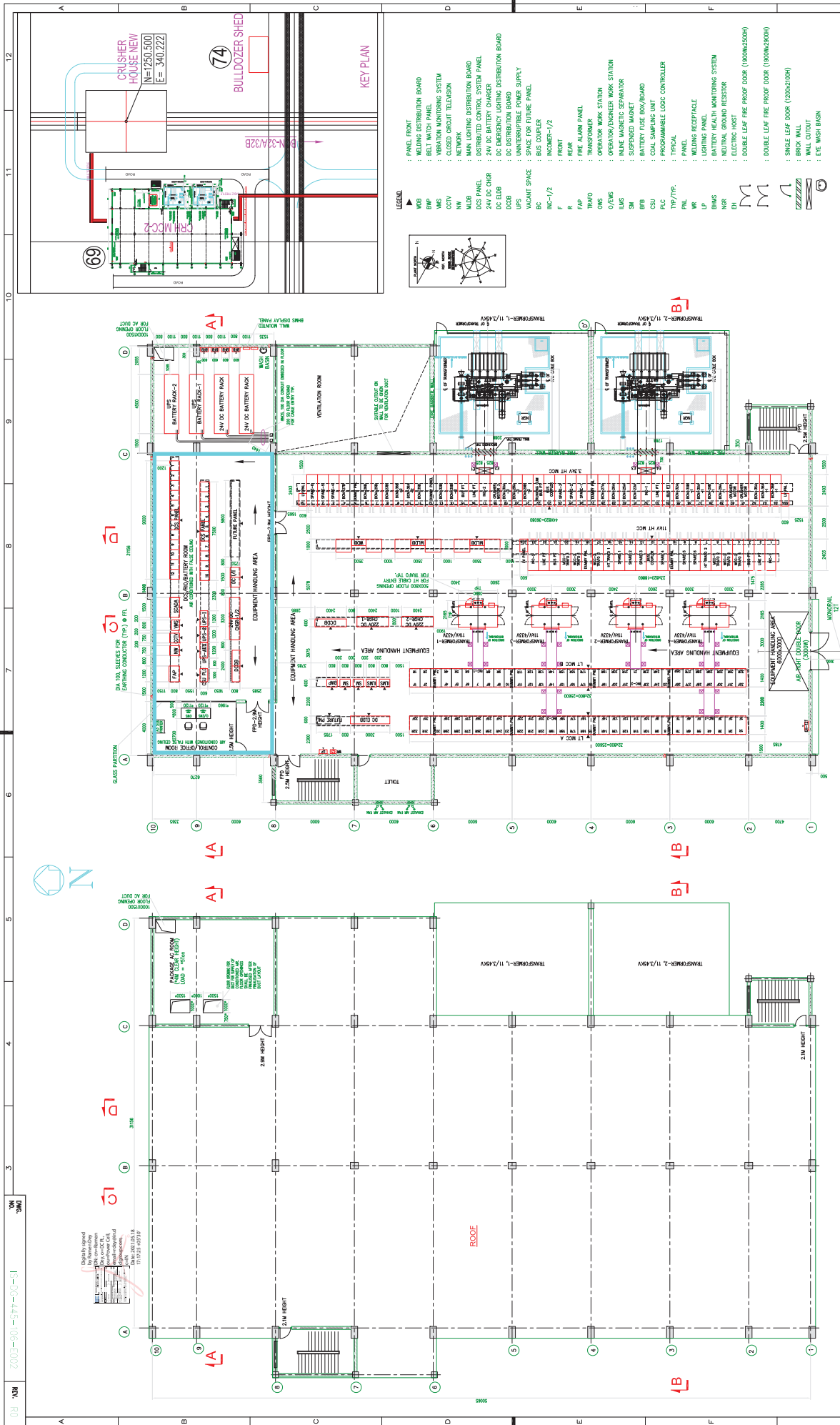
EQUIPMENT LIST				REMARKS	
S.L. NO.	EQUIPMENT DESCRIPTION	QTY.	DIMENSIONS/INSTRUMENT NO.	LOCATION	REMARKS
1	DRY TYPE TRANSFORMER 1500KVA	2 NOS.	3000 X 2250 X 3100H	TRANSFORMER AREA	
2	LT MCC	1 SET	2200 X 1400 X 2400H	TRANSFORMER AREA	
3	MSB	1 NOS.	400 X 300 X 2000H	TRANSFORMER AREA	
4	MSB	1 NOS.	400 X 300 X 2000H	TRANSFORMER AREA	
5	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
6	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
7	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
8	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
9	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
10	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
11	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
12	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
13	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
14	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
15	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
16	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
17	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
18	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
19	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
20	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
21	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
22	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
23	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
24	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
25	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	
26	UPS	1 NOS.	400 X 300 X 2000H	UPS ROOM	

REFERENCE DRAWINGS	
S.L. NO.	DRAWING DESCRIPTION
1	PLAT PLAN
2	GENERAL LAYOUT OF THE STATION
3	GENERAL LAYOUT OF THE STATION
4	GENERAL LAYOUT OF THE STATION
5	GENERAL LAYOUT OF THE STATION

THE WEST BENGAL POWER DEVELOPMENT CORP.LTD.
SAGARCOM THERMAL POWER STATION
15660MW/PHASE-III/EXN. UNIT#5
DEVELOPMENT CONSULTANTS PVT. LTD.

BRHAT HEAVY ELECTRICALS LTD.
15660MW/PHASE-III/EXN. UNIT#5
DEVELOPMENT CONSULTANTS PVT. LTD.

SCALE: 1:1000
DATE: 2021.07.20
SHEET NO.: 1 OF 1



CHP-2 : ELECTRICAL EQUIPMENT LAYOUT (ROOF PLAN)

CHP-2 : ELECTRICAL EQUIPMENT LAYOUT (PLAN), FIRST FLOOR

	THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD. SAGARDIGHT THERMAL POWER STATION 1x660MW, PHASE-III, EXIN. UNIT #5
	DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS

[illegible]

REV.	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471
REV.	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471
REV.	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471
REV.	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205																																																																																																																																																																																																																																																																										



NOTES:

1. ALL DIMENSION ARE IN MM AND LEVELS IN METERS UNLESS OTHERWISE SPECIFIED
2. ALL OPENING AND PLATFORM SHALL HAVE 100 MM CURB ALL AROUND WITH CURB ANGLE OF ISA 50x6 BY BHEL.

- [illegible]

Digitally signed by
Rajdeep Adhya
DN: cn=Rajdeep
Adhya, o=Power Cell
ous=DCPL,
email=rajdeep.adhya@
alindagroup.com,
c=IN
Date: 2021.04.02
20:22:58 +05'30'

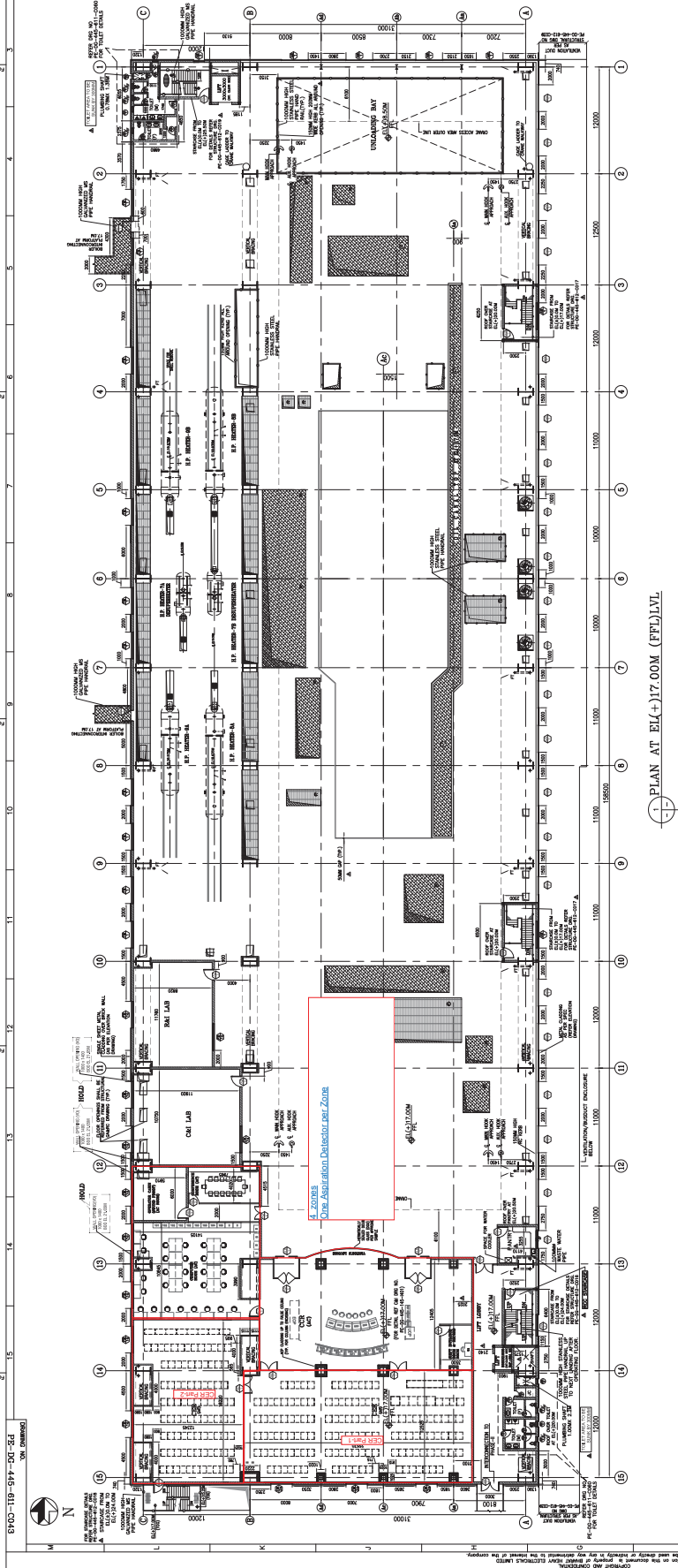
 THE WEST BENGAL POWER DEVELOPMENT CORPN.LTD, SAKARDIOTI THERMAL POWER STATION 14606MW/PHASE-II,ILEXIN, UNIT#5	 DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA, MUMBAI, CHENNAI, NEW DELHI
 SCS CORP. LTD.	 SCS CORPORATION

[illegible]

REFERENCE DRAWING NO.

DESCRIPTION	TKII DRG NO.	BHEL DRG. NO.
GA OF WT COMPLEX	370036 M04 000 01	IS-DG-445-103-4088
GA OF SDE ARM CHARGER	370036 M06 000 01	IS-DG-445-103-4093
GA OF INDEXER	370036 M07 000 01	IS-DG-445-103-4096
GA OF APRON FEEDER	R370036 F64 2100	IS-DG-445-103-4097

Digitally signed by Manas Mandal
Reason: Submitted for Approval
Date: 2021.03.30 17:14:45
+05'30'



KEY PLAN

- [illegible]

[illegible][illegible]

NOTE	1) FOR OPERATING FLOOR FLOORING DETAILS REFER DRG NO. PE-DG-445-611-C053
	2) REFER DRG NO. PE-DG-445-611-C062 FOR COR/CIR AREA FALSE CEILING & PARTITION DETAILS.
	3) THE CLEAR HEIGHT OF THE CONTROL ROOM BELOW FALSE CEILING SHALL BE MINIMUM 3.50M

[illegible]

ANNEXURE-D

Technical Specification for FDA System

Amendments / Addenda

AMENDMENT-I

AMENDMENT/ADDENDA ON TENDER DOCUMENTS OF MAIN PLANT PACKAGE SAGARDIGHI EXTN UNIT-5(1X660 MW)

Sl. No.	Vol. No. /Page no./ Sec. no. /Clause	Original Text	Amended Text /Addenda/Deletion
1.	V.II-J1/ Section: I/ Page 4 of 5/ Clause No. 3.07.00/	Reverse Osmosis (RO) Plant Reverse Osmosis (RO) Plant may be required to be installed for treatment of cooling tower blow-down water and further re-use of the same to achieve “Zero Waste Water Discharge”, as per latest MoEF guidelines.	For detailed scope please refer V.II-12/AMEND/01
2.	V.II-J1/ Section: II, Page 13 of 32/ Clause No. 7.13.05/	Motor shall be suitable for eight (8) equally spreaded starts per hour.	Motor shall be capable of three equally spread starts per hour, three starts in quick succession from cold condition and two restart from hot condition.
3.	V. II-J1/ Section: III/ Page 4,5 of 103/ Clause No. 3.01.02.b	Category – B type HVW Spray System shall be provided for the following areas: All oil filled transformers having capacity less than equal to 10MVA. ☐ Turbine Lub oil tanks and purifiers. ☐ Boiler Burner Fronts. ☐ Central Lub Oil & Control oil Tanks (both clean oil and dirty oil tanks) and purifier units. ☐ Drain Oil Tank of Boiler area ☐ Generator seal oil system. ☐ Lube oil & control oil system for turbine driven boiler feed pumps. ☐ Turbine oil canal pipe lines in main plant. ☐ Diesel Tank of DG set	Flame detection along with Heat Detection to be provided for the following Areas 1. Turbine Lube Oil tank/MOT & Purifiers 2. Central Lube Oil & Control Oil Tanks(Both clean oil & Dirty Oil Tanks) & Purifier Units 3. Lube Oil & Control Oil system for TD BFP 4. Boiler Burner Front Rest Areas mentioned in NIT for Category B Fire to be provided with heat detection
3.	V. II-J1/ Section: III/ Page 5 of 103/ Clause No. 3.01.02.b	The operation of the Deluge Valve shall be annunciated in the Main Fire Alarm Panel as well as in Sub-Fire Alarm Panel.	The operation of the Deluge Valve shall be annunciated in the Main Fire Alarm Panel.
4.	V. II-J1/ Section: III/ Page 6 of 103/ Clause No. 3.01.03	Upon detection of fire, drive motor shall automatically stop and annunciation shall be provided in the Main Fire Alarm Panel as well as sub- Fire alarm panel.	Upon detection of fire, drive motor shall automatically stop and annunciation shall be provided in the Main Fire Alarm Panel.
5.	V. II-J1/ Section: III/ Page 6 of 103/ Clause No.	On receipt of impulse from the detectors, in the event of fire, suitable annunciations signal shall be	On receipt of impulse from the detectors, in the event of fire, suitable annunciations signal shall be exhibited in the main Fire Alarm Panel.

Sl. No.	Vol. No. /Page no./ Sec. no. /Clause	Original Text	Amended Text /Addenda/Deletion
	3.03.00.e	exhibited in the main Fire Alarm Panel as well as sub- Fire alarm panel.	
6.	V. II-J1/ Section-III/ Page 12 of 103/ 3.13.00	If water pressure in the hydrant pipe network is not adequate to maintain minimum 3.5 kg/cm² (g) at the hydraulically furthest hose station at elevated floors of boiler houses and turbine building, then 2x100% booster pumps (one (1) no. motor driven+ one (1) no. diesel engine driven) shall be provided for individual areas for supplying pressurized water to the hydrant points.	Clause Delete
7.	V. II-J1/ Section: III/ Page 26 of 103/ Clause No. 6.02.00.e	Three hydrant ring mains shall be provided and entire power plant area shall be suitably divided amongst these ring mains. These ring mains shall be interconnected with isolation valves. It shall be possible to enable to take up part of any of the ring mains for maintenance without any loss of system in the balance part.	Four hydrant ring mains shall be provided and entire power plant area shall be suitably divided amongst these ring mains. These ring mains shall be interconnected with isolation valves. It shall be possible to enable to take up part of any of the ring mains for maintenance without any loss of system in the balance part.
8.	V. II-J1/ Section: III/ Page 38 of 103/ Clause No. 7.01.03	For technical requirements of Electrical drive motors, Diesel Engine Vol.II-F/1 & 2 shall be referred to.	For technical requirements of Electrical drive motors, Vol.II-F/1 & 2 shall be referred to.
9.	V. II-J1/ Section: III/ Page 49 of 103/ Clause No. 7.15.15.d	Any other technology for Linear Heat Sensing cables shall be subject to Owner's approval.	Any technology for Linear Heat Sensing cables shall be subject to Owner's approval.
10.	V. II-J1/ Section: III/ Page 53 of 103/ Clause No. 7.18.02	For design and construction of Battery Charger refer Volume V.	Delete
11.	V. II-J1/ Section: III/ Page 60 of 103/ Clause No. 7.19.07	Only Mineral Insulated Steel Clad Cables /Fire Survival cables(2CX1.5 Sq.mm - Control Cable & 3CX2.5 Sq.mm Power Cable) will be considered as per Electrical Specification Volume IIF1 & IIF2.	Only Mineral Insulated Steel Clad Cables/Fire Survival cables(2CX1.5 Sq.mm - Control Cable & 3CX2.5 Sq.mm Power Cable) will be considered. Details Fire Survival cables shall be as per Electrical Specification Volume IIF1 & IIF2.

Sl. No.	Vol. No. /Page no./ Sec. no. /Clause	Original Text	Amended Text /Addenda/Deletion
12.	V. Il-J1/ Section: III/ Page 67 of 103/ Clause No. 8.07.02	Flow test shall be conducted on the hydrant valves. The flow through the valve shall not be less than 900 liters/min. Vender may submit type test report of similar size of valves duly certified by ISI.	Flow test shall be conducted on the hydrant valves. The flow through the valve shall not be less than 900 liters/min at 3.5kg/cm ² during PG Test. Vender shall also submit type test report of similar size of valves duly certified by ISI/as per approved Manufacturing Quality Plan.
13.	V. Il-J1/ Section: III/ Page 103 of 103/ Zone 60	Water Monitor on both sides of Boiler to cover Roof Top Transformer at ESP top & Hydrant Riser at Both Sides with Hydrant Post	Water Monitor(at 0.0mtr) on both sides of Boiler to cover Roof Top Transformer at ESP top & Hydrant Riser at Both Sides of ESP with Hydrant Post till roof top transformer level.
14.	V. Il-J1/ Section: III/ Page 3 of 62 / Clause No. 1.03.00	3 X 75% capacity Water cooled Semi-hermetic Screw Chiller	3 X 50% capacity Water cooled Semi-hermetic Screw Chiller
15.	V. Il-J1/ Section: III/ Page 5 of 62 / Clause No. 2.01.00.i	3 X 75% capacity Water cooled Semi-hermetic Screw Chiller	3 X 50% capacity Water cooled Semi-hermetic Screw Chiller
16.	V. Il-J1/ Section: III/ Page 19 of 62 / Clause No. 3.01.00	The chilled water plant shall operate with, 3 x 75% capacity Packaged Screw Chiller unit (Two (2) nos. working and One (1) no. Standby), 3x50.....	The chilled water plant shall operate with, 3 x 50% capacity Packaged Screw Chiller unit (Two (2) nos. working and One (1) no. Standby), 3x50.....
17.	V. Il-J1/ Section: III/ Page 3 of 38 / Clause No. 1.03.00.k	Following buildings under FGD package i. Ball mill building ii. Gypsum Dewatering Building	Deleted.
18.	V. Il-J1/ Section: III/ Page 28 of 38 / Clause No. 5.13.01.c	All duct for ventilation supply or exhaust shall be manufactured of at least 1 mm thick G.I./M.S. sheet.	All duct for ventilation supply or exhaust shall be manufactured of at least 1 mm thick G.I./M.S. sheet(Up to Duct Largest Side 2250 mm) and at least 1.25mm thick G.I./M.S. sheet(Duct Largest Side more than 2250 mm)
19.	V. Il-J1/ Section: V/ Page 7 of 25 / Clause No. 5.01.01	The pipe sizes chosen shall be the next higher size to that calculated by taking velocity of water does not exceed 2.5 m/s. Underground CW & ACW piping shall be concrete encased (min. 300 mm thickness) with appropriate protective coating.	The pipe sizes chosen shall be the next higher size to that calculated by taking velocity of water does not exceed 2.5 m/s. Underground CW & ACW piping shall be laid without concrete encasing. However, in areas of road/rail way crossing, pipes shall be RCC encased. The entire piping system shall be designed for a pressure not less than shut-off head of respective pumps and under 80% vacuum condition.

Clarifications / Confirmations

QUERIES/CLARIFICATIONS ON TECHNICAL SPECIFICATIONS FOR 1X660 MW SAGARDIGHI EXTENSION PROJECT (SGPRJ03)

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
Section - I					
1.	V.II-J1	<u>Section: I</u> /Cl. 2.01.00 / Page 2 of 5	Coal Handling Plant (CHP) Make-up	Customer shall provide sufficient water for DS/SW/PW system. Kindly furnish co-ordinate of tap point also	The tapping point from the existing SW network of Phase-II shall be finalized during detail engineering phase considering the pressure and flow availability in the existing network.
2	V.II-A	<u>Section: III</u> /Cl. 7.00.00 / Page 4 of 17 V.II-J1/ <u>Section: I</u> /Cl. 2.01.00 e) / Page 2 of 5	b) One (1) no. boiler fill pump (though no additional pump is considered for Phase-II, as the capacity of boiler fill pumps of Phase-II is envisaged to be sufficient for requirement of Phase-III). Existing CST pump house shall house cycle make-up pump, CPU regeneration pumps which shall run in parallel to the existing pumps of Phase-II. No additional boiler fill pump shall be installed in this pump house, as capacity of existing pump is deemed to be sufficient for this purpose. Only extension of the filling line up to boiler & deaerator of Phase-III is required.	Regarding the ITB requirement for provision of the Boiler Fill Pump, we found the inconsistency between the ITB requirements mentioned in Description column in this table. Please clarify the ITB requirement.	Though there is provision for installation of boiler fill pump for Phase-III in existing pump house, but boiler fill pump for phase-III is not required. Existing boiler fill line of phase-II will be extended to meet the requirement of phase-III.
3.	V.II-J1	<u>Section: II</u> /Cl. 3.04.00 / Page 2 of 32	Compressors, after coolers and intercoolers shall be of water cooled type and shall utilize Passivated Demineralised water (DMCW) for cooling purposes from DMCW system.	Based on the bidder and heat exchanger supplier's engineering practice, the water quality is one of the most important factor for selection of cooling water source for the heat exchanger. If the water	Please note that it is only emergency requirement and may be required during commissioning only. Moreover, ACW is clarified water quality and analysis is

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			The compressors and coolers shall also be connected with ACW system for cooling at the time of commissioning and during emergency.	quality of Aux. cooling water is not good, the ACW shall be prohibited to use the cooling water source. Therefore, we would like to request the Owner to withdraw the ITB requirement "The compressors and coolers shall also be connected with ACW system for cooling at the time of commissioning and during emergency."	attached with the specification. Hence, bidder is requested to follow the specification.
4.	V.II-J1	Section: I /Cl. 3.07.00 / Page 4 of 5	Reverse Osmosis (RO) Plant may be required to be installed for treatment of cooling tower blow-down water and further re-use of the same to achieve "Zero Waste Water Discharge", as per latest MoEF guidelines	Please clarify whether bidder to provide separate stand alone PLC (control system) for this proposed RO plant , If so whether bidder to provide interface to Main DCS of Phase II.	For detailed scope please refer V.II-12/AMEND/01 issued along with this reply
		Section: I /Cl. 3.07.00 / Page 4 of 5	Reverse Osmosis (RO) Plant may be required to be installed for treatment of cooling tower blow-down water and further re-use of the same to achieve "Zero Waste Water Discharge", as per latest MoEF guidelines.	Please provide the detailed specification and scope of the Reverse Osmosis (RO) Plant for Blowdown water treatment	
Section - II					
5.	V.II-J1	Section: II /Cl. 4.01.03 / Page 5 of 25	Valves, Flanged butterfly valves, strainers, flanges, root-valves other accessories shall be provided. Butterfly valves at condenser inlet and outlet, CW, ACW, pump discharge shall be provided with Power actuators.	DCPL/WBPDCCL is requested to give option for quick closing type electrical actuated type BF valves also in line with previously executed projects viz. Santaldih, Bakreshwar etc. of DCPL/WBPDCCL project. Pl. confirm.	Butterfly valves at discharge of CW & ACW pumps shall be hydraulically operated quick closing type, as specified.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
		<u>Section: V</u> /Annexure-II, Note-1/ Page 25 of 25	Butterfly valves at discharge of CW & ACW pumps shall be hydraulically operated quick closing type.		
6.	V.II-J1	<u>Section: II</u> /Cl. 5.03.00/ Page 4 of 32	.. Thus the instrument air compressor capacity for Phase-III shall be same as Phase-II.. ...Hence, identical compressors shall be considered to ensure utilization of already constructed foundations at site...	We understand that make and model of compressors and dryers of Phase-II shall be used in Phase III also. Please confirm our understanding Further, it is requested to share the make and model of Phase II compressors and dryers	Bidder's understanding is correct. Compressor: Make- Atlas Copco (India) Ltd. Model- ZR 275 Dryer- Make- Atlas Copco Airpower, Belgium Model- MD 600 W
7.	V.II-J1	<u>Section: II</u> /Cl. 5.16.00/ Page 6 of 32	Each Air Receiver shall be so sized that even in the event of total stoppage of air inflow to the same, the pressure in the Air Receiver shall not fall below 5.5 kg/cm2 (g) within 45 seconds of such stoppage	Considering the bleed down time of 45 sec. & compressor cap. of 36Nm ³ /min. The air receiver capacity comes out to be 18 M3. This air receiver is on much higher side. Also as per existing Unit#3 & #4, the air receiver capacity provided was 10 M3. Hence bidder request to accept air receiver capacity both for Instrument air & Service air of 10M3 only, also there is be additional Unit air receiver of 10M3 for Instrument air. This will help to utilise the same spare parts as that of Unit#3 & 4 air receivers. Pl. accept.	Bidder to follow specification requirement. Instead of one 18 m ³ air receiver, bidder to consider two nos. receivers of capacity 10 m ³ each. One no. IA receiver near compressor house and another in B-C bay of power house of capacity 10 m ³ each will meet the requirement. Another SA receiver of capacity 10 m ³ in addition to receiver near compressor house will be installed to meet the requirement of specification.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
8.	V.II-J1	<u>Section: II</u> /Cl. 5.16.00/ Page 6 of 32	The capacity of each Air Receiver shall be determined in accordance with the following guidelines: ...	We understand that air receiver capacity shall be same as per phase -II plant air receivers (i.e. 10 m3) Please confirm our understanding.	Bidder to follow specification requirement. Instead of one 18 m ³ air receiver, bidder to consider two nos. receivers of capacity 10 m ³ each. One no. IA receiver near compressor house and another in B-C bay of power house of capacity 10 m ³ each will meet the requirement. Another SA receiver of capacity 10 m ³ in addition to receiver near compressor house will be installed to meet the requirement of specification.
9.	V.II-J1	<u>Section: II</u> /Cl. 7.07.00/ Page 9 of 32 /Cl. 7.09.00/ Page 10 of 32 /Cl. 7.10.00/ Page 10 of 32 /Cl. 7.12.00/ Page 12 of 32 / ANNEXURE-A, Clause No. C / Page 23 of 32 / ANNEXURE-A, Clause No. H(c) /	Compressor casing, rotor and shaft Gear Box Inter Cooler, After Cooler and Moisture Separator Intake Air Filter and Silencer Materials of Construction Intercooler, After cooler, Moisture Separator, Piping,	Pl. note that material of construction within the compressor skid shall be as per OEM standard only. MOC outside compressor skid shall be as per customer specification. This is inline with the projects executed by Bidder for M/s WBPDCCL and other customers. Pl. accept.	Accepted only if the offered material is better compared to specified material. However, it will be reviewed during detail engineering stage.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
		Page 27 of 32/ ANNEXURE-B, Clause No. C & D /Page 23 of 32	Valves etc. : Clause C: Material Clause D: Supply of accessories And Services For Each ADP		
10.	V.II-J1	<u>Section: II</u> /Cl. 7.13.05/ Page 13 of 32	Motor shall be suitable for eight (8) equally spreaded starts per hour.	Pl. note that the following frequency of starts shall apply for HT motors employed in CAS package: a) Two starts in succession with the motor initially at temp. not exceeding the rated load operating temp. b) Three equally spread starts in an hour, the motor initially at a temp. not exceeding the rated load operating temp. Pl. accept.	Motor shall be capable of three equally spread starts per hour, three starts in quick succession from cold condition and two restart from hot condition. Refer Amendment in regard to the subject clause.
11.	V.II-J1	<u>Section: II</u> /Cl. 8.03.01/ Page 17 of 32	Each compressor shall operate in 50% or 100% load under load/unload mode of control depending on system demand.	Pl. note that in case of oil free screw air compressors, capacity control is not possible since these compressors operates either at no load or at full load. This is inline with air compressor supplied by bidder for WBPDCCL unit #3 & 4 and other previously executed WBPDCCL projects. Pl. accept.	It will be reviewed during detail engineering stage.
12.	V.II-J1	<u>Section: II</u> /Cl. 8.02.03/ Page 17 of 32	Each compressor shall be operated independently from its own microprocessor based control system having hardware/software interface with unit#3&4 DCS. However, provision shall be also made to operate & monitor the Compressors from the unit #5 DCS	Bidder understood that compressor will be operated independently from its own microprocessor based control system having hardware/software interface with unit#3&4 DCS. However Bidder recommends only monitoring Status of Compressors from U#5.	The entire compressed air system is common for all the three units. Hence, operation, monitoring and control of the all the compressors shall be available from the all the three units. Hence, Bidders proposal is not acceptable

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			also		and bidder is requested to follow the tender specification requirement.
13.	V.II-J1	<u>Section: II</u> /Cl. 8.02.02/ Page 17 of 32	Compressor control systems of unit#5 shall be interfaced with the unit # 3&4 DCS. Since, the compressors of unit #5 will be connected to existing compressed air header, any loss of header pressure for what so ever reason including failure of unit#5 compressors, will automatically start the standby compressor with the help of existing control system of units #3&4. However, the status of all compressors including the same of unit#3&4 shall be available at unit#5 control room.	Bidder requests clarification for the clauses 8.02.02, 8.02.03 & 8.05.00. Bidder requests clarification for the above clauses as it is not clear that the monitoring and Control of compressors for U#5 related Compressors lies with which unit Control.	For better clarity, Bidder may please refer vol-II E, Sec-V, Table-I [A(iii)] and cl. no. 2.02.01 to 2.02.06, page 10 of 24.
		<u>Section: II</u> /Cl. 8.05.00/ Page 18 of 32	Interfacing With Plant DCS : Individual proprietary control systems will be interfaced with existing phase II DCS through software link. Phase II DCS shall be interfaced with unit#5 DCS via Network Bridge. Hardwired signals of the new systems shall be terminated in the new Phase-III unit DCS.		
14.	V.II-J1	<u>Section: II</u> /Cl. 8.06.00/ Page 18 of 32 <u>Section: II</u>	Indication/ Annunciation System Interlock	Pl. note that material of construction within the compressor skid shall be as per manufacturer standard only. MOC outside compressor skid shall be as per customer specification. This is inline with the projects executed by bidder for M/s WBPDCCL	Accepted only if the offered material is better compared to specified material. However, it will be reviewed during detail engineering stage.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
		/Cl. 8.07.00/ Page 19 of 32 <u>Section: II</u> /Cl. 9.00.00/ Page 19 of 32	INSPECTION AND TESTING	and other customers. Pl. accept.	
15.	V. II-J1	<u>Section: II</u> / ANNEXURE-A, Clause No. E / Page 24 of 32	1) Maximum Allowable temp. rise : 5.5 deg C 2) Design pressure : Bidder to indicate. Shall not be less than the shut off head of DMCCW pump. 3) Maximum pressure drop allowable between inlet and outlet points : 7.0 MWC	1) Pl. note that temp. rise within compressor skid shall be max. 10 deg. C. as per OEM standard. 2) Pl. note that cooling water pumps are common for boiler, STG and BOP area, the shut-off head may be higher than the design pressure of instrument air & service air compressors. So, pressure reducing valve shall be provided in cooling water line to air compressors. Design pressure for cooling circuit for instrument and service air compressor shall be as per OEM standard design. Pl. accept. 3.) Pl. note that pressure drop within compressor skid shall be max. 10 MWC as per OEM standard. This is inline with the projects executed by bidder for M/s WBPDCCL and other customers. Pl. accept.	1) Bidder to follow specification requirement. 2) Bidder to follow specification requirement. 3) Accepted, pump head shall be calculated accordingly.
16.	V. II-J1	<u>Section: II</u>	Particle removing efficiency : 99.9% up to particle size of 1 Micron	Pl. note that particle removing efficiency shall be as per OEM	Bidder to follow specification requirement.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
		/ ANNEXURE-A, Clause No. H/ Page 25 of 32		standard to the best available as per industry practice. Restricting particle size will restrict the intake air to compressor. This is inline with the projects executed by bidder for M/s WBPDCCL and other customers. Pl. accept.	
17.	V.II-J1	Section: II /Cl. 5.03.00/ Page 4 of 32	foundations of both IA & SA compressors and dryer of Phase-III are already constructed at site considering existing models of compressor and dryer of Phase-II. Hence, identical compressors shall be considered to ensure utilization of already constructed foundations at site.	Customer to pl. clarify whether the foundation of compressor, air dryer & air receiver for the proposed Unit#5 are already casted or the civil foundation of these equipment is in bidder scope. Pl. clarify.	Foundation of new Air Receivers will be in Bidder's scope, rest will be as mentioned in Volume II-J1/Section-II//Cl. 5.03.00/ Page 4 of 32
Section - III					
18.	V.II-J1	Section -III/ Page 1 & 2 of 103/ 2.00.00	NFPA 10/11/12/13/14/15/20/22/24/37/850 and TAC Manuals on fire protection system, hydrant system, spray system, sprinkler system, fire alarm system	Owner has mentioned both NFPA and TAC standard for Fire protection system, fire pumping system, fire hydrant, fire water spray system, fire sprinkler system. Bidder will follow TAC rules for designing of Fire protection and detection system. Owner to confirm compliance.	Bidder shall offer system which shall cover all applicable requirements under both NFPA and TAC standards.
19.	V.II-J1	Section -III/ Page 2 of 103/ 2.00.00	The design, construction, testing and operation of the equipment or any item under Fire protection and detection system shall comply with the requirements of the latest revisions of one or more of the following standards as applicable: OISD- 117 - Fire protection	OISD-117 is developed for use in the oil and gas industry as announced in the note. Therefore, it is not quite appropriate to use it for coal fired power plant. In addition, many of requirements included in the OISD-117 are not consistent with the requirements of TAC manuals.	OISD -117 not applicable . As Fuel Oil Tanks excluded from Stage III scope.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDC
		Page 25 of 103/6.01.00.ii	facilities for Petroleum depots, terminals and pipeline installations ii) The complete fire detection and protection systems shall be designed in conformity with TAC/NFPA/IS-3034/OISD. Fire protection system shall be designed as per the guidelines of Tariff Advisory Committee (TAC) established under Insurance Act 1938 and NFPA.	Therefore, we would like to propose to exclude this standard from the fire detection & protection system requirements.	
20.	V.II-J1	Section-III/ Page 2 of 103/ 3.01.01	Hydrant System The Hydrant System of Fire Protection essentially consists of a large network of over ground pipe which feeds water to a number of hydrants valves – indoor as well as outdoor and to a number of outdoor type fixed installations.	Based on the paragraph of clause 3.01.01 and note a) of datasheet 3.00.00 the ring main pipe is supposed to be installed above ground. However, some requirements described in clause 5.01.00, 5.02.00, and 7.05.12 are not consistent with the clause 3.01.01. Please clarify whether underground road crossing of piping and RCC valve chambers are required even though the pipe is installed above ground, or not.	In general Fire Water pipes shall be laid above ground on the pipe RCC pedestals/sleepers. However in case of road and rail crossing pipe shall be laid under ground through appropriate grade hume pipe. In case of paved area the pipes shall be laid through RCC trench (with removable cover).
		Page 22 of 103/ 5.01.00	z) RCC Pipe encasement/hume pipes of appropriate class for buried pipelines for all road crossings, rail crossing & for all places where bulldozer may operate.	In addition, based on paragraph f) of 6.02.00 and 6.03.00 the ring main pipe is supposed to be install on pipe rack mainly. However, as per clause 7.5.3 of fire protection manual of TAC, fire water main pipe shall not be on pipe racks. Please clarify.	RCC valve Chambers only for underground/buried part only.
		Page 22 of 103/ 5.02.00	b) Excavation, preparation of bed and backfilling with compaction for laying underground pipelines and underground cables (wherever accepted by Owner). c) Construction of RCC valve chamber as required.		
		Page 26 of 103/ 6.02.00	f) All hydrant pipe mains/ pipe lines shall be routed over-ground on pipe		

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDC
			racks. Where pipe rack is not feasible, the pipes shall be routed on concrete sleepers. In main plant area, pipes shall be laid on RCC pedestals. f) All spray pipe mains/ pipe lines shall be routed over-ground on pipe racks. Where pipe rack is not feasible, the pipes shall be routed on concrete sleepers. In main plant area, pipes shall be laid on RCC pedestals. Buried piping shall be laid generally at a depth of 1.0 M below grade. In case of road crossing, same shall be 1.5 M minimum. For the operation of valves located in the valve pits, suitable arrangement shall be provided to operate the valves from the ground level (i.e. from the top of Valve Pit). For this purpose wrench-operated valve may be looked for. Note: a) Generally Pipes shall be over ground. If Over ground Pipe is not feasible (Road Crossing etc.), then under-ground/buried Pipe lines may be accepted. However, Final decision of Client/Consultant in this regard will be final.		
21.	V.II-J1	Section -III/Page 3 of 103/3.01.01.b	Hydrant system protects the following building/facilities. b) Baharampur Switchyard (2No.	Owner is requested to provide the referred Phase-II drawing, as the same is unavailable.	Details shall be shared with the contractor during detail engineering.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDC
			Bays) & Farraka – Jeerat (LILO) - 2 No Bays built by M/s PGCIL(1350N to 1500N) & other switchyard areas		
22.	V.II-J1	Section -III/Page 3 of 103/3.01.01.k	Hydrant system protects the following building/facilities. k) FGD & SCR area	Please note that the Material Handling Portion of FGD shall not be part of Bidder's scope of work. Please confirm.	Fire Detection, Protection System for all Areas/Buildings covered under this Specification is in bidder's scope. For the Areas/Buildings which are not covered under this specification but shall be under other owner's package viz. FGD, bidder shall keep provision and provide 3 nos. of tapping point with isolation valves and accessories from main ring header. Size of the tapping shall be decided during detail engineering.
23.	V.II-J1	Section -III/ Page 3 of 103/ 3.01.01.O	2 Nos. of Hydrant & Spray Water tapping points with isolation valves from Header for future use shall be considered	Please advise the approximate location of the tapping points for future use.	Bidder may kindly note the requirement of this 2 Nos. of Hydrant & Spray Water tapping points with isolation valves is in addition to the requirement as spelt above for FGD. The location shall be decided during detail engineering.
24.	V.II-J1	Section-III/ Page 4 of 103/ 3.01.02.b	Category – B type HVW Spray System shall be provided for the following areas: -All oil filled transformers having capacity less	Please note that as per TAC, oil insulated transformers with oil capacity less than 2000 litre and dry type transformer of less than 10 MVA	Tender specification prevails

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDC
			than equal to 10 MVA.	rating don't need to be protected by automatic spray protection system. Customer to confirm the same.	
25.	V.II-J1	Section-III/ Page 4 of 103/ 3.01.02.b	In this system fire shall be detected by use of heat detectors, flame detectors depending upon the area.	We understand either heat detector or flame detector shall be provided depending upon the area. Customer to confirm.	Flame detection along with Heat Detection to be provided for 1. Turbine Lube Oil tank/MOT & Purifiers 2. Central Lube Oil & Control Oil Tanks(Both clean oil & Dirty Oil Tanks) & Purifier Units 3. Lube Oil & Control Oil system for TD BFP 4. Boiler Burner Front Rest Areas as in NIT for Category B Fire with heat detection
26.	V.II-J1	Section-III/ Page 4 of 103/ 3.01.02.b	All oil filled transformers having capacity less than equal to 10 MVA	As per IS 3034 The HVWS system is not required for oil filled transformers having capacity equal or less than 2000 L. Hence please confirm that HVWS system will be provided based on above guideline only.	Tender specification prevails
27.	V.II-J1	Section-III/Page 5 of 103/3.01.03	MVWS	MVWS system is not considered for running cable tray in Power House or out door over cable rack etc. as per cl no. 3.01.03. Please confirm the same.	Confirmed.
28.	V.II-J1	Section -III/ Page 6 of 103/ 3.01.04.a	Each Silo fill gallery (bunker bay)	We are not aware of the mentioned location clearly. Please clarify what the silo fill gallery and where it is	Trippler floor shall be considered

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
29.	V.II-J1	Section-III/ Page 7 of 103/ 3.01.04.b & c	Sprinkler system for following area: b) Each Turbine Generator area under-floor (Ground floor, including all areas subject to spread of oil) c) Each Turbine Generator area under-floor (Mezzanine floor and turbine lagging, including all areas subject to spread of oil)	located. We understand Sprinkler system shall be provided underneath of Turbine operating floor as per NFPA guidelines. Customer to confirm.	Bidder shall follow the tender specification.
30.	V.II-J1	Section -III/ Page 7 of 103/ 3.01.04.d	d) Locker rooms, corridors, laboratories and office spaces shall be protected by closed head sprinkler systems.	We understand that the mentioned areas are the ones included in the turbine building. Please confirm.	This shall be in Power house building.
31.	V.II-J1	Section-III/Page 9 of 103/3.03.00	FAP connectivity with Phase-II	Please indicate the route length between Phase-II and Phase-III FAP connectivity for estimation purpose	The length shall be calculated from CWPB of phase II FAP to CWPB of phase III FAP. Bidder to check from uploaded Plot Plan and uploaded drawing no. PE-VO-373-522-A0013, Rev.2
32.	V.II-J1	Section-III/ Page 9 of 103/ 3.03.00.h	There shall be a centralized Fire Water Control Room at CW pump house of phase III. FAP network of phase III at Centralized Fire Water Control Room shall have connectivity to phase II FAP Network so that both stage II and Stage III fire alarm system can be monitored from the new Fire Water Control Room of phase III. Necessary hardware/software required for this integration shall be in bidder's scope.	For the linking of Fire alarm panels, Panels must be compatible and hence to ensure the same Customer to provide the make and details of existing Fire Alarm Panel.	Make - Schrack Seconet Model - Integral IPMX Series

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDC
33.	V.II-J1	Section -III/ Page 10 of 103/ 3.04.00.e	Air sampling type smoke detector shall be provided for above false ceiling area in the Central control room and control equipment room.	The requirements of air sampling type smoke detectors are described inconsistently in the specification. One shown under clause 3.04.00 indicates that air sampling type smoke detectors are required in the above false ceiling area of central control room and control equipment room, but other ones shown under clause 3.11.00 & 6.06.00 indicates that the same is required in the above false ceiling area of all (or major) control rooms and control equipment rooms. Please clarify.	Air sampling HSSD(High Sensitivity Smoke Detection) type smoke detector shall be provided for above ceiling area and below ceiling area for all control rooms.
34.	V.II-J1	Section-III/ Page 11 of 103/ 3.06.02	The Cable Spreader Room and Cable Vault shall be divided into a smaller risk zones. These zones shall be separated by 120 minutes rating fire barrier walls.	Please note that if more than one zone is there in the cable spreader, fire occurrence at any zone will also initiate spray system in adjacent zones and hence fire barrier between zones are not required. Customer to confirm. However, we confirm if two separate cable spreader rooms are adjacent, fire wall of 120 min shall be provided between two rooms.	Tender specification prevails
35.	V.II-J1	Section -III/ Page 11 of 103/ 3.07.00	For containment of fire and preventing it from spreadingshall be provided. At least two fire escape exit openings to the open areas shall be provided for the TG area as prescribed by the TAC/LPA.	The requirements of fire resistance rating of fire sealing material are described inconsistently in the specification. One shown under section III, volume II-J indicates minimum 3 hours rating, but the other one shown under section VII, volume II-F/2 indicates minimum 2	Minimum 3 hours rating shall be considered.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDC
				hours rating for certain rooms and minimum 1 hour rating for other rooms. Please clarify.	
36.	V.II-J1	Section-III/ Page 12 of 103/ 3.11.00	Gas sensing fire detectors working on air sampling shall be provided for all control rooms and control equipment room.	Is it Gas detector or Air sampling type smoke detector. Customer to clarify.	HSSD(High Sensitivity Smoke Detection) shall be provided
37.	V.II-J1	Section -III/ Page 12 of 103/ 3.11.00	Gas sensing fire detectors working on air sampling shall be provided for all control rooms and control equipment room.	The requirements of air sampling type smoke detectors are described inconsistently in the specification. One shown under clause 3.04.00 indicates that air sampling type smoke detectors are required in the above false ceiling area of central control room and control equipment room, but other ones shown under clause 3.11.00 & 6.06.00 indicates that the same is required in the above false ceiling area of all (or major) control rooms and control equipment rooms. Please clarify.	Air sampling HSSD(High Sensitivity Smoke Detection) type smoke detector shall be provided for above ceiling area and below ceiling area for all control rooms.
38.	V.II-J1	Section -III/ Page 12 of 103/ 3.11.00	Gas sensing fire detectors working on air sampling shall be provided for all control rooms and control equipment room.	Bidder understands that Gas sensing fire detectors working on air sampling shall be provided for control room and control equipment room of Power House building. Other control room like ESP control room, FGD control room, AHP control room, CHP control room etc. shall not be provided with Gas sensing fire detectors working on air sampling. Owner to confirm bidder understanding.	All control rooms shall be considered with HSSD.(High Sensitivity Smoke Detection)

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDC
39.	V.II-J1	Section-III/ Page 12 of 103/ 3.13.00	If water pressure in the hydrant pipe network is not adequate to maintain minimum 3.5 kg/cm ² (g) at the hydraulically furthest hose station at elevated floors of boiler houses and turbine building, then 2x100% booster pumps (one (1) no. motor driven+ one (1) no. diesel engine driven) shall be provided for individual areas for supplying pressurized water to the hydrant points.	We understand total one set (2x100%) of booster pumps, if required shall be provided to meet pressure requirement of all elevated areas. Customer to confirm.	Subject Clause delete. Bidder may please refer to Amendment section.
40.	V.II-J1	Section-III/ Page 14 of 103/ 4.04.01	4.00.00 OPERATIONAL PHILOSOPHY 4.04.00 Functional Requirement of Various Panels in Fire detection & Protection System 4.04.01 The Common Centralized Fire Water Control Room shall have OWS, EWS for Stage III Fire Water Systems. It shall also house Stage III Fire Water PLC & UPS.	Regarding the "UPS" of Stage III Fire Water Control Room, please confirm if this requirement of clause 4.04.01 is satisfied by locating sub UPS distribution board fed from main UPS DB of CCB, in this Fire Water Control Room.	Separate UPS system is envisaged.
41.	V.II-J1	Section -III/Page 14 of 103/4.04.01 & 5.04.07	Control of Fire water Pumping System is envisaged from Common Centralized Fire Water Control Room through PLC & SCADA/OWS of Unit#5. Control of all pumps etc. of Unit# 3, 4 shall also be carried out from the Centralised Fire Water Control Room. Hence, OWS & EWS of Unit #3 & #4 Fire Water system PLC shall be relocated to Common Centralised Fire Water Control Room. Necessary arrangements (both Hardware &	Fire water pump system does not need frequent operation logic adjustment; therefore, as EWS for the fire water pump system control seems not necessary. In addition, a laptop which can be used as an EWS will be provided as per the specification.	Tender specification prevails

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDC
			software) for the above are in the bidder's scope. The Common Centralised Fire Water Control Room shall have OWS, EWS for Stage III Fire Water Systems. It shall also house Stage III Fire Water PLC & UPS Industrial grade Laptop based engineering station loaded with all latest version licensed software required for programming, troubleshooting and analysis for Fire detection and alarm panel. This laptop shall also have licensed Office documentation software and Antivirus software only EWS to be provided at Common centralised fire water Station.		
42.	V.II-J1	Section-III/ Page 14 of 103/ 4.04.01	Dual hot redundant Programmable Logic controller (PLC) based Fire Water Pump Control Panel, located in Common Centralized Fire Water Control Room. Detailed PLC Panel description as per Volume II E. The fire pumps controllers shall be UL labeled, FM approved or equivalent.	Customer to confirm whether one PLC based control panel shall be provided for all fire water pump or separate FM/UL listed fire pump controllers shall be provided for each pump.	Common PLC shall be provided
43.	V.II-J1	Section-III/ Page 14, 15 of 103/ 4.04.01	Control of Fire water Pumping System is envisaged from Common Centralised Fire Water Control Room through PLC & SCADA/OWS of Unit#5. Control of all pumps etc. of Unit# 3, 4 shall also be carried out from the Centralised Fire Water	We suggest customer not to relocate the OWS & EWS of existing fire water pump house PLC. As Common main Fire alarm panel shall be in the centralized fire water control room. Existing fire water pumps can also be operated from	Bidder to adhere to the specification requirement.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			Control Room. Hence, OWS & EWS of Unit #3 & #4 Fire Water system PLC shall be relocated to Common Centralised Fire Water control room. Necessary arrangements (both Hardware & Software) for the above are in the bidder's scope.	Main FAP. Customer to accept. Customer is requested to accept the same. In order to consider the size and layout of common centralised fire water control room, please provide the layout and quantity of PLC, OWS & EWS of Unit #3 & #4 fire water system. In addition, we believe that rearrangement of Unit #3 & #4 fire water system PLC, OWS & EWS can only be done by the supplier of the same due to warranty issue. Please exclude the rearrangement scope from ours.	
44.	V.II-J1	Section -III/ Page 15 of 103/ 4.04.01	Fire men's Telephone/ Voice Communications which will be connected to Stage III and as well as FAP Stage - II FAP is to be located in Common Centralised Fire Water Control Room. Necessary Speaker/ Announcement/ Output System of Stage III Fire men's telephone system is to be provided at UCR Stage I, II, III, Stage I Fire Station & Critical areas of Stage III.	Please clarify whether the fire men's telephone system for UCR stage I, II and stage I fire station have to be provided or only interface between stage III fire men's telephone system and fire men's telephone system of UCR stage I, II, and stage I fire station, which is assumed to be existing.	Regarding Fire Mens telephone announcement : 1. Fire men's telephone system to be provided or Stage-III which shall be interfaced with Fire men's telephone Stage-II (A Square Technosolution),. 2. Announcement system to be installed in CCR-Phase-I, Phase-II, Phase-III and Stage I fire station from Stage-III.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
45.	V.II-J1	Section -III/ Page 21 of 103/ 5.01.00.(s)	Dual wavelength Infrared flame detectors for boiler burner fronts and turbine oil tanks.	Boiler burner front and turbine oil tanks are provided with spray water system with QBD as detector, Bidder request owner to delete infrared flame detectors in boiler burner front and turbine oil tanks.	Also in addition to QBD & Spray System, Flame Detection along with Heat Detection to be provided as per specification.
46.	V.II-J1	Section-III/ Page 24 of 103/ 5.04.10	24V DC (2X12V DC) Battery and Battery charging units for each Fire detection and alarm panel.	We understand battery for fire alarm panel is either 24VDC or 2X12VDC. Customer to confirm.	Bidder to consider only 2X12V DC Battery and Battery charging units for each detection and alarm panel.
47.	V.II-J1	Section -III/ Page 24 of 103/ 5.04.11 & 7.19.01 Page 53 of 103 /7.19.01	240V AC, 50Hz, +/- 1% Mini UPS system for Operator station of Fire detection and alarm panel. FAP will be powered through two normal AC mains of 240V AC, 50Hz.	There is in consistency in the requirement of FAP power in different sections of the specification. Please clarify which power the FAP should be fed by, normal 240 AC or UPS 240 AC.	FAP shall be powered from two sources. one from dedicated Mini UPS system and other from normal AC mains of 240V AC, 50Hz.
48.	V.II-J1	Section -III/ Page 26 of 103/ 6.02.00.e	e) Three hydrant ring mains shall be provided and entire power plant area shall be suitably divided amongst these ring mains. These ring mains shall be interconnected with isolation valves. It shall be possible to enable to take up part of any of the ring mains for maintenance without any loss of system in the balance part.	Please clarify what the three hydrant ring main means. We will provide one hydrant fire mains and one water spray fire mains to be looped around the main power block and other strategic areas so that fire water can be supplied in case of any part of the fire mains in out of service or maintenance.	Refer Amendment issued with the reply sheet (Four Ring Mains to be provided)
49.	V.II-J1	Section-III/ Page 26 of 103/ 6.02.00.f	All hydrant pipe mains/ pipe lines shall be routed over-ground on pipe racks. Where pipe rack is not feasible, the pipes shall be routed on concrete sleepers. In main plant	Please note that as TAC guidelines, Fire water headers can not be laid on pipe racks and in the BTG area (Main plant area) there will be lot of vehicle movements during erection	In general FW pipe shall be laid above ground on the pipe RCC pedestals/sleepers. However in case of road and rail crossing pipe shall be laid

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			area, pipes shall be laid on RCC pedestals.	and also removable paver blocks shall be there in the main plant areas. So we propose Fire water pipes shall be buried in Main plant areas and for other areas Pipes shall be on sleepers. Customer is requested to accept the same.	underground through appropriate grade hume pipe. In case of paved area the pipes shall be laid through RCC trench (with removable cover).
50.	V.II-J1	Section -III/ Page 26 of 103/ 6.02.00.k	First aid fire protection system for power house floors and service building as per guide line of TAC.	Since Service building not in scope of bidder first aid fire protection system for the same will not be provided by bidder. Owner to confirm .	All Buildings in Battery Limit of Stage III to be covered
51.	V.II-J1	Section -III/ Page 27 of 103/ 6.03.00.f	All spray pipe mains/ pipe lines shall be routed over-ground on pipe racks. Where pipe rack is not feasible, the pipes shall be routed on concrete sleepers. In main plant area, pipes shall be laid on RCC pedestals.	In main plant area, wherever pipe rack not available Bidder proposes to provide fire water pipes UG buried to avoid any interference with other facility. Owner is requested to accept.	In general FW pipe shall be laid above ground on the pipe RCC pedestals/sleepers. However in case of road and rail crossing pipe shall be laid under ground through appropriate grade hume pipe. In case of paved area the pipes shall be laid through RCC trench (with removable cover).
52.	V.II-J1	Section-III/ Page 28 of 103/ 6.04.00.vi	The discharge time period shall be such that the design concentration is achieved within 60 seconds.	As per NFPA 2001 latest edition discharge time duration has been revised to 120 seconds. Customer to confirm the same.	Noted
53.	V.II-J1	Section -III/ Page 29 of 103/ 6.06.00.	ii) The FAP shall be listed as a Proprietary Control Panel. The FAP, associated equipment and detectors shall be included in the Approval Guide as published by Factory Mutual Engineering./VDS Approved /UL Listed test	The requirements of FAP certification are different from a section to another. Clause ii) indicates that FAP should be certified by FM or VDS or UL, but clause xi) only indicates as FM or VDS. We would like to propose FAP certified by FM or VDS	FAP shall be FM/ VDS APPROVED/ UL LISTED.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			certificates of detectors shall be furnished by the manufacturer along with the datasheet for Owner's acceptance. xi) The Fire Alarm System panels & enclosure shall be as follows or as per the manufacturer standard when no special requirements are indicated. Control panels (local) IEC 56 (NEMA 4) Fire Alarm Panels [FAP] (to be located in AC control room) IEC 52 (NEMA 12) The panel will operate on specified volts ac, and will be FM approved/ VDS Approved.	or UL	
54.	V.II-J1	Section-III/ Page 34 of 103/ 6.06.00.xii	A local control panel shall be furnished for each of the sprinkler/spray system valve stations. All local control panels shall be capable of operation as a stand-alone system.	We understand this local control panel is for spray system only. Sprinkler system is a standalone system with no requirement of Control panel. Customer to confirm.	DVLCP(Deluge Valve Local Control Panel) shall be provided for HWWS & MVWS.
55.	V.II-J1	Section -III/ Page 35 of 103/ 6.06.00.xiii.f	Aspiration / Air sampling type detector system installed in major control room equipped with false ceiling shall be interconnected with FA panel in the respective area via addressable interface module or by any other suitable method. The main purpose of connecting so is to consider aspiration system also as part of main detection system and all alarm signals in aspiration system shall be made to known to	The requirements of air sampling type smoke detectors are described inconsistently in the specification. One shown under clause 3.04.00 indicates that air sampling type smoke detectors are required in the above false ceiling area of central control room and control equipment room, but other ones shown under clause 3.11.00 & 6.06.00 indicates that the same is required in the above false ceiling area of all (or major) control rooms and control	All control rooms shall be considered with HSSD.(High Sensitivity Smoke Detection) for both above false ceiling and below false ceiling

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDC
			main panel and appropriate actions shall be initiated by main panel like other alarm signals.	equipment rooms. Please clarify.	
56.	V.II-J1	Section-III/ Page 35 of 103/ 6.07.00.a	Each zone of cable spreader room shall be provided with one (1) no. cut-off BFV.	We understand one set of deluge system with pipes, valves and nozzles shall be provided for each zone of cable spreader room. Customer to clarify if the given clause asks for any additional requirement.	DV system with strainer, Isolating Valves, necessary trim, pressure switches, Pr. gauges, DVLCP etc as per standard practice including Deluge Valve Bypass Line to be provided.
57.	V.II-J1	Section-III/Page 35 of 103/6.07.00.c	Water velocity in Fire water pipes shall be as per TAC recommendation. However, Velocity of water thru' pipelines at pump's suction and discharge shall be limited to 1.5 M/sec and to 2.5 M/sec respectably.	Please note that as per TAC, allowable velocity in fire water pump discharge pipe is limited to 5m/s and same shall be considered for sizing pump discharge in network sizing. Customer to confirm.	Follow Bid Specification
58.	V.II-J1	Section-III/ Page 37 of 103/ 6.09.06.b	Notify automatically central fire station.	We understand no further connection is required from new fire alarm panel to existing central fire station and interconnection with existing fire alarm panel will fulfill the criteria. Customer to confirm.	Confirmed
59.	V.II-J1	Section -III/Page 38 of 103/7.01.02	The pumps shall comply with the regulations of Tariff Advisory Committee (TAC) and National Fire Protection Association (NFPA), USA as applicable.	Bidder will provide Pumps in compliance with TAC requirement and as per IS standard. Owner to accept.	Bidder will provide Pumps in compliance with TAC requirement and as per IS standard.
60.	V.II-J1	Section -III/ Page 45 of 103/ 7.11.00	b) Branch pipes shall be constructed of Stainless steel (SS-304) and have rings at both the ends. One end of the branch pipe will receive the quick coupling while	As per clause A.2.00.00 of data sheet the material of pipe is mild steel as per IS-1239 and IS-3589, however, clause 7.11.00 mentions that branch pipes shall be	Branch pipe shall be made of Stainless steel (SS-304)

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			the nozzle will be fixed to the other end. Material M. S. ERW pipes as per IS-1239, Part – 1 heavy grade (for pipes of sizes 150 NB or below) and IS-3589 Gr.410 ERW (For sizes 200 NB and above) or equivalent and galvanized as per IS 4736 for pipes normally empty and periodically charged with water system application.	constructed of stainless steel. Please clarify which specific part of the branch pipes need to be made of stainless steel.	
61.	V.II-J1	Section-III/ Page 52 of 103/ 7.18.01.b	The Battery driven Power supply shall be available to main fire alarm panel shall be designed to provide supply for a minimum period of 48 hours.	The Battery driven Power supply shall be available to main fire alarm panel shall be designed to provide supply for a minimum period of 48 hours for normal condition and not in alarm condition. Customer to confirm.	Follow Bid specification, however for alarm condition 12 hrs minimum shall be considered
62.	V.II-J1	Section-III/Page 53 of 103/7.19.01.I	FAP ----- based. Microprocessor based fire alarm panel shall comprise of the processors, various functional modules, adequate number of loop modules for detector loops, display devices, output modules for alarm, control & interlocks, keyboard, amplifier modules, modules for communication with the local area network, two sets of battery; battery chargers	As per previous point we understand if battery is 12VDC then two sets of battery and if it is 24VDC FAP shall consist of only one battery and battery charger. Customer to confirm.	Bidder to consider only 2X12V DC Battery and Battery charging units for Fire detection and alarm panel.
63.	V.II-J1	Section -III/ Page 60 of 103/ 7.19.07	Conduits, pipes and ducts will be embedded in walls.	Bidder would like to propose to modify the description of this requirement as follows, because	Bidders apprehension is noted and accepted. In case of process/system

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
				normally conduits located where operators stay are embedded in walls, but in case of process/system room or space where mechanical equipment are located, conduits are exposed. Please confirm if it is acceptable: "Conduits will be embedded in walls in case of the rooms/spaces where operators stay as fire water control room."	room or space where mechanical equipment are located, conduits shall be exposed but neatly laid and supported all along static structure.
64.	V.II-J1	Section-III/ Page 60 of 103/ 7.19.07.1	Only Mineral Insulated Steel Clad Cables /Fire Survival cables(2CX1.5 Sq.mm - Control Cable & 3CX2.5 Sq.mm Power Cable)	As per standard practice, 2CX1.5 Sq.mm - Control Cable & 3CX2.5 Sq.mm Power Cable (FRLS) shall be provided. Customer is requested to accept the same.	Tender specification prevails
65.	V.II-J1	Section-III/ Page 67 of 103/ 8.07.02	Flow test shall be conducted on the hydrant valves. The flow through the valve shall not be less than 900 liters/min.	Customer to be informed that flow test of hydrant valve shall be at 7kg/cm2 pressure and not at 3.5 kg/cm2 which is the required pressure for installed hydrants. Customer to confirm.	Refer Amendment issued with the reply sheet. (900LPM at 3.5Kg/Cm2)
66.	V.II-J1	Section -III/ Page 69 of 103/ 9.01.00	Drawings to be Submitted by the Bidder 9.01.01 Flow diagram showing the complete fire protection scheme with associated controls for the following : i) Hydrant System both Indoor and Outdoor. ii) Automatic type High Velocity Water Spray System with quartzoid bulb detection system in pressurized water loop.	Bidder understands that the referred drawings/documents are part of detail engineering and shall be submitted after contract award stage. Please confirm bidder's understanding.	Confirmed bidder's understanding is correct.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			iii) Automatic type Medium Velocity water spray system with Linear heat sensing cable as detector. iv) Multi-criteria smoke detection system arranged in cross-zoning principle. v) Heat Detection System (IC type). vi) Diagram showing the lubricant system etc. 9.01.02 Schematic and wiring diagram for Battery Charger. 9.01.03 Layout arrangement of battery with catalogues. 9.01.04 Mounting arrangement of battery charger. 9.01.05 Typical general arrangement drawing showing constructional features, space required in front & back, Power/Control/Signal Cable entry points, etc. of local fire panels, main fire panel and local control panel. 9.01.06 Typical Control Schematic diagram for solenoid operated valves, drive motors, Fire-detector circuits. 9.01.07 Contact multiplication diagram for hook-up with Air-conditioning System, Ventilation System, Coal Handling System. 9.01.08 Typical Annunciation System Schematic Diagram along with control and instrumentation scheme of the Fire Protection System. 9.01.09 Layout arrangement of		

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			Battery Charger inside. 9.01.10 Typical drawings for Fireproof Sealing System indicating fixing details and dimensions. 9.01.11 Write up on control and operating philosophy of complete Fire Fighting System. 9.01.12 System configuration of Fire water pumping & pressurizing system, Fire alarm detection & protection system etc. along with interface technique of other systems. 9.01.13 Proposed GA drawing of different panels. 9.01.14 I/O list 9.01.15 Technical data sheets 9.01.16 Bill of Materials 9.01.17 P&I diagrams 9.01.18 Details of Spares 9.01.19 Details of Training 9.01.20 Filled up Bid Proposal Sheets 9.01.21 Deviation Sheet. 9.02.00 Data and Curves 9.02.01 Battery cell voltage characteristics and data for different discharge rates. 9.02.02 Schedule of projectors in MVW spray system and various types of detectors i.e. quartzoid bulb, smoke detector, heat detectors & fire sensing cable, indicating nos. selected for each type of equipment/area. 9.02.03 Technical Leaflets on fireproof sealing system and Fire		

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			Protection Coating System. 9.02.04 Type Test Certificate for all the tests specified elsewhere in the specification.		
67.	V.II-J1	Section-III/ Page 95 of 103/ Annexure V, Zone 2 V.II-B / Page 26 of 83/ 5.10.11	Air Pre-heater-Hydrant protection-- Fire sensing thermo-couple-Alarm Permanent firefighting equipment including sprays, pipe work and valves shall be provided. The air heaters shall be provided with infra-red sensing device / the thermocouple type fire sensing device and redundant temperature elements for each bearing and oil sump and the fire fighting system shall be complete with accessories, ----- ANNEXURE-V LIST OF FIXED FIRE PROTECTION AND DETECTION SYSTEM Zone description 41 New Crusher house 1 & 2 42 Cable spreader for New Crusher house 1 & 2 43 Sub-station buildings for crusher house 1 & 2	Both clauses are having ambiguity. Please confirm whether spray system shall be provide for Air pre-heater or only hydrant protection shall be provided.	As per standard practice each Air Pre-heater shall be equipped with Fire-fighting spray lines with nozzles to combat fire breakouts inside the Air Pre-heaters. Externally there shall be one Fire-hydrant post near each Air Pre-heater.
68.	V.II-J1	Section -III/ Page 100 of 103	ANNEXURE-V LIST OF FIXED FIRE PROTECTION AND DETECTION SYSTEM Zone description 41 New Crusher house 1 & 2 42 Cable spreader for New Crusher house 1 & 2 43 Sub-station buildings for crusher house 1 & 2	Bidder understands that New Crusher house 1 & 2 shall be read as "one no. New Crusher House" Please confirm.	Crusher House has 2 Nos of of Crusher. Total area to be covered.
69.	V.II-J1	Section -III/ Page 100 of 103	ANNEXURE-V LIST OF FIXED FIRE PROTECTION AND DETECTION SYSTEM	Bidder understands that since the Limestone & Gypsum Handling is excluded from scope of work, hence the Fire Detection & Protection	Fire Detection, Protection System for all Areas/Buildings covered under this Specification is in bidder's

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			Zone description 48 Ball Mill Building (Limestone grinding house) 49 Ball Mill Building (Limestone grinding house) cable spreader room 50 Gypsum Dewatering building 51 Gypsum Dewatering building cable spreader room	System shall also be excluded from Bidder's scope of work. Please confirm bidder's understanding.	scope. For the Areas/Buildings which are not covered under this specification bidder shall not consider the same under their scope of works.
70.	V.II-J1	Section -III/ Page 103 of 103/ Zone 60	ANNEXURE-V LIST OF FIXED FIRE PROTECTION AND DETECTION SYSTEM Zone description 61 Any Bay Control Room including - Bay Control Unit Rooms of Sagardighi - Baharampur Switchyard (2No Bays) & Farraka – Jeerat (LILO) - 2 No Bays built by M/s PGCIL(1350N to 1500N) & any other Switchyard Area Rooms	In case, the bidder has to consider the hydrant system for the referred systems, Owner to provide the GA drawing & other details so as to design the Hydrant System. Please confirm acceptance.	Details shall be shared with the contractor during detail engineering.
Section - IV					
71.	V.II-J1	<u>Section: IV</u> /Cl. 4.01.00/ Page 3 of 4	Bidder shall enclose with his proposal besides the filled up Proposal Exhibits the following. 4.01.01 Calculations to obtain the total number of H2, CO2 and N2 Gas Cylinders for 1x660 MW unit. 4.01.02 Manufacturer's standard catalogue, literature and drawing showing technical details of each type of gas cylinder.	Bidder understands that the referred drawings/documents are part of detail engineering and shall be submitted after contract award stage. Please confirm bidder's understanding.	Bidder will furnish all basic drawing/ documents, which are required to justify the selection of equipment/ system offered by him.
Section - V					
72.	V.II-J1	<u>Section: V</u>	The Large Diameter Piping to be fabricated and installed shall	We understand that CW piping (condenser inlet and outlet) shall be	Underground CW & ACW piping shall be laid without

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
		/Cl. 1.01.00/ Page 1 of 25 Section: V /Cl. 5.01.01/ Page 7 of 25 Section: V /Cl. 9.01.07/ Page 21 of 25 V.II-G1/ Section: I /Cl. 4.3 / Page 21 of 35 V.II-I1/ Section: I /Cl. 4.01.09/ Page 6 of 14	include the following pipe lines having sizes 450 mm NB and above: a) Circulating Water Piping The pipe sizes chosen shall be the next higher size to that calculated by taking velocity of water does not exceed 2.5 m/s. Underground CW & ACW piping shall be concrete encased (min. 300 mm thickness) with appropriate protective coating. The pipes that will be buried underground shall be spark tested after completion of wrapping of each sections/field jointing to check the quality of insulation that has been provided on the pipe. CW Tunnels/ duct: The underground tunnels / piping from CW pump house to cooling tower basin for circulating cooling water to condenser shall be of watertight RCC construction. Underground CW and ACW piping shall be provided with suitable protective coating/wrapping and shall be suitably stiffened to withstand soil loads and loads due to heavy vehicles at road crossings.	carbon steel and Underground CW buried piping shall be provided with suitable protective coating/wrapping. RCC encasement of 300mm shall be provided under rail/road crossing only. The above is in line with earlier executed Phase-II of Sagardhigi project. Pl. confirm	concrete encasing. However, in areas of road/rail way crossing, pipes shall be RCC encased. The entire piping system shall be designed for a pressure not less than shut-off head of respective pumps and under 80% vacuum condition. Refer Amendment issued for the subject clause. In regard to the pipe painting system, Clause No. 9.01.05 & 9.01.06 of Volume-II - J1 Section-V for 'large diameter low pressure piping' section to be followed.
73.	V.II-J1	Section: V	All plates used will be of mild steel quality conforming to IS-2062 Gr B	There is a discrepancy in the clauses. Bidder proposes to consider	450 NB and above pipes shall be fabricated as per clause

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
		/Cl. 5.01.03/ Page 7 of 25 <u>Section: V</u> /Cl. 1.01.04/ Page 1 of 25	(latest revision) or equivalent. The Large Diameter Piping to be fabricated and installed shall include the following pipe lines having sizes 450 mm NB and above: a) Circulating Water Piping b) Auxiliary Cooling Water Piping c) DM Closed Cooling Water Piping (Only pipes of size 450 NB and above) d) Cooling Tower Make-up Water Piping	mild steel IS-2062 Gr B (latest revision) or equivalent for pipe lines having sizes 500 mm NB and above. For pipe size from 200 NB to 450 NB, IS 3589 mild Steel, ERW, IS-3589 Grade Fe 410 / ASTM-A 53 Grade B (Welded), Type-E, Schedule 40 shall be used as per VOL II 12 Section VIII. Please confirm.	5.01.03 of Section: V of Vol. II-J1. Rest material of construction shall be system specific and as specified in various section of specification.
		V.II-12/ <u>Section: VIII</u> /Cl. 4.04.01/ Page 8 of 37	Material of construction for pipes under different services shall be as below: 200 mm to 450 mm NB: Mild Steel, ERW, IS-3589 Grade Fe 410 / ASTM-A 53 Grade B (Welded), Type-E, Schedule 40. Carbon Steel 500 mm NB and above: Rolled and Butt Welded from IS-2062 Grade A plates or SA-285 Grade C or Equivalent (subject to approval by Purchaser). / Spiral Welded pipes.		

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
74.	V.II-J1	<u>Section: V</u> /Cl. 5.04.04/ Page 13 of 25	Support selection and MoC	As per the standard practice of OEM based on the load and application.	Subject to review and approval of owner.
75.	V.II-J1	<u>Section: V</u> /Cl. 8.01.01/ Page 18 of 25	After complete pipe lines have been laid and joined, the same shall be tested hydrostatically as specified in Vol.-IIA, for hydrostatic test pressure of circulating water piping, Auxiliary Cooling Water Piping.	As per ASME B31.1 Table 136.4, Visual test is minimum mandatory NDE test which for piping temperature below 175°C. However we propose 100% Radiographic examination (RT) instead of Hydrostatic test for field welded joint of CW and ACW at site to detect weld joint defect.	Bidder to follow specification requirement.
76.	V.II-J1	<u>Section: V</u> /Cl. 8.01.01/ Page 18 of 25	After complete pipe lines have been laid and joined, the same shall be tested hydrostatically as specified in Vol.-IIA, for hydrostatic test pressure of circulating water piping, Auxiliary Cooling Water Piping.	No such requirement available in Vol.-IIA, please clarify the requirement.	Hydro test shall be done at 1.5 times the design pressure of the pipe line. The procedure of Hydro test need to be submitted during detail engineering stage by the Bidder, which will be subject to review and approval of owner.
77.	V.II-J1	<u>Section: V</u> /Cl. 8.01.02/ Page 18 of 25	Large diameter piping: All the longitudinal and circumferential welded seams shall be subjected to chalk and kerosene test prior to hydraulic testing of the complete pipeline. This shall be done at the presence of Owner/Consultant.	At shop, 10% RT and 100% Visual test will be done for longitudinal and circumferential welds. At site, the complete system will be hydro tested.	Bidder to follow specification requirement.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
78.	V.II-J1	<u>Section: V</u> /Cl. 9.01.00/ Page 20 & 21 of 25	PAINTING – Large diameter Piping Overground piping Inner surface of each section of the pipe shall be given ad-equate number of coats of epoxy resin based red oxide primer paint or approved equal so as to achieve a DFT of minimum 500 micron. Outside surface of pipes and fittings including hangers and support that will be overground or in a pit shall be given one coat of red lead primer before despatch from fabrication yard. After installation, the part of the pipeline from where priming coat has been rubbed off shall be retouched with primer. Then two coats of Synthetic Enamel paint of ap-proved quality and colour shall be applied. Buried Piping (External) External surface of the pipe, fittings etc to be painted with one coat of two part chemically cured polyurethane primer of min 50 micron dry film thickness followed by three or maximum four coats of two part solvent free polyurethane to provide a high build coating of dry film thickness of 1500 micron including primer coat.	Below bidder's proposal painting scheme is in line with the approved Painting scheme for Sagardhigi TPP Phase II (2x500 MW) and other ongoing projects like Wanakbori 1x800MW. Overground piping Inner surface (Applicable for pipes of dia ≥ 1000mm) Surface Preparation-Blast CleaningSSPC-SP10 SA2½ Primer - Epoxy resin based Red oxide 1 coat x 40 µ Finish – Coal tar epoxy, 2 coats x 100 µ. Total DFT = 240 µ Outer surface Surface Preparation-SSPC-SP3 Power tool cleaning Primer – Red Oxide Zinc Phosphate (alkyd base to IS 12744) 2 coats x 25 µFinish– Synthetic enamel Long oil alkyd to IS 2932 (2x35 µ at Shop and 1x35 µ at Site)Total DFT = 120 µ at Shop and 35 µ at Site = 155 µ Applicable for pipes of dia ≥ 1000mm. Surface Preparation-Blast CleaningSSPC-SP10 SA2½ Primer : Coal Tar primer compatible with coal tar enamel grade. 2 coats of 35 microns each. Total DFT:70microns. Finish Coat : Coal tar enamel (25mm overlap min) Type-I to IS7193-1974 conforming to table of 10 of IS10221-1982. Thickness - 4.0mm (or) Coal	Bidder to follow specification requirement. However, for underground large diameter piping, please refer to, Clause No. 9.01.05 & 9.01.06 of Volume-II - J1/ Section-V for 'large diameter low pressure piping' section.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			Buried Piping (Internal) All internal surfaces of pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT followed by two part polyamide cured solvent less epoxy. Minimum DFT of internal lining shall be 500 micron.	Tar Wrapping Applicable for pipes of dia $\geq$ 1000mm. Surface Preparation-Blast CleaningSSPC-SP10 SA2½ Primer - Epoxy resin based Red oxide 1 coat x 40 μ Finish – Coal tar epoxy, 2 coats x 100 μ. Total DFT = 240 μ	
79.	V.II-J1	Section: V /Cl. 10.01.01/ Page 21 of 25	The Tenderer shall submit with his formal proposal the following besides the different information required elsewhere under this section of specification. 10.01.01 Outline and fabrication drawings of the tanks indicating plate thickness, details of structural support, stiffeners and details of connections provided. 10.01.02 Illustrative literature and drawings and the equipments supplied for the accessories supplied with tanks. 10.01.03 General Arrangement and Sectional drawings with data on weight and material of construction for each category of Expansion Joints with control rod assemblies. 10.01.04 A comprehensive write-up or brochure on the manufacturing and testing facilities in the shop of the manufacturer for rubber expansion joints. 10.01.05 Complete technical details	Bidder shall try and submit as much details as possible. However, it is not possible to submit all the details during bid submission. The same shall be submitted after award stage. Please confirm acceptance.	Bidder will furnish all basic drawing/ documents, which are required to justify the selection of equipment/ system offered by them.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			of each type of spring support. The Bidder shall also submit outline drawings showing the support arrangements indicating principal dimensions and weight of the supports. Whenever necessary, cross-sectional details shall be furnished showing the details of assembly of components and their material of construction. 10.01.06 The Bidder shall clearly indicate for each type of support the number of spring used, rated load of springs, actual load to be carried, initial compression requirement, etc. The Bidder shall also indicate maximum and minimum spring compressions within which his design will permit spring movement for loaded and empty working conditions.		
80.	V.II-J1	Section: V /Annexure-I, Sl. No. 3/ Page 23 of 25	RCC Over head tank--capacity 150 Cum	Annexure-I specifies the requirement for misc. steel tank however as per description at s. no. 2, RCC service water tank is mentioned. Pl. confirm if the service water tank shall be RCC.	Service water tank shall be of RCC construction.
81.	V.II-J1	Section: II /Cl. 5.03.00/ Page 4 of 32	However, since service and instrument air are of same quality (instrument air) and the headers are interconnected, there will be adequate supply of instrument air. Thus the instrument air compressor capacity for Phase-III shall be same as Phase-II i.e. 36 Nm ³ /min, which	We understand that the capacity of each Instrument air & Service air compressor for Unit#5 shall be 36 Nm³/min, irrespective of the capacity derived for Unit#5 standalone. New compressors shall be connected to the existing CAS network and increase / decrease in	Bidder's understanding is correct.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDC
			will also ensure the interchangeability	demand shall be met by combination of new and existing compressors. Pl. confirm.	
82.	V.II-J1	Sec : V/Page 24 of 25/Clause No. 1.00.00 V.II-I2/ Section: VIII /Cl. 4.14.02/ Page 21 of 37	Cast Iron Body Butterfly valve Valve classification code: CIBF/DIBF (double flanged, double eccentric) Butterfly valves shall be of double flanged or lugged wafer type	Bidder proposes to consider double flanged or lugged wafer type as per VOL II I2 section VIII, clause no. 4.14.02. Please confirm.	Bidder to follow the specification requirement as mentioned in Annexure-II, Section-V of Vol.-II-J1.
83.	V.II-J1	Sec. V / Page 24 of 25/ Annexure II/ Serial No 6.00.00	6.00.00 Material a) Body 2% Ni Cast Iron as per..... b) Valve Disc -..... d) Seat ring..... e) Shaft Bearing f) Gland Packing..... g) Seal Nitrile ...	There is a discrepancy in the mentioned clauses for butterfly valve material. Please confirm material of butterfly valves.	Valve selection criteria will be system specific. Hence, Bidder to follow specification as detailed in various volumes of specification applicable for respective systems.
	V.II-I2	Sec. :VIII// Page 21 of 37/ Clause No 4.14.02	The various components of butterfly valves shall be of the following: i) Body : Cast Iron – ASTM-A 48 Cl.40; ii) Disc : Cast Iron – ASTM-A 48.....		

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			iii) Shaft : ASTM-A 296 Grade CF 8M / iv) Seat rings : Nitrile rubber.....		
84.	V.II-J1	Volume: II-J1 Section: V Large Diameter Low Pressure Piping 8.00.00 TESTING AND INSPECTION 8.01.00 Large Diameter Piping	8.01.01 After complete pipe lines have been laid and joined, the same shall be tested hydrostatically as specified in Vol.-IIA, for hydrostatic test pressure of circulating water piping, Auxiliary Cooling Water Piping.	Cooling water pipe be carried out by selecting either hydraulic test or non-destructive testing.	Bidder to Carry out the testing as per the requirement mentioned in Technical Specification
85.	V.II-J1	Sec : V/Page 25 of 25/Clause No. 10.00.00	Cast Iron Body Butterfly Valve Actuator: Electrical actuator as specified in Volume-II/F/1 & F/2 of the specification.	Bidder understands for the type of electrical actuator/manual operated valves, bidder shall refer as per tender flow diagram for the butterfly valve in CW, ACW, DMCW and CT makeup system. Please confirm.	Tender drawings are for tentative guidelines only. Type of valves, operation etc. shall be decided during detail engineering only.
Section - VI					
86.	V.II-D	Section: VI/ Page 53 OF 59/ Annexure I	19. Deaerator filling line : Between Condensate Transfer pump discharge and deaerator. 20. Boiler filling line : Between Condensate Transfer pump discharge and Boiler bottom ring header / economiser inlet.	Shall be part of Low Pressure piping considering process parameters	Bidder to follow the specification requirement, as mentioned in Vol-II/D/Sec-I/Page 53 of 59.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			21. Fill up and Emergency : From Condensate Transfer pump discharge to make-up to condenser. 22. DMCW make-up tank : From Cycle make-up pump discharge to DMCW make-up tank. 23. Gravity Make-up to : From condensate storage tank to condenser. 24. Condensate Dump Line : Between M.C. line after GSC and condensate storage tank. 25. Cycle make-up (DMSW) : Between Cycle make-up pump discharge Pump Recirculation header and suction header. 26. Cycle make-up (DMSW) : From condensate storage tanks to Cycle Pump Suction Line make-up pump suction header. Demineralised Water -supply system including hot well make-up water piping from condensate storage tank, suction to different pumps and distribution to different consumption points.		
87.	V.II-J1	V.II-J1/ Section: VI/ Page 1 OF 21/ 1.03.00 Section: VI/ Page 6 OF 21/ 4.01.09	Drain Pipe Work For pipes up to 50mm NB, pipe wall thickness shall be as per schedule 80 of ANSI B36.10.	As per Vol II J1 ,Section VI Annexure -I, Carbon steel pipe IS-1239 heavy grade upto 150 NB for clarified water, service water, filter water, waste water shall be provided.	Noted.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			Specification of Pipes for Different Services For clarified water piping, drinking/potable water supply piping: Carbon steel IS-1239 heavy grade upto 150 NB. Water services, stainless steel shall be used for sizes of 50mm NB and above	Please confirm.	
88.	V.II-J1	Section: VI/ PAGE NO 8 OF 21/ CL 4.05.01 g	Check valves shall conform to BS-1868 or approved international standards and shall be of swing check type.	Bidder Propose- For Large bore(NS>50 mm) Swing check valves, For NS ≤ 600 mm Dual Plate Check valve & For Small bore(NS ≤ 50 mm) Piston Lift Check valve shall be provided	Bidder to follow the specification requirement.
89.	V.II-J1	Section VI/ Page 9 of 21/ 4.05.01 Part o)	o) Gate valves, in addition shall be provided with following extra features i) Bypass valve for valves of 300 mm size and above. ii) Draining arrangement iii) Enclosed Gear operators for valves 300 mm size and above for ease in operation. iv) Motorized operation as specified by Engineer.	Requirements mentioned in part i) and ii) are generally complied in higher pressure applications for pressure equalization & easy operation such as in condensate system, feed water system, heater drain system, etc. Also drain valves shall be provided at all low points as per piping layout drawing. For part iii) As per standard practice, Gear operated gate valves are supplied for	Bidder to follow the specification requirement,

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDC
				350NB & above only for all earlier executed projects. Kindly review and confirm.	
90.	V.II-J1	Section: VI/ Page 9 OF 21/ 4.05.01.n	Gate, Globe and Ball valves shall be provided with the following accessories in addition to other standard items: i) Hand wheel with embossed open and shut directions. ii) Local position indicator. iii) Motorised operation as specified by Engineer. Gate valves, in addition shall be provided with following extra features i) Bypass valve for valves of 300 mm size and above. ii) Draining arrangement iii) Enclosed Gear operators for valves 300 mm size and above for ease in operation. iv) Motorised operation as specified by Engineer.	1. Bidder understand by the phrase 'as specified by engineer' in technical Specification for Low Pressure piping, valves and specialties refers to the motorized operation for gate, globe & ball valves as shown in tender flow diagram. Please confirm. 2. Bypass valve for gate valves of 300 mm size & above shall be provided as per tender flow diagram. Please confirm	1. Tender drawings are for tentative guidelines only. Type of valves, operation etc. shall be decided during detail engineering only. 2. Bypass valves to be provided for all gate valves of 300 NB and above.
91.	V.II-J1	Section: VI/ Page 13 OF 21/ 5.10.00.d V. II-12/ Section: VI/ Page 13 OF 37/ 4.07.04	Overhead piping shall have a minimum overhead clearance of 4 meters above walkways and working areas and 6 meters above roadways unless otherwise approved by the Owner. Overhead indoor piping shall have a vertical clearance of minimum 3.0 m above finished floor level of working areas / walkways.	Overhead piping shall be routed at an elevation of 2.1m clearing headroom in walkways/access path	Bidder to consider vertical head room clearance, as specified in Vol-IIA/Sec-V/ BUILDING/EQUIPMENT LAYOUT REQUIREMENTS, page 24 of 27.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			Overhead outdoor piping shall have a vertical clearance of minimum 4.0 m above finished ground level and minimum 7.5 m above finished road level unless addressed otherwise elsewhere in this specification.		
92.	V.II-J1	Section: VI/ Page 15 OF 21/ 1.00.00/ ANNEXURE-I	1. Demineralised Water, DMCW piping, Service and Instrument Air Piping less than and equal to 50 NB Stainless Steel as per ASTM A-312 Gr. 304. Thickness- as per schedule 40S, ANSI B36.19	We suggest usage of the following 1)IS 1239/IS3589 for DMCW 2)IS 1239(gal) for Service & Instrument Air These have been used for several projects executed by Bidder which will be economical and sufficient for the service.	Bidder to follow the specification requirement,
93.	V.II-J1	Section: VI/ Page 15 OF 21/ CL 1.00.00/ ANNEXURE-I	C. 1. Demineralised Water, DMCW piping, Service and Instrument Air Piping less than and equal to 50 NB - Stainless Steel as per ASTM A-312 Gr. 304. Thickness- as per schedule 40S, ANSI B36.19 D. 1. Demineralised Water, 2. DMCW piping, Service and Instrument air piping for sizes equal to greater than 65 NB -Stainless Steel as per ASTM A-312 Gr. 304. Thickness- as per schedule 10S, as per ANSI B36.19	Generally DMCW piping are constructed as Carbon steel. So we would like to apply Carbon steel for DMCW piping design.	Bidder to follow the specification requirement,
94.	V.II-J1	Section: VI/ Page 15 OF 21/ Annexure-I	Specification of Pipes for Different Services DMCW piping (less than and equal to 50 NB): Stainless Steel as per	As the DMCW piping contains passivated DM water, Bidder proposes carbon steel pipe as IS 1239 heavy grade upto 150 NB and IS 3589 above 150 NB. Please	Bidder to follow the specification requirement,

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			ASTM A-312 Gr. 304. Thickness- as per schedule 40S, ANSI B36.19 DMCW piping (equal to and greater than 65 NB): Stainless Steel as per ASTM A-312 Gr. 304. Thickness- as per schedule 10S, ANSI B36.19	confirm.	
95.	V.II-J1	<u>Section: VI</u> /Annexure-I, Sl. No. 1.00.00 C,D/ Page 15 of 21 <u>Section: VI</u> /Annexure-II,B/ Page 18 of 21	Stainless Steel as per ASTM A-312 Gr. 304. Thickness- as per schedule 40S, ANSI B36.19. Stainless Steel as per ASTM A-312 Gr. 304. Thickness- as per schedule 10S, as per ANSI B36.19 Stainless steel body/Gate/Globe/Check/Ball Valve--iii) inhibited Stainless steel body/ Gate/Globe /Check/Ball Valve	DCPL/WBPDCCL is requested to give option for alternative material viz. carbon steel pipe and valves for DMCW system also in line with previously executed projects viz. Santaldih, Bakreshwar etc. of DCPL/WBPDCCL project as these material is suitable for intended application. Pl. confirm for consideration of proposed MOC of pipe & valves in DMCW system.	Bidder to follow specification requirement.
96.	V.II-J1	Section: VI/ Page 16 OF 21/ CL 4.01.00/ ANNEXURE-I	Clarified water : Fittings: Pipe Sizes > =65 mm NB ASTM-A-234 Gr. WPB Fittings :Pipe Sizes < = 50 mm NB	As per Normal practice and as followed , the fitting material for sizes up to and including NB 150 will be SA105/ IS 1239 . For the sizes above NB 150, the fitting material will be IS 3589/ Gr.WPB.	Bidder to follow the specification requirement,
97.	V.II-J1	Section: VI/ Page 16 OF 21/ CL 4.01.00 ANNEXURE-I	Drinking/Potable water : Fittings: Pipe Sizes > =65 mm NB ASTM-A-234 Gr. WPB galvanized as per IS-4736 Fittings :Pipe Sizes < = 50 mm NB ASTM-A-105 galvanized as per IS-4736	As per normal practice and as followed , the fitting material for sizes up to and including NB 150 will be IS 1239 (gal). For the sizes above NB 150, the fitting material will be IS 3589/ Gr.WPB (GAL) The end connection shall be threaded.	Bidder to follow the specification requirement,

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
98.	V.II-J1	Section: VI/ Page 18 OF 21/ CL 4.01.00 ANNEXURE-II	For Clarified water, service water & potable water : Steel body valves - for sizes 50 NB and below Globe Valves (for river water / clarified water / filtered water / similar application) Globe valves shall conform to the following technical specifications: For sizes 50 mm NB and below Material of construction : Body - Leaded tin bronze conforming to IS 318 Freade 2	There are discrepancy between two clauses for material of construction of valves (50 NB & below). Bidder proposes to consider carbon steel valves for 50 NB & Below for river water, filtered water, clarified water, service water & potable water application as per VOLII J1 Section VI . Please confirm.	Noted.
99.	V.II-J1	Section: VI/ Page 18 OF 21/ Annexure-II	For Inhibited Demineralised water : Stainless steel body - for all sizes	As the DMCW system contains passivated DM water, Bidder consider carbon steel / cast iron valves for DMCW system. Please confirm.	Bidder to follow the specification requirement,
100.	V.II-J1	Section: VI/ Page 18 OF 21/ ANNEXURE-II V.II-I2/ Section : VIII/ Page 24 OF 37/ CL 4.14.05	For demineralised water : Check valve MOC: Stainless steel body A351 CF8M for cast body, A182 F304 for forged body Non return Valve for demineralized water: The body, cover & Disc shall be lined with natural Rubber, PTFE or Viton. The Hinge, Hinge Pin & Disc Pin shall be coated with PVDF,	There are discrepancy in mentioned clauses for material of construction of check valves. Please confirm the material of check valves.	For MOC of Check valves in demineralized water lines, Annexure-II/ Section: VI/ Vol-II-J1 is to be followed.

Sl. No.	VOL. No.	Sec.: Page no./ Clause No.	As specified	Clarification Required	Reply of WBPDCCL
			or suitable elastomer. The bearing bushes shall be PTFE or Equivalent (subject to approval by Purchaser) material (subject to approval by Purchaser). Bolting shall be of stainless steel. In the absence of lining/coating, the complete valve shall be of stainless steel construction (AISI-316).		



WBPDCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

VOLUME: II-J1

SECTION: III

**TECHNICAL SPECIFICATION
FOR
FIRE DETECTION & PROTECTION SYSTEM**



Development Consultants Pvt. Ltd.

**Volume: II-J1
Section: III
Fire Detection & Protection System**



WBPDCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

CONTENTS

CLAUSE NO.	DESCRIPTION	PAGE NO.
1.00.00	GENERAL INFORMATION	1
2.00.00	CODES & STANDARDS	1
3.00.00	SYSTEM DESCRIPTION	2
4.00.00	OPERATIONAL PHILOSOPHY	12
5.00.00	SCOPE OF WORK	20
6.00.00	DESIGN BASIS AND INPUT	25
7.00.00	DESIGN AND CONSTRUCTION	38
8.00.00	INSPECTION AND TESTING	65
9.00.00	DRAWINGS, DATA & MANUALS TO BE SUBMITTED BY THE BIDDER	69

ATTACHMENT

ANNEXURE-I	DATA SHEET OF MECHANICAL ITEMS	73
ANNEXURE-II	DATA SHEET OF HOSE HOUSE	86
ANNEXURE-III	DATA SHEET OF DELUGE VALVE SHED	87
ANNEXURE-IV	DATA SHEET OF DETECTORS	88
ANNEXURE-V	LIST OF FIXED FIRE PROTECTION AND DETECTION SYSTEM	94



Development Consultants Pvt. Ltd.

i

**Volume: II-J1
Section: III
Fire Detection & Protection System**

**SECTION-III****FIRE DETECTION & PROTECTION SYSTEM****1.00.00 GENERAL INFORMATION**

This section covers the requirements envisaged for Fire Detection and Protection System including Alarm and Communication which will be used to control any outbreak of fire in the proposed 1x660 MW Sagardighi Thermal Power Station, Phase-III, Unit-5 for The West Bengal Power Development Corporation Limited (WBPDCL) at Sagardighi, Murshidabad District, West Bengal to reduce consequential damages by containing and extinguishing the same. This section of the Specification shall have two parts – Fire Extinguishing System and Fire Detection & Alarm System. Bidder's scope of work covers supply, erection, commissioning and testing of the entire Fire water pumping system, hydrant and spray piping network, fire detection, alarm and protection system including supply of all fire extinguishing equipment and systems, fire detectors, manual call points, linear heat sensing cables/ Intelligent addressable type heat sensing cable, all local, remote fire detection & alarm panels, PCs and peripherals, hardware and licensed versions of software as detailed hereunder, meeting all code requirements to make the system complete.

2.00.00 CODES AND STANDARDS

The design, construction, testing and operation of the equipment or any item under Fire protection and detection system shall comply with the requirements of the latest revisions of one or more of the following standards as applicable:

High Voltage Direct Current Converter Stations Electric Generating Plants

IS: 3034 - Fire Safety of Industrial Buildings: Electrical Generating and Distributing Stations – Code of Practice.

NFPA 10: Portable fire extinguishers

NFPA 11 - Standard for Low-Expansion Foam

NFPA 12: Carbon Dioxide extinguishing system

NFPA 13 - Standard for the Installation of Sprinkler Systems

NFPA 14 - Standard for the installation of Standpipe, Private Hydrant and Hose systems

NFPA 15 - Standard for Water Spray Fixed Systems for Fire Protection





NFPA 20: Centrifugal fire pumps, installation

NFPA 2001 - Standard for Clean Agent extinguishing system

NFPA 22: Water storage tanks

NFPA 24: Private fire service mains and their appurtenances, installation

NFPA 37: Standard for the installation and use of stationary combustion engines and gas turbines

NFPA 72: National fire alarm code

NFPA 850 - Recommended Practice for Fire Protection for Electric Generating Plants and

OISD- 117 - Fire protection facilities for Petroleum depots, terminals and pipeline installations

Fire Protection Manual of TAC

Rules for Fire Alarm System of TAC

Rules for Hydrant System of TAC

Rules for Sprinkler System of TAC

Rules for Water Spray System of TAC

3.00.00

SYSTEM DESCRIPTION

For protection against fire, all yard equipment will be protected by a combination of hydrant system, automatic sprinkler spray system (emulsifier system), automatic high velocity and medium velocity sprinkler spray system, auto-modular clean agent system for control rooms apart from portable and mobile fire extinguishers located at strategic areas of plant buildings and adequate Passive Fire Protection measures.

Fire extinguishing system is broadly divided into following sub-systems:

3.01.01

Hydrant System

The Hydrant System of Fire Protection essentially consists of a large network of over ground pipe which feeds water to a number of hydrants valves – indoor as well as outdoor and to a number of outdoor type fixed installations. Water in the pipe network is kept pressurized by hydro-pneumatic tank and jockey pump arrangement. These hydrant valves shall be located in the entire power station including all the auxiliaries and buildings in the plant area. Hosepipes of suitable lengths fitted with standard accessories like branch pipes, nozzles etc. are kept in “Hose Houses” (for outdoor hydrants) and in



“Hose Boxes” (for indoor hydrants). When the fire hoses are coupled to the hydrant valves through the instantaneous coupling, jet of water is directed towards the fire. Hydrant system protects the following building/facilities.

- a) Entire Power House including Boiler Area and Turbine House.
- b) Baharampur Switchyard (2No. Bays) & Farraka – Jeerat (LILO) - 2 No Bays built by M/s PGCIL(1350N to 1500N) & other switchyard areas
- c) Mill Building
- d) ESP Control Building
- e) Generator & Unit transformer, Station Transformers in transformer Yard, switchyard area
- f) CW & ACW Pump House including chlorination plant and dosing pump house
- g) HVR transformer at ESP roof top
- h) Wagon Tippler (WT) with Sub-station building, Pent house, Crushers houses with Sub-station building, connecting conveyors and Transfer points (TP)
- i) Coal conveyor from existing TP-19 to Boiler including tripper floor
- j) Fly Ash Vacuum Pump cum Transport Air Compressor House
- k) FGD & SCR area
- l) Ammonia storage and handling area
- m) DG Building
- n) CPU regeneration building
- o) 2 Nos. of Hydrant & Spray Water tapping points with isolation valves from Header for future use shall be considered

Note: Buildings not specifically identified above but required to be covered by hydrant system shall also be included in the scope of the Bidder.

3.01.02

High Velocity Water Spray System (HVWS System)

- a) Category- A

This system shall automatically detect, control and extinguish any out-break of fire and simultaneously give audible alarm. The system shall also be designed for remote operation. Water line forms a ring around the equipment to be protected with projected outlets at various



As per Amendment Sl. No 3, I - Flame detection along with Heat Detection to be provided for the following Areas

1. Turbine Lube Oil tank/MOT & Purifiers

2. Central Lube Oil & Control Oil Tanks(Both clean oil & Dirty Oil Tanks) & Purifier Units

3. Lube Oil & Control Oil system for TD BFP

4. Boiler Burner Front

Rest Areas mentioned in NIT for Category B Fire to be provided with heat detection

Document
er Project
Phase - III

selected points fitted with the specially designed nozzles. The water supply to the HVW spray system is controlled by deluge valve, which shall be operated hydraulically. All deluge valves shall be provided with manual Override with Bypass line (with Isolating valve). This valve is normally closed by water pressure in the water piping. The same water pipe forms a ring around the equipment to be protected and frangible bulb type detectors are mounted on this water line at selected places. When the surrounding temperature rises more than the rated temperature of the detector, detector quartzoid bulb collapses releasing water and consequently pressure in water line will fall sharply. This fall of pressure opens the deluge valve and water starts projecting out from the projectors. Local audible alarm shall be produced by water motor alarm gong. The operation of the Deluge Valve shall be annunciated in Main Fire Alarm Panel to be located in Central control room & Fire water Pump House. All Fire Alarm Panels are Main.

The system shall also have a manual over riding facility along with regular testing facility

Category – A type HVW Spray Protection shall be provided for the following equipment:

- Three (3) nos. single phase generator transformer.
- Two (2) nos. Unit transformers.
- One (1) no. Station transformers.
- Unit and Station Auxiliary transformers as per design requirement.
- Spare Generator Transformer
- Any other transformer having capacity above 10 MVA.

b) Category- B

In this system fire shall be detected by use of heat detectors, flame detectors depending upon the area. Upon detection of fire, HVW Spray System shall be brought in operation automatically by opening deluge valves.

Category – B type HVW Spray System shall be provided for the following areas:

- All oil filled transformers having capacity less than equal to 10 MVA.
- Turbine Lub oil tanks and purifiers.





WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- Boiler Burner Fronts.
- Central Lub Oil & Control oil Tanks (both clean oil and dirty oil tanks) and purifier units.
- Drain Oil Tank of Boiler area
- Generator seal oil system.
- Lube oil & control oil system for turbine driven boiler feed pumps.
- Turbine oil canal pipe lines in main plant.
- Diesel Tank of DG set

The operation of the Deluge Valve shall be annunciated in the Main Fire Alarm Panel ~~as well as in Sub Fire Alarm Panel~~. The system shall also have a manual over riding facility along with regular testing facility.

3.01.03

Medium Velocity Water Spray System

This system essentially consists of a network of sprayers fitted with a special deflector to give required angle of discharge for the water around the area to be protected. The sprayers discharge a cone of water spray consisting of medium size droplets of water. The droplet size shall be so designed to achieve efficient cooling of the flame zone by evaporation and sufficiently large to penetrate the flame so as to reach and cool surfaces heated by the fire.

The operation of the Deluge Valve shall be annunciated in Main Fire Alarm Panel to be located in Central control room & Fire water Pump House. All Fire Alarm Panels are Main. For avoiding overall flooding of the area, in the event of fire, only the two adjacent zones on either side shall only operate.

The Medium Velocity Water Spray System shall be provided for the protection of following areas:

- * All conveyor galleries, transfer points, bunker bay conveyors and tripper floor area in coal handling plant. Full length of each conveyor both top and bottom belt shall be protected with MVW Spray System.

Spray system for coal conveyor galleries shall be divided in several zones fed through individual deluge valves. Spray system for each zone shall consist of spray nozzles mounted, on a water network. Spray system shall cover both forward and return belts of conveyor including hoppers, feeders & head end pulley.

High sensitive Linear Heat Sensing (LHS) Cable/ Intelligent addressable type heat sensing cable and solar blind infra-red



As per Amendment Sl. No 4, I -Upon detection of fire, drive motor shall automatically stop and annunciation shall be provided in the Main Fire Alarm Panel.



WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

amber detector shall be provided to detect fire in coal conveyor. Upon detection of fire, drive motor shall automatically stop and annunciation shall be provided in the Main Fire Alarm Panel ~~as well as in Sub Fire Alarm Panel~~. Simultaneously, the MVW spray system shall be automatically brought into operation by opening the solenoid operated deluge valve actuated from the detection circuit. The spray system shall be designed to spray water on the three zones of Conveyors (one forward & one preceding zone and the zone under fire).

LHS cable/Thermal sensor based addressable Heat sensing Cable shall be provided along the complete length of conveyor suitably covering both top, bottom & side of belt and including the head end drive & tail end drive.

Amber detector shall be provided one at head end, one at tail end and one at middle of each conveyor section. Solar Blind Infra-red amber detectors shall be provided with air purging unit.

• All Cable vaults & cable spreader rooms of Phase-III.

The entire area of cable spreader room and cable vaults is to be sectionalized into suitable number of zones and each zone shall be protected by automatic operation of MVW Spray System.

Addressable, analogue multi criteria (smoke & heat) type detectors in cross zoning principle shall be provided in all cable vaults and cable spreader rooms. In addition linear heat sensing cable/Intelligent addressable type heat sensing cable shall also be provided on each cable tray to detect the fire. Upon detection of fire and actuation of zone annunciation, MVW Spray System will be brought into operation by automatically opening deluge valve, which will allow the projectors located in that zone to direct water in the form of spray ~~which will cut off oxygen supply and extinguish the fire.~~

3.01.04

Sprinkler System

Wet pipe sprinkler systems are most commonly installed sprinkler systems. They are the most reliable, because they are simple, with the only operating components being the automatic sprinklers. And automatic water supply provides water under pressure to the system piping.

Each closed-head sprinkler is held closed by either a heat-sensitive glass bulb or a two-part metal link held together with fusible alloy. The glass bulb or link applies pressure to a pipe cap which acts as a plug which prevents water from flowing until the ambient temperature around the sprinkler reaches the design activation temperature of the individual sprinkler head. In a standard wet-pipe sprinkler system, each sprinkler activates independently when the predetermined heat level is reached.

a) Each Silo fill gallery (bunker bay)





- b) Each Turbine Generator area under-floor (Ground floor, including all areas subject to spread of oil)
- c) Each Turbine Generator area under-floor (Mezzanine floor and turbine lagging, including all areas subject to spread of oil)
- d) Locker rooms, corridors, laboratories and office spaces shall be protected by closed head sprinkler systems.

3.01.05 **Inert gas flooding system / Auto modular clean agent system**

One centralized total flooding type clean inert gas extinguishing system shall be provided for the following areas as a protection for fire damage.

- (a) Above false ceiling and below raised floor (if required) of Common Control room (CCR), Electronic Equipment Room (EER), Shift-in Charge Room & Record room and Computer Room.

The inert gas flooding system for the above areas shall consist of battery of inert gas storage cylinders of adequate capacity, which shall be located suitably at a centralized location. Discharge nozzles shall be provided on the gas distribution pipe network suitably located on the areas to be protected.

In the event of fire, the fire detectors initiate an alarm in Main Fire Alarm Panel in central control room. Simultaneously, the detection signal opens the valves automatically and the protected area is filled up by rapid injection of required quantity of inert gas through the pipe network and discharge nozzles to create a homogenous air/inert gas atmosphere within.

The pipe network shall be connected to a gas manifold, through a manually operated valve. The manifold shall be connected to a group of inert gas cylinders.

- 3.01.06 Portable and mobile (wheel mounted) fire extinguishers, such as soda acid type, pressurized water type, carbon-dioxide type, foam type, dry chemical powder type shall be located at strategic locations throughout the plant area. Inert gas canister type fire extinguisher shall be installed in all UPS & HUB room.

- 3.02.00 Fire water and Jockey pumps along with all drives and accessories shall be located in CW-ACW pump house of Phase-III. Suitable dedicated water storage as per statutory guidelines shall be provided in CW sump for fire water pumps. Water for both hydrant and Spray System shall be supplied by means of dedicated sets of hydrant/spray water pumps. The pumps will be started automatically in proper sequence when a large quantity of water flows out from pressurized water circuit. All the pumps used in the Fire Protection System shall be of vertical, centrifugal type.

Necessary arrangement for proper continuous circulation of water shall be provided. The sump shall have two (2) nos. (Redundant) Level Transmitter (Non-contact radar Type) for continuous level measurement for monitoring



WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

and control. The 4-20 mA output from the level transmitter shall be hardwired to the PLC for monitoring and control.

In addition to above, two (2) nos. tap-off points for hydrant and spray network each has been provided for Phase-III from pressurized headers of Phase-II. For details of existing pumping system, please refer section-III of Volume-IIA.

3.03.00

Fire Detection & Alarm System

- a) Fire detection and Alarm system proposed shall provide continuous surveillance against fire in the areas of plant including the main plant TG Building and other in site plants & buildings.
- b) The Main Objectives of the Fire Detection system are as follows:
 - i) To detect fire in its early stages and activate or alert for implementation of Emergency action, thus protecting personnel and equipment.
 - ii) To provide an appropriate level of monitoring in the event of fire and audiovisual annunciation at respective Fire Alarm Panel (FAP) and the PC based operator station.
 - iii) The sensing of fire is accomplished through various types of fire detectors / LHS cable //Intelligent addressable type heat sensing cable/ IR & Amber detector / Air sampling type detector depending upon application.
 - iv) To ensure high reliability and availability of the system with quick and exact identification of the fire location without false alarm.
 - v) To provide contact output from FAP to fire protection systems viz. opening of deluge valves, tripping of Ventilation System Fans / Dampers / Air Handling Units / tripping of belt conveyor / / Clean Agent flooding system on detection of fire in specific area for effective fire protection.
- c) Fire detection and Alarm System shall broadly consist of individual Fire detectors; Fire Alarm Panel (FAP) with system control terminal & annunciation system and PC based operator station & printer.
- d) FAP (consisting of alarms, acknowledge, troubles, and supervisory) shall be provided in accordance with all codes and standards to annunciate fire alarm signals from fire protection and detection systems provided for the facility, to annunciate system / device fault and to provide supervisory functions as required.
- e) On receipt of impulse from the detectors, in the event of fire, suitable annunciations signal shall be exhibited in the main Fire Alarm Panel ~~as well as sub Fire alarm panel~~. The complete areas including electrical control rooms, switchgear rooms, cable vault, coal conveyors etc. shall be suitably sectionalized as far as the fire detection is concerned and to identify the affected zone quickly in the FAP.





f) The FAP & their locations shall be as follows:

S/N	DESCRIPTION	LOCATION OF FAP & OPERATOR STATIONS
1.	FIRE ALARM PANEL-1	CW Pump house
2.	FIRE ALARM PANEL-2	Central Control Room
3.	Microprocessor based Fire Detection and Alarm panel (FAP) with PC based OWS, LED Monitor & Printer shall be provided and to be located in Control Room of Coal Handling Plant, if required during detail engineering.	

FAP shall have provision of Emergency Fire Alarm SMS through Mobile Network.

- g) The Fire Alarm System consists of multiple Fire sensors distributed throughout the plant buildings in various areas of the plant and these detectors are connected to the Fire Alarm Panel. This system shall automatically detect the presence of Smoke / Heat /Fire phenomena round the clock.
- h) There shall be a centralized Fire Water Control Room at CW pump house of phase III. FAP network of phase III at Centralized Fire Water Control Room shall have connectivity to phase II FAP Network so that both stage II and Stage III fire alarm system can be monitored from the new Fire Water Control Room of phase III. Necessary hardware/software required for this integration shall be in bidder's scope
- i) The Fire detector shall determine whether a fire condition exists in the room / area where the detector is located. In case of fire, the audio-visual fire alarm shall be generated at Fire Alarm Panel (FAP) and also initiate signal to operate Hooters located at convenient places in the plant. Alarms will be displayed at both the fire alarm panels and. No new Siren is required for phase III system. The new system to be hooked up with existing (phase-II) system. Necessary hardware required for interfacing shall be in the scope of bidder.

3.04.00 Type of detectors to be provided shall be as follows:





- a) Multi criteria (smoke & heat) type detectors shall be provided in the following areas:
 - i) All cable Spreader Rooms & Cable Vaults in powerhouse (TG Building) and in all other building Cable Vaults.
 - ii) All Electrical Switchgear /MCC Rooms located in Power House (TG Building) and in all Switchgear /MCC Rooms of other buildings.
 - iii) Main plant Central Control Room, Control equipment room equipped with DDCMIS & other electrical/electronic panels, computer rooms, UPS & battery charger room, SWAS analyzer room, CPU control room, ESP control room, etc. and in all in site plant building control rooms.

Cross-zoning of detectors shall be provided for release of clean agent and MVW spray.

- b) Fixed cum Rate of rise (ROR) Heat detectors shall be provided in the following areas.
 - i) Battery rooms.
 - ii) Smaller capacity LT transformer (less than 10 MVA).
 - iii) Main and unit Turbine oil tank and purifier.
 - iv) Boiler Firing Floors.
 - v) Inside turbine acoustic enclosure.
- c) Linear heat sensing cable/ intelligent addressable type heat sensing cable shall be provided for coal conveyor and cable rack inside all cable Spreader Rooms & Cable Vaults in the plant boundary.
- d) Solar blind infra-red amber detectors in each coal conveyor to detect presence of fire (glowing coal).
- e) Air sampling type smoke detector shall be provided for above false ceiling area in the Central control room and control equipment room.

3.05.00

Entire Power House Building and the outdoor yard of plant shall be divided into a number of zones with addressable manual call points in each zone. The outdoor call points shall be installed on approximately 1.4 M +/- 0.2m above floor level for ease of operation. The manual call points inside the Power House Building shall be suitable for wall mounting, Manual call points of "break glass push button station type" or "lever type" shall be provided specifically in the following areas.

- a) Switch gear and MCC room in Power house.





- b) Outdoor transformer yard.
- c) All floors in power House, including Boiler House.
- d) All areas of boiler house.
- e) Coal bunker and coal mill area.
- f) Transfer points.
- g) All pump houses namely CW Pump House, CW Treatment building, Vacuum Pump cum AHP Compressor house etc.
- h) All buildings like ESP Control building, FGD control building etc.

Number of manual call points shall be decided during detailed engineering.

3.06.00 Passive Fire Protection System for all outdoor transformers and indoor transformers having rating more than 10 MVA, Cable Vault, Cable Spreader Room & Enclosed Cable Risers (Cable Shafts) shall be provided.

3.06.01 The Transformer to be protected by automatic High Velocity Water Spray System shall be separated from each other by explosion proof barrier walls of 120 minutes fire rating so that fire in one does not affect the adjacent Transformers.

3.06.02 The Cable Spreader Room and Cable Vault shall be divided into a smaller risk zones. These zones shall be separated by 120 minutes rating fire barrier walls.

3.07.00 For containment of fire and preventing it from spreading in cable galleries, unit wise fire barriers with self-closing fire doors will be provided. In addition, all cable entries / openings in the cable galleries, tunnels, floors will be sealed with non-inflammable / fire resistant sealing materials to prevent fire propagation for at least three (3) hour. Fire protection cable coating compound over cables at switchgear entry points, power station building entry points and trays shall be provided to prevent damage from fire for at least thirty (30) minutes. The number of fire doors as prescribed by the TAC/LPA shall be provided. At least two fire escape exit openings to the open areas shall be provided for the TG area as prescribed by the TAC/LPA.

3.08.00 Back Lit maintained type emergency "exit light" shall be provided in control room, control equipment rooms, switchgear and MCC rooms, battery charger rooms, escape stair case in power house and transfer points in coal conveyor area and other buildings in the plant. These shall be switched on upon detection of fire.

3.09.00 Addressable analog smoke detector shall also be provided in all false ceiling in power house i.e. Control room, Control equipment room, ESP control room.



WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- 3.10.00 "First aid fire protection system" shall be provided for Power house.
- 3.11.00 Gas sensing fire detectors working on air sampling shall be provided for all control rooms and control equipment room.
- 3.12.00 Provision should be kept for automatic closing of fire dampers in ventilation ducts or tripping of related ventilation fans as required on detection of fire.
- 3.13.00 ~~If water pressure in the hydrant pipe network is not adequate to maintain minimum 3.5 kg/cm² (g) at the hydraulically furthest hose station at elevated floors of boiler houses and turbine building, then 2x100% booster pumps (one (1) no. motor driven+ one (1) no. diesel engine driven) shall be provided for individual areas for supplying pressurized water to the hydrant points. Booster pumps shall be installed online to the branch header to riser pipes. The booster pumps, if required, shall be started through pressure switch when pressure on their discharge side falls below the set pressure.~~
- 3.14.00 Adequate separating distances will be maintained between different process blocks and hazardous equipment. To prevent fire from spreading through ventilation & air conditioning ducts, dampers with auto closing arrangements will be provided at appropriate locations. Fire Survival Cables will be used as per Electrical specification –section-IV of vol. II-F/2.
- 4.00.00 **OPERATIONAL PHILOSOPHY**
- 4.01.00 **Hydrant System**
- 4.01.01 Operation of hydrant system shall be semi-automatic. A pressurised hydrant main shall be maintained through the combination of hydro pneumatic tank, jockey pumps and compressors. When the header pressure of fire water pumps falls below a preset limit, 1st motor driven fire water pump placed in "auto mode" shall be automatically cut-in. If the header pressure is not built-up even after the running of 1st pump and falls further down, this low pressure shall actuate another pressure switch which in turn shall cut in automatically the second motor driven pump in hydrant system. Similarly the standby Diesel Engine driven pump will come into operation based on the system requirement sequentially. In each case above, if any of the above pumps is not started even after the signal from pressure switch is through, "pump fails to start" alarm shall be annunciated in the local control panel.
- 4.01.02 Hydro-pneumatic tank shall be filled up with water up to 2/3rd portion of its height. Air space shall be kept above the water-filled portion. The hydro-pneumatic tank will be equipped with necessary level switches and pressure switches. Minor leakage in the pressurised fire water system shall be replenished from hydro-pneumatic tank. When the level of hydro pneumatic tank is low, jockey pump shall be started automatically to replenish the level of water in the tank. Jockey pump shall be cut-out automatically when the level of water in the hydro pneumatic tank reaches its higher limit. Pressure switches provided in the hydro pneumatic tank shall be interlocked with the cut-in/cut-out operation of compressor which is used to maintain a constant pressure in the hydro pneumatic tank and thereby to the whole firefighting system.





4.01.03 Hydrant network of Phase-III shall have provision for interconnection with pressurized hydrant network system of Phase-II through two (2) manual valves. In case of persisting low pressure annunciation in the hydrant network in spite of starting of both the hydrant pumps of Phase-III, these interconnection valves will be opened & Vice Versa.

4.02.00 **Spray Water System**

4.02.01 Operation of Spray Water System shall be automatic.

4.02.02 Header pressure of spray water system shall be maintained at a constant value with the help of hydro pneumatic tank as stated earlier in case of hydrant system.

4.02.03 When the pressure of spray water system falls down to a preset value, it will actuate a pressure switch which in turn shall send starting signal to the motor driven spray water pump for automatic starting. If the pressure falls further below, stand-by pump shall be started automatically from the signal of it's pressure switch. Further, if necessary to arrest the falling pressure, pumps for hydrant system shall also be started automatically and deliver water to the spray water system through opening of motorised interconnection (fast opening type) Valve.

In each case above, "pumps fail to start" alarm shall be annunciated in LCP if any pump does not start even the start-up of signal from it's pressure switch is through.

4.02.04 Any Fire water pump, if started automatically, shall not be stopped without manual intervention

4.02.05 In case of detection of fire in HT transformer, "deluge valve" in spray water line shall be opened automatically and spray water system shall come into operation fully automatically. Operation shall be annunciated.

In case of detection of fire in coal conveyor, alarm shall be annunciated in the local fire panel located in the CHP control room and the solenoid operated deluge valve in spray water line shall be opened automatically and the spray water system shall be brought into operation.

4.02.06 In all other areas of spray water system, detection of fire shall produce annunciation in the respective local fire panel and the spray water system shall be brought into operation by opening automatically the deluge valves of the particular area.

4.03.00 **Clean Agent Flooding System**

4.03.01 The system shall consist of two (2) nos 100% capacity batteries of gas cylinders, discharge nozzles, associated piping & valves, actuators, etc. The cylinders shall be permanently connected to the piping and arranged for easy changeover. The gas cylinders shall be DOT/CCE approved UL/FM listed.





- 4.03.02 The quantity of extinguishment agent and the no. of cylinders shall be designed for the largest area, specified in 3.01.05, to be flooded. One zone valve shall be provided for each separate fire protected area, specified in 3.01.05. In case of fire only the Zone Valve for that particular area shall be actuated.
- 4.03.03 The system shall be modular in construction and shall work on master-slave principle with pneumatic actuation. The inert gas cylinder shall be connected to the manifold through high pressure, double wire braided hoses. The manifold shall be connected to a pipe network having strategically located nozzles. The master cylinder shall be opened by a pilot solenoid valve through electrical actuation from fire alarm panel.
- 4.03.04 In the event of fire, the fire detectors (either cross-zoned or two detectors) shall be provided to sense fire and initiate an alarm in the local panel, and main fire alarm panel. Simultaneously, the detection signal opens the deluge valve automatically and the protected area is filled up by rapid injection of required quantity of Clean Agent through the pipe network and discharge nozzles to create a homogenous air/Clean Agent atmosphere within.

4.04.00 **Functional Requirement of Various Panels in Fire detection & Protection System**

- 4.04.01 Dual hot redundant Programmable Logic controller (PLC) based Fire Water Pump Control Panel, located in Common Centralised Fire Water Control Room. Detailed PLC Panel description as per Volume II E. The fire pumps controllers shall be UL labeled, FM approved or equivalent. The system shall be complete with dual redundant CPU & memory, dual redundant power supply modules, dual redundant communication modules and dual redundant network communication processors and necessary input output devices and termination units as per the PLC specification in Control & Instrumentation specification Vol. II-E, Section VI, Clause no. 6.00.00. Connections from all. Connections from all field devices and interfacing signals with MCC / SWGR related to the fire protection system shall be terminated in the Termination & Relay cabinet. Fire water pumps and its associated systems shall be operated from two PC based work stations each with 23" LED monitor in local control room of FW Pumps House. No Control of associated system is envisaged from Central Control Room. Control of Fire water Pumping System is envisaged from Common Centralised Fire Water Control Room. The PLC system shall have interface with DCS. Necessary hardware and software for the interface shall be in bidder's scope.

Diesel Engine Driven & Motor Driven Hydrant Pumps & Spray pumps, Jockey Pumps, Air Compressor Hydro pneumatic pumps shall be controlled from PLC system at fire water control room.

Control of Fire water Pumping System is envisaged from Common Centralised Fire Water Control Room through PLC & SCADA/OWS of Unit#5. Control of all pumps etc. of Unit# 3, 4 shall also be carried out from the Centralised Fire Water Control Room. Hence, OWS & EWS of Unit #3 & #4 Fire Water system PLC shall be relocated to Common Centralised Fire Water





Control Room. Necessary arrangements (both Hardware & Software) for the above are in the bidder's scope.

Fire men's Telephone/ Voice Communications which will be connected to Stage III and as well as FAP Stage - II FAP is to be located in Common Centralised Fire Water Control Room. Necessary Speaker/ Announcement/ Output System of Stage III Fire men's telephone system is to be provided at UCR Stage I, II, III, Stage I Fire Station & Critical areas of Stage III.

New Fire Water System Control Room for Stage II & Stage III shall be located in the Common Centralised Fire Water Control Room. Both Stage II & Stage III Fire Water Systems shall be controlled, Monitored from dedicated OWS located in the Common Centralised Fire Water Control Room. Bidder shall provide FO Connectivity from Stage II PLC (Ethernet Switch) to the Network Enclosure (Ethernet Switch) located in the Common Centralised Fire Water Control Room.

The Common Centralised Fire Water Control Room shall have OWS, EWS for Stage III Fire Water Systems. It shall also house Stage III Fire Water PLC & UPS

Control & monitoring function not limited to the following shall be provided for Fire water pumps.

- a) Start/Stop push buttons and indicating lamps for motor driven fire water pumps.
- b) Local Remote Selector Switch for Local/ Remote Operation of the Fire Water Pumps.
- c) Start /Stop push buttons for "starting DC motor" of Diesel engine driven pumps.
- d) Start/Stop push button switch and indicating lamps for jockey pumps.
- e) Start/Stop push button switch and indicating lamps for compressor.
- f) Opening / Closing of motorized valves on fire water main header and fire water tanks with indication.
- g) Auto/ Manual selector switch for fire water pumps, jockey pumps & air compressors.
- h) Ammeter for motors.
- i) Vibration & Temperature Monitoring of all Fire Water Pumps & Motors to be provided. Vibration monitoring at each bearing in both X and Y direction shall be provided. Duplex type RTD shall be provided for each bearing and winding for temperature monitoring.
- j) Annunciation system
- k) A Laptop computer for engineering configuration with both FAP Software and PLC Software loaded to be provided at the Common Centralised Fire water Room. Regarding PLC system , Specification Volume II E to be followed.



4.04.02 NOT IN USE

4.04.03 Microprocessor based Fire Detection and Alarm panel (FAP) shall be provided and to be located in Central Control Room (CCR) at main Plant TG Building. One (1) PC based OWS with LED Monitor & Printer in CCR for sector / zone wise alarm, graphic display & logs. Each Fire Detection and Alarm Panel (FAP) shall receive signals from the fire detectors & Manual call points of the respective area and shall also issue command to the deluge valves.

4.04.04 Microprocessor based Fire Detection and Alarm panel (FAP) with PC based OWS, LED Monitor & Printer shall be provided (if required to be decided during detailed engineering) for New CHP areas. Otherwise New CHP areas will be hooked up with existing Stage II FAP located at CHP Control Room. Fire Alarm Panel shall receive signals from the fire detectors & Manual call points of the respective area and shall also issue command to the deluge valves.

4.04.05 The new FAP in the Common Centralised Fire water Control Room of unit # 5 shall be hooked up with the Stage II FAP network. In case this interface is not feasible, then a new Fire Alarm Panel for unit#5 shall be provided along with OWS, LED Monitor in the existing Fire Station Building (under the discretion of owner/consultant).

4.04.06 Indication (bright LED type) and Graphic Display (LED type) shall be provided in each FAP. Information / data from these Fire Alarm Panels shall also be available in a dedicated computer based operator station in unit control room. This computer will be an UL/FM Listed PC used to display event information from the network in a text and graphical format. Graphic screens will be created with a built-in drawing utility of the protected area and are linked to fire alarm devices. Should a device go into alarm, the appropriate graphic floor plan is displayed along with operator instructions. This will provide a quick and easy way to inform operators of a fire's location in the buildings. The computer shall have features including event logging, event history tracking, fire panel programming and control.

4.04.07 Display of the status of the detector, sequence of the events, alarm and trouble summary etc. shall be displayed on the display unit of FA panel and as well as on the operator station and printer.

4.04.08 NOT USED

4.04.09 Operation under Normal Condition

During normal condition of operation of detection system, quiescent current shall flow through each connecting line. Local indication of individual detector shall be continuously ON and all indications of fire alarm panel except 'MAINS ON' shall be in "off" condition.





4.04.10 Operation under Shutdown Condition

The fire detection and alarm system shall be in normal operation even during 2 Nos of mains 240V ac power failure. The stand by DC power supply from the battery in FAP shall be capable of maintaining the system in normal operation & in alarm condition for a period of not less than 48 hours after the failure of mains supply. The operation of trigger devices in further zones must not result in cancellation of fire alarms existing at that time.

4.04.11 Operation under "OFF Normal" Condition

Fire Condition

Whenever the fire occurs in any area, the following sequence of events will take place.

- a) One of the detectors located in the area after sensing the fire, shall send an alarm signal to the fire alarm panel.
- b) The fire alarm panel verifies the signal by sending a reset signal to the detector or comparing with reference level set in the panel. After a predetermined time (the time is field settable) if the detector is still in alarm condition the panel confirms it as a fire alarm.
- c) Once the fire alarm panel has reported the fire condition, following sequence of annunciation take place on the fire alarm panel. i.e. fire indication. If one more fire incident takes place immediately before the first incident is set off, 'new fire' indication comes. The electronic hooters located at convenient places shall give audible alarm in case of fire alarm. Response indicators will be provided at strategic locations. The detector and the connecting line identification numbers, area and zone description shall be displayed on the fire alarm panel. FAP faulty signal comes if any fire alarm panel becomes faulty.
- d) Simultaneously LED mounted on the detector shall light up.
- e) The alarm status shall also be reported to the respective operator station. Display shall contain area description, zone, the type of detector and detector identification number and time.
- f) The audible alarm can be silenced by the acknowledge push button provided on panel as well as from the keyboard of OWS.
- g) Main control panel visual indication shall be reset like other annunciation only after initiating contact in Fire alarm panel is reset.
- h) In case of multiple alarms, the multiple alarm indication shall be 'ON'. The indicated alarm can be displayed on the fire alarm panel in chronological order by pressing the push button provided on the fire alarm panel.

**Pre-alarm**

The sensitivity of the detector changes if the detector gets gradually polluted due to dust and other particles entering inside the detector. This shall be indicated on the fire alarm panel as pre Alarm condition. This condition indicates that detector needs servicing. The indication should appear in the connected fire alarm panel and operator station.

Test Condition

The healthiness of the system including connecting lines shall be continuously monitored by the fire alarm panel. Facility to test the line shall be provided. The healthiness of the lamps and the detectors shall be checked from the fire alarm panel. The performance of the detector and its base shall be tested in its location by the test equipment supplied by the manufacturer.

Isolation of zone

Facility to isolate any zone/loop shall be provided on the fire alarm panel. The details of isolation shall be available on the FAP & monitor.

Audible Alarm

The audible alarm for fire shall be distinctive and different from any other plant alarm. The minimum sound level shall be 65 db or 5 db above background sound level whichever is more.

Power Supply Failure

One number of redundant power supply unit for FA panel shall be provided with adequate backup facility for 48 hours of normal operation and operation in alarm condition, in case of failure of power. Failure of mains supply and backup power shall be alarmed.

Fault in the fire alarm panel

All the alarm and protection equipment of fire alarm panel shall be monitored. Facility for auto scanning shall be provided for each electronic card / module. The fault in the fire alarm panel shall be indicated by 'FAULT' indication on the fire alarm panel.

Fault in Detector and Detector Line

An open circuit or short circuit condition of the detector lines, defect in detector or its base by the way of component or internal circuit failure and removal of detector shall be indicated on the FA Panel as 'FAULT' alarm.. The fault alarms shall also be communicated to Computer System. Even when Computer System is out of action, fire alarm panel shall indicate the loop under fault. For any failure of computer system in the main computer, the FA panel shall operate in standalone mode. Indication of failure of communication amongst FA panels and computer system shall be annunciated on the fire alarm panels.



- 4.05.00 Annunciations not limited to the following shall be provided:
- 4.05.01 Fire water Pumping & Pressurizing System:
- a) Running / Tripping of fire water pumps both Hydrant and Spray pumps
 - b) Running / Tripping of jockey pumps
 - c) Running / Tripping of compressors
 - d) Fire water pumps "fails to start"
 - e) Jockey pump "fails to start"
 - f) Compressor "fails to start"
 - g) Low level in fuel oil tank of DE driven fire water pumps
 - h) Low/High water level of hydro pneumatic tank
 - i) Low/High pressure of air in hydro pneumatic tank
 - j) Lube oil pressure low of Diesel engine
 - k) Diesel engine over speed
 - l) High temperature of Diesel engine
 - m) Fire water header pressure low
 - n) Power supply trouble
 - o) Motorized valves "fail to open".
- 4.05.02 Alarms from all the Fire Detectors and Manual Call Points (MCP) in the respective Fire Alarm Panels.
- 4.05.03 Alarms from all the Deluge Control Panels for Deluge Valve Opened indicating sector / Zone.
- 4.05.04 Alarms for power supply supervision of all control panels in the Fire Alarm system.
- 4.05.05 Alarm for all fault condition
- 4.05.06 Detector connections shall be supervised to indicate fault condition in case of removal of one or more fire detectors from the detector base.
- 4.05.07 Cable in between detector and the panel shall be supervised so as to indicate fault condition in case of open/short in detector or in cable with a direct fault condition.



4.05.08 Annunciation System

- a) Sequence of Annunciation System shall be as per the following Table:

Status	Visual Display	Audio Signal
NORMAL	OFF	OFF
FAULT	ON WITH BLINKING	ON
ACCEPT	ON (STEADY)	OFF
NORMAL BEFORE ACCEPT	ON WITH BLINKING	ON
FAULT CLEAR BUT NOT RESET (after ACCEPT)	ON (STEADY)	OFF
RESET WHEN FAULT IS CLEARED	OFF	OFF
RESET WHEN FAULT IS	ON (STEADY)	OFF

5.00.00 **SCOPE OF WORK**5.01.00 **Mechanical**

- Three (3) nos. vertical centrifugal type fire water pumps of 410 m³/hr capacity with drive motors and all other accessories as specified.
- Two (2) nos. vertical centrifugal type fire water pumps of 410 m³/hr capacity with diesel engines along with all accessories required for automatic starting of diesel engine, including fuel oil system, lub oil system etc.
- Hydro-pneumatic tank along with two (2) nos. electric motor driven jockey pumps and two (2) nos. compressors with drive motors. Jockey pumps & compressors shall be provided with all regular accessories.
- Two (2) nos. booster pumps (one (1) electric motor driven + one (1) diesel engine driven) horizontal centrifugal type booster pumps with accessories, if required during detail engineering stage, for elevated floors of boiler and Power House.
- One centralized inert gas flooding system for the areas specified, complete with cylinder rack, gas manifold, pressure reducing stations, detection system components, panel, nozzles, piping, fittings and valves.





- f) Required nos. of portable fire extinguisher.
- g) Outdoor hydrant valves with hoses, solid jet/triple purpose/fog type branch pipes with nozzles and quick coupling as required for the entire outdoor hydrant system specified. The equipment shall be as per specification. The required no. of hydrant valves shall be decided during details engineering stage abiding by all stipulations of TAC/other relevant codes & Standards.
- h) Indoor hydrants (landing valves) with hoses, triple purpose branch pipe with nozzles and quick coupling end & "hose boxes" as required for the entire indoor hydrant system specified as per TAC/LPA rules.
- i) Out of total nozzles provided in indoor & outdoor hydrant system, at least 10% shall be "fog type" and balance shall be of ordinary type.
- j) The number of hose hoses and hoses shall be as per TAC/LPA stipulations.
- k) 32 NB connections for first aid hose reels, first aid hose reels along with branch pipe fitted with nozzles and quick coupling ends and isolating valves, hose boxes as required for the entire first aid fire protection system specified.
- l) "Water monitors" on as required basis for the areas identified in the specification.
- m) Sets of hydraulically operated deluge valves with bypass valve, isolating valve & test valve for all HT transformers as specified.
- n) Sets of solenoid operated deluge valves with bypass valve, isolating valve & test valve for entire spray system for coal conveyors, Transfer points (TP), turbine lub oil tank, boiler burner front and cable vault/spreader rooms etc.
- o) Sets of Chrome plated frangible bulb type detectors for areas identified elsewhere in the specification.
- p) Sets of addressable analog optical type of smoke detection arranged in X-zoning fashion for areas identified in the specification.
- q) Sets of addressable analog multi criteria smoke detectors arranged in X-zoning fashion for areas identified in the specification.
- r) Sets of Analogue Addressable type heat detectors for the areas identified in specification.
- s) Three (3) nos. Solar blind Infrared detectors with inbuilt air purging unit for each conveyor. Dual wavelength Infrared flame detectors for boiler burner fronts and turbine oil tanks.



- t) Lot of linear heat sensing cables (non-electrically operated Fibre Optic LHSC/ Thermal sensor based addressable Heat sensing Cable) for the areas mentioned in the specification.
- u) Gas sensing fire detectors working on air sampling for all control rooms and control equipment room.
- v) Required nos. of addressable manual call points for the areas mentioned in the specification.
- w) Lot of open sprayers for HVW & MVW spray system.
- x) For periodic testing of deluge valve, one frangible bulb detector with GI pipe & isolating valve connected to detector network shall be provided for each of HT transformers.
- y) Complete lot of pipelines including all fittings for
 - a. Entire hydrant system.
 - b. Entire spray water (both HVW & MVW) system including network of sprayers.
 - c. Lot of cut-off gate valves, globe type instrument root valves.
- z) RCC Pipe encasement/hume pipes of appropriate class for buried pipelines for all road crossings, rail crossing & for all places where bulldozer may operate.
- aa) Vents and drains as required. Vent and drain valves shall be lockable type and drain lines shall be terminated to nearest surface drain.
- bb) Pressure break-down orifices as required for hydrant system, spray system and first-aid-fire protection system.
- cc) Pipe pedestal for over ground pipes where pipe racks not available.

5.02.00

Civil

- a) Design and construction of FW pump house (extension of CW pump house) including foundation of fire water system equipment (viz, pumps & motors, diesel engine, HP Tank, compressor etc.)
- b) Excavation, preparation of bed and backfilling with compaction for laying underground pipelines and underground cables (wherever accepted by Owner).
- c) Construction of RCC valve chamber as required.
- d) Construction of shed for deluge valve for spraying system as per specification.





- e) Design & construction of hose houses as specified.
- f) Construction of pylon support including foundation for spray water ring and water circuit for detection of H.T. Transformer.
- g) Adequate no. of staircases as per TAC.
- h) Fire stops below switchgear /MCC / Switchboards, junction boxes/panels/cabinets etc. which are floor-mounted type.
- i) Fire barrier / baffle wall in transformer yard, fire barriers for compartmentalizing the cable spreader rooms, fire proof door.
- j) Materials for fire barrier walls/baffle wall in Transformer Yard.
- k) Materials for fire barrier for compartmentalizing the cable spreader rooms.
- l) Materials for fire proof doors.
- m) Fire stops in wall / floors.

5.03.00 **Electrical**

All electrical equipment and accessories as required for this system shall be supplied. These equipment and accessories shall meet the technical requirements of individual equipment specification covered under "Electrical Equipment & Accessories – Volume II-F/1 & II-F/2" of this specification.

5.04.00 **Control and Instrumentation**

Scope of supply shall not be limited to the following:

- 5.04.01 All field mounted instruments viz. process transmitters, local indicators/gauges, process switches, sensors, converters, etc. along with accessories as per specification and approved P & ID. All process transmitters shall be smart type with HART protocol.
- 5.04.02 All type of analogue addressable Fire sensors / detectors and associated detector loop cable and addressable interface modules.
- 5.04.03 Floor mounted vertical Fire detection and alarm panel complete with panel, racks, redundant electronic modules, redundant power supply units, battery & battery charger, redundant CPU module, zone modules, redundant communication modules, display units, indicating lamps, relays, communication / networking & interconnection cables, prefabricated cables, network components etc. in fully wired condition with all accessories viz. terminal blocks, gland plates, base channel, anti-vibration mountings etc.
- 5.04.04 PC based Operator station
- 5.04.05 A3 Laser Jet type Printer.





- 5.04.06 Hot redundant PLC.
- 5.04.07 Industrial grade Laptop based engineering station loaded with all latest version licensed software required for programming, troubleshooting and analysis for Fire detection and alarm panel. This laptop shall also have licensed Office documentation software and Antivirus software only EWS to be provided at Common centralised Fire water Station.
- 5.04.08 Licensed version of all software for the Fire detection and alarm panels , PLC systems, MMI & Peripherals etc.
- 5.04.09 Ergonomically designed Control desks complete with all accessories and operator's chair for all Operator stations.
- 5.04.10 24V DC (2X12V DC) Battery and Battery charging units for each Fire detection and alarm panel.
- 5.04.11 240V AC, 50Hz, +/- 1% Mini UPS system for Operator station of Fire detection and alarm panel.
- 5.04.12 Optical fiber cable, networking hardware comprising of LIU & Media converter to establish communication link in between the fire detection and alarm panel.
- 5.04.13 Complete process hook up materials such as. Impulse pipes & tubes of different grades, pneumatic tubing, stub, root valves, instrument isolation & blow down drain valves, valve manifolds, gauge valves, fittings, stands, brackets, supports, stanchions, frames, racks, foundation bolts, nuts and others erection hardware as applicable for installation of all field instruments / racks.
- 5.04.14 All instrument racks, gauge board, Junction boxes and enclosure complete with all accessories. Canopy shall be provided for all outdoor applications.
- 5.04.15 All safety grounding cable
- 5.04.16 All instrumentation signals, control, power, detector loop cable, special, prefabricated cable, fiber optic cable , Linear heat sensing cable and grounding cable with all accessories such as cable glands, lugs, ferrules etc. as required for interconnecting Bidder's supplied Instruments, panels, annunciators, junction box or any other equipments within Bidder's scope of supply.
- 5.04.17 All perforated trays, flexible & rigid conduits, cable tray supports and hangers, cable accessories including pull / cable boxes, inspection covers, lugs, ferrules, fittings etc. for the above cables.
- 5.04.18 All special tools and tackle viz. Copper cable splicing & crimping tool, Optical fiber splicing & jointing tool kit, Hand held programmer / calibrator (HART) for configuration of smart Transmitter, Fire detector testing kits as required for erection, commissioning & maintenance.



- 5.04.19 Supply of all start-up / commissioning spares.
- 5.04.20 All consumables like lubricants, tapes, markers, printer papers etc. up to handing over of I&C system.
- 5.04.21 Any other hardware / software, not mentioned explicitly, but essential for successful completion of work shall be considered in the scope of the Bidder.
- 5.04.22 **Scope of Works**
- All items supplied by Bidder shall be erected, tested and commissioned by Bidder. The quality of erection work shall conform to industry standards and shall take into cognizance of dust & water ingress.
- 5.04.23 Volume II-E of this specification shall be referred for technical requirements of different items eg. PLC, operator station, printer, panel, field instruments, cable etc.
- 6.00.00 **DESIGN BASIS AND INPUT**
- 6.01.00 **General**
- i) All equipment/system components of complete fire protection & detection system should have the approval from one of the following:
 - a) BIS
 - b) Underwriters Laboratories (UL) of USA
 - c) VDS - Germany
 - d) FM – USA
 - e) LPCB – UK
 - ii) The complete fire detection and protection systems shall be designed in conformity with TAC/NFPA/IS-3034/OISD. Fire protection system shall be designed as per the guidelines of Tariff Advisory Committee (TAC) established under Insurance Act 1938 and NFPA.
- 6.02.00 **Hydrant System**
- a) Two (2) nos. motor driven fire pumps and one (1) no diesel engine driven fire pump shall be provided for supplying pressurized water to the hydrant system piping network.
 - b) All the landings of boiler staircases, turbine buildings, and other multistoried structures, transfer points, Crusher house in the coal Handling plant, etc shall be provided with hydrant landing valves. All the landings of boiler staircases, turbine buildings, and other multistoried structures, transfer points, Crusher house in the coal Handling plant, etc shall be provided with hydrant landing valves. Provision of "double headed hydrants" as per the configuration of "risk

As per Amendment Sl. No 7, I -Four hydrant ring mains shall be provided and entire power plant area shall be suitably divided amongst these ring mains. These ring mains shall be interconnected with isolation valves. It shall be possible to enable to take up part of any of the ring mains for maintenance without any loss of system in the balance part.



WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

area" shall be acceptable. Provision of Hydrants for ESP Roof Tops on both sides to be provided.

- c) Spacing of hydrant (outdoor) shall be 45 M in general and for internal hydrant/landing valves spacing shall be 30 M (max.). For buildings etc., at least one hydrant shall be provided for every 45 meter of external wall measurement.
- d) Minimum terminal pressure of 3.5 kg/cm² shall be maintained at the farthest / remotest hydrant point.
- e) **Three** hydrant ring mains shall be provided and entire power plant area shall be suitably divided amongst these ring mains. These ring mains shall be interconnected with isolation valves. It shall be possible to enable to take up part of any of the ring mains for maintenance without any loss of system in the balance part.
- f) All hydrant pipe mains/ pipe lines shall be routed over-ground on pipe racks. Where pipe rack is not feasible, the pipes shall be routed on concrete sleepers. In main plant area, pipes shall be laid on RCC pedestals.
- g) Hydrants shall not be located less than 2M from building. No building shall be deemed to be protected by a hydrant unless such hydrant is within 15M of the building. When height of structure, tower exceeds 15M, the concerned hydrants shall be replaced by water monitors.
- h) All hydrant valves should be of stainless steel conforming to IS:5290
- i) Based on total nos. of hydrants (outdoor), nos. of branch pipes, tripple purpose nozzles & hoses shall be determined as per guideline of TAC.
- j) Based on total nos. of indoor hydrants (landing valves), nos. of hoses branch pipe, tripple purpose nozzles & hose boxes shall be determined as per guideline of TAC.
- k) First aid fire protection system for power house floors and service building as per guide line of TAC.

6.03.00

Spray Water System (HVV & MVW System)

- a) For HVV spray system the water pressure at any projector/spray nozzle shall be not less than 3.5kg/cm² and not greater than 5.0 kg/cm². For MVW spray system minimum water density and minimum pressure shall be as under:

Area	Minimum water density	Minimum pressure
Cable galleries	12.2 LPM/m ²	2.8 kg/cm ²
Coal conveyors	10.2 LPM/m ²	1.4 kg/cm ²





- b) Water density for all surfaces of Transformer shall be 10.2 lpm/Sq.m only.
- c) For turbine oil tank and purification area, burner front water density shall be 10.2 lpm/sq.m. (min.).
- d) Wet type fire detection system using quartzoid bulb detectors shall be provided for HVW / MVW spray system employed for coal conveyors, transformers, etc. In case of fire, QB detector shall break due to heat and pressure in wet detector network resulting in fall in pressure, which shall actuate the respective deluge valve resulting in water spray on the protected equipment.
- e) Each deluge valve shall be suitable for automatic actuation. Each deluge valve shall also be provided with a LCP from which valve may be operated remote manually. In addition, each deluge valve shall also be provided with an operational latch / hand lever.
- f) All spray pipe mains/ pipe lines shall be routed over-ground on pipe racks. Where pipe rack is not feasible, the pipes shall be routed on concrete sleepers. In main plant area, pipes shall be laid on RCC pedestals.
- g) Chrome plated nozzles shall be arranged in the form of ring to all transformers and nos. of such rings/tiers shall be decided considering maximum gaps between two (2) consecutive tier of rings as 2.5 M. The distance of the deluge valves from the transformers shall be approx. 10 metres.
- h) All nozzles shall be open sprayer type and chrome plated.
- i) No. of nozzles for any particular risk shall be selected considering the characteristic of nozzles provided by the bidder and also the density of water needed to protect completely the risk as per sl. no. (b) to (e) above/NFPA.
- j) In cable galleries the water spray shall cover the exposed area of all the trays and racks. As far as possible fire compartmentalization shall be done in case of cable galleries, cable vaults, cable spreader rooms, electrical equipment rooms etc. Cable vaults/cable spreader rooms shall be suitably zoned. Total water requirement for each zone shall be limited to one-third the capacity of each spray water pump.
- k) The spray system for the coal conveyor system shall cover the exposed area of both the forward and return conveyors and idlers. In transfer points etc., the water spray shall cover the drive equipments, pulleys, chutes, other equipment of the floor and at various elevations. Conveyor belt shall be suitably zoned. Length of each zone shall be so selected such that water requirement of each zone shall be limited to one-third the capacity of each spray water pump and in case



of fire, three (3) zones (one forward and one backward and the zone under fire) shall be flooded.

- I) The spray system for the boiler burner front shall cover all the fuel oil and coal burner elevations, its adjacent piping structures, floors etc.

6.04.00 Inert gas flooding system

- i) Complete design shall be approved and listed by UL/FM /VDS /LPCB.
- ii) Design, manufacture and installation of Clean Agent fire extinguishing system shall be in accordance with NFPA-2001 standard and all the system components / equipment shall be certified by UL/FM/VDS /LPCB.
- iii) The complete volume of the rooms including the above false ceiling shall be considered for estimation of quantity of gas and containers.
- iv) When determining the gas quantity, the leakage losses from the enclosure shall be taken into account. Further volume of re-circulating type air conditioning system and its duct work (at least upto the automatic fire dampers of the ducts) shall be considered as a part of the total volume so that the design concentration is achieved throughout the hazard area. Further gas quantity shall be adjusted for ambient pressure & temperature conditions.
- v) Centralised Clean Agent system along with 100% standby / reserve gas quantity and cylinders shall be provided for each of the areas specified in 3.01.05.
- vi) The discharge time period shall be such that the design concentration is achieved within 60 seconds. The flow calculations shall establish this criteria.
- vii) Operating devices shall be by mechanical, electrical and pneumatic means conforming to NFPA-2001. The power supply to electrical actuators shall be backed up with reliable battery supply. Such batteries shall be charged automatically by battery chargers.
- viii) Facility for manual release of gas through push buttons shall be provided. In addition, local manual release through lever operation shall also be provided near the cylinder banks. Further, manual abort switches shall be provided for each of the area/zone.
- ix) Appropriate warning signs shall be fixed outside of those areas protected by the system and also in areas where the gas may spread indicating the hazard clearly. Apart from written warning signs, audio-visual type warning signs i.e. hooters & strobe lights shall be provided for pre-discharge and post- discharge activity.



- x) To prevent the loss/release of gas automatically or manually during maintenance, the system shall have the facility of "LOCKOUT"

6.05.00 **Portable Fire Extinguishers**

- i) Bidder shall establish the requirement of Portable Fire Extinguishers based on the fire hazard, access. The final requirement shall be subject to approval by the TAC and by the Purchaser.
- ii) The portable fire extinguishers shall be selected according to the type of fire that may be encountered.

6.06.00 **Fire Alarm Detection System (Microprocessor Based)**

- i) Codes & Standards

FAP and associated equipment shall be designed and tested in full accordance with the latest issues of all codes specified as below :

Fire detection system equipment/ components	NFPA, FM*, UL*, ANSI, ASME, ASTM, National Electrical Manufacturers Association (NEMA), IEEE
--	---

Smoke detection	: NFPA 70, 72, 90A, and 850
-----------------	-----------------------------

Heat detection	: NFPA 70, 72, and 850, IS: 2175
----------------	----------------------------------

Manual Call Point	: NFPA 70, 72, 101 and other applicable codes
-------------------	--

Indicating devices	: NFPA 70, 72, and 850
--------------------	------------------------

Control panel initiating and indicating devices	: NFPA 70, 72, and 850
--	------------------------

Fire alarm system wiring (Initiating devices, notification appliances, solenoids, signaling line circuits)	: NFPA and applicable codes
---	-----------------------------

Code of Practice for selection installation and maintenance of automatic fire detection and alarm system.	: IS: 2189
--	------------

Wiring and installation work	: NEC
------------------------------	-------

- ii) The FAP shall be listed as a Proprietary Control Panel. The FAP, associated equipment and detectors shall be included in the Approval



Guide as published by Factory Mutual Engineering./VDS Approved /UL Listed test certificates of detectors shall be furnished by the manufacturer along with the datasheet for Owner's acceptance.

FAP to be provided for Centralised Fire Water Control Room with connectivity to both Stage II & Stage III FAP Network. Location of other FAP will be CCR(Unit #5), CW Pump House & if required (to be decided during detailed engineering) separate FAP to be provided for the CHP Area. If Stage II & Stage III FAP network interface is not feasible, a separate FAP at Fire Station Building to be provided (under the discretion of owner/consultant).

- iii) Fire Alarm System envisaged for the plant is "2-Wire Analog Addressable" type. All fire Detectors are incorporated with microprocessor and shall provide linear output corresponding to the quantity of smoke or fire, it encounters. The communication between the detectors and the control unit is by means of digital addressing and analog data communication over supervised 2-wire zone wise loop cable. The address shall be set by means of a DIP switch on the addressable base or stored in non-volatile memory. The non-addressable sensors like probe type heat detector, Ember detector & Potential free contacts will be interfaced with the FAP through the addressable interface module into a supervised two-wire zone as per manufacturer's standard range of control units for wiring.

iv) **Fire Detectors**

The fire detector shall detect the fire in the early stage by sensing one of its characteristic phenomena like combustion gases in fire, rise of temperature due to fire and convert the same into an electrical signal for initiating the alarm.

- a) The electronic circuit shall be of solid state and of fail-safe design and virtually hermetically sealed to have resistance to humidity and corrosion and to prevent its operation from being impaired by dust and dirt.
- b) The circuit shall be protected against usual electrical transients, electromagnetic and radio frequency interference (EMI & RFI) normally present.
- c) Reverse polarity or fault in the field wiring shall not damage the detector.
- d) No moving parts subject to wear and tear shall be provided.
- e) The sensitivity of the detector shall be field adjustable and also from fire panel over a wide range to suit site conditions. It shall be possible to test the sensitivity of a detector in the field.



- f) The visual (alarm) response of a detector (by a local LED) shall be clearly visible from the outside by a steady / flashing light of sufficient brightness. Separate Response indicator clearly visible from the outside shall be considered for above false ceiling detector.
- g) The base plate of the detector shall be suitable for mounting on single junction box for terminating directly the field cable run. The field terminals shall be suitable for field wires of core size 1.5 sq. mm (minimum).
- h) The detector shall be suitable to connect to the control unit via a two-wire circuit (Class-B wiring) as per UL standard. The system shall be a Class X system in accordance with NFPA 72.
- i) The fire detectors shall be plug in type. Suitable locking device shall be supplied along with each detector. It shall be inserted into or removed from the standard base by simple push twist mechanism to facilitate easy exchange for cleaning and maintenance.
- j) All types of detectors offered shall have in built electronic circuit for addressing capability for individual address on the fire alarm panel.
- k) All types of detectors shall be suitable for connection in any particular loop / circuit with any other type of detector.
- l) All detector listed above shall fit into the common plug in type standard base.
- m) The following types of detectors shall be provided in the plant.
 - i) Heat detectors of rate of rise type.
 - ii) Multi – criteria type combined smoke & heat detectors
 - iii) Infrared Ember Detector.
 - iv) IR /UV Flame detectors
 - v) Manual call points (MCP)
 - vi) Linear Heat Sensing cables.
 - vii) Aspiration / Air sampling type detector for central control room.

Choice of a particular type of detector for protected areas will be as per the specification.

- n) Detectors shall be located in accordance to the spacing requirement between the detectors as per NFPA-72.and listing such as UL.



- o) Detectors performance shall not be affected by the environmental temperature, humidity, air flow conditions.

v) **Fire Alarm Panels**

- a) The Fire alarm Panel (FAP) shall be intelligent microprocessor based system. Fire alarm panels shall be provided on per unit basis and as well as for the in site common plants. All FAP shall be interlinked for an IP based network configuration.
- b) FAP shall broadly comprise of its Power Supply Module (PSM), Central Processing Unit (CPU) Module, Signal / Loop Module (LM) and Networking Interface Modules (NIM). Redundancy shall be incorporated for the critical modules like PSM, CPU and NIM.
- c) The network configuration shall be IP based in Dual Fiber Optic cables and peer to peer communication shall be established amongst the nodes i.e all FAP, Operator work stations (OWS) and Printers.
- d) Fiber optic cable shall be routed through LIU unit. Media converter and shielded twisted pair cable as required shall be provided.
- e) Regarding OWS (Except printer), Please refer Volume IIE Specification.
- f) Individually addressable type detector, which has detected the fire, can be identified on the fire alarm panel. Each individually addressable detector shall transmit its address and analogue value in terms of voltage signal which is normally proportional to the smoke concentration or temperature inside the detector chamber, corresponding to the smoke / temperature, to the fire alarm panel. Non-addressable detectors / devices like MCP will be made addressable by incorporating addressable interface module and will be displayed on the FAP in case of detection.
- g) The communication between detectors and the control unit is by means of digital communication over 2-wire, which further provides power to the detectors. The sensitivity of sensors (for applicable sensors like Photoelectric, Multi criteria, UV / IR etc.) can be individually adjusted from the FAP to suit the conditions of each location. Each detector shall have self-test facility, which is monitored in the FAP. The Panel shall also check each sensor for contamination of dust / dirt and give signal for "Service" in case of accumulation of dust / dirt reaches a preset limit.
- h) The fire alarm panel shall continuously monitor the status of the detectors and connecting lines. The panel shall evaluate the analogue information received from each addressable detector and compare with set value to check for alarm condition.



- i) FAP comprises of loop interface boards with specified loop capacity. The individual elements (detectors /sensors /control /fault isolation modules /interface modules) are looped together and connected to the loop interface board on the FA panel on a 2-wire circuit (class B wiring).
 - j) Each Fire Alarm Panel shall be capable of operating in stand-alone mode. All FAPs and PC based operator stations will be connected by a dedicated fault tolerant Local Area Network (LAN).
 - k) FAP will have multiple loop processing capability. Each zone will be monitored by one independent loop and a loop shall not be shared between different zones. Each FAP shall have additional capacity of handling at least ten alarms per zone, requiring only field wiring, as a spare for future modification or expansion.
 - l) The FAP will be installed as a vertical floor mounted panel in the above areas.
 - m) Except for the system executive software which will be ROM based, all configuration software shall be stored in non volatile, reprogrammable Flash ROM. In addition to the FAP integral keypad programming, a laptop computer will be provided for on /off line programming & downloading of the system configuration. Laptop will be used/located only at Common Centralised Fire water Control Room.
- vi) Following indications shall be provided on the fire alarm panel.
- (a) Fire.
 - (b) Fault.
 - (c) Isolate.
 - (d) Pre-alarm.
 - (e) Multiple alarms.
- vii) Following controls shall be provided on the FAP.
- (a) Push button -Acknowledge.
 - (b) Push button- Reset.
 - (c) Push button -Test.
 - (d) Push button - switch -Isolate.



viii) Following information shall be displayed on the panel.

- (a) Detector identification number.
- (b) Connecting line identification number.
- (c) Zone/ Area description.

ix) Potential free contacts shall be provided for use in control of ventilation system, coal conveyor system. Potential free contact per loop/zone for use in extinguishing /deluge system will also be provided. In addition spare contacts shall be provided for each of the loop/zone.

x) PLC Systems

Dual hot redundant PLC based controls shall be considered for the following areas

xi) The Fire Alarm System panels & enclosure shall be as follows or as per the manufacturer standard when no special requirements are indicated.

Control panels (local)	IEC 56 (NEMA 4)
Fire Alarm Panels [FAP] (to be located in AC control room)	IEC 52 (NEMA 12)

The panel will operate on specified volts ac, and will be FM approved/ VDS Approved.

xii) Local Control Panel / Enclosure

Sprinkler and Spray Systems

A local control panel shall be furnished for each of the sprinkler/spray system valve stations. All local control panels shall be capable of operation as a stand-alone system. For automatic operation (in case of fire) there shall be protective relay interlocking system with the FAP.

xiii) System Other Requirements:

- a) Guidelines in various standards such as NFPA-72, IS: 2189 standards etc. shall be followed.
- b) Each zone shall be monitored by two independent loops.
- c) Control of individual elements of the system is possible from the fire alarm panel. The FA panel shall be functionally independent and operates in standalone mode. It shall be in operation even when there is failure of communication with computer system.



- d) The locations of the individual detectors in the system shall be such that total area under consideration is covered under the fire alarm detection system, without any blind zone.
- e) The loop size shall be designed such that 20% spare capacity is available in each loop for connecting any device in future.
- f) Aspiration / Air sampling type detector system installed in major control room equipped with false ceiling shall be interconnected with FA panel in the respective area via addressable interface module or by any other suitable method. The main purpose of connecting so is to consider aspiration system also as part of main detection system and all alarm signals in aspiration system shall be made to known to main panel and appropriate actions shall be initiated by main panel like other alarm signals.
- g) Detector self test / diagnostic message shall be annunciated in the FA panel.
- h) Two (2) AC power feeders to each Fire Alarm Panels along with Separate DC Power supply of 48 Hours Battery Back Up. Two Nos of power feeder to PLC Panel shall be through UPS.

xiv) Cable & Cabling Accessories

Supply, install, test / commission of all cables including special cables, loop cables as required for interconnecting fire alarm panel, detectors, manual call points, PC, printer, fire extinguishing / deluge system control panels, etc. for the complete fire detection, alarm and protection system shall be considered.

- xv) Bidder shall refer to Vol. II-E of the technical specification for "Control & Instrumentation" for the design basis and technical specification for Field instruments, PLC system and Control & Instrumentation cable .

6.07.00

Miscellaneous issues

- a) Each zone of cable spreader room shall be provided with one (1) no. cut-off BFV.
- b) Each zone of conveyor belt shall be provided with one (1) no. solenoid operated deluge valve.
- c) Water velocity in Fire water pipes shall be as per TAC recommendation. However, Velocity of water thru' pipelines at pump's suction and discharge shall be limited to 1.5 M/sec and to 2.5 M/sec respectably.





- d) Frictional drop shall be calculated based on Hazen-Williams equation considering "C" as 120. Hardy-cross Method shall be applied to find out total frictional drop during selection of pump head. 10% margin in frictional head shall be considered during pump head selection.
- e) Actual pipe size & TDH of pumps shall be selected by Bidder based on "design basis & inputs" specified herein and as approved by the Consultant.
- f) Cut-off gate valves shall be provided for each small and big loops on as required basis.
- g) Water sprayer shall be placed in such a way so that the "spray cone" overlaps each other. This is applicable for all transformers, cable vaults, conveyor belts and other areas where MVW or HVW spray system has been asked for.

6.08.00 Civil

6.08.01 Buried piping shall be laid generally at a depth of 1.0 M below grade. In case of road crossing, same shall be 1.5 M minimum.

6.08.02 Construction of Valve chamber for underground pipes, Hose house and shed for deluge valves and compressor as per good engineering practice.

6.09.00 General Requirements of Fire Detection System

6.09.01 The automatic fire detection and alarm system shall be designed with microprocessor based system having built-in redundancy to ensure availability at all times.

6.09.02 Bidder shall offer microprocessor based Intelligent/ analogue addressable type fire detection and alarm system. Fire alarm system working on microprocessor based system shall have dual redundant fiber optic data highway.

The fire detection and alarm system shall essentially consist of Fire Detection and Alarm Panels with respective OWS & Printer located in CCR, CW Pump House, CHP (If Required) & Other Areas (if required), detectors, Manual Call stations, Alarm devices, accessories, wiring and all connections to devices.

6.09.03 The Fire Detection and Alarm Panels in CCR and the Satellite Fire Alarm Panels shall be used for fire detection, associated annunciation system, power supply distribution etc. of the fire protection system. Satellite Fire Alarm panels shall be strategically located in different areas of the Power Plant considering zone-wise detection.

The Fire Detection and Alarm panels in CCR and the Satellite Fire Alarm Panels shall be microprocessor based and their primary function shall be to raise an effective alarm by visual and audible means upon receipt of an alarm





signal from any of its detection circuit(s) and to activate any device(s) that may be connected to the system(s).

Each detection circuit shall be continuously monitored for fire and fault. Alphanumeric indications shall be provided for fire and fault. Facility shall also be provided for simulation, for test purposes, of these conditions by operation of a control switch, which shall also have a facility to isolate and reset the alarm-receiving group.

- 6.09.04 The Fire Detection and Alarm Panels located in CCR shall be used to hook-up with each Satellite Fire Alarm Panel to indicate group zone-wise fire annunciation from Satellite Fire Alarm Panels. Fire Detection and Alarm Panels shall also supervise, monitor and annunciate the abnormal condition of the circuitry of the fire detection system through local panels.
- 6.09.05 External circuit supervision shall not require additional wires other than the pair used for detection or alarm. These two wires shall provide both supervision and alarm signals.
- 6.09.06 Upon activation of any detection device installed in the circuit, the system shall automatically report the status and initiate the sequence of operations with the following functions as minimum:
- a) Sound an alarm on audible devices.
 - b) Notify automatically central fire station.
 - c) Light an indicating lamp on device initiating the alarm.
 - d) Display "zone" and / or device no. on the panel with defined message.
 - e) Activate the output relays for shutdown of ventilation/air- conditioning system, coal conveyor etc. as per requirement.
 - f) Actuate in fire protection devices & deluge valves etc.
- 6.09.07 Alarm shall have priority over trouble. All trouble conditions shall be reported to include the zone / device no., location etc.
- 6.09.08 In the event of detection of fire, auxiliary systems like ventilation, air-conditioning may require shutdown. For this purpose potential free contacts from the output of the fire protection system shall be made available in the local / main fire panel and terminated in the terminal block
- 6.09.09 All Fire detection & Alarm Panels shall be Main Fire Alarm Panel. All Panels shall have the provision and facilities for connection to Intel i5 (or latest version at the time of supply) WIN NT (or latest at the time of supply) based Personal Computer with 23" LED Monitor and A3 Laser Printer to be provided by the Bidder. Fire response program shall be furnished on screen and automatic action shall be initiated by keyboard / mouse operation. For OWS specification, please refer Volume II-E.



WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

7.00.00 **DESIGN AND CONSTRUCTION**

7.01.00 **Fire Water and Jockey Pumps**

7.01.01 Performance Requirement

- a) Performance requirement for the pumps shall be guided by the 'Data Sheet' enclosed in this section and TAC recommendation.
- b) Pumps shall deliver not less than 150% of rated capacity at a head of not less than 65% of total head. The shut-off head shall not exceed 140% of total head of the pump.
- c) Pump sets shall be capable of continuously delivering the rated output for the voltage variation of ($\pm$) 10% and frequency variation of ($\pm$) 5% occurring separately or combined voltage and frequency variation of ($\pm$) 10% (absolute sum).

7.01.02 Constructional Features

- a) The design and Testing Standards of the Pumps shall conform to the standards as indicated in the Data sheet of Vertical Pumps and TAC recommendation.
- b) The pumps shall comply with the regulations of Tariff Advisory Committee (TAC) and National Fire Protection Association (NFPA), USA as applicable.
- c) Drive Unit Power rating for the fire water pumps shall be selected such that it is equal to higher of the two conditions :
 - i) 110% of the duty point power requirement.
 - ii) Motor input power required at 150% of the duty point capacity of pump.

7.01.03 For technical requirements of Electrical drive motors, ~~Diesel Engine~~ Vol.II-F/1 & 2 shall be referred to.

7.02.00 **Diesel Engine**

7.02.01 Performance requirement of the diesel engine shall be guided by TAC recommendations.

7.02.02 The engine shall be capable of operating continuously on full load at the site conditions for a period of at least Eight (8) hours.

7.02.03 The engine shall be naturally aspirated, super charged or turbo-charged as recommended by the manufacturer. (Ref. Fire Protection Manual by TAC).





7.02.04 The continuous engine brake horse power rating (after accounting for all auxiliary power consumption) at the site conditions shall be at least 20% greater than the brake horse power required to drive the pump at its duty point at rated R.P.M. and in no case less than the brake horse power required to drive the pump at 150% of rated discharge or at any condition of operation of pump. De-rating Factors considered by the manufacturer to arrive at the shaft power of the diesel engine at site, shall not be less than the following for normally aspirated engines only:

- a) 3% for each 305 metre elevation above MSL (Ref. NFPA, Volume-2, 1978).
- b) 1% for each 5.6° C rise in air temperature above 15.6° C (Ref. NFPA, Volume-2, 1978).

The base power rating of the diesel engine shall be referred to any accepted datum like BS/SAE Standard condition or equivalent. In any case, horsepower rating shall not be higher than the limit set by Tariff Advisory Committee.

7.02.05 Design and construction of the diesel engine shall be guided by the TAC recommendations.

7.02.06 Starting

- a) The engine shall be capable of both automatic and manual start.
- b) Automatic cranking shall be effected by a battery driven D.C. motor having high starting torque to overcome full engine compression. Starting power shall be supplied from two (2) sets of storage batteries. One (1) set of battery is for automatic starting of the engine and the other provided for manual starting. A selector switch shall be provided at the automatic starting control panel to select any of the two (2) sets of battery for manual/auto starting of the engine.

The automatic starting arrangement shall include, as a safeguard, a "Repeat Start" feature so that if the pinion of the starting motor does not engage the flywheel at the first attempt, it is automatically retracted and after a short pause again will advance towards the flywheel. This repeat start cycle will continue until five (5) kicks after which there will be suitable annunciation. The battery capacity shall be adequate for ten (10) consecutive starts without recharging with a cold engine under full compression.

- c) Arrangement for both trickle and booster charge of the batteries shall be provided. When the engine starts running, provision should be kept to ensure that the charger is automatically disconnected and the battery is charged by engine dynamo. Battery Charger shall comply UL certified tests.

Each diesel engine shall be provided with two (2) battery charger units of air cooled design. Each charger unit shall be capable of charging one



(1) set of battery at a time. Provision shall, however, be kept so that any of the charger units of a particular engine can be utilised for charging any one of the two (2) batteries of that engine.

7.02.07 Governing System

- a) The engine shall be fitted with a speed control device which will control the speed under all conditions of load.
- b) The governor shall offer following features:
 - i) Engine should be provided with an adjustable governor capable of regulating engine speed within 10% of its rated speed under any condition of load up to the full load rating. The governor shall be set to maintain rated pump speed at maximum pump load. (Refer Fire Protection Manual by TAC).
 - ii) Engine shall be provided with an over speed shut-down device. It shall be arranged to shut-down the engine at a speed approximately 20% above rated speed and for manual reset, such that the automatic engine controller will continue to show an over speed signal until the device is manually reset to normal operating position. (Refer NFPA).
- c) The governor shall be suitable for operation without external power supply.

7.02.08 Fuel System

- a) The diesel engine will run on High Speed diesel oil, analysis of which has been indicated elsewhere in specification.
- b) Each engine shall be provided with fuel oil tank having storage capacity sufficient to run the engine at full load for at least eight (8) hours as per NFPA-20.
- c) For each compression ignition engine driven pump set, there shall be individual fuel tank and fuel feed pipes.
- d) A suitable 1 phase 230 Volt fuel pump (portable) to be provided to fill up diesel oil from Diesel Drum received from supplier of Diesel. This pump should also have facility to be operated by hand, in case electricity fails.

7.02.09 Lubricating Oil System

Automatic pressure lubrication shall be provided by a crankshaft driven oil pump.



7.02.10 Cooling Water System

The cooling water system shall conform to any one of the systems specified in Fire Protection Manual of the Regional committee of the Tariff Advisory Committee/NFPA.

7.02.11 Instrumentation & Control

Instrumentation shall not be limited to the following:

- a) Temperature indicator at cooling water inlet and outlet.
- b) Temperature indicator at lubricating oil outlet from the oil cooler.
- c) Pressure gauges for lubricating oil system.
- d) Differential pressure gauges across strainers/ filters.
- e) Process switches
- f) Speed indicator.
- g) Running hour meter.
- h) Dip. stick type lubricating oil sump level indicator.
- i) Gauge glass type Fuel Oil Tank level indicator.
- j) Voltmeter & Ammeter.

7.03.00 **Air Compressors**

7.03.01 Air Compressors shall be designed for intermittent operation with high efficiency to satisfy the requirement as specified in the data sheets.

7.03.02 The design, manufacture of air compressors shall comply with the Specification data sheet enclosed with this section.

7.03.03 Compressor shall be mounted on an air receiver of ample size so that delivery air pressure is kept within ($\pm$) 5% of rated pressure without excessive start-stop operations in the working cycle.

7.03.04 Instrumentation and Miscellaneous Equipment & Accessories:

The package air compressor and drive shall be supplied complete with the following instrumentation and accessories as a minimum.

- a) Discharge air pressure gauge.
- b) Pressure switch for compressor control.





- c) Starter for drive motor.
- d) Pressure relief valve.
- e) Drain valve.
- f) Delivery valve.

7.04.00 Hydro-pneumatic Tank

7.04.01 Design of Hydro-pneumatic tank shall conform to IS-2825/ASME Section-VIII, Div.1. Design pressure should be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for vessel placed in the discharge line of pumps shall be based on the shut off head of the pump plus static head at pump suction, if any.

7.04.02 Design temperature of vessel shall be 10°C higher than the maximum temperature that any part of the vessel is likely to attain in course of operation.

7.04.03 Corrosion allowance of 2 mm (minimum) on shell and dished ends shall be considered while designing the tank. Suitable mill-allowance shall also be considered for shell and dished ends. Thinning/scaling allowance of 2 mm (minimum) shall be considered for dished ends.

7.04.04 Tank Connections

- a) Bidder shall furnish all pipe material required for vessel connections. All flanged connections should be supplied complete with matching counter flanges, nuts, bolts and gasket materials.
- b) Bolts and nuts shall be of hexagonal head conforming to IS-1367 or equal.
- c) Gaskets shall be full-face type.
- d) Level gauge with isolating valve shall be provided.
- e) All connection as required for pressure gauge, pressure switch, level switch etc.
- f) Manholes/inspection hole shall be provided in the tank for providing easy access into the same.
- g) Suitable ladders attached to the tank shall be provided for easy access to various instruments mounted there on.

**7.05.00 Piping, Fittings, Valves and Specialties**

- 7.05.01 All pipelines under Bidder's scope of work shall be sized considering flow velocities as indicated in "Design Basis and Inputs".
- 7.05.02 Design condition of piping and material of construction, galvanization etc. for pipes and fittings, handling different fluid shall conform to piping data sheet enclosed.
- 7.05.03 Pipes shall be provided with vent connection and vent valves at all high points and drain connection & drain valves at all low points. Drain valves shall be lock-closed type.
- 7.05.04 All pipe bends shall be long radius forged elbow and having bend radius $R=1.5D$.
- 7.05.05 Hangers and supports shall be capable of carrying the sum of all concurrently acting loads. They shall be designed to provide the required supporting effects and allow pipe lines movements as necessary. All guides, anchors, braces, dampener, expansion joint and structural steel to be attached to the building/structure/ trenches etc. shall be provided. Type of hangers and components for all piping shall be selected by Bidder and approval of the same shall be obtained from the Purchaser.
- 7.05.06 All piping system shall be capable of withstanding the maximum pressure arising from any condition of operation and testing, including water hammer effects.
- 7.05.07 Gate, Globe and check valves shall be used respectively for isolation, regulation and water line upto a certain size as indicated in valve data sheet. Suitable size of drain valves shall be used in drain lines.
- 7.05.08 All valves shall be suitable for service conditions i.e. flow, temperature and pressure under which they are required to operate.
- 7.05.09 Gate valves shall be outside screw rising spindle type
- 7.05.10 Gate valves shall be provided with hand wheel, position indicator, pressure-equaliser for valves 350 mm NB and above and drainage arrangement. Locking facility shall also be required where necessary. Gate valve shall be provided with back seating bush to facilitate gland renewal during full open condition. Globe valve shall have adequate profile for controlling action, check valve shall be swing check type and shall have arrow inscription to show the direction of flow.
- 7.05.11 Whenever any valve is found to be so located that it cannot be approached manually from the nearest floor/gallery/platform, hand wheel with floor stand or chain operator shall be provided for the same.
- 7.05.12 For the operation of valves located in the valve pits, suitable arrangement shall be provided to operate the valves from the ground level (i.e. from the top of Valve Pit). For this purpose wrench-operated valve may be looked for.



**7.06.00 Safety Relief Valves**

Design and construction shall be as per Volume :II-J1, Section-VI.

7.07.00 Deluge Valves

Deluge valves shall be used for automatic HVW spray system and MVW spray system. In automatic HVW Spray System, deluge valve in spray water line shall be kept closed normally by water pressure. Same water line will form the water circuit of fire detector. When the detector quartzoid bulb collapses in the event of fire, the water pressure in the deluge valve will fall resulting in the opening of deluge valve.

But the deluge valves, which will be used in the MVW spray system shall be of solenoid-operated type, will remain normally closed but in the event of fire, the solenoid will be energised to open the valve.

For further details of Specification of all valves mentioned above, Data Sheet shall be referred to.

7.08.00 Hydrant Valve (Outdoor) & Stand Post Assembly

The general design of hydrant valve shall conform to IS:5290 type A and shall be suitable for outdoor operation and for further details data sheet shall be referred to.

The general arrangement of outdoor stand post assembly, consisting of a column pipe and a hydrant valve with a quick coupling end shall be as approved by the Regional Committee of the Tariff Advisory Committee/NFPA.

7.09.00 Indoor Hydrant Valves (Internal landing valves)

The general arrangement of the indoor hydrant valves (also known as internal landing valves) shall be as approved by the Regional Committee of the Tariff Advisory Committee/NFPA.

The general design of hydrant valve shall conform to IS:5290 Type-A and shall be suitable for indoor operation. It shall be identical with hydrant valves (outdoor) as outlined above to facilitate interchangeability.

7.10.00 Hydrant Valves for First Aid Fire Protection System

The Water Supply connection for the first aid hose reels shall be taken/tapped from the closest hydrant riser.

The general design and construction of the hydrant valves for first aid fire protection system shall conform to IS: 5290 Type-A and shall be suitable for indoor operation.





7.11.00

Hoses, nozzles, branch pipes and hose boxes

- a) The first aid hose shall be provided with cotton-reinforced hoses as per IS: 884 with corrugated external surfaces. Each fire hose shall be provided with quick coupling, branch pipes, nozzles, spanners, etc. The hoses for the internal and external hydrant system should be Rubber impregnated woven jacketed type conforming to IS:636 Type-II.
- b) Branch pipes shall be constructed of Stainless steel (SS-304) and have rings at both the ends. One end of the branch pipe will receive the quick coupling while the nozzle will be fixed to the other end.
- c) The nozzle sizes shall be of not less than 16mm (or 5/8 inch.) in diameter, nor more than 25 mm (or 1 inch.) in diameters for indoor and outdoor hydrants and 6.35 mm (or 1/4 inch) for first aid fire protection system.
- d) 2 Nos. 15m long Hose pipe fitted with quick coupling ends, branch pipes, nozzles, spanner etc. shall be kept in a hose box, which shall be located near point of use. The furnished design must meet the approval of the Regional Committee of the Traffic Advisory Committee/NFPA. The general design and construction of instantaneous couplings, branch pipes and nozzles shall comply with IS:903 (latest revision).
- e) All instantaneous couplings, shall be of identical design (both male and female designs shall be utilised) so that anyone can be interchanged with another. One male/female combination shall get locked in by mere pushing of the two valves together but will provide leak tightness at a pressure of 21 Kg/sq.cm. Designs employing screwing or turning to have engagement shall not be accepted.

7.12.00

First Aid Hose Reels (Small Bore Hose Reels)

- a) First aid hose reels shall be provided inside the power house building only to provide facilities of preliminary fire fighting by people other than fire personnel.
- b) At each floor 32 mm (or 1 and 1/4 inch) diameter first aid hose connection shall be provided from the hydrant risers. The first aid hose reels shall comprise of one no. SS (AISI- 304) isolation valve, reinforced (cotton) rubber hose pipe and one no. SS (AISI-304) nozzle (with isolation arrangement) duly mounted on a swing type (90 deg. min) hose reel.
- c) The number and distribution of hose reels shall be such that the whole or each floor is protected and that no part of the floor is more than 6m (or 20 ft.) distant from a hose nozzle when the hose is fully extended.



7.13.00 All instrument root valves shall be stainless steel Gr. 316 globe type.

7.14.00 **Potable Fire Extinguisher**

- a) Design and manufacture of the extinguishers shall conform to the latest editions of Indian and other equivalent International Standards and shall be suitable for respective design pressure, temperature and service conditions.
- b) All the extinguishers along with accessories shall be guaranteed for satisfactory and trouble-free operation.
- c) Portable extinguishers shall be complete with brackets/fittings suitable for mounting on wall and a carrying handle of ample strength.
- d) Mobile extinguishers shall be provided with a wheeled trolley for movement. Trolley mounted extinguishers shall be provided with 6 or 9 meter long high pressure discharge hose with horn/ telescopic applicator.
- e) Spanner and other accessories as required shall be supplied with each fire extinguisher.
- f) Each extinguisher shall be designed, constructed, tested and painted in accordance with respective Indian/International Standard and marked with BIS Certification.
- g) First charge of chemicals in each extinguisher shall be provided. All chemical charges shall be refilled after testing at site.
- h) Fire extinguishers shall be fitted with pressure gauges as applicable to indicate whether the extinguisher is charged or in need of a recharge.
- i) The discharge horn of the CO₂ extinguishers shall be made of a material non-conducting to electricity.
- j) As required by Tariff Advisory Committee, 10% spare charge of the total no. of extinguishers installed, with a minimum of six recharges, shall be supplied for each type of extinguishers.
- k) All extinguishers shall be mounted at strategic locations in bunches and/or individually to TAC approval. These extinguisher cylinders shall have the approval of Chief Inspector of Explosive (CIE), Nagpur.
- l) Fire proof entry suits (at least 2 nos.) and oxygen masks with cylinder and other accessories (at least 4 nos.) should be furnished.

7.15.00 **Detectors (Microprocessor Based)**

7.15.01 Detectors shall be intelligent analogue addressable type. Detectors shall be housed or mounted in suitable enclosures in such a way that their performance is in no way affected. Special maintenance procedures, if any,





required for the satisfactory operation of the detectors shall be clearly described.

- 7.15.02 In case detectors having electrical contact signal output on sensing fire, it shall be noted that the contact shall be "NC" type so that under fire conditions, this contact will open to initiate fire alarm system.
- 7.15.03 Normally the detectors, which has sensed fire and operated to give fire alarm could be easily located by the numbering scheme both on the detectors and zone-panel, for fire alarm system.
- 7.15.04 The various fire detectors serving a particular area/zone of plant may be wired-up in group and one common signal for each area or zone is transmitted to the zone indicating panel. The number of detectors to be installed shall be governed by total area to be protected, type of building construction, air movement, ceiling construction and sensitivity required.
- 7.15.05 The detectors shall be located where the largest combustion gas concentration can be expected.
- 7.15.06 It shall be possible to replace any type of detector head by a different type detector without requiring change in cabling/panel wiring and condition of the zone originally covered by the detector, thereby making it possible for a smoke detector to be replaced by either heat or flame type or vice versa.
- 7.15.07 All detectors shall be provided with built-in response indicating Lamp/LED which shall give local visual indication, in dense smoke condition when it will operate. The failure of lamps shall not prevent the function of detector.
- 7.15.08 The exact location of detectors shall be coordinated with other services like air-conditioning grills, light fittings, cable trays etc. to provide aesthetically pleasing appearance. The return air paths of air conditioning shall be avoided for detector location.
- 7.15.09 In such areas where detectors themselves are not easily accessible, the remote response indicators outside the enclosed areas shall be provided to indicate the fire condition.
- 7.15.10 Make and type of detectors shall be subject to Purchaser's approval.
- 7.15.11 The indigenous detectors shall have the approval of ISI/ISO in addition to the approval of FM approved/UL listed/VDS approved. Detectors and panels shall be preferably from the same manufacturer for compatibility.
- 7.15.12 The detectors shall not be effected by temperature, humidity, air flows.
- 7.15.13 **Multi Criteria Smoke Detectors**
- a) The multi criteria smoke detectors shall be capable of sensing the fire in the incipient or smoldering stage itself, long before the fire matures to a visible flame. For achieving this requirement, the detector shall be



capable of sensing visible combustion gases (in the form of smoke) or invisible combustion gases, which are the only clues for a long time in smoldering fires.

- b) The detectors shall be sensitive to very low smoke densities of the order of 0.05 gm/cu.m.
- c) The detectors shall be of Multisensor type with a combination of photoelectric and heat sensing elements. The multicriteria smoke detector provides photoelectric sensing and heat sensing combined in a single sensor/base assembly. The multisensor base provides two sequentially addressable points, automatically assigned with one address selection.
- d) The sensitivity of multicriteria smoke detectors shall be selected depending upon the environmental condition.
- e) For further specification of multicriteria smoke detector, data sheet shall be referred to.

7.15.14

Rate-of-Rise and Fixed Temperature Heat Detector (IC Type)

- a) The detector shall be solid thermal detector.
- b) It shall operate on electronic-principle to provide precise fire detection.
- c) The detector shall be of integrated circuit design enclosed in a robust moulded base.
- d) It shall be completely moisture proof and air tight with exposed metal part specially treated to allow the device to be used in particularly corrosive atmospheres.
- e) The detector should work on rate-of-rise and fixed temperature modes of operation.
- f) It shall have no moving mechanical parts.
- g) The detector shall be either surface mounted or with the body concealed above the ceiling and only the detecting element in view.
- h) The rate-of-rise detector shall function when the rate of temperature increase exceeds a pre-determined value, around 7°C to 8°C per min. This detector shall be designed to compensate with the normal changes in ambient temperature, less than 6.7°C per min., which are expected under non-fire conditions.
- i) For further details, data sheet shall be referred to.

7.15.15

Detection System by Linear Heat Sensing Cable

- a) Linear Heat sensing cable shall be non-electrically operated optical fibre type / Intelligent addressable type.





WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- b) The Linear Heat Sensing cable shall be designed as per international/national standard & approved by FOC/ FM/ UL/ TAC/ LPA/ NFPA/ VDS/ LPCB. The cable shall be suitable for fire/ temperature detection in very harsh & dusty environment for indoor as well outdoor applications. The cable shall be immune to Electromagnetic Interference of all kinds and shall be rugged enough to resist most environmental influences like temperature and pressure.
- c) The cable shall be programmable as per site requirements between - 20°C to +150°C with the temperature resolution of 0.1°C.
- d) The detector system shall consist of an optical fibre sensor and the detection unit. The detector unit shall house the electronic circuitry that interfaces with the optical fiber sensor. Any ~~other~~ technology for Linear Heat Sensing cables shall be subject to Owner's approval.
- e) There shall be at least one controller for every 1000 meters monitoring length. There shall be redundancy in controller & cable in such a way that if there is any single fault in cable or in controller, system shall keep working without losing any function.
- f) The fire or excessive temperature condition shall be sensed by the fibre. The detector unit shall recognize the change in optical transmittance of the fiber and cable breaker Fire/Alarm condition shall be identified within 1 mtrs locational accuracy.
- g) The control system shall be microprocessor based and shall provided with GUI based operator interface for calibration, configuration etc. It shall be interfaced with the Fire Alarm Panels via TCP/IP or Modbus or any other industry standard protocol. The controller shall provide at least 16 nos relay output in the form of potential free contact for alarm reporting to Main Fire Alarm Panel.
- h) The controller shall have individual password-protected access levels for operators, maintenance and service personnel, as well as for commissioning personnel.
- i) In addition to Detection by Linear Heat Sensing Cable as described above, Detection by Thermal sensor based addressable Heat sensing Cable shall obey the following:
 - 1. The Linear Heat sensing cable shall be a resettable type, reusable, flame retarding, halogen free sealed structure (IP66) fire detection system designed as per international/ national standard & approved by VdS/ UL/ FM.
 - 2. The microprocessor based sensor element is completely encapsulated in the heat sensing cable at a suitable distance as per NFPA/ EN54/ IS2189 standard to protect sensors from environmental influences. Sensor element shall detect both fixed temperature as well as rate of rise of temperature. The sensor elements shall be





addressable & programmable to pin point the location of fire or temperature monitoring via individual address. The sensor cable shall be suitable for fire/ temperature detection in very harsh & dusty environment for indoor as well outdoor applications. Each sensor in the cable shall be programmable as per site requirements between -40°C to +85°C with the temperature resolution of 0.1°C. It shall be free from false alarms caused by natural ambient temperature fluctuations.

3. System architecture shall be decentralised type to minimise the effect in case of any fault in a controller. There shall be minimum one controller for each zone measuring upto 1000 meter cable each. Controller shall check the temperature values from the sensor cable on a cyclical basis. The thresholds used to create pre-signals or alarms shall be stored in the processor unit. The alarm shall be triggered by using both an absolute temperature value (maximum temperature evaluation i.e. fixed temperature) and a temperature rise within a set period of time (differential temperature evaluation i.e. rate of rise in temperature). Controller shall have individual password-protected access levels for operators, maintenance and service personnel, as well as for commissioning. Relay module providing potential free contacts shall be used to provide interface with 3rd party items. It shall provide MODBUS output for integration with SCADA or any other 3rd party centralised system.

A Laptop of latest configuration with necessary Licensed Software for programing Controller of Addressable LHS cable/Controller of FOLHS Cable to be provided.

For details of linear heat sensing cable, data sheet shall be referred to.

7.15.16

Frangible (Quartzoid) Bulb Type Detector

- a) In frangible bulb type detectors a small amount of gas along with heat sensitive liquid (colored) is entrapped and hermetically sealed. This detector shall generally be mounted on the pressurized water line which forms a ring around the equipment to be protected. When the surrounding temperature rises more than the rated temperature of the detector, the gas inside the detector shall expand and as a result the quartzoid bulb shall collapse releasing water and consequently pressure in the water line shall fall sharply. This fall in pressure will give signal/annunciation in the Panel.
- b) The frangible bulb shall be capable of withstanding the hydraulic test pressure as per latest applicable norms/standards/Rules.
- c) Type and make of frangible bulb shall be of Owner's choice /approval.
- d) For further details data sheet shall be referred to.





7.15.17 **Infra Red Spark/Ember Detector**

- a) The detector must respond satisfactorily even when the lens, through which the detection is sensed are covered with coal dust or oily dust substance.
- b) The detectors shall be designed to work satisfactorily in the event of vibration in any axis.
- c) To prevent false alarms, the detectors shall be provided with purge air facility to keep the lines clean.
- d) Facility for remote response indication shall be envisaged in each detector.

7.15.18 **Infra Red Flame Detector**

The Dual wavelength Infrared Flame Detector shall be provided in Boiler Burner front and Turbine Oil tanks to provide an alarm in case of fire.

7.15.19 **Gas Sensing Fire Detector**

Gas sampling type fire detectors working on the principle of air sampling shall be provided for early detection of fire in the high value control rooms.

7.16.00 **Manual Call System of Fire Alarm (Intelligent Addressable Type)**

7.16.01 Each Manual Call point unit shall comprise of a push button of reputed make enclosed in a ABS Box. The push button shall have minimum 1 NO and 1NC contact. The push button shall not be shrouded and the same shall be projected out from the surface the ABS box. This whole assembly of push button in ABS box shall again be enclosed in an external ABS enclosure with all sides covered except the front side. The front side shall be sealed with breakable glass cover using neoprene or equivalent gasket.

The glass cover shall be fixed in such a way that the actuating push button is kept depressed (with NC contact closed and NO contact Open) so long as the glass cover is intact. In case of fire, when glass cover is broken to give fire warning, the push button shall be released due to spring action hence giving remote fire alarm through NC contact which is now changed over. The status of the changeover of contact may be conveyed digitally also.

7.16.02 The ABS Box and the external ABS enclosure shall be completely dust, weather and vermin proof. The housing of the electronic circuitry shall have minimum IP 65 protection.

7.16.03 The complete unit shall be suitable for wall/column mounting with necessary mounting accessories.

7.16.04 Clear inscription reading (in English) "FIRE ALARM - IN CASE OF FIRE BREAK GLASS" shall be provided for each manual call point unit, either on





the ABS enclosure or on a separate metal plate mounted behind the glass cover. The metal plate for inscription shall not tarnish under the atmospheric conditions

7.16.05

Each manual call point unit shall be provided with the following accessories:

- i) An iron hammer of sufficient weight, which could be used to break the glass cover. The iron hammer shall be suspended on a hook fixed to the external ABS enclosure by means of a non-corrodible iron chain of sufficient length and play to facilitate easy breaking of the glass cover
- ii) Two numbers diametrically opposite earthing studs located on the outside surface of the external ABS enclosure.
- iii) An identification number (on a number plate) which will be invariably same as the number given to the fire alarm, indicating point on the Zonal and Main Fire Alarm panel. The identification number shall match with the address of the intelligent addressable Manual call point for easy identifying the Call Point unit.
- iv) A dust sealing gland or equivalent on the external ABS enclosure for outgoing cable from the unit.
- v) A compression type cable terminating brass gland of reputed make for outgoing cable from the internal ABS enclosure.
- vi) In addition to this a red lamp Response Indicator shall be provided which will light up on actuation of manual call point to locate the manual call point station, which is operated.

7.17.00

Control and Instrumentation

For features and requirements of the control and instrumentation items including field instrument, Panels and Panel mounted instruments, relays, annunciators, selector switches, PLCs and other hardware and peripherals under scope of supply for the Fire Detection and Protection system. Bidder shall also refer the relevant clauses of the Volume II-E of this Specification.

7.18.00

Battery and Battery Charger

7.18.01

Battery

- a) All controls, interlocks, indications, annunciation system etc. for each of the Fire Detection and Alarm Panels (located in Central Control room, CW Pump House, & any Other Areas if required), shall have power supply from 24 V (2 X 12V) Battery and Battery Charging Units. The Battery of each of the above Panels shall be located in the bottom portion of the same Panel. The PC with Printer in the central control room shall be powered up by the respective UPS Power of the Plant Instrumentation and Control System.





WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- b) The Battery driven Power supply shall be available to main fire alarm panel shall be designed to provide supply for a minimum period of 48 hours.
- Bidder shall compute the ampere hour capacity at suitable discharge rate based on above duty and furnish the calculation along with the Bid which shall consider the duty cycle and 25% & 15% compensation for ageing & unforeseen future growth respectively of each battery unit. The maximum and minimum ambient shall be 50°C and 5°C respectively.

The minimum voltage at the end of the load cycle shall not be less than 1.8 volts per cell.

~~7.18.02~~ ~~**Battery Charger**~~

~~For design and construction of Battery Charger refer Volume V.~~

7.18.03 **Layout of Battery & Battery Charger**

- a) The battery and charger of the respective panels shall be an integral part of each of the main fire panel..
- b) Bidder shall indicate his own layout of 24 volt Battery and Charger to suit the space available.

7.18.04 **Fittings & Accessories - Battery**

Each battery shall be furnished with necessary accessories required.

7.19.00 **Fire Alarm Detection & Protection System**

7.19.01 **Fire Alarm Panels (FAP)**

- (I) FAP shall be microprocessor based, where the major functionality of the FAP has been distributed across multiple cards, each major component shall be microprocessor based. Microprocessor based fire alarm panel shall comprise of the processors, various functional modules, adequate number of loop modules for detector loops, display devices, output modules for alarm, control & interlocks, keyboard, amplifier modules, modules for communication with the local area network, two sets of battery; battery chargers & power modules etc. as required by the system to incorporate all the features called for in the specification. The FAP shall be designed to provide a high level of tolerance to lightning and interference from other systems. FAP will be powered through two normal AC mains of 240V AC, 50Hz.

Except for the system executive software which will be ROM based, all configuration software shall be stored in non volatile, reprogrammable Flash ROM. In addition to the FAP integral keypad programming, a laptop computer shall be provided for on /off line programming & downloading of the system configuration.





- (II) FAP shall be scalable for future expansion or modification by at least 10 alarms per zone, requiring only field wiring, as a spare without degradation of the response time. Loss of any one module shall not affect the functionality of the rest of the system.
- (III) FAP shall be designed for ambient condition of 50°C and 95% RH (non condensing).
- (IV) For the purpose of easy identification and location of the fire, the entire building area is divided into zones. Zones correspond to the protective areas will be identified on the panel.
- (V) Fire alarm panel shall receive signals from compatible addressable field devices viz. fire detectors, manual call points, etc. connected in each loop. FAP shall meet the standard NFPA 72 requirements, UL listed and FM approved or VDS approved.
- (VI) The microprocessor based, intelligent addressable fire alarm panel shall incorporate the following features:
 - a) Continuous supervision of the detector connecting lines, individual detector performance / operation and disconnection / removal of detectors.
 - b) The system shall automatically reset on clearance of a fault.
 - c) Discrimination between a real fire alarm and false fire conditions by incorporating signal verification and other features.
 - d) Individual detector addressing capability.
 - e) Detection of over / under sensitive detectors and automatic recalibration by increasing or decreasing their sensitivity levels based on environmental conditions like air movement, fumes, humidity, etc.
 - f) Pre alarm in case of any detector / detectors requiring maintenance.
 - g) Facilities shall be provided such that for alteration or access to the stored program the relevant codes are to be entered. The system should be protected against interference by unauthorised personnel.
 - h) Compatibility with all detectors / devices connected to the fire alarm panel.
 - i) Logging of alarms with times and action text on printers and Operator station.



- j) Programmed activation of various interlocks with fire extinguishing / protection system i.e activation of deluge valve and other associated systems such as coal conveyor, ventilation and air conditioning etc.
 - k) Programmed activation of sequence of events to be carried out in case of fire in any particular protective area of the plant including activation of fire alarm sounders and evacuation alert signal. History SOE shall be provided.
 - l) The circuits shall be arranged such that a fault in the detector or an open circuit in the connecting line does not affect the operation / performance of other detectors in that connecting line and does not prevent receipt of fire alarm signals on the fire alarm panel.
 - m) Alarm verification features for smoke detectors shall be such that the detector activates the alarm, if the detector is in activated condition for 60s. In case of other type of detectors the alarm shall be initiated within 15s.
 - n) The fire alarm panel shall have adequate number of detector circuits / loops so as to cover all the areas to be protected. Provision shall also be made in the fire alarm panel to add additional detector loop modules for further expansion.
 - o) The fire alarm panel and the field devices shall be suitable for Class – B wiring to meet all the requirements specified for the system.
 - p) The fire alarm panel shall have provision to transmit annunciations to the PC based operator station.
 - q) The fire alarm panel shall provide contacts to all the fire protection/extinguishing panels for actuation of protection device and also activity signals to isolation dampers and shutdown signal for the coal belt.
 - r) The annunciation scheme provided on the fire alarm panel shall have the following features :
- (VII) The annunciation system shall have visual and audible alarms with accept, reset and lamp test facilities.
- a) The fire alarm panel shall have a separate alphanumerical display area for visual annunciation of fire alarm, system faults and to indicate the address of the detector, connecting line, the zone description and the action text, if any. The display should be clearly visible even in the dark. The fire alarm shall be displayed with bold big red letters and shall flash at a frequency of about 90 cycles per minute.



- b) Hooters provided for audio annunciation in the buildings shall be clearly audible even at the ambient noise level in the area installed. The minimum sound level of the hooter shall be either 65 dB or 5dB above the other noise likely to persist for a period longer than 30 s, whichever is greater.
 - c) Fire alarm panel normal power supply failure shall be annunciated audio – visually.
 - d) Use of earth as a return circuit shall not be allowed for any annunciation system.
 - e) Accept and reset facility of audiovisual alarms shall be possible either from the fire alarm panel or OWS. Normally acknowledgement will be performed from OWS at CCR.
 - f) In case of multiple alarms, the multiple alarm indication shall be 'ON'. The multiple alarm indication shall be displayed & scrolled on the fire alarm panel in chronological order through push buttons provided on the panel.
 - g) The fire alarm panel shall have provision for programmed activation of required annunciations on the main control panel, control and interlocks with fire protection systems.
- (VIII) The fire alarm panel shall have provision for necessary control and interlocking functions where the following systems / equipment are provided on occurrence of a fire in corresponding zones :
- a) To switch off the air conditioning
 - b) To close dampers in ventilation ducts.
 - c) Initiating the required alarms on the main annunciation panel / PC station.
 - d) To stop coal conveyor
 - e) To operate the deluge valves.
 - f) To operate inert gas system

(IX) **FA Panel Construction details**

- a) Fire alarm panel shall have a degree of protection of IP: 54.
- b) Fire alarm panel shall be fabricated out of sheet steel having a minimum thickness of 2 mm, with adequate bracing and stiffeners.
- c) All sheet steel shall be degreased, pickled, phosphated and then applied with two coats of chlorinated rubber based primer and two coats of finishing paint, both inside and outside with colour shade.



- d) All doors, removable covers and plates shall be gasketed all around with neoprene gaskets.
- e) Suitable removable undrilled cable gland plates shall be gasketed all around with neoprene gaskets.
- f) The panel shall be completely factory wired, absolutely ready in all respects for installation at site and termination of all external cabling. The internal wiring of the panel shall be carried out with 1100 V grade, stranded copper wires of size rated for the current in the corresponding circuit. The minimum size of the wire shall not be less than 0.75 sq. mm for electronic circuits and 2.5 sq. mm for electrical circuits & 14 AWG for grounding.
- g) Non-flammable Terminal blocks of 1100V grade and of adequate size and current rating shall be provided for terminating all external cables. Spare terminals shall be provided on the terminal blocks for future expansion.
- h) Adequate space shall be provided for termination of external cables. The minimum distance between two rows of terminal blocks shall be 175 mm. The minimum distance between the lowest terminal and the gland plate shall be 250 mm.
- i) All wiring termination shall be done using ferrules having indelible marking.
- j) All floor mounted, free standing panels shall be provided with 240V, 1 – phase AC, fluorescent lighting fixture for interior illumination controlled by a door switch. A 240V, 1phase, 5A, 3 pin receptacle shall be provided on the fire alarm panels.

7.19.02

Operator Stations

- a) Operator stations shall be furnished in the Control rooms for the central monitoring of all the functions of the fire alarm system.
- b) Operator stations shall have provision for communicating / interfacing with various components of the microprocessor based fire alarm system viz. Fire alarm panels, Monitor, printer etc.
- c) The system software shall be specifically designed for fire detection and alarm system application, which includes alarm processing, control, status monitoring and various other functions to meet all the requirements of the system specified.
- d) The capacity of the processor shall be adequately designed to include all input/output signals and various functional requirements of the system.
- e) The processor offered shall be of 64 bit configuration (minimum) and shall support multi-tasking functions.





- f) The processor shall be designed to meet the following requirements.
- g) Updating of analog parameters display on the Monitor shall be less than 1s.
- h) In case of graphic display, time for display on VDU screen on operators request shall be less than 3s.
- i) Operator Station shall be of Latest Standard as specified in Volume II-E.

7.19.03 **Monitor and key board**

Monitor shall have the following features:

- a) 23" Color LED monitor (TFT based) with graphic display facility
- b) Data retrieval
- c) Alarm annunciation, accept and reset facility.
- d) Display of individual detector status sensitivity and setting of detector sensitivity
- e) Commands and programming facility for performing various functions
- f) The software used shall be provided with brief user's guide menu to enable the operator for proper use of various menu functions.
- g) Access to various programs and operation shall be through password to restrict the use to authorized personnel.
- h) Any other features necessary for proper functioning of the system.

7.19.04 **Operator station software**

- a) The system and fire alarm panel in general shall be suitable to be operated from PC.
- b) The system shall be upgradeable.
- c) Operator Station (OS) software shall include as a minimum the operating System, Data Base Manager, Communications Control, Operator Interface (OI) Trend and History Files, Report Generator and Support Utilities, Scheduler and Time and Event Support Programs, layout view of the detectors and protection device in room / building. Detectors & protection device will have colour changing with the normal, pre alarm and fire condition.
- d) Real Time operating system shall be true multi-tasking providing concurrent execution of multiple real time programs and custom program development.



- e) Data Base Manager is to manage all data on an integrated and non-redundant basis. It shall allow additions and deletions to the data base without detriment to the existing data. Cross linkages are to be provided such that no data required by a software program may be deleted by the operator until that data has been deleted from its respective program.

7.19.05 **Printer**

- a) Separate A3 Laser Printers shall be provided in CCR Unit #5, CW Pump House, CHP & other areas (If required). Printer shall provide all outputs of status, alarms, events, acknowledgement, reset, commands, selection etc. with time and create records.
- b) Alarms shall be highlighted differently than other messages, including type, location, time, date, address of alarm point etc. Multiple alarm shall be recorded in chronological order. If an alarm is received during the preparation of the reports, the printer shall interrupt the report to record the alarm received and resume automatically on receipt of alarm.
- c) All changes to system programming shall be recorded automatically.
- d) Communication with CPU shall be monitored and faults displayed on the monitor.
- e) The printer shall be suitable for 240V, 1 pH AC power supply.

7.19.06 **Local Control Panel / Enclosure**

A. **Sprinkler and Spray Systems**

A local control panel installed in a hut shall be furnished for each of the sprinkler/spray system valve stations. All local control panels shall be capable of operation as a stand-alone system. For automatic operation (in case of fire) there shall be protective relay interlocking system with the FAP.

B. **Enclosures**

Enclosures for each local control panel shall meet the International Electro-technical Commission (IEC) /NEMA requirements. When a NEMA rated enclosure is required, the system will maintain its listings and/or approvals. Sufficient space shall be allocated to conveniently locate the terminal blocks on the back or bottom of the enclosure. Enclosure shall be UL listed.

C. **Lamps & Switches**

Indicating lamps and switches shall be furnished for the local control panels. Indicators and switches shall be face mounted for external access or viewable through a window kit. When a window is provided,



As per Amendment Sl. No 11, I - Only Mineral Insulated Steel Clad Cables/Fire Survival cables(2CX1.5 Sq.mm - Control Cable & 3CX2.5 Sq.mm Power Cable) will be considered. Details Fire Survival cables shall be as per Electrical Specification Volume IIF1 & IIF2.



WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

the fire protection equipment will be easily and quickly accessible with no tools except the key. Fire alarm indicators will be red, and trouble and supervisory alarm indicators will be amber. System normal indicators will be green. The enclosure will be located in such a manner to protect it from tampering by installing a lock on the panel door that is accessible only to authorized personnel.

7.19.07

Cable and cable Accessories

Supply, install, test / commission of all cables including special cables, loop cables as required for interconnecting fire alarm panel, detectors, manual call points, CPU, main control panel for annunciation purpose, PC, printer, fire extinguishing / deluge system control panels, etc. for the complete fire detection, alarm and protection system shall be supplied by the Bidder.

Cables for the fire detection, alarm and protection system shall be as follows:

- (I) Only Mineral Insulated Steel Clad Cables /Fire Survival cables(2CX1.5 Sq.mm - Control Cable & 3CX2.5 Sq.mm Power Cable) will be considered as per Electrical Specification Volume IIF1 & IIF2.
- (II) Communication cables for Local Area Networking (LAN) interconnecting the FA panels and Operator station through two redundant Fiber optic communication cable. The network shall be fault tolerant so that a single break or short-circuit anywhere in the communication loop shall not degrade the operation of the system. Two cores shall be kept as spare for future use.
- (III) All cables supplied shall bear the relevant ISI certification mark.
- (IV) Installation / wiring of detectors, laying of cables in various areas etc. shall be done in coordination with other Bidder in the respective areas. After installation, each core of the cable shall be tested for continuity and insulation resistance to earth and between cores.
- (V) The cables used for fire detection system are exclusive and are not shared with any other system. The cables are routed away from other system cables.
- (VI) Conduits, Pipes and Ducts.
 - (a) Cable wherever laid in the conduit shall conform to latest revision of IS: 9537 Part I. The size of the conduit shall be 25 mm.
 - (b) The routings, laying and fixing of conduits and pulling of cables shall be done by the Bidder based on the various layout drawings.
 - (c) The fabrication and installation of supports and the clamping or fastening of conduits to racks and supports shall be included in the scope of work of Bidder.





- (d) Cable termination will include making the requisite holes in the gland plate of the equipment, fixing the cable glands, terminating the cables in the gland, fixing of crimping type cable lugs on each core with necessary ferruling and dressing of cable cores inside the panel and connection to the equipment terminals.
- (e) Conduits, pipes and ducts will be embedded in walls. All accessories / fittings required for making the installation complete, including but not limited to ordinary and inspection tees and elbows, check nuts, brass or galvanized steel end caps, PVC / brass bell mouths for water - proof / fire - proof sealing, pull boxes, saddles, spacers and required steel supporting work shall be supplied by the Bidder on as required basis.
- (f) Conduit fittings shall be of the same materials as conduits. Conduits / pipes running horizontally above false ceiling and other exposed conduit running along the walls / structural members wherever necessary shall be under Bidder's scope. All conduits / pipes shall have their ends closed by caps until cables are pulled.
- (g) Each conduit run shall be marked with its designation. Identification shall be by means of painting so located that each run of conduit is readily identified at each end. Where conduits terminate at flush mounted boxes, cabinets or other enclosures, the designations shall also be marked on the inside of the enclosure adjacent to the conduits.
- (h) Dies for threading pipe or conduit of diameters and threads corresponding to the standards shall be provided by the Bidder. Bidder shall thread or cut off and rethread pipe / conduit and shall install adapters or reducers when required to connect sections conforming to different standards or specifications. All field threaded ends of metallic conduits / pipes shall be reamed after threading and anticorrosive paint applied. Exposed conduit (if, any) shall be adequately supported by racks, clamps, straps or by other approved means. Conduit supports shall be erected square and true to line and grade with an average spacing between as given below, except where details give closer spacing. Nominal Bore (dia) - 16 to 25 mm -1.2M. Drilled and tapped holes for screw fastening for conduits on galvanized or painted steel shall be touched up with red lead and same finishing paint before making up the connections.
- (i) Conduit shall be entered into terminal boxes at locations as per manufacturer guideline. In general, all equipment enclosures, cabinets and housings requiring conduit or cable entry shall be provided with terminal boxes designed for terminating and



sealing the ends of cable with compound or will have conduit terminating above level of emergence from floor concrete, with a wiped joint required between lead sheath and wiping sleeve on terminal box. However, a reasonable amount of drilling cutting, reaming and relocating holes shall be considered as normal part of the work.

- (j) Pull boxes, junction boxes, outlet boxes and terminal boxes other than standard items and standard pull sleeves and floor plates, plates terminating conduit runs at cable trays and other plates in the path of conduit runs should be initially furnished without conduit or cable entry holes. The Bidder will later be required to cut entry holes located to meet actual conduit locations as installed after which boxes and plates shall be hot dip galvanized / painted as required.
- (k) For long conduit wiring runs, inspection / pull boxes shall be provided at intervals not exceeding 10 m. Such facilities shall also be provided at conduit bends.

7.19.08 Special Tools

All the special tools & tackle as required for fixing, removal and testing of the sensor shall be furnished by the manufacturer and which shall not be limited to the following:

- (I) Detector Removal Tool:
- (II) Tool shall be universal type to remove / replacement of different size detectors mounted on the ceiling.
- (III) Telescopic Pole:
- (IV) To access detectors fitted upto 6 m above floor level. Removable tool can be fixed on the top of the pole for removal of detector.
- (V) Heat Detector Tester:
- (VI) The heat source is directed at the detector sensor, not the plastic components. This will be 240V AC, 50 Hz and battery operated. Adequate cable length not less than 5 m shall be supplied.
- (VII) Smoke Detector Tester:
- (VIII) Aerosol shall be suitable for all makes and models of detector, whilst not harming the detector, its components, the user or the environment.
- (IX) A Laptop computer for engineering configuration with both FAP Software and PLC Software loaded to be provided at the Common Centralised Fire water Room . Regarding PLC System follow Volume II E Specification.



- (X) Addressing Tool:
- (XI) Address and mode setting tool for all analog detectors and other addressable units.
- (XII) Portable UV / IR Test Lamp:
- (XIII) Portable battery operated explosion-proof source of UV / IR radiation that will be used for UV, IR, UV/IR flame detection systems.
- (XIV) Any other tools and tackle as deemed necessary by the Bidder for his supplied system.

7.20.00 **Fire proof sealing/Fire Stop/Fire Protection Coating System**

The fire-proof sealing/fire stop system/fire protection coating system is required to prevent spreading of fire from one place to another (or one zone to another) through the openings in wall/floor, cables laid in trays/racks and openings below Electrical Switchgear/MCC/Distribution Boards/Cabinets/Panels etc.

7.21.00 **Fire-proof Sealing System**

The material/components used for fire-proof sealing system shall be provided to meet the following requirements:

- a) Life expectancy should not be less than 30 years from the date of installation.
- b) Free from shrinkage or cracking or asbestos in composition and should achieve smoke and gas tightness during fire and should be modifiable.
- c) Not to generate toxic gas and harmless to the personnel handling the system.
- d) Prohibition of production of acid or alkali during gas generation.
- e) Will not produce suffocating/corrosive gas.
- f) Repellant to pest/ rodent/ termite.
- g) Expansion co-efficient - very low, which is to be comparable with masonry concrete.
- h) Not soluble/reactive to acid, water, alkali.
- i) Thermal conductivity - low.
- j) The material in contact with the cables in the fire-proof sealing system shall be compatible with the material used for outer sheath of cables.





- k) It should not have any adverse effect on the cables and should not alter the current carrying capacity of the cables.
- l) Retrofit in design to accommodate not less than 15% more addition of cables depending upon the size of cables, physically and chemically stable.
- m) Capable of withstanding vibrations, drop-loads, foot traffics, mechanical loads, etc.
- n) Non-hygroscopic, non-inflammable and shall not get affected over a period of time due to humidity, moisture and ozone etc. and should not contain volatile solvents which may cause a fire hazard during application.
- o) The fire rating shall not be less than three (3) hours and the system shall be stable after application of water jet in the exposed side in order to extinguish fire.

7.22.00

Fire Protection Coating to Be Applied On Installed Cables

- a) The cables shall be coated with fire protection material of 2 mm dry thickness at the strategic locations as follows so as to limit the spread of fire :
 - i) At fire stops in walls and floors on either side upto 500 mm length.
 - ii) At fire stops below Electrical Switchgears/MCCs/Panels/ Cabinets etc. on one side coating of 500 mm length i.e. on the cable vault side/cable trench side.
 - iii) Length of 500 mm on all sides of the junction/crossing of cabling work in open cable routes/cable trench.
 - iv) In fire risk areas and where specified at suitable intervals as decided upon site conditions in open cable routes.
 - v) Where necessary and specified at site at intervals along cable routes in cable trenches.
 - vi) The coating shall be applied evenly on the cables only.
- b) The fire protection coating shall have the following properties/ composition:
 - i) Asbestos free, non-volatile, not eatable by vermin, harmless and non-irritant to skin of human.
 - ii) Not affecting the current carrying capacity of the cables and the properties of the installed cables.



- iii) It shall delay fire damage to cables and prevent flame spreading meeting the requirement of IEC-332-1 & IEEE- 383.
- iv) Coating material shall show no signs of cracking and peeling when the coated cable is bent to the radius of minimum 12 times the diameter of the maximum sized cable at 180°C.
- v) The limiting oxygen index of the material shall not be less than 35% as per ASTM D-2863.
- vi) Life expectancy equivalent to the cable installations.

7.23.00 The various openings in the cable vault, vertical/horizontal raceways of cables penetrating walls/floors and the bottom of Electrical Switchgears/MCCs/ Distribution Boards/Cabinets/Panels shall be provided with fire stop systems. Cables passing through the openings at various locations are laid on various tiers of the cable trays/racks in the bunch formation. In case, for the purpose of installation of seal system, steel frames are required to be fabricated and fixed in the openings, the fabrication of frame and fixing of the same shall have to be done by the Bidder. Any, civil works required to be done in the openings shall be carried out by the Bidder. Bidder shall also include one set of tools and accessories required for addition or removal of cables after the seal is made. This shall include special tools, compound injection guns, spray guns, etc.

7.24.00 **Power and Control Cables**

7.24.01 Fire survival Power and Control Cables shall be of following types:

a) **Power Cables**

Please refer section-IV of Volume-II-F/2 of this specification.

b) **Control Cables (for fire detection)**

Survival cables shall be similar to the above. In addition the cables shall have high degree of immunity from electromagnetic interference.

7.24.02 **FRLSH Power and Control Cables**

a) **Power Cables**

Please refer section-IV of Volume-II-F/2 of this specification.

b) **Control Cables**

1100 V grade 70°C continuous rating under normal condition and 160°C short time rating under short circuit condition PVC insulated FRLSH outer sheathed control cable conforming to following requirement and in line with IS:1554, IS:8130, IS:5831 and IS:3975.





8.00.00 **INSPECTION AND TESTING**

8.01.00 **Fire Water and Jockey Pumps**

8.01.01 All pumps shall be tested at the shop at rated speed for capacity, head, efficiency and brake horse power. The tests are to be done according to the requirements of the "Hydraulic Institute, USA".

8.01.02 Shaft forgings shall be subjected to ultrasonic testing and checks for hardness and microstructure in addition to chemical and mechanical properties.

8.01.03 MPI/DP test shall be carried out on impellers and shafts to ensure freedom from defects.

DP test shall be carried out on casing.

8.02.00 **Diesel Engine**

8.02.01 DPT on machined parts of piston and cylinder.

8.02.02 Ultrasonic testing of casting and forgings.

8.02.03 Determination of capacity, efficiency and characteristic curves of all engines.

8.02.04 Calibration tests of all fuel pumps, injectors, standard orifices, nozzles, instruments etc.

8.02.05 Over-speed test of the assembly at 120% of rated speed.

8.02.06 Power run test.

8.02.07 Performance test of the diesel engine to determine its torque, power and specific fuel consumption as function of shaft speed. Performance test of the engine shall be carried for 12 hours out of which 11 hours at full load and one hour at 110% overload.

8.02.08 Functional checks and adjustments of speed governor.

8.03.00 **Hydro-pneumatic Tank**

8.03.01 Hydro-pneumatic tank shall be hydraulically tested at 1.5 times the design pressure or two times the working pressure whichever is higher for a period not less than one (1) hour. The tank also be subjected to pneumatic testing at design pressure.

8.03.02 DPT shall be carried out on all final weldments including fillet joints.



As per Amendment Sl. No 12, I - Flow test shall be conducted on the hydrant valves. The flow through the valve shall not be less than 900 liters/min at 3.5kg/cm² during PG Test. Vender shall also submit type test report of similar size of valves duly certified by ISI/as per approved Manufacturing Quality Plan.



WBPDCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

8.04.00 Air Compressors and Receiver

8.04.01 All rotating components of the system shall be subjected to static as well as dynamic balancing testing.

8.04.02 Assembled receiver shall be hydrostatically tested at 150% of the design pressure and the test pressure shall be maintained for at least 30 minutes. All joints shall be gently hammered during the test.

8.04.03 Pneumatic test at design pressure shall also be carried out.

8.05.00 Pipes/Fittings

8.05.01 Hydraulic test or Eddy Current test shall be carried out at manufacturer works on pipes as per IS: 1239 Part 1/ IS: 3589. Fittings (bends, elbow, etc.) shall be as per IS 1239 Part 2 or equivalent specification.

8.05.02 Butt welds joints on buried as well as on above ground pipes shall be subjected to radiographic inspection as per TAC/LPA's manual.

8.06.00 Water and Air Line Valves

8.06.01 All valves shall be tested as per relevant design code of valve.

8.06.02 Valve trim material shall be subjected to NDT if diameter is equal to or greater than 50 mm.

8.06.03 Air tests shall be conducted as per applicable codes to detect seat leakages.

8.06.04 As cast heat marks shall be provided on castings and must be co-related with test certificates.

8.07.00 Hydrant Valves and Stand Post Assembly

8.07.01 The stand post assembly along with the hydrant valve (valve being open and outlet closed) shall be pressure tested to detect any leakage.

8.07.02 Flow test shall be conducted on the hydrant valves. The flow through the valve shall not be less than 900 liters/min. Vender may submit type test report of similar size of valves duly certified by ISI.

8.07.03 Leak tightness test of the valve seat shall be conducted.

8.08.00 Indoor Hydrant Valves (Internal landing valves)

Each internal landing valve shall be tested for pressure, flow and leak tightness as per latest applicable standards & norms.





8.09.00 **Hydrant Valves for First Aid Fire Protection System**

Each hydrant valve for first aid fire protection system shall be tested for pressure, flow and leak tightness as per latest applicable standards & norms.

8.10.00 **Fire Water Monitors**

Tests shall be done on Fire Water Monitor as per Code and Data Sheet.

8.11.00 **Hoses, Nozzles, Branch Pipes and Hose Boxes**

8.11.01 Rubber lined impregnated woven jacketed hoses shall be tested as per IS-636, Type-II and first aid fire protection hose shall be tested as per IS-444. In both cases, following tests shall be included.

- a) Percolation test b) Pressure test c) Burst test

The branch pipe, coupling and nozzles shall be subject to a hydrostatic test pressure to detect any leakage.

8.12.00 **Strainers**

Pressure drop test shall be carried out for basket strainers as well as Y-type line strainers.

8.13.00 **Battery and Battery Charger**

All equipment and components thereof shall be subject to shop tests as per relevant IS/IEC standards. The tests shall also include dielectric tests on Battery Charger.

8.14.00 **Fire Detection and Alarm Panels**

8.14.01 All equipment shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards.

8.14.02 **Routine Tests**

The tests for the panels shall include but not necessarily limited to the following :

- a) Operation under simulated service condition to ensure accuracy of wiring, correctness of control schemes/annunciation system and proper functioning of the equipment/devices and continuity test of printed circuit cards.
- b) All wiring and current carrying part shall be given appropriate High Voltage Test.
- c) Routine test shall be carried out on all equipment such as contactors, relays, switch, fuse, instrument transformers, meters etc.





- d) Power frequency withstand test shall be performed on control/secondary wiring.

8.14.03 Type Test

Type test on typical section of a panel consisting of Transformer Panel, Power pack module unit, Control and operation unit, Annunciation unit etc. shall be performed as per relevant IEC/Fire codes.

8.14.04 Auxiliary Equipment

All component parts and auxiliary equipment such as space heater, insulator etc. shall be routine tested as per relevant IS/IEC.

8.15.00 Type Tests on Fire Proof Sealing System and Fire Stop System

The type tests for fireproof sealing system for floor/wall opening/fire stop system for bottom of Electrical Switchgear MCCs/Panel are as under:

- a) Fire rating test
- b) Hose stream test
- c) Accelerated ageing test
- d) Fire rating test on the penetration seal system built of accelerated aged components followed by Hose Stream Test.
- e) Temperature rise test for cable in the fire stop.
- f) Water absorption test followed by fire rating test.
- g) Flame resistance test for fire protection coating material.
- h) Anti-rodent Test.

The detailed test procedures for each of these tests are to be submitted by the bidder and is subject to approval by Owner/ Consultant.

9.00.00 DRAWINGS, DATA AND MANUALS TO BE SUBMITTED BY THE BIDDER

9.01.00 Drawings to be Submitted by the Bidder

9.01.01 Flow diagram showing the complete fire protection scheme with associated controls for the following :

- i) Hydrant System both Indoor and Outdoor.
- ii) Automatic type High Velocity Water Spray System with quartzoid bulb detection system in pressurized water loop.





- iii) Automatic type Medium Velocity water spray system with Linear heat sensing cable as detector.
 - iv) Multi-criteria smoke detection system arranged in cross-zoning principle.
 - v) Heat Detection System (IC type).
 - vi) Diagram showing the lubricant system etc.
- 9.01.02 Schematic and wiring diagram for Battery Charger.
- 9.01.03 Layout arrangement of battery with catalogues.
- 9.01.04 Mounting arrangement of battery charger.
- 9.01.05 Typical general arrangement drawing showing constructional features, space required in front & back, Power/Control/Signal Cable entry points, etc. of local fire panels, main fire panel and local control panel.
- 9.01.06 Typical Control Schematic diagram for solenoid operated valves, drive motors, Fire-detector circuits.
- 9.01.07 Contact multiplication diagram for hook-up with Air-conditioning System, Ventilation System, Coal Handling System.
- 9.01.08 Typical Annunciation System Schematic Diagram along with control and instrumentation scheme of the Fire Protection System.
- 9.01.09 Layout arrangement of Battery Charger inside.
- 9.01.10 Typical drawings for Fireproof Sealing System indicating fixing details and dimensions.
- 9.01.11 Write up on control and operating philosophy of complete Fire Fighting System.
- 9.01.12 System configuration of Fire water pumping & pressurizing system, Fire alarm detection & protection system etc. along with interface technique of other systems.
- 9.01.13 Proposed GA drawing of different panels.
- 9.01.14 I/O list
- 9.01.15 Technical data sheets
- 9.01.16 Bill of Materials
- 9.01.17 P&I diagrams
- 9.01.18 Details of Spares





- 9.01.19 Details of Training
- 9.01.20 Filled up Bid Proposal Sheets
- 9.01.21 Deviation Sheet.
- 9.02.00 **Data and Curves**
- 9.02.01 Battery cell voltage characteristics and data for different discharge rates.
- 9.02.02 Schedule of projectors in MVW spray system and various types of detectors i.e. quartzoid bulb, smoke detector, heat detectors & fire sensing cable, indicating nos. selected for each type of equipment/area.
- 9.02.03 Technical Leaflets on fireproof sealing system and Fire Protection Coating System.
- 9.02.04 Type Test Certificate for all the tests specified elsewhere in the specification.
- 9.03.00 **Design Basis & Back-up Calculations to be submitted by Bidder after award of contract**
- 9.03.01 Head calculation of pumps selected for :
- i) Hydrant system,
 - ii) Spray water system &
 - iii) Pressurisation of fire water system (i.e. jockey pump). Design calculation and basis of equipment/system selection.
- 9.03.02 Hydraulic calculation for hydrant and spray system.
- 9.03.03 Capacity and pressure rating for compressors selected for Hydro pneumatic tank. Capacity sizing & thickness calculation of hydro pneumatic tank.
- 9.03.04 Back-up calculation for no. of quartzoid bulb detectors provided for detection of fire in transformers.
- 9.03.05 Back-up calculation for no. of multi criteria smoke detectors (optical type arranged in X-zoning fashion), provided for cable spreader room/cable vault/switchgear room/ control room etc.
- 9.03.06 Back-up calculation of IC type heat detectors provided for Indoor/outdoor type LT Transformers (Rating less than 10MVA).
- 9.03.07 Back-up calculation of heat sensing cable provided for detection in coal conveyor.
- 9.03.08 Basis of selecting no. of high velocity spray nozzles in LT transformer. One typical calculation each type of transformer shall be furnished.





- 9.03.09 Basis of selecting no. of medium velocity sprayer nozzles in coal conveyor, cable spreader room etc. One typical calculation in each case shall be furnished.
- 9.03.10 Pipe sizing calculation including thickness calculation considering allowable velocity of fluid in pipe line as furnished in "Design basis and input".
- 9.03.11 All civil/structural design calculations as applicable within civil scope of work.
- 9.03.12 Calculation for sizing of Battery and Battery chargers for each category of service.
- 9.03.13 Detail dimensional drawings of various panels , cabinets , equipment , components / sub assemblies with internal views.
- 9.03.14 Complete layout diagrams with foundation details of all panels , cabinets etc.
- 9.03.15 Junction Box / Rack GA & schedule and Instrument / JB location drawing.
- 9.03.16 Complete interconnection and cable schedule
- 9.03.17 JB / Panel Wiring drawings
- 9.03.18 Power Distribution Drawing
- 9.03.19 Pneumatic / Process Hookup drawing.
- 9.03.20 Complete loop and Logic diagrams
- 9.03.21 Logs and Graphics
- 9.03.22 List of special tools and tackle
- 9.03.23 List of consumables
- 9.03.24 Erection drawings and documents
- 9.03.25 Calibration and shop test certificates
- 9.03.26 QAP



WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

ANNEXURE-I

**DATA SHEET
FOR
FIRE WATER PUMPS**

				Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps
1.00.00	Service	:	a)	←- Fire Hydrant System -→		For pressurisation of fire water system
			b)	← Fire spray water system →		
2.00.00	Duty	:		←----- Intermittent -----→		
3.00.00	Location	:		←----- Indoor -----→		
4.00.00	Number of Pumps Required	:	a)	Hydrant Pump – 2 Nos.	Hydrant Pump – 1 No.	Two (motor-driven)
			b)	Spray Water Pump – 1 No.	Spray Water Pump – 1 No.	
5.00.00	Number of Pumps working	:	a)	Hydrant Pump– 2 Nos.	Nil	One
			b)	Spray Water Pump-1No.		
6.00.00	Number of Pumps Stand-by	:	a)	Hydrant Pump – 1 No.	Nil	One
			b)	Spray Water Pump – 1 No.		





			Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps
7.00.00	Pump Performance Requirement				
a)	Performance standard	:	<----- Hydraulic institute standard ----->		
b)	Rated capacity (Cu.m/hr.)	:	410	410	40
c)	Total head, (MLC) not less than	:	Bidder shall decide to meet TAC requirements		Should be more than that of fire water pumps
d)	Rated speed (rpm) Max.	:	<----- 1500 ----->		
e)	Permissible tolerance in rated capacity (%)	:	←----- As per IS : 5120 ----->		
f)	Permissible tolerance in efficiency at rated capacity (%)	:	←----- No negative tolerance ----->		
g)	Range of operation	:	←----- As per IS-1710 ----->		
8.00.00	Design standard	:	←----- IS-5120 ----->		
9.00.00	Pump type	:	←----- Non-pull out type & above floor discharge --->		
10.00.00	Impeller type	:	←----- Closed ----->		
11.00.00	Type of gland lubrication and sealing	:	←----- Self ----->		
12.00.00	Shaft sealing arrangement	:	←----- Mechanical seal/Stuffing box --->		
13.00.00	Axial thrust balancing device to be designed for pump shut-off operation	:	←----- Yes ----->		
14.00.00	Type of pump-motor connection	:	Direct	Direct through bevel gear box	Direct
15.00.00	Type of coupling	:	←----- Flexible Coupling ----->		





WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

			Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps
16.00.00	Mode of pump starting	:	←----- As per manufacturer's recommendation -----→		
17.00.00	Type of shaft bearing	:	←---- Cut-less rubber backed by bronze, shore hardness 60-65 Deg.A ----→		
18.00.00	Bearing lubrication	:	←----- By self-water -----→		
19.00.00	Material of Construction				
a)	Casing/bowl	:	← 2.5% NiCl as per IS:210 Gr. FG 260 →		
b)	Suction Bell	:	←----- Do -----→		
c)	Column pipe	:	←-- Fabricated C. S. as per IS-2062, Gr.B----→		
d)	Impeller	:	←----- ASTM A 351 Gr. CF8M -----→		
e)	Wearing rings	:	←-----Do -----→		
f)	Shaft sleeve	:	←----- AISI 410 (Hardened) -----→		
g)	Shaft bearings	:	←---- Cutless rubber backed by bronze shore hardness 60-65 Deg. A -----→		
h)	Base plate	:	←Carbon Steel as per IS-2062, Gr. B --→		
i)	Stuffing box	:	←-- 2.5% Ni C. I. As per IS-210 Gr. FG 260 ----→		
j)	Stuffing box packing	:	←----- Graphited Asbestos -----→		
k)	Line shaft	:	←----- SS AISI Type 410 -----→		
l)	Pump shaft	:	←----- Do -----→		
m)	Shaft coupling	:	←----- Forged/Cast Steel -----→		
n)	Fastners	:	←----- SS-316 which in contact with water and CS for others -----→		
o)	Discharge head	:	←-- Fabricated C. S. as per IS-2062 --→		
p)	Companion flange	:	←----- M. S.-----→		





WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

			Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps
20.00.00	Supply of accessories & services				
a)	Base plate	:	←-----	Yes -----→	
b)	Foundation bolts, nuts, sleeves etc.	:	←-----	Yes -----→	
c)	Discharge companion flanges with bolts, nuts & gaskets	:	←-----	Yes -----→	
d)	Gland sealing/cooling arrangement complete with pipes, valves, fittings & instruments as required	:	←-----	Yes -----→	
e)	Bearing lubrication/cooling arrangement	:	←-----	Yes -----→	
f)	Discharge pressure indicator	:	←-----	Yes -----→	
g)	Suction strainer	:	←-----	Yes -----→	
h)	Pump-motor coupling and guard	:	Yes	No	Yes
i)	Bevel gear box between pump and engine	:	No	Yes	No
j)	Vent with isolating valve	:	←-----	Yes -----→	
k)	Instrument connections	:	←-----	Yes -----→	
l)	Pre-lubrication tank and accessories (if required)	:	←-----	Yes -----→	
m)	Eye-bolts, lifting tackle etc.	:	←-----	Yes -----→	





**DATA SHEET
FOR
DIESEL ENGINE**

1.00.00	GENERAL INFORMATION		
1.01.00	Service	:	Fire Water Pumps
1.02.00	Designation	:	Internal combustion Diesel Engine.
1.03.00	Type	:	Compression ignition, mechanical (air less) direct injection, multi-cylinder and four stroke cycle and cold starting type.
1.04.00	No. of engine required	:	Two (2)
1.05.00	No. of engine working	:	Two (2)
1.06.00	Duty	:	Intermittent
1.07.00	Location	:	Indoor
2.00.00	ENGINE PARAMETERS		
2.01.00	Nominal output of engine at site operating under ambient conditions	:	Bidder to indicate during detailed engineering.
2.02.00	Speed of the engine	:	Not more than 2300 rpm.



WBPDCCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

**DATA SHEET
FOR
RECIPROCATING AIR COMPRESSOR**

For Hydropneumatic
Tank

- 1.00.00 Service : For Pressurisation of
Hydropneumatic Tank
- 2.00.00 Number required : Two (2) (1- working + 1-
standby)
- 3.00.00 Type : ←----- Receiver mounted, non-lubricated,
reciprocating, air cooled -----→
- 4.00.00 Duty : ←----- Intermittent from receiver pressure ---→
- 5.00.00 Location : ←----- Indoor -----→
- 6.00.00 Drive : ←----- Electric motor as per Volume : II-F/1
and V-Belt drive -----→





WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

DATA SHEET FOR HYDRO-PNEUMATIC TANK

Description	:	Hydro-pneumatic Tank	Type	:	Vertical Cylindrical
Installation	:	Outdoor	Capacity of Cylindrical Portion	:	[22.5 Cu.M (min.)] To be indicated by Bidder
Fabricated	:	At shop	Water space capacity	:	[15 Cu.M (min.)] To be indicated by Bidder
Construction	:	Welded	Working Pressure	:	Discharge pressure of Compressor
Steel	:	As per IS-2002 Gr. 2A	Design & Testing Code	:	IS-2825/ASME Section VIII Div. I
(*) Plate Thickness (Min.)	:				
Shell (for all Houses)	:	Bidder to indicate			
Dished ends	:	Bidder to indicate			
Corrosion Allowance	:	2.0 mm (Min.)			
Joint Efficiency Factor	:	0.85			

(*) Bidder to indicate plate thickness after giving back-up calculation as per ASME SEC.VIII DIV.-I, Boiler & PV Code.





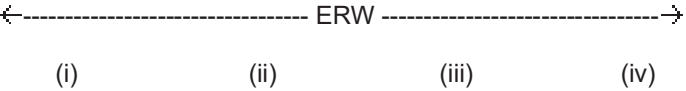
DATA SHEET FOR PIPING, FITTINGS, VALVES AND SPECIALTIES

A. PIPING AND FITTINGS

1.00.00	Type	Overground pipes normally full of water (i)	Overground pipes normally empty but periodically charge with water (ii)
2.00.00	Material	M. S. ERW pipes as per IS-1239, Part – 1 heavy grade (for pipes of sizes 150 NB or below) and IS-3589 Gr.410 ERW (For sizes 200 NB and above) or equivalent and galvanized as per IS 4736 for pipes normally empty and periodically charged with water system application.	
3.00.00	Piping Thickness	Pipes for sizes 200 NB & above shall conform to IS: 3589 Grade Fe410. The final thickness shall not be less than that specified as per IS: 3589 as indicated below.	
		Nominal Pipe Size (mm)	Outside Diameter (mm)
		200 NB	219.1
		250 NB	273
		300 NB	323.9
		350 NB	355.6
		400 NB	406.4
		450 NB	457
		500 NB	508
		600 NB	610
			Wall Thickness (mm)
			6.3
			6.3
			7.1
			7.1
			8.0
			8.0
			8.0
			8.0

- Note :
- Generally Pipes shall be over ground. If Over ground Pipe is not feasible (Road Crossing etc.), then under-ground/buried Pipe lines may be accepted. However, Final decision of Client/Consultant in this regard will be final. To prevent soil corrosion buried pipes shall be properly lagged with two coat and two wrap coal tar enamel and fibre glass/kraft paper as per IS : 10221 or corrosion protective tapes of minimum thickness of 4 mm (in two layers) of coal tar type as per AWWA C 203 / IS : 15337.
 - For detail of painting, please refer Section-XI of Volume-IIA. The shade of paint shall be Fire Red.



4.00.00	Size	As per final design and engineering by Bidder and approved by Owner. However Bidder shall consider velocity of fluid in the pipeline & other criteria as indicated elsewhere for selection of pipe size.	
5.00.00	Construction		
6.00.00	Joints	Butt-welded for size 65 mm NB & higher as per ANSI B 16.9 and socket welded for sizes up to 50 NB as per ANSI B16.11	Screwed flange as required for dismantling purposes for sizes 65 NB & above as per ANSI B 16.5 and screwed socket for sizes 50 NB & below. Welding on GI Pipes/fittings would be permitted provided the same is carried out by means of special electrodes suitable for the above application and the same shall be approved by the employer. After welding, welded portions shall be applied with three coats of zinc silicate treatment/rich paint over one coat of suitable primer. Further the Bidder shall provide proper zinc paint at the point of welding.
7.00.00	Fittings		
	Ratings/Wall thickness	Minimum thickness to match with that of pipe for pipe size 65 NB and above. For pipe size above 150 NB, minimum thickness shall be 6 mm. For pipe size 50 NB & below rating shall be 3000 lbs or wall thickness matching with that of corresponding pipe.	
	Material	The material shall conform to ASTM A234 Gr. WPB or ASTM A 105 or equivalent.	

Note:

- 1) All fittings and flanges for galvanized pipes shall be galvanized.
- 2) Unless otherwise specified, all elbows/bends shall be long radius type.
- 3) The fittings shall be galvanized as per IS: 4736 for galvanized pipe application. In case of branching connections from GI mains for spray piping network socket may be welded for more than two pipe reductions instead of standard tees.





- 4) Fabricated fittings shall not be acceptable up to pipe size of 300 NB. For sizes 350 NB & above, fittings may be fabricated as per BS: 2633/BS: 534.
- 5) Working and test pressure of piping & fittings shall be as per IS or relevant international standards.

B. VALVES

I. Gate, Globe & Check Valve

1. Basic Design Code

- a) Gate Valve : i) IS-14846 for sizes 65 mm NB to 300 mm NB
ii) IS-2906 for sizes 350mm NB and above

- b) Globe Valve : BS EN-13789

- c) Check Valve : BS-1868

2. Construction : Cast body and bonnet/cover.

3. Material of Construction for Gate and Globe Valve

- a) Body and bonnet Material for Gate and Globe valve cover IS-210 Gr. FG 260.

- b) Trim/disc. : IS-210 Gr. FG 260.

- c) Stem : Stainless steel to AISI-410 13% Cr. St.

4. Material of Construction of Check Valve shall be as given below:

- a) Body, Bonnet & Cover: ASTM-A-216 Gr. WCB

- b) Trim/Disc : 13% Cr. Steel as per ASTM-A-182 Gr. F6
Heat treated and Hardened, min.
Hardness-250 HB.

- c) Back seat & Hinge Pin: 13% Cr. Steel as per ASTM-A-182 Gr. F6.

Note: Gate, globe and check valve of size 50 mm NB & below shall be of forged CS body as per API 602(Gate valve), BS 1868(Check valve) and BS 1873(Globe valve). These valves shall have socket welded ends. Valves will be provided with locking arrangements.





II. Deluge Valve

1. Type : Differential pressure type with diaphragm & clapper assemblies.
2. Code/Standard : As applicable.
3. Material of construction
 - a) Body : CI conforming to IS-210 Gr. FG-260
 - b) Valve internal : Brass/bronze
4. Water motor alarm gong shall be provided for hydraulically operated Deluge valve. For solenoid operated deluge valve, same is not required.

C. **HYDRANT VALVE (OUT DOOR)/LANDING VALVE (INTERNAL HYDRANT VALVE) / HYDRANT VALVE FOR FIRST AID FIRE PROTECTION SYSTEM**

1. Type : Female oblique type with the outlets angled towards ground.
2. Code/Standard : IS-5290 Type-A
3. Material of Construction
 - a) Body : SS-304
 - b) Stop valve : SS-304
 - c) Spindle : SS-304
 - d) Seat : SS-304

D. **WATER MONITORS**

1. Type : Fixed type
2. Code/Standard : IS: 8442
3. Flow : 2580 litre/min at 7 Kg/Sq.cm
4. Rotation of body
 - a) Horizontal : 360°
 - b) Vertical : minimum 125 Deg (80° upward and 45° downward)





5. Throw of monitors

Horizontal : 55 - 60 M

Vertical : 25 - 30 M

6. Material of construction

a) Base flange : M.S. conforming to IS: 6392

b) Reducer : M.S. conforming to IS: 1239 Part-II

c) Water nozzle : SS304

E. FIRE HOSE FOR INTERNAL AND OUTDOOR HYDRANTS

1. Type : Impregnated woven jacketed

2. Code/Standard : IS-636 Type II

3. Wt. (gm/M) : Not more than 250

4. Coil diameter : Not more than 44 Cm. (for 30 M long)

F. FIRE HOSE FOR FIRST AID FIRE PROTECTION SYSTEM

1. Manufacturer : As per approved make

2. Type : Corrugated external surface, reinforced rubber hose pipe.

3. Code/Standard : IS-884

G. BRANCH PIPES AND NOZZLES

1. Manufacturer : As per approved make

2. Type : Triple purpose, solid jet and Fog type

3. Code/Specification : IS-2871 for branch pipe and IS- 952 for Fog Nozzles.

4. Material of construction

a) Branch pipe : SS AISI-304 & Construction as per IS-2871

b) Nozzle : SS-304

c) Diffuser : SS-304 & Construction as per IS-2871

d) Fog Nozzle : SS-304 & Construction as per IS-952.



**H. HOSE BOXES/CABINET (INDOOR)**

1. Manufacturer : As per approved make.
2. Material of construction : MS 16 SWG & 3 mm thick glass panel in front door with lock & two keys.
3. Size : To accommodate a pair of hoses one branch pipe, nozzles, spanner etc.
4. Mounting : Wall/Column/Pedestal mounted

I. HOSE BOXES/CABINET (FIRST-AID FIRE PROTECTION)

1. Manufacturer : As per approved make.
2. Material of construction : MS 16 SWG & 3 mm thick glass panel in front door with lock & two keys.
3. Size : To accommodate One (1) no. of hose with end fittings, one branch pipe, nozzles, spanner etc.
4. Mounting : Wall/Column/ Pedestal mounted

J. STRAINERS

1. Type : Simplex basket type
2. Material of construction
 - a) Body : MS fabricated IS:2062 tested quality
 - b) Internal : SS (AISI 316), 30 mesh suitably reinforced

K. SPRAY NOZZLES FOR HVW AND MVW SPRAY SYSTEM

1. Manufacturer : As per approved make
2. Type : Open head type / open nozzle solid cone
3. Discharge angle : 60°-150°
4. K - factor : Bidder to indicate
5. Flow rate : Bidder to indicate
6. Material of construction
 - a) Body : SS-304
 - b) Insert : SS-304





WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

ANNEXURE-II

DATA SHEET FOR HOSE HOUSE

1.00.00	Service	:	To accommodate the hoses for outdoor hydrants with nozzles, branch pipes, spanner etc.
2.00.00	Location	:	Outdoor, to be strategically located in the entire plant area.
3.00.00	Number	:	As per TAC/LPA requirement





WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

ANNEXURE-III

DATA SHEET FOR DELUGE VALVE SHED

1.00.00	Service	:	To accommodate deluge valves of transformers rating more than 10 MVA, deluge Valves of coal conveyor and cable galleries etc. fire protection system.
2.00.00	Location	:	Outdoor. Bidder to select the suitable locations based on piping layout.
3.00.00	Number	:	Bidder to indicate





ANNEXURE-IV

DATA SHEET
FOR
DETECTORS

A. MULTI CRITERIA SMOKE DETECTORS

1.00	Manufacturer	:	As per approved make
2.00	Type	:	Combination of Photo electric sensing and heat sensing, intelligent Analogue Addressable.
3.00	Code/Specification	:	NFPA-72E/BS-5839/IS
4.00	Sensitivity	:	Preset at factory/Adjustable at site (as per UL-268).
5.00	Temperature range	:	1.6°C to + 60°C
6.00	Humidity range	:	15% to 90% RH
7.00	Air velocity	:	0 to 300 ± 25 feet/minute
8.00	Plug in type detector to be provided	:	Yes
9.00	No. of terminals on detector on mounting base	:	Bidder to indicate
10.00	Area covered by single detector	:	Bidder to indicate
11.00	Operating voltage	:	24 volt D.C.
12.00	Inbuilt indicating lamp to indicate operation of the detector provided	:	Yes [Separate response indicators mounted on false ceiling to be provided for smoke detectors mounted above false ceiling]
13.00	Material of detector body	:	Metallic/Plastic
14.00	Detector is approved by UL/FOC/FM/TAC/LPA/VDS	:	Yes
15.00	Detector Base	:	Mounting box (if applicable) Double Compression gland.
16.00	Coverage area	:	Considering maximum spacing as per IS: 2189



**B. HEAT DETECTORS**

1.00.00	Manufacturer	:	As per approved make
2.00.00	Type	:	Fixed temperature cum rate of rise type, intelligent Addressable Analog
3.00.00	Sensitivity	:	Preset at factory/Adjustable at site
4.00.00	Operating temperature range	:	54°C. to 60°C.
5.00.00	Humidity range	:	5% to 90% RH
6.00.00	Detector automatically resets after actuation	:	Yes
7.00.00	Area covered by single detector	:	Bidder to indicate
8.00.00	Operating voltage	:	24V DC
9.00.00	Type of contacts	:	Silver
10.00.00	Principle of operation	:	As per Specification
11.00.00	Detector approved by UL/FOC/FM/TAC/LPA/VDS	:	Yes
12.00.00	Detector Base	:	Mounting box (if applicable) Double compression gland.
13.00.00	Coverage area	:	50 Sq.m per detector (Max.) / Maximum spacing as per IS-2189
14.00.00	Special cable	:	To be provided

C. QUARTZOID BULB DETECTORS

1.00.00	Manufacturer	:	As per approved make
2.00.00	Type	:	Frangible bulb type
3.00.00	Operating temperature	:	79°C





4.00.00	Material of Construction	
	a) Frame	: Bronze (ASTM B 145) Class-5A Leaded gun metal, Chrome plated
	b) Bulb	: Glass filled with heat sensitivity liquid (coloured)
	c) Deflector	: Brass
	d) Cap	: Copper
	e) Seal	: Teflon/Rubber
5.00.00	Working pressure	: 3.5 Kg/Sq. cm (g) minimum
6.00.00	Detector approved by TAC/LPA/FOC/UL/FAS/NFPA	: Yes

D. LINEAR HEAT SENSING CABLE

1.00.00	Manufacturer	:	As per approved make	
2.00.00	Type	:	Non-electrically operated Fibre Optical type linear heat sensing cable / Intelligent Addressable type. It shall be totally immuned to EMI/RFI	
3.00.00	Operating voltage	:	24 Volt D.C.	
4.00.00	Ambient temperature	:	-20°C to 85°C	
5.00.00	Operating temperature	:	Programmable type, with combination of fixed temperature and Rate of Rise in temperature.	
6.00.00	Cable Optical Parameter	:	62.5/125 µm graded index, Multimode Fiber. Cable parameter for other type of cables shall be subject to owner's approval.	
7.00.00	Cable Jacket	:	Steel Type (for conveyor)	Thermoplastic (for cable tray)
	i) Nominal Cable Diameter	:	3.2mm	4 mm
	ii) Maximum weight	:	33 kg/km	23 kg/km
	iii) Minimum Bending Radius	:	75 mm	63 mm





8.00.00	Typical Performance	:	
	i) Sampling Resolution	:	1.0 meter
	ii) Measurement Time	:	10 sec for 4 kms
	iii) Measurement Range	:	-20°C to 150°C
9.00.00	Detector/Control Unit Condition	:	LED for Power ON/Fault/Alarm It shall have freely programmable Relay Contact, minimum 16 nos.
10.00.00	Enclosure for Detector Unit	:	Weather tight and gasketed, IP-54 or better
11.00.00	All accessories such as fittings, fastenings, sleeves, straps, staples, clips (mounting) rings, test terminals, Junction Box etc. as may be required for interconnection of linear heat detector cables as well as interconnection to Control and Power Cable	:	Yes
12.00.00	Linear Heat Detector approved by FOC/FM/UL/TAC/LPA/NFPA/VDS/LPCB	:	Yes
13.00.00	Interface	:	PC Interface via Ethernet/Mod-bus output etc.
14.00.00	Fire Detection	:	Unit should be able to detect abnormal/hot spot within 1 mtrs. Span. Further it shall be able to measure both side of the FO LHS cable in the event of wire break. So as to ensure continued fire protection over the entire length.

E. INFRARED DETECTORS

1.00.00	Manufacturer	:	As per approved make.
2.00.00	Type	:	Infrared Spark/Ember detectors, (Solar Blind) Intelligent analogue addressable with inbuilt air purging unit.
3.00.00	Operating Voltage	:	24V DC





4.00.00	Ambient Temperature	: 8°C to 45°C
5.00.00	Temperature Range	: - 40°C to 60°C
6.00.00	Nominal Response Time	: 75 m.Sec. (Max.)
7.00.00	Sensitivity	: 1.0- 5.0 Microwatt shall be Field Adjustable
8.00.00	Dimensions	: As per manufacturer's standard.
9.00.00	Enclosure	: Dust and Water proof.
10.00.00	Mounting	: To be mounted in protective sheet metal housing above conveyor.
11.00.00	Quiescent Current	: 10 mA/As per manufacturer standard.
12.00.00	Alarm Current	: 20 mA/As per manufacturer standard.
13.00.00	Acceptance Angle	: 120°/As per manufacturer standard
14.00.00	Spectral Response	: 0.8 to 2.0 Micron/As per manufacturer standard.
15.00.00	Half Power Cone Vision	: 90°/As per manufacturer standard.
16.00.00	All accessories such as air purging facilities for cleaning lens, protective housing mounting hinge & latch, J. Box Glands etc. as required	: Yes
17.00.00	Detector shall be solar blind	: Yes

F. INFRARED FLAME DETECTORS

1.00.00	Manufacturer	: As per approved make
2.00.00	Type	: Dual wavelength Infrared flame detectors.
3.00.00	Application	: Boiler Burner Fronts and Turbine Oil Tanks
4.00.00	Operating voltage	: 24V DC
5.00.00	Ambient temperature	: 8°C to 45°C
6.00.00	Temperature range	: -40°C to 60°C
7.00.00	Response time	: Flame - 20 Sec.





8.00.00	Sensitivity	: One (1) foot diameter flame at 35 foot distance.
9.00.00	Field at view	: 90 Degrees
10.00.00	Quiescent current	: 7.5 mA/As per manufacturer's standard.
11.00.00	Alarm current	: 25 mA/As per manufacturer's standard
12.00.00	Stability	: Bidder to indicate
13.00.00	Dimensions	: As per manufacturer's standard
14.00.00	Mounting	: Bidder to indicate in the offer itself.
15.00.00	Enclosure	: Dust and weather proof
16.00.00	All accessories such as air purging facilities for cleaning lens, protective housing, bracket etc. as required	: Yes

G. GAS SENSING FIRE DETECTORS

1.00.00	Manufacturer	: As per approved make
2.00.00	Type	: Gas sensing fire detectors working on air sampling
3.00.00	Application	: All control rooms and control equipment room
4.00.00	Operating voltage	: 24V DC
5.00.00	Ambient temperature	: 8°C. to 45°C.
6.00.00	Relative Humidity	: 0.95%, non condensing
7.00.00	Sensitivity	: 0.006 to .06% obscuration per foot
8.00.00	Maximum Transport time	: 120 seconds
9.00.00	Detector Current	: 300 mA
10.00.00	Dimensions	: Bidder to indicate
11.00.00	Mounting	: Bidder to indicate in the offer itself
12.00.00	Enclosure	: Dust and weather proof
13.00.00	All accessories as required	: Yes





H.	THERMAL SENSOR BASED ADDRESSABLE HEAT SENSING CABLE		
1.00.00	Type	:	Addressable type with inbuilt addressable thermal sensor chip
2.00.00	Detection	:	Fixed temperature & Rate of Rise temperature
3.00.00	Monitoring of temperature	:	Real time temperature monitoring by individual sensor chip with pin point location.
4.00.00	Sensor Chip spacing between two chips	:	max. 5 meter (freely selectable)
5.00.00	Diameter of cable	:	min. 15 mm
6.00.00	Bending Radius	:	min. 0.25 meter
7.00.00	Cable Sheath	:	Halogen free, flame retarding
8.00.00	Color	:	Grey (should not be in Red color)
9.00.00	Measuring Range	:	-40°C to +120°C
10.00.00	Operating Temperature	:	-40°C to +85°C
11.00.00	Resolution	:	0.1°C
12.00.00	Approval	:	VdS as per EN54
13.00.00	Controller	:	Minimum 1 No per 1000 Meter LHS Cable



WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

ANNEXURE-V

LIST OF FIXED FIRE PROTECTION AND DETECTION SYSTEM

Zone No	Zone description	Protection system	Design density	Detection system	Action on detection
1	Boiler Burner Front	Automatic HVW Spray	10.2 lpm/sqm	Automatic detection with quartzoid bulb & Dual wavelength IR detector	System activation
2	Air pre-heater of boiler	Hydrants	-	Fire sensing thermo-couple	Alarm
3	Drain oil tank near boiler	Automatic HVW Spray	10.2 lpm/sqm	Automatic detection with quartzoid bulb	System activation
4	Coal conveyor galleries	Automatic MVW Spray	10.2 lpm/sqm	Auto eye clean type Infrared +UV detectors, LHS cable	Alarm + system activation
5	Tripper conveyor galleries	Automatic MVW Spray	10.2 lpm/sqm	Automatic detection with quartzoid bulb	System activation
6	Transfer points	Automatic MVW Spray	10.2 lpm/sqm	Auto eye clean type Infrared +UV detectors	Alarm + system activation
7	MCC for Boiler & HVAC	Inert Gas Canister type Fire Potable Extinguisher	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion.	Alarm



Development Consultants Pvt. Ltd.

Page 95 of 103

Volume: II-J1
Section: III
Fire Detection & Protection System



WBPDCL

Zone No	Zone description	Protection system	Design density	Detection system	Action on detection
8	SWAS Room	Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
9	Cable spreader room	Automatic MVW Spray	12.2 lpm/sqm	Multi criteria smoke detectors + LHS cable	Alarm + system activation
10	UPS Panel room	Inert Gas Canister type Fire Extinguisher	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
11	ACDB & DCDB room	Inert Gas Canister type Fire Extinguisher	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
12	UPS Battery room	Inert Gas Canister type Fire Extinguisher	-	Spot type heat detectors	Alarm
13	HT Switchgear Room	Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
14	LT Switchgear Room	Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
15	Cable spreader room below ESP control room	Automatic MVW Spray	10.2 lpm/sqm	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion & LHS Cable.	Alarm + system activation





WBPDCCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

Zone No	Zone description	Protection system	Design density	Detection system	Action on detection
16	Turbine Bearing	Automatic HVW Spray	10.2 lpm/sqm	As per TG Vendor recommendation	As per OEM recommendation
17	Control Equipment Room	Inert gas flooding system (Room Proper)	-	Combination of Multi-criteria Smoke Detector .+ Gas Sensing fire detector (HSSD)	Alarm + system activation
18	Central Control Room & Computer Room	Inert gas flooding system (Room Proper)	-	Combination of Multi-criteria Smoke Detector .+ Gas Sensing fire detector(HSSD)	Alarm + system activation
19	C&I Computer Room	Inert gas flooding system (Room Proper)	-	Combination of Multi-criteria Smoke Detector .+ Gas Sensing fire detector(HSSD)	Alarm + system activation
20	Shift In-charge Room & Record room	Inert gas flooding system (Room Proper)	-	Combination of Multi-criteria Smoke Detector .+ Gas Sensing fire detector (HSSD)	Alarm + system activation
21	Main Oil Tank Area	Automatic HVW Spray	10.2 lpm/sqm	Rate-of-rise cum fixed temp. IC type heat detectors.	Alarm + system activation
22	Turbine Control Oil Tank area	Automatic HVW Spray	10.2 lpm/sqm	Rate-of-rise cum fixed temp. IC type heat detectors.	Alarm + system activation
23	TDBFP Lub. Oil Tank Area	Automatic HVW Spray	10.2 lpm/sqm	Rate-of-rise cum fixed temp. IC type heat detectors.	Alarm + system activation



Development Consultants Pvt. Ltd.

Page 97 of 103

Volume: II-J1
Section: III
Fire Detection & Protection System



WBPDCCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

Zone No	Zone description	Protection system	Design density	Detection system	Action on detection
24	Generator Seal Oil Tank & Pump Area	Automatic HVW Spray	10.2 lpm/sqm	Rate-of-rise cum fixed temp. IC type heat detectors.	Alarm + system activation
25	Clean Oil and Dirty Oil Tank area	Automatic HVW Spray	10.2 lpm/sqm	Rate-of-rise cum fixed temp. IC type heat detectors.	Alarm + system activation
26	ESP Control Room	Hydrants/hose station + Potable Fire Extinguishers	-	Combination of Multi-criteria Smoke Detector .+ Gas Sensing fire detector (HSSD)	Alarm
27	Generator Transformers	Automatic HVW Spray	10.2 lpm/sqm	Automatic detection with quartzoid bulb	Alarm + system activation
28	Spare Generator Transformer	Automatic HVW Spray	10.2 lpm/sqm	Automatic detection with quartzoid bulb	Alarm + system activation
29	Station Transformer	Automatic HVW Spray	10.2 lpm/sqm	Automatic detection with quartzoid bulb	Alarm + system activation
30	Unit Transformers	Automatic HVW Spray	10.2 lpm/sqm	Automatic detection with quartzoid bulb	Alarm + system activation
31	Unit Aux. Transformers	Automatic HVW Spray	10.2 lpm/sqm	Automatic detection with quartzoid bulb	Alarm + system activation
32	Any other oil filled transformers more than 10 MVA	Automatic HVW Spray	10.2 lpm/sqm	Automatic detection with quartzoid bulb	Alarm + system activation
33	All oil filled transformers less than 10 MVA	Automatic HVW Spray	10.2 lpm/sqm	Automatic detection with quartzoid bulb	Alarm + system activation



Development Consultants Pvt. Ltd.

Page 98 of 103

Volume: II-J1
Section: III
Fire Detection & Protection System



WBPDCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

Zone No	Zone description	Protection system	Design density	Detection system	Action on detection
34	Diesel Tanks of DG Sets	Automatic HVW Spray	10.2 lpm/sqm	Automatic detection with quartzoid bulb	Alarm + system activation
35	Cable spreader for DG Electrical Room	Automatic MVW Spray	12.2 lpm/sqm	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion & LHS Cable.	Alarm + system activation
36	Vacuum pump cum AHP conveying compressor House & MCC room	Hydrants/hose station + Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion.	Alarm
37	Cable spreader room for Vacuum pump cum AHP conveying compressor House	Automatic MVW Spray	12.2 lpm/sqm	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion & LHS Cable..	Alarm + system activation
38	Condensate storage tank pump house (extended part)	Hydrants/hose station + Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
39	CPU regeneration building & MCC	Hydrants/hose station + Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
40	CPU regeneration building cable spreader room	Automatic MVW spray	12.2 lpm/sqm	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm + system activation



Development Consultants Pvt. Ltd.

Page 99 of 103

Volume: II-J1
Section: III
Fire Detection & Protection System



WBPDCCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

Zone No	Zone description	Protection system	Design density	Detection system	Action on detection
41	New Crusher house 1 & 2	Hydrants/hose station + Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
42	Cable spreader for New Crusher house 1 & 2	Automatic MVW spray	12.2 lpm/sqm	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion & LHS Cable.	Alarm + system activation
43	Sub-station buildings for crusher house 1 & 2	Hydrants/hose station + Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
44	Wagon tripler building	Hydrants/hose station + Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
45	Cable spreader for Wagon tripler building	Automatic MVW spray	12.2 lpm/sqm	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion & LHS Cable.	Alarm + system activation
46	Wagon tripler Sub-station building	Hydrants/hose station + Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion.	Alarm
47	FGD Control Room	Hydrants/hose station + Potable Fire Extinguishers	-	RIO Control Room/ Combination of Multi-criteria Smoke Detector + Gas Sensing fire detector(HSSD).	Alarm



Development Consultants Pvt. Ltd.

Page 100 of 103

Volume: II-J1
Section: III
Fire Detection & Protection System



WBPDCCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

Zone No	Zone description	Protection system	Design density	Detection system	Action on detection
48	Ball Mill Building (Limestone grinding house)	Hydrants/hose station + Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion.	Alarm
49	Ball Mill Building (Limestone grinding house) cable spreader room	Automatic MVW Spray	12.2 lpm/sqm	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion.	Alarm + system activation
50	Gypsum Dewatering building	Hydrants/hose station + Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
51	Gypsum Dewatering building cable spreader room	Automatic MVW Spray	12.2 lpm/sqm	Combination of Smoke and Flame Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm + system activation
52	RC pump+Oxidation Blower house	Hydrants/hose station + Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
53	RC pump+Oxidation Blower house cable spreader room	Automatic MVW Spray	12.2 lpm/sqm	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion & LHS Cable.	Alarm + system activation



Development Consultants Pvt. Ltd.

Page 101 of 103

Volume: II-J1
Section: III
Fire Detection & Protection System



WBPDCCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

Zone No	Zone description	Protection system	Design density	Detection system	Action on detection
54	SO2 Analyser room	Hydrants/hose station + Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
55	SO2 Analyser room cable spreader room	Automatic MVW Spray	12.2 lpm/sqm	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion & LHS Cable.	Alarm + system activation
56	CW/ACW cum Fire Water Pump House & MCC control room	Hydrants/hose station + Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
57	CW/ACW cum Fire Water Pump House cable spreader room	Automatic MVW spray	12.2 lpm/sqm	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion & LHS Cable.	Alarm + system activation
58	CW Treatment Building & MCC	Hydrants/hose station + Potable Fire Extinguishers	-	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion	Alarm
59	CW Treatment Building cable spreader room	Automatic MVW spray	12.2 lpm/sqm	Multi-criteria Smoke Detectors of both ionisation and optical type to be arranged in cross zoning fashion & LHS Cable.	Alarm + system activation



Development Consultants Pvt. Ltd.

Page 102 of 103

Volume: II-J1
Section: III
Fire Detection & Protection System



WBPDCCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

V. II-J1/ Section: III/ Page 103 of 103/ Zone 60 ::

As per Amendment SI. No 13, I - Water Monitor(at 0.0mtr) on both sides of Boiler to cover Roof Top Transformer at ESP top & Hydrant Riser at Both Sides of ESP with Hydrant Post till roof top transformer level.

Zone No	Zone description	Protection system	Design density	Detection system	Action on detection
60	ESP top, Rectifier Transformer at ESP top	Water Monitor on both sides of Boiler to cover Roof Top Transformer at ESP top & Hydrant Riser at Both Sides with Hydrant Post	-	-	-
61	Any Bay Control Room including - Bay Control Unit Rooms of Sagardighi - Baharampur Switchyard (2No Bays) & Farraka – Jeerat (LILO) - 2 No Bays built by M/s PGCIL(1350N to 1500N) & any other Switchyard Area Rooms	Hydrants/hose station + Potable Fire Extinguishers	-	Multi Criteria Smoke detector of both ionisation and optical type to be provided.	Alarm
62	Entire Switchyard Area	Hydrants/hose station	-	-	-



Development Consultants Pvt. Ltd.

Page 103 of 103

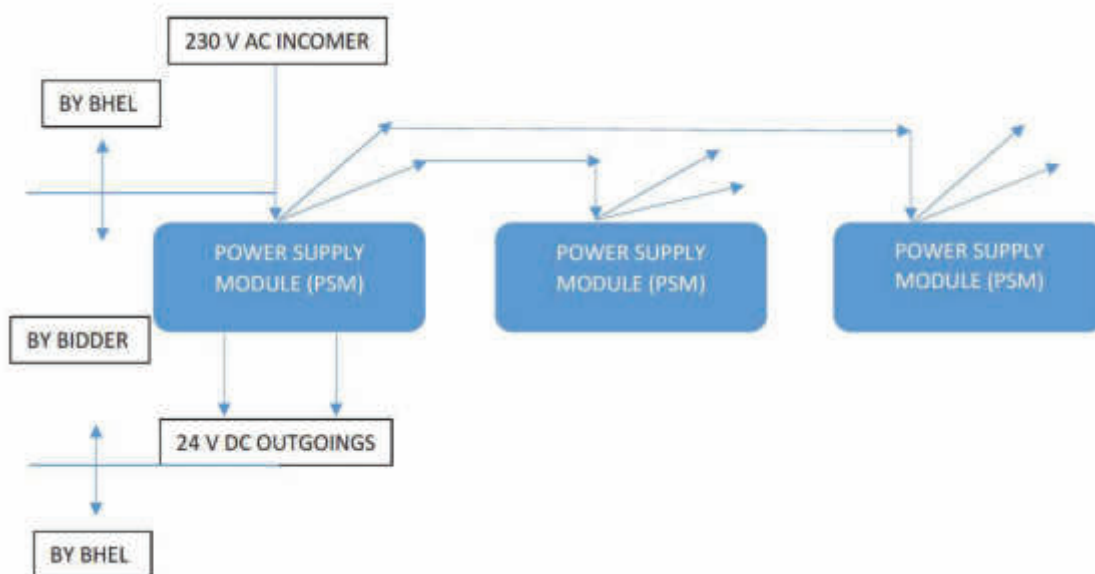
Volume: II-J1
Section: III
Fire Detection & Protection System

TD-201 Rev No. 00	Form No.  HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD		Annexure - E REV 00 Page 1 of 3	
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company. <u>Specification for Power Supply Modules (SMPS with Battery)</u> 1. SCOPE This technical specification covers the Design, Engineering, Manufacturing, Assembly, testing at vendor works, inspection by purchaser, packing and transportation to site with necessary documentation like data sheets, statutory approvals, O&M manuals etc., as required for Power supply modules. 2. SCOPE of SUPPLY – As per enquiry 3. INSTRUCTIONS TO BIDDERS 3.1 Bidders are advised to contact BHEL for essential technical queries in writing within one week of issue of Enquiry. Offers with incomplete information will not be considered for evaluation, and are likely to be rejected outright without any further interaction with the Bidder. 3.2 Any technical features [over & above BHEL enquiry specification requirements] proposed by Bidder will not be given preference for the purpose of evaluation. 3.3 In the event of any conflict between these specifications, data sheets, related standards, codes etc. the vendor shall refer the matter to the purchaser for clarifications and only after obtaining, the same shall proceed with the manufacture of the items in question. 4. APPLICABLE CODES & STANDARDS 4.1 The design engineering and testing of the item shall be as per IS 60950, IS 13252, IEC 60950 and any other relevant & applicable international codes/standards. 5. TECHNICAL SPECIFICATIONS 5.1 SMPS with batteries shall be supplied in fully wired condition. BHEL terminal point shall be 230V AC $\pm$ 10% incomer (cable size: 3C x 6 sq.mm) and 24V DC outgoing feeders. 24V DC outgoing cables shall be provided by BHEL (cable size: 2C x 2.5 sq.mm). Suitable cable terminations shall be provided by bidder in their SMPS. 5.2 All our cables (indicated in S.no. 4.2 above) are armoured cables. Hence, bidder shall include suitable cable glands & lugs to meet the IP-class in scope of supply for all incoming / & outgoing cables of SMPS. 5.3 Bidder shall supply all the erection material required for installation/mounting of SMPS. 5.4 Batteries shall be 2 x 12V SMF type. Back up time shall be for 30 min. at full load condition. 5.5 The Power Supply Module shall be provided with AC to DC conversion circuits and the battery charger circuits. The SMPS panels having requirement of equal to and less than 16 Amp., A.C. power supply shall be suitable to receive, 240 Volt $\pm$10%, single phase, 50 Hz $\pm$5%, phase and neutral, through MCB. 5.6 The Power Supply Module shall provide 24V DC outputs with a current capacity of 6A. Two nos. of 24V DC outputs shall be provided in each Power Supply Module. The application of Power Supply module shall be such that only one output of 6A current capacity or two outputs with a total current capacity of 6A shall be used. Accordingly, each 24 V DC output shall be designed for 6A. 5.7 Each power supply module shall have provision to take two tap offs from incomer to extend incoming power supply to other two power supply modules as shown below.					
Ref. Doc	Revision :00 Refer Record of Revisions	Prepared: D V PRASHANT KUMAR	Approved: P CHANDRA SEKHAR	Date : 22.05.2021	

COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.

- 5.8 Incomer and tap off cables shall be 2C x 4 sq.mm. CU. These cables are in BHEL scope of supply. However, necessary cable lugs & glands for termination shall be in bidder scope.
- 5.9 The panel shall have in-built stabilized power supply unit for its electronic circuitry, which rectifies A.C. power supply to D.C. for system operation.
- 5.10 Output of SMPS shall be field/site adjustable in the range of 24 V DC + 10% to 24V DC - (minus) 0% as per end user requirement.
- 5.11 Irrespective of AC input variation (230V AC $\pm$ 10%); output of SMPS shall be constant i.e. in the range of 24 V DC + 10% to 24V DC - (minus) 0%.
- 5.12 Brief scope demarcation is indicated below:-



6 BILL OF QUANTITY

BOQ shall be supplies as per specification. IP certificates shall be submitted by bidder along with data sheets.

7 INSPECTION & TESTING

- 7.1 Inspection & testing of the item shall be as per IS 60950, IS 13252, IEC 60950 and any other relevant & applicable international codes/standards.

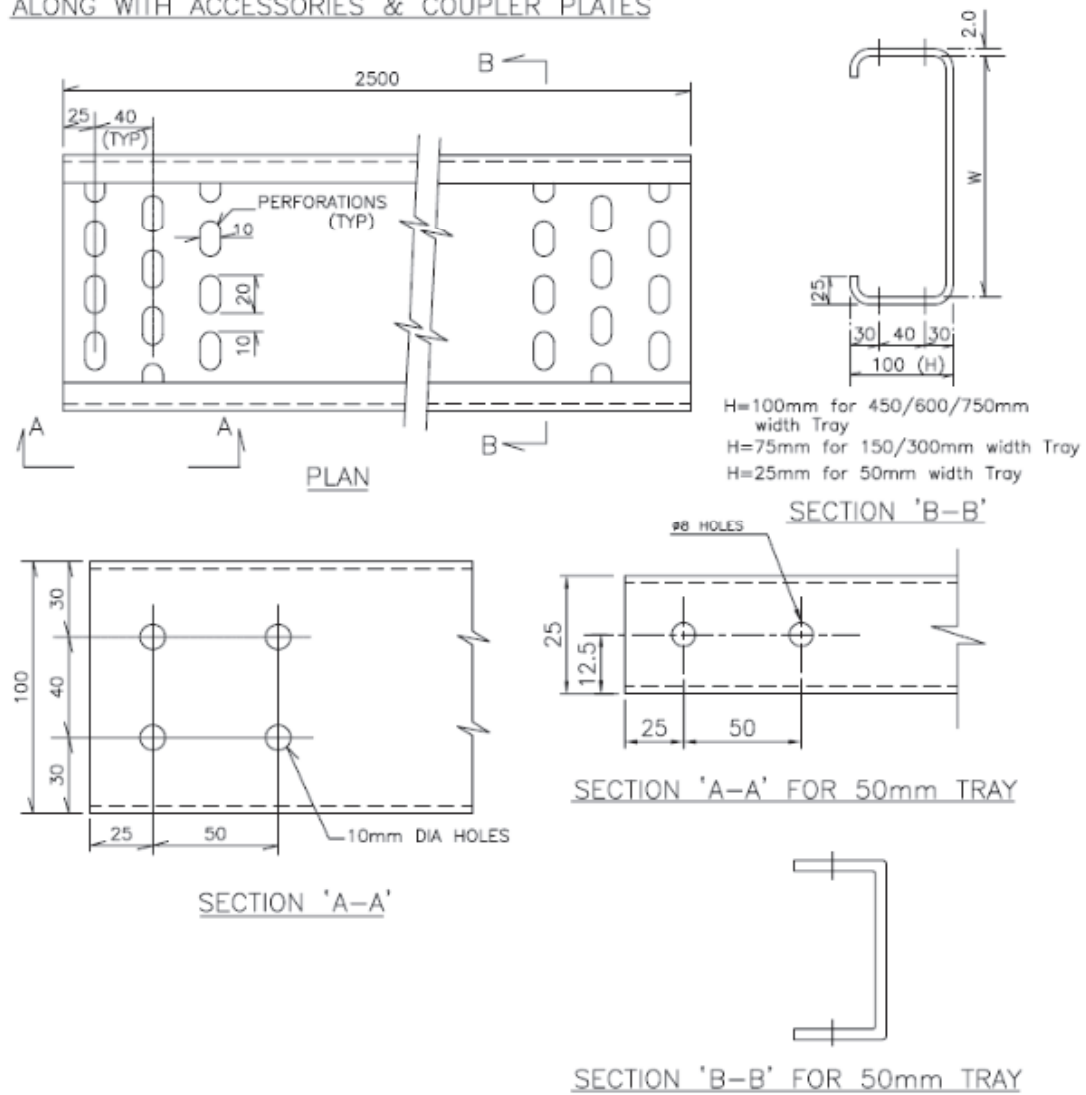
SPECIFICATION FOR CABLE TRAY

- Applicable Standards
 - IS-1079: For hot rolled carbon steel sheets and strips specifications.
 - IS-2629: For practice of hot dip galvanising & adhesion test
 - IS-1363: For heat bolts, screws and nuts.
 - IS-1367: For threaded steel fasteners.
 - IS-5986: For hot rolled steel plates, sheets, strips and flats for flanging & forming operation.
- Constructional Requirements
 - The cable trays and accessories such as coupler plates shall have rigid welded constructions and shall be fabricated out of minimum 2mm thick hot rolled sheet steel.
 - Hot dip galvanizing shall be done after fabrication as per relevant Indian standards. The amount of galvanizing shall be min. 610 g/m².
 - All hardware and fittings like bolts, nuts, washers etc. shall be hard chrome or Cadmium plated or Zinc passivated.
 - Straight run for perforated cable tray shall include 2 sets of coupler plates along with accessories like nut, bolts and washers
- Inspections & Tests
 - Test for thickness of Galvanized coating by Elcometer.
 - Test for mass of Galvanized coating by stripping test.
 - Test for determination of uniformity of Galvanized coating.

1 x 660 MW SAGARDIGHI TPP

Annexure – E

TYPICAL ARRANGEMENT FOR PERFORATED TYPE STRAIGHT RUN CABLE TRAY ALONG WITH ACCESSORIES & COUPLER PLATES



Annexure – E

The drawing consists of two parts: a plan view and a cross-section A-A.

Plan View: Shows a rectangular cable tray with a width of 20 units. It has four circular holes spaced 25 units apart, with a 50-unit gap between the first and second hole, and a 50-unit gap between the third and fourth hole. A 10-unit gap exists between the tray and the wall. Section line A-A is indicated.

Cross-Section A-A: Shows the tray mounted on a wall. The tray has a height of 2.0 units. It is supported by two coupler plates, each 2.0 units thick. The wall is 2.0 units thick. The assembly is secured with 8 DIA round headed bolts with washers and nuts (TYP).

NOTES:

- 8 DIA ROUND HEADED BOLTS WITH WASHERS AND NUTS (TYP)
- TWO COUPLER PLATES
- CABLE TRAY (TYP)

SECTION A-A

NOTES

ANNEXURE-E

Price Bid format [for Main Supply + Mandatory
Spares + Services]

	Price Bid Format [Main Supply + Mandatory Spares + Services]		Annexure -[E] of PY51873
	Fire Detection & Alarm System		Rev.00
	Project: 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)		
BHEL ENQUIRY NO :		Vendor Offer ref no:	
Ref. date:		Ref. date:	
NOTES ::			
1	This document details the price schedule format for the enquiry. No other format will be entertained. Applicable taxes and duties shall be indicated separately in commercial offer.		
2	Duly signed & stamped un-priced price schedule format indicatinf "QUOTED" shall be submitted by vendor in the technical offer as a token of concurrence that price schedule would be submitted in this format. Any tampering / modification / additions, etc. are NOT allowed and not considered binding and is liable for rejection of the offer.		
3	Bidders shall be evaluated on overall L1 basis.		
4	For addition/reduction of quantity, unit rate quoted in the present offer shall be considered during order execution and shall be valid up to execution of the contract to the extent of + 10%, - 20% of overall order Value. These would include the cost up to engineering, installation of the item, wiring up in the panel and seamless integration with main system at works/site without any cost implications. All accessories as required for this purpose also shall be included in the Price Quoted		
5	Components/Items for addition/deletion, spares shall be identical to the main equipment.		
6	Billing will be as per BOM of actual supplied main equipment (including accessories) & spares.		
7	Unit Rates of the individual package items shall be derived by multiplying the "% Weightage" with the Grand Total BASIC Price quoted. Unit Rates of the Individual items thus arrived, shall be binding on the bidder, in case of any repeat order/Amendment of Purchase Order as per this specification and BHEL policies. Please refer sheet 3 & 4 for this purpose and information.		
8	Nil		
9	The Bid Evaluation is on Overall L1 Basis. Partial offers will not be considered for evaluation and the same are liable for rejection.		
10	Bidders will be required to quote Grand Total BASIC Price only in Price Bid Form in the e-procurement portal, considering all items as per this Price Format. Basic Prices of various line items shall be calculated by BHEL by multiplying the quoted Total Basic Price with the Weightages mentioned in this Price Format against the respective line items.		

		Price Bid Format [Main Supply + Mandatory Spares + Services]				Annexure -[E] of PY51873	
		Fire Detection & Alarm System				Rev.00	
		Project: 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)					
S. No	Material Code	Item Description	Quantity [I]	Unit	TOTAL PRICE (Rs.) [I*II]	Weightage (%) for Calculation of Line Item Prices	REMARKS
[A]	MAIN SUPPLY						
	PY9751873010	Main Supply of Fire Detection and Alarm System	1	Set	Not to be filled by Bidder	87.10%	
[B]	MANDATORY SPARE						
	PY9751873029	Mandatory Spares Supply of Fire Detection and Alarm System	1	Set	Not to be filled by Bidder	10.91%	
[C]	SERVICES						
(i)	PY9751873037	Supervision of Erection & Commissioning Services charges at site including lodging, boarding, local travel, insurance, etc. [Unit Rate = Per man day charges]	50	Days	Not to be filled by Bidder	1.73%	
(ii)	PY9751873045	Supervision of Erection & Commissioning visit charges [i.e. travel expenses like travel to & fro from vendors work to site, clearance charges like visa fee, etc.] [Unit rate = per visit travel expenses]	10	Visits	Not to be filled by Bidder	0.26%	
Grand Total Basic price for overall L1 evaluation ([A]+[B]+[C]) (Rs.) ::					To be filled by Bidder (Refer Note-10)	100.00%	

	Price Bid Format [Main Supply + Mandatory Spares + Services]		Annexure -[E] of PY51873
	Fire Detection & Alarm System		Rev.00
	Project: 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)		
Unit Rates for Main Plant Area			
S. No	Type of instrument	% Weightage for calculation of Line Item Unit Price (Refer Note-7)	Remarks
1	Fire Alarm Panel (Each panel shall have 10 Loops) Floor Mounted	3.5114%	
2	Fire Alarm Panel (Each panel shall have 8 Loops) Floor Mounted	3.0674%	
3	Fire Alarm Panel (Each panel shall have 6 Loops) Floor Mounted	2.8790%	
4	Loop Card	0.7872%	
5	Network Card	0.3936%	
6	Multisensor Detectors with detector base and mounting back box (Analogue addressable) along with PVC cable glands	13.8148%	
7	Heat Detectors with detector base and mounting back box (Analogue addressable) along with PVC cable glands	1.5347%	
8	Rate of Rise cum Fixed Temp (IC type) Heat Detector	1.5925%	
9	Beam Detectors (Addressable) along with PVC cable glands	0.3211%	
10	Air Sampling Type Smoke Detection System (including modules for interfacing with fire detection & alarm system)	12.3082%	
11	24V DC Back Lit Exit Sign	1.6271%	
12	Indoor Manual Call Points with mounting back box (Addressable type) along with PVC cable glands	1.8821%	
13	Outdoor Manual call points with mounting back box (IP-65 min.) (Addressable type) along with PVC cable glands	3.1755%	
14	Indoor Hooter cum Strobe with mounting back box (Addressable type & Loop powered) along with PVC cable glands	3.8527%	
15	Response Indicators	0.0641%	
16	Module for LHS Cable (1 Input) with IP-65 enclosure along with PVC cable glands	2.3988%	

		<u>Price Bid Format</u> <u>[Main Supply + Mandatory Spares + Services]</u>	Annexure -[E] of PY51873
		<u>Fire Detection & Alarm System</u>	Rev.00
		<u>Project: 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)</u>	
Unit Rates for Main Plant Area			
S. No	Type of instrument	% Weightage for calculation of Line Item Unit Price (Refer Note-7)	Remarks
17	Module for Deluge Valve (2 Input + 1 Output) with IP-65 enclosure along with PVC cable glands	3.6332%	
18	Module for Back Lit EXIT Sign (1 Output) along with PVC cable glands	2.2623%	
19	Module for Tripping (1 Output)	0.5009%	
20	Module for Monitoring Pumps Status (1 Input) with IP-65 enclosure along with PVC cable glands	0.1748%	
21	Module for Interface with DCS (1 Output) with IP-65 enclosure along with PVC cable glands	0.0667%	
22	Module for Interface with IGES, IR Ember Detectors (1 Input + 1 Output), Dual Wavelength UV-IR Flame Detector with IP-65 enclosure along with PVC cable glands	2.2758%	
23	24 V DC Power Supply Modules with Battery Back Up	3.5993%	
24	6 Fiber Armoured single mode Optical Fiber Cable with 2" rodent proof HDPE conduits (for fire alarm panels and PC networking)	4.6130%	
25	Operator Workstation & A4 size color laser Printer along with Commissioning software, Graphic software i.e., (GUI) Software with License /Dongle	6.1441%	
26	Laptop along with Fire Alarm Panel Commissioning Software with License /Dongle	0.4488%	
27	Furniture for Operator Workstation & Printer	0.1124%	
28	Cable Tags for 2C x 1.5 Sqmm Fire Survival MICA Cable	0.0017%	
29	Cable Tags for 3C x 2.5 Sqmm Fire Survival MICA Cable	0.0020%	
30	Cable Saddle + Saddle Bars along with fixing screws and rawl plugs for 1P x 1.5 sqmm Cable	3.0148%	
31	Cable Saddle + Saddle Bars along with fixing screws and rawl plugs for 2C x 2.5 sqmm Cable	1.1111%	
32	50 mm Cable Tray	4.1995%	
33	Nylon Cable Tie for 2C x 1.5 Sqmm Fire Survival MICA Cable	0.3062%	
34	Nylon Cable Tie for 3C x 2.5 Sqmm Fire Survival MICA Cable	0.0146%	
35	All mounting Accessories & Erection Hardware Software required for installing above components and establishing the networking between all fire alarm panels, repeater panels, DCS, PCs, Printers, Erection & Termination hardware for Optical Fibre cables etc shall be considered.	1.4051%	

87.10%



Price Bid Format
[Mandatory Spares]

Annexure -[E] of PY51873

Fire Detection & Alarm System

Rev.00

Project: 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)

Unit Rates

S. No	Type of instrument	% Weightage for calculation of Line Item Unit Price (Refer Note-7)	Remarks
1	Fire Alarm Panel (Each panel shall have 10 Loops) Floor Mounted	0.000%	
2	Fire Alarm Panel (Each panel shall have 8 Loops) Floor Mounted	0.000%	
3	Fire Alarm Panel (Each panel shall have 6 Loops) Floor Mounted	0.000%	
4	Loop Card	0.000%	
5	Network Card	0.000%	
6	Multisensor Detectors with detector base and mounting back box (Analogue addressable) along with PVC cable glands	1.381%	
7	Heat Detectors with detector base and mounting back box (Analogue addressable) along with PVC cable glands	0.153%	
8	Rate of Rise cum Fixed Temp (IC type) Heat Detector	0.228%	
9	Beam Detectors (Addressable) along with PVC cable glands	0.000%	
10	Air Sampling Detection with Piping and other accessories (Analogue addressable)	1.231%	
11	24V DC Back Lit Exit Sign	0.000%	
12	Indoor Manual Call Points with mounting back box (Addressable type) along with PVC cable glands	0.205%	
13	Outdoor Manual call points with mounting back box (IP-65 min.) (Addressable type) along with PVC cable glands	0.353%	
14	Indoor Hooter cum Strobe with mounting back box (Addressable type & Loop powered) along with PVC cable glands	0.000%	
15	Response Indicators	0.000%	
16	Module for LHS Cable (1 Input) with IP-65 enclosure along with PVC cable glands	0.000%	
17	Module for Deluge Valve (2 Input + 1 Output) with IP-65 enclosure along with PVC cable glands	0.088%	
18	Module for Back Lit EXIT Sign (1 Output) along with PVC cable glands	0.000%	
19	Module for Tripping (1 Output) along with PVC cable glands	0.087%	

20	Module for Monitoring Pumps Status (1 Input) with IP-65 enclosure along with PVC cable glands	0.087%	
21	Module for Interface with DCS (1 Output) with IP-65 enclosure along with PVC cable glands	0.000%	
22	Module for Interface with IGES, IR Ember Detectors (1 Input + 1 Output), Dual Wavelength UV-IR Flame Detector with IP-65 enclosure along with PVC cable glands	0.090%	
23	24 V DC Power Supply Modules with Battery Back Up	0.000%	
24	6 Fiber Armoured single mode Optical Fiber Cable with 2" rodent proof HDPE conduits (for fire alarm panels and PC networking)	0.000%	
25	Operator Workstation & A4 size color laser Printer along with Commissioning software, Graphic software i.e., (GUI) Software with License /Dongle	0.000%	
26	Laptop along with Fire Alarm Panel Commissioning Software with License /Dongle	0.000%	
27	Furniture for Operator Workstation & Printer	0.000%	
28	Cable Tags for 2C x 1.5 Sqmm Fire Survival MICA Cable	0.000%	
29	Cable Tags for 3C x 2.5 Sqmm Fire Survival MICA Cable	0.000%	
30	Cable Saddle + Saddle Bars along with fixing screws and rawl plugs for 2C x 1.5 Sqmm Fire Survival MICA Cable	0.000%	
31	Cable Saddle + Saddle Bars along with fixing screws and rawl plugs for 3C x 2.5 Sqmm Fire Survival MICA Cable	0.000%	
32	50 mm Cable Tray	0.000%	
33	Nylon Cable Tie for 2C x 1.5 Sqmm Fire Survival MICA Cable	0.000%	
34	Nylon Cable Tie for 3C x 2.5 Sqmm Fire Survival MICA Cable	0.000%	
35	All mounting Accessories & Erection Hardware Software required for installing above components and establishing the networking between all fire alarm panels, repeater panels, DCS, PCs, Printers, Erection & Termination hardware for Optical Fibre cables etc shall be considered.	0.000%	
36	Fire Alarm Panel Items		
a	Power Supply Module	1.056%	
b	CPU Card/Main Control Board	1.574%	
c	Network Interface Items	1.574%	
d	Zone Control Card/Module	1.574%	
e	Audio Control Modules	0.787%	
f	Input/Output Control Modules	0.089%	
g	Relay Modules	0.089%	
h	Any Other Electronic Cards/Modules used	0.044%	
i	Battery	0.223%	

10.91%

ANNEXURE-F

Inert Gas Extinguishing System Partition Details

ANNEXURE-G

Pre Bid Query Format



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING & SYSTEMS DIVISION

PROJECT: - 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III),

ANNEXURE-G

PREBID QUERIES FORMAT				
Sl. No.	Bidding document Reference			Subject
	Spec/Annexure	Page No	Clause No	

ANNEXURE-H

Master Document Schedule

BHEL		Master Document Schedule										Annexure-H of PY51873	
Project: 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)													
S. NO	Drawing / Document Name	VENDOR Drg/ Document No	Category (A/I)	Schedule of submission from P.O. Date	First Submission (Rev -00)			Current Revision		Current Status (Approved / commented)	BHEL APPD CATEGORY		
					Rev No	Actual Date of Submission	Return Date	Actual Date of Submission	Return Date				
A. Project Execution Plan													
1	Quality Plan		A	2 WEEKS									
2	Sub-vendor List		A	2 WEEKS									
B. Design Output documents													
1	Aspiration Detector Layouts of TG Building as per Inert Zones (04 zones)		A	4 WEEKS									
2	Aspiration Detector Layout of Control Rooms (CHP MCC buildings 1, 2 & 3)		A	4 WEEKS									
3	Aspiration Detector Layout of Control Room Unit (AHP MCC buildings - 1)		I	4 WEEKS									
4	Aspiration Detector Layout of Control Room Unit (CW & ACW Pump House)		I	4 WEEKS									
5	Aspiration Detector Layout of Control Room Unit (Wagon Tippler Complex)		I	4 WEEKS									
6	Complete Bill of Material		A	2 WEEKS									
7	Electrical Load List		I	2 WEEKS									
8	Earthing Layout / Scheme		A	2 WEEKS									
Data Sheets													
1	Technical Datasheet of Fire Alarm Panel & its Components along with Battery		A	2 WEEKS									
2	Technical Datasheet of Network Card		A	2 WEEKS									
3	Technical Datasheet of Loop Card		A	2 WEEKS									
4	Technical Datasheet of Multisensor Detector with detector base and back box		A	2 WEEKS									
5	Technical Datasheet of Heat Detectors with detector base and back box		A	2 WEEKS									
6	Technical Datasheet of Rate of Rise cum Fixed Temp (IC type) Heat Detector		A	2 WEEKS									
7	Technical Datasheet of Beam Detector		A	2 WEEKS									
8	Technical Datasheet of Air Sampling Detector and Accessories		A	2 WEEKS									
9	Technical Datasheet of Manual Call Point (Indoor, Outdoor & Flame Proof)		A	2 WEEKS									
10	Technical Datasheet of Addressable Loop Powered Hooter cum strobe		A	2 WEEKS									
11	Technical Datasheet of Interface Modules		A	2 WEEKS									

Logo		Master Document Schedule										Annexure-H of PY51873			
Project: 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)															
S. NO	Drawing / Document Name	VENDOR Drg/ Document No	Category (A/I)	Schedule of submission from P.O. Date	First Submission (Rev -00)			Current Revision			Current Status (Approved / commented)	BHEL APPD CATEGORY			
					Rev No	Actual Date of Submission	Return Date	Rev No	Actual Date of Submission	Return Date					
12	Technical Datasheet of Response Indicator		A	2 WEEKS											
13	Technical Datasheet of Screen with Siren Control Panel and Interface- Module		A	2 WEEKS											
14	Technical Datasheet of Graphics Software		A	2 WEEKS											
15	Technical Datasheet of Work Station		A	2 WEEKS											
16	Technical Datasheet of Printer		A	2 WEEKS											
17	Technical Datasheet of Laptop		A	2 WEEKS											
18	Technical Datasheet of Furniture		A	2 WEEKS											
19	Technical Datasheet of 24V DC Power Supply Modules with Battery- Back Up		A	2 WEEKS											
20	Technical Data Sheet of Cable Saddles + Saddle Bar		A	2 WEEKS											
21	Technical Data Sheet of Cable Tags		A	2 WEEKS											
22	Technical Data Sheet of Cable Glands & Lugs		A	2 WEEKS											
23	Technical Data Sheet of Cable Tray		A	2 WEEKS											
D.	ERECTION														
1	GA & Wiring Diagram of Fire Alarm Panel		I	3 WEEKS											
2	Installation diagram for Fire alarm componenets		I	3 WEEKS											
3	Termination details of Fire alarm componenets		I	3 WEEKS											
4	Fire Alarm networking details (Interconnection between FAP & RP)		I	3 WEEKS											
5	Battery Sizing Calculation		I	3 WEEKS											
6	Erection & Commissioning procedures		I	3 WEEKS											
7	Fire Detection & Alarm Syatem Operating Manual		A	3 WEEKS											
8	Billing Break up		A	3 WEEKS											
9	Certificates(Factory tests, calibration reports, statutory approval certificates)		I	3 WEEKS											
10	Packing procedure + Packing list		I	3 WEEKS											

ANNEXURE-I

SUB VENDOR LIST

TD-201 Rev No. 00 Form No.	 HYDERABAD	PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD	ANNEXURE – I
			Rev No. 00
			Page 1 of 1

ANNEXURE - I

SUB – VENDOR LIST

Sl. No.	Vendor Name	Remarks
1.	Battery – EXIDE, AMCO	
2.		
3.		
4.		
5.		
6.		
7.		

NOTE: -

1. Bidder to comply with sub-vendor list as listed above. The sub-vendors for any item that is not appearing in the above list shall be proposed for BHEL’s approval. These approvals shall be subjected to End-User’s confirmation.
2. Non-acceptance of any proposed sub-vendor by bidder shall not have any commercial implication. While submitting sub-vendors for approval of BHEL, bidder shall furnish following documents:
 - a) UL / FM / Vds / LPCB / CE etc. certificates of Sub-vendors
 - b) Proven track record (references for makes and models supplied in the last 3 years along with supporting documents like unpriced PO, customer approved datasheets, proof of supply).

COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED,
It must not be used directly or indirectly in any way detrimental to the interest of the company.

ANNEXURE-J

Quality Requirements

**PROJECT ENGINEERING & SYSTEMS DIVISION****RC PURAM, HYDERABAD.****QUALITY & BUSINESS EXCELLENCE****INSPECTION / TC REVIEW FORMAT**

1	Vendor's Name:		5	Applicable BHEL Spec No:	
2	Project:		6	Approved Drawing No:	
3	PO No:		7	Approved Data Sheet No:	
4	Item Description:		8	Approved QAP No:	

OFFER LIST

S.No	BBU/ PO Sr. No.	Item Description	Total Qty as per PO/BBU	Qty. already accepted	Qty offered for TC review	Cumulative Qty	Balance Qty
A							
B							
C							
D							

TC REVIEW REQUISITION

BBU / PO Sr. No.	QAP Clause No.	Format of Record	Certificate No. & Date	Page No.	REMARKS
A. Item Description:					
B. Item Description:					
C. Item Description:					
D. Item Description:					
E. Item Description:					

SUPPLIER / VENDOR SIGNATURE WITH SEAL**BHEL/ BHEL's TPIA SIGNATURE WITH SEAL****Dt:****Dt:**

		TYPICAL MANUFACTURING QUALITY PLAN							MQP. NO.:				
		PROJECT ENGINEERING & SYSTEMS		PRODUCT: FIRE DETECTION & ALARM SYSTEM			REV NO: 00		DATE:				
		DIVISION BHEL, RC PURAM, HYD-502032							PAGE 1 OF 11				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
	Incoming Material like fabricated items, PCBs, Lamps, Push buttons, Fire detectors, temp detectors, UV, IR, Ionisation Type, MCP, Annunciators, battery, battery charger, exit signs, zener batteries, short circuit/fault/isolator etc..	Visual, Dimensional, physical, operational checks, matching of detectors with given specification, statutory body certification, make of item	MAJOR	PHYSICAL & CHEMICAL PROPERTIES	100%	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	TEST CERTIFICATE E/LOG BOOK	✓	2	1		
	PCBs,	Burn-in Test of PCBs for 96 hrs at 50 deg C	MAJOR	PHYSICAL	100%	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	TEST CERTIFICATE E/LOG BOOK	✓	2	1		

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICATE REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT / CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY BHEL QA SIGNATURE & STAMP	APPROVED BY BHEL QA SIGNATURE & STAMP	APPROVED BY CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)
---	--	--	---



TYPICAL MANUFACTURING QUALITY PLAN

PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032					PRODUCT: FIRE DETECTION & ALARM SYSTEM					MQP. NO.: REV NO: 00 DATE: PAGE 2 OF 11				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS	
2.0 INPROCESS INSPECTION														
	ASSEMBLY	WIRING,EARTHING	MAJOR	VISUAL	100%	BHEL SPECIFICATI ON/DATA SHEET/APPR D DRG.	BHEL SPECIFICATI ON/DATA SHEET/APPR D DRG.	TEST CERTIFICAT E/LOG BOOK	✓	2		1		
	GENERAL ARRANGEMENT	COMPONENT MOUNTING	MAJOR	VISUAL	100%	BHEL SPECIFICATI ON/DATA SHEET/APPR D DRG.	BHEL SPECIFICATI ON/DATA SHEET/APPR D DRG.	TEST CERTIFICAT E/LOG BOOK	✓	2		1		
3.0 FINAL INSPECTION & TESTING														
	Conventional fire Alarm system	Visual check, including GA, Layout, Tag Plates, paint shade, panel gasketing, identification and location of component, mimic layout, check of specification of all types of detectors w.r.t data sheet ect..	CRITICAL	VISUAL	100%	BHEL SPECIFICATI ON/DATA SHEET/APPR D DRG.	BHEL SPECIFICATI ON/DATA SHEET/APPR D DRG.	TEST CERTIFICAT E	✓	2		1		

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICAT REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

PREPARED BY	APPROVED BY	APPROVED BY
BHEL QA SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)



TYPICAL MANUFACTURING QUALITY PLAN

PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032 PRODUCT: FIRE DETECTION & ALARM SYSTEM		MQP. NO.:		DATE:	
		REV NO: 00		PAGE 3 OF 11	

SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* AGENCY				REMARKS
									D	P	W	V	
		BOM/Make of component	CRITICAL	VISUAL	100%	BHEL SPECIFICATION/DATA SHEET	BHEL SPECIFICATION/DATA SHEET	TEST CERTIFICATE	✓	2	1		
		Quality of lacquering and inter changeability of PCBs	CRITICAL	VISUAL	100%	BHEL SPECIFICATION/DATA SHEET	BHEL SPECIFICATION/DATA SHEET	TEST CERTIFICATE	✓	2	1		
		Verification of cable termination arrangement	CRITICAL	VISUAL	100%	BHEL SPECIFICATION/DATA SHEET	BHEL SPECIFICATION/DATA SHEET	TEST CERTIFICATE	✓	2	1		
		Operation check of scheme, mimic lamps by simulating fire, cable fault condition w.r.t different types of detectors	CRITICAL	ELECTRICAL	100%	BHEL SPECIFICATION/DATA SHEET	BHEL SPECIFICATION/DATA SHEET	TEST CERTIFICATE	✓	2	1		

PREPARED BY BHEL QA SIGNATURE & STAMP	APPROVED BY BHEL QA SIGNATURE & STAMP	APPROVED BY CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)
--	--	---

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICATE REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

TYPICAL MANUFACTURING QUALITY PLAN											
PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PRODUCT: FIRE DETECTION & ALARM SYSTEM			MQP. NO.: REV NO: 00 DATE: PAGE 4 OF 11					
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V	REMARKS
		Check of detector operation wrt to loop impedance	CRITICAL	ELECTRICAL	ONE	BHEL SPECIFICATION/DATA SHEET	BHEL SPECIFICATION/DATA SHEET	TEST CERTIFICATE	✓	2 1	
		Operation check of schemes, mimic lamps, wrt to different type of release and inhibit switch through output relays	CRITICAL	ELECTRICAL	ONE	BHEL SPECIFICATION/DATA SHEET	BHEL SPECIFICATION/DATA SHEET	TEST CERTIFICATE	✓	2 1	
		Simulation of all alarms	CRITICAL	VISUAL	100%	BHEL SPECIFICATION/DATA SHEET	BHEL SPECIFICATION/DATA SHEET	TEST CERTIFICATE	✓	2 1	
		Auto and manual release operation	CRITICAL	VISUAL	100%	BHEL SPECIFICATION/DATA SHEET	BHEL SPECIFICATION/DATA SHEET	TEST CERTIFICATE	✓	2 1	

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICATE REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	BHEL QA SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)

TYPICAL MANUFACTURING QUALITY PLAN										MQP. NO.:			
PROJECT ENGINEERING & SYSTEMS					PRODUCT: FIRE DETECTION & ALARM SYSTEM					REV NO: 00			
DIVISION BHEL, RC PURAM, HYD-502032										DATE:			
										PAGE 5 OF 11			
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS
		Fail safe operation	CRITICAL	ELECTRICAL	100%	BHEL SPECIFICATION/DATA SHEET	BHEL SPECIFICATION/DATA SHEET	TEST CERTIFICATE	✓	2	1		
		Verification of battery type and capacity	CRITICAL	ELECTRICAL	100%	BHEL SPECIFICATION/DATA SHEET	BHEL SPECIFICATION/DATA SHEET	TEST CERTIFICATE	✓	2	1		
		Operation check on break glass assembly	CRITICAL	VISUAL	100%	BHEL SPECIFICATION/DATA SHEET	BHEL SPECIFICATION/DATA SHEET	TEST CERTIFICATE	✓	2	1		
		Operation check on applicable accessories, lamps, siren, switches, beacons etc..	CRITICAL	VISUAL	100%	BHEL SPECIFICATION/DATA SHEET	BHEL SPECIFICATION/DATA SHEET	TEST CERTIFICATE	✓	2	1		
		Provision of cable glands and earthing	CRITICAL	VISUAL	100%	BHEL SPECIFICATION/DATA SHEET	BHEL SPECIFICATION/DATA SHEET	TEST CERTIFICATE	✓	2	1		

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICAT REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	BHEL QA SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)

TYPICAL MANUFACTURING QUALITY PLAN										MQP. NO.:			
PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032					PRODUCT: FIRE DETECTION & ALARM SYSTEM					REV NO: 00		DATE:	
										PAGE 6 OF 11			
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
	Computer aided Fire alarm system consisting of Central Fire alarm panel , MFAP and Repeat panel (Final Inspection)	Visual check, including GA, Layout, Tag Plates, paint shade, panel gasketing, identification and location of component, mimic layout, check of specification of all types of detectors w.r.t data sheet ect..	CRITICAL	VISUAL	100%	BHEL SPECIFICATION/ DATA SHEET/ APPR D DRG.	BHEL SPECIFICATION/ DATA SHEET/ APPR D DRG.	TEST CERTIFICATE	✓	2	1		
		BOM/Make of component	CRITICAL	VISUAL	100%	BHEL SPECIFICATION/ DATA SHEET/ APPR D DRG.	BHEL SPECIFICATION/ DATA SHEET/ APPR D DRG.	TEST CERTIFICATE	✓	2	1		

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICATE REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	BHEL QA SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)

TYPICAL MANUFACTURING QUALITY PLAN										MQP. NO.:			
PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032					PRODUCT: FIRE DETECTION & ALARM SYSTEM					REV NO: 00		DATE:	
										PAGE 7 OF 11			
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS
		Verification of cable termination arrangement	CRITICAL	VISUAL	100%	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	TEST CERTIFICATE	✓	2	1		
		Operation check of scheme, mimic lamps by simulating fire, cable fault condition w.r.t different types of detectors	CRITICAL	ELECTRICAL	100%	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	TEST CERTIFICATE	✓	2	1		
		Check of detector operation wrt to loop impedance	CRITICAL	ELECTRICAL	100%	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	TEST CERTIFICATE	✓	2	1		

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICATE REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	BHEL QA SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)



TYPICAL MANUFACTURING QUALITY PLAN

TYPICAL MANUFACTURING QUALITY PLAN				MQP. NO.:									
PROJECT ENGINEERING & SYSTEMS			PRODUCT: FIRE DETECTION & ALARM SYSTEM			REV NO: 00		DATE:					
DIVISION BHEL, RC PURAM, HYD-502032						PAGE 8 OF 11							
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
									D	P	W	V	
		Operation check of schemes , mimic lamps, wrt to different type of release and inhibit switch thro iutput relays	CRITICAL	ELECTRICAL	100%	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	TEST CERTIFICATE	✓	2	1		
		Simulation of all alarms	CRITICAL	ELECTRICAL	100%	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	TEST CERTIFICATE	✓	2	1		
		Auto and manual release operation	CRITICAL	ELECTRICAL	100%	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	TEST CERTIFICATE	✓	2	1		
		Fail safe operation	CRITICAL	ELECTRICAL	100%	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	BHEL SPECIFICATION/DATA SHEET/APPR D DRG.	TEST CERTIFICATE	✓	2	1		

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICAT REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

PREPARED BY	APPROVED BY	APPROVED BY
BHEL QA SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)

TYPICAL MANUFACTURING QUALITY PLAN										MQP. NO.:			
PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032					PRODUCT: FIRE DETECTION & ALARM SYSTEM					REV NO: 00			
										DATE:			
										PAGE 9 OF 11			
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS
		Redundancy check	CRITICAL	ELECTRICAL	100%	BHEL SPECIFICATION/DATA SHEET/APPRD DRG.	BHEL SPECIFICATION/DATA SHEET/APPRD DRG.	TEST CERTIFICATE	✓	2	1		
		Verification of battery type and capacity	CRITICAL	ELECTRICAL	100%	BHEL SPECIFICATION/DATA SHEET/APPRD DRG.	BHEL SPECIFICATION/DATA SHEET/APPRD DRG.	TEST CERTIFICATE	✓	2	1		
		Operation check on applicable accessories, lamps, siren, switches, beacons etc.	CRITICAL	ELECTRICAL	100%	BHEL SPECIFICATION/DATA SHEET/APPRD DRG.	BHEL SPECIFICATION/DATA SHEET/APPRD DRG.	TEST CERTIFICATE	✓	2	1		
		Operation check on break glass assembly	CRITICAL	ELECTRICAL	100%	BHEL SPECIFICATION/DATA SHEET/APPRD DRG.	BHEL SPECIFICATION/DATA SHEET/APPRD DRG.	TEST CERTIFICATE	✓	2	1		

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICATE REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.		PREPARED BY	APPROVED BY	APPROVED BY
		BHEL QA SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)

TYPICAL MANUFACTURING QUALITY PLAN																			
PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PRODUCT: FIRE DETECTION & ALARM SYSTEM			MQP. NO.: REV NO: 00 DATE: PAGE 10 OF 11													
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V	REMARKS								
Fire alarm system & accessories	Certificate of statutory approval authority like CCOE/PESO /DGFASLI as applicable	CRITICAL	VISUAL	ONE	BHEL SPECIFICATION/DATA SHEET/APPROVED DRG.	BHEL SPECIFICATION/DATA SHEET/APPROVED DRG.	TEST CERTIFICATE	✓	2	1									
	Valid BIS license as applicable	CRITICAL	VISUAL	ONE	BHEL SPECIFICATION/DATA SHEET/APPROVED DRG.	BHEL SPECIFICATION/DATA SHEET/APPROVED DRG.	TEST CERTIFICATE	✓	2	1									
	Certificate of statutory testing authority like FM, UL, BASEEFA, CMRI etc for MFAP , detectors and other accessories		VISUAL	ONE	BHEL SPECIFICATION/DATA SHEET/APPROVED DRG.	BHEL SPECIFICATION/DATA SHEET/APPROVED DRG.	TEST CERTIFICATE	✓	2	1									
4.0	PRESERVATION & PACKING																		

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICATE REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	BHEL QA SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)

		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:				
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PRODUCT: FIRE DETECTION & ALARM SYSTEM			REV NO: 00		DATE:		
											PAGE 11 OF 11	
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V		REMARKS
	PACKING	FINISH	MAJOR	VISUAL	100%	BHEL SPECIFICATI ON/DATA SHEET/APPR D DRG.	BHEL SPECIFICATI ON/DATA SHEET/APPR D DRG.	TEST CERTIFICAT E/LOG BOOK	✓	2	1	

NOTE:

1. This Standard MQP should be read along with specification (latest revision as per PO), approved drawings & approved datasheet, approved BOM (as applicable).
2. Approved drawing/datasheet & specification shall prevail over quality plan in case contradiction if any.
3. Any other tests/ checks indicated in specification, P.O., or drawing/data sheet & any additional checks envisaged by BHEL/Customer as part of correspondence to ensure workmanship, finish, aesthetics, etc. shall also be conducted and witnessed/verified by BHEL /TPIA /Customer as per project requirement.
4. All documents issued by statutory authorities such as CCOE, CMRI, ATEX etc., shall be submitted during inspection.
5. Only type test certificate of same design and same Material of Construction of equipment to be submitted, wherever required.
6. All the relevant test reports /certificates shall be submitted during inspection. The reviewed and certified documents by BHEL/TPIA/Customer shall be submitted to BHEL as documentation package.
7. All sub-ordered items, bought out items, electrical & instrumentation Items shall be procured from approved / agreed vendor list with BHEL/BHEL's Customer.

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICAT REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	BHEL QA SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)

ANNEXURE-K

Checklist

ANNEXURE - K		
CHECK LIST FOR OFFER SUBMISSION		
		REV-00
SL No	Description	Bidder's Confirmation
1	Technical offer complies with the specifications and its associated annexures, pre-bid clarifications in Toto and there are no technical deviations. Signed and stamped copy of this specification along with annexures enclosed along with technical offer.	
2	Bidder to quote as per BHEL price format only. No other format is acceptable. Bidder to attach un-priced price bid format by indicating "QUOTED" and submit with technical offer duly signed & stamped.	
3	Bidder to submit Pre-Qualification criteria along with necessary documents like: 1) Unpriced Purchase Order copy 2) Commissioning Certificate / Job Completion Certificate / Performance Certificate from End Customer 3) Customer Approved Documents like Datasheets etc.	
4	All items are manufactured conforming to latest version of material grade standard and manufacturing standard mentioned in this specifications	
5	For addition/reduction of quantity, unit rate quoted in the present offer shall be considered during ordering and shall be valid up to execution of the contract to the extent as specified in the price bid format.	
6	In case of deviation, vendor to confirm that these are technically not feasible deviations and same are to be submitted in BHEL format during pre-bid stage only.	
7	It shall be bidder's responsibility to get all his queries and deviations addressed by the purchaser during the pre-bid stage itself. No queries / deviations shall be accepted by purchaser from the bidder in their technical offer.	
8	Bidder to submit the No Deviation letter w.r.t. BHEL spec: PY51873, Rev-00 along with offer.	
9	Vendor shall supply all the material to meet the performance, sizing & technical requirement as per specification & its Annexures, scope matrix etc.	
10	Confirm that the quote includes training, commissioning spares, special tool & tackles, erection & mounting hardware/ accessories, terminations, networking components, license/dongle etc. as required for erection & commissioning activities.	
11	Bidder to confirm that supply of software and hardware as required for complete functioning and maintenance of the system shall be in the scope of the bidder.	
12	All the equipments / items / sensors / detectors etc., supplied by bidder are having valid statutory approval certificates and same will be produced at any stage of contract execution to BHEL. The same were eligible to take local statutory regulatory body approval during commissioning of the system	
13	Conventional hooter cum strobe or conventional hooter and conventional strobe with addressable module is not acceptable. Bidder to consider addressable loop powered hooter cum strobe or addressable loop powered hooter and addressable loop powered strobe only.	

BIDDER'S SIGNATURE:

NAME:

DATE:

COMPANY SEAL:

ANNEXURE-L

Deviation Format

ANNEXURE - L						
LIST OF DEVIATIONS						
Project: FDA SYSTEM FOR 1 x 660 MW SAGARDIGHI TPP (Unit-5, Phase-III)						
Sl. No.	Part No./ Volume	Page no.	Clause No.	Subject	Deviation/Clarification	Reason for Deviation
1						
2						
3	--- NO DEVIATION ---					
4						
5						

NOTES:

1. Any deviation shall be specified during prebid stage itself. No deviations shall be accepted by purchaser in bidder's technical offer.
2. Nature of Deviations shall only be of Design / Manufacturing constraints and non-availability of items / components / makes in market.
3. Reasons for the deviations shall be clearly specified in the above format.
4. In case, bidder submits any deviation in their technical offer; then their offer may be rejected without any prior intimation.
5. This 'NO DEVIATION' shall be signed, stamped and shall be part of bidder's technical offer.

SIGNATURE OF THE BIDDER_____

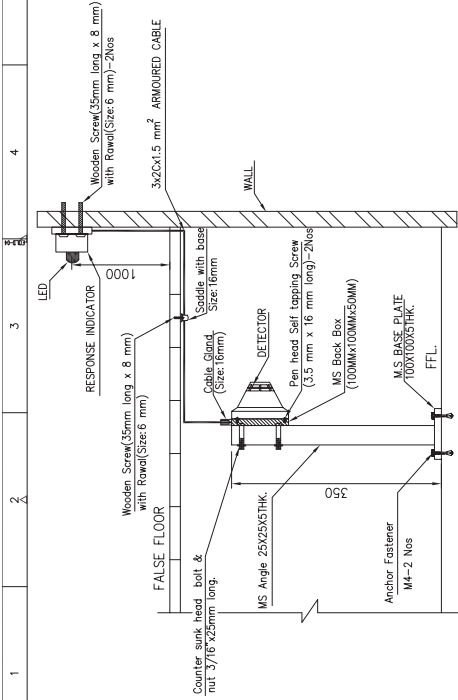
NAME_____

DESIGNATION_____

COMPANY SEAL DATE_____

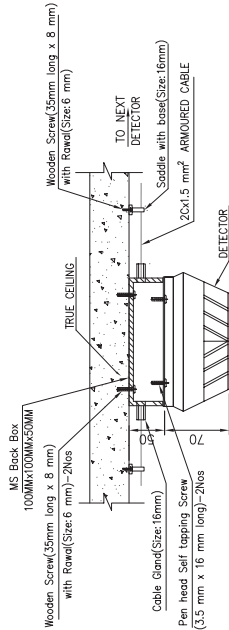
ANNEXURE-M

Typical Erection/Mounting Drawings of FDA
components



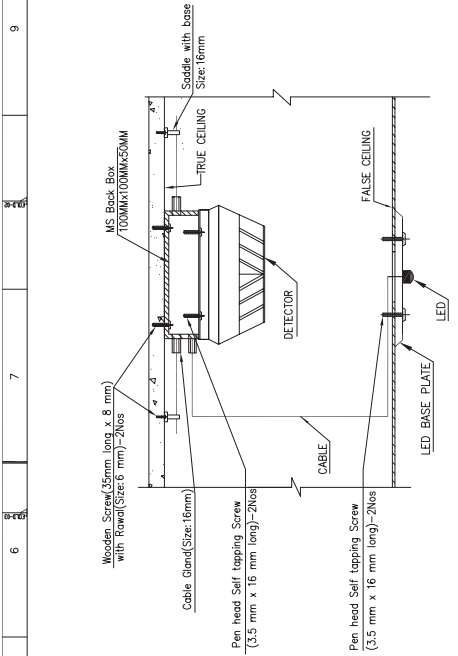
INSTALLATION DETAIL FOR DETECTORS
BELOW FALSE FLOOR

DETECTOR WITH RESPONSE INDICATOR BELOW FALSE FLOOR			
Sr.No	ITEM DESCRIPTION	UNIT	QTY/ITEM
1	MS ANGLE(SIZE:25 X 25 X 5 MM,350 LONG)	Nos	1
2	MS Back Box(Size:100 x 100 x 50 mm)	Nos	1
3	MS Base Plate(Size:100 x 100 x 5 mm)	Nos	1
4	Anchor Fastener (Size: M-4)	Nos	2
5	Saddle with base(Size:16mm)	Nos	9
6	Counter sunk head bolt & nut 3/16"x25mm long	Nos	2
7	Wooden Screw(35mm long x 8 mm with Rowal(Size:6 mm)	Nos	2
8	Cable Gland(Size:16mm)	Nos	3
9	Cable Lug(Size:1.5Sqmm)	Nos	6
10	Pen head Self tapping Screw(3.5 mm x 16 mm long)	Nos	2



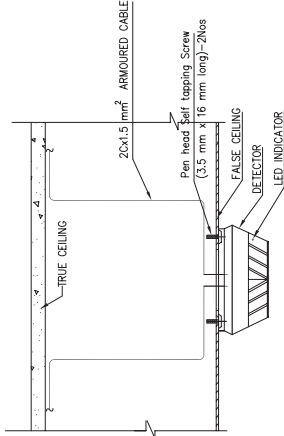
MOUNTING ARRANGEMENT OF
DETECTOR ON TRUE CEILING

DETECTOR ON TRUE CEILING			
Sr.No	ITEM DESCRIPTION	UNIT	QTY/ITEM
1	MS Back Box-(100 x 100 x 50 mm)	Nos	1
2	Wooden Screw(35 mm x 8 mm) with Rowal(Size:6 mm)	Nos	2
3	Cable Gland(Size:16mm)	Nos	2
4	Cable Lug(Size:1.5Sqmm)	Nos	2
5	Saddle with base(Size:16mm)	Nos	4
6	Pen head Self tapping Screw(3.5 mm x 16 mm long)	Nos	2



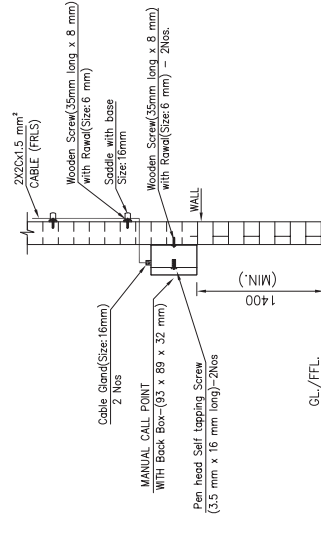
MOUNTING ARRANGEMENT OF
RESPONSE INDICATOR ON FALSE CEILING

DETECTOR ABOVE FALSE CEILING WITH RESPONSE INDICATOR ON FALSE CEILING			
Sr.No	ITEM DESCRIPTION	UNIT	QTY/ITEM
1	MS Back Box-(100 x 100 x 50 mm)	Nos	1
2	Saddle with base(Size:16mm)	Nos	2
3	Pen head Self tapping Screw(3.5 mm x 16 mm long)	Nos	4
4	Cable Gland(Size:16mm)	Nos	3
5	Cable Lug(Size:1.5Sqmm)	Nos	6
6	Wooden Screw(35mm long x 8 mm with Rowal(Size:6 mm)	Nos	4



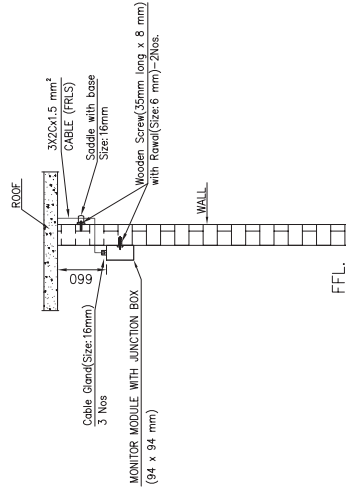
MOUNTING ARRANGEMENT OF
DETECTOR ON FALSE CEILING

DETECTOR ON FALSE CEILING			
Sr.No	ITEM DESCRIPTION	UNIT	QTY/ITEM
1	Pen head Self tapping Screw(3.5 mm x 16 mm long)	Nos	2
2	Cable Lug(Size:1.5Sqmm)	Nos	4
2	Cable Gland(Size:16mm)	Nos	2



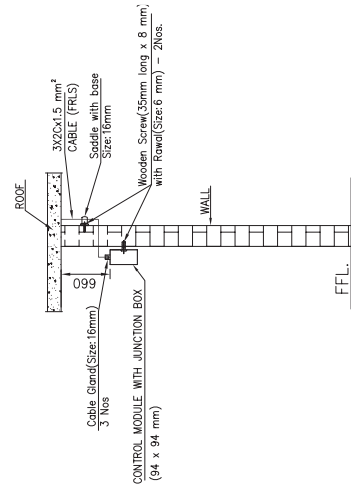
TYPICAL MOUNTING ARRANGEMENT OF MANUAL CALL POINT

MANUAL CALL POINT			
Sr.No	ITEM DESCRIPTION	UNIT	QTY/ITEM
1	MANUAL CALL POINT –(93 x 89 x 32 mm)	Nos	1
2	Wooden Screw(35 mm x 8 mm) with Rowel(Size 6 mm)	Nos	4
3	Cable Gland(Size:16mm)	Nos	2
4	Cable Lug(Size:1.5gprmm)	Nos	4
5	Saddle with base(Size:16mm)	Nos	2
6	Pen head self tapping Screw(3.5 mm x 16 mm long)	Nos	2



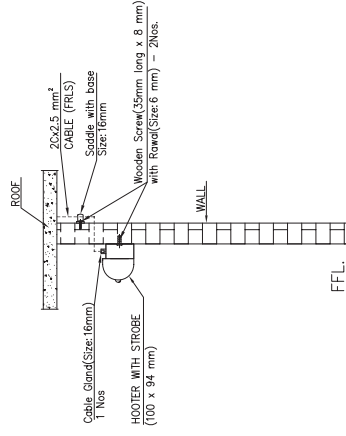
TYPICAL MOUNTING ARRANGEMENT OF MONITOR MODULES

MANUAL CALL POINT		
Sr.No	ITEM DESCRIPTION	UNIT
1	MONITOR MODULE WITH JUNCTION BOX (94 x 94 mm)	Nos 1
2	WOODEN Screw(35 mm x 8 mm) with Rowal(Size:6 mm)	Nos 3
3	Cable Gland(Size:16mm)	Nos 3
4	Cable Lug(Size:1.5qmm)	Nos 6
5	Saddle with base(Size:16mm)	Nos 1



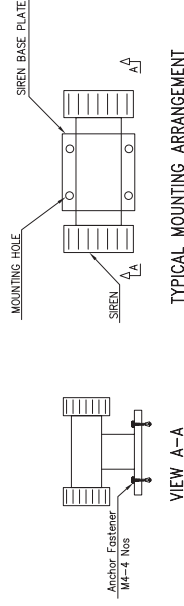
TYPICAL MOUNTING ARRANGEMENT OF CONTROL MODULES

MANUAL CALL POINT			
Sr.No	ITEM DESCRIPTION	UNIT	QTY/ITEM
1	CONTROL MODULE WITH JUNCTION BOX (94 x 94 mm)	Nos	1
2	Wooden Screw(35 mm x 8 mm) with Rowal(Size:6 mm)	Nos	3
3	Cable Gland(Size:16mm)	Nos	3
4	Cable Lug(Size:1.5sqmm)	Nos	6
5	Saddle with base(Size:6mm)	Nos	1



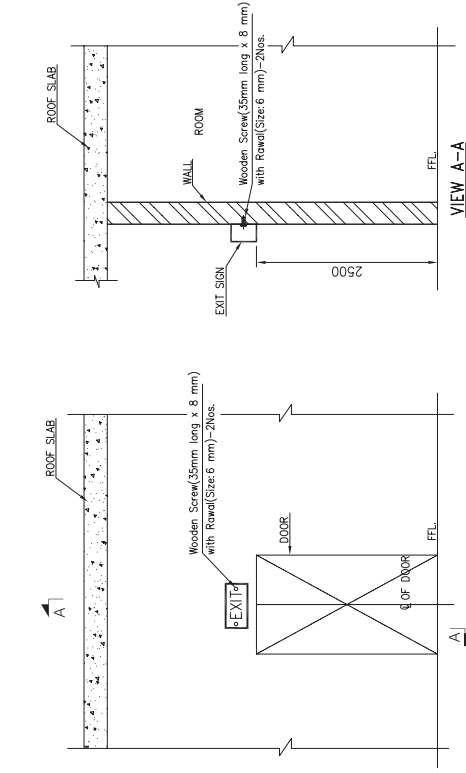
TYPICAL MOUNTING ARRANGEMENT
OF HOOTER WITH STROBE

HOOPER WITH STROBE			
Sr.No	ITEM DESCRIPTION	UNIT	QTY/ITEM
1	HOOPER WITH STROBE (100 x 94 mm)	Nos	3
2	Wooden Screw(35 mm x 8 mm) with Rawal(Size:6 mm)	Nos	3
3	Cable Gland(Size:16mm)	Nos	1
4	Cable Lug(Size:2.55cm)	Nos	2
5	Saddle with base(Size:16mm)	Nos	1



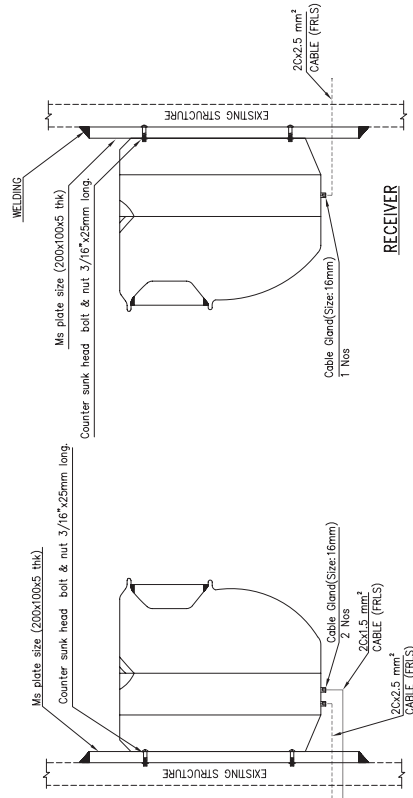
TYPICAL MOUNTING ARRANGEMENT OF SIREN

SIREN			
Sr.No	ITEM DESCRIPTION	UNIT	QTY/ITEM
1	Anchor Fastener (Size: 6ø)	Nos	4
2	Cable Guard(Size:16mm)	No	1
3	Cable Lug(Size:2.5sqmm)	Nos	3



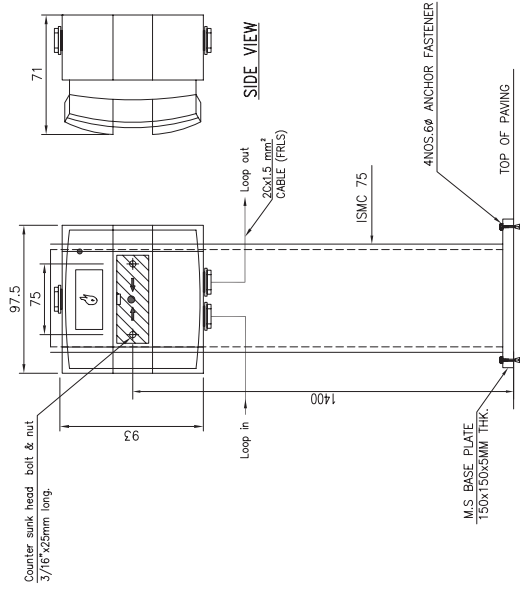
TYPICAL MOUNTING ARRANGEMENT

WALL MOUNTED TYPE EXIT SIGN			
Sr.No	ITEM DESCRIPTION	UNIT	QTY/ITEM
1	EXIT SIGN (200X200)	Nos	1
2	Wooden Screw (35 mm x 8 mm) with Rowal (Size: 6 mm)	Nos	2



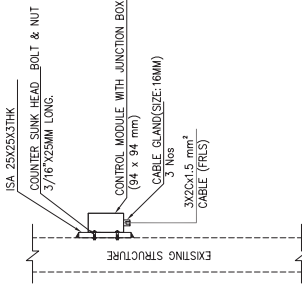
TYPICAL MOUNTING ARRANGEMENT

BEAM DETECTOR			
Sr.No	ITEM DESCRIPTION	UNIT	QTY/ITEM
1	Counter sunk head bolt & nut 3/16"x.25mm long.	Nos	4
2	NIS PLATE SIZE (200X100X5 THK)	Nos	2
3	Cable Gland(Size: 6mm)	Nos	3
	Cable Lug(Size:1.55gmm)	Nos	2
5	Cable Lug(Size:2.55gmm)	Nos	4



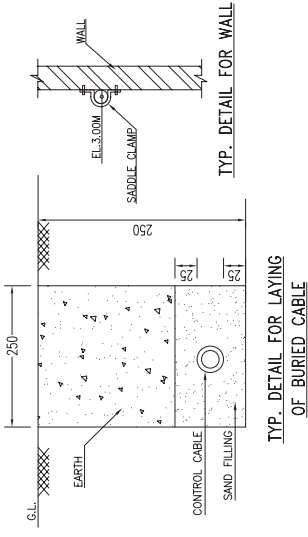
MOUNTING ARRANGEMENT OF OUTDOOR
MANUAL CALL POINT

OUTDOOR MANUAL CALL POINT			
Sr.No	ITEM DESCRIPTION	UNIT	QTY/ITEM
1	MS Base Plate(Size:150 x 150 x 5 mm)	Nos	1
2	Anchor Fastener (Size: 6#)	Nos	4
3	Counter sunk head bolt & nut 3/16"x25mm long.	Nos	2
4	Cable Gland(Size:16mm)	Nos	2
5	Cable Lug(Size:155gmm)	Nos	4
5	Ismc 75 (Length 1500mm)	Nos	1

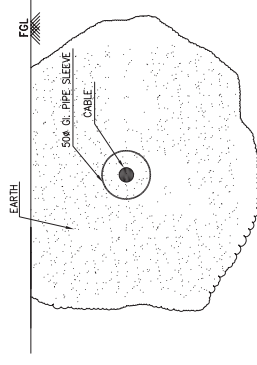


TYPICAL MOUNTING ARRANGEMENT OF INPUT OUTPUT MODULE FOR COAL CONVEYOR

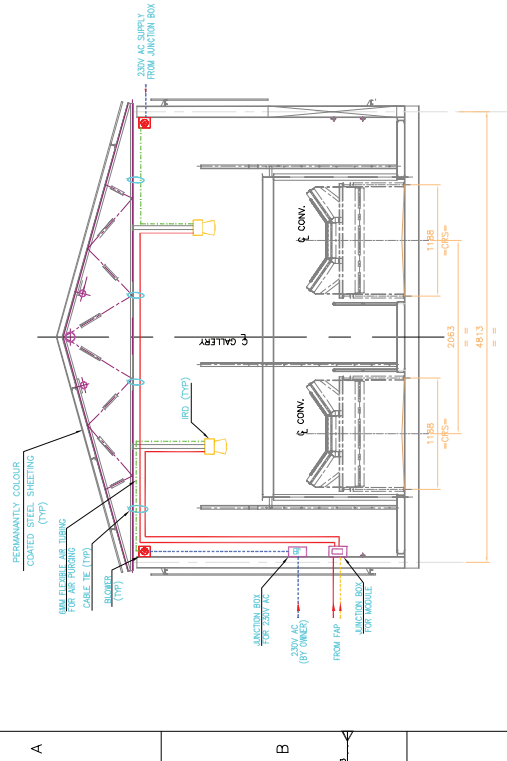
INPUT OUTPUT MODULE FOR COAL CONVEYOR			
Sr.No	ITEM DESCRIPTION	UNIT	QTY/ITEM
1	Control module with junction box (94 x 94 mm)	Nos	1
2	Counter sunk head bolt & nut 3/16"x25mm long.	Nos	2
3	Cable Gland(Size:16mm)	Nos	3
		Nos	6
5	Cable Lug(Size:1.5sqmm)	N	1
	M5 Angle (Size:25 x 25 x 5 MM/100MM LONG)	N	1



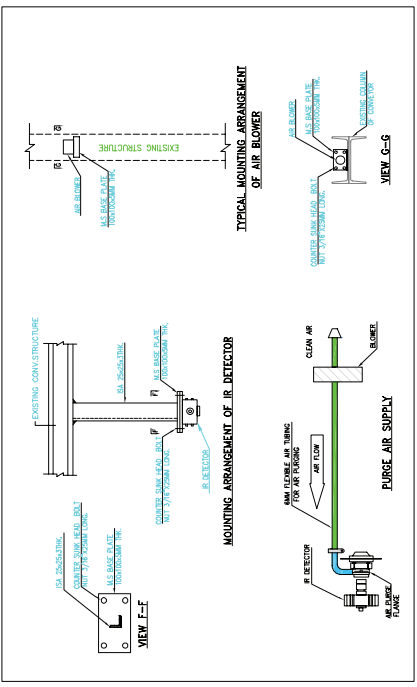
TYP. DETAIL FOR LAYING
OF BURIED CABLE



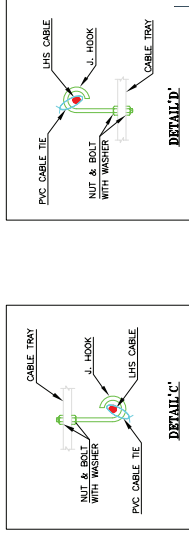
TYP. DETAIL FOR ROAD CROSSING



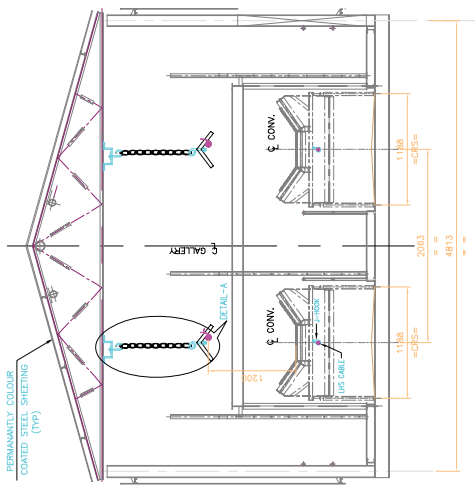
TYPICAL MOUNTING ARRANGEMENT FOR
IRD FOR COAL CONVEYOR



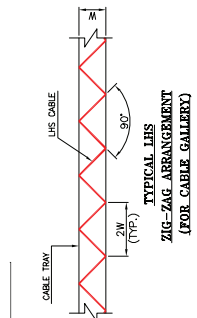
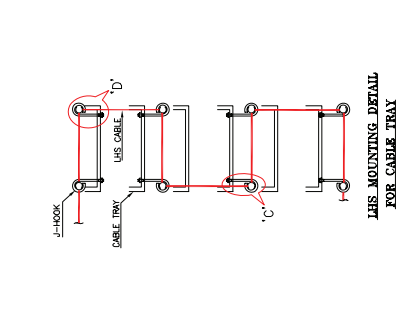
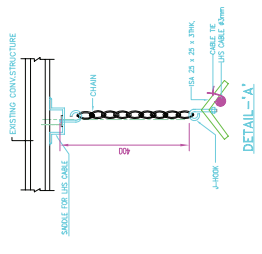
INFRA RED DETECTOR & BLOWER			
S.No	ITEM DESCRIPTION	UNIT	QTY/ITEM
1	MS Base Plate(Std:100 x 100 x 5 mm)	Nos	4
2	Counter sunk head bolt & nut 3/16"x25mm long	Nos	8
3	MS ANGLE(Std:25 X 25 X 5 MM/500MM LONG)	Nos	2
4	JUNCTION BOX FOR 230V AC SUPPLY	Nos.	1



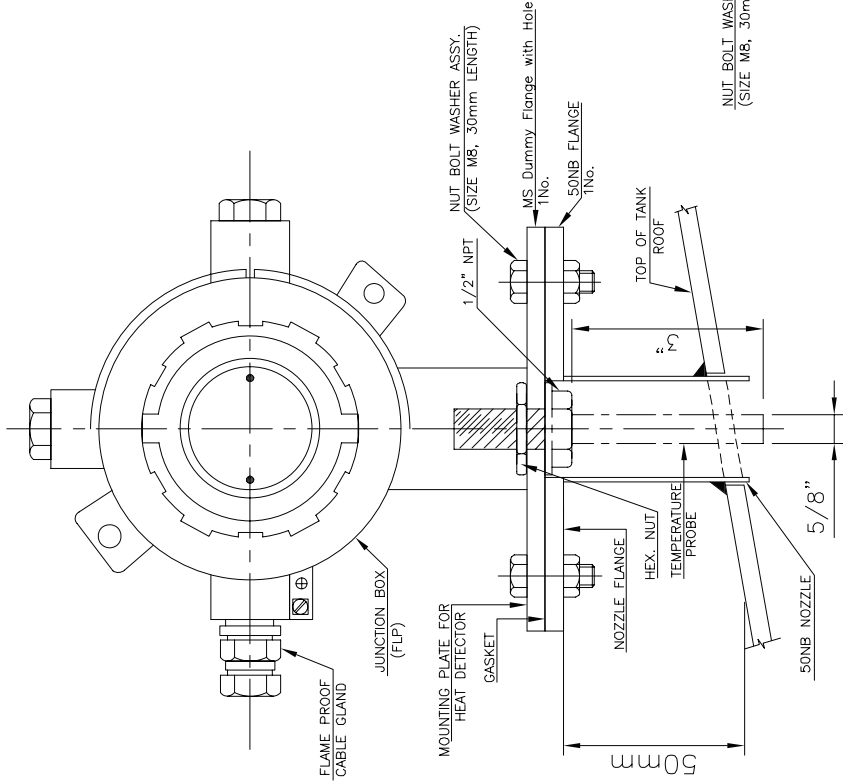
200mm long J- Hook for
every 1 metre



TYPICAL MOUNTING ARRANGEMENT FOR
LHS CABLE FOR COAL CONVEYOR

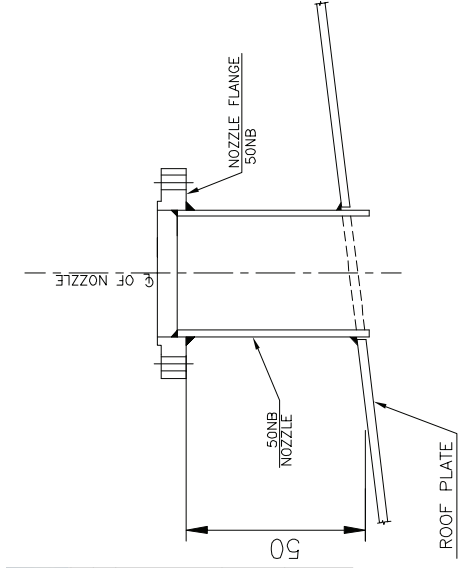


TYPICAL LHS
ZIG-ZAG ARRANGEMENT
(FOR CABLE GALLERY)

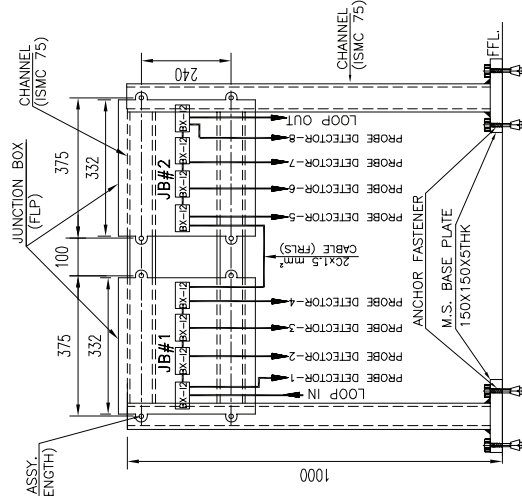


TYPICAL MOUNTING ARRANGEMENT
OF PROBE TYPE DETECTOR

PROBE DETECTOR & JUNCTION BOXES			
Sr.No	ITEM DESCRIPTION	UNIT	QTY/ITEM
1	MS BASE PLATE(SIZE:150 X 150 X 5 MM)	Nos	2
2	ANCHOR FASTENER (SIZE: 6φ)	Nos	8
3	NUT BOLT WASHER ASSY. (SIZE M8, 30MM LENGTH)	Nos	12
4	CABLE GLAND(SIZE:16MM)	Nos	20
5	CABLE LUG(SIZE:1.5SQMM)	Nos	40
6	ISMC 75 (LENGTH 1000MM)	Nos	2
7	ISMC 75 (LENGTH 850MM)	Nos	2
8	MS DUMMY FLANGE WITH HOLE	Nos	8
9	JUNCTION BOX FOR PROBE DETECTOR	Nos	8
10	JUNCTION BOX FOR MODULES	Nos	2



NOZZLE ARRANGEMENT
TANK ROOF FOR PROBE TYPE DETECTOR



TYPICAL MOUNTING DETAIL
OF JUNCTION BOX

ANNEXURE-N

Domestic Packing Details



CORPORATE STANDARD

AA0490010

Rev. No. 01

PAGE 1 of 26

DOMESTIC PACKING

COMMON GUIDELINES

1 GENERAL:

This standard lays down packing instructions for domestic packing of Components/Assemblies/Equipment to be despatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments.

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit & storage. For specific applications the concerned engineering department shall issue a product standard. Reference of this product standard, must appear in the Shipping list/Packing List.

2 TYPES OF PACKING:

The following 5 types of packings have been standardized for packing of General Components/Assemblies.

- 1) 'OP' - Open Type.
- 2) 'PP' - Partially Packed.
- 3) 'CP' - Crate/Box Packing - Components/Equipment requiring physical protection.
- 4) 'CQ' - Case Packing - Small & Medium Components/ Assemblies/ Equipment which require corrosion & physical protection.
- 5) 'CR' - Case Packing - Electrical Components/Assemblies, which require special packing viz. Water Proof, Shock Proof etc...

3 DESCRIPTION OF TYPES OF PACKING:

The various types of packing, as standardized above, are described below.

3.1 'OP' - Open Type

In case, of components which are not affected by water & dust and do not require special protection, are generally not machined, shall be sent as open packages. However, these components may be sent in crates, wherever necessary.

3.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film to Specification No.AA51420. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film

3.3 'CP' - Crate Packing

Assemblies/Components which need only physical protection from the point of view of handling shall be despatched duly packed in crates.

3.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of

Revisions:

APPROVED:PROCEDURAL GUIDELINES COMMITTEE –
PGC (Packing)

Rev. No. 01

Amd. No.

Reaffirmed

Prepared

Issued

Dt. of 1st Issue

Dt: 12-06-2018

Dt:

Year:

HPBP, Trichy

Corp. R&D

31-05-2018



silica gel to AA55619 or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall be entirely covered with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420, wherever required.

3.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons. Adequate quantity of Silica gel to AA55619 packed in cotton bags of 100grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420 before being packed in the cases. VCI Powder/Tablets can be used as an alternative to Silica Gel to AA 55619.

Empty space in the cartons shall be filled with rubberized coir to get proper cushioning effect. The cartons shall be manufactured from corrugated Fiber Board, meeting requirements of AA51414.

4 PREPARATION OF PACKING CASES

4.1 DOMESTIC:

Based on the availability, the wood shall be Rubber wood (Havea Brasiliensis)/Pine wood for packing of cubicles, loose items, spares and photovoltaic items meant for customers in India.

4.2 DIMENSIONS:

- a) Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25 +2/-3 mm.
- b) Width of all planks including the tongue shall be more than 125mm and after planing it shall be minimum 100mm.
- c) Minimum number of planks shall be used for a shook.
- d) Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel).
- e) External sides of front and rear planks to be planed to facilitate writing of address and other markings.
- f) Width of binding planks shall be minimum 100mm.
- g) Distance between any 2 binding planks shall be less than 750mm.
- h) diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm
- i) Distance of the outer edges of these planks from the edge of case shall be less than 250mm.
- j) Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

4.3 JOINTING OF PLANKS

Single length planks shall be used for cubicles whose overall length is less than 2400mm. For cubicles of length more than 2400mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag manner. From the joint along height side, it shall be of lap joint with overlap of at least the width of plank.

4.4 TONGUE AND GROOVE JOINTS

Two Consecutive planks shall be joined by tongue and groove joint. Depth of tongue shall be 12+1 mm, thickness of tongue shall be 8 +1 mm. The groove dimensions shall be such that the tongue fits tightly into the groove to make a good joint. This type of joint can be done based on the product requirement wherever required.

4.5 PERMISSIBLE DEFECTS

Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.



CORPORATE STANDARD

AA0490010

Rev. No. 01

PAGE 3 of 26

End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60mm per meter run of shook's. Wood pins shall be used to prevent further development of split.

Surface cracks: Surface cracks with a maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.

4.6 CHEMICAL TREATMENTS FOR PRESERVATION OF WOOD

- 1) This treatment provides protection to the packing wood against deterioration due to fungi and attack by termites, borers and marine organism and any kind of infections.
- 2) The wooden planks, after making tongues / grooves shall be treated with chemicals. For pine wood, treatment with ASCU/ CCA solution need not be done.
- 3) The chemical used shall be ready mix ASCU paste. This consists of Arsenic pent oxide, copper sulphate sodium dichromate. This Paste shall be mixed at the rate of 1 kg of paste per 10 liters of water to the extent of water used. Alternate this CCA paste as mentioned at Para 4.6.5) can also be used.
- 4) The chemical treatment shall be done at the premises of the contractor. A cement concrete tank of capacity to hold a minimum of 2000liters of solution shall be constructed. The solution shall be prepared in the presence of BHEL Representative by contractor. The wooden planks shall be soaked in the solution for a minimum of 12 hours. The solution shall be replenished after treating a maximum of 12 cubic meters of wood. A log book shall be maintained by the contractor to give the details of date of preparation of solution, quantity of solution prepared, quantity of chemicals used, Quantity of wood treated and the details of replenishment. Samples of solutions before mixing will be tested at the laboratories designated by BHEL. The testing fees to be paid to the laboratories will have to be borne by the contractor. The paste shall be tested as and when required.
- 5) Specifications for water soluble type wood preservatives: Copper – Chromium – Arsenic [CCA]: Copper – Chromium – Arsenic preservative formulation shall be as per IS:10013 Part – II – 1981 shall consist of following active ingredients in nominal proportions by weight as shown below:

– Arsenic Pent oxide	AS ₂ O ₅ 2H ₂ O	12.5
– Copper Sulphate	CuSO ₄ 5H ₂ O	37.5
– Sodium Dichromate	Na ₂ Cr ₂ O ₇ 5H ₂ O	50.0
– Or Potassium Dichromate	K ₂ Cr ₂ O ₇	

4.7 OTHER MATERIALS

4.7.1 NAILS

The dia. of the nails shall be 3.15mm. The length of the nails shall be 65mm wherever two planks of 25mm thickness are joined and 75mm wherever a 25mm planks is joined to a 50mm plank.

4.7.2 BLUE NAILS

These are used for nailing bituminized Kraft paper/hessian cloth to the planks. The length of the nails shall be 16mm.

4.7.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6 +0.01mm. The material shall be free from rust.

4.7.4 CLIPS

These shall be used for strapping the hoop iron strips on the boxes.

4.7.5 BRACKETS

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness min 2mm and width 25+1mm. The brackets shall be of "L" shape, the length of each side being 100+2mm. Two holes shall be provided towards the end of each side for screwing /nailing.

**4.7.6 FASTENERS**

Bolts, double nuts, spring washers will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box. The bolts, nuts, washers will be provided by the vendor. Drilling of holes will have to be done using contractor's tools.

4.7.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

70GSM (Colourless) Multi Layered Cross Laminated Polythelene Film Specification No: AA51420 are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

4.7.8 RUBBERISED COIR:

The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

4.7.9 FOAM RUBBER / 'U' FOAM:

This is used for covering the delicate items. This material is provided by the vendor.

4.7.10 MARKING PLATE:

This shall be of anodized aluminium sheet. Details and specifications are given in Fig-4

4.7.11 PACKING SLIP HOLDER:

This shall be of galvanized iron tinned sheet /Aluminium sheet

4.7.12 SILICA GEL:

This shall be of indicating type to conform to IS: 3401/AA55619.

4.7.13 COTTON BAGS:

These are used for holding silica gel. The bags shall have the following matter indicated on them:

BHEL-UNIT NAME	PLACE-PINCODE
SILICA GEL	INDICATING TYPE
BLUE :	ACTIVE
ROSE :	REDUCED ACTIVITY
WHITE :	NO ACTIVITY. TO BE REPLACED WITH FRESH SILICA GEL

4.7.14 COTTON/ PLASTIC TAPE:

This is used for tying small items. And also to prevent vibrations of moving parts within the cubicles.

4.7.15 MARKING INK:

The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water.

4.7.16 POLYETHYLENE BAGS:

These are to be used for keeping the Packing slips. The bag shall be of size 70mm X 100mm (minimum).



CORPORATE STANDARD

AA0490010

Rev. No. 01

PAGE 5 of 26

4.7.17 Hessian cloth, twine thread, paint will have to be used in packing certain items.

4.7.18 Mechanical Latching clamps:

For CLW Railway panels and similar Panels self-locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement. For reusable boxes, these clamps provide easy locking and unlocking arrangement. These clamps will be made available from BHEL in some cases.

4.7.19 STICKERS

The following stickers to be put by the vendor on cubicles/Boxes after packing.

1. Case No sticker: 2 nos. Size 25.Cm x 0.45Cm
- 6) BHEL Monogram sticker: 1 no. Size 1.75Cm x 2.3Cm
- 7) Address sticker: 2 nos. Size 3.8Cm x 3.0Cm
- 8) Direction sticker " Front " & " Back " - 4 nos. Size 2.0Cm x 0.75Cm
- 9) Chain Mark Sticker: 4 Nos. Size – 3.0Cm x 0.75Cm
- 10) "Fragile " sticker: 2 Nos Size. 2.1Cm x 1.5Cm
- 11) "DO NOT STACK " sticker - 2 Nos. Size 3.0Cm x 2.2Cm

5 PACKING OF CUBICLES WITH RUBBER WOOD:

5.1 The packing is to be done as per clause 4 in all respects.

5.2 The cubicles are already fixed on wooden pallets. Hence the contractor need not arrange the bottom pallets normally.

5.3 The cubicles will be of different sizes both widthwise and lengthwise. The cubicles may be made up of single suite, 2 Suite, 3 Suite, 4 Suite, etc., The width of the cubicles generally varies from 400 mm to 1650mm. The length of the cubicle, generally varies from 1500 mm to 4800 mm. The height is normally 2430 mm. In some cases, the height may be less/more.

5.4 MULTI LAYER CROSS LAMINATED POLY FILM

The inner surface of 4 sides of shoo's shall be nailed with Multi-layer cross laminated poly film (as per 4.7.7) using blue nails (as per 4.7.2) wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film (as per 4.7.7). This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film (as per 4.7.7).

5.5 SILICA GEL:

Silica gel (as per 4.3.15) packed in cotton bags shall be kept at different places inside the cubicle as per BHEL-Unit directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 4.7.13).

5.6 LOOSE PARTS:

Any loose parts in the cubicles shall be tied using cotton/ plastic tape. Wooden battens shall be provided wherever necessary.

5.7 WOODEN BATTENS:

In case of cubicle which are not rectangular in shape like control desks, sufficient number of wooden rafters/battens of proper size shall be provided to give strength to the package.

5.8 RUBBERISED COIR:

Gap between the cubicle and the case shall be filled with rubberized coir (as per 4.7.8) with distance between consecutive layers less than 500mm.

**5.9 CLAMPING:**

Packing shall be bound at edges by nailing M.S. Clamps / Brackets (as per 4.7.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

5.10 PACKING SLIP:

Packing slip kept in the polyethylene bag (As per 4.7.16) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 4.7.11) shall be nailed to front / rear of case.

5.11 MARKING PLATE:

One no. (As per 4.7.10) shall be nailed to the front side of the case.

5.12 CASE MOUNTING:

After complete packing, stencil marking of various details and marking of symbols shall be done as per BHEL instructions using indelible / non washable marking ink.

5.13 Different types (Typical) of Cubicles with sizes for Packing

1. Single suite cubicle - 900 x 950 x 2500
2. Two suite cubicle - 1650 x 950 x 2500
3. Three suite cubicle - 2400 x 950 x 2500
4. Four suite cubicle - 3150 x 950 x 2500
5. Regulation cub - 1300 x 1350 x 2500
6. Thy cub - 2870 x 1350 x 2500
7. VFD Cub - 3800 x 1550 x 2500

5.14 PACKING OF CUBICLES WITH PINE WOOD

Packing of cubicles for export shall be done exactly in same manner as described at Cl.No 5 except for the following changes: -

Wood shall be Silver oak/ Pine wood instead of rubber wood.

- Double polyethylene petticoat instead of one.
- Fumigation may have to be done if required (BHEL Scope).

6 PACKING OF LOOSE ITEMS/SPARES USING RUBBER WOOD:

- 1) Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.
- 2) Wood shall be rubber wood with Tongue and Groove joint as per clause 4.4.
- 3) Chemical treatment as per Clause 4.6 to be done.
- 4) Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.
- 5) External surface of planks on front and rear shall be plane 100% (except bottom plank).
- 6) Inner surfaces of all 6 sides shall be lined with bitumen coated hessian polyethylene Kraft paper (as per clause 4.7.7) using blue nails.
- 7) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.
- 8) Internal packing: Items that go into the box shall be packed using 70GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No: AA51420. Any space left Between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect .
- 9) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.



CORPORATE STANDARD

AA0490010

Rev. No. 01

PAGE 7 of 26

- 10) Silica gel as per clause 4.7.12 held in cotton bags as per clause 4.7.13 shall be kept at proper places in the box.
- 11) Packing slip kept in polyethylene bag (clause 4.7.16) shall be placed in the box.
- 12) Marking plate as per clause 4.7.10 shall be nailed to side of the box.
- 13) Two numbers of hoop iron strips as per clause 4.7.3 shall be strapped tightly on the case using clips.
- 14) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
- 15) Loose items to be kept inside the cubicle
- The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually, kept in wooden box and tied firmly in bottom of Cubicle.
 - Other items which are given loose in addition to cubicle shall be packed in separate boxes.

7 BOX SIZES

7.1 BOX SIZES

Table 1 – SPARES WOODEN BOX DETAILS

SNO	BOX TYPE	BOX SIZE (in mm)	BOX Wt (in KG)	Carrying Capacity
1	A	800 X 200 X 200	15	
2	B	1500 X 200 X 200	22	
3	C	2000 X 200 X 200	27	
4	D	1100 X 200 X 200	15	
5	E	200 X 200 X 200	5	
6	F	320 X 250 X 260	13	
7	G	320 X 250 X 430	16	
8	H	430 X 370 X 430	23	
9	I	1100 X 400 X 400	45	
10	J	1500 X 500 X 400	65	
11	K	2000 X 500 X 400	93	
12	L	2500 X 500 X 400	88	
13	M	900 X 600 X 600	100	
14	N	3000 X 400 X 400	60	
15	P	600 X 500 X 400	35	
16	Q	710 X 630 X 600	90	
17	R	850 X 630 X 670	102	
18	S	1000 X 770 X 670	140	
19	T	2500 X 850 X 800	180	
20	U	1500 X 700 X 700	120	
21	W	1200X900X600	120	
22	Y	450 X 200 X 200	10	

7.2 BOX SIZES**Table 2 – VALVES WOODEN BOX DETAILS**

BOX TYPE	BOX SIZE (in MM)	BOX Wt (in KG)	Carrying Capacity
1A	320X250X260	10	
1	320X250X430	15	
2	430X370X430	25	
3	670X670X470	65	
4	720X630X600	75	
6	1000X770X660	100	
7	1100X430X670	80	
8	1200X1200X900	80	
10	1300X770X1050	155	
11	2500X850X800	225	
12	2000X1500X1200	305	
14	1850X1050X1250	260	
15	2000X800X800	180	
17	2600X1500X1600	470	
21	250X250X600	20	
22	250X250X880	30	
23	300X300X700	25	
24	380X380X880	45	
25		25	
26	510X510X1400	60	
27	570X570X1400	80	
28	575X575X1875	105	
29	3600X1100X1100	390	
30	900X500X800	110	
52	2000X950X740	225	
53	1600X1120X700	220	
54	2500X2000X1200	490	
55	2900X1900X1400	525	
56	3000X1000X900	370	
57	3200X2200X950	450	
58	2150X1100X750	325	
61	2000X2000X700	130	
62	700X1200X1325	130	

TYPICAL PATTERN OF WOODEN BOX

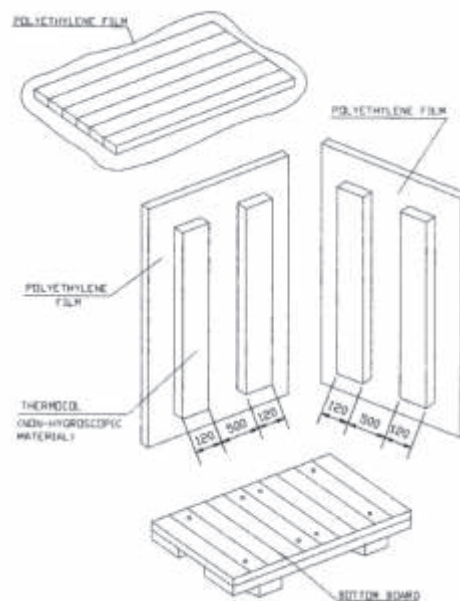


Figure 1

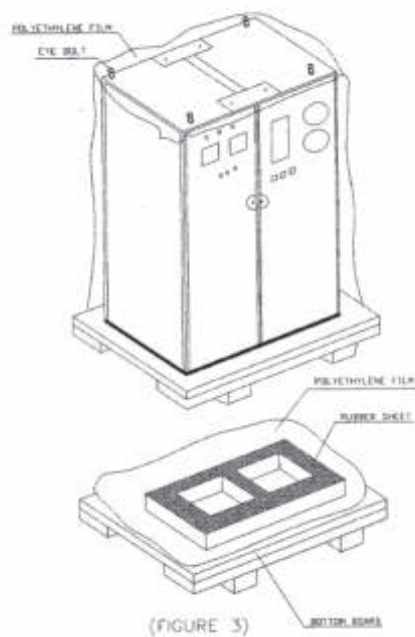


Figure 2

7.3 STANDARD BOX SIZES

WOODEN BOXES:

SL NO	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
01	I	2370	1570	1650	675	4000
02	IIA	1570	720	885	200	2500
03	II	1200	900	600	150	2000
04	III	900	600	600	100	1000
05	IV	600	450	450	40	750
06	V	600	300	300	35	500

STEEL BOXES:

SL NO	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
07	I	2480	1680	1500	339	4500
08	II	1200	900	600	061	2000
09	IIB	1800	850	950	115	2500
10	III	900	600	600	029	1000
11	IV	600	450	500	019	750
12	V	400	350	300	011	500

Table 3

7.4 STEEL CONTAINERS

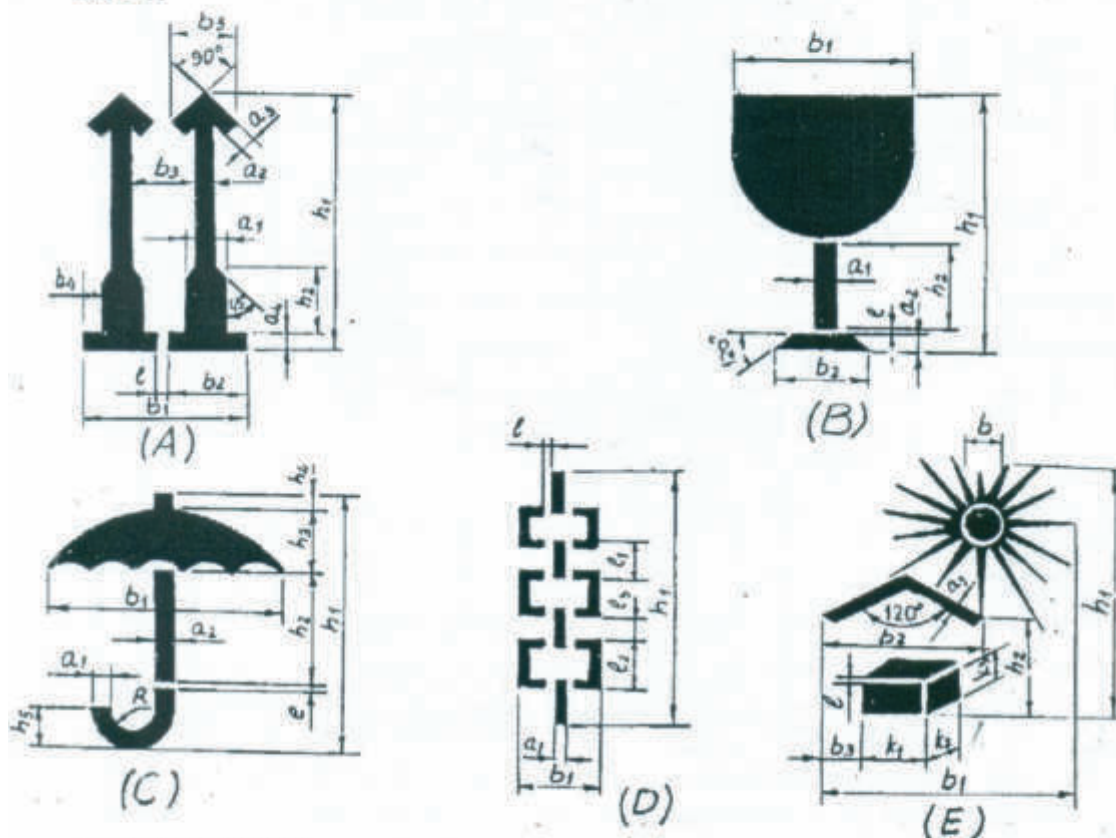
Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies. The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections.

- Following precautions are to be taken during packing: -
- Put the machine in the steel container properly,
- Cover the machine with polythene.
- To arrest the movement in the steel container necessary wooden Blocks/Battons may be put.
- Put cover on steel, container and Bolt Properly

8 MARKINGS/STENCILINGS

MARKINGS ON PACKING CASES

1. THIS PLANT STANDARD PRESCRIBES THE VARIOUS CAUTION SIGNS AND OTHER MARKINGS ON PACKING CASES.
2. DIMENSIONS IN THE TABLE 1 SHALL BE USED FOR MAKING STENCILS ONLY.



DESIGN- ATION		DIMENSION IN MM																							
		a1	a2	a3	a4	b1	b2	b3	b4	b5	b	l	h1	h2	h3	h4	h5	k1	k2	k3	l1	l2	l3	R	
A	1	12	5	5	4	52	25	19	8	21		2	84	23											
	2	17	7	7	6	75	36	29	11	30		3	119	33											
	3	24	10	10	8	104	50	38	16	42		4	168	46											
	4	34	14	14	11	147	71	59	23	60		5	239	65											
B	1	5	5			50	33					2	84	25											
	2	7	7			71	47					3	119	36											
	3	10	10			100	66					4	168	50											
	4	14	14			142	94					5	239	71											
C	1	4	3			66						2	80	39	19	5	11								6
	2	6	4			85						3	114	55	27	7	16								9
	3	8	6			120						4	160	78	38	10	22								12
	4	11	9			170						5	227	110	54	14	31								17
D	1	6				30						4	148								30	30	10		
	2	9				42						5	209								42	42	14		
E	1	3				69	47	10			16	2	91	26				17	8	11					
	2	4				98	67	15			23	3	128	33				24	11	16					
	3	6				138	94	20			32	4	182	62				34	16	22					

Table 4

Black and Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height.

In case of consignment consists of more than one package, each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in high quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel(AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks.

Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: Incase the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

225			
BHEL-EDN-BANGALORE-26			
CONSIGNEE			
MATERIAL			
CUSTOMER REF.		MO. NO.	
DESPATCH ADVICE, NOTE NO.		CASE NO.	
DIMENSIONS(MM) LXBXH		NET WT -KGS	GROSS WT -KGS
SPECIAL INSTRUCTIONS	HANDLE WITH CARE - KEEP DRY DO NOT DROP - DO NOT TILT		
		170	

Figure 4 – TYPICAL MARKING PLATE



Figure 5

Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

9 RECYCLING OF INCOMING WOODEN PACKING CASES

OBJECTIVES

- To utilize useable wood of incoming packing cases, for manufacturing of new packing boxes.
- To recycle incoming wooden packing cases, as such, wherever possible.



- 1) All incoming wooden packing cases received from suppliers /customers will be opened carefully, with the intention of reusing them, by Shop.
- 2) After carefully taking out the contents, the empty wooden packing cases will be shifted by Shop to the specified locations i.e. bin / nearly spaces, already earmarked in stores.
- 3) Material shifting contractor engaged by store, will collect all such wooden packing cases and scrap wood from specified points, on a regular basis.
- 4) After collecting / loading the empty packing cases/ scrap wood, contractor will take the carrier first to weighment bridge for weighment, thereafter, he will go to Carpentry, where Carpentry representative will identify the packing cases which can be used by Carpentry for manufacturing of New Packing Boxes. All such identified packing boxes will be unloaded and handed over to Carpentry by contractor.
- 5) These packing boxes will be made re-useable after necessary rectification and additional work.
- 6) Contractor will again take the carrier for weighment and this second reading will also be recorded on the same "Weighment Slip".
- 7) Weight of empty packing cases / scrap wood taken will be calculated on the basis of 1st and 2nd weighment readings recorded on the "Weighment Slip". A copy of "Weighment Slip" (where both the weighment readings are recorded) will be given by the contractor to the carpentry representative. Based on this "Weighment Slip", carpentry will maintain a register in which details of quantity received will be recorded.
- 8) All "Weighment Slips" will invariably be signed by carpentry representative (even when no boxes have been unloaded by carpentry). Store will accept the scrap wood only if "Weighment Slips" are signed by carpentry representative.
- 9) Balance empty packing cases / scrap wood will be handed over by contractor to Store, for storing in scrap yard.
- 10) A separate area in Scrap yard will be provided, for executing the work of de-nailing of wooden packing cases, under supervision of carpentry.
- 11) Carpentry contractor will identify packing cases / scrap wood for denailing, which will be handed over to him by Store, at Scrap yard, for denailing and further operation.
- 12) Quality and Carpentry will jointly inspect the wood generated by de-nailing process and will prepare "INSPECTION CUM RECEIPT REPORT OF USEABLE WOOD RECEIVED FROM TPS –STORE BY CARPENTRY".
- 13) After acceptance of the wood by Quality and Carpentry, the same will be shifted to carpentry for receipt and its record will be maintained by carpentry.
- 14) This will be a Permanent Productivity Project executed by carpentry. "Productivity Savings" duly verified at the current Purchase Order rate of wood, will be sent every month to Resource Management Department, for highlighting it in their monthly progress report.

10 STANDARD METHOD OF PACKING

Table 5 –

STANDARD METHOD OF PACKING								
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
PRESSURE VESSELS								
TOWERS					O			
TANKS					O			
VESSELS					O			
GASKETS	O							
FASTENERS	O							



CORPORATE STANDARD

AA0490010

Rev. No. 01

PAGE 15 of 26

STANDARD METHOD OF PACKING

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
COVERS		O						
EXCHANGERS								
HEAT EXCHANGERS					O			
TUBE BUNDLE	O							
SHELL					O			
AIR FIN COOLERS					O			
COLOUMNS, MOTOR SUSPENSIONS, PLENUM CHAMBERS, SCREEN GUARDS, ETC					O			
BEARING BLOCKS	O							
FANS	O	O						
MOTORS	O							
GASKETS	O							
FASTENERS	O							
TEST FLANGES			O					
TEST RINGS			O					
COVERS			O					

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
CRYOGENIC VESSELS								
COLD CONVERTERS					O			
HORIZONTAL STORAGE TANKS					O			
TRANSPORTATION TANK					O			
COLD BOX					O			
DRYING UNIT					O			
DRYING BOTTLES					O			
MOISTURE SEPARATORS					O			
SILENCERS					O			
ONGC SKIDS					O			
VAPORISER		O						
SPECIAL PRODUCTS								
SI/VI PIPING		O						
CRO BIO CONTAINERS	O							
AIR BOTTLES	O							
TITANIUM BOTTLE	O							
WAR HEAD CONTAINER	O							
MISSILE CONTAINER	O							
FUEL CONTAINER	O							
AIR LOCK ASSEMBLY	O							

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
BOILERS								

CORPORATE STANDARD



BOILER DRUMS					O			
BOILER ITEMS								
COILS			O					
PANELS					O			
HEADERS			O		O			
FEEDERS								
MACHINED ITEMS								
SHELL SEGMENTS					O			
SHELL SEGMENTS IN STACKS					O			
SPHERE PETALS								
COLOUMNS, BASE PLATES, TIERCOS, PIPES, NOZZLE E1, F1, INTERNAL PIPES, PADS ETC.					O			
ROLLERS	O							
VALVE TRAYS								
VALVE TRAY COMPONENTS	O							
LATTICE GIRDERS		O						
FASTENERS	O							
GASKETS	O							

DESCRIPTION	CA SE	CRA TE	SK ID	BUN DLE	BA RE	DR UM	METAL DRUM	FIBRE DRUM
SUB CONTRACTS								
FAB STRUCTURALS					O			
SUPPORTING STRUCTURALS					O			
STRUCTURE SUB ASSEMBLY					O			
FAB PIPES					O			
GRATINGS					O			
STAIR CASES					O			
HANDRAILS/ PLATFORMS					O			
BOUGHT OUT COMPONENTS								
IRON & STEEL (LIKE PLATES, BEAMS, ANGLES, CHANNELS ETC.)					O			
PIPE FITTINGS								
CS PIPES, TUBES					O			
SS PIPES, TUBES					O			
FIN TUBES	O							
ELBOWS		O			O			
FLANGES	O	O						
VALVES	O							
GAUGES	O							
DEMISTERS		O						
DESCRIPTION	CA SE	CRA TE	SKI D	BUND LE	BA RE	DR UM	METAL DRUM	FIBRE DRUM



CORPORATE STANDARD

AA0490010

Rev. No. 01

PAGE 17 of 26

ABSCRIBANTS (LIKE MOLECULAR SIEVES, ACTIVATED ALUMINA, MOBILE SORBID)									
PAINT TINS		O							
PAINT DRUMS							O		
IGNITORS	O								
SPRAY NOZZLES	O								
ELECTRICAL INSTRUMENTATION									
MOTORS, PUMPS, COMPRESSORS, TURBINES	O								
SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES		O							
INDICATORS, VIBRATOR SWITCHES	O								
CABLE BUNDLES, CABLE DRUMS						O			
CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL		O							
OPERATIONAL SPARES	O								

11 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

- 11.1 Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.
- 11.2 Appropriate material handling equipment like fork lifters, cranes etc. shall be used where needed.
- 11.3 Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. shall be done carefully.
- 11.4 For critical items, where specified, special handling fixtures shall be used for lifting.
- 11.5 Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.
- 11.6 Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.
- 11.7 Precision machined components like blades, catches, rollers etc. shall be lifted using suitable wooden pallets.

11.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

Before loading/unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

- a) The markings showing the upright position.
- b) The markings showing the sling position
- c) Markings showing the fragile contents.
- d) Other required markings as per CI.no:08



- 11.8.1** Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15°.
- 11.8.2** Handling and lifting should be done without jerks or impacts.
- 11.8.3** Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.
- 11.8.4** On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.
- 11.8.5** Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.
- 11.8.6** Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

12 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

Based on the Dimensions/Weight indicated in the Transportation Sketch, the type of Trailer is decided and indicated in the Tender Enquiry.

12.1 TRANSPORTATION:

1. **LOW BED TRAILERS (LB 8):**
 - Well Bed Length: 10000mm
 - Over Gooseneck: 13000mm
 - Width: 3000mm
 - Carrying Capacity: 40MT
2. **LOW BED TRAILERS (LB 16):**
 - Well Bed Length: 12000mm
 - Over Gooseneck: 16000mm
 - Width: 3000mm
 - Carrying Capacity: 75MT
3. **TOW TYPE TRAILERS (WITH FRONT DOLLEY 16 TYRES): 12000MM length**
(for Exceptional equipment length: 30000mm and above)
 - Bigger Dia equipment are loaded in the Well with overhanging.
 - Smaller Dia equipment with excess length are loaded over Gooseneck with rear hanging.
 - The Vehicle Dimensions are defined above are only guidelines for selection based on actual Dimensions/ Weight of the Consignment

12.2 PACKING:

For all ODCs, Wooden Saddles are cut to the diameter of equipment as per the Transportation Sketch.

For Diameter up to 4000mm



CORPORATE STANDARD

AA0490010

Rev. No. 01

PAGE 19 of 26

Wooden Saddles Length: 1836/2743mm (6'0"/9'0")
Width: 300mm (1'0")
Height: Saddle + one/two wedges a top.

For Diameter up to 4000mm

Wooden Saddles Length: 3353mm (11'0")
Width: 300mm (1'0")
Height: Saddle + three/four wedges a top.

NUMBER OF SADDLES:

Minimum: 3 in case of Loading inside Well
+ 1 when loaded on Gooseneck.

Maximum: 4 in case of Loading inside Well
+2 when loaded on Gooseneck.

For Securing the equipment firmly on the Trailer, 19mm (3/4"), wire rope with 25mm (1") Heavy Duty Turn Buckles / BD Clamps are used as Lashing for the equipment.

12.3 NUMBER OF LASHINGS ARE:

	CONSIGNMENT LOADED INSIDE WELL BED	CONSIGNMENT LOADED OVER GOOSENECK
a) up to 40MT	4 (2 Single Line lashing 2 Double Line Lashing)	5 (3 Single Line Lashing 2 Double Line Lashing)
b) 40MT to 60MT	5 (3 Single Line Lashing 2 Double Line Lashing)	5 (Single Line Lashing 3 Double Line Lashing)
c) 60MT and above	5 (2 Single Line Lashing 3 Double Line Lashing)	6 (3 Single Line Lashing 3 Double Line Lashing)

13 GUIDELINES FOR HANDLING/LOADING/LASHING

13.1 HANDLING



Figure 6

Before unloading the jobs Completely painted and neatly stencilled will be checked.

Pipes with split type end cover will be checked

**Figure 7**

All Coil Tubes to be provided with End Caps.

**Figure 8**

Neatly stacked Coil Assemblies.

**Figure 9**

Columns to be lifted with Nylon belts. This protect painting, edges and attachments.

**Figure 10**

13.2 LOADING

All the components to be transported by putting inside the properly fabricated Crating

**Figure 11**

Small components may fall down while transporting without closed crating and there are chances of missing of small parts. Hence, it is always better to transport small components in closed containers/crating. Loose to be being shipped in a closed crating.

**Figure 12**

No component loaded over the crating.



Figure 13

Headers supported with wooden V blocks at 3 meters interval.



Figure 14

Spacers in between each coil assembly.



Figure 15

Goose pipe to be provided with rubber pad protects removal of painting and damage to the job.



Figure 16

13.3 LASHING

Use Nylon belts only for lashing of all components. It prevents removal off painting and cut in the materials.

**Figure 17**

Nylon Belts used for lashing the beams.

**Figure 18**

14 PRODUCT WISE SPECIAL INSTRUCTION

Additional instructions of packing not included in this standard shall be covered by individual product standard

**15 REFERRED STANDARDS (Latest publications including amendments):**

- | | | | |
|------------|------------|------------|------------|
| 1) AA51420 | 2) AA55619 | 3) AA51414 | 4) IS:3401 |
| 5) AA10108 | 6) AA56126 | | |

ANNEXURE-O

PC & Printer details



operation of the plant shall be possible from any operator station. Multiple windows, not less than 4 (four) nos., at a time shall be available on the HMI screen for operation.

Each station shall be complete with latest configuration window based PC, application software, display builders with object oriented programming like Visual basic, Active-X etc..

Display selection shall be possible with least number of keystrokes or steps. Functional requirement of an operator station shall not be limited to the followings:

- a) Issuance of control command like start/stop, set point adjustment, auto/manual, increase / decrease etc. Bidder shall ensure that when a particular operator workstation initiates a dialog, no other operator workstation shall have access to the same dialog, at the same point of time.
- b) Display of plant graphic, overview display, area display, loop/drive display, control related displays, other standard displays for monitoring, trending of parameters.
- c) Display & print of SOE/Trend/Graphic / System Diagnostic.
- d) Alarm display & acknowledgement.
- e) Print of screen, logs, operator message, etc.
- f) Last command call.
- g) Copy & paste.
- h) Display of sequential / logic and tag with facility of forcing through suitable password
- i) Multiple pop up faceplate for drive control & point detail.

In case of exigencies, operator station shall be capable to be used as an engineering / diagnostic station with Password protection & hard key switch operation.

Bidder shall provide all necessary Operator interface devices like PCs, UTP cables, LED Monitors with keyboard & mouse, colour laserjet printers, large video screen, multimedia beeper/buzzer etc. Quantity /assignment for HMI and Peripherals are described elsewhere in this section. Bidder shall meet the following general specification.

Operator's Station / Engineering Station / Shift Charge Station

- | | | |
|----|----------------|--|
| 1. | Processor | : Latest , minimum Intel Core i5 quad core |
| 2. | Configuration | : Tower |
| 3. | Internal clock | : 3.2 GHz (minm.) |





4. Architecture : 32 bit
5. Video Card : PCI
6. RAM : 4 GB (Minimum) DDR
7. Hard drive : 500 GB SATA (7200 RPM)
8. Cache : 512 KB Level 2
9. CD/DVD Drive : DVD - Both Read & Write for OWS.
BothDVD Read & Write for ES
10. Audio controller : 16-bit
11. Operating system : windows 8.1 Professional downgraded to
Windows 7 Professional 64 bit
12. Graphic accelerator : 8MB (minm.)
13. Communication ports : (a) RJ-45 NIC- 02 Nos.
(b) USB ports – 04 nos (min.)
(c) USB 3.0 - 02 nos

g) Monitor

01. Type : LED
02. Screen diagonal : 23"
03. Display : Full HD
04. Resolution : 1920 X 1080 or better
05. Degree of protection : IP-30
06. External Controls : Brightness, contrast, Horizontal / Vertical
amplification & shift
07. Power supply : 240 V, 50 Hz, 1 phase
08. Ambient temperature : 0-50° C
09. Humidity : 95% non-condensing.
10. Version : To suit industrial application(latest
version as per availability at the time of
detailed Engineering/procurement).

h) Key Board (for all application)

01. Type : Flat spill proof membrane type or
Positive depression type.





- | | | | |
|-----|----------------------|---|---|
| 02 | Interface | : | USB |
| 03. | Different keys | : | <ul style="list-style-type: none"> a) Soft and user defined function keys for software/ programming including text correction, scan rate alteration, zooming/ flashing color selection etc. b) Panel select keys for alarm summary, control loop display, overview, trend, graphic, operator guide message etc. c) Standard Alphanumeric keys d) Alarm acknowledge keys e) Cursor keys f) Mode/loop status switching keys g) Setting change keys h) Print-out command keys i) Other keys as required to operate the system |
| 04 | Key lock | : | Lockable type push button mounted on keyboard |
| 05. | Life Expectancy | : | 50 million cycles per key |
| 06. | Version | : | To suit industrial application |
| i) | Color Laser Printer | | |
| 01. | Type | : | Electro-photographic laser, tabletop |
| 02. | Printer Memory | : | 512 MB (min.) |
| 03. | Speed | : | Monochrome 24 ppm - A4
Color 6 ppm - A4 |
| 04. | Resolution | : | 1200 x 1200 DPI in color |
| 05. | No. of color (Basic) | : | 4 (four) minimum |
| 06. | Duty cycle | : | Monochrome 75000 pages / month |
| 07. | Power supply | : | 240V AC, 50 Hz, 1 phase UPS |
| 08. | Ambient temperature | : | 0-50° C |



09. Humidity : 95% non-condensing.
10. Interface : USB and Ethernet (RJ45)
11. Size of paper : Letter, A4, Legal, Ledger, A3
12. Print media : Plain paper, transparencies, thick stock, glossy stock, envelopes
13. Special Features : 1) Automatic Two-sided printing.
2) Built in Networking with Fast ethernet 10/100 Base-T network port.
3) Minimum 2 Nos. Multi purpose sheet tray
14. Accessories : i) Printer table
ii) Connector & Cable

j) Dot Matrix Printer

01. No. of Needles : 24 Pin
02. Printing speed : 300 characters per second (approx.)
03. Character dimension : 9 x 8
04. Buffer : 80 KB (Min)
05. Local memory : RAM with battery backup
06. Interface : Serial / parallel
07. Power supply : 240 V, 50 Hz, 1 phase
08. Ambient temperature : 0-500 C
09. Humidity : 95% non-condensing.
10. Size of paper : Fanfold, A4, A3
11. Character sets : ASCII, IBM (Sets 1 & 2), Italics, user defined
12. Transfer distance : 200 Mtrs. (minimum)
13. Print features : Graphic printout, emphasized, double width, underlined, subscript, superscript, double strike, backspace, margin etc.
14. Reliability : MTBF more than 8000 Hrs.
15. Noise level : Less than 60 dBA

ANNEXURE-P

Fibre Optic Cable Details



SL. No	APPLICATION		TYPE OF TERMINATION		TYPE OF CABLE
	FROM (A)	To (B)	END (A)	END (B)	
	Termination Cabinet	Cabinet	Cage Clamp type.	Cage Clamp type.	
09.	UCP mounted equipments	Post mounted Maxitermi / Cage Clamp type	Post mounted Maxitermi / Cage Clamp type.	Plug Connector / Cage Clamp type (rail mounted)	F, G (with connector at one end)
10.	DCS/ PLC Cabinets	PC, Printers etc.	Plug connector in	Plug connector in	Manufacturer Standard

NOTES :

01. For Sl. No. 05, 06, 07 & 08, normally 10% spare core shall be provided.
02. For analog signals individual pair shielding & overall shielding & for Binary signals only overall shielding of instrumentation cables shall be provided.
- 03 *For high temperature application only.

11.04.00 CONTROL & POWER CABLE

Bidder shall refer to Volume IIF of the electrical specification for detail.

11.05.00 OPTICAL FIBER CABLE

11.05.01 This specification defines the minimum general requirements for the Design, manufacture, supply, inspection, installation, testing & commissioning of optical fiber cables and accessories, such as fiber distribution (patch) panels, adapters, connectors, joint boxes, pigtails and other components, as required to complete the system. Bidder shall consider all related activities, such as cable stripping, cable entry in boxes and panels, cable fiber splicing/fusion, cable performance testing and other services, to achieve a properly documented and operational cable network. all Fibre Optic cables shall be Single Mode type.

11.05.02 Fiber Optic Cables shall be installed on cable tray, duct bank, cable trench installation as necessary. For outdoor applications the cable shall be armoured with Poly Ethylene sheathing. In all cases cable shall be routed through suitable grade HDPE permanently lubricated protection pipe as per IS 4984, IS 12235 & TEC.G/CDS-08 /01 of suitable size @ 53% fill factor. Permanent route marking in FRP (Fibre Reinforced Plastic) material shall be provided at intervals not exceeding 5 meters for all FO cables layed outdoor buried under the ground.

11.05.03 The Optical Fiber core shall be of ultra pure fused silica glass coated with UV-cured acrylate suitable to withstand temperature of about 80°C (continuous).





- 11.05.04 Fiber optic cable shall be of loose tube design. Typically, fibers shall be housed in-groups of 6 (minimum) within gel-filled buffer tubes to protect against ingress of moisture and vibration. The tubes shall be manufactured with industry standard material like Poly-Butylenes Terathylate (PBT). They shall be colored for easy identification. Buffer tubes shall be approachable with industry standard tools and practices. The buffer tubes shall be stranded around the Central Strength Member utilizing Reverse Oscillating Lay (ROL). Blank fillers shall be used as necessary to maintain circular cable structure. The fiber optic cable shall withstand water penetration when tested with a one meter static head or equivalent continuous pressure applied at one end of a one meter length of filled cable for one hour. No water shall leak through the open cable end.
- 11.05.05 The central strength member of the cable shall be Fiberglass Reinforced Plastic (FRP) or other material with equivalent mechanical strength to provide both tensile and anti buckling strength to the cable.
- 11.05.06 In addition to central strength member, additional strengthening substance like aramid yarns shall be helically applied over the cable core to provide additional tensile strength to the cable.
- 11.05.07 The cable shall be of dual jacket & armoured. Inner sheath consists of a medium density polyethylene (MDPE) jacket extruded over the cable core. Two highly visible ripcords are placed under the jacket to aid in sheath removal. A co-polymer coated steel tape is corrugated and wrapped around the inner jacket to provide additional cable compression strength and rodent protection. The armor is covered with an outer black FRLS MDPE jacket. A ripcord is also placed underneath the armor for easy outer jacket removal.
- 11.05.08 Minimum bending radius shall be equal or more to 15 D (D= Diameter). A continuous strength member shall be provided for the entire length of the cables. Every tube and fiber shall be colour coded to provide easy identification. The outer sheath shall be marked to show fiber type and cable classification at suitable intervals.
- 11.05.09 The entire length of each cable shall be marked with the following items:
- Manufacturer's Name
 - Month and year of manufacturing
 - Coded description of the cable based on Telcordia's (Bellcore) SR-2014 Suggested Optical Cable Code (SOCC).
 - Sheath Identification Number
 - Sequential Length Marking in meter
 - A Telephone Handset symbol to distinguish communication from power cable as per NESC section –35 G.
- 11.05.10 Fiber optic cable shall provide a long life expectancy of minimum 25 years and shall meet the industrial standard of operation at temperature of 55⁰ C



and humidity to 100% without degradation to optical or mechanical performance.

- 11.05.11 Optical fiber used in the plant shall generally conform to the following specification.

SPECIFICATION FOR G.652 MONOMODE FIBER

ATTRIBUTES		VALUE
1.	Cladding Diameter	125 $\mu\text{m} \pm 1.0 \mu\text{m}$
2.	Cladding non-circularity	$\leq 1.0\%$
3.	Attenuation Coefficient at (a) 1290 nm to 1340 nm (b) 1525 nm to 1575 nm	$< 0.36 \text{ dB/km}$ $< 0.25 \text{ dB/km}$
4.	Chromatic Dispersion Coefficient at (a) 310 nm (b) 1550 nm	$< 3.5 \text{ ps/nm.km}$ $< 18 \text{ ps/nm}$
5.	Polarization Mode Dispersion (PMD)	$\leq 0.5 \text{ ps}/\sqrt{\text{km}}$
6.	Mode Field Diameter at (a) 1310 nm (b) 1550 nm	$9.2 \pm 0.4 \mu\text{m}$ $10.50 \pm 1.0 \mu\text{m}$
7.	Mode Field Concentricity Error	$\leq 0.5 \mu\text{m}$
8.	Proof Test	$\geq 1\%$
9.	Fiber Curl (ROC)	$\geq 4.0 \text{ m}$
10.	Macro-bend Test on Fiber at 1550 nm	$\leq 0.1 \text{ dB}$

- 11.06.00 Cable Assembly

- 11.06.01 Optical Fiber Environmental Splice Enclosure

Optical fiber environmental splice joint enclosures shall be re-enterable and rack / wall mountable. The interior splice case shall be equipped to mechanically accommodate single-mode optical fibers connected by the fusion method. Splice case shall be equipped to organize the splice trays and the required service loops of buffered incoming optical fibers and outgoing 'pigtailed' in such a way that allows each completed splice and associated optical fiber to be maintained in an unstrained configuration. Splice enclosure shall be dust and weather proof.

- 11.06.02 Fiber Optic Distribution Patch Panel





Fiber optic distribution panels shall be provided as required. The fiber optic distribution panels shall be of a standard wall mounted sheet metal enclosure type. Fiber optic distribution panels shall be equipped to secure optical fiber patch cables and pigtails to prevent damage during all operation and maintenance functions. In general splice enclosure are envisaged. However, If no optical fiber splice enclosures are implemented, than the fiber optic distribution panels shall be equipped with splice trays for storage and protection of fusion splice connections of single-mode fiber optic cable and pigtails. Each fiber optic distribution panel shall be fully equipped with 'SC' type bulk head connector sleeves or equivalent. Unused sleeve ports shall be equipped with reusable caps to prevent the intrusion of dust.

11.06.03 Pigtail and Patch Cord

All pigtails shall be factory SC-connectorized, and satisfy specified performance for optical links. All unused pigtails (including spares) shall be terminated with the connector to a bulkhead connector sleeve, protected by a reusable cap on the opposite sleeve port, to prevent the intrusion of foreign material or dust. All necessary connectorized pigtails shall be provided in the lengths required.

11.06.04 Fiber Optic Tool Kit

Fiber Optic Splicer, Terminator And Tool Kit Box

Bidder shall provide new unused tools comprise of Splicer and Fusion Jointer and tool kit comprise of cutter, stripper, polishing tool, handheld microscope, heat shrinkable sleeve, scissor, knife etc. as required for maintenance and commissioning.

11.07.00 Tests

Following minimum test as per any approved standards shall be carried out on the cables

- a. Attenuation And Dispersion Characteristics Tests
- b. Proof Tests
- c. Macro-Bend Resistance Test
- d. Mechanical Tests
- e. Low And High Temperature Cable Bend Test
- f. Impact Resistance Test
- g. Compressive Strength Test
- h. Tensile Strength Test
- i. Cable Twist Test
- j. Cable Cyclic Flexing Test
- k. Environmental Characteristics Test
- l. Temperature Cycling Test





- m. Color Permanence Test Cable Aging Test
 - n. Water Penetration Test
 - o. Lightning Test
 - p. Routine Test / Sample Test
- Site Test (Like Continuity & Attenuation)

12.00.00 ERECTION HARDWARE

This section provides the general technical guidelines for the erection materials for instruments. All erection materials shall be of good quality and conform to the operating environment of the corresponding instrument.

12.01.00 ELECTRICAL ACCESSORIES

Electrical conduit and associated materials shall conform to the requirements of the articles which follow :

a) Rigid Steel Conduit

- i) Conduits up to and including 25 mm shall be of 16 SWG and conduits above 25 mm shall be of 14 SWG. Minimum size of conduits shall be 19 mm.
- ii) Each piece of conduit shall be straight, free from blister and other defects and covered with capped bushing at both ends.
- iii) All rigid conduit couplings and elbows shall be hot dip galvanized rigid mild steel in accordance with ANSI C 80.1 and UL6. The conduit interior and exterior surfaces shall have a continuous zinc coating with an over coat of transparent enamel or zinc chromate. Conduits shall be furnished in standard length of 3 meters, threaded at both ends.
- iv) All conduit fittings shall conform to the requirements of ANSI C 80.4 and UL-514 where these standards apply.

b) Flexible Conduit

- i) Flexible conduit shall be of three layer construction of very high quality of lead coated steel. Outside and inside layer shall be reinforced with heat resistant material.
- ii) Lead coating outside and inside of the conduit steel surface shall provide a non-corrosive characteristic particularly in acidic atmosphere. Besides flexibility, this shall be strong enough to stay at the desired profile without support and shall be durable and strong so as to offer sufficient mechanical protection. It shall also be fully liquid dust and air tight and shall withstand a continuous hydraulic pressure up to 2 Kg/Sq. cm and temperature up to 200 °C.

c) Special Fittings

