

ANNEXURE-IV

**DATA SHEET
FOR
FIRE WATER STORAGE TANK & HYDRO-PNEUMATIC TANK**

Description	:	Hydro-pneumatic Tank	Type	:	Vertical Cylindrical
Installation	:	Outdoor			
Fabricated	:	At shop	Water space capacity	:	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.)	:	To be indicated by Bidder			
Shell (for all Houses)	:	Bidder to indicate			
Dished ends	:	Bidder to indicate			
Corrosion Allowance	:	2.0 mm (Min.)			
Joint Efficiency Factor	:	0.85			

Description	:	Fire Water Storage Tank	Type	:	Vertical Cylindrical
Installation	:	Outdoor	Nos.	:	1 (one) with 2 (two) compartments
Fabricated	:	At shop	Water space capacity	:	To be indicated by Bidder. However, minimum capacity of the tank shall be 5000 m ³ .
Construction	:	Welded	Working Pressure	:	Atmospheric

Steel	:	As per IS-2002 Gr. 2A	Design & Testing Code	:	IS-2825/ASME Section VIII Div. I
(*) Plate Thickness (Min.)	:	To be indicated by Bidder			
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/ IS 2825.

ANNEXURE-V

**DATA SHEET
FOR
PIPING, FITTINGS, VALVES AND SPECIALTIES**

A. PIPING AND FITTINGS

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

- Note :
- To prevent soil corrosion buried pipes shall be properly lagged with two coat and corrosion protective tapes of minimum thickness of 4 mm (in two layers) of coal tar type as per AWWA C 203 / IS :15337.
 - Over-ground pipes normally empty but periodically charged with water, foam system applications & compressed air shall be galvanized as per IS : 4736. These pipes shall be provided with one coat of primer and three coats of chlorinated rubber paint.

3.00.00	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.			
4.00.00	Construction	←----- ERW -----→ (i) (ii) (iii) (iv)			
5.00.00	Joints	Butt-welded for size 65 mm NB & higher as per ANSI B 16.9 and socket welded for sizes up to 50 m NB as per ANSI B16.11	Screwed flange as required for dismantling purposes for sizes 65 mm NB & above as per ANSI B 16.5 and screwed socket for sizes 50 mm 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 contractor shall provide proper zinc paint at the point of welding.		
6.00.00	Fittings				
	Ratings/Wall thickness	Minimum thickness to match with that of pipe for pipe size 65 mm NB and above. For pipe size above 150 mm NB, minimum thickness shall be 6 mm. For pipe size 50 mm 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 : 2500-2700 litre/min at 7 Kg/Sq.cm
4. Rotation of body
 - a) Horizontal : 360°
 - b) Vertical : + 105°- 20°
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

ANNEXURE-VI

**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

ANNEXURE-VII

**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-VIII

**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 Deg.C to + 60 Deg.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	:	Yes
15.00	Detector Base	:	Mounting box (if applicable) Double Compression gland.
16.00	Coverage area	:	Considering maximum spacing as per

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 FOC/FM/UL/TAC/LPA	:	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. 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 70 °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
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

ANNEXURE-IX

Technical Specifications for Nitrogen Gas Injection System for Oil Filled Transformer

1. Operation Controls

The system is to be provided with automatic control for fire protection and fire extinction, beside automatic control remote electrical push button control on control box and local manual control in the fire-extinguishing cubicle is provided.

2. System Activating Signals

Transformer isolation through master trip relay or circuit breaker (HV & LV in series). Besides, two electrical signals to be provided in series, for activating the system as under:

- i) For prevention :
Differential relay
Buchholz Relay paralleled with pressure relief valve or RPRR.
- ii) For Extinction :
Fire Detector
Buchholz Relay paralleled with pressure relief valve or RPRR.

3. System Equipment

- A. Fire extinguishing cubicle (FEC) to be placed on plinth at about minimum 5 meter away from the transformer, shall consist of:
 - i) Nitrogen cylinder with regulator and falling pressure electrical contact manometer.
 - ii) Oil drainpipe with mechanical quick drain valve.
 - iii) Electro mechanical control equipments for oil drain and predetermined regulated nitrogen release.
 - iv) Pressure monitoring switch for back up protection for nitrogen release.
- B. Control box with activating, monitoring devices and line faults indicators (to be placed in the control room).
- C. Pre-stressed non-return valve (PNRV) to be fitted in the conservator pipe line, between conservator and buchholz relay operating mechanically on transformer oil flow rate with electrical signal for monitoring.
- D. Fire detectors to be fixed on transformer tank top cover for sensing fire.
- E. Signal box to be fixed on transformer sidewall for terminating cable connections from fire detectors and PNRV.

4. Other Requirements for System Installation

- A. Oil drain and nitrogen openings with gate valve on transformer tank, flanges with dummy piece in conservator pipe and fire detector brackets on transformer top cover.
- B. Spare potential free contacts for system activating signals i.e. Differential relay, Buchholz relay, PRV/ RPRR, Transformer isolation.
- C. Pipe connections between transformer to fire extinguishing cubicle and fire extinguishing cubicle to oil pit.
- D. Cabling on transformer top cover. All fire detector to be connected in parallel and inter cabling between signal box to control box and control box to FEC.
- E. Plinth for FEC, Oil pit with capacity as 10% of total oil quantity of transformer.

5. Technical Details

Fire Extinction Period

On Commencement of Nitrogen injection: Maximum 30 seconds

On system activation up to post cooling: Maximum 3 minutes

Fire Detectors heat sensing temperature: 141 ° C

Heat Sensing Area: 800 mm radius

Pre-stressed non-return valve setting for operation: Minimum 60 litre per minute.

6. Power Source

Control Box: 220V DC

Fire Extinguishing cubicle: 240V AC, 40W

7. Cabling

Fire survival cables 4 C x 1.5 mm ² for connection of fire detectors in parallel.

Fire survival cable 12 C x 1.5 mm ² for connection between transformer signal box/ marshalling box to control box and control box to FEC.

Fire survival cable 4 C x 1.5 mm ² for connection between control box to DC supply source and FEC to AC supply source, signal box/ marshalling box to pre-stressed non-return valve connection on transformer.

SCOPE OF SUPPLY & INSTALLATION ACTIVITIES FOR NITROGEN INJECTION FIRE PROTECTION SYSTEM FOR TRANSFORMER

A. System Equipments

1. Fire extinguishing cubicle with base frame and containing oil drain assembly, nitrogen cylinder, electro mechanical control unit for oil drain and nitrogen release, pressure monitoring switch for back up protection for release of nitrogen, detectors necessary for monitoring system, flanges with gate/ butterfly valves on top panel for connecting pipe connections from transformer, panel lighting etc.
2. Control box for monitoring system operation, automatic control and remote operation, with alarms, indication light switches, push buttons, audio signals, line fault detection suitable for tripping and signaling on 220V DC supply.
3. Pre-Stressed non-return valve (PNRV) working mechanically on transformer oil flow rate, with proximity switch for remote alarm indication and with visual position indicator.
4. Required no. of fire detectors rated for 141°C for heat sensing each fitted with two number cable glands.
5. Signal box for terminating cable connections from PNRV and fire detectors.

B. Other Material Requirements

1. FRLS cable 4 C x 1.5 mm² for fire detector connections.
2. Fire survival cables 12 C x 1.5 mm² for connections between transformer - control box.
3. Fire survival cables 4 C x 1.5 mm² for signals from relay panels to control box, panel lighting, PNRV connections on transformer etc.
4. Pipe connections between transformer and FEC, ERW class 'C' pipes with bends, flanges, other fittings and gate/ butterfly valves as required.
5. Pipe connections with fittings for connection between FEC – oil pit.
6. Mandatory Spares: 1 No. spare N₂ cylinder for each sub station 3 No. Heat Sensors for each system 1 set Hose pipes with fittings.

C. Installation of System

1. Civil Work

- i) Plinth for fire extinguishing cubicle.

2. Pipe Connections between Transformer, FEC and Oil Pit

- i) Oil drainpipe connections between outlet valve provided on the transformer tank and the flanges provided on FEC top panel.
- ii) Drainpipe connections between oil drainpipe bottom (in FEC) to the oil pit.

- iii) Nitrogen injection pipe connections between inlet openings on transformer tank and flange provided on FEC top panel.

3. Cabling

- i) Connecting all fire detectors in parallel and terminating in signal box, using fire survival cables 4 C x 1.5 mm² cable.
- ii) Connecting PNRV to signal box, using Fire survival cables 4C x 1.5 mm²
- iii) Connections to FEC for 230V AC single-phase panel light supply, using fire survival cables 4C x 1.5 mm²
- iv) Connections from relay panel to control box using fire survival cables 4Cx1.5mm²
- v) Connections from DC source to control box directly or through DC-DC connector, using fire survival cables 4C x 1.5 mm²
- vi) Connections between signal box to control box and between control box to FEC using fire survival cables 12 C x 1.5 mm²

D. Pre-Commissioning Tests

Pre-Commissioning tests shall be carried out jointly by system manufacturer and the purchaser or his representative prior to commissioning the system.

Note: This system shall be provided in addition to the Spray System for the transformers