भारत हैवी ईलैक्ट्रिकल्स लिमिटेड

BHARAT HEAVY ELECTRICALS LIMITED

पारेषण व्यापार अभियांत्रिकी प्रबंधन

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

प्रलेख संख्या DOC. No	TB-377-552-032	Rev. No.	00		बनाया/ Prepared	जांचा/ Checked	स्वीकृती/ Approved
TYPE/ प्रकार OF DOC.	**TECHNICAL SPECIFICATION**			हस्ता. / SIGN			
TITLE/ शीर्षक				नाम / NAME	**TDT**	**SKS**	**AS**
FIRE FIGHTING SYSTEM (SWITCHYARD)				दिनांक/ DATE	**27.09.17**	**27.09.17**	**27.09.17**
				समूह/GROUP	**TBEM**	W.O. No	**83011**

ग्राहक/ CUSTOMER	**TELANGANA STATE POWER GENERATION COMPANY (TSGENCO)**
परामर्शदाता/ CONSULTANT	**DEVELOPMENT CONSULTANTS PVT. LTD. (DCPL)**
परियोजना/ PROJECT	**1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD**

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	To	TBEM	TBMM	TBQM	Vendor
	Copies	1	1	1	4

CHECKLIST FOR TECHNICAL OFFER

Along with the Technical Bids of the offers, the Bidder should submit this checklist confirming the inclusion of the enclosures as listed below. (Shall tick as ✓)

Sr No	Documents to be enclosed	Bidder to check & confirm
1	Copy of Unpriced BOQ as enclosed in the Technical Specification to confirm that bidder has quoted in the same format (Schedule-2 of Section-5)	
2.	Schedule of Technical Deviation format duly signed. (Schedule-1 of Section -5)	
3.	Supporting documents as asked in the Technical PQR.(Annexure-I)	
4.	Checklist of Technical parameters as per Section-5 duly filled and signed.	Not Applicable

NOTE: - If the Bidder fails to submit any of the documents as asked in the above check list, their bid is likely to be rejected / not evaluated.

The above checklist is verified for:-

NIT Ref No. :

Name of Equipment :

Name of Project :

Name of Bidder :

Signed with Seal of Bidder.

Date ……..

ANNEXURE - I

PRE- QUALIFYING CRITERIA (PQR) FOR BIDDERS

Fire Detection and Protection System:

The Bidder is required to meet the pre-qualification requirement for Fire detection and protection system as per criteria stipulated below:

- The bidder should have designed, co-ordinated with the manufacturer, supplied, erected, tested & commissioned at least one number fire protection system of each type described in (i), (ii) & (iii) below in installations such as power plants, sub-stations, refineries, fertilizer plants, oil storage installations, LPG storage or other industrial or commercial installations during the last ten (10) years as on the date of bid opening.

i) Hydrant type fire protection system comprising outdoor & indoor pipe work, hydrant valves, hoses with branch pipes, nozzles, hose boxes and other accessories including instrumentation & control.

ii) Automatic high velocity water spray type fire protection system for electrical equipment such as Transformers, reactors. Each system shall comprise of pipe work, sprinkler/ nozzle array, heat detector network and all other accessories including instrumentation & control.

iii) Smoke detection and alarm System.

iv) Vendor should have successfully executed similar job having order value not less than Rs. 72 lakh (combined value comprising of hydrant, spray and detection system) during last ten years from original scheduled date of bid opening.

v) In support of the same the bidder should submit copy of Purchase order/work order along with completion certificate from buyer/ customer.

Note: Bidder's offer will be technically acceptable subject to final acceptance of vendor by ultimate customer as approved supplier.

SECTION 1

INTENT, SYSTEM REQUIREMENT, DESIGN CRITERIA AND SCOPE

1.0 INTENT OF SPECIFICATION

1.0.0 This specification is intended to cover following activities and services in respect of all the equipment of the **Fire detection and protection System to be provided for 400 kV Substation of 1 x 800 MW Kothagudam Thermal Power Station, Khammam Distt., Telangana** of **Telangana State Power Generation Company (TSGENCO).**

i) Detailed design of all the equipment and equipment system(s).
ii) Complete manufacturing including shop testing.
iii) Providing O & M manuals as per specified format etc. for owners/purchaser's review, approval and records.
iv) Packing and transportation from the manufacturer's works to the site including customs clearance/port clearance, if required.
v) Receipt, storage, preservation and conservation of equipment at site.
vi) Fabrication, pre-assembly, if any, erection testing and putting into satisfactory operation all the equipment including successful completion of trial operation.
vii) Performance and Guarantee tests after successful completion of trial operation.

1.0.1 The requirements specified under SECTION 2, SECTION 3, SECTION 4 & SECTION 5 of the specification shall be considered as part of this section. In the event of any conflict between the various sections/sub-sections of this specification, SECTION 1 shall prevail. *TSGENCO contract specification attached with SECTION 2 shall be referred strictly and requirements of the same regarding systems applicable for switchyard part shall be provided by the contractor.*

1.0.2 It is not the intent to specify herein all the details of design and manufacture. However, the equipment and the system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to Purchaser/ Owner, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgment is not in full accordance herewith.

1.0.3 **The Contract shall be on unit rate basis for the quantities furnished by BHEL. Variations (upward/ downward) in quantities during contract stage shall be settled on the basis of unit rates furnished in the bid.**

1.0.4 **During contract stage, quantities of various items of BOQ may vary and same rates will be applicable so far the resultant variation in total contract value is within ±20%. Variations beyond ±20% shall be negotiated mutually.**

1.0.5 The Bidder shall deem to have understood completely all the tender drawings and documents and quoted accordingly.

1.0.6 **Deviation:** There shall preferably be no deviation on technical specification. The bidder shall sign and stamp the "Certificate for No Deviation" enclosed in Schedule-2, Section-5 towards confirmation. Except for these deviations/variations covered under Deviation Schedules which

are accepted by the Purchaser before the award of the Contract, it will be the responsibility of the Bidder to fully meet the intent and the requirements of the specification within the quoted price. *Deviations in any other form including clarifications / assumptions / etc will not be considered and it will be construed that the bid conforms strictly to the specification*.

1.0.7 The Bidder to note carefully that the parameters, estimated capacities of equipment indicated and the tender drawings in the specification are for the guidance of the Bidder. The system shall be designed as per relevant standards/ codes and exact capacities.

1.0.8 It is the responsibility of the successful Bidder to obtain necessary approval/ clearance from statutory organizations wherever applicable for the equipment/ systems under the scope specified.

1.0.9 The term '**Owner**' appearing in this specification shall refer to **Telangana State Power Generation Company (TSGENCO),** the term '**Purchaser'** shall refer to **BHEL** and the term '**Contractor**' shall refer to the **successful Bidder**.

2.0 FIRE FIGHTING REQUIREMENTS FOR VARIOUS AREAS

The makes/models and technical features offered for various firefighting system components/ equipment shall comply with the standards of TAC/ BIS/ UL/ VDs and FM / NFPA/ FOC as applicable The key elements of fire protection cum detection scheme and the related areas are presented as under:

System Area	Areas Protected
Hydrant System	i. Switchyard Control Building ii. Outdoor switchyard
HVW Spray System	i. 125 MVAr Bus reactors – 1 no.
MVW Spray System	i. Cable Spreader room of Switchyard control building
Addressable Fire Detection & Alarm System	i. Switchyard Control Building (of BOSCH make)
Portable Fire Extinguisher	i. Switchyard Control Building

- ***Data Sheets pertaining to all above five nos. system areas are provided as enclosures to section – 5 of this specification. Contractor shall adhere to all details/ requirements mentioned in these data sheets in strict manner.***

3.0 SYSTEM REQUIREMENT & DESIGN PHILOSOPHY

This system shall be designed to provide fire detection and protection services for Switchyard and its control Building. Design criterion shall be based on "**Ordinary Hazard Occupancies**" classification as described in Tariff Advisory Committee's (TAC) guidelines. All equipment or systems in the designed fire detection cum protection arrangement shall be completely in compliance with the regulations of Tariff Advisory Committee (TAC) of India/ Loss Prevention

Association (LPA) / National Fire Protection Association (NFPA)/ LPCB/ VDs.

3.1 DETECTION SYSTEM

a) The system shall consist of addressable manual call points, addressable intelligent automatic detectors of various types, addressable interface units, microprocessor based fire alarm panel as required for the complete system of **"BOSCH"** make with associated cabling and cabling accessories, fire sirens, etc.

b) All detection and sensing devices forming an integral part of the microprocessor based, addressable, intelligent fire detection and alarm system shall be approved by UL/ FOC/ Any other internationally recognized body acceptable to the Owner.

c) The number of detectors, spacing and their locations shall comply with NFPA 72E/ BS 5839, Part 1/ IS 2189/ Rules for fire alarm system. The actual quantity of detectors required, taking into consideration the obstruction due to floor beams, air movement, air velocity, ceiling obstruction etc., so as to obtain complete coverage, shall be worked out based on the final drawings of the control building during detailed engineering. However area coverage per detector shall be 25 m^2. Also detector spacing shall be as per 30 air changes per hour in the rooms.

d) Addressable multi-sensor type smoke detectors shall be provided in all areas of Control Building except for the Battery rooms, AHU room & Pantry where Addressable corrosion proof rate of rise of heat detector with fixed temperature element shall be provided.

e) Areas such as Control/ relay room, office room, shift manager room and maintenance staff room will have false ceiling.

f) In air conditioned areas of control room where false ceiling is present, the detectors shall be installed both above and below false ceiling. For above false ceiling detectors, a response indicator shall be provided below false ceiling for the purpose of detector's alarm status indication. Multisensor type smoke detectors shall be used for both above and below false ceiling areas of AC rooms and other areas of control room.

g) Cable spreader room shall be provided with addressable multi-sensor smoke detector & non-electrically operated fibre optic linear heat sensor cables. The complete area shall be covered by cross zoning method. LHS cables shall be provided in top tray, bottom tray & in alternative trays. Suitable supports to clamp this cable shall be provided. Fibre optic LHS cable shall be laid in cable galleries as per Cl. No. 6.5.2 of TAC (Rules for Fire Alarm System).

h) Manual call points shall be provided as per the guidelines listed in NFPA 72E/IS 2189. Customer specification provided as annexure to section shall be referred for specification of MCPs to be provided.

i) Manual call points shall be provided in switchgear room & control/ relay room & corridors.

j) Manual call points with flame proof enclosure shall be located at each floor of control building such that no person needs to travel more than 30 meters from any point within the premises, in order to give an alarm. Manual call points shall be located on the exit routes and in particular on floor landings of stair cases and near exits from the building/ area.

k) All the detectors in the switchyard control building shall be looped into a Fire Alarm Panel situated in the switchyard control building.

l) **Fire Alarm Panel of hot redundant microprocessor based,** analogue addressable type shall be dedicated to Switchyard control building which shall evaluate the signals received from the detectors, transmit the fire or trouble alarms (audio-visual) to prearranged points, supervise and monitor the complete fire detection circuits and initiate the shutdown of air-conditioning equipments. One no. spare loop card shall be provided in the FAP as hot standby.

m) The fire alarm panel shall be designed to include all the standard features and shall also accommodate programmed activation of various interlocks with fire protection system and other associated systems and programmed activation of sequence of events to be carried out in case of fire in any particular protective area. Facilities shall be provided on the fire alarm panel for simulating fire conditions, sensitivity adjustment, isolation of detectors etc. from the panel.

n) All the circuits from the detectors to the panels and the circuits from the panels to the actuating devices shall be closed loop type and shall be supervised for open and short circuiting.

o) Fire alarm control panel shall have filters to ignore false alarm and increase sensitivity to real fire from sensors and provision for automatic re-calibration of sensitivity levels of over/ under sensitive detectors. The sensitivity of each detector should be automatically raised if detectors are gradually polluted due to dust and dirt entering inside the detector. If detectors are more polluted the control panel shall give a warning. The trouble report shall indicate the location of device requiring service.

p) All devices shall be individually identifiable for its type, its zone location, and alarm set value, alarm and trouble indication by a unique alpha numerical label.

q) The detectors shall be self compensating for ambient temperature and humidity. Incipient fires sensed by these detectors shall trigger an alarm at the FAP. The detectors shall display a steady LED when in the alarm state. The LED shall flash when in standby or normal mode. Factors like beam depth and area separation criterion shall also be implemented in deciding coverage of each of the detectors.

r) Each floor shall be provided with one electronic hooter besides the staircase.

s) All detectors and interface units for detectors which do not have response indicators shall be provided with local LED response indicators which will light up steadily when the detectors sense a fire and operates.

t) The Batteries shall be of maintenance free sealed lead-acid type. The battery shall supply the normal power requirements for a period of 48 hours from the instant of charger AC supply failure, after which sufficient capacity would still be available to provide full load operation for atleast 30 minutes.

u) The detector cable and other control cable shall be armored, screened and twisted pair FRLS type which shall be cleated to roof/ wall surface.

v) Cable shall be 1100V grade, multicore, annealed, high conductivity stranded copper conductor, extruded PVC insulated, laid up inner sheathed, galvanized steel strip /wire armoured, outer FRLS extruded PVC sheathed cable as per IS-1554-Part - I, 1988.

- **INTERFACES**

Fire detection & alarm system will have three interfaces-

i) Interface with air conditioning system of switchyard control building to shut down the AHU equipment in building.

ii) Interface with fire dampers to close it in case of fire.

iii) Interface with Main fire alarm panel in the power plant main control room.

Distance between main plant control room & switchyard control building is **750 m** approx. Optical fiber cable shall be used to wire switchyard FAP with main plant FAP located in main plant control room. Switchyard fire alarm panel will be put in a ring topology with other panels of main plant FDA, hence necessary network cards requirement shall be ensured.

3.2 Protection System

3.3.1 Hydrant System

a. Hydrant systems for the switchyard area shall be tapped off from main hydrant header for main plant. Double feed will be provided to the switchyard hydrant ring mains from the tap-off point. Tap-off coordinates for switchyard hydrant system shall be provided by main plant fire pipeline as indicated in the switchyard layout drawing provided as enclosure to sec-5 of this specification.

b. **Hydrant system is designed for Ordinary Hazard Classification.**

c. An underground ring shall be formed around the switchyard. Isolation gate valves shall be provided in the ring main so that a portion of the loop can be taken out for maintenance without any loss of system in the balance part. Hydrants valves & water monitors shall be provided in the switchyard fire water piping network as per requirement inline with TAC guidelines. Hydrant risers in staircases shall be provided with isolation valves.

d. The Hydrant System of Fire Protection shall consist of underground pipe that will feed water to a number of hydrants valves/ monitors in switchyard area.

e. System shall be designed in a way so that minimum terminal pressure of 3.5 kg/cm^2 can be maintained at the farthest/remotest hydrant point of the switchyard.

f. All the outdoor & indoor hydrants shall be provided with a front glass type hose box carrying 2 nos. 15 mtrs hose along with branch pipe coupling and nozzle.

g. All hydrant pipe ring mains/ pipe lines shall be routed underground duly covered with coating and wrapping as per specification. Road, Rail or pipe trench crossing shall be through RCC Hume pipes duly covered with coating and wrapping as per specification. Hume pipe for road crossing shall be NP3 class and that for rail crossing shall be NP4.

3.2.1.0 Specific Data

i) All hydrant valves shall be of 63 NB dia. Single headed, oblique type having Stainless steel

construction conforming to IS: 5290, Type-A.

ii) Hoses shall be rubber impregnated woven jacketed type conforming to IS: 636 Type-II. Branch pipes shall be straight jet type conforming to IS: 903, MOC-SS.304.

iii) Water monitor shall conform to IS: 8442 of fixed type.

iv) **PIPING**

Specific features of piping for Fire Protection System shall be as follows: -

1. Pipe thickness shall be 6.35 mm for sizes 200 to 350NB, 7 mm for 400 NB and 8 mm for sizes 450 NB and above.
2. The pipe protection shall be as follows: To prevent soil corrosion, buried pipes shall be properly lagged with 4mm thick wrapping and coating corrosion protection tape as per IS: 10221.

A. Above ground piping

a. Material GI for spray system after deluge valve / MS for other system

b. Standard (Pipes) IS 1239/ IS 3589

c. Standard (Fitting) IS 1239 part II/ TAC

d. Type of joint Welded / Flanged

e. Type of protection: Painted (Two coats of Grey zinc primer. Two coats of enamel paint of 75 microns thickness with color shade conforming to IS: 5).

f. Class Heavy

B. Underground piping

a. Material MS

b. Standard (Pipes) IS 3589/ IS 1239 Part – I

c. Standard (Fitting) IS 1239 part II for fittings NB 150 & below & Fabricated from parent pipes for NB 200 & above.

d. Type of joints Welded

e. Type of protection IS 10221/ IS 15337-2003.

f. Class Heavy

C. FITTINGS

i. Unless otherwise specified all elbows/ bends shall be long radius type.

ii. All the fittings the material shall be mild steel shall be IS 1239 Part-II up to 150 mm dia and above shall fabricated from parent pipe in addition to following:

- Unless otherwise specified all elbows/ bends will be long radius type.
- The material will conform to IS-1239 part-II heavy grade /malleable iron as per IS: 1879 Part I to X

iii. Fittings (Normally filled with water): Elbow, Tee & Reducers.

- Screwed Fittings up to 50 mm diameter
- Butt welded fittings 65 NB to 150 NB
- Site fabricated from parent pipe and fabricated as per BS: 2633/ BS: 534
- (90 degree elbow 3 cut, 4piece construction. 45 deg. elbow 2 cut, 3 piece construction)
- Slip-on flanges/blind flanges as per IS: 2062 Gr.A, Dimension/ Drilling standard as per ANSI B 16.5/ IS-1538 Table IV & VI F/F.
- SS-304 for Bolt & Nuts.

D. VALVES

i) All isolation valve/cut-off valves shall be CI as per IS: 210, FG 260 body, with 13% Cr. SS stem & seating surfaces of gate valves as per guidelines/requirements specified in TAC. All butterfly valves shall be CI as per IS: 210, FG 260 body, SS to AISI: 410 stem & seating surfaces of gate valves as per guidelines/ requirements specified in TAC manual. All globe/ check valves of sizes 50 NB and below shall be gunmetal valves conforming to IS: 778. These valves shall have screwed ends.

ii) All check valves of sizes 65 NB and above shall carbon steel valves conforming to BS: 1868: all globe valves of sizes 65 NB & above shall be CI valves confirms to BS: 5152 Valve shall have provision of locking arrangements in open and closed position. All the flanges & counter flanges will conform to IS-2062 Gr. A Slip on (Dimension/Drilling as per ANSI B 16.5 Cl. 150 /IS: 1538) All valves shall be of Minimum class of 150. Strainer Body shall be as per IS: 2062 (tested).

iii) Overground pipes normally empty, but periodic charge of water and for detector line for spray system shall be of mild steel galvanized pipes as per IS: 1239, Part-I medium grade (for pipes of sizes 150 NB and below) or IS: 3589, Fe 410 grade (for pipes of sizes 200 NB and above).

iv) All fitting used in GI piping shall be threaded type. Welding shall not be permitted on GI piping.

v) All piping system shall be capable of withstanding the maximum pressure (1.5 times of the maximum working pressure) arising from any condition of operation and testing including water hammer effects.

vi) Cast iron gate/sluice valve will be used for isolation of flow in pipe lines and shall be as per BS-5150. Valves shall be of rising spindle type. PN 1.6 class.

vii) Cast Iron non-return valves shall be swing check type. Valves will have a permanent "arrow" inscription on its body to indicate direction of flow of the fluid. These valves shall generally conform to IS: 5312.

3.3.2 HVW and MVW Spray System

- HVW Spray system is envisaged for reactors, 125 MVAr – 1 no.
- MVW Spray System is envisaged for Cable spreader room in switchyard control building.
- Tap-off point for HVW & MVW spray system is indicated in switchyard plan layout enclosed.

I. General

a. System shall be pressurized continuously to normal working pressure up to the Deluge valves.

b. It shall consist of spray main tapped from the main spray header of power plant, Deluge valve, Isolation valves, Y-type strainer, spray nozzles/ projectors, spray nozzles piping network, detection system, instrumentation, junction boxes, cables etc.

c. Switchyard Spray System shall be tapped off the main spray header of power plant. One no. tap off point will be as indicated in switchyard layout provided for HVW spray system & MVW spray system.

d. Minimum pressure at these two tap-off points will be 6 Kg/ cm^2.

II. Design Criteria

a. The system for HVW spray system shall consist of water supply system, suitable number of spray nozzles, deluge valve, quartzoid bulb detectors, strainers, pipes and necessary valves, instrumentation, junction boxes, cables etc.

b. The system for MVW spray system shall consist of water supply system, suitable number of spray nozzles, deluge valve, LHS cable, strainers, pipes and necessary valves, instrumentation, junction boxes, cables etc.

c. Minimum running water pressure at any projector/spray nozzle shall be not less than 3.5 Kg/ Sq.cm and not greater than 5.0 Kg/ sq.cm.

d. For MVW spray system, minimum running water pressure at any projector/spray nozzles shall not be less than 2.8 Kg/ sq.cm for cable galleries.

e. Design discharge density shall be as per the rules of water spray system of Tariff Advisory Committee (TAC). Discharge density for HVW spray system shall be 10.2 lpm /sqm and that of MVW Spray system shall be 12.2 lpm/ sqm.

f. In cable spreader room the water spray shall cover the exposed area of all the trays and racks.

g. Gate valve shall be provided at upstream of each of the deluge valve. The size shall be same as that of the deluge valve.

h. Fast acting butterfly valves will be provided in the bypass line of deluge valve, so that this valve can be kept closed and can be operated manually, if there is any malfunction of deluge valves.

i. In bypass line of deluge Valve, a globe valve shall be provided.

j. Water motor gong shall form part of accessories to be provided with deluge valve. Local audible alarm is produced by water motor gong.

k. A strainer ('Y' type) shall be provided at upstream of deluge valve.

l. Strainer wire shall be SS (AISI 316), 30 SWG, and 30 mesh. Strainer area shall be at least 4 times the pipe cross-section at the pipe inlet, pressure drop across strainer in clean condition shall not exceed 1.0 kg/cm^2 at design flow of deluge valve.

m. Limit switch (open & close) for Deluge valves shall be provided for upstream & downstream isolation valve.

n. Pressure gauges at both upstream and downstream of deluge valves, and in the detector pipe network shall be provided.

o. Pressure switches shall be provided in spray and detector piping to exhibit "FIRE" and "SPRAY ON" annunciations and as well as for interlock.

p. Wet type detection shall be provided for actuating the Deluge system. QB detectors are set at 79ºC. At the preset temperature the detector burst and releases the pressure with the detector piping network around the reactor & actuating the flow of water across deluge valve.

q. Non-electrically operated fiber optic LHS cable shall be used for detection in MVW spray system of the cable spreader room. Detection by LHS cable shall be in the following manner:

i. This 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.

ii. The optical fibre shall be connected to the detector unit in a single continuous loop to ensure redundancy and full coverage of the protected zones even if the cable is broken/cut/damage at one point.

iii. The fire or excessive temperature condition shall be sensed by the fiber. 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. FAP shall process the signal from smoke detectors of the cable spreader & actuates the DV in case of any fire.

r. MVW system 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 of droplets of water. The droplet size shall be designed so as to achieve efficient cooling of the flame zone by evaporation and also sufficiently large to penetrate the flame so as to reach and cool surfaces heated by the fire.

s. Pipe structure for pylon support around reactor shall be fixed to the bottom of sump with the help of Anchor fasteners. The structure will be in two pieces with a flanged joint at around Zero level above chequered plate. Pipe size for pylon, size of Anchor fasteners etc. shall be adequate for the support to provide sufficient rigidity against vibration & load during operation.

t. Sprayers/ projectors/ nozzles shall be arranged in the form of a ring around reactor and number of such rings/ tiers shall be decided considering maximum gap between two (2) consecutive tiers of rings shall be as per TAC. The distance of the deluge valves from the protected equipment shall be 6 m (min.) in line with TAC manual.

u. All Spray pipe mains/ pipe lines shall be routed underground duly covered with coating and wrapping as per specification. Road, Rail or pipe trench crossing shall be through RCC Hume pipes duly covered with coating and wrapping as per specification. Hume pipe for road crossing shall be NP3 class and that for rail crossing shall be NP4. Underground pipe shall be provided with coating and wrapping as per specification and IS: 10221 /TAC norms.

v. As per the modern practice of fire detection system, all Deluge Valves (DV's) will be networked to Micro-processor analogue addressable Fire Alarm Panel.

w. Facility for manual initiation of deluge valves locally, through hand operations (manually by

operating the push button) shall also be provided.

x. Each of the outdoor deluge valves and its accessories shall be provided with deluge valve housing. (As per TAC).

y. Local control panel for deluge valves shall be provided. Remote actuation of the deluge valve shall be provided.

3.3.3 Portable Fire Extinguishers

- The switchyard control building including cable spreader room shall be provided with:
  a. Carbon dioxide of 4.5 kg capacity portable fire extinguisher conforming to IS 15683.
  b. Dry chemical powder type 6 kg capacity portable fire extinguishers conforming to IS 15683.
  c. Trolley mounted 22.5 kg CO_2 extinguisher conforming to IS 2878 shall be provided for control room.
  d. Trolley mounted 50L mechanical Foam type extinguisher shall be provided for protection of each of the LT transformer located inside cable spreader room.
- For switchgear rooms a combination of adequate number of DCP and CO_2 extinguishers shall be provided.
- Selection of type and location of installation of fire extinguishers for the various rooms of the switchyard control building shall be done in accordance with TAC guidelines.

3.4.0 Mandatory Spares

Mandatory spares items shall be provided as per BOQ mentioned in Annexure B.

4.0 SCOPE OF SUPPLY & SERVICES

4.1. <u>Bill of Quantities as Annexure - B to Section - 1 clearly indicates list of material and its quantity required at site.</u>

4.2. <u>Bidder is required to quote in his offer for the supply of items required and their ETC listed in Annexure - B.</u>

4.3. The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Special Conditions of Contract, Technical Specifications, and Drawings.

4.4. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The exact quantity of each items shall be finalised during detailed engineering.

4.5. A rate or price shall be entered against each item in the priced Bill of Quantities. Cost of items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.

4.6. The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bill of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.

4.7. General directions and descriptions of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant sections of the Contract documentation shall be made before entering prices against each item in the priced Bill of Quantities.

4.8. Miscellaneous items like hardware, fixtures etc. shall be deemed to be included under the relevant BOQ items and bidders shall consider the same while quoting for BOQ items.

4.9. Exact requirements shall be worked out during detailed engineering after award of contract. The scope of the work under the contract shall be deemed to include all such items, which although not specifically mentioned in the bid documents and/or in the bidder's proposal, but are required to make the equipment/system complete for its safe, efficient, reliable and trouble free operation, unless the same is specifically excluded from the Bidder's scope of work.

4.10. Bidder shall also consider the following while quoting for the system:

i) Power & Control cables for fire protection system (except for cable for detection and alarm system & FO cable) will be supplied on free issue basis to contractor. BHEL shall procure various sizes of cables (as per Annexure 'A' of this section) for the complete requirement of sub-station. Contractor shall have to choose their cables from the available sizes only and necessary modifications in their equipment for termination of these cables shall be made by contractor.

ii) Since laying & termination of all power & control cables is in contractor's scope, supply of cable accessories such as lugs, glands, cable tags & markers etc. shall be included by the bidders in their offers alongwith supply of cable (2C X 1.5 sq.mm, FRLS, twisted pair, armoured Cu cable) for fire detection and alarm system.

iii) Necessary cable trays will be supplied on free issue basis to the contractor, however necessary hardware for fixing the same on walls or elsewhere shall be included by the bidders in their offers.

iv) Earthing material viz. GS flat & wire will also be supplied on free issue basis to contractor; however requirement shall be given by the bidders in their respective bids.

v) Bidder shall ensure that sufficient quantities of commissioning spares are made available for timely completion of commissioning of the system. The bidder shall furnish a list of Commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the bidder.

vi) The contractor shall lay the underground piping required for hydrant system and also shall construct RCC pedestals & pylon supports for above ground pipe if required.

vii) Pipe size for pylon, size of Anchor fasteners etc. shall be adequate for the support to provide sufficient rigidity against vibration & load during operation. The whole arrangement shall be in bidder's scope. The contractor shall justify adequacy of design during engineering.

viii) Conducting performance guarantee tests as per approved procedure to the satisfaction of Owner/ Purchaser and handing over an operational system to the owner. Procedure for performance guarantee test shall be submitted by contractor for customer review and approval.

4.11. Scope of services

A. Erection, Testing & Commissioning (ETC) requirements

i) The scope of ETC shall include receipt of material at site, unloading, safe storage of material, handling of equipment/ material at site, erection of equipment /material at site including fabrication, equipment and system testing, commissioning of the entire system, conducting performance guarantee tests to the satisfaction of Owner / Purchaser and final handing over to the owner of the entire system.

B. With Other Electrical System

i) Preparations of cable interconnection diagram for equipment supplied under this contract and accordingly offer guidance to the purchaser for laying necessary cables. Termination details shall also be furnished in the said interconnection table.

ii) Laying & Termination of Power and Control cables for the equipment under the scope of this specification. Bidders shall include all cable accessories like lugs, glands, cable tags, markers etc in their respective bids.

iii) Earthing of all installations (to the nearest earth mat/ earthing pad) supplied under the scope of this specification.

C. With Civil System

i) Providing location of pipes crossing the road & trenches and laying of adequately sized Hume pipes.

ii) Making RCC pedestals for above ground piping wherever required.

D. All machinery tools & tackles and consumables required for erection/testing / commissioning of the system shall be arranged by the Bidder.

E. Minor modifications, alterations in system installation as per customer's specific requirements shall be done without any extra cost to purchaser.

F. Bidders to ensure that sufficient quantity of spares are made available for timely completion of commissioning of the system. The bidder shall furnish a list of commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the bidder.

G. **Obtaining approval from TAC/ TAC accredited agency on documents & installations.**

i) Obtaining, "As Built" certification from purchaser or owner on applicable drawings. Completing documentation as per specification requirement.

ii) Obtaining customer's written acceptance of satisfactory completion of job. (Acceptance of PG + handing over of plant and mandatory spares (if any)).

iii) Any other service not explicitly illustrated herein but which may be required to complete the system with its desired functionality or in the spirit of contract shall also deemed to be under the scope of bidder.

H. Civil Works

Major civil works such as foundations, cut outs etc., shall be in Purchaser's scope. The Bidder

shall however supply foundation bolts & hardware and undertake minor civil works such as grouting, filling up of crevices/ cut outs etc. Any damage caused to civil works during ETC work of the equipment/system shall have to be made good to the original finish by the Contractor at no extra cost to the Purchaser.

In addition the following shall be in the scope of Contractor:

i) Laying of underground piping and construction of RCC pedestals to support the above ground piping for hydrant wherever required.

ii) RCC supports to the base of pylon pipes (if required) of HVW system of various transformers/ reactors.

iii) Each of the outdoor deluge valves and its accessories shall be provided with deluge valve housing. (As per TAC). Construction of deluge valve housing with RCC roof and its painting (inside & outside).

5.0 Exclusions

a) Supply of power & control cables except for detection cable. However laying and termination of these cables shall be in contractor's scope. ***The bidder shall furnish quantity and type of cables required complete system in their respective bids. Laying & termination is in contractor scope.***

b) Supply of necessary cable trays for laying power and control cables, however hardware for fixing the same on wall trenches or elsewhere shall be included by the bidder in his bid.

c) Supply of GI flat for earthing of equipments.

6.0 Utilities Available

Construction water and electricity shall be available at one point each. Contractor shall be required to make own arrangement for taking supplies from there.

7.0 OPERATION & MAINTENANCE (O&M) MANUAL

Operation and Maintenance manuals shall be specifically compiled for the project by the bidders. The draft O&M manual shall be submitted along with the supply of the items. The O&M manual shall contain the following information:

a. Description of the system and equipment with design particulars.
b. Instruction for erection.
c. Instruction for operation, maintenance and repair.
d. Recommended inspection practices and inspection schedule.
e. Ordering information for all replaceable parts.
f. Recommendation for type of lubricants and frequency of lubrication.

8.0 Handing & Taking Over

It is the responsibility of the contractor to maintain the plant till it is handed over. Any defect noted during the period shall be rectified by the contractor without any price implication to BHEL. Also suitable PG tests shall be conducted by the contractor to show the achievement of guaranteed parameters in line with the requirements of specification/ standards/ codes and to

the satisfaction of Purchaser/ Owner.

9.0 Inspection & Testing

All the equipments shall be inspected prior to dispatch in line with relevant IS, approved GTP/ drawing and technical specification, BHEL/ customer approved QAP.

ANNEXURE-'A'

Cable Sizes being procured by BHEL for Sub-Station

2C x 2.5 sq mm PVC/Copper, Armoured Control Cable
5C x 4 sq mm PVC/Copper, Armoured Control Cable
5C x 2.5 sq mm PVC/Copper, Armoured Control Cable
7C x 2.5 sq mm PVC/Copper, Armoured Control Cable
10C x 2.5sqmm PVC/Copper, Armoured Control Cable
14C x 2.5 sq mm PVC/Copper, Armoured Control Cable
19C x 2.5 sq mm PVC/Copper, Armoured Control Cable
2C x 10 sq.mm XLPE/Aluminium, Armoured Auxiliary Power Cable
4C x 16 sq.mm XLPE/Aluminium, Armoured Auxiliary Power Cable
3.5C x 35 sq.mm XLPE/Aluminium, Armoured Auxiliary Power Cable
3.5C x 95 sq.mm XLPE/Aluminium, Armoured Auxiliary Power Cable
3.5C x 400 sq.mm XLPE/Aluminium, Armoured Auxiliary Power Cable
1C x 50 sq.mm XLPE/Aluminium, Armoured Auxiliary Power Cable
1C x 630 sq.mm XLPE/Aluminium, Armoured Auxiliary Power Cable

ANNEXURE- B TO SECTION-1

BILL OF QUANTITY (ANNEXURE-B)

FIRE FIGHTING SYSTEM FOR SWITCHYARD, 1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD AS PER TECHNICAL SPECIFICATION

Supply and ETC of Main Items as listed below

BOQ Sl. No.	DESCRIPTION	UNIT	QTY
A	**Hydrant System**		
1	Pipe-150 NB	Mtrs	685
2	Pipe-100 NB	Mtrs	515
3	Pipe-80 NB	Mtrs	90
4	Gate Valve-150 NB	Nos	3
5	Hume Pipe-300 NB	Mtrs	5
6	Hume Pipe-200 NB	Mtrs	55
7	Single Hydrant	Nos	14
8	Water Monitor	Nos	7
9	Fire Escape Hydrant	Nos	2
10	Fire Hose (15 m)	Nos	32
11	Branch Pipe with Nozzle	Nos	16
12	Fire Hose Cabinet with Acc.	Nos	16
B	**Portable Fire Extinguishers**		
13	DCP Type Fire Extinguishers-6 Kg	Nos	6
14	CO2 Type Fire Extinguishers-4.5 KG	Nos	8
15	Co2 Type (Trolley Mounted)-22.5 Kg	Nos	1
16	Mechanical Foam Type (Trolley Mounted)-50 Litre	Nos	2
C	**MVWS Spray System**		
17	Deluge Valve-100 NB with fittings	Nos	1
18	Strainer-100 NB	Nos	1
19	Gate Valve-100 NB	Nos	2
20	Pressure Gauge	Nos	2
21	Pressure Switch	Nos	1
22	Solenoid Valve	Nos	1
23	Spray Nozzle (K-18, 120 Deg)	Nos	39
24	GI Pipe (IS:1239) Heavy Class:100 NB	Mtrs	2
25	GI Pipe (IS:1239) Heavy Class:80 NB	Mtrs	16
26	GI Pipe (IS:1239) Heavy Class:50 NB	Mtrs	6
27	GI Pipe (IS:1239) Heavy Class:40 NB	Mtrs	2
28	GI Pipe (IS:1239) Heavy Class:32 NB	Mtrs	12
29	GI Pipe (IS:1239) Heavy Class:25 NB	Mtrs	37
30	MS Pipe-100 NB	Mtrs	4
D	**HVWS Spray System**		
31	Deluge Valve-100 NB	Nos	1
32	Strainer-100 NB	Nos	1

33	Gate Valve-100 NB	Nos	2
34	Pressure Gauge	Nos	2
35	Pressure Switch	Nos	2
36	Spray Nozzle (K-23, 120 Deg)	Nos	47
37	QB Detector	Nos	42
38	MS Pipe-100 NB	Mtrs	5
39	GI Pipe (IS:1239) Heavy Class:100 NB	Mtrs	15
40	GI Pipe (IS:1239) Heavy Class:80 NB	Mtrs	20
41	GI Pipe (IS:1239) Heavy Class:50 NB	Mtrs	95
42	GI Pipe (IS:1239) Heavy Class:25 NB	Mtrs	15
43	MS Pipe-Class-B-80 NB	Mtrs	60
44	MS Pipe-Class-B-25 NB	Mtrs	110
E	**Fire Alarm & Detection System (BOSCH Make)**		
45	Mulisensor Detector	Nos	66
46	Heat Detector	Nos	9
47	Loop Cable	Mtrs	350
48	Optical LHS cable	Mtrs	400
49	Optical LHS Panel	Nos	1
50	Optical Fibre cable	Mtrs	750
51	FO Converters	Nos	2
52	Hooter	Nos	2
53	DV control Panel	Nos	2
54	Manual Call Point	Nos	4
55	Fire Alarm Panel	Nos	1
56	Input/ Output Modules	Nos	2
F	**Spares**		
57	Complete Hydrant Valves	Nos	2
58	Set of Seat & Rubber ring of Hydrant Valves	Nos	1
59	Deluge valve assemble complete with trimming drain	Nos	1
60	Isolating valves	Nos	2
61	Spray Nozzle (K-18, 120 Deg)	Nos	3
62	Spray Nozzle (K-23, 120 Deg)	Nos	3
63	Branch Pipe with Nozzle	Nos	2
64	Fire Hose with SS fittings complete assembly	Nos	4
65	Manual Call Point	Nos	1
66	QB Detector	Nos	5
67	Muticriteria Type Smoke Detector	Nos	7
68	Heat Detector	Nos	1
69	Optical LHS cable	Mtrs	40
70	Input/ Output Control Modules	Nos	2
71	Battery	Nos	2

SECTION - 2

EQUIPMENT SPECIFICATION

2.0 CODES AND STANDARDS

The design, manufacture, inspection and testing of complete system shall comply with the latest applicable Indian/British/American standards. The equipment shall conform to the latest edition to the following standards:

a. "Fire Protection Manual" - Issued by the Regional Committees of Tariff Advisory Committee (TAC).
b. Underwriters Laboratories of USA
c. LPCB – United Kingdom
d. National Fire Codes of National Fire Protection Association (NFPA) of USA.

2.1 GENERAL DESIGN AND CONSTRUCTIONAL REQUIREMENT

It is not the intent to specify herein all the details of design and manufacture. However the equipment and the system shall conform in all respects to high standards of design engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser /Owner who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgment is not in full accordance herewith.

- **DCPL-TSGENCO technical specification for firefighting system is provided as Annexure- I to Section-2. Contractor shall adhere to requirements mentioned in this annexure that is applicable to switchyard portion of the project.**

2.2 **Deleted**

2.3 **Deleted**

2.4 **Deleted**

2.5 SHOP & SITE TESTS

2.5.1 SHOP TESTS

All acceptance and routine tests in accordance with relevant IS codes/standards shall be carried out by the contractor/manufacturer as per BHEL/ Customer approved QAP. Charges for all these routine and acceptance tests for all the equipment & components shall be deemed to be included in the bid price.

Contractor shall submit the QP for all such equipments calling inspection/ testing for purchaser's approval in the prescribed format enclosed as Schedule-5 in Section 5 of the technical specification. This Owner/Purchaser approved QP shall be the basis of inspection/ testing.

2.5.2 SITE TESTS

The Contractor shall prepare and submit detailed field quality plans in the format prescribed, setting out the quality practice and procedures to be adopted by him for assuring quality of each equipment/material from the receipt of material at site, during storage erection, pre-commissioning to final commissioning of the system. These procedures shall necessarily include all checks/tests conducted at site for preservation, assembly, alignment, positioning of equipment, foundation preparation, welding/bolting heat treatment, non-destructive examination, hydraulic test, running test, performance test etc.

Performance test and guarantee

After erection at site, the Fire Protection system shall be subjected to tests to show achievement of guaranteed parameters in line with the requirements of specification/ standards/ codes and to the satisfaction of Purchaser/ Owner.

The Contractor shall take full responsibility for the safe and efficient operation of each of the equipment as well as the whole system. If the shop/ site tests indicate failure of the equipment or if the system does not meet the guarantee in any respect, the Contractor may be required to make alterations in the system/ equipment. Such alterations shall be carried out after purchaser's/ Owner's approval at no extra cost to purchaser. Additional tests required to show the effect of such alterations should also be performed at no extra cost to Purchaser. Above mentioned tests shall be carried out separately for each sub-system. All the testing instruments shall be tested/ calibrated in accordance with the applicable codes & standards. Under PG testing, interlocks, protections, vibrations & noise levels shall also be checked. Detailed procedure for PG test shall be submitted by the contractor in advance. The Contractor shall give guarantee of satisfactory and trouble free operation of the equipment/ systems for a duration described in Section-3 of this specification.

The following codes and standards shall be applicable for conducting test unless otherwise modified or supplemented by the enclosed procedure and mutually agreed to between the purchaser and contractor.

1. NFPA – 72 E3: Standard on Automatic Fire Detectors.
2. Fire Protection manual of TAC (Latest edition) IS 3034: Fire safety

ANNEXURE TO SECTION - 2

VOLUME-IIIE

SECTION-II

TECHNICAL SPECIFICATION FOR FIRE PROTECTION SYSTEM

THIS ANNEXURE CONTAINS FPS SPEC FOR THE ENTIRE POWER PLANT AREA. CONTRACTOR SHALL REFER THIS ANNEXURE IN CONJUNCTION TO SEC-1 OF THIS TS WHERE SCOPE APPLICABLE TO SWITCHYARD AREA ONLY IS MENTIONED.

CONTENT

ATTACHMENT

VOLUME: IIIE

SECTION-II

TECHNICAL SPECIFICATIONS FOR FIRE DETECTION, ALARM AND 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 proposed1 x 800 MW Sri Kothagudem Thermal Power Station (KTPS), Stage-VII, Unit-12 for Telangana State Power Generation Corporation Limited (TSGENCO) at Kothagudem, Telangana 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 detection, alarm and protection system including supply of all fire extinguishing equipment and systems, fire detectors, manual call points, linear heat sensing cables, all local, remote Fire detection alarm cum MIMIC panels , repeater fire 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 system shall be designed keeping in view the recommendations of Tariff Advisory Committee (TAC) of Insurance Companies of India/LPA India/NFPA USA. Any other International Standard having equivalent stringent codes may also be considered. However, the system shall be approved by statutory authorities.

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), fixed foam system for oil handling areas, 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 pipe, both underground and over ground 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 are 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) Raw Water Pump House

b) Entire Power House including Boiler Area and Turbine House.

c) Mill Building.

d) Mill reject system compressor house.

e) ESP Control Building.

f) Generator & Unit transformer, Station Transformers in transformer Yard, switchyard area.

g) CW Pump House including chlorination plant and dosing pump house.

h) DG & Compressor building.

i) HFO & LDO/ HSD unloading and transfer pump house, pressurizing pump house area, HFO, LDO/HSD Day tank area.

j) DM plant

k) Coal Handling Plant including conveyors, TPs, Coal stack yard etc.

l) Ash water pump house.

m) Ash Slurry Pump House

n) Ash Handling Plant Electrical cum Control Room

o) Ash Handling Plant Compressor Room

p) Fly Ash Vacuum Pump House

q) AHP Chemical House in AHP Clarifier Area

r) Effluent treatment Plant.

s) Stores.

t) Clarified Water Pump House

u) Filtered water Reservoir and Pump House

v) Sludge Sump & Pump House

w) Filter Backwash Waste Sump & Pump House

x) Chemical House

y) Chlorination Building

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 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. 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 the Local Zonal Fire Alarm Panel as well as in the Central Fire detection alarm cum MIMIC panel.

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.
- Unit and Station Auxiliary transformers as per design requirement.

- Spare Generator Transformer

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:

- Turbine oil tanks and purifiers.
- Boiler Firing Floors.
- Lube oil piping in turbine areas.
- Generator seal oil system.
- Lube oil system for turbine driven boiler feed pumps.
- All oil filled transformer below 10 MVA.

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 valves in MVW Spray System shall be annunciated in the respective local zonal panels and in the central Fire detection alarm cum MIMIC panel with repeat alarm at fire station buildings. 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, and bunker bay conveyors in coal handling plant. In this connection, it may be noted that 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. Detection system shall consist of quartz bulb detectors, IR detectors, LHS cables.

- Cable vault and cable galleries of main plant, switchyard control room, and ESP control room. Detection system shall consist of smoke detectors, LHS cables.

- Fuel oil storage and day tank area, DG set diesel tanks.

3.01.04 **Fixed Foam Protection System**

Water based automatic activated low expansion foam protection system shall be provided for HFO & LDO/ HSD storage and day tanks.

Foam protection systems are based on the principle of blanketing the burning surface of oil stored inside the tanks by pouring foam mixed with water, enabling to cut-off the oxygen to the burning fuel thus achieving immediate Extinguishments of fire.

Foam concentrate will be pumped from the foam concentrate storage tank by two (1W + 1S) foam pumps to foam proportioner skids one provided for each fuel oil (FO) tank. Pressurized water connection is provided to the eductor of each foam proportioner skid. In the event of fire, the foam system for respective tank shall be automatically activated on detection of fire by ROR/Probe type heat detectors provided inside the FO tanks. Water will start flowing through the eductor where foam concentrate is induced and mixed with the flowing water in definite proportion.

This foam water mixture flows to tank, where the foam solution expands by sucking air from the atmosphere and foam thus formed fills the oil surface inside tank by suitably designed deflectors.

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.

- Control room, Control equipment room, computer room and other electrical and electronic equipment rooms.

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 the local panel, and main fire alarm panel. 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.

3.02.00 Microprocessor based addressable analog type multi criteria smoke detectors connected in cross-zoning principle as per NFPA recommendation and in two wires circuitry shall be provided in the following areas:

- All cable Spreader Rooms & Cable Vaults, cable gallery in powerhouse and in all ancillary plant buildings.
- All Electrical Switchgear/MCC Rooms located in Power House and in all ancillary plant buildings.
- Central Control Rooms, Control equipment room housing DDCMIS, UPS etc. and in all ancillary plant building control rooms.

3.03.00 Heat detection system (microprocessor based analogue addressable based heat detector) shall be provided in the following areas in order to avoid spurious operation of the smoke detectors due to fumes, smoke & dust which are present in these areas:

- Battery and battery charger rooms.
- Turbine oil tanks and purifiers.
- Boiler Firing Floors.
- Lube oil piping in turbine areas.
- Generator seal oil system.
- Lube oil system for turbine driven boiler feed pumps.
- All oil filled transformer below 10 MVA.

3.04.00 Quartzoid bulb detector shall be used in all transformers rated more than 10 MVA.

3.05.00 Heat sensing cable, as detector shall be used for coal conveyor gallery including bearings and both drive pulley and non-drive pulley, transfer points. This shall be used in whole length of top belt and bottom belt (in a zig-zag fashion). These detectors shall also be used for tripping the conveyor drives.

3.06.00 Solar Blind Infra-red detectors with inbuilt air purging unit shall be used in coal conveyor gallery for detection of moving fire. Rate of rise cum fixed

temperature heat detectors shall be used for Boiler burner fronts, turbine oil tanks and HFO and LDO/HSD storage day tank inside. Heat detectors shall be analogue addressable type.

3.07.00 The entire Power House Building and the outdoor yard of plant have been divided into a number of zones with a few addressable manual call points in each zone. The outdoor call points shall be installed on approximately 1M high angle iron supports 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, Ash Water Pump House, Fire Water Pump House etc.

i) All buildings like Compressor and DG area etc.

Adequate number of manual call points along with automatic fire alarm system shall be provided for the respective areas. Location of the manual call points shall be near to the respective areas. Annunciations from the manual call points shall be received to the nearest satellite fire alarm panel and directly on the fire alarm panels located in the Control room and fire station.

3.08.00 All detectors shall be located and spaced as per NFPA-72E and shall be UL/FM approved. On receipt of impulse from the detectors, in the event of fire, suitable annunciation signals shall be exhibited in the respective repeater fire panels as well as Main and Master Fire Panels. The 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 as such the affected Zone can also be spotted.

3.09.00 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.

3.09.01 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.

3.09.02 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.

3.10.00 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. Atleast two fire escape exit openings to the open areas shall be provided for the TG area as prescribed by the TAC/LPA.

3.11.00 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.

3.12.00 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.

3.13.00 “First aid fire protection system" shall be provided for Power house.

3.14.00 Gas sensing fire detectors working on air sampling shall be provided for all control rooms, and control equipment room.

3.15.00 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.

3.16.00 The main source of water to the fire pumps and jockey pumps shall be from steel made fire water storage tank which is to be sized by the EPC contractor based on TAC/LPA guideline. However, the minimum capacity of the steel tank shall be 5000 m^3 with two compartments . The Water for both hydrant and High/Medium Velocity Water Spray System shall be supplied by six (6) nos. automatic firewater pumps. Out of six (6) pumps two (2) nos. motor driven working hydrant pumps and one (1) no. diesel engine driven standby hydrant pumps for hydrant system and one (1) no. motor driven and one (1) no. diesel engine driven (both are working) spray pumps for HVW & MVW spray water system and one (1) no. diesel engine driven pump is common standby for spray system. Out of these six (6) nos. fire water pumps three nos. (3) will be motor driven and three (3) nos. will be diesel engine driven. The pumps will be started automatically in proper sequence when a large quantity of water flows out from pressurized water circuit. There shall be adequate arrangement of meeting up system leakages and at the same time the system pressure shall be maintained by providing a hydro pneumatic tank along with two (2) nos. motor driven jockey pumps, one (1) working and one (1) standby and two (2) nos., one (1) working & one (1) standby compressors. Booster Pumps shall be provided as per the TAC/LPA guidelines. However, the no. of pumps and their capacity, head etc. are to be finally decided by the Contractor during detail engineering stage.

3.17.00 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% motor driven booster pumps shall be provided for individual areas for supplying pressurized water to the hose stations. Booster pumps are installed online to the branch header to riser pipes. The booster pumps if required shall start through pressure switch when pressure on their discharge side falls below the set pressure.

3.18.00 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. FRLS power and control cables will be used.

3.19.00 **Nitrogen Injection System**

Nitrogen Injection Fire Prevention and extinguishing system designed for oil filled transformer (for Generator Transformer) shall prevent tank explosion and the fire during internal faults resulting in the arc where tank explosion will normally take few seconds after arc generation and also to extinguish the external oil fires on transformer top cover due to tank explosion and/ or external failures like bushing fires, due to OLTC fires and fire from surrounding equipments.

Nitrogen Injection System shall be provided along with the emulsifiers for the transformers.

The system shall work on the principle of DRAIN and STIR and on activation, shall drain a pre determined quantity of oil from the tank top through outlet valve, to reduce the tank pressure and inject nitrogen gas at high pressure from the lower side of the tank through the inlet valves to create stirring action and reduce the temperature of top oil surface below flash point to extinguish the fire.

Conservator tank oil shall be isolated during the bushing bursting, tank explosion and oil fire, to prevent aggravation of oil fire.

Transformer isolation shall be an essential pre condition for activation of the system.

The system shall be designed to operate manually, in case of failure of power source.

The details including Design, description, control, scope, etc. of this system are attached with Annexure-IX of this specification.

3.20.00 Two (2) nos. Mobile Fire tenders shall be envisaged for this project. However as no fire station is envisaged, these two (2) nos. mobile fire tenders shall be placed in the new fire Station of the unit of this project. For details of Fire Tender, refer to Annexure-X of this Volume.

4.00.00 **OPERATIONAL PHILOSOPHY**

4.01.00 **Hydrant System**

4.01.01 Operation of hydrant system shall be semi-automatic. A pressurized 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, diesel engine 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 diesel engine driven pump and falls further down, this low pressure shall actuate another pressure switch which in turn shall cut in automatically the standby Diesel Engine driven hydrant pump. 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 pressurized 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 there by to the whole fire fighting system.

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/ diesel engine driven HVW/ MVW spray water pump for automatic starting. If the pressure falls further below, common standby Diesel Engine driven 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.

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.

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 **Inert Gas Flooding System**

Nitrogen Injection Fire Prevention and extinguishing system designed for oil filled transformer (for Generator Transformer) shall prevent tank explosion and the fire during internal faults resulting in the arc where tank explosion will normally take few seconds after arc generation and also to extinguish the external oil fires on transformer top cover due to tank explosion and/ or external failures like bushing fires, due to OLTC fires and fire from surrounding equipments.

4.04.00 Fire Alarm Panel

Bidder shall provide necessary local control panels for the fire protection system, which shall contain the following components and perform the following functions as minimum.

4.04.01 Fire water pumping and pressurizing system

Hot redundant PLC based system shall be provided for control and monitoring of hydrant system and spray water system. The system shall be provided with Graphic User Interface (GUI) with LCD screen based display unit , control switches and other operational keys and hardwired annunciation system. Necessary hardwired interface along with cables shall be provided for remote Operation & monitoring in the Main Fire Alarm Panel & workstations to be located in CCR .

4.04.03 Fire alarm detection and protection system

Hot redundant Microprocessor based Fire detection alarm cum MIMIC panels shall be provided in the following locations

i) Master Fire detection alarm cum MIMIC panel along with PC based operator station, 24 inch TFT LCD monitor, A3/A4 color laser jet printer , in fire station.

ii) Main Fire detection alarm cum MIMIC panel along with PC based operator station , 24 inch TFT LCD monitor , A3/A4 color laser jet printer , in CCR

iii) Repeater Fire detection alarm cum MIMIC panels , one each , in local area rooms eg , DM plant , AHP , CHP , CW pump house etc.

4.04.04 Volume VI of this specification shall be referred for technical requirements of different items eg. operator station, printer , panel , field instruments , cable

etc.

5.00.00 SCOPE OF WORK

5.01.00 Mechanical

a) One (1) no. automatic electric motor driven horizontal centrifugal fire water pumps with accessories for hydrant service.

b) Two (2) no. automatic diesel engine driven horizontal centrifugal fire water pumps with accessories for hydrant service.

c) One (1) no. automatic electric motor driven horizontal centrifugal fire water pumps with accessories for high velocity spray service.

d) One (1) no. automatic diesel engine driven horizontal centrifugal fire water pumps with accessories for medium velocity spray service.

e) One (1) no. automatic diesel engine driven horizontal centrifugal fire water pumps with accessories for common standby service for both HVW and MVW spray service.

f) Two (2) nos. (1 working + 1 standby) automatic electric motor driven vertical centrifugal jockey pumps.

However, the no. of hydrant and spray pumps shall be finalized by the EPC bidder during detail engineering.

g) Two (2) nos. electric motor driven vertical centrifugal type booster pumps (1W+1S) with accessories, as required, for individual area.

h) One (1) no hydro pneumatic tank and one (1) fire water storage tank of 5000 m^3 capacity with two (2) compartments.

i) Two (2) nos. (1 working + 1 standby) air compressor.

The capacity and head of hydrant, spray and jockey pumps and the sizing of compressors and hydro-pneumatic tank shall be finalized by the EPC bidder during detail engineering.

j) One centralized inert gas flooding system for the areas specified, complete with cylinder rack, gas manifold, pressure reducing stations, detection system components and panel, nozzles, piping, fittings and valves.

k) Foam tank skids for foam concentrate storage, complete with foam concentrate feed pumps, piping, fittings, valves, tank sludge trap and sludge disposal arrangement, safety valves, pressure gauges, level transmitter, level indicator and other required accessories.

l) Foam proportional skids, complete with skid base frame, foam and water piping, deluge valve, adductor, foam nozzles, ROR heat

detector and alarm system, local alarm panel and other required accessories for the protected areas as specified elsewhere in the specification.

m) Required nos. of portable fire extinguisher.

n) 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.

o) 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.

p) Out of total nozzles provided in indoor & outdoor hydrant system, at least 10% shall be "fog type" and balance shall be of ordinary type.

q) The number of hose houses and hoses shall be as per TAC/LPA stipulations.

r) 32 mm 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.

s) Sets of hydraulically operated deluge valves with bypass valve, isolating valve & test valve for all HT transformers as specified.

t) Sets of solenoid operated deluge valves with bypass valve, isolating valve & test valve for entire spray system for coal conveyors, turbine lub oil tank, boiler burner front and cable vault/spreader rooms.

u) Two (2) nos. of basket type strainers to be located at the discharge of spray water pumps.

v) Sets of Chrome plated frangible bulb type detectors for areas identified elsewhere in the specification.

w) Sets of addressable analog optical type of smoke detection arranged in X-zoning fashion for areas identified in the specification.

x) Sets of addressable analog multi criteria smoke detectors arranged in X-zoning fashion for areas identified in the specification.

y) Sets of Analogue Addressable type heat detectors for the areas identified in specification.

z) 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.

aa) Lot of linear heat sensing cables (non-electrically operated Fibre Optic LHSC) for the areas mentioned in the specification.

bb) Gas sensing fire detectors working on air sampling for all control rooms and control equipment room.

cc) Required nos. of addressable manual call points for the areas mentioned in the specification.

dd) Lot of open sprayers for HVW & MVW spray system.

ee) 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.

ff) One (1) no. of siren of 10 KM range (minimum diametric).

gg) Complete lot of pipelines including all fittings for

- Entire hydrant system.
- Entire spray water (both HVW & MVW) system including network of sprayers.
- Entire compressed air piping for pressurising hydro pneumatic tank.

hh) Lot of cut-off gate valves, globe type instrument root valves and discharge valves for pumps & also for compressors. NRV's as required for firewater & compressed air lines.

ii) RCC Pipe enclosures/hume pipes of appropriate class for buried pipelines for all road crossings, rail crossing & for all places where bulldozer may operate.

jj) Vents and drains as required. Vent and drain valves shall be lockable type and drain lines shall be terminated to nearest surface drain.

kk) Pressure break-down orifices as required for hydrant system, spray system and first-aid-fire protection system.

5.02.00 **Civil**

For civil works refer to Volume VII.

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 V” of this Bid Document.

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 alarm cum MIMIC panel & repeater panels 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 / A4 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 alarm cum MIMIC panel & Repeater panel. This laptop shall also have licensed Office documentation software and Antivirus software.

5.04.08 Licensed version of all software for the Fire detection alarm cum MIMIC 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 & repeater panel .

5.04.11 240V AC, 50Hz, +/- 1% Mini UPS system for Operator station of Fire detection alarm cum MIMIC panel & Repeater Panels.

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5.04.12 Optical fiber cable, networking hardware comprising of LIU & Media converter to establish communication link in between the Fire detection alarm cum MIMIC panel & Repeater 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 VII of this specification shall be referred for technical requirements of different items eg. operator station, printer , panel , field instruments , cable etc.

6.00.00 DESIGN BASIS AND INPUT

6.01.00 Mechanical

6.01.01 Hydrant System

a) Provision of "double headed hydrants" as per the configuration of "risk area" shall be acceptable.

b) Spacing of hydrant (outdoor) shall be 45 M in general and for internal

hydrant/landing valves spacing shall be 30 M (max.)

c) Pressure at each hydrant point (both outdoor & indoor) shall be minimum 3.5 Kg/Sq.cm(g).

d) Based on total nos. of hydrants (outdoor), nos. of branch pipes, triple purpose nozzles & hoses shall be determined as per guideline of TAC/LPA.

e) Based on total nos. of indoor hydrants (landing valves), nos. of hoses branch pipe, triple purpose nozzles & hose boxes shall be determined as per guideline of TAC/LPA.

6.01.02 **Spray Water System (HVW & MVW System)**

a) Minimum pressure at HVW nozzles and MVW nozzles shall be 3.5 bar and 1.4 bar respectively. Maximum pressure at HVW nozzles and MVW nozzles shall be 5 bar and 3.5 bar respectively. However, for cable vaults, same shall be as per TAC/LPA regulations.

b) Water density for top & bottom conveyor belt shall be 10.2 lpm/ sq.m.(min.)

c) Water density for all surfaces of Transformer shall be 10.2 lpm/Sq.m only.

d) Water density for Cable Spreader Room/ Cable Vault shall be 12.2 lpm/sq.m. (min.) of cable tray area.

e) For turbine oil tank and purification area, burner front water density shall be 10.2 lpm/sq.m. (min.).

f) 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 3.0 M. The distance of the deluge valves from the transformers shall be approx. 6 metres.

g) All nozzles shall be open sprayer type and chrome plated.

h) 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.

i) 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.

j) 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.

6.01.03 **Inert gas flooding system**

a) Proprietary inert gas shall be used for inert gas flooding system.

b) The centralized inert gas flooding system shall be designed considering the single largest protected volume.

c) Required number of pressure reducing stations shall be provided in the gas manifold for gas pressure reduction from cylinder pressure to required gas flooding pressure.

d) The inert gas flooding system and its components shall be designed as per NFPA 2001 recommendations.

e) The cylinder rack shall be designed to accommodate sufficient number of inert gas cylinders so that the largest protected volume can be flooded.

6.01.04 **Detection System (Microprocessor Based)**

a) Coverage of Frangible bulb type detectors, Infra red type heat detectors and multi criteria smoke detectors shall be considered. One smoke detector for every 100 m^2 or one heat detector for every 50m^2 of the compartment area shall be considered.

b) Solar blind IRD with inbuilt air purging unit shall be 3 nos. minimum for each conveyor, 1 no. each at a distance of 1-2 M from tail end and head end and 1 no. at middle. However, same shall be verified with the covering range indicated by the manufacturer.

c) Linear heat sensing cable shall be provided along the whole length of the top belt and bottom belt of each conveyor and on bearing and pulley of driving and non driving ends.

6.01.05 **General**

a) Each zone of cable spreader room shall be provided with one (1) no. cut-off quick opening type Deluge valve.

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/LPA recommendation.

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 Owner/Consultant.

f) Cut-off gate valves shall be provided for each small and big loops on as required basis.

g) Pressure break-down orifice shall be provided as necessary to restrict pressure of all hydrant point upto 3.5 Kg/cm.sq.(g).

h) 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.

6.02.00 Fire Detection Panel and repeater panel ,Linear Heat sensing cable

6.02.01 Fire Detection, Alarm and Protection system proposed through the Fire detection and Repeater panels shall provide continuous surveillance against fire in the areas of plant. All Fire detection and repeater panels shall be colored MIMIC based.

6.02.02 The Main Objectives of the of these panels are as follows:

a) To detect fire in its early stages and activate or alert for implementation of Emergency action, thus protecting personnel and equipment.

b) To provide an appropriate level of monitoring in the event of fire and audiovisual annunciation at respective Fire detection alarm cum MIMIC panel Repeater panel and the PC based operator station.

c) Opening of the deluge valve in case of fire detection.

d) The sensing of fire is accomplished through various types of fire detectors / LHS cable.

e) To ensure high reliability and availability of the system with quick and exact identification of the fire location without false alarm.

f) To provide contact output in the loop / from fire detection and protection panel & repeater panel for fire protection & other systems viz. opening of deluge valves, tripping of Ventilation System Fans / Dampers / Air Handling Units / tripping of belt conveyor / activating foam system / inert gas flooding system on detection of fire in specific area for effective fire protection.

6.02.03 Fire detection and alarm & Repeater cum MIMIC panel 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, annunciate system / device fault and to provide supervisory functions as required.

6.02.04 In case of fire, the audio-visual fire alarm shall be generated at Fire detection

and alarm & Repeater panel and also initiate a signal to operate hooter(s) in the area where the fire signal is detected.

6.02.05 Indication (bright LED type) and Graphic Display (LCD type) shall be provided ineach Fire detection and alarm & Repeater panel . Information / data from these Fire detection alarm cum MIMIC panel s shall also be available in a dedicated computer based operator station in.. This computer shall be an UL/FM Listed PC used to display event information from the network in a text and graphical format. Graphic screens shall 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 shall 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.

6.02.06 Each Fire detection alarm cum MIMIC panel shall be capable of operating in stand-alone mode. All Fire detection alarm cum MIMIC panel, Repeater panels and PC based operator stations shall be connected by a dedicated fault tolerant Local Area Network (LAN) through redundant Fiber optic communication cable.

6.02.07 Fire detection alarm cum MIMIC panel shall have multiple loop processing capability. Each area / zone shall be
monitored by one independent loop and a loop shall not be shared between different zones. Each Fire detection alarm cum MIMIC panel shall have additional capacity of handling at least ten alarms per zone, requiring only field wiring, as a spare for future modification or expansion.

6.02.08 The Fire detection alarm cum MIMIC 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.

6.02.09 Fire detection alarm cum MIMIC panel 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 Fire detection alarm cum MIMIC panel on a 2-wire circuit (class B wiring).

6.02.10 Minimum indications to be provided on the Fire detection alarm cum MIMIC panel shall be Fire , Fault , Isolate , Pre-alarm, Multiple alarms.

6.02.11 Minimum controls to be provided on the Fire detection alarm cum MIMIC panel shall be Push button -Acknowledge , Push button- Reset , Push button -Test ,Push button - switch -Isolate.

6.02.12 Minimum information to be provided on the panel shall be Detector identification number, Connecting line identification number, Zone / Area description, Detector in isolated condition

6.02.13 Display of the status of the detector, sequence of the events, alarm and trouble summary etc. shall be displayed on the display unit of Fire detection

alarm cum MIMIC panel and as well as on the operator station and printer.

6.02.14 Alarms and indications of Fire detection alarm cum MIMIC panel s are repeated in the repeater panel. Repeater panels shall be provided with a 24" LCD display unit indicating major events, alarm, trouble etc., which shall repeat the information related to sector / area,zone, floor Elevation, room no. and detector no. etc., which are being displayed in the related Fire detection alarm cum MIMIC panel. Repeater panels shall allow acknowledgement of all alarm
signals generated by fire alarm system.

6.02.15 The fire detection and alarm system shall be in normal operation even during mains 240V AC power failure. The stand by DC power supply from the battery in Fire detection alarm cum MIMIC panel 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.

6.03.00 **Electrical**

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

6.03.02 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 fibre optic data highway.

The fire detection and alarm system shall essentially consist of Fire detection alarm cum MIMIC panels with respective CRT Key Board Stations located in CCR, Fire detection alarm cum MIMIC panel, Master Fire Alarm Panel with CRT Key Board Station located in Fire Station, Satellite Fire Alarm panels located in various Plant areas, detectors, Manual Call stations, alarm devices, accessories, wiring and all connections to devices.

6.03.03 The Fire detection alarm cum MIMIC 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 alarm cum MIMIC 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.

6.03.04 The Fire detection alarm cum MIMIC 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 alarm cum MIMIC panels shall also supervise, monitor and annunciate the abnormal condition of the circuitry of the fire detection system through local panels.

6.03.05 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.

6.03.06 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.

6.03.07 Alarm shall have priority over trouble. All trouble conditions shall be reported to include the zone / device no., location etc.

6.03.08 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

6.03.09 The Fire detection alarm cum MIMIC panels as well as Master Fire Alarm Panel shall have 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 SVGA Monitor and dot matrix 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.

6.04.00 **Civil**

6.04.01 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.

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

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/LPA recommendation.

b) Pumps shall be capable of furnishing not less than 150 % of rated capacity at a head of not less than 65 % of the rated head. The shut-off head shall not exceed 120 % of rated head in the case of horizontal pumps and 140 % in the case of vertical turbine type pumps.

c) Pump-Motor sets shall be capable of continuously delivering the rated output for the voltage variation of (±) 10% and frequency variation of (±) 5% occurring separately or combined voltage and frequency variation of (±) 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 TAC/LPA recommendation.

b) The pumps shall comply with the regulations of Tariff Advisory Committee (TAC)/LPA 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

7.02.00 **Diesel Engine**

7.02.01 Performance requirement of the diesel engine shall be guided by TAC/LPA 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 six (6) 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/LPA).

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 it's 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. Deaerating 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/LPA 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.

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 that 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 it's 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/LPA).

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 six (6) hours.

c) For each compression ignition engine driven pump set, there shall be individual fuel tank and fuel feed pipes.

d) A suitable 1 phase 240 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, taking suction from a sump and deliver pressurized oil through cooler and fine mesh filters to a main supply header fitted in the bed plate casing. High pressure oil shall be supplied to main and big end bearings, cam-shaft bearings, cam-shaft chain and gear drives, governor, auxiliary drive gears etc. Valve gear shall be lubricated at reduced pressure through a reducing valve and the cams by an oil bath. The above lubricating oil sump shall be equipped with adequate heaters having thermostat control to maintain the lubricating oil at recommended temperature for maintaining oil at low viscosity.

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 / LPA / NFPA. The Contractor shall clearly indicate in his offer the type of cooling system adopted. In case fire water is used as a cooling media by tapping of the water from the fire water pump discharge (before the pump discharge valve), the capacity of the fire pump shall be increased, so that the net capacity meets the specification requirement.

7.02.11 **Instrumentation & Control**

The diesel engine shall be provided with adequate instrumentation. These shall include but not limited to the following:

a) Temperature indicator (contact type) in cooling water inlet and outlet.

b) Temperature indicator in lubricating oil outlet from the oil cooler.

c) Pressure gauges (contact type) for lubricating oil system.

d) Differential pressure gauges (contact type) across strainers/ filters.

e) Speed indicator.

f) Running hour meter.

g) Dip stick type lubricating oil sump level indicator.

h) Gauge glass type Fuel Oil Tank level indicator.

i) Voltmeter & Ammeter in dynamo type battery charging circuit.

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

7.03.04 **Instrumentation and Miscellaneous Accessories**

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

a) Discharge air pressure gauge.

b) Pressure switch to control actuation of compressor drive motor.

c) Starter for drive motor.

d) Pressure relief valve.

e) Drain valve.

f) Delivery valve.

7.04.00 **Fire Water Storage Tanks and Hydro-pneumatic Tank**

7.04.01 Fire Water Storage tanks hall be of Steel made of 5000 m^3 capacity with two compartments.

7.04.02 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.

7.04.03 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.

7.04.04 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.

7.04.05 Plates shall be cold rolled through plate bending machine by several number of passes to true curvature and joined by welding.

7.04.06 Tank seams shall be so positioned that they do not pass through vessel connections. Inside seam weld shall be ground smooth, suitable for application of corrosion resistant coating.

7.04.07 All welding shall be as per IS-816 or equal. Bidder shall state clearly in his proposal the make and type of welding rods necessary for construction work.

7.04.08 The tank should preferably be fabricated complete and tested at Manufacturer's works to ensure better workmanship.

7.04.09 **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 per TAC/LPA.

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 Contractor 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 non-return services in general for compressed air 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.

7.05.13 **Safety Relief Valves**

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

7.05.14 **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. Fast acting butterfly valves shall be provided as a bypass valve to the deluge valve, so that the butterfly valve can be operated manually in the event of fire, if there is any malfunction of deluge valve. Isolation valves on upsteam and downstream side of deluge valve shall be provided.

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.

Wherever deluge valves are located, they shall be located in protective room For further details of Specification of all valves mentioned above, Data Sheet shall be referred to.

7.05.15 **Strainers**

a) For basket strainer details Data Sheet shall be referred to.

b) Y-type Inline Strainer (If required) - Body shall be constructed of mild steel as per IS:2062 (tested quality). Strainer wires shall be of stainless steel AISI:316, 18 BWG, 30 mesh. Blowing arrangement shall be provided with removable plug at the outlet. Screen open area shall be at least 4 times pipe cross-sectional area at inlet.

7.05.16 **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.

7.05.17 **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.

7.05.18 **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.

7.05.19 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 any one 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.

7.05.20 **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.

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

7.06.00 **Detectors (Microprocessor Based)**

7.06.01 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.

7.06.02 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.

7.06.03 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.

7.06.04 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.

7.06.05 The detectors shall be located where the largest combustion gas concentration can be expected.

7.06.06 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.

7.06.07 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.

7.06.08 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.

7.06.09 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.

7.06.10 Make and type of detectors shall be subject to Purchaser's approval.

7.06.11 The indigenous detectors shall have the approval of ISI/ISO in addition to the approval of FM/UL/. Detectors and panels shall be preferably from the same manufacturer for compatibility.

7.06.12 The detectors shall not be effected by temperature, humidity, air flows.

7.06.13 **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.

7.06.14 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 to 8 Deg C per min. This detector shall be designed to compensate with the normal changes in ambient temperature, less than 6.7 Deg C per min., which are expected under non-fire conditions.

i) For further details, data sheet shall be referred to.

7.06.15 Detection System by Linear Heat Sensing Cable

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

b) 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.

c) The optical fibre shall be connected to the detector unit in a single continuous loop to ensure redundancy and full coverage of the protected zones even if the cable is broken/cut/damage at one point.

d) 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.

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

7.06.16 **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 (19 Kg/Cm^2 g) in normal practice.

c) Type and make of frangible bulb shall be of Owner's choice /approval.

d) For further details data sheet shall be referred to

7.06.17 **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.

7.06.18 **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.

7.06.19 **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.

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

7.07.01 Each Manual Call point unit shall comprise of a push button of reputed make enclosed in a M.S 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 MS box. This whole assembly of push button in MS box shall again be enclosed in an external MS 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 change over of contact may be conveyed digitally also.

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

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

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

7.07.05 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 MS 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 MS 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 MS enclosure for outgoing cable from the unit.

v) A compression type cable terminating brass gland of reputed make for out going cable from the internal MS 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.

7.08.00 **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 VI of this Specification.

Specifications and data sheets for Detectors are furnished at the end of present Specification volume.

7.09.00 **Battery and Battery Charger**

7.09.01 **Battery**

a) Battery to be located in Plant Service Water Pump House shall be suitable to meet starting requirements of Diesel Engine driven pumps. Besides these all controls, indications, annunciations etc. (including multiplication of process interlock relays and auxiliary relays) shall have power supply from 24 V (2 X 12 V) Battery and Battery Charger

unit.

b) All controls, interlocks, indications, annunciation system etc. for each of the Fire detection alarm cum MIMIC panels (located in Central Control room) and the Repeater Panel (located in Fire Station), 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.

c) Diesel Engine Driven Fire Water Pump

The Battery shall have the capacity to start the Diesel engine at least for eleven starts. Further Battery shall have capacity to meet auxiliaries & other loads of Local Control Panel (if any) for a minimum period of 10 hours. Minimum Ampere-hour capacity of the Battery shall be selected accordingly.

d) The Battery driven Power supply shall be available to main and repeater fire alarm panel shall be designed to provide supply for a minimum period of 10 hours. Minimum ampere hour capacity of the Battery shall be selected accordingly.

e) 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 42°C and 11.7°C respectively.

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

7.09.02 **Battery Charger**

For design and construction of Battery Charger refer Volume V.

7.09.03 **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 / local fire panel / repeater panel.

b) Bidder shall indicate his own layout of 24 volt Battery and Charger to suit the space available.

7.09.04 Fittings & Accessories

Battery

Each battery shall be furnished with necessary accessories required.

8.00.00 **INSPECTION AND TESTING**

8.01.00 **Pipes/Fittings**

8.01.01 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.

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

8.02.00 **Water and Air Line Valves**

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

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

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

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

8.03.00 **Hydrant Valves and Stand Post Assembly**

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

8.03.02 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 reputed TPIA (eg Lloyds, BV etc) or by ISI

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

8.04.00 **Indoor Hydrant Valves (Internal landing valves)**

Each internal landing valve shall be tested for pressure, flow and leak tightness as in clause no. 8.03.00 above.

8.05.00 **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 in clause no. 8.03.00 above.

8.06.00 **Fire Water Monitors**

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

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

8.07.01 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.

8.08.00 **Strainers**

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

8.09.00 **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.

8.10.00 **Fire detection alarm cum MIMIC panels and Repeater panels**

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

8.10.02 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.

8.10.03 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.

8.10.04 Auxiliary Equipment

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

8.11.00 **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 **DRAWING, DATA AND MANUALS TO BE SUBMITTED BY 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 digital type heat sensing cable as detector.

iv) Multicriteria 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, repeater fire panels 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.

9.01.15 I/O list

9.01.16 Technical data sheets

9.01.17 Bill of Materials

9.01.18 P&I diagrams

9.01.19 Details of Spares

9.01.20 Details of Training

9.01.21 Filled up Bid Proposal Sheets

9.01.22 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 Final version of all drawings and data submitted along with bid.

9.03.02 Back-up calculation for no. of quartzoid bulb detectors provided for detection of fire in transformers.

9.03.03 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.

9.03.04 Back-up calculation of IC type heat detectors provided for Indoor/outdoor type LT Transformers (Rating less than 10MVA).

9.03.05 Back-up calculation of heat sensing cable provided for detection in coal conveyor.

9.03.06 Basis of selecting no. of high velocity spray nozzles in LT transformer. One typical calculation each type of transformer shall be furnished.

9.03.07 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.

9.03.08 Pipe sizing calculation including thickness calculation considering allowable velocity of fluid in pipe line as furnished in "Design basis and input".

9.03.09 All civil/structural design calculations as applicable within civil scope of work.

9.03.10 Calculation for sizing of Battery and Battery chargers for each category of service.

9.03.11 Detail dimensional drawings of various panels , cabinets , equipment , components / sub assemblies with internal views.

9.03.11 Complete layout diagrams with foundation details of all panels , cabinets etc.

9.03.12 Junction Box / Rack GA & schedule and Instrument / JB location drawing.

9.03.13 Complete interconnection and cable schedule

9.03.14 JB / Panel Wiring drawings

9.03.15 Power Distribution Drawing

9.03.16 Pneumatic / Process Hookup drawing.

9.03.17 Complete loop and Logic diagrams

9.03.18 Logs and Graphics

9.03.19 List of special tools and tackle

9.03.20 List of consumables

9.03.21 Erection drawings and documents

9.03.22 Calibration and shop test certificates

9.03.23 QAP

ANNEXURE-I

DATA SHEET FOR FIRE WATER PUMPS

			Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps	Booster Pumps, if required
1.00.00	Service	:	a) ←- Fire Hydrant System -→ b) ← Fire spray water system →		For Pressurization of fire water system	Fire Hydrant & Spray System
2.00.00	Duty	:	←---------- Intermittent ----------→			
3.00.00	Location	:	←---------- Indoor ----------→			
4.00.00	Number of Pumps Required	:	a) Hydrant Pump – 1 No. b) High Velocity Water Spray Pump – 1 No c) Medium Velocity Water Spray Pump – 1 No.	Hydrant Pump – 2 Nos. Out of two one (1) is standby for hydrant system. Common standby for HVW & MVW Spray Water System – 1 No	Two (motor driven)	Two nos. for individual area
5.00.00	Pump Performance Requirement					

			Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps	Booster Pumps, if required
	a) Performance standard	:	<---------- Hydraulic institute standard ---------->			
	b) Rated capacity (Cu.m/hr.)	:	410	410	By Bidder	By Bidder
	c) Total head, (MLC) not less than	:	Bidder shall decide to meet TAC/LPA requirements		Bidder shall decide to meet TAC/LPA requirements	Bidder shall decide to meet TAC/LPA requirements
	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	:	←---------- 25% to 130%----------→			
6.00.00	Design standard	:	←----------HIS/ IS 5120/Equivalent Standard----------→			
7.00.00	Impeller type	:	←----------Semi open----------→			
8.00.00	Type of gland lubrication and sealing	:	←----------By Bidder----------→			
9.00.00	Shaft sealing arrangement	:	←---------- Mechanical seal ----------→			

			Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps	Booster Pumps, if required
10.00.00	Axial thrust balancing device to be designed for pump shut-off operation	:	←---------- Yes ----------→			
13.00.00	Type of pump-motor connection	:	←----------Direct ----------→			
14.00.00	Type of coupling	:	←---------- Flexible Coupling ----------→			
15.00.00	Mode of pump starting	:	←-- Discharge valve fully open ---→			
16.00.00	Material of Construction					
	a) Casing	:	← 2.5% NiCI as per IS:210 Gr. FG 260 →			
	b) Casing liner	:	←---------- Do ----------→			
	c) Impeller	:	<--------ASTM - A 743 GR. CF 8 M-------→			
	d) Wearing rings	:	<------ SS-304 -------→			
	e) Pump shaft	:	←--------- AISI 410 (Hardened) ----------→			
	f) Gland	:	← 2.5% NiCI as per IS:210 Gr. FG 260 →			
	g) Base plate	:	←----- Carbon Steel as per IS-2062 -----→			
	h) Mechanical Seal	:	<----- As per Manufacturer's Standard-------→			
	i) Wetted Fastners	:	←---------- SS-316 ----------→			

			Elec. Motor Driven	Diesel Eng. Driven	Jockey Pumps	Booster Pumps, if required
	j) Companion Flange	:	←----- Carbon Steel as per IS-2062 -----→			
17.00.00	Supply of accessories & services					
	a) Base plate	:	←---------- Yes ----------→			
	b) Foundation bolts, nuts, sleeves etc.	:	←---------- Yes ----------→			
	c) Suction & Discharge companion flanges with bolts, nuts & gaskets	:	←---------- Yes ----------→			
	d) Priming connection with 3 way SS isolating valve	:	←---------- Yes ----------→			
	e) Suction & Discharge pressure indicator	:	←---------- Yes ----------→			
	f) Vent with 3 way SS isolating valve	:	←---------- Yes ----------→			
	g) Pump-motor coupling and guard	:	←---------- Yes ----------→			
	h) Drain connection with valve		←---------- Yes ----------→			
	i) Eye-bolts, lifting tackle etc.	:	←---------- Yes ----------→			

ANNEXURE-II

DATA SHEET FOR DIESEL ENGINE

1.00.00	**GENERAL INFORMATION**		
1.01.00	Service	:	Plant Service Water Pump House
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	:	Three (3)
1.05.00	Duty	:	Intermittent
1.06.00	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.

ANNEXURE-III

DATA SHEET
FOR
AIR COMPRESSOR

1.00.00	Service	:	For Pressurization of Hydro pneumatic Tank
2.00.00	Number required	:	Two (2) (1- working + 1- standby)
3.00.00	Type	:	Oil free, water cooled, Rotary Screw Compressor.
4.00.00	Duty	:	Intermittent from receiver pressure
5.00.00	Location	:	Indoor
6.00.00	Drive		Electric motor as per Volume V and V-Belt drive

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 Storae 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 compressd 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 : a) 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.

b) 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^{o} - 150^{o}
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

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 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^{o} C to 70 ^{o}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^{o} C to 150^{o}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 N_2 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 mm ² cable.

ii) Connecting PNRV to signal box, using Fire survival cables 4C x 1.5 mm ²

iii) Connections to FEC for 230V AC single-phase panel light supply, using fire survival cables 4C x 1.5 mm ²

iv) Connections from relay panel to control box using fire survival cables 4Cx1.5mm ²

v) Connections from DC source to control box directly or through DC-DC connector, using fire survival cables 4C x 1.5 mm ²

vi) Connections between signal box to control box and between control box to FEC using fire survival cables 12 C x 1.5 mm ²

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

SECTION - 3

PROJECT DETAILSGENERAL TECHNICAL REQUIREMENTS

GENERAL TECHNICAL REQUIREMENTS

1.0 PROJECT DETAILS

A) Kothagudem TPS

Customer	:	M/s Telangana State Power Generation Corporation Ltd.
Project Title	:	1x800MW Kothagudem Thermal Power Station Stage VII, Unit 12
Project Location	:	Paloncha Village, Khammam District, Telangana
Nearest Railway station	:	Bhadrachalam Road railway station.
Nearest Road Head	:	Khammam 16 km approx., Nearest Highway NH221 (Vijaywada – Jagdalpur Highway).
Nearest Airport	:	Hyderabad (about 200 Km)
Postal Address	:	Chief Engineer (O&M), Kothagudem Thermal Power Station Stage VII, Unit – 12, TSGENCO, Village - Paloncha, Dist. – Khammam, Telangana -507115

1.1. SITE CONDITIONS (FOR design PURPOSES)

1.1.1 SITE CONDITIONS

a).	Average rainfall per year	:	1124 mm
b).	Maximum hourly rainfall intensity	:	102 mm
c).	Altitude	:	1000 m

1.1.2 DESIGN AMBIENT

a).	Minimum Temperature	:	13.5°C
b).	Maximum Temperature	:	45°C
c).	Design Ambient Temperature	:	50 °C

1.1.3 RELATIVE HUMIDITY

a).	Maximum	::	85%

1.1.4 WIND PRESSURE (AS PER IS:875-1987)

a). Design wind speed : 44 m/sec.

1.1.5 SEISMIC FACTORS

a). Horizontal Seismic Coefficient : As per latest IS : 1893 } ***Zone – III***

b). Vertical Seismic Coefficient : As per latest IS : 1893

1.1.6 ELECTRICAL DATA

		400 kV System	415V AC System	240V AC System	220 V DC System	48 V DC System
1.	Nominal Voltage	400 kV	415 V	240 V	220 V	48 V
2.	Highest System Voltage	420 kV	457 V	264 V	242 V	55 V
3.	No. of phases	3	3	1	NA	NA
4.	Frequency	50 Hz	50 Hz	50 Hz	NA	NA
5.	Voltage variation	± 5%	± 10 %	± 10 %	+10 % to -15%	± 10 %
6.	Neutral Earthing	Effectively Earthed	Solidly Earthed	Solidly Earthed	-	-
7.	Fault Level	50 kA for 1 sec.	50 kA for 1 sec.	50 kA for 1 sec.	15 kA for 1 sec.	-

1.1.7 SYSTEM PARAMETERS

Dry and wet one minute power frequency withstand voltage	630 kV rms
Dry impulse withstand voltage positive and negative	1425 kV peak
Minimum Total Creepage	25 mm/kV

1.1.8 MINIMUM CLEARENCE (AS PER IS: 10118)

Phase to phase (PP)	4200 mm
Phase to earth (PE)	3500 mm
Section clearance	6500 mm
Minimum ground clearance from plinth level (Plinth level : 300 mm)	8000 mm

1.2. INSTRUCTION TO BIDDERS

The bidders shall submit the technical requirements, data and information as per the technical data sheets, provided in Section-4.

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification. It is recognised that the Manufacturer may have standardised on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously.

1.3. STANDARDS

The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

The equipment to be furnished under this specification shall conform to latest issue (with all amendments) of specified standards.

In addition to meeting the specific requirement called for in Sections 1 and 2 of the Technical Specification, the equipment shall also conform to the general requirement of the applicable standards, which shall form an integral part of the specification. The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other. When the specific requirements stipulated in the specifications exceed or differ from those required by the applicable standards, the stipulation of the specification shall take precedence.

Other internationally accepted standards, which ensure equivalent or better performance than that specified in the standards referred, shall also be accepted. The bidder shall submit copies of such standards.

In case governing standard for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in the offer along with English language version of standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's / owner’s approval. The bidder shall clearly indicate in his bid the specific standards in accordance with which the works will be carried out.

1.4. TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

All equipment being supplied shall conform to type tests and shall be subject to routine and acceptance tests in accordance with requirements stipulated under respective sections. Purchaser reserves the right to witness any or all the tests. The Manufacturer shall intimate the Purchaser the detailed programme about the tests at least three (3) weeks in advance in

case of domestic supplies & six (6) weeks in advance in case of foreign supplies. Purchaser reserves the option for getting any or all the type tests repeated on the equipment. The Manufacturer shall also submit type test procedure for approval of the Purchaser.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the technical specification or any/all additional type tests not carried out without any additional cost implication to the Purchaser.

The price of conducting all tests and additional type tests is deemed to be included in Bid price. In case any bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to be rejected.

The purchaser intends to repeat the type tests and additional type tests on cables for which test charges shall be payable as per provision of contract.

The Purchaser, his duly authorised representative and/or outside inspection agency acting on behalf of the Purchaser shall have at all reasonable times free access to the Contractors premises or Works and shall have the power, at all reasonable times to inspect and examine the materials and workmanship of the Works during its manufacture or erection if pert of the Works is being manufactured or assembled at other premises or works, the Manufacturer shall obtain for the Engineer and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Manufacturer's own premises or works. Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

The Manufacturer shall give the Purchaser/inspector thirty (30) days written notice of any material being ready for testing. Such tests shall be to the Manufacturer's account except for the expenses of the inspector. Unless witnessing of the tests is virtually waived, the Purchaser/ inspector will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/ inspection, failing which the Manufacturer may proceed with the test which shall be deemed to have been made in the Inspector's presence and the Manufacturer shall forthwith forward duly certified copies of test reports in triplicate to the Inspector.

The Purchaser or Inspector shall, within fifteen (15) days from the date of inspection as defined herein, give notice in writing to the Manufacturer, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Manufacturer shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Purchaser/ inspector giving reasons therein, that no modifications are necessary to comply with the Contract.

When the factory tests have been completed at the Manufacturer's works, the Purchaser/ inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Purchaser/inspector, the certificate shall be issued within fifteen (15) days of receipt of the Manufacturer's Test certificate by the Engineer/ Inspector. Failure of the Purchaser/inspector to issue such a certificate shall not prevent the Manufacturer from proceeding with the Works. The completion of this test or the issue of the certificate shall not bind the Purchaser to accept the equipment should it, on further tests/ after erection, be found not to comply with the Contract. The equipment shall be dispatched to site only after

approval of test reports and issuance of MICC by the Purchaser.

In all cases where the Contract provides for tests whether at the premises or at the works of the Manufacturer or of any Sub-Contractor, the Manufacturer except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Purchaser /Inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Purchaser Inspector or to his authorised representative to accomplish testing.

The inspection by Purchaser and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Manufacturer in respect of the agreed quality assurance programme forming a part of the Contract.

The Purchaser will have the right of having at his own expenses any other test(s) of reasonable nature carded out at Manufacturer's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.

The Purchaser reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipment for these tests shall be provided by the Purchaser.

1.5. MATERIAL/WORKMANSHIP

1.5.1 GENERAL REQUIREMENT

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood that the same must be new, of highest grade of the best quality of their kind conforming to best engineering practice and suitable for the purposes for which they are intended.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfil their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from purchaser.

Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

All materials and equipment shall be installed in strict accordance with the manufacturer's

recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be construed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, levelling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances /instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture's limits. Suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.

All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. If such is the case, he shall declare in the proposal where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

1.5.2 PROVISIONS FOR EXPOSURE TO HOT AND HUMID CLIMATE

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipment located in non-air conditioned areas shall also be of same type.

1.6. COLOUR SCHEME AND CODES FOR PIPE SERVICE

The contractor shall propose a colour scheme for those equipment/Items for which the colour scheme has not been specified in the specification for the approval of purchaser. The decision of purchaser shall be final. The scheme shall include:

Finishing color of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

All steel structures, plates etc. shall be painted with non-corrosive paint on a suitable primer. It may be noted that normally all electrical equipment in switchyard are painted with shade 631 of IS-5. All The indoor cubicles shall be of same colour scheme and for other miscellaneous items,

colour scheme will be approved by the purchaser.

1.7. PAINTING

a) All sheet steel work shall be phosphated in accordance with the following procedure and in accordance with IS: 6005 "Code of practice for Phosphating Iron and Steel".

b) Oil, grease, dirt and swerve shall be thoroughly removed from emulsion by cleaning.

c) Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

d) After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute bichromate solution and over drying.

e) The phosphate coating shall be sealed by the application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be "Flash dried" while the second coat shall be stoved.

f) After application of the primer, two coats of finishing epoxy paint shall be applied, each coat followed by stoving. The panel shall have colour conforming to shade 631 of IS-5 for outside and inside of the panel with black colour for base frame.

g) Each coat of primer and finishing paint shall be of a slightly different shade to enable inspection of the painting.

h) Finished painted appearance of panel shall present an asthetically pleasing appearance free from dents and uneven surface.

i) A small quantity of finishing paint shall be supplied for minor touching up required at site after the installation of the panels.

1.8. PROTECTION

a) All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

b) All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.

c) The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.

d) Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

1.9. FUNGISTATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the

treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

1.10. SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be throughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

1.11. GALVANIZING

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support channels, structures, shall be hot dip galvanized conforming to latest version of IS:2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvanized. Minimum weight of zinc coating shall be 610 gm/sq.mm and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM.

1.12. AUXILIARY POWER SUPPLY

1.12.1 A.C power supply for auxiliaries will be available at 240 V, 50 C/s 1-phase, 2 wire and 415V, 50 C/s, 3-phase, 4 wire, neutral solidly earthed with variation in frequency of +/-5% and variation in voltage +/-10%

1.12.2 D.C. power supply at 220 V, 2-wire ungrounded will be available 187 V to 242 V.

1.13. INSPECTION AND TESTING

All tests and inspection of the equipment specified shall be performed to the extent and in the manner as stipulated in the relevant standards and in this specification. All type tests/routine tests/acceptance tests as specified shall be conducted in the presence of purchaser. Wherever equipment similar to the one being offered has already been type tested within 5 years from the date of opening the bid. Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off. Otherwise the subcontractor will have to carry out the type tests without any extra cost and without any delivery implications.

1.14. PACKAGING

Aluminium Tube shall be partially packed with Hessians cloths. Similar items shall be grouped and tied with steel wires/strip for convenient handling during transits.

MARKINGS

The following details are to be clearly indicated in the material forwarding documents:

a) Name and address of the consignee.
b) Purchase order number.
c) Name of supplier/s.
d) Description of equipment / material.
e) Tare weight.
f) Gross weight.

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/ material at a later date, in case the need arises, while packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage wagons and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Purchaser takes no responsibility of the availability of the wagons.

1.15. HANDLING, STORING AND INSTALLATION

In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the purchaser or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented. Commercial use of switchyard equipment means completion of all site tests specified and energisation at rated voltage.

Contractor may engage manufacturer's Engineers to supervise the unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's supervisory Engineer(s) and shall extend full cooperation to them.

In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser.

Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary

mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the contractor at his own expenses.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. The Contractor shall submit to the purchaser every week a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the Contractor' account.

The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning. Contractor shall be responsible for the maintenance to the equipment/material while in storage as well as after erection until taken over by Purchaser, as well as protection of the same against theft, element of such nature, corrosion, damages etc.

The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipments which require indoor storage.

The words erection and installation used in the specification are synonymous. Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

1.16. TOOLS AND TACKLES

The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipment. However, these tools and tackles shall be separately, packed and brought on to Site.

1.17. EQUIPMENT BASES

A cast iron or welded steel base-plate shall be provided for all rotating equipment, which is to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base-plate shall

support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units shall have a raised lip all around, and shall have threaded drain connections.

1.18. QUALITY

BHEL quality plan to be followed subject to TBQM / customer's approval.

1.19. DOCUMENTATION

DRAWINGS

All drawings shall be prepared in AutoCAD and ultimate documentation would include drawings/documents on CDs. All dimensions and data shall be in SI metric units.

All items of the equipment should be clearly identified by proper part nos. in the contract drawings. Such parts, which are to be dispatched to site from works in dispatch able units and are reassembled at site, should be marked by proper identification marks at works and indicated in the drawings and quantified. The shipping list should be sent along with the general arrangement drawings for engineer's approval. All the items of the shipping list should be identified in the drawing.

The drawing submitted by the supplier shall be reviewed by the purchaser as far as practicable within two weeks of receipt of drawings and shall be modified by the sub-contractor if any modifications and/or corrections are required by the purchaser. The sub-contractor shall incorporate such modifications and / or corrections and submit the final drawings for approval. Any delay arising out of failure of the subcontractor to rectify the drawings shall not alter the contract completion date.

Further work by the subcontractor shall be in strict accordance with these drawings and no deviation shall be allowed without the written approval of the purchaser.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at supplier's risk.

Approval of drawing or work by the purchaser/consultant shall not relieve the subcontractor of any of his responsibilities and liabilities under the contract.

In case of any modifications that may be necessary during erection or commissioning of the equipment, the subcontractor shall carry out modifications in the original drawing & submit 'As Built drawings' and required no. of prints thereof.

INSTRUCTION MANUALS

The supplier shall submit to the purchaser, draft instruction manuals for approval within 30 days of placement of order. The final instruction manuals complete in all respects shall be submitted 60 days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipment furnished, the erection procedures, testing, operation & maintenance procedures of the equipment.

If after the commissioning and initial operation of the plant, the instruction manuals require any

modification/ addition / changes, the same shall be incorporated and the up- dated final instruction manuals shall be submitted as required.

TITLE BLOCK & DRAWING/ DOCUMENT NUMBERING SCHEME

Title block for drawing / document should be followed as per ANNEXURE-3

DOCUMENTATION SCHEDULE AT CONTRACT STAGE

A.	For approval	No of Copies
	Copies of all drawings with project details, Dimension, shipping weights, No. of cases & Dimensions, fixing details, tolerance etc.	10
	Copies of type test reports.	5
	Copies of works quality plan & field quality plan.	5
	Copies of installation, operation & maintenance manual.	5
	Copies of drawings on floppies/CDs	1 set
B.	After approval and for information / distribution	
	Copies of all drawings	15
	Copies of installation, operation & maintenance manual	15
	CDs of Drgs.	3
C.	As Built Drawings	
	Hard copies of Drawings	15
	CDs	3

NOTE:

1. Any revision of drawings / documents shall be submitted in the same no. of copies submitted first time for approval
2. Final drawings / documents shall be submitted in bound volume with customer and project details etc. written on the top.

SECTION 4
LIST OF DOCUMENTS

1.0 LIST OF DOCUMENTS

Following drawings will be submitted during detailed engg. of the project:

Drawing/Document No.	Drawing/Document Title
TB-DG-377-552-002	P & I Diagram
TB-DG-377-552-003	Fire Water Piping Layout
TB-DG-377-552-004	Distribution of Extinguisher inside control room
TB-DG-377-552-006	Fire Detection layout for Control bldg. & FOLHS cable detection layout for Cable spreader room
TB-DG-377-552-007	MVW Spray drawings for Cable Spreader
TB-DG-377-552-008	Deluge Valve Local Control panel Drg
TB-DG-377-552-009	HVW Spray Plan/Isometric Drg with Hydraulic Calc. for 125 MVAR Reactor
TB-DG-377-552-005	Schematic of Fire detection system
TB-BQ-377-552-11	BOQ - FPS

SCHEDULES AND ENCLOSURES

SECTION- 5

ENCLOSURES TO SPECIFICATION

SCHEDULES TO BE FILLED UP BY THE BIDDER

Schedule 1 **Schedules of Deviations**

Schedule 2 **Schedule of Unpriced bid**

Schedule 3 **Details of contact persons (technical & commercial)**

Schedule 4 **Enclosures to Specification**

ANNEXURE-A Drawings

SCHEDULE-1

SCHEDULE OF TECHNICAL DEVIATION

The following are the deviations / variations / exceptions from the specification:

Section	Clause No. / Page No.	Statement of deviation/ Variations/Exceptions

1) In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract are deemed to be in compliance with the specification.

2) If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**

3) Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

Place — Signature of the authorized representative of Bidder

Name ----------

Date — Designation----------

Company seal----------

SCHEDULE-2

Bidders shall attach signed and stamped **unpriced** copy of the BOQ under the following heads with their technical offer:

Sl. No.	Item Description	Whether unit Rates have been furnished in priced bid?
1A	Supply of main items as per BOQ attached as Annexure-B to Section-1 of technical specification	YES
1B	Supply of Mandatory Spares as per BOQ attached as Annexure-B to Section-1 of technical specification	YES
2.	Erection, Testing & commissioning of the firefighting system scope excluding Mandatory Spares	YES

Place

Date

Signature of the authorized representative of Bidder

Name ----------

Designation----------

Company seal----------

SCHEDULE - 3

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Date

Signature of the authorized representative of Bidder

Name----------

Designation----------

Company seal ----------

Note: Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

SCHEDULE – 4

ENCLOSURES TO SPECIFICATION

DRAWINGS (ANNEXURE-A)

Sl. No.	Drawing / Document No.	Drawing / Document Title
1	TB-DS-377-552-01	D.S. for Fire Protection items
2	TB-DS-377-552-08	D.S. For Twisted Pair Control Cable
3	TB-0-377-510-002 Rev.07	400 KV SWITCHYARD PLAN
4	TB-0-377-316-005 Rev.01	CABLE TRENCH LAYOUT FOR 400 KV SWITCHYARD
5	34690001468 Rev.01	OGA OF 125 MVAR REACTOR.
6	TB-DS-377-552-10	D.S. for Fire Detection items

TECHNICAL DATA SHEETS OF FIRE PROTECTION ITEMS

INDEX

A. PIPES (MS & GI)

A-1	PIPING NORMALLY FILLED WITH WATER - MS PIPE		
1.0	MAKE	:	TATA/ JINDAL/SURYA ROSHNI/GOOD LUCK TUBES
2.0	TYPE	:	ERW, BLACK
3.0	CLASS & GRADE	:	**a. FOR 150NB & BELOW**
		:	MS BLACK HEAVY GRADE TO IS : 1239 (Part- I)
		:	**b. FOR 200 NB & ABOVE**
		:	IS: 3589, Gr. 410
4.0	THICKNESS	:	**a. FOR 150NB & BELOW**
		:	AS PER IS 1239 (Part - I), Heavy Grade
		:	**b. FOR 200 NB to 250 NB**
		:	6.3 mm
5.0	ENDS	:	**a. FOR 150NB & BELOW**
		:	PLAIN ENDS
		:	**b. FOR 200 NB & ABOVE**
		:	BEVELLED
6.0	QUANTITY	:	AS PER APPROVED DRAWING
7.0	ACCEPTANCE/ INSPECTION	:	AS PER APPROVED QAP
8.0	PAINTING	:	FOR U/G PIPES AT SITE ONLY
8.1	WRAPPING CAOTING APPLICATION FOR UNDERGROUND PIPING	:	Min. 4 mm thick wrapping and coating will be provided as an anti corrosive protection (2 layers x 2mm THK Tape) as per IS :10221.
9.0	HYDROTEST PRESSURE	:	18 Kg/sq.cm (i.e 1.5 TIMES WORKING PRESSURE)

A-2	PIPING NORMALLY EMPTY OR PERIDICALLY CHARGED WITH WATER - GI PIPE		
1.0	MAKE	:	TATA/ JINDAL/SURYA ROSHNI/GOODLUCK TUBES
2.0	TYPE	:	ERW, GALVANIZED AS PER IS:4736
3.0	CLASS & GRADE	:	**a. FOR 150NB & BELOW**
		:	HEAVY GRADE TO IS : 1239 (Part- I)
		:	**b. FOR 200 NB & ABOVE**
		:	IS: 3589, Gr. 410
4.0	THICKNESS	:	**a. FOR 150NB & BELOW**
		:	AS PER IS :1239 (Part - I), Heavy Grade
		:	**b. FOR 200 NB to 250 NB**
		:	6.3 mm
5.0	ENDS	:	**a. FOR 200NB & BELOW**
		:	PLAIN ENDS
6.0	QUANTITY	:	AS PER APPROVED DRAWING
7.0	ACCEPTANCE/ INSPECTION	:	AS PER APPROVED QAP
8.0	PAINTING	:	FOR A/G PIPES
8.1	PRIMER	:	1 COAT OF ETCH PRIMER FOR ALL GI PIPES
8.2	FINISH	:	3 COAT of CHLORINATED RUBBER PAINT

B. FITTINGS (MS & GI)

1.0	MAKE	:	M S FITTINGS/METAL LLOYDS /BHARAT FORGE /TUBE PRODUCTS /NITIN PROFILE/PARMAR/ RAJENDRA FORGE/JUPITER METAL
2.0	FITTINGS STANDARD	:	Fittings Shall be Butt-welded As per IS : 1239, Part I, heavy class for sizes 50NB and above.
		:	Fittings Shall be threaded as per IS 1879 : Malleable cast Iron Fittings for 40NB and below.
		:	All fittings downstream of Deluge Valve shall be Galvanized. Galvanzing shall be as per 4736
3.0	**THREADED FITTINGS (GI)**	:	
3.1	DIMENSIONAL STANDARD	:	ANSI B 16.11
3.2	MOC	:	IS:1879 Malleable Cast iron fittings
4.0	**BUTT WELDED FITTINGS**	:	
4.1	DIMENSIONAL STANDARD	:	ANSI B 16.9
4.2	MOC	:	Carbon Steel ASTM A-234 Gr WPB
5.0	**FLANGES**	:	
5.1	DIMENSIONAL STANDARD	:	ANSI B 16.5 #150
5.2	MOC	:	Mild Steel As per IS 2062
6.0	**ANCHOR & FASTENER**	:	As Per manufacturer's Standard
7.0	**NUT & BOLTS**	:	
7.1	DIMENSIONAL STANDARD	:	IS:1367 CL 4
7.2	MOC	:	IS:1367
8.0	**GASKET**	:	
8.1	DIMENSIONAL STANDARD	:	ANSI B 16.5 FF, CL 150 , 3 MM THK
8.2	MOC	:	Rubber as per IS:638
9.0	**GI U CLAMP**	:	

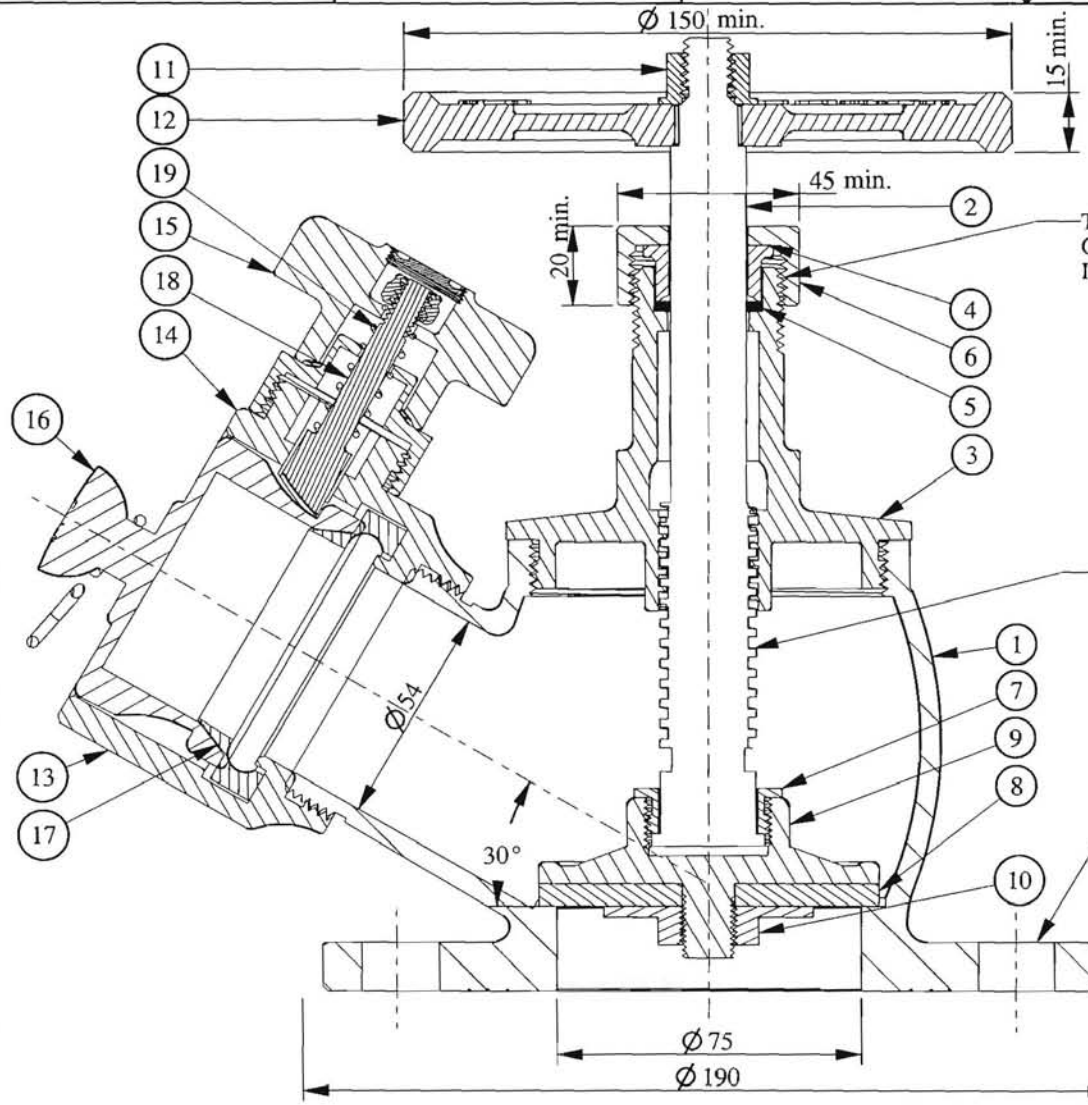
9.1	DIMENSIONAL STANDARD	:	IS:1367 CL 4.6 (For pipe sizes upto 80 NB - 6 MM THK) (For pipe sizes 100 NB & above - 8 MM THK)
9.2	MOC	:	IS:1367
10.0	ACCEPTANCE	:	As Per manufacturer's TC & COC

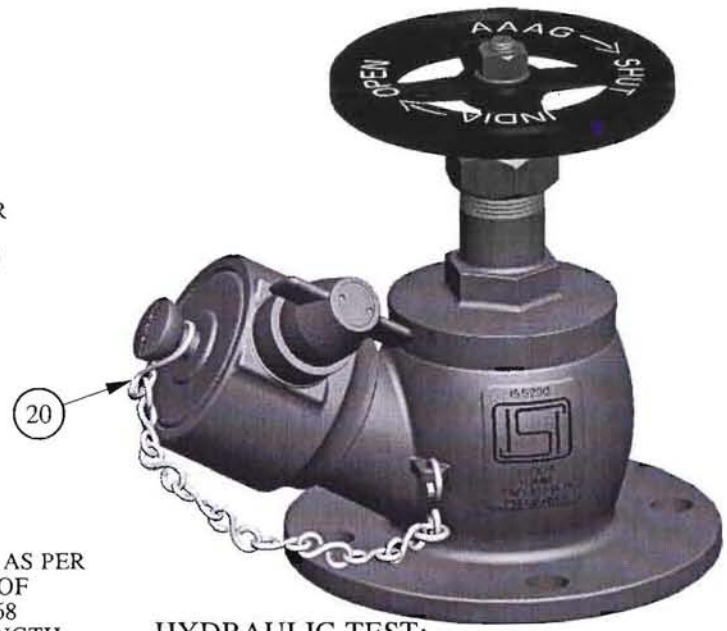
TECHNICAL DATA SHEET FOR FPS ITEMS

PROJECT : 1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD	**PACKAGE : FIRE PROTECTION SYSTEM**
MAIN CONTRACTOR : BHEL	
S	
DOC NO : TB-DS-377-552-02	**REV:0 PAGE:8 of 76**

C. HYDRANT VALVE

1.0	**MAKE**	:	**Shah Bhogilal**
2.0	TYPE	:	Single Headed Oblique Type
3.0	SIZE	:	Outlet 63 NB Instanteneous
4.0	DESIGN & DIM STANDARD	:	IS: 5290-1993 Type A
5.0	OPERATION	:	By Hand Wheel
6.0	OPERATING DIRECTION	:	Anticlockwise to open
7.0	BONNET	:	Screwed
8.0	STEM	:	Rising
9.0	**END CONNECTION**	:	
9.1	INLET	:	Flanged (Flat Faced), as per ANSI B 16.5, 150# , Size-80 NB
9.2	OUTLET	:	63 MM Female Instantaneous couplling with blank cap & (G.I) chain
10.0	**MATERIAL OF CONSTRUCTION**	:	
10.1	BODY ,BONNET ,STOP VALVE,CHECK NUT,GLAND NUT INST.COUP	:	SS 304 (IS : 3444 GR.1)
10.2	SPRING	:	SS 304 (IS: 6528)
10.3	SPINDLE	:	SS 304 (IS : 6603)
10.4	HAND WHEEL	:	CI IS : 210
10.5	RUBBER RING	:	RUBBER IS : 937
11.0	**HYDRAULIC TEST**	:	
11.1	BODY	:	21 Kgf/cm^2 For 2.5 Minutes
11.2	SEAT	:	14 Kgf/cm^2 For 2.5 Minutes
12.0	FLOW TEST	:	900 LPM Min. at 7 Kgf/cm^2
13.0	MARKING	:	PERMANENTLY MARKED BRAND : SIZE : 63 MM & YEAR of MANUFACTURING
14.0	QUANTITY	:	As per Approved Drawing
15.0	INSPECTION & TESTING	:	As per Manufacturer TC





HYDRAULIC TEST:

SEAT TIGHTNESS	**:14KGF/CM2. (FOR 2.5 MINIUTES)**
BODY	**:21KGF/CM2. (FOR 2.5 MINIUTES)**
FLOW TEST	**:900 LPM MIN @ 7KGF / CM2.**

REV NO	DESCRIPTION	D.R.D / DRN	MRG / CHKD	DATE

REVISIONS

PROJECT

CLIENT

PROJECT MANAGEMENT CONSULTANT

MANUFACTURER

SHAH BHOGILAL JETHALAL & BROS.
AHMEDABAD
SINCE 1933

TITLE : 63mm OBLIQUE TYPE LANDING VALVE

SCALE	DRAWING NO :	SHEET	REV.
N.T.S	SBJ/104/SS-ASA	1 OF 1	0

PARTLIST

NO.	DESCRIPTION	MATERIAL
20	CHAIN	GALVANIZWD
19	SPRING	SS 304 (IS:6528)
18	CAM TOOTH	SS 304 (IS:3444 Gr.1)
17	RUBBER RING	RUBBER IS:937
16	BLANK CAP	PVC
15	UPPER LUG	SS 304 (IS:3444 Gr.1)
14	LOWER LUG	SS 304 (IS:3444 Gr.1)
13	FEMALE OUTLET	SS 304 (IS:3444 Gr.1)
12	HAND WHEEL	C.I. IS : 210
11	HEX.NUT	M.S.

PART LIST

NO.	DESCRIPTION	MATERIAL
10	SEAT CHECK NUT	SS 304 (IS:3444 Gr.1)
9	STOP VALVE	SS 304 (IS:3444 Gr.1)
8	SEAT WASHER	RUBBER IS:937
7	CHECK NUT (SPINDLE)	SS 304 (IS:3444 Gr.1)
6	GLAND NUT	SS 304 (IS:3444 Gr.1)
5	GLAND PACKING	ASBESTOSE ROPE
4	GLAND BUSH	SS 304 (IS:3444 Gr.1)
3	BONNET	SS 304 (IS:3444 Gr.1)
2	SPINDLE	SS 304 (IS:6603)
1	BODY	SS 304 (IS:3444 Gr.1)

D. BRANCH PIPE WITH NOZZLE

1.0	MAKE	:	SHAH BHOGILAL/SUKAN /NEWAGE /WINCO
2.0	TYPE	:	STRAIGHT JET TYPE
3.0	SIZE	:	63 NB -INLET
		:	15NB/20NB - OUTLET
4.0	DESIGN & DIM STANDERD	:	IS: 903
5.0	HYDRAULIC PRESSURE TEST	:	21 KG/CM^2
6.0	**MATERIAL OF CONSTRUCTION**	:	
6.1	BRANCH PIPE	:	SS 304 (IS: 3444 Gr.1)
6.2	NOZZLE	:	SS 304 (IS: 3444 Gr.1)
6.3	WASHER	:	RUBBER TO IS : 937
7.0	LENGTH OF BRANCH PIPE	:	200 MM (Min.)
8.0	LENGTH OF NOZZLE	:	100 ± 1 mm
9.0	MARKING	:	SHALL BE AS PER IS : 903
10.0	QTY	:	AS PER APPROVED DRAWING
11.0	ACCEPTANCE	:	AS PER MANUFACTURER TC

TECHNICAL DATA SHEET FOR FPS ITEMS

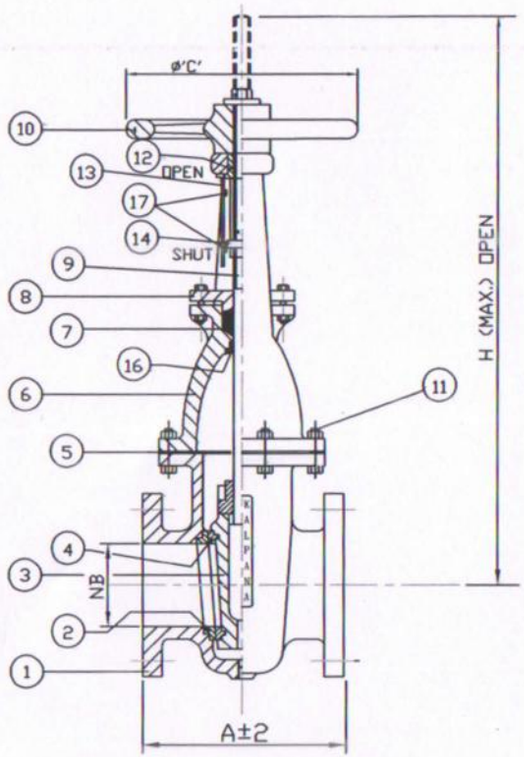
PROJECT : 1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD	**PACKAGE : FIRE PROTECTION SYSTEM**
MAIN CONTRACTOR : BHEL	
S	
DOC NO : TB-DS-377-552-01	**REV. 0 PAGE : 11 OF 76**

E. HOSE BOX

1.0	MAKE	:	REPUTED MAKE
2.0	TYPES	:	For All Indoor Hydrants - Wall Mounted type
		:	For All Outdoor Hydrants -Pedestal Mounted type
3.0	SIZE	:	A.FOR INDOOR HYDRANT & OUTDOOR HYDRANT
			750 MM × 600 MM × 250 MM
4.0	APPLICATION	:	For All Outdoor Hydrants 2 Nos. of 15 mtr. Long Hose Pipe with coupling & Branch pipe with Nozzle
		:	For All Indoor Hydrants 2 Nos. of 7.5 mtr. Long Hose Pipe with coupling & Branch pipe with Nozzle
5.0	**CONSTRUCTION FEATURES**	:	
5.1	BODY	:	16 SWG MS SHEET
5.2	DOORS	:	Two Front doors (Glass type) shall be double hinged, the same reflected in GA Drawing
6.0	**MATERIAL OF CONSTRUCTION**	:	
6.1	BODY & KEY BOX	:	MS SHEET
6.2	DOOR GLASS	:	3 MM Thickness
6.3	ACCESSORIES	:	Key with duplicate
6.4	SUPPORTS	:	**WALL MOUNTED TYPE** - Hooks are provided for fixing on wall **PEDESTAL MOUNTED TYPE-** Hooks & Angles are used.
6.5	PAINTING	:	Two coates of red oxide primer inside & outside. One finished coat of epoxy white from inside.
7.0	QUANTITY	:	As per Approved Drawing
8.0	INSPECTION & TESTING	:	As per Manufacturer's Test Certificate
9.0	GA DRG	:	Attached
10.0	MARKING	:	"FIRE HOSE" Painted prominently in graphic style (150 MM size Letter on glass)

F. GATE VALVE

1.0	MAKE	:	KALPANA
2.0	RATING	:	PN 1.6
3.0	SIZE	:	80 MM TO 150 MM
4.0	TYPE	:	RISING TYPE
5.0	REFERENCE STANDARD & DESIGN	:	IS 14846 (PD) / BS:5150
6.0	**MATERIAL OF CONSTRUCTION**		
6.1	BODY & COVER	:	CAST IRON TO IS:210, FG 260
6.2	BODY SEAT RING	:	BRONZE TO IS:318 LTB-2
6.3	WEDGE FACING RING	:	BRONZE TO IS:318 LTB-2
6.4	STEM	:	S.S. TO AISI-410
6.5	GLAND	:	CAST IRON TO IS:210, FG 260
6.6	BOLTS & NUTS	:	CARBON STEEL TO IS:1363 CL-4.6/4
6.7	WEDGE	:	CAST IRON TO IS:210, FG 260
6.8	YOKE BUSH	:	BRONZE TO IS:318 LTB-2
6.9	GLAND PACKING	:	JUTE & HEMP TO IS:5414
6.10	GASKET	:	RUBBER AS PER IS:638,TYPE-B
6.11	END CONNECTION	:	FLANGED END
6.12	FLANGE DRILLING STANDARD	:	ANSI B 16.5 CLASS-150 (F/F)
6.13	LIMIT SWITCH	:	PROVIDED FOR GATE VALVE OF UPSTREAM AND DOWNSTREAM LINE OF MVWS AND HVWS.
7.0	**HYDRAULIC TEST PRESSURE**		
7.1	BODY	:	24 Kg/cm² for 5 minute
7.2	SEAT	:	16 Kg/cm² for 2 minute
8.0	PAINTING SPECIFICATION	:	AS PER IS:5/TWO COAT PRIMER AND TWO COAT BLACK PAINT
9.0	QUANTITY	:	As per Approved Drawing
10.0	TESTING	:	AS PER IS:14846/2000/BS:5150



SIZE FOR 100MM

Sl. NO.	NAME OF PARTS	MATERIALS & SPECN.
1	BODY	CAST IRON IS:210 FG-260
2	BODY SEAT RING	BRONZE TO IS:318 LTB-II
3	WEDGE	CAST IRON IS:210 FG-260
4	WEDGE FACING RING	BRONZE TO IS:318 LTB-II
5	GASKET	RUBBER IS.:638.
6	COVER	CAST IRON IS:210 FG-260
7	PACKING	JUTE & HEMP
8	GLAND	CAST IRON IS:210 FG-260
9	STEM	S. S. ASTM TYPE- 410
10	HAND WHEEL.	CAST IRON IS:210 FG-260
11	BOLTS & NUTS.	CARBON STEEL. IS.:1363 Cl.-4.6/4.
12	YOKE SLEEVE	BRONZE TO IS:318 LTB-II
13	INDICATOR SCALE	M.S.
14	INDICATOR RING	G.M.
15	LOCKING ARRGT.	STEEL.
16	BONNET/BACKSEAT BUSH	BRONZE TO IS:318 LTB-II
17	LIMIT SWITCH	2 NOS.

NOTES

1. DESIGN CODE : IS:14846(PD)/BS:5150 PN-16.
2. FLANGE DRILLING DIMENSIONS AS PER ANSI B 16.5 CLASS-150
3. STANDARD TOLERANCE ARE APPLICABLE.
4. HYDRAULIC TEST PRESSURE :

RATING	BODY	SEAT
PN.- 16	24 Kg/cm2.	16 Kg/cm2.

KALPANA VALVES MFG. CO. (P) LTD. HOWRAH

00	229	720	320	229	23.8	190	8	19	27	04
B	A	H- MAX. OPEN	ØC±5	O.D.	FLANGE THICK.	P.C.D.	NO. OF. HOLES.	DIA. OF. HOLES.	STEM DIA.	QTY NOS.

P.O. NO.- PUR/LOI/181 R1, DATE.-12-07-2017/08-07-17

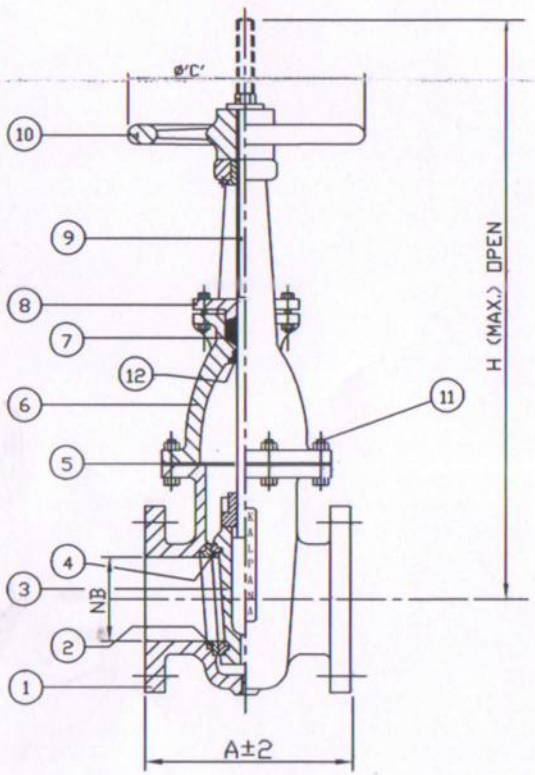
CLIENT: HITEK ENGINEERING SERVICES.

KALPANA VALVES MFG. Co. (P) LTD.
ICHAPUR H.I.T. ROAD, SASTHIBAGAN.
HOWRAH - 711104.

TITLE:
CAST IRON GATE VALVE.
(RISING SPINDLE.)

DATE: 14-07-2017	SCALE= N.T.S.	DRG. NO.-
DSGN-	CHKD-S. BISWAS.	KVMC/HES/GV/17/101
DRWN- L.PANJA	APPD-S. GHOSH.	REV.- 00 DATE:

SL. NO.	NAME OF PARTS	MATERIALS & SPECN.
1	BODY	CAST IRON IS:210 FG-200
2	BODY SEAT RING	BRONZE TO IS:318 LTB-2
3	WEDGE	CAST IRON IS:210 FG-200
4	WEDGE FACING RING	BRONZE TO IS:318 LTB-2
5	GASKET	RUBBER IS.:638.
6	COVER	CAST IRON IS:210 FG-200
7	PACKING	JUTE & HEMP
8	GLAND	CAST IRON IS:210 FG-200
9	STEM	S. S. TO AISI-410
10	HAND WHEEL.	CAST IRON IS:210 FG-200
11	BOLTS & NUTS.	CARBON STEEL. IS.:1363 CL.-4.6/4.
12	BACK SEAT BUSH	BRONZE TO IS:318 LTB-II



SIZE UP TO 150MM

NOTES

1. DESIGN CODE : IS:14846(PD)/BS:5150 PN-1.6.
2. FLANGE DRILLING DIMENSIONS AS PER ANSI B 16.5 CLASS-150(F/F)
3. STANDARD TOLERANCE ARE APPLICABLE.
4. HYDRAULIC TEST PRESSURE :

RATING	BODY	SEAT
PN.- 1.6	24 Kg/cm2.	16 Kg/cm2.

NB	A	H- MAX. OPEN	ØC±5	O.D.	FLANGE THICK.	P.C.D.	NO. OF. HOLES.	DIA. OF. HOLES.	STEM DIA.	QTY NOS.
150	267	950	320	279	25.4	241	8	22.22	27	03
100	229	720	320	229	23.8	190	8	19	27	07
80	203	610	225	190	23.8	152	4	19	22	02

KALPANA VALVES MFG. CO. (P) LTD. HOWRAH

P.O. NO.- PUR/LOI/181 R1, DATE.-12-07-2017/08-07-17

CLIENT: HITEK ENGINEERING SERVICES.

KALPANA VALVES MFG. Co. (P) LTD.
ICHAPUR H.I.T. ROAD, SASTHIBAGAN.
HOWRAH - 711104.

TITLE:
CAST IRON GATE VALVE .
(RISING SPINDLE.)

DATE: 14-07-2017	SCALE= N.T.S.	DRG. NO.- KVMC/HES/GV/17/102
DSGN-	CHKD-S. BISWAS.	
DRWN- L.PANJA	APPD-S. GHOSH.	REV.- 00 DATE:

G.AIR RELEASE VALVE

1.0	**MAKE**	:	H.SARKAR/LEADER /KALPANA /VENUS/A.V VALVES LTD. /WINCO/SHAH BHOGILAL
2.0	TYPE	:	Single acting (operated under pressure)
3.0	SIZE	:	25 NB
4.0	WORKING PRESSURE	:	11 Kg/cm² Max
5.0	WORKING TEMPERATURE	:	50 Deg.C
6.0	END CONNECTION	:	Screwed
7.0	SERVICE	:	Fire Water Application
8.0	**MATERIAL OF CONSTRUCTION**	:	
8.1	BODY, CAP, NUT	:	GM IS: 318 LTB 2
8.2	BALL WASHER	:	RUBBER
8.3	O' Ring	:	RUBBER
9.0	PAINTING/FINISH	:	Natural Finish - Polish
10.0	QUANTITY	:	As per Approved Drawing
11.0	INSPECTION & TESTING	:	As per Manufacturer TC

H. WRAPPING COATING

1.0	Make	:	PORWAL TAR /RUSTECH/IWL
2.0	STANDARD	:	IS:10221
3.0	THICKNESS	:	4 MM (2MM x 2 COATS)
4.0	WIDTH	:	500 mm
5.0	QTY	:	AS PER APPROVED DRAWING
6.0	LENGTHWISE TENSILE STRENGTH	:	> 90 - Length Wise as per Din 52123
7.0	CROSSWISE TENSILE STRENGTH	:	> 70 -Cross Wise as per Din 52123
8.0	SOFTENING POINT	:	65 - 121^{0}C (ASTM D : 36)
9.0	FILLER	:	20 - 30% (IS : 1217)
10.0	HEAT RESISTANCE	:	DOSE NOT DRIP AT 100^{0}C (ASTM D : 146)
11.0	PENETRATION AT 25 DEG C 100 G 5 Sec	:	3-20 dmm (ASTM-D5)
12.0	**PRIMER DETAILS**	:	
12.1	PRIMER TYPE	:	PYPSTICK PRIMER
12.2	VISCOSITY @23Deg C, Secs (Ford Cup No.4	:	35 to 60
12.3	DRYING TIME (Min.)	:	15 MINUTES
12.4	FLASH POINT	:	> 23^0 C
12.5	DENSITY (gm/cubic.cm)	:	0.9 to 0.95
12.6	THICKNESS	:	25 to 50 Microns
13.0	ACCEPTANCE	:	AS PER MANUFACTURER TC

I. DELUGE VALVE

1.0	MAKE	HD Fire	
2.0	MODEL	A (Differential pressure type with diaphragm & clapper assemblies)	
3.0	TYPE OF ACTUATION	By Fusing of Q B Detector Signal	
4.0	SIZE	50 NB TO 200 NB	
5.0	QUANTITY	As per approved drawings	
6.0	END CONNECTION	Flanged end (Flat Face) Dimensions & drilling to ANSI B 16.5, # 150	
7.0	RECOMMENDED FLOW RATES AGAINST VARIOUS SIZES DELUGE VALVES	Size	Flow rate in m3/hr
		50 NB	10-55
		80 NB	30-110
		100 NB	50-225
		150 NB	170-650
		200 NB	300-1150
8.0	**MATERIAL OF CONSTRUCTION**		
8.1	BODY HOUSING	Cast Iron IS-210 Gr. FG 260	
8.2	SEAT	BRONZE IS:318 LTB-II	
8.3	CLAPPER	BRONZE IS:318 LTB-II	
8.4	SEAT RUBBER	NEOPRENE	
8.5	RUBBER CLAMP	BRONZE IS:318 LTB-II	
8.6	BOLTS	STAINLESS STEEL - 304	
8.7	DIAPHRAGM	NEOPRENE	
8.8	CLAMP RING	BRONZE IS:318 LTB-II	
8.9	COVER	Cast Iron IS: 210 Gr. FG 260	
9.0	**ACCESSORIES**		
9.1	TEST STRAINERS, DRAIN VALVE & NRV	PROVIDED (Bronze to IS : 318 LBT II)	
9.2	WATER MOTOR GONG	PROVIDED (Aluminium TO IS : 617 Gr.4450)	
9.3	INSTRUMENTS SUCH AS PRESSURE GAUGE AND PRESSURE SWITCHES	Provided by as per Approved Suppliers only (not by H.D Fire)	
10.0	WHETHER CAPABLE OF RESETTING MANUALLY	YES	
11.0	WHETHER CAPABLE OF RESETTING MANUALLY	SOLENOID VALVE PROVIDED	

12.0	NORMAL WORKING PRESSURE	7 TO 12 kg/cm^2
13.0	MAXIMUM WORKING PRESSURE	12 kg/cm^2
14.0	HYDRO TEST PRESSURE	25 kg/cm^2
15.0	APPROVAL	UL Listed
16.0	INSPECTION & TESTING	As per Manufacturer TC
17.0	PAINTING	DFT:125 Micron (2 coat of primer & 2 coat of finish)
18.0	PRIMER	Epoxy Primer- Two Coats (75 micron)
19.0	FINISH	Fire Red to Shade RAL 3000 - Two coats (50 micron)

DELUGE VALVE MODEL- A

HD FIRE PROTECT PVT. LTD.

TECHNICAL DATA :

MODEL	A
NOMINAL SIZE	200, 150, 100, 80 & 50NB
MAXIMUM SERVICE PRESSURE	12 Bar (175 psi)
THREADED OPENING	BSPT
MOUNTING vertical mounting.	90° pattern inlet to outlet
FACTORY HYDROSTATIC TEST PRESSURE	25 Kg./sq.cm. (350 psi)
FLANGE CONNECTION	ANSI B 16.1 FF #125
TRIM	Galvanized steel with brass valves
RECOMMENDED FLOW RATE	200NB - 300 to 1150 m^3/hr 150NB - 170 to 650 m^3/hr 100NB - 50 to 225 m^3/hr 80NB - 30 to 110 m^3/hr 50NB - 10 to 55 m^3/hr
FRICTIONAL LOSS IN TERMS OF EQUIVALENT LENGTH OF PIPE (C-120)	200NB - 26.00 metres 150NB - 19.00 metres 100NB - 11.00 metres 80NB - 5.50 metres 50NB - 1.80 metres
WET PILOT SPRINKLER HEIGHT LIMITATION	As per graph in the catalogue.
NET WEIGHT WITHOUT TRIM	200NB - 214 Kg. 150NB - 136 Kg. 100NB - 76 Kg. 80NB - 52 Kg. 50NB - 47 Kg.
FINISH	Fire red PU painted.
APPROVAL	UL listed.
ORDERING INFORMATION	Size of valve, flange connection and trim details.

Deluge Valve is known as a system control valve in a deluge system, used for fast application of water in a spray system. Deluge valve protects areas such as power transformer installation, storage tank, conveyor protection and other industrial application etc. With the addition of foaming agent they do protect aircraft hanger and inflammable liquid fire.

VALVE OPERATION

Deluge valve is a quick release, hydraulically operated diaphragm valve. It has three chambers, isolated from each other by the diaphragm operated clapper and seat seal. While in 'SET' position, water pressure is transmitted through an external bypass check valve and restriction orifice from the system supply side to the top chamber, so that supply pressure in the top chamber acts across the diaphragm operated clapper which holds the seat against the inlet supply pressure because of differential pressure design. On detection of fire the top chamber is vented to atmosphere through the outlet port via opened actuation device(s). The top chamber pressure cannot be replenished through the restricted inlet port, thus it reaches less than half the supply pressure instantaneously and the upward force of the supply pressure lifts the clapper allowing water to enter the system piping network and alarm devices.

TRIM DESCRIPTION

a) BASIC TRIM

The basic trim is required on deluge valve regardless of the release system. It contain those components which are required in all types of installation, such as the main drain valve, priming connection, drip check valve, emergency release valve and pressure gauges.

b) DRY PILOT TRIM (PNEUMATIC RELEASE)

Dry pilot operation uses a pilot line of closed Sprinklers/ QB detectors containing air under pressure, located in the area to be protected. It requires regulated dry air supply with main supply point through restricted orifice. The pilot line is connected directly to the top of POSITIVE DRAIN ACTUATOR (PDA). The bottom of PDA is connected to the top chamber of the deluge valve.

When the air pressure drops, due to release of any of the release devices on detection of fire, the diaphragm of PDA is lifted and allows the water to drain. This reduces the water pressure in the top chamber of the deluge valve and when the pressure in the top chamber reaches 50% of the supply pressure, the deluge valve opens. The direct drain of PDA start when the top chamber pressure of deluge valve reaches approximately 0.5 Kg/sq.cm. This positive drain will not permit the deluge valve to close unless the PDA is set manually. The recommended air supply pressure is as per TABLE-1.

TABLE - 1

LINE WATER PRESSURE Kg./ Sq.cm. MAXIMUM	AIR PRESSURE IN DETECTION LINE Kg./ Sq.cm.	
	MINIMUM	MAXIMUM
2	1.2	3.0
4	1.5	3.0
6	2.0	3.5
8	2.5	3.5
10	3.0	3.5
12	3.5	4.0

c) WET PILOT TRIM (HYDRAULIC RELEASE)

Wet pilot operation uses a pilot line of closed sprinklers containing pressurised water, supplied through the upstream side of the deluge valve, through a restricted orifice. All the release lines are connected to a common release line. Due to release of any one of the release device, the water pressure in the top chamber of the deluge valve reaches 50% of the supply pressure, the deluge valve opens.

CAUTION

While using a deluge valve in the wet pilot system the height and the length of the wet pilot detection line is to be limited as given in the wet pilot sprinkler height limitation graph.

d) ELECTRIC RELEASE TRIM

To actuate a deluge valve electrically, a solenoid valve is provided to drain the water from the top chamber of the deluge valve. A pressure switch is provided to activate an electric alarm, to shut down the desired equipment or to give "Tripped" indication to the panel. In addition to this two nos of pressure switchs can be used to monitor "Low air pressure" and "Fire condition" when used in dry pilot air line.

e) TEST AND ALARM TRIM WITH SPRINKLER ALARM

This trim is supplied with the sprinkler alarm bell, which bells on actuation of the deluge valve. A test valve is provided to test the normal operation of the sprinkler alarm bell.

RESETTING PROCEDURE FOR THE DELUGE VALVE

(i) Close the upstream side stop valve provided below the deluge valve.

(ii) Open both the drain valves and close them when the flow of water has ceased.

(iii) Inspect and release if required, or close the section of the detection system subjected to "Fire condition".

(iv) In case of dry pilot detection system, open the air supply valve to build-up air pressure as shown in TABLE-1. Open the priming valve fully and press hold the knob of PDA till the water pressure gauge indicate full service line pressure, then release the PDA knob. Open the upstream side of the stop valve provided below the deluge valve. No water should flow into the system, this can be checked by depressing the drip check valve knob.

CAUTION

(a) Do not close the priming valve, down stream and upstream stop valves, while the system is in service.

(b) The releasing device must be maintained in the open position, when actuated, to prevent the deluge valve from closure.

SYSTEM TESTING PROCEDURE

(i) Keep the upstream side of the stop valve partially open. Open the upstream side of the drain valve, to maintain a minimum pressure of 3 bar on the upstream side of the deluge valve. To avoid water damage close the system side stop valve. This valve is to be kept in open position after the testing is completed.

(ii) Open the system side drain valve of the deluge valve.

(iii) Let any of the release devices to trip. This will result in a sudden drop of water pressure in the deluge valve top chamber resulting the deluge valve to open. The water flowing through the down stream side drain valve confirms that the deluge valve has actuated, immediately close the upstream side stop valve .

(iv) Once testing is over reset the valve as per procedure given under heading "RESETTING PROCEDURE FOR THE DELUGE VALVE".

INSPECTION AND MAINTENANCE

All the newly installed system piping network must be flushed properly before placing the deluge valve in service.

A qualified and trained person must commission the system. After few initial successful tests an authorised person must be trained to perform inspection and testing of the system. It is recommended to have regular inspection and test run the system as per NFPA guidelines or in accordance with the guideline laid down by the organisation having local jurisdiction.

(i) WARNING

Inspection and testing is to be carried out only by authorised and trained personnel. DO NOT TURN OFF the water supply or close any valve to make repair(s) or test the valve, without placing a roving fire patrol in the area protected by the system. Also inform the local security personnel and central alarm station, so that a false alarm is not signalled.

It is recommended to carry out physical inspection of the system at least twice in a week. The inspection should verify that all the control valves are in proper position as per the system requirement and no damage has taken place to any component.

(ii) NORMAL CONDITION

(a) All main valves are open and are sealed with tamper proof seal.

(b) Drain valves must be kept closed.

(c) No leak or drip is detected from the drip valve.

(d) All the gauges except the system side water pressure gauge, should show the required pressure.

(e) There should be no leakage in the system.

(iii) NORMAL CONDITION TEST

(a) The system should be checked for normal condition at least once in a month.

(b) Test the sprinkler alarm bell or electric alarm by turning the alarm test valve to the test position. The alarm should sound. This test should be carried out at least once in a week.

(c) Depress the drip valve knob. Significant water accumulation indicates a possible seat leakage.

(d) Conduct the water flow test as per the procedure of system testing at least once in a month.

(iv) PERIODIC CHECK

Conduct the water flow test by actuating few of the release devices provided in the system. Clean all strainer(s) and priming line restriction. This test is to be carried out at least once in six months.

ABNORMAL CONDITION

(i) ALARM FAILS TO SOUND

(a) Check for any obstruction in the alarm test line, Ensure that the sprinkler alarm is freely operating.

(b) If an electric alarm is provided, check the electrical circuitry to the alarm.

(ii) FALSE TRIPS

(a) Check the priming valve, clogged priming line, restriction orifice check valve or strainer.

(b) Leakage in the release system.

(c) The deluge air panel orifice clogged or low supply pressure.

(iii) LEAKAGE THROUGH THE DELUGE VALVE

(a) Damaged deluge valve seat or obstruction on the seat face by foreign object.

(b) Leakage in release system.

(c) Partly clogged priming line, restriction check valve.

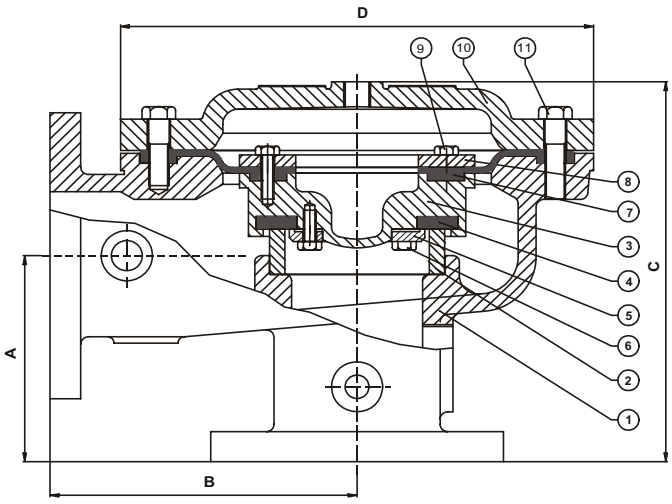
(d) Low air pressure on release system line or leakage in release system.

(e) PDA seat leakage due to seat damage or obstruction on seat face by foreign objects (in dry pilot system only)

NOTE

UL listing is valid only when Deluge Valve is installed with trim set as per trim drawing.

DELUGE VALVE MODEL-A SIZE 200 / 150 / 100 / 80 / 50 NB



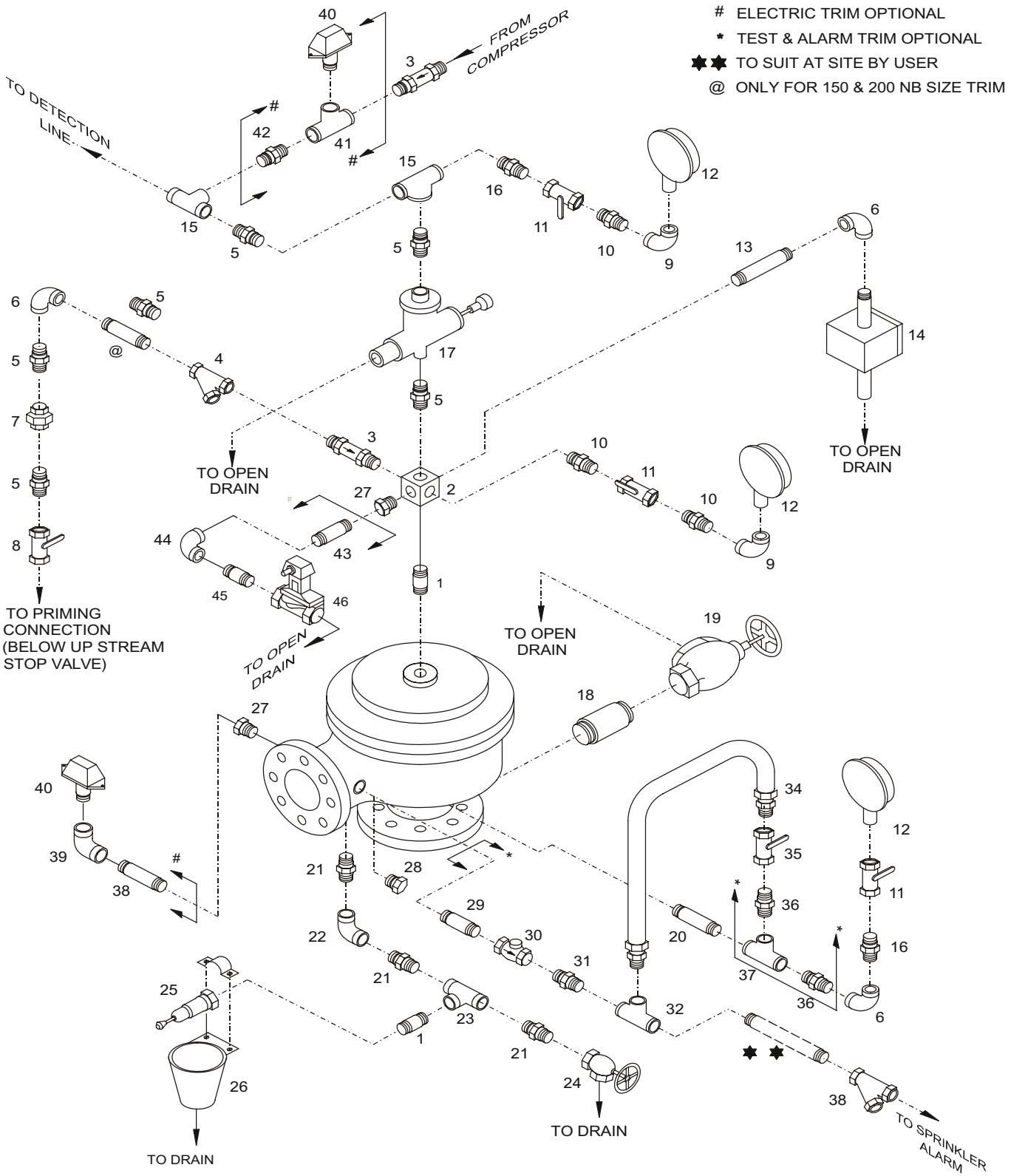
DIMENSION in millimeter (Approximate)

VALVE NOMINAL SIZE	'A'	'B'	'C'	'D'
200NB	230	330	455	540
150 NB	200	300	382	464
100 NB	165	240	304	370
80 NB	135	210	272	316
50 NB	135	210	272	316

PART LIST

ITEM	PART NO. 200 NB	150 NB	100 NB	80 NB	50 NB	DESCRIPTION	QTY. 200 NB	150 NB	100 NB	80 NB	50 NB	MATERIAL SPECIFICATION
1	2181	2101	2121	2141	2161	HOUSING	1	1	1	1	1	CAST IRON
2	2187	2107	2127	2147	2147	SEAT	1	1	1	1	1	CAST BRONZE
3	2185	2105	2125	2145	2145	CLAPPER	1	1	1	1	1	CAST BRONZE
4	2189	2109	2129	2149	2149	SEAT RUBBER	1	1	1	1	1	NEOPRENE
5	2190	2110	2130	2150	2150	RUBBER CLAMP	1	1	1	1	1	CAST BRONZE
6	9102	9102	9102	9102	9102	BOLT	6	4	4	3	3	STAINLESS STEEL
7	2188	2108	2128	2148	2148	DIAPHRAGM	1	1	1	1	1	NEOPRENE
8	2186	2106	2126	2146	2146	CLAMP RING	1	1	1	1	1	CAST BRONZE
9	9105	9105	9105	9105	9105	BOLT	12	12	8	8	8	STAINLESS STEEL
10	2184	2104	2124	2144	2144	COVER	1	1	1	1	1	CAST IRON
11	-	-	-	-	-	BOLT	16	16	12	12	12	STEEL

DRY PILOT BASIC TRIM , WITH TEST AND ALARM TRIM & ELECTRIC RELEASE TRIM MODEL -A



NOTE - WHEN TEST & ALARM TRIM IS SUPPLIED THEN SERIAL NO. 28 (PLUG) IS NOT REQUIRE
- WHEN ELECTRIC TRIM IS SUPPLIED THEN SERIAL NO.27(PLUG) IS NOT REQUIRE

DRY PILOT BASIC TRIM , WITH TEST AND ALARM TRIM & ELECTRIC RELEASE TRIM MODEL -A

TRIM ITEM				QUANTITY PER DELUGE VALVE				
				DELUGE VALVE SIZE				
NO	CODE	DESCRIPTION	SIZE	200NB	150NB	100NB	80NB	50NB
1	9480	PIPE NIPPLE	½" X 80 MM LONG	2	2	2	2	2
2	6251	6 WAY MANIFOLD	'HD' MAKE, MODEL-A	1	1	1	1	1
3	1906	RESTRICTION CHECK VALVE	'HD' MAKE, MODEL-A	2	2	2	2	2
4	9381	'Y' TYPE STRAINER	½"	1	1	1	1	1
5	9416	PIPE NIPPLE	½" X 110 MM LONG	1	1	-	-	-
5	9365	HEX NIPPLE	½"	5	5	6	6	6
6	9376	ELBOW	½"	3	3	3	3	3
7	9370	UNION	½"	1	1	1	1	1
8	9423	BALL VALVE	½"	1	1	1	1	1
9	9374	ELBOW	¼"	2	2	2	2	2
10	9363	HEX NIPPLE	¼"	3	3	3	3	3
11	9477	GAUGE VALVE	¼"	3	3	3	3	3
12	9526	PRESSURE GAUGE	'HD' MAKE, MODEL-HDP	3	3	3	3	3
13	9403	PIPE NIPPLE	½" X 210 MM LONG	-	-	1	-	-
13	9401	PIPE NIPPLE	½" X180 MM LONG	-	-	-	1	1
13	9564	PIPE NIPPLE	½" X 300 MM LONG	1	-	-	-	-
13	9565	PIPE NIPPLE	½" X 255 MM LONG	-	1	-	-	-
14	1921	EMERGENCY RELEASE STATION	'HD' MAKE, MODEL-MR	1	1	1	1	1
15	9410	TEE	½"	2	2	2	2	2
16	9413	REDUCING HEX NIPPLE	½" X ¼"	2	2	2	2	2
17	1436	POSITIVE DRAIN ACTUATOR	'HD' MAKE, MODEL-A	1	1	1	1	1
18	9566	PIPE NIPPLE	2" X 110 MM LONG	1	1	1	-	-
18	9562	PIPE NIPPLE	1¼" X 110 MM LONG	-	-	-	1	1
19	9394	ANGLE VALVE	2"	1	1	1	-	-
19	9392	ANGLE VALVE	1¼"	-	-	-	1	1
20	9399	PIPE NIPPLE	½" X 130 MM LONG	1	1	1	1	1
21	9367	HEX NIPPLE	1"	1	1	3	-	-
21	9366	HEX NIPPLE	¾"	-	-	-	3	3
22	9378	ELBOW	1"	3	3	1	-	-
22	9377	ELBOW	¾"	-	-	-	1	1
23	9412	REDUCING TEE	1" X ½" X 1"	1	1	1	-	-
23	9411	REDUCING TEE	¾" X ½" X ¾"	-	-	-	1	1
24	9391	ANGLE VALVE	1"	1	1	1	-	-
24	9393	ANGLE VALVE	¾"	-	-	-	1	1
25	1911	DRIP VALVE	'HD' MAKE, MODEL-A	1	1	1	1	1
26	1901	FUNNEL	'HD' MAKE, MODEL-A	1	1	1	1	1
27	9431	PLUG	½"	2	2	2	2	2
28	9432	PLUG	¾"	1	1	1	1	1

....CONTINUED ON PAGE 7

DRY PILOT BASIC TRIM , WITH TEST AND ALARM TRIM & ELECTRIC RELEASE TRIM MODEL -A

TRIM ITEM				QUANTITY PER DELUGE VALVE				
				DELUGE VALVE SIZE				
NO	CODE	DESCRIPTION	SIZE	200NB	150NB	100NB	80NB	50NB
		TEST & ALARM TRIM (OPTIONAL)						
29	9406	PIPE NIPPLE	¾" X 100 MM LONG	1	1	1	1	1
30	9421	SWING CHECK VALVE	¾"	1	1	1	1	1
31	9366	HEX NIPPLE	¾"	1	1	1	1	1
32	9411	REDUCING TEE	¾" X ½" X ¾"	1	1	1	1	1
33	9382	'Y' TYPE STRAINER	¾"	1	1	1	1	1
34	2198	COPPER TUBE ASSEMBLY	½"	1	-	-	-	-
34	2119	COPPER TUBE ASSEMBLY	½"	-	1	-	-	-
34	2135	COPPER TUBE ASSEMBLY	½"	-	-	1	-	-
34	2157	COPPER TUBE ASSEMBLY	½"	-	-	-	1	1
35	9423	BALL VALVE	½"	1	1	1	1	1
36	9365	HEX NIPPLE	½"	2	2	2	2	2
37	9410	TEE	½"	1	1	1	1	1
		ELECTRICAL TRIM FOR PRESSURE SWITCH (OPTIONAL)						
38	9400	PIPE NIPPLE	½" X 135 MM LONG	1	1	1	1	1
39	9376	ELBOW	½"	1	1	1	1	1
40	-	PRESSURE SWITCH *	½"	2	2	2	2	2
41	9410	TEE	½"	1	1	1	1	1
42	9365	HEX NIPPLE	½"	1	1	1	1	1
		ELECTRICAL TRIM FOR SOLENOID VALVE (OPTIONAL)						
43	9400	PIPE NIPPLE	½" X 135 MM LONG	-	—	-	2	2
43	9399	PIPE NIPPLE	½" X 130 MM LONG	1	1	1	-	-
44	9376	ELBOW	½"	1	1	1	1	1
45	9401	PIPE NIPPLE	½" X 180 MM LONG	1	1	1	-	-
46	-	SOLENOID VALVE @	½", TWO WAY	1	1	1	1	1

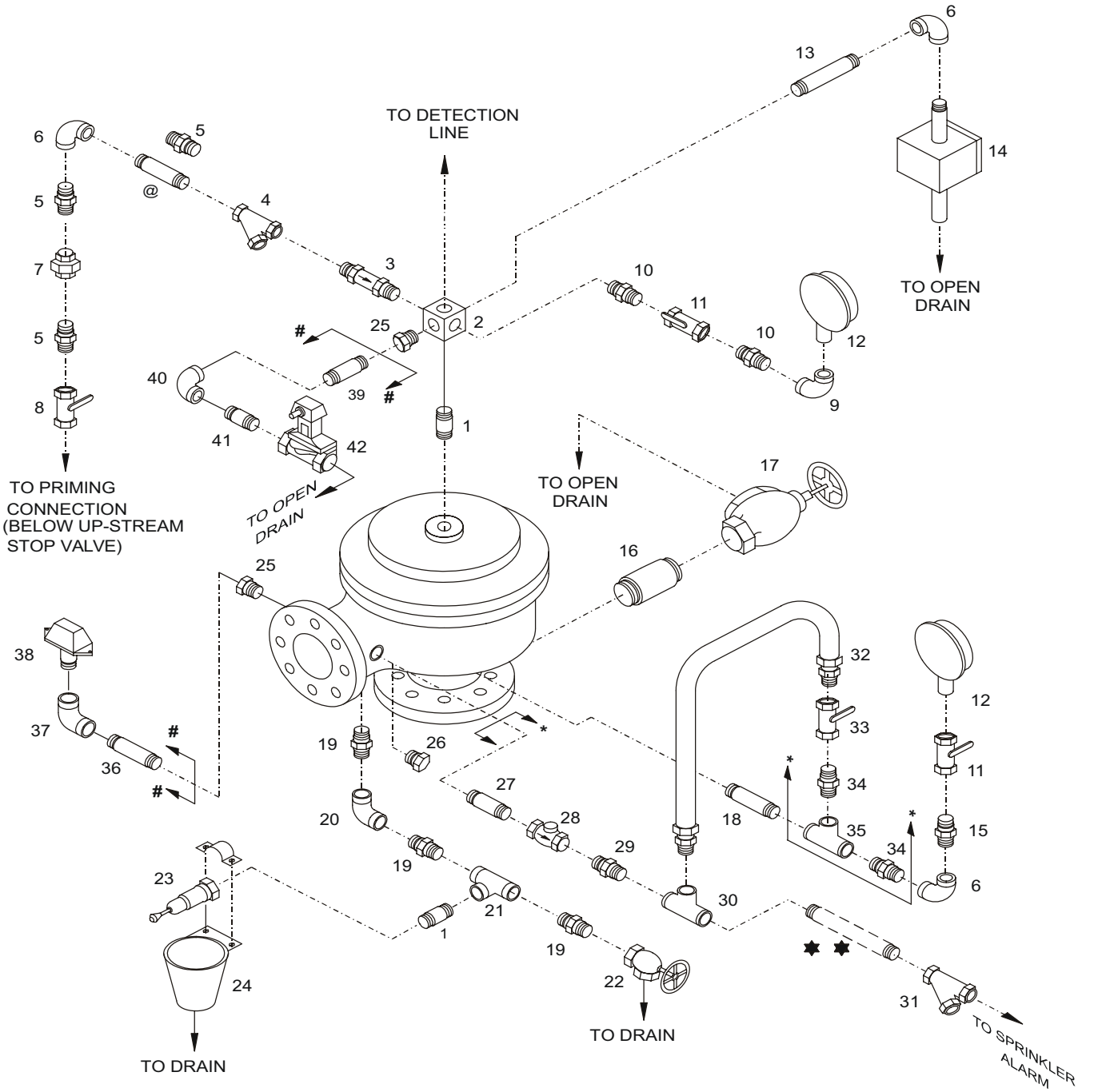
* SPECIFICATION TO BE PROVIDED AT TIME OF ORDERING.

Pressure switch as optional can be provided for "DV actuated" announciation, switch to be mounted at the outlet of deluge valve. In dry pilot trim additional pressure switch can be provided for low pressure alarm.

@ 2 way solenoid valve with 24VDC/110 VAC/220 VAC for remote actuation

WET PILOT BASIC TRIM , WITH TEST AND ALARM TRIM & ELECTRIC RELEASE TRIM MODEL -A

ELECTRIC TRIM OPTIONAL
* TEST & ALARM TRIM OPTIONAL
★★ TO SUIT AT SITE BY USER
@ ONLY FOR 150 & 200 NB SIZE TRIM



NOTE - WHEN TEST & ALARM TRIM IS SUPPLIED THEN SERIAL NO. 26 (PLUG) IS NOT REQUIRE
- WHEN ELECTRIC TRIM IS SUPPLIED THEN SERIAL NO.25(PLUG) IS NOT REQUIRE

WET PILOT BASIC TRIM , WITH TEST AND ALARM TRIM & ELECTRIC RELEASE TRIM MODEL -A

TRIM ITEM				QUANTITY PER DELUGE VALVE				
				DELUGE VALVE SIZE				
NO	CODE	DESCRIPTION	SIZE	200NB	150NB	100NB	80NB	50NB
1	9480	PIPE NIPPLE	½" X 80 MM LONG	2	2	2	2	2
2	6251	6 WAY MANIFOLD	'HD' MAKE, MODEL-A	1	1	1	1	1
3	1906	RESTRICTION CHECK VALVE	'HD' MAKE, MODEL-A	1	1	1	1	1
4	9381	'Y' TYPE STRAINER	½"	1	1	1	1	1
5	9416	PIPE NIPPLE	½" X 110 MM LONG	1	1	-	-	-
5	9365	HEX NIPPLE	½"	3	3	4	4	4
6	9376	ELBOW	½"	3	3	3	3	3
7	9370	UNION	½"	1	1	1	1	1
8	9423	BALL VALVE	½"	1	1	1	1	1
9	9374	ELBOW	¼"	1	1	1	1	1
10	9363	HEX NIPPLE	¼"	2	2	2	2	2
11	9477	GAUGE VALVE	¼"	2	2	2	2	2
12	9526	PRESSURE GAUGE	'HD' MAKE, MODEL-HDP	2	2	2	2	2
13	9403	PIPE NIPPLE	½" X 210 MM LONG	-	-	1	-	-
13	9401	PIPE NIPPLE	½" X180 MM LONG	-	-	-	1	1
13	9564	PIPE NIPPLE	½" X 300 MM LONG	1	-	-	-	-
13	9565	PIPE NIPPLE	½" X 255 MM LONG	-	1	-	-	-
14 .	1921	EMERGENCY RELEASE STATION	'HD' MAKE, MODEL-MR	1	1	1	1	1 .
15	9413	REDUCING HEX NIPPLE	½" X ¼"	1	1	1	1	1
16	9566	PIPE NIPPLE	2" X 110 MM LONG	1	1	1	-	-
16	9562	PIPE NIPPLE	1¼" X 110 MM LONG	-	-	-	1	1
17	9394	ANGLE VALVE	2"	1	1	1	-	-
17	9392	ANGLE VALVE	1¼"	-	-	-	1	1
18	9399	PIPE NIPPLE	½" X 130 MM LONG	1	1	1	1	1
19	9367	HEX NIPPLE	1"	3	3	3	-	-
19	9366	HEX NIPPLE	¾"	-	-	-	3	3
20	9378	ELBOW	1"	1	1	1	-	-
20	9377	ELBOW	¾"	-	-	-	1	1
21	9412	REDUCING TEE	1" X ½" X 1"	1	1	1	-	-
21	9411	REDUCING TEE	¾" X ½" X ¾"	-	-	-	1	1
22	9391	ANGLE VALVE	1"	1	1	1	-	-
22	9393	ANGLE VALVE	¾"	-	-	-	1	1
23	1911	DRIP VALVE	'HD' MAKE, MODEL-A	1	1	1	1	1
24	1901	FUNNEL	'HD' MAKE, MODEL-A	1	1	1	1	1
25	9431	PLUG	½"	2	2	2	2	2
26	9432	PLUG	¾"	1	1	1	1	1

....CONTINUED ON PAGE 10

WET PILOT BASIC TRIM , WITH TEST AND ALARM TRIM & ELECTRIC RELEASE TRIM MODEL -A

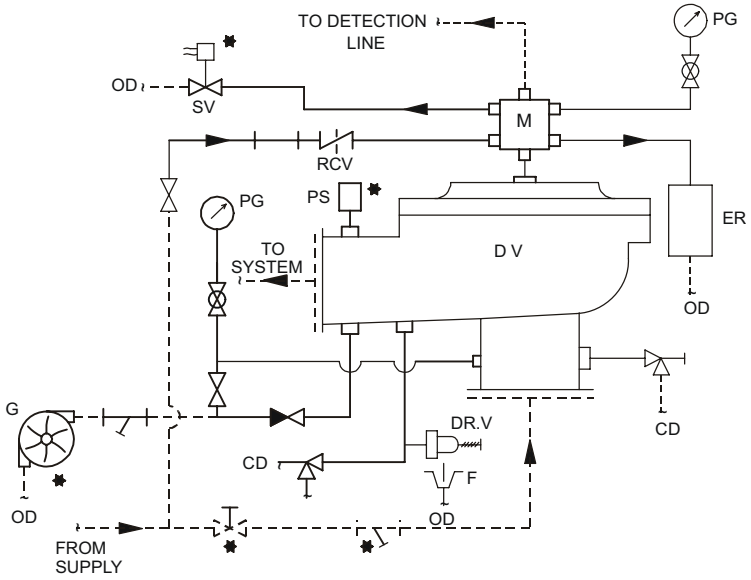
TRIM ITEM				QUANTITY PER DELUGE VALVE				
				DELUGE VALVE SIZE				
NO	CODE	DESCRIPTION	SIZE	200NB	150NB	100NB	80NB	50NB
	TEST & ALARM TRIM (OPTIONAL)							
27	9406	PIPE NIPPLE	¾" X 100 MM LONG	1	1	1	1	1
28	9421	SWING CHECK VALVE	¾"	1	1	1	1	1
29	9366	HEX NIPPLE	¾"	1	1	1	1	1
30	9411	REDUCING TEE	¾" X ½" X ¾"	1	1	1	1	1
31	9382	'Y' TYPE STRAINER	¾"	1	1	1	1	1
32	2198	COPPER TUBE ASSEMBLY	½"	1	-	-	-	-
32	2119	COPPER TUBE ASSEMBLY	½"	-	1	-	-	-
32	2135	COPPER TUBE ASSEMBLY	½"	-	-	1	-	-
32	2157	COPPER TUBE ASSEMBLY	½"	-	-	-	1	1
33	9423	BALL VALVE	½"	1	1	1	1	1
34	9365	HEX NIPPLE	½"	2	2	2	2	2
35	9410	TEE	½"	1	1	1	1	1
	ELECTRICAL TRIM FOR PRESSURE SWITCH (OPTIONAL)							
36	9400	PIPE NIPPLE	½" X 135 MM LONG	1	1	1	1	1
37	9376	ELBOW	½"	1	1	1	1	1
38	-	PRESSURE SWITCH *	½"	1	1	1	1	1
	ELECTRICAL TRIM FOR SOLENOID VALVE (OPTIONAL)							
39	9400	PIPE NIPPLE	½" X 135 MM LONG	-	—	-	2	2
39	9399	PIPE NIPPLE	½" X 130 MM LONG	1	1	1	-	-
40	9376	ELBOW	½"	1	1	1	1	1
41	9401	PIPE NIPPLE	½" X 180 MM LONG	1	1	1	-	-
42	-	SOLENOID VALVE @	½", TWO WAY	1	1	1	1	1

* SPECIFICATION TO BE PROVIDED AT TIME OF ORDERING.

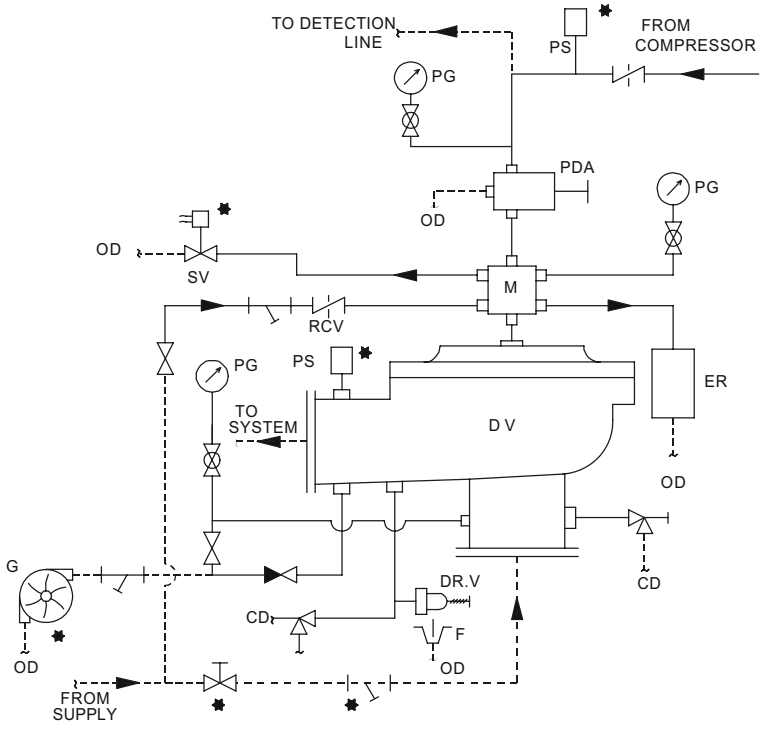
Pressure switch as optional can be provided for "DV actuated" announciation. Pressure switch to be mounted at the outlet of deluge valve.

@ 2 way solenoid valve with 24VDC/110 VAC/220 VAC for remote actuation

ELECTRIC & HYDRAULIC RELEASE TRIM - SCHEMATIC
DELUGE VALVE 200 / 150 / 100 / 80 / 50 NB A

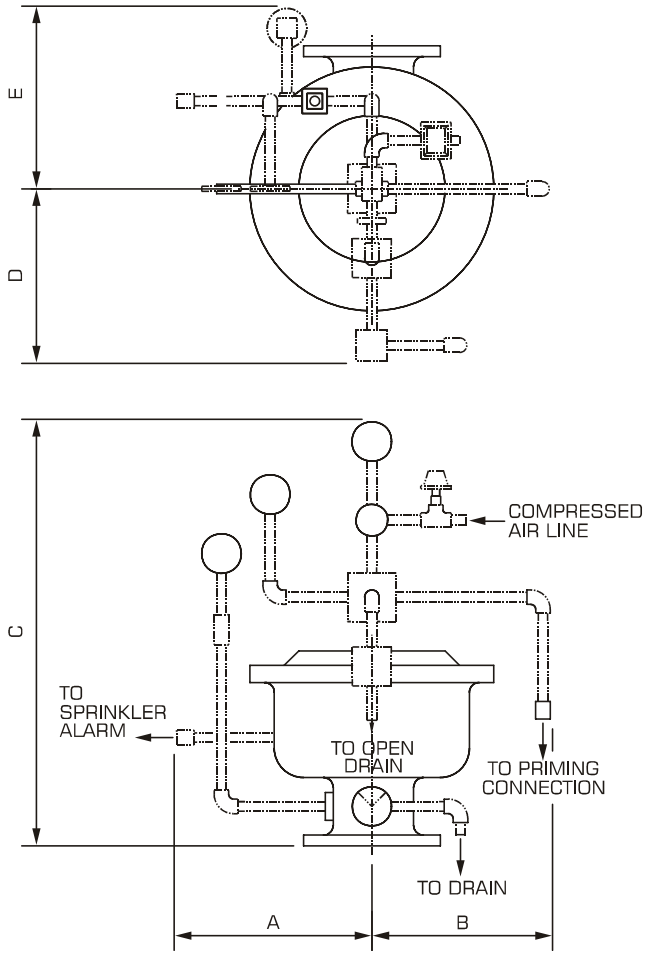


ELECTRIC & PNEUMATIC RELEASE TRIM - SCHEMATIC
DELUGE VALVE 200 / 150 / 100 / 80 / 50 NB A



VALVE
STRAINER
OPTIONAL
GAUGE VALVE
ANGLE VALVE
STOP VALVE
BY USER
SV - SOLONOID VALVE
PS - PRESSURE SWITCH
M - SIX WAY MANIFOLD
DR.V - DRIP VALVE
CD - COMMON DRAIN
F - FUNNEL
DV - DELUGE VALVE
PG - PRESSUER GAUGE
NON RETURN VALVE
OD - OPEN DRAIN
ER - EMERGENCY RELESE BOX
RCV - RESTRECTION CHECK VALVE

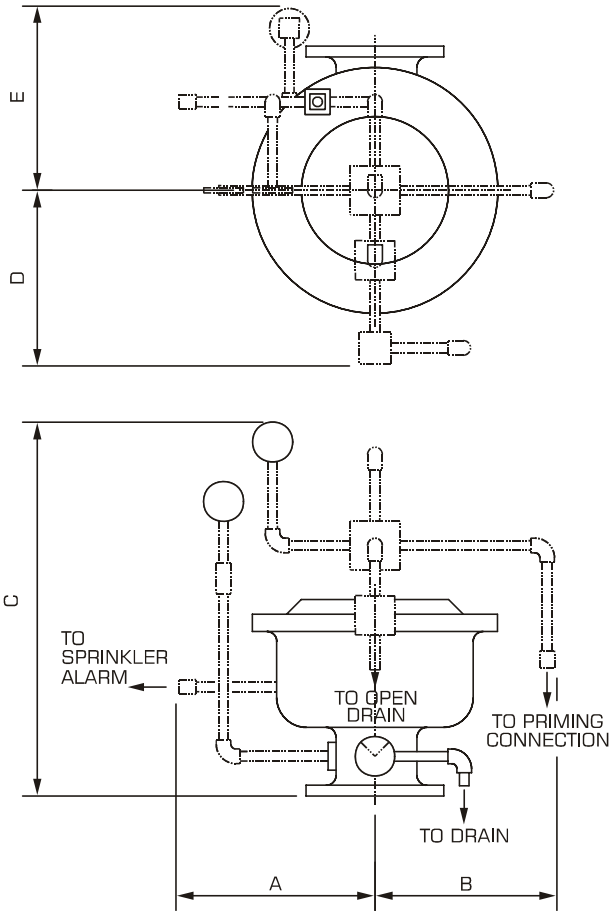
PNEUMATIC AND ELECTRIC RELEASE TRIM



INSTALLATION MEASUREMENT IN MM. (Approximate)

SIZE	200NB	150NB	100NB	80NB	50NB
A	390	370	370	350	350
B	525	500	450	450	450
C	1050	1025	950	930	930
D	510	500	450	450	450
E	500	480	420	410	410

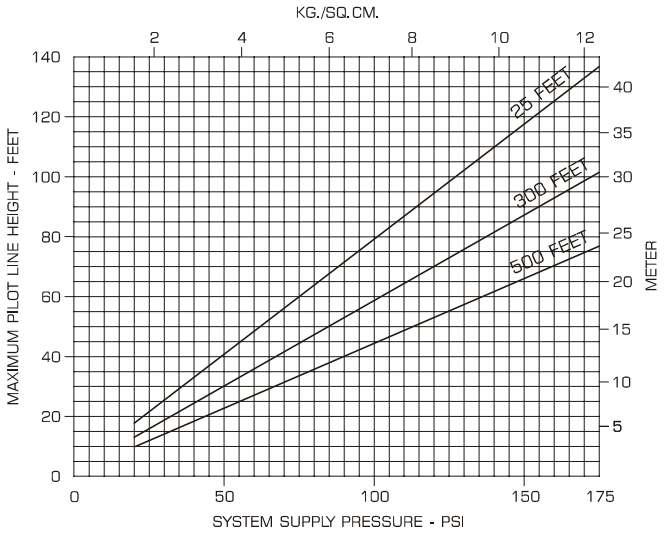
HYDRAULIC AND ELECTRIC RELEASE TRIM



INSTALLATION MEASUREMENT IN MM. (Approximate)

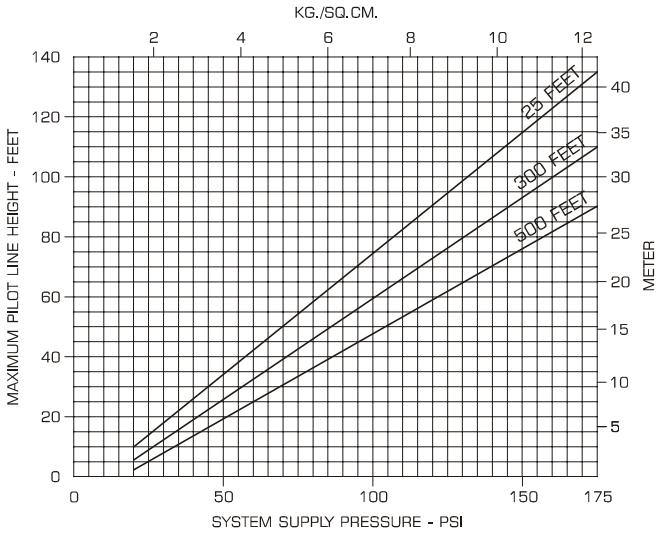
SIZE	200NB	150NB	100NB	80NB	50NB
A	390	370	370	350	350
B	525	500	450	450	450
C	875	800	750	700	700
D	510	500	450	450	450
E	500	480	420	410	410

WET PILOT SPRINKLER HEIGHT LIMITATION OF 200NB

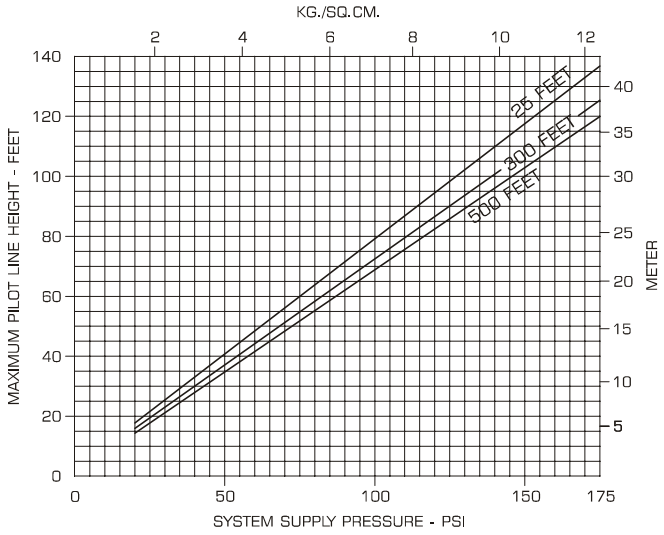


EQUIVALENT LENGTH BASED ON ½" SCHEDULE 40 PIPE WITH C = 120

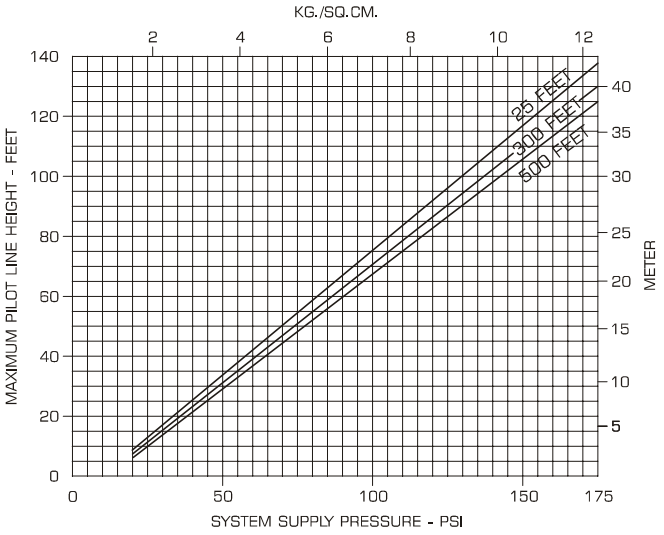
WET PILOT SPRINKLER HEIGHT LIMITATION OF 150NB



EQUIVALENT LENGTH BASED ON ½" SCHEDULE 40 PIPE WITH C = 120

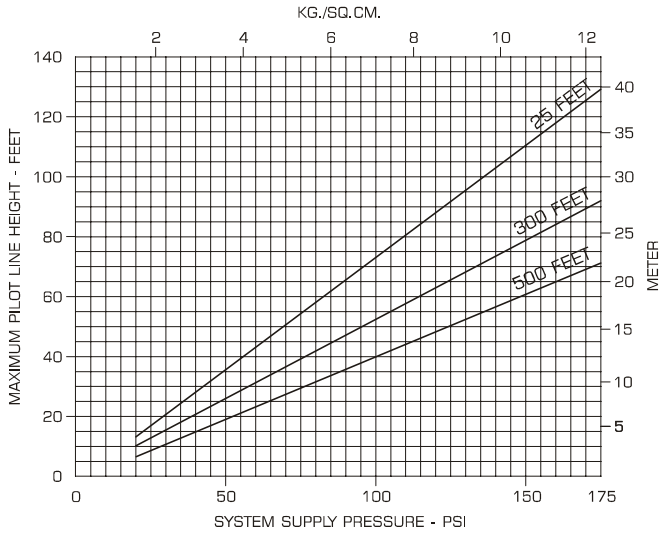


EQUIVALENT LENGTH BASED ON ¾" SCHEDULE 40 PIPE WITH C = 120



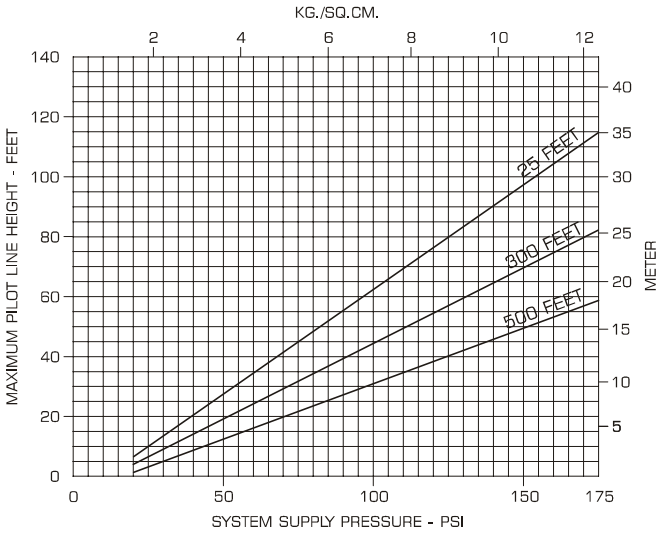
EQUIVALENT LENGTH BASED ON ¾" SCHEDULE 40 PIPE WITH C = 120

WET PILOT SPRINKLER HEIGHT LIMITATION OF 100NB

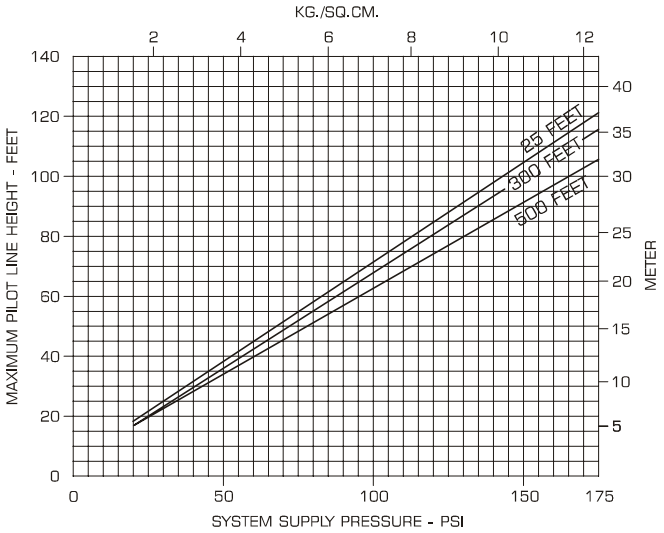


EQUIVALENT LENGTH BASED ON ½" SCHEDULE 40 PIPE WITH C = 120

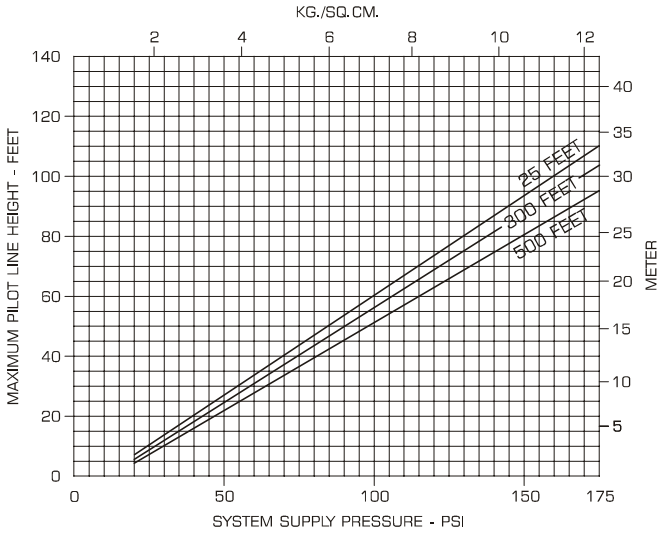
WET PILOT SPRINKLER HEIGHT LIMITATION OF 80NB



EQUIVALENT LENGTH BASED ON ½" SCHEDULE 40 PIPE WITH C = 120

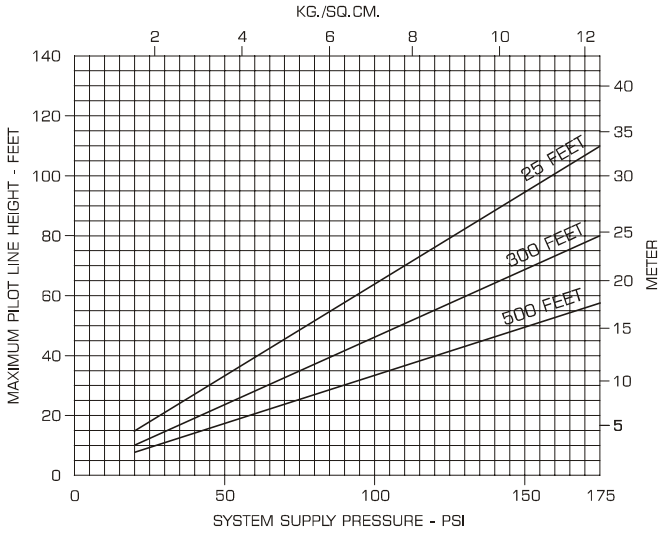


EQUIVALENT LENGTH BASED ON ¾" SCHEDULE 40 PIPE WITH C = 120

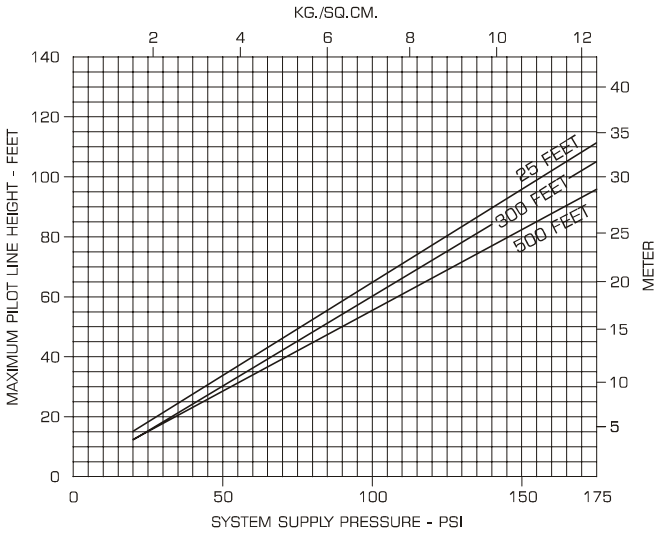


EQUIVALENT LENGTH BASED ON ¾" SCHEDULE 40 PIPE WITH C = 120

WET PILOT SPRINKLER HEIGHT LIMITATION OF 50NB



EQUIVALENT LENGTH BASED ON ½" SCHEDULE 40 PIPE WITH C = 120



EQUIVALENT LENGTH BASED ON ¾" SCHEDULE 40 PIPE WITH C = 120

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Products manufactured by HD FIRE PROTECT PVT.LTD.. are warranted against defects in material and workmanship for a period of Two (2) years from the date of shipment.

HD's obligation under this warranty is limited to replace or repair the products or its parts, which are shown to HD's examination to be in a defective condition attributable to HD. No warranty is given for products or components which have been subject, to misuse, improper installation, corrosion, wear and tear, improper storage, modification or repaired. If the defect attributable to HD cannot be rectified by repair or replacement, then HD may elect to refund the purchase price of the equipment in complete discharge of its obligation under this Limited Warranty.

IN NO EVENT SHALL HD FIRE PROTECT PVT. LTD. BE LIABLE IN CONTRACT, STRICT LIABILITY OR ANY OTHER LEGAL THEORY, FOR INCIDENTAL, IN-DIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING DAMAGES. FOR INJURY TO PERSON OR DEATH OR DAMAGE TO PROPERTY AND OR PENALTIES RESULTING FROM ANY PRODUCTS OR COMPONENT MANUFACTURED OR ASSEMBLED BY HD. THIS IS LIMITED WARRANTY ONLY. HD DISCLAIMS WITH RESPECT TO THE PRODUCTS ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND ALL IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE. THERE IS NO WARRANTY OF ANY NATURE MADE BY HD BEYOND AS STATED ABOVE.

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The information provided by us are to the best of our knowledge and belief, and are general guidelines only. Site handling and installation control is beyond our reach. Hence we give no guarantee for result and take no liability for damages, loss or penalties whatsoever, resulting from our suggestion, information, recommendation or damages due to our product.

Product development is a continuous programme of HD FIRE PROTECT PVT. LTD. and hence the right to modify any specification without prior notice is reserved with the company.

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J.SPRAY NOZZLE

J.1.	HVW SPRAY NOZZLE		
1.0	**MAKE**	:	H.D Fire
2.0	TYPE	:	Open Headed Type
3.0	MODEL	:	HV-B
4.0	**DESIGN PARAMETERS**	:	
4.1	Discharge Pressure	:	3.5 kg / sq.cm (Min), 10.5 kg / sq.cm (Max)
4.2	End connection	:	3/4" MALE THREADED (BSPT)
4.3	Spray angle	:	MAX. 120 Deg
4.4	K-FACTOR	:	K-18 - 80˚
		:	K-22 - 75˚
		:	K-23 - 120˚
		:	K-26 - 100˚
		:	K-32 - 90˚
		:	K-42 - 115˚
5.0	**MATERIAL OF CONSTRUCTION**	:	
5.1	NOZZEL HOUSING (BODY)	:	ASTM A351 CF8M
5.2	Scroll	:	SS-316
5.3	WEIGHT(Approx.)	:	0.200 KG
5.4	FINISH	:	NATURAL FINISH
5.5	MARKING ON EQUIPMENT	:	Mfg Trademark, YEAR & BATCH
		:	K Factor
		:	Model
6.0	APPROVAL	:	UL LISTED
7.0	QUANTITY	:	AS PER APPROVED DRG.
8.0	HYDROSTATIC TEST PRESSURE	:	175 PSI (12 KG /SQ.CM)
9.0	ACCEPTANCE	:	As per Manufacturer TC
10.0	CATALOGUE	:	Enclosed

HIGH VELOCITY WATER SPRAY NOZZLE (STAINLESS STEEL)

HD FIRE PROTECT PVT. LTD.

TECHNICAL DATA

MODEL	HV-B without strainer
MAXIMUM WORKING PRESSURE	12 Bar (175 PSI)
EFFECTIVE WORKING PRESSURE	3.5 to 10.5 Bar (50 - 150 PSI)
END CONNECTION	¾" BSPT (¾" NPT OPTIONAL)
MATERIAL	Housing & Scroll - SS 316
INCLUDED WATER SPRAY ANGLE AND K-FACTOR	SPRAY ANGLE — K-FACTOR METRIC (US) 75° - 22 (1.54) 80° - 18 (1.26) 90° - 32 (2.24) 100° - 26 (1.82) 115° - 42 (2.94) 120° - 23 (1.61)
WEIGHT (Approx)	0.200 Kg
FINISH	Natural Finish
APPROVALS	UL Listed
ORDERING INFORMATION	Specify Model, K-Factor, Spray angle and end Connection

DESCRIPTION

High Velocity Water Spray Nozzles are internal swirl plate type open nozzles designed for use in fixed water spray or deluge system for the fire protection application.

These nozzles produce solid uniform and dense core of high velocity water spray to effect fire control. Nozzles are normally used to cool the surface as well as for extinguishment. Nozzles are typically used for Deluge protection of special hazards such as oil filled transformers, switch-gear, chemical process equipments, conveyor system and flammable liquid storage areas. The minimum desirable pressure to achieve a reasonable spray pattern is 3.5 Kg./sq.cm. (50 psi). The water distribution pattern as shown in the graph in following pages giving maximum effective axial distance from the nozzle. The spray pattern shown is with indoor application. The system designer must consider wind velocity while designing the system for outdoor application. Field obstruction if any affecting the spray pattern of the nozzle must be considered.

The nozzle may be oriented in any position as deemed necessary to cover the hazard.

3.5 bar to 7 bar pressure at Nozzle is recommended for effective application requiring High Velocity Water delivery for rapid extinguishment of all fires by emulsification.

The main pipeline strainers are required in the system.

The Blow-off cap can be used to prevent the depositing of foreign material in the water way of the nozzle. Use of Blow-off cap is optional and not UL listed.

MAINTENANCE

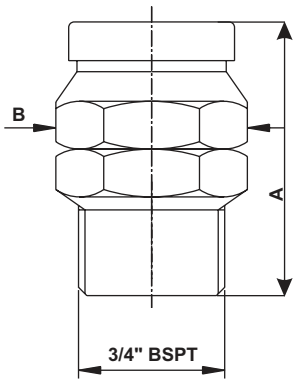
The spray nozzle must be handled with due care. For best results , the storage as well as any further shipment be made in original packing only.

Nozzle which is visibly damaged should not be installed. Use Teflon tape or soft thread sealant on the male thread of the nozzle.

It is recommended that the water spray system be inspected by an authorised technical personnel. The nozzle must be checked for corrosion, external and internal obstruction, blockage if any. The nozzle should be cleaned or replaced if required. The system must be operated with optimum water flow at least three times in a year or as per the provision of NFPA/TAC or local authority having jurisdiction.

The owner is solely responsible for maintaining the water spray system and components therein, so that it performs properly when required.

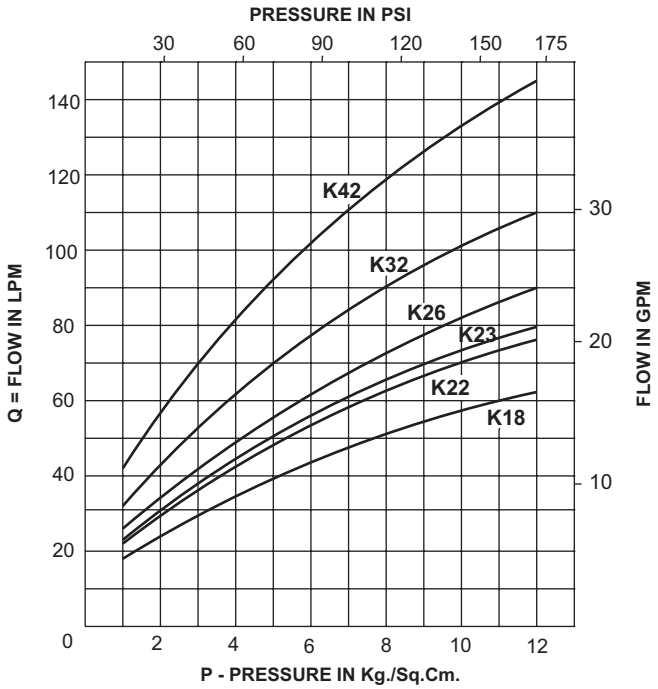
HV-B



DIMENSION In millimetres (Approximate)

NOZZLE K-FACTOR & SPRAY ANGLE	A	B (A / F)
K 22 x 75°	49	30
K 18 x 80°	44	30
K 32 x 90°	49	30
K 26 x 100°	55	30
K 23 x 120°	49	30
K 42 x 115°	49	30

DISCHARGE CHARACTERISTICS

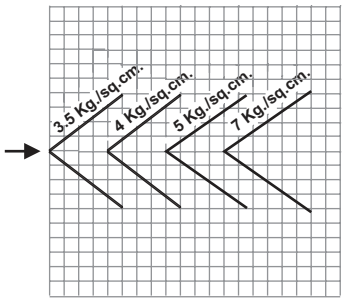


$Q = K\sqrt{P}$ where P is supply pressure in Kg/sq.cm., K= nozzle constant (K-factor) in metric

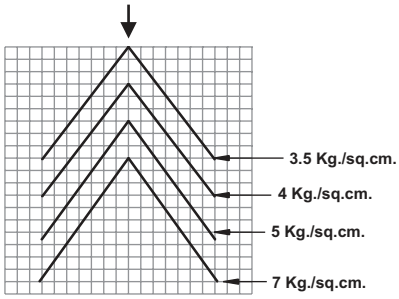
US K factor = Metric K factor ÷14.2745

SPRAY PATTERN

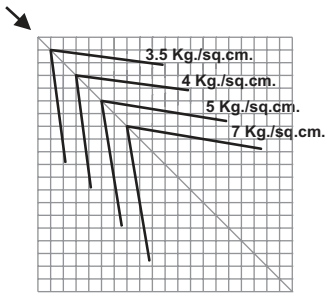
K22 X 75°



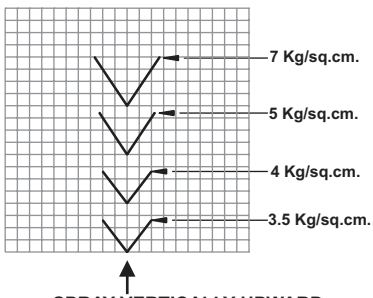
SPRAY HORIZONTAL



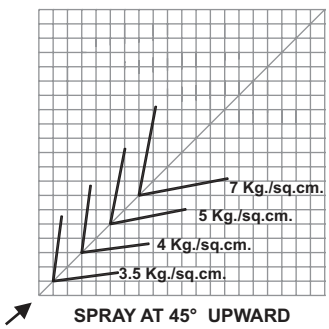
SPRAY VERTICALLY DOWNWARD



SPRAY AT 45° DOWNWARD

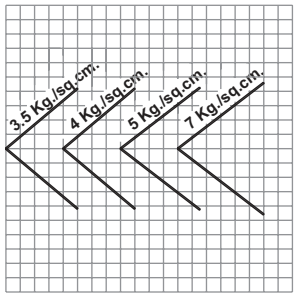


SPRAY VERTICALLY UPWARD

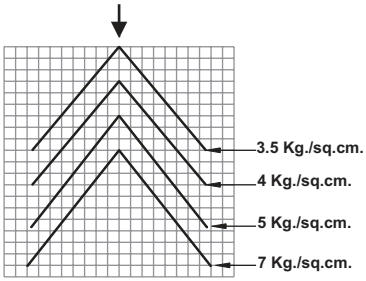


SPRAY AT 45° UPWARD

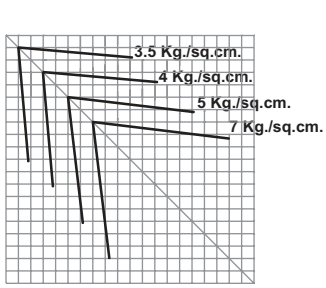
K18 X 80°



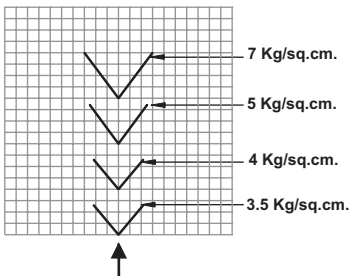
SPRAY HORIZONTAL



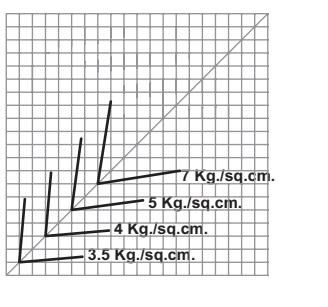
SPRAY VERTICALLY DOWNWARD



SPRAY AT 45° DOWNWARD

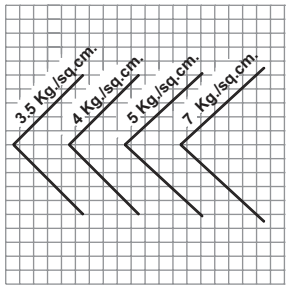


SPRAY VERTICALLY UPWARD

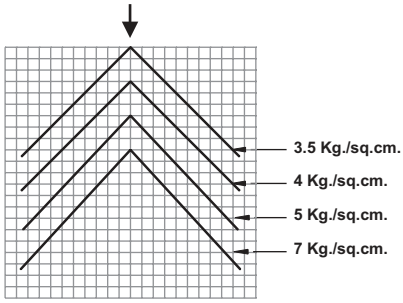


SPRAY AT 45° UPWARD

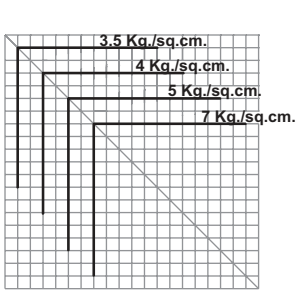
K32 X 90°



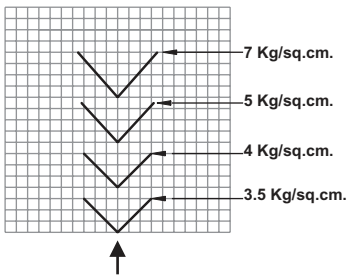
SPRAY HORIZONTAL



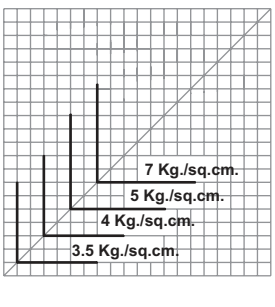
SPRAY VERTICALLY DOWNWARD



SPRAY AT 45° DOWNWARD



SPRAY VERTICALLY UPWARD

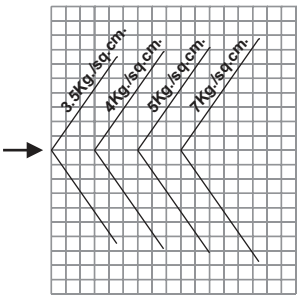


SPRAY AT 45° UPWARD

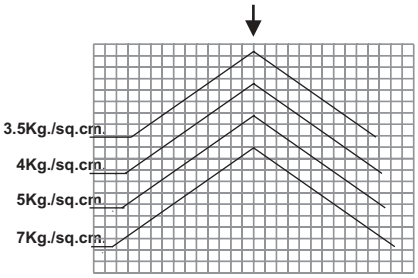
Note : One square is 200 X 200 mm.

SPRAY PATTERN

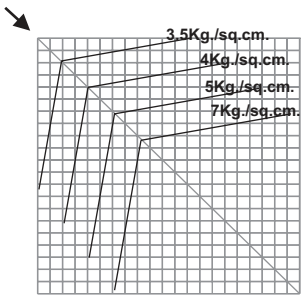
K42 X 115°



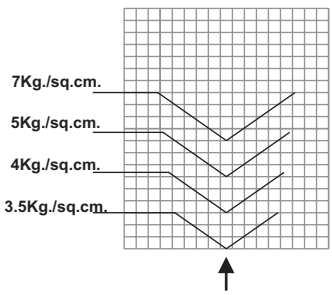
SPRAY HORIZONTAL



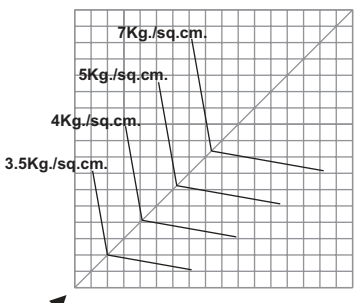
SPRAY VERTICALLY DOWNWARD



SPRAY AT 45° DOWNWARD

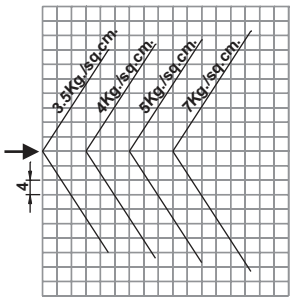


SPRAY VERTICALLY UPWARD

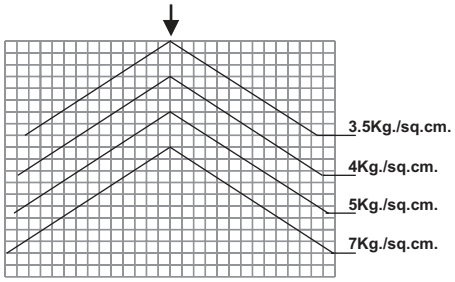


SPRAY AT 45° UPWARD

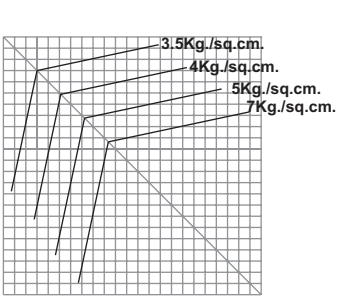
K23 X 120°



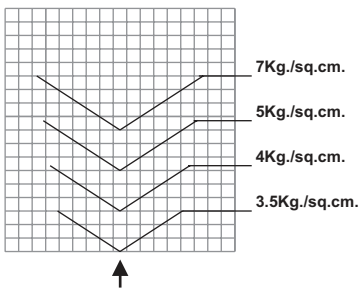
SPRAY HORIZONTAL



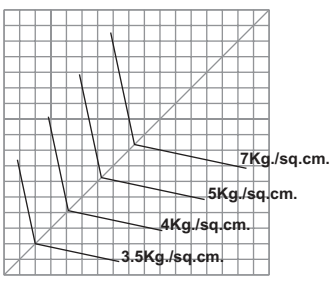
SPRAY VERTICALLY DOWNWARD



SPRAY AT 45° DOWNWARD



SPRAY VERTICALLY UPWARD

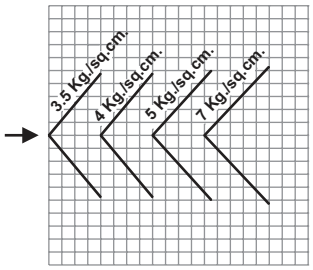


SPRAY AT 45° UPWARD

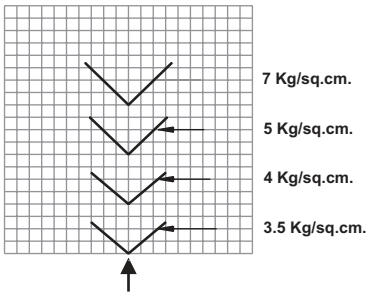
Note : One square is 200 X 200 mm.

SPRAY PATTERN

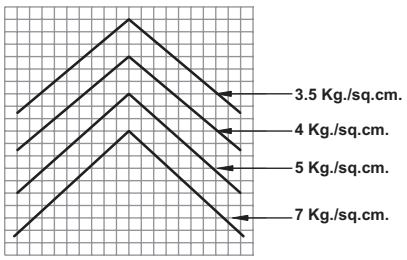
K26 X 100°



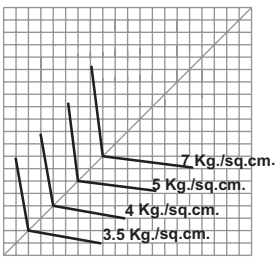
SPRAY HORIZONTAL



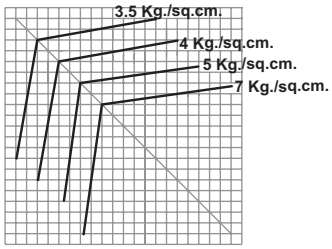
SPRAY VERTICALLY UPWARD



SPRAY VERTICALLY DOWNWARD



SPRAY AT 45° UPWARD



SPRAY AT 45° DOWNWARD

Note : One square is 200 X 200 mm.

LIMITED WARRANTY

HD FIRE PROTECT PVT. LTD. hereby referred to as HD FIRE warrants to the original purchaser of the fire protection products manufactured by HD FIRE and to any other person to whom such equipment is transferred, that such products will be free from defect in material and workmanship under normal use and care, for two (2) years from the date of shipment by HD FIRE. Products or Components supplied or used by HD FIRE, but manufactured by others, are warranted only to the extent of the manufacturer's warranty. No warranty is given for product or components which have been subject to misuse, improper installation, corrosion, unauthorized repair, alteration or un-maintained. HD FIRE shall not be responsible for system design errors or improper installation or inaccurate or incomplete information supplied by buyer or buyer's representatives.

HD FIRE will repair or replace defective material free of charge, which is returned to our factory, transportation charge prepaid, provided after our inspection the material is found to have been defective at the time of initial shipment from our works. HD FIRE shall not be liable for any incidental or consequential loss, damage or expense arising directly or indirectly from the use of the product including damages for injury to person, damages to property and penalties resulting from any products and components manufactured by HD FIRE. HD FIRE shall not be liable for any damages or labour charges or expense in making repair or adjustment to the product. HD FIRE shall not be liable for any damages or charges sustained in the adaptation or use of its engineering data & services. In no event shall HD Fire's product liability exceed an amount equal to the sale price.

The foregoing warranty is exclusive and in lieu of all other warranties and representation whether expressed, implied, oral or written, including but not limited to, any implied warranties or merchantability or fitness for a particular purpose. All such other warranties and representations are hereby cancelled.

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Product development is a continuous programme of HD FIRE PROTECT PVT. LTD. and hence the right to modify any specification without prior notice is reserved with the company.

HD FIRE PROTECT PVT. LTD.

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- FAX : +(91) 22 2581 2524 • 6796 9049
- EMAIL : info@hdfire.com • WEBSITE : www.hdfire.com

J.2	MVW SPRAY NOZZLE		
1.0	**MAKE**	:	H.D Fire
2.0	MODEL	:	MV-B
3.0	TYPE	:	Open Headed type
4.0	**DESIGN PARAMETERS**	:	
4.1	Size	:	15NB
4.2	Working Pressure	:	Minimum:1.4 BAR (for cable spreader room) and Maximum:-12.0 BAR
4.3	End connection	:	1/2"MALE THREADED (BSPT)
4.4	Spray angle	:	MAX.140 Deg
4.5	K' Factor	:	18,22,30,35,41,51,64,79,91,102
5.0	**MATERIAL OF CONSTRUCTION**	:	
5.1	HOUSING (BODY)	:	ASTM A351 CF8M
5.2	DEFLECTOR PIN	:	ASTM A479 GR.31803
5.3	DEFLECTOR	:	ASTM A240 GR.2205
5.4	WEIGHT(Approx)	:	0.115 KG
5.5	FINISH	:	NATURAL FINISH
5.6	MARKING ON EQUIPMENT	:	Mfg Trademark, YEAR & BATCH
		:	K Factor
		:	Model
6.0	APPROVAL	:	UL LISTED
7.0	QUANTITY	:	AS PER APPROVED DRG.
8.0	HYDROSTATIC TEST PRESSURE	:	175 PSI (12 KG / SQ.CM)
9.0	ACCEPTANCE	:	As per Manufacturer TC
10.0	CATALOGUE	:	Enclosed

MEDIUM VELOCITY WATER SPRAY NOZZLE (STAINLESS STEEL)

HD FIRE PROTECT PVT. LTD.

TECHNICAL DATA

MODEL	MV-B - without Strainer MV-BS - with Strainer
MAXIMUM WORKING PRESSURE	12 Bar (175 PSI)
EFFECTIVE WORKING PRESSURE	1.4 to 3.5 Bar (20 - 50 PSI)
END CONNECTION (½" NPT OPTIONAL)	½" BSPT
MATERIAL	Model MV B - Stainless Steel 316 Model MV BS - Stainless Steel 316 with SS Strainer
INCLUDED WATER SPRAY ANGLE FOR EACH K-FACTOR	140°, 120°, 110°, 100°, 90° , 80° & 65°
ORIFICE SIZE AND K-FACTOR	MM (INCH) - METRIC (US) 6.3 (0.248) - K18 (1.26)** 6.0 (0.236) - K22 (1.54) 7.0 (0.275) - K30 (2.10) 7.5 (0.295) - K35 (2.45) 8.0 (0.314) - K41 (2.87) 9.0 (0.354) - K51 (3.57) 10.0 (0.393) - K64 (4.48) 11.0 (0.433) - K79 (5.53) 12.0 (0.472) - K91 (6.37) 12.5 (0.492) - K102 (7.14) (Only K-factors K-18, K-22, K-30, K-35 & K-41are available with strainer in Model-AS) **K-18 nozzle is with square edge orifice, others with tapered bore.
WEIGHT (Approx)	0.115 Kg
FINISH	Natural Finish
ORDERING INFORMATION	Specify K-Factor, Spray Angle, Model & end connection details

DESCRIPTION

The HD® Medium Velocity Water Spray Nozzles are open type (non-automatic) nozzles, designed for directional spray application in fixed fire protection system.

Medium velocity water spray nozzle has an external deflector, which discharges water in a directional cone shaped pattern of small droplet size. The water is uniformly distributed over the surface to be protected.

The Nozzles are effectively designed to apply water to exposed vertical, horizontal, curved and irregular shaped surfaces to allow cooling to prevent excessive absorption of heat from external fire and avoide structural damage or spread of fire. In some application nozzles may be installed to control or extinguish the fire depending on water design density as per applicable codes.

The nozzle is used in deluge water spray system for special hazard fire protection application.

As the design and intent of specific water spray system may vary considerably, MV-B nozzle is made available in several combination of orifice sizes and spray angles.

The minimum desirable pressure to achieve a reasonable spray pattern is 1.4 Kg./Sq.cm. The water distribution pattern as shown in the graph in following pages is at an average pressure of 2.0 Kg/Sq.cm. The change in pressure between 1.4 to 3.5 Kg./sq.cm. does not affect considerable change in spray angle. The spray pattern shown is with indoor application. System designer must consider wind velocity while designing the system for outdoor application. Field obstruction if any affecting the spray pattern of the nozzle must also be considered. The nozzle may be oriented to any position as deemed necessary to cover the hazard.

The Blow-off plugs can be used to prevent the depositing of foreign materials in the water way of the nozzles, which could interfere with discharge of the spray nozzle. Blow-off plugs are optional and are not UL listed.

The main pipeline strainer as per NFPA-15 is required for system utilizing nozzle orifice diameter less than 9.5 mm (3/8 inch) i.e. HD Nozzle having K-Factor 51 and less, and also for the system water likely to contain obstructive materials.

MAINTENANCE

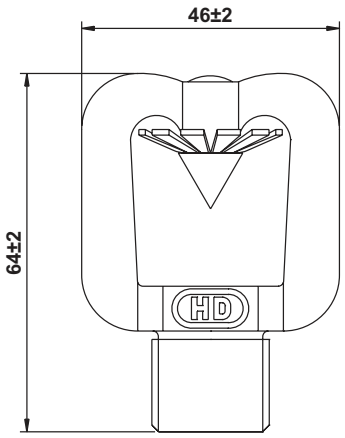
The spray nozzle must be handled with due care. For best results, the storage as well as any further shipment be made in original packing only.

Nozzle which is visibly damaged should not be installed.

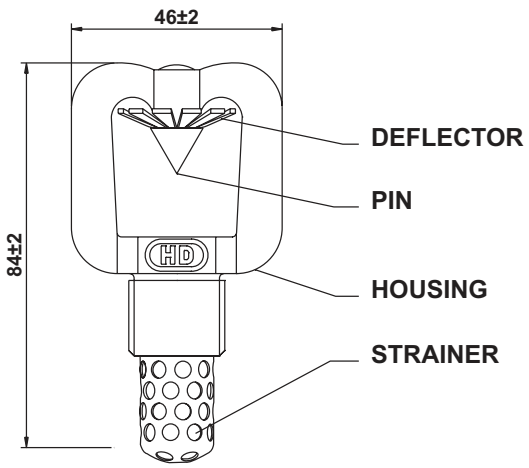
Use Teflon tape or soft thread sealant on male thread of the nozzle. The nozzles must be hand tightened into the fitting. Excessive tightening torque may result into serious damage to nozzle arms and the deflector which may affect spray pattern of the nozzle and it's performance.

It is recommended that water spray system be inspected regularly by authorised technical personnel. The nozzle must be checked for corrosion, external and internal obstruction, blockage if any. The nozzle should be cleaned or replaced if required. The system must be operated with optimum water flow at least twice in a year or as per the provisions of NFPA/TAC or local authority having jurisdiction. The owner is solely responsible for maintaining the water spray system and the components therein so that it performs properly when required.

MODEL MV-B

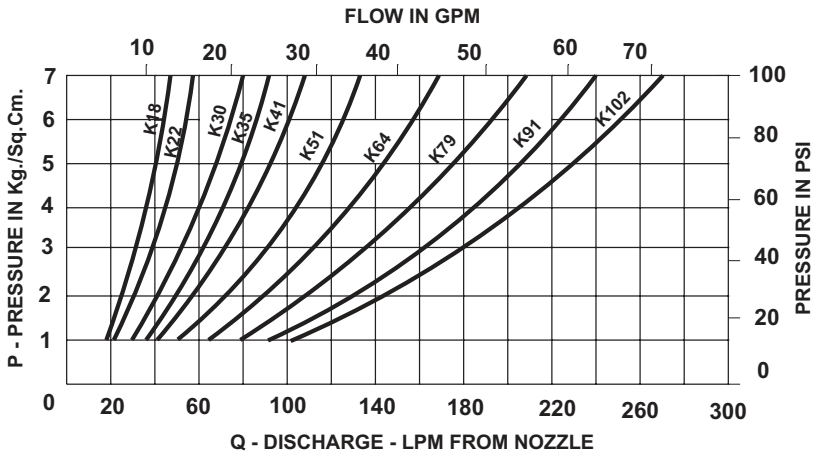


MODEL MV-BS



*** ONLY K18, K22, K30, K35, K41 WITH STRAINER

DISCHARGE CHARACTERISTICS

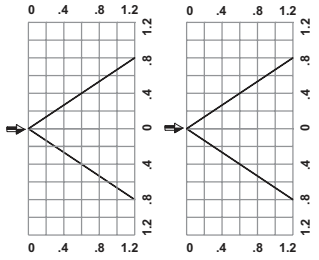


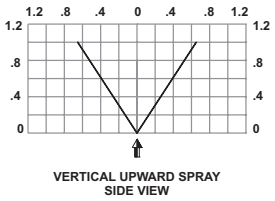
$Q = K\sqrt{P}$ where P is supply pressure in Kg/sq.cm., K= nozzle constant (K-factor) in metric

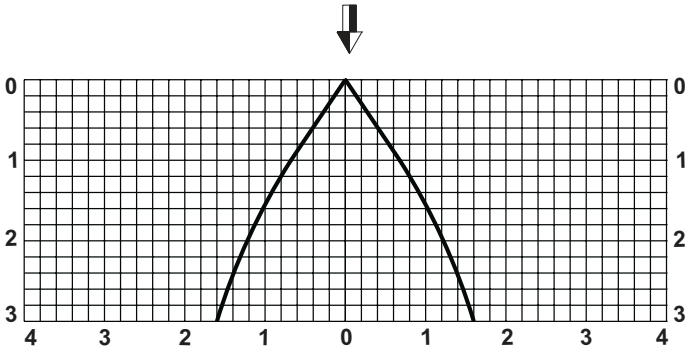
US K factor = Metric K factor ÷ 14.2745

SPRAY PATTERN

SPRAY ANGLE 65°

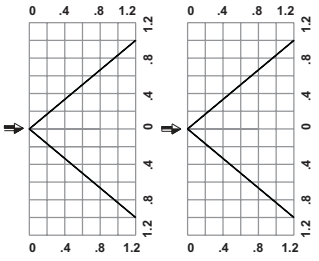


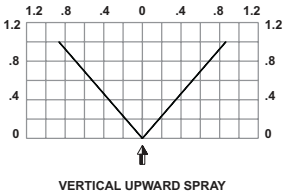


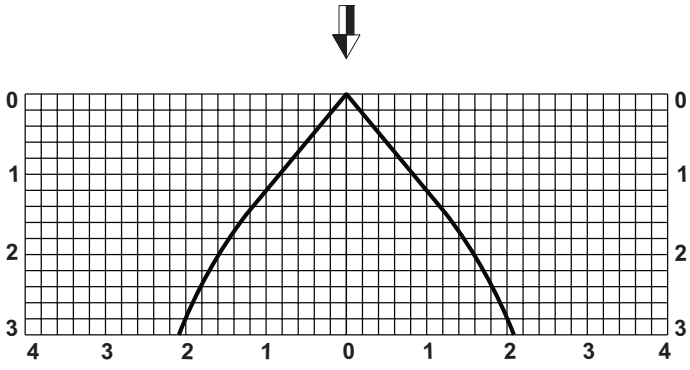


VERTICAL DOWNWARD SPRAY

SPRAY ANGLE 80°





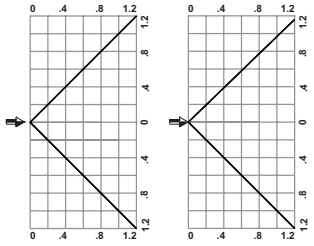


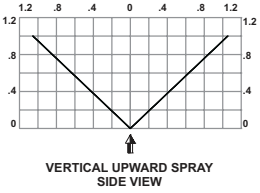
VERTICAL DOWNWARD SPRAY

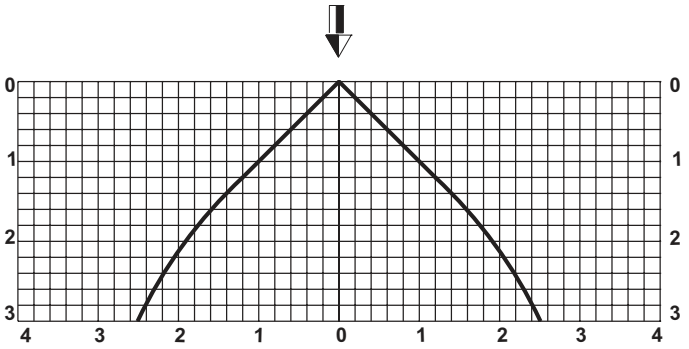
ALL DIMENSIONS ARE IN METERS

SPRAY PATTERN

SPRAY ANGLE 90°

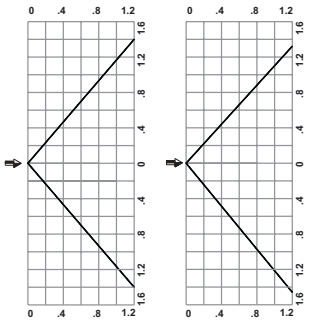


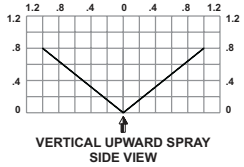


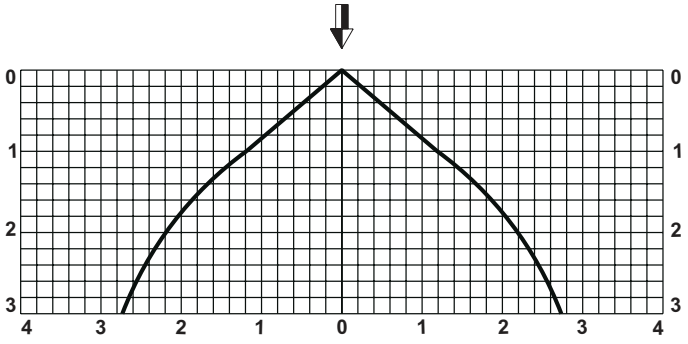


VERTICAL DOWNWARD SPRAY

SPRAY ANGLE 100°





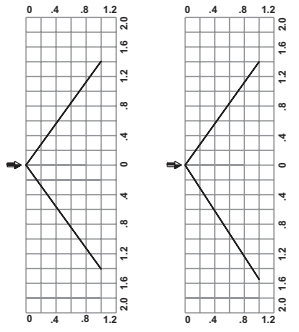


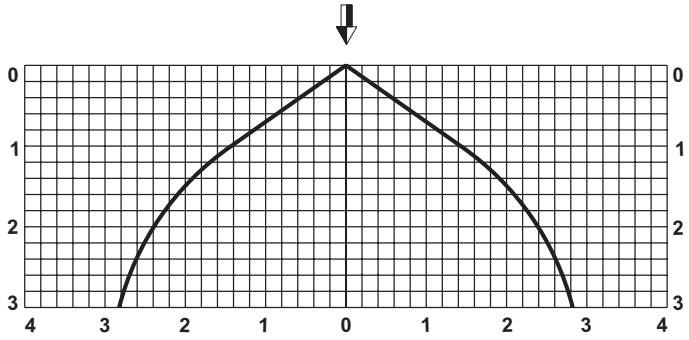
VERTICAL DOWNWARD SPRAY

ALL DIMENSIONS ARE IN METERS

SPRAY PATTERN

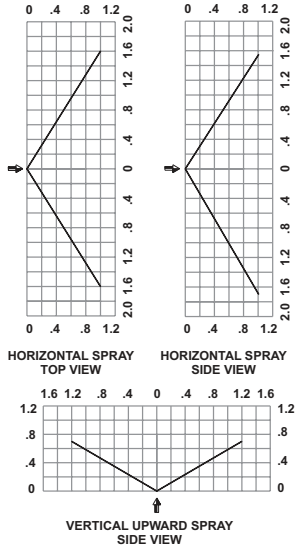
SPRAY ANGLE 110°

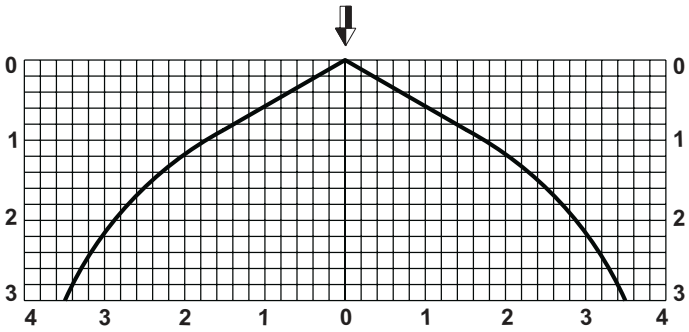




VERTICAL DOWNWARD SPRAY

SPRAY ANGLE 120°



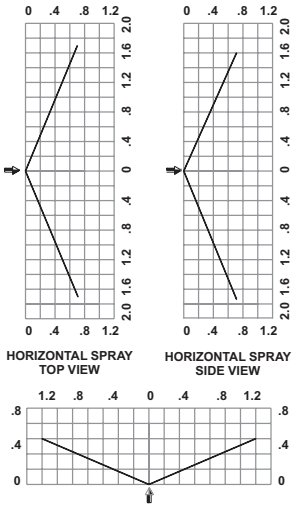


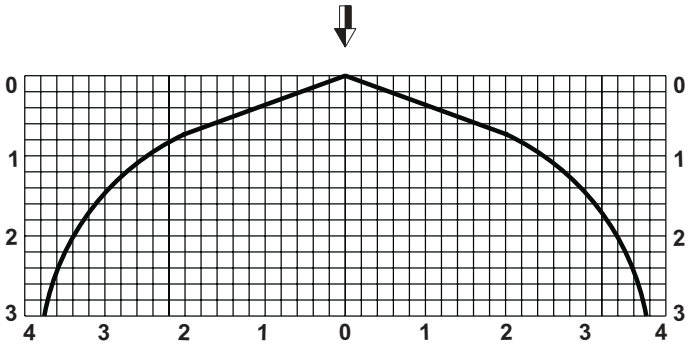
VERTICAL DOWNWARD SPRAY

ALL DIMENSIONS ARE IN METERS

SPRAY PATTERN

SPRAY ANGLE 140°





VERTICAL DOWNWARD SPRAY

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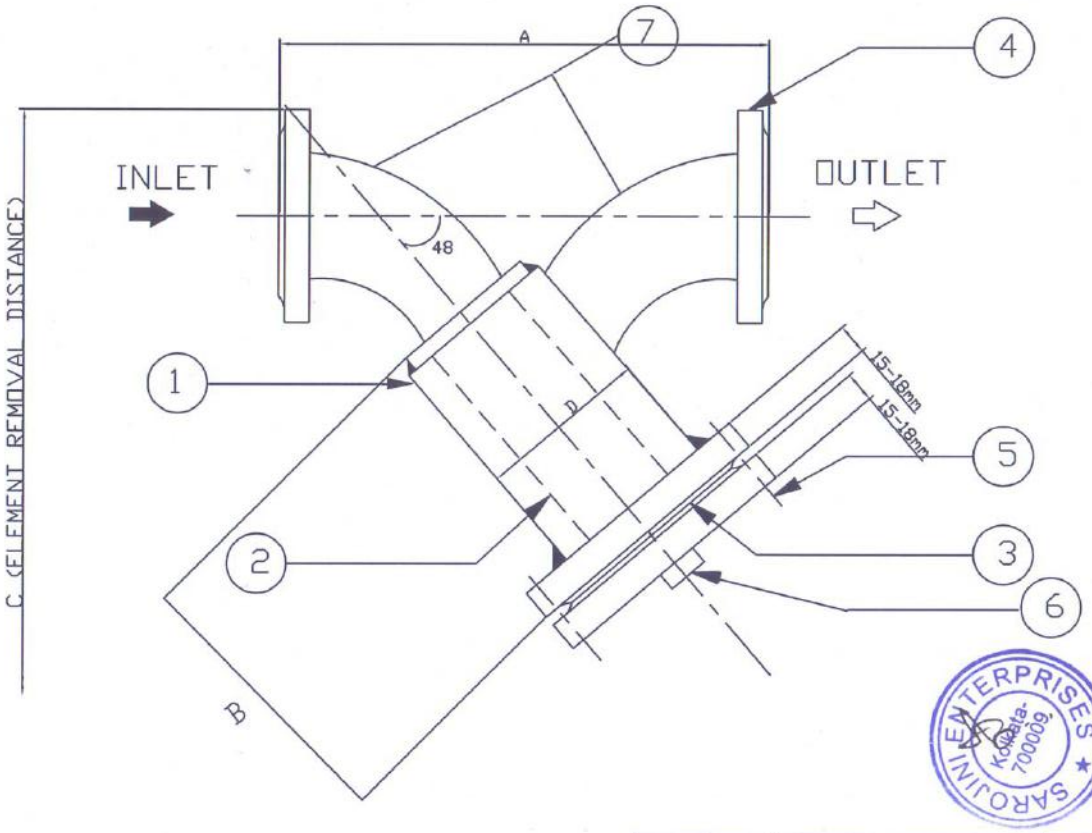
K. Y -TYPE STRAINER

1.0	Make	:	SAROJINI ENTERPRISES
2.0	Type & Size	:	Y-Type Strainer (50mm / 80mm / 100mm / 150 mm / 200 mm)
3.0	Service	:	Upstream of Each Deluge Valve
4.0	Liquid Handled	:	Fire Water
5.0	**Rated Flow (Max)**		
5.1	For NB 150	:	279 m^3/hr
5.2	For NB 100	:	225 m^3/hr
5.3	For NB 80	:	175 m^3/hr
6.0	Design Pressure	:	12 KG/SQ.CM
7.0	Working Temperature	:	50 DEG C
8.0	Hydrostatic test Pressure	:	18 KG /SQ.CM
9.0	Ratio of Screen Open Area To Inlet Area (Min)	:	4 : 1
10.0	**Presure drop at design flow rate**		
10.1	For NB 150		
	at 100% clean condition	:	5.9 MWC(MAX)
	at 50% clogged condition	:	6.2 MWC (MAX)
10.2	For NB 100		
	at 100% clean condition	:	5.0 MWC(MAX)
	at 50% clogged condition	:	5.7 MWC (MAX)
10.3	For NB 80		
	at 100% clean condition	:	4.5 MWC(MAX)
	at 50% clogged condition	:	4.9 MWC (MAX)
11.0	Cover	:	Bolted Type
12.0	Code Standard	:	ASME Sec.VIII, DIV-I

13.0	**MATERIAL OF CONSTRUCTION**		
13.1	Body	:	From ERW Black Pipe IS 1239 (Part-1)/ IS 3589 Gr.410 / IS 2062 Gr.B
13.2	Wire Mesh & Strainer Wire	:	SS 316 , 30 MESH & 30 SWG
13.3	Reinforcement Jacket	:	SS 304, 6mm (Approx) Hole perforated sheet 0.6mm to 0.8mm thick
14.0	Bolt and Nuts	:	CS to IS:1364, CL4.6/4.0
15.0	Quantity	:	As per approved Drawing
16.0	Inspection & testing	:	As per Manufacturer TC
17.0	GA Drawing	:	Enclosed



PART NO.	DESCRIPTION	NO. OFF	MATL. SPEC.
1	VESSEL	1	IS 2062 Gr.B/ ERW Pipe, IS 1239/3589 Gr.410, Medium
2	ELEMENT	1	SS 316,30 MESH 30,SWG
3	GASKET	1	CAF
4	END FLANGES(PLATE TYPE)	2	ANSI B16.5 # 150 R-F
5	FASTNERS	1 SET	CS to. IS 1364, CL 4.6/4.0
6	BLOW OFF PLUG (1/2" BSP)DRAIN	1	CARBON STEEL
7	Elbow (Medium Class)	2	CARBON STEEL

NOTES :

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. TOLLERENCE FOR ALL DIMENSION +/- 5mm
3. PAINTING

   INSIDE TWO COATS OF RED OXIDE PRIMER.

   OUTSIDE TWO COATS OF RED OXIDE & TWO COATS OF SYN.ENAMEL P.O. RED,SHED NO. 538
4. CORROSION ALLOWANCE 1.5 mm.
5. HYDROSTATIC TEST PRESSURE : AS PER TABLE GIVEN BELOW
6. INLET AREA : FILTRATION AREA = 1 : 4 FOR WATER LINE

SAROJINI ENTERPRISES Kolkata-700009

SIZE NB	QTY.	DIMENSIONS 'A'	'B'	'C'	'D'	DRAIN CONN.	DESIGN PRESSURE	HYD.TEST PRESS.
200		735	470	1700	405	½"BSP		18 Kg/cm²
150		550	455	1000	270	½"BSP		18 Kg/cm²
100		400	330	750	220	½"BSP		18 Kg/cm²
80		380	280	575	168	½"BSP		18 Kg/cm²
50		275	250	425	168	½"BSP		18 Kg/cm²

REV.	DATE	DESCRIPTION	BY
1	21.10.06	REVISED AS PER BHEL CQS ADVISE	P.P

SAROJINI ENTERPRISES

SCALE N.T.S.	DATE	TITLE: 'Y' TYPE STRAINER
DRAWN DAR	28.06.04	
CHECKED ABhattacharya	29.06.04	
APPROVED ABhattacharya		
MATERIAL : AS ABOVE	DRG. NO. SE/Y TYPE/GR/001	SHT 1 OF 1 REV. 1

TECHNICAL DATA SHEET FOR FPS ITEMS			
PROJECT : 1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD		**PACKAGE : FIRE PROTECTION SYSTEM**	
MAIN CONTRACTOR : BHEL			
S			
DOC NO. TBDS -377-552-01		**REV.: 0**	**PAGE 52 OF 76**

L.PRESSURE GAUGE

1.0	MAKE	:	H GURU
2.0	TYPE	:	Bourdon
3.0	SERVICE	:	Fire Water
4.0	RANGE	:	0-16 Kg/sq.cm
5.0	DIAL SIZE	:	150 mm
6.0	COLOR	:	WHITE BACKGROUND & BLACK ENGRAVED
7.0	ACCURACY	:	+/-1% Fsd
8.0	OVER RANGE PRESSURE	:	125% OF MAX. RANGE
9.0	SENSING ELEMENT	:	SS 316 BOURDEN TUBE
10.0	POINTER ZERO ADJUSTMENT FACILITY	:	Micrometer type Provided
11.0	WINDOW	:	Toughned Glass
12.0	MOUNTING	:	DIRECT BOTTOM ENTRY
13.0	MOVEMENT	:	AISI 304
14.0	OVER RANGE PROTECTOR	:	PROVIDED
15.0	SPAN ADJUSTMENT FACILITY	:	PROVIDED (INTERNALLY)
16.0	PROCESS CONNECTION	:	1/2 INCH BSP (M)
17.0	QUANTITY	:	As per Approved Drawing
18.0	ACCEPTANCE	:	As per Manufacturer's Test Certificate

About H. Guru North

H. GURU INSTRUMENTS (N.I.) PVT. LTD. a distinguished name driven by 'concept to creation through design & development with quality and innovation'. The pioneer in the field of instrumentation H Guru Instruments Pvt. Ltd. was established in 1983 with insatiable passion for new inventions to support its clients. Backed by a team of experienced and qualified electronics & mechanical engineers, we soon grew into prominence winning the trust of our prominent clients with unmatched quality products like Pressure Checking & temperature measuring instruments. Our work force engages in intense research to strive to offer innovative solutions for trouble free-pressure checking & temperature measuring experience.

We are committed to provide our valued clients the products and services which cater to their exact requirements and exceed their expectation levels. We emphasize upon adhering to the highest standard of quality in all areas of our operation, striving to win complete customer satisfaction. Our products provide our clients a total value for money and designed with perfection. With our commitment in Pressure & temperature measuring instruments & dedicated service, we have etched a special place in the market scenarios.

Our in house std. room features calibration & testing capacity of high accuracy pressure instruments with ranges from:-

400mmwc to 700 kg/cm2
-38dg c to 650dg c in Thermometer

Our customers have been very supportive in terms of maintaining good & a healthy relationship. And we continue to endeavor to serve our customers better than the best. Hence, our engineering expertise, coupled with our commitment to excellence, has enabled us to satisfy the highly challenging global markets.

Pressure, Vacuum & Compound Gauge

Dial Size	-	100, 150 & 250 Mm
Accuracy	-	+/- 0.5%, 1% Fsd. As Per Is 3624
Sensing Element	-	Boudon Tube
Sensing Element Material	-	Aisi - 316
Movement	-	Aisi - 304, Brass
Block	-	Extruded Brass/ Aisi - Ss 316
Case	-	Cast Aluminum 304 Weather Proof As Per Ip 65
Connection Size	-	3/8" Bsp, ½" Bsp, ½" Npt, M 20 X 1.5
Dial	-	Aluminum White Finish With Black Lettering
Pointer	-	Aluminum Black Finished With Micro Adjustable
Window	-	Glass, Shutter Proof Glass, Toughened Glass, Acrylic Glass
Mounting	-	Direct/ Projection With Bottom Entry & Flush Panel With Back Entry
Range	-	0-1, 1.6, 2, 2.5, 4, 6, 7, 10, 14, 16, 21, 25, 40, 60, 100, 160, 250, 400, 600 Kg/cm2 - 760 Mmhg And Compound Ranges
Accessories	-	Single & Double Electric Contact, Syphon, Gaugecock, Snubbers Niddle Valve, Liquid Filling Etc.

Sealed Diaphragm Pressure Gauge

Dial Size	-	100 & 150 Mm
Accuracy	-	+/- 1% Fsd. As Per Is 3624
Case & Bezel	-	Die Cast Aluminum / ss 304 Weather Proof As Per Ip 65
Bourdon	-	Ss - 316
Movement	-	Aisi - 304
Block	-	Aisi - Ss 304
Connection Size	-	½" Bsp & ½" Npt (m) Optional - Flange As Per Bs, Asa & Din Standard
Dial	-	Aluminum White Finish With Black Lettering
Pointer	-	Aluminum Black Finished With Micro Adjustable
Window	-	Glass, Shatter Proof Glass, Toughened Glass, Acrylic Glass
Mounting	-	Projection With Bottom Entry, Direct With Bottom Entry & Flush Panel With Back Entry
Range	-	0-1, 1.6, 2, 2.5, 4, 6, 7, 10, 14, 16, 21, 25, 40, 60, 100, 160, 250 Kg/cm2 Vacuum & Compound Ranges
Temperature	-	Upto 150°c With Silicon Oil (max)
Diaphragm Material	-	Aisi 316
Diaphragm Protection	-	Teflon Coating, Teflon Lining Silver Foil (optional)
Top Chamber	-	Aisi 304
Bottom Chamber	-	Aisi 316
Accessories	-	Flanges, Liquid Filling, Gauge Cock & Snubbers.

Receiver Gauge

Dial Size	-	100 & 150 Mm
Accuracy	-	+/- 1% Of Range Span
Sensing Element	-	Boudon Tube
Sensing Element Material	-	Ss 316 / Brass
Movement	-	Ss 304, Non Ferrous
Case	-	Die Cast Aluminum Weather Proof As Per IP 65
Connection	-	¼" npt & ¼" bsp
Mounting	-	Direct with Bottom Entry Or Flush Panel With Back Entry
Range	-	0.2 To 1kg/cm2 Or 3 To 15 Psi

Schaffer Diaphragm Pressure Gauge

Dial Size	-	100 & 150 Mm
Accuracy	-	+/- 1.5% Of Fsd. As Per Is 3624
Sensing Element	-	Spring Steel / Ss 316 Diaphragm
Movement	-	Non Ferrous/ Stainless Steel
Case	-	Cast Aluminum Weather Proof As Per Ip 65
Connection Size	-	½" Bsp (m)
Dial	-	Aluminum White Finish With Black Lettering
Pointer	-	Aluminum Black Finished With Micro Adjustable
Window	-	Glass, Shutter Proof Glass, Toughened Glass, Acrylic Glass
Mounting	-	Direct With Bottom Entry
Range	-	0 - 1, 2, 2.5, 4, 7, 10, 14, 16, 21 Kg/cm2, 760 Mm/hg &

Differential Pressure Gauge

Dial Size	-	150 Mm
Accuracy	-	+/- 1.5% Of Fsd. As Per Is 3624
Sensing Element	-	Diaphragm Of Ss 316 Up to 2.5 Bar/kg/cm2 Above 2.5 Bar/kg/cm2 Up to 25 Bar/kg/cm2 Diaphragm Is Alloy Steel
Movement	-	Ss 304
Case	-	Cast Aluminum Weather Proof As Per Ip 65
Connection Size	-	¼" Npt (f) Standard, Other Connection are available with Adaptor
Dial	-	Aluminium White Finish With Black Lettering
Pointer	-	Aluminium Black Finished With Micro Adjustable
Window	-	Acrylic Glass
Mounting	-	Direct With Bottom Entry & Flush Panel With Bottom Entry /back Entry
Range	-	0-400, 600, 1000, 1600, 2500, 4000, 6000 Mmwc & 0-0.6, 1, 1.6, 2, 2.5, 4, 6, 10, 16 & 25 Bar/kg/cm2
Max Static Pressure	-	10 Kg/cm2 - 100 Bar/kg/cm2
Chamber Material	-	Aisi 304
Standard Fitment	-	1) Over Range Relief Valve 2) External Zero Adjustment
Accessories	-	Electric Contact, Adjustable, Capillary & Sealed Separator (in This Case No Equalizer Valve Is Provided) Three Way Manifold Made Of Ss 304/316.

Bi- Metlic Thermometer

Types	-	Rigid Stem
Dial Size	-	63, 100, &150 Mm
Accuracy	-	+/- 1.5% Of Range Span
Stem & Connection Material	-	Brassor Ss 304
Case & Bezel	-	Cast Aluminum 304 Weather Proof As Per Ip 65
Stem Dial	-	6 Mm, 8 Mm, 9.5 Mm & 12.5 Mm
Immersion Length	-	Adjustable Upto 1000 Mm
Connection	-	3/8" Bsp, ½" Bsp, ½" Npt
Window	-	Vertical (bottom Entry) & Horizontal (back Entry) with Adjustable Union Or Fixed Type.
Mounting	-	Glass, Shutter Proof Glass
Range	-	-20 + 60, 50, 60, 100, 120, 150, 200, 250, 300°c
Accessories	-	Thermowell

TECHNICAL DATA SHEET FOR FPS ITEMS		
PROJECT : 1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD	**PACKAGE : FIRE PROTECTION SYSTEM**	
MAIN CONTRACTOR : BHEL		
S		
DOC NO. TB-DS-377-552-01	**REV.: 0**	**PAGE 55 OF 76**

M.PRESSURE SWITCH

1.0	MAKE	:	INDFOS INDUSTRIES
2.0	MODEL CODE	:	B4-64-S-P5-XSC
3.0	TYPE	:	DIAPHRAGM SEALED PISTON ACTUATOR
4.0	SENSING ELEMENT	:	DIAPHRAGM IN SS316L
5.0	WETTED PARTS	:	SS 316
6.0	CASE (HOUSING)	:	DIE CAST ALUMINIUM WEATHER PROOF ENCLOSURE ACCORDING TO IP-66
7.0	CABLE ENTRY	:	1/2" NPT (F) ENTRY HOLE
8.0	SWITCH	:	2 SPDT, SNAP ACTING MICRO SWITCH
9.0	SWITCH RATING	:	6A AT 24V DC
10.0	SWITCHING DIFFERENTIAL	:	FIXED-2.51 KG/SQ.CM, MAXIMUM
11.0	PROCESS CONNECTION	:	1/2" NPT (F)
12.0	RANGE R1	:	0.7 TO 14 KG/SQ.CM
13.0	MAX. WORKING PRESSURE OF SYSTEM	:	10.5 KG/SQ.CM
14.0	SET POINT	:	ADJUSTABLE BETWEEN 10% & 90% OF THE RANGE
15.0	REPEATABILITY	:	± 0.5 % FSR
16.0	MAX. TEMPERATURE	:	150^{o} C
17.0	PROCESS MEDIUM	:	FIRE WATER
18.0	ACCESSORIES	:	2 WAY MANIFOLD VALVE
19.0	INSPECTION / ACCEPTANCE	:	AS PER MANUFACTURER'S TEST CERTIFICATE
20.0	QUANTITY	:	AS PER APPROVED DRAWING
21.0	CATALOGUE	:	ENCLOSED

PRESSURE SWITCHES
B–SERIES

- STURDY, ROBUST AND PRECISE
- HIGH STATIC PRESSURE
- VACUUM, PRESSURE & COMPOUND RANGES
- CHOICE OF DIAPHRAGM MATERIAL

B–Series Pressure / Vacuum Switches are designed for high proof pressures to handle pressure from vacuum to 210 Kg/Cm². B–Series switches use a **diaphragm sealed piston actuator**. As the pressure on the calibrated piston increases, the adjusted spring force is over-come and the snap action switch is actuated. The piston is sealed from the process by a diaphragm (Actuator Seal). Choice of diaphragm materials offers compatibility with virtually any medium.

The rugged diaphragm sealed piston actuator provides setpoint repeatability of ±0.5%. The enclosure is die-cast Aluminium and is available in weatherproof and flameproof versions (Table 'A'). A wide variety of SPDT (Single) and 2 × SPDT (Dual) snap action switches are available to meet many electrical load requirements (Table 'B').

Applications include : Pumps, Compressors, Heat Exchangers, Boilers, Marine Equipment, Lube Systems, Filters, Degreasers, Evaporators, Heat Recovery System, Ground Support Equipments, Textile Machinery, Heating & Air Conditioning Systems, Food Processing, Heat Tracing, Fire Fighting, Bottling, Bulk Conveying, Packing & Filling, Furnace, Blowers and Air Dryers, etc.,

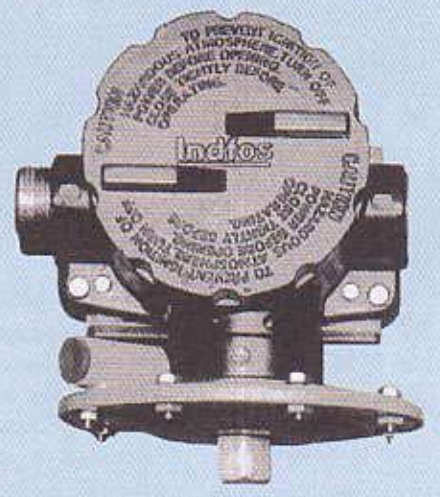
GENERAL SPECIFICATION

Ranges	(–)1 ~ 0 to 0 – 210 Kg/Cm², various split-up ranges
Deadband	Fixed or Narrow adjustable deadband
No. of Microswitches	1 or 2 SPDT (Form C)
Repeatability	±0.5% FSR
Sensor	Diaphragm sealed piston actuator
Actuator Seal	Buna N, Viton®, Teflon®, 316SS diaphragm
Material of Pressure Housing (wetted part)	
mm H_2O Ranges	304 SS Std. for Buna–N, Viton, Teflon Sensor; 316 SS optional
	316 SS Std. for Stainless Steel Sensor
Other Ranges	316 SS Std. for all Sensors
Process Connection	1/4" NPTF – Standard
	Others through adaptors
Electrical Connection	B4 : 3/4" NPTF Std.
	1/2" NPTF optional
	B7 : 1/2" NPTF Std.
Conformity	Generally to BS 6134 : 1991

* Viton® is a registered trademark of DuPont Dow Elastomers
Teflon® is a registered trademark of E.I.DuPont de Nemours and Company

WEATHERPROOF PRESSURE SWITCH – TYPE B4

FLAMEPROOF PRESSURE SWITCH – TYPE B7



ORDERING MATRIX

A	ENCLOSURE

Code	Description
B4	Pressure Switch in Type 400 weatherproof enclosure to meet IP:66 as per IS:13947 (Part I) : 1993.
B7	Pressure Switch in Type 700 flameproof enclosure to meet to gas Gr.IIA, IIB & IIC as per IS:2148:2004.
Ambient operating limit (–)30°C to 65°C for all switches	

ORDERING

How to order : Select the desired features in the form shown below to arrive at Model Number :

B4	20	Enclosure Code ..... Refer Table 'A' – Enclosure
		Switch Code ..... Refer Table 'B' – Switch Type
	B	Seal Type ..... Refer Table 'C' – Seal (Diaphragm) material
	P2	Range Code ..... Refer Table 'C' – Adjustable Range
	XNH	Options & Accessories ..... Refer Table 'D' – Options & Accessories

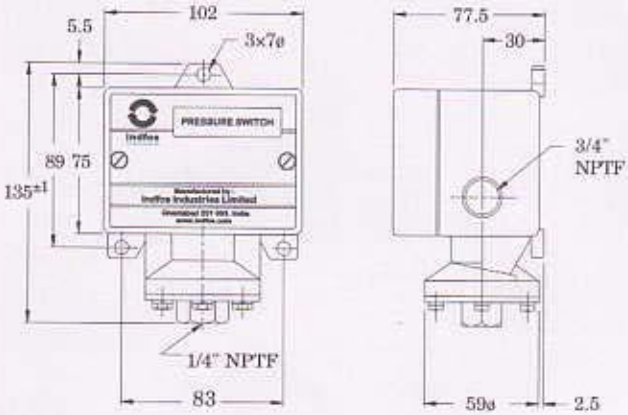
Example : B4 20 B P2 XNH

B4	Type 400 Weatherproof Enclosure
20	SPDT 15A 250V AC
B	Buna N diaphragm
P2	0.2 to 2.0 Kg / Cm²
XNH	SS Tag Plate

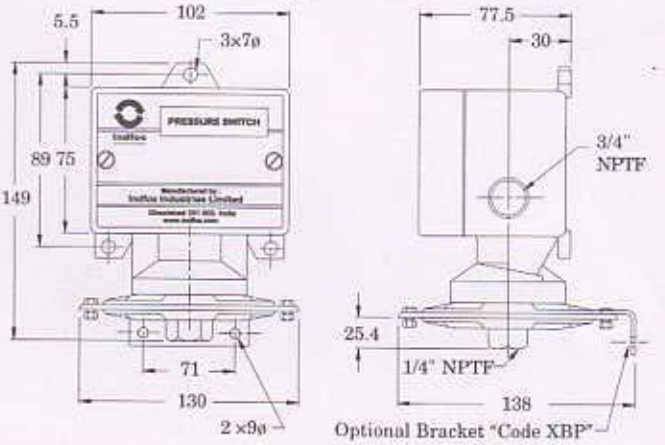
MOUNTING DIMENSIONS

Type 400 — Weatherproof Enclosure

Kg / Cm² Range

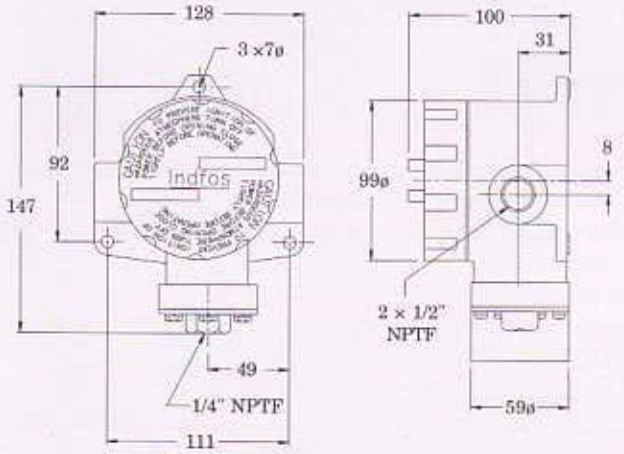


mmH$_2$O Range

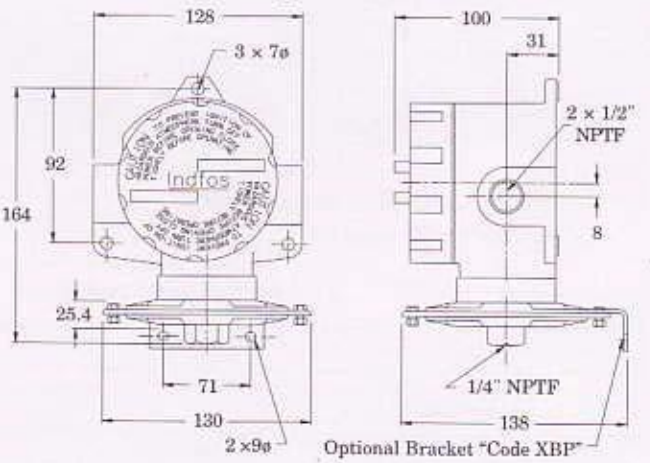


Type 700 — Flameproof Enclosure

Kg / Cm² Range



mmH$_2$O Range



All dimensions are in mm

This is not a contractual document. Prior notification of changes in specifications is impracticable due to continuous improvement

Indfos Industries Limited

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web-site : www.indfos.com

WORKS

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   Ph : 0120–2712016 / 2712134 **Fax :** 0120–2712023 **E-mail :** sales@indfos.com
2. 86, Thirupurkumaran Street, Athipet, Ambattur, Chennai 600 058

SALES	E-MAIL	PHONE	FAX
Chennai	chennai@indfos.com	044–2435 3407	044–2431 1760
Coimbatore		9486191368	
Delhi	delhi@indfos.com	011–2589 7296	011–4500 9460
Kolkata	kolkata@indfos.com	033–2486 6761	033–2486 6761
Mumbai	mumbai@indfos.com	022–2565 6936	022–2565 1237

#0510 B-Series-Rev.1-2*

ORDERING MATRIX Contd.,

B SWITCH TYPE

Code		Type	Electrical Rating	
1 SPDT	2 SPDT		AC	DC
10 *	N.A.	Low Force for Low ranges	10A 125 / 250 / 480V 1/8 HP 125V; 1/4 HP 250V	N.R.
20	61	Low Differential (Narrow)	15A 125 / 250V / 480V	N.R.
24	64	General Purpose	15A 125 / 250 / 480V	0.4A 125V; 0.2A 250V; 6A 30V (R)
26	62	Sealed Environment Proof	5A 125 / 250V	3A(R) / 2A(I) 24V
31	70	Gold Plated Contacts	1A 125V	0.5A(R) / 0.25A(I) 24V
32S	68S	Hermetically Sealed Inert Gas filled Silver alloy contact	5A125 / 250V	5A(R) / 3A(I) 24V
42S	71S	Hermetically Sealed Inert Gas filled Gold alloy contact	N.R.	1A(R) / 0.5A(I) 24V
50	N.A.	Variable Deadband (Narrow band)	15A 125 / 250V	N.A.

* *Available in pressure ranges of 2.5 to 25 mmH_2O and 5.0 to 50 mmH_2O only.*

N.R. – Not Recommended; **N.A.** – Not Available; **(R)** – Resistive Load **(I)** – Inductive Load

C SEAL TYPE AND ADJUSTABLE RANGE

Range Code	Range	Seal (Diaphragm) Type					MWP Kg/Cm²
		Seal Code	B	V	T	S	
		Material	Buna-N	Viton	Teflon	316 SS	
		Max. Temp.	65°C	150°C	150°C	150°C	
Vacuum							
V1	(–) 1 to 0 Kg/Cm²		✓	✓	✓	N.A.	10.5
Compound							
C1	± 375 mmH_2O		✓	✓	✓	✓	1.0 (1)
C2	± 760 mH_2O		✓	✓	✓	✓	1.0 (1)
C3	± 1 Kg/Cm²		✓	✓	✓	N.A.	10.5
C4	(–)1 to (+)2 Kg/Cm²		✓	✓	✓	N.A.	10.5
C5	(–)1 to (+) 4 Kg/Cm²		✓	✓	✓	N.A.	10.5
Water Column							
W1	2.5 to 25 mmH_2O		✓	✓	✓	N.A.	1.0 (1,2)
W2	5 to 50 mmH_2O		✓	✓	✓	N.A.	1.0 (1,2)
W3	12.5 to 250 mmH_2O		✓	✓	✓	✓	1.0 (1)
W4	37.5 to 750 mmH_2O		✓	✓	✓	✓	1.0 (1)
W5	75 to 1500 mmH_2O		✓	✓	✓	✓	1.0 (1)
W6	125 to 2500 mmH_2O		✓	✓	✓	✓	1.0 (1)
W7	187.5 to 3750 mmH_2O		✓	✓	✓	✓	1.0 (1)
Pressure							
P1	0.1 to 1 Kg/Cm²		✓	✓	✓	✓	22
P2	0.2 to 2 Kg/Cm²		✓	✓	✓	✓	22
P3	0.2 to 4 Kg/Cm²		✓	✓	✓	✓	22
P4	0.35 to 7 Kg/Cm²		✓	✓	✓	✓	40
P5	0.7 to 14 Kg/Cm²		✓	✓	✓	✓	40
P6	1.4 to 28 Kg/Cm²		✓	✓	✓	✓	110
P7	2.1 to 42 Kg/Cm²		✓	✓	✓	✓	110
P8	3.5 to 70 Kg/Cm²		✓	✓	✓	✓	Note 3
P9	5.5 to 110 Kg/Cm²		✓	✓	✓	✓	
P10	7 to 140 Kg/Cm²		✓	✓	✓	N.A.	
P11	10.5 to 210 Kg/Cm²		✓	✓	✓	N.A.	

NOTES :

1. Order option "XHX" for MWP of 4.5 Kg/Cm².
2. For ranges 2.5 to 25 mmH_2O and 5 to 50 mmH_2O (Ranges W1 & W2) only type 10 microswitch is available. No other micro switch type is possible.
3. **MWP (Kg / Cm²) :**
   110 for 316 SS
   230 for Viton
   530 for Buna-N & Teflon
4. Other diaphragm material like 316LSS, Monel can be provided on request in certain ranges. Consult Sales for details.
5. "CSD" Chemical seal available in Kg/Cm² ranges only. Consult Sales for details.
6. Proof pressure is 1.5 times the Maximum Working Pressure (MWP)

Pressure Switches Deadband Chart for B4 / B7 Switches with BUNA–N Diaphragm

Range Code	Range	Microswitch Code										
		1 SPDT					2 SPDT				1 SPDT	
		10	20	26	24,31	32,42	61	62	64,70	68,71	50 (Adj. Diffl.)	
		Maximum Deadband									Min	Max.
	Low Pressure Range	mmH_2O										
W1	2.5 to 25 mmH_2O	2	6	N.A.			N.A.				N.A.	
W2	5 to 50 mmH_2O	3	7									
W3	12.5 to 250 mmH_2O	N.A.	13	26	51	72	21	35	81	114	9	38
W4	37.5 to 750 mmH_2O		16	32	64	89	26	40	102	142	11	51
W5	75 to 1500 mmH_2O		33	66	89	127	54	85	142	203	22	64
W6	125 to 2500 mmH_2O		41	82	140	196	64	105	224	305	27	102
W7	187.5 to 3750 mmH_2O		64	128	216	305	102	160	330	483	43	165
C1	±375 mmH_2O		19	38	64	89	31	50	102	142	11	51
C2	± 750 mmH_2O		15	30	64	89	26	40	102	142	11	51
	Vacuum Range	mm Hg										
V1	(–)760 mmHg	N.A.	18	36	76	107	31	45	122	173	12	56
	Compound Range	mm Hg / Kg/Cm^2										
C3	(–)760 mmHg	N.A.	25	50	76	107	41	65	122	170	19	64
	1 Kg/Cm^2		0.05	0.10	0.11	0.15	0.08	0.15	0.17	0.25	0.04	0.07
C4	(–)760 mmHg		38	76	153	213	61	100	244	330	30	114
	2 Kg/Cm^2		0.06	0.12	0.15	0.20	0.10	0.15	0.23	0.32	0.05	0.11
C5	(–)760 mmHg		76	152	229	305	122	200	356	483	63	178
	4 Kg/Cm^2		0.11	0.22	0.35	0.50	0.17	0.3	0.56	0.81	0.1	0.28
	Pressure Range	Kg / Cm^2										
P1	0.1 to 1 Kg/Cm^2	N.A.	0.02	0.04	0.11	0.15	0.04	0.05	0.17	0.25	0.01	0.07
P2	0.2 to 2 Kg/Cm^2		0.04	0.08	0.11	0.15	0.06	0.10	0.17	0.25	0.02	0.07
P3	0.2 to 4 Kg/Cm^2		0.07	0.14	0.25	0.35	0.11	0.20	0.39	0.56	0.05	0.18
P4	0.35 to 7 Kg/Cm^2		0.12	0.24	0.35	0.5	0.20	0.30	0.71	0.8	0.08	0.25
P5	0.7 to 14 Kg/Cm^2		0.21	0.42	0.92	1.28	0.34	0.55	1.48	2.0	0.14	0.65
P6	1.4 to 28 Kg/Cm^2		0.5	1.0	1.7	2.4	0.8	1.25	2.7	3.8	0.4	1.1
P7	2.1 to 42 Kg/Cm^2		0.8	1.6	2.1	3.00	1.2	2.0	3.4	5.0	0.5	1.4
P8	3.5 to 70 Kg/Cm^2		2.1	4.2	7.8	11.0	3.4	5.50	12.4	17.6	1.3	4.9
P9	5.5 to 110 Kg/Cm^2		3.2	6.4	12.0	16.0	5.0	8.0	19.2	27.2	2.0	6.0
P10	7 to 140 Kg/Cm^2		3.2	6.4	12.0	16.0	5.0	8.0	19.2	27.2	2.0	6.0
P11	10.5 to 210 Kg/Cm^2		4.2	8.4	16.5	23.2	6.8	10.5	26.5	37.0	2.6	11.3

Notes :

1. Deadbands for optional diaphragms :
   Multiply Buna–N value by: 1.4 for Viton
   1.2 for Teflon and
   1.7 for 316SS and Monel.
2. Switches may generally be set between 5% and 90% of nominal range on falling pressure.
3. The set and reset points must fall within the adjustable range.
4. N.A. – Not available

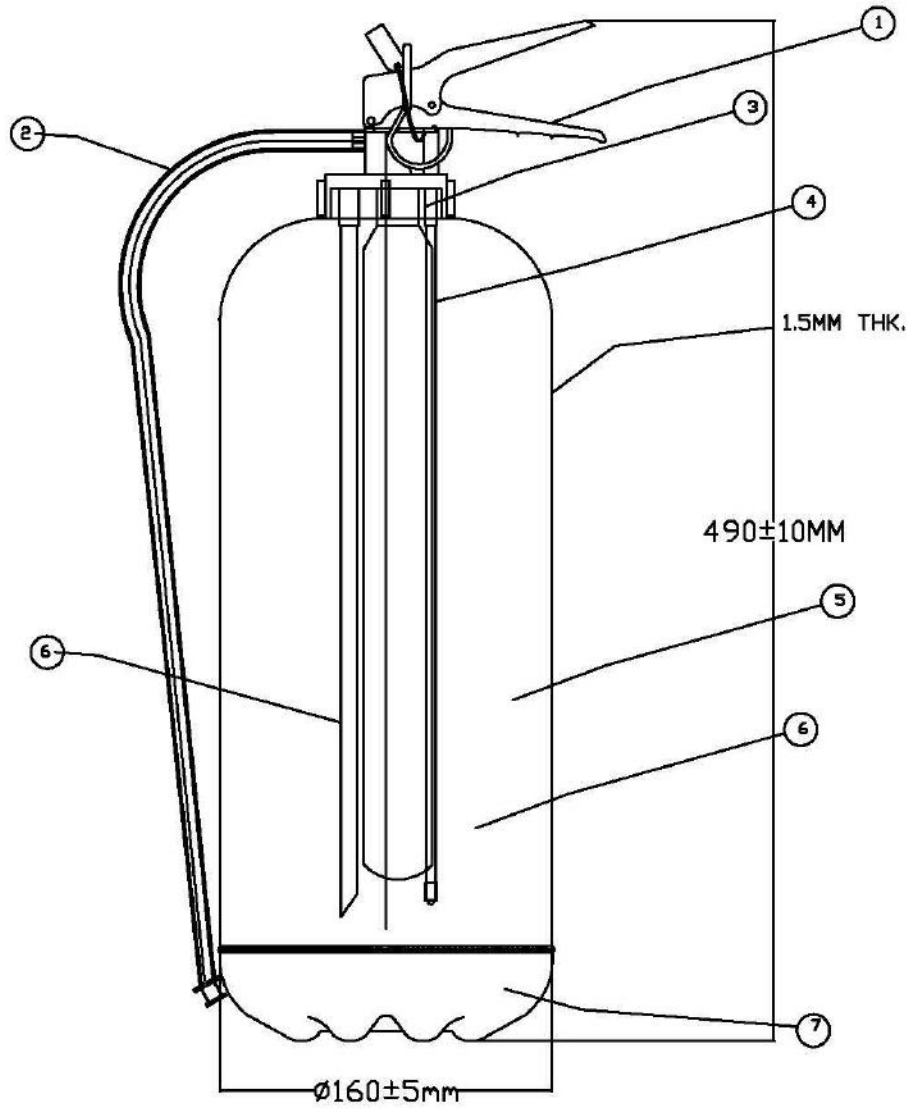
D OPTIONS / ACCESSORIES

Code	Description	Code	Description
CSD	Chemical Seal	XCL	304 SS flameproof Gr.IIA / IIB / IIC Cable gland
XHX	High Static Pressure for mmH_2O ranges only	XPC	Plug in Connector 7 or 9 PIN
XJL	1/2" NPT Aluminium Cable Entry adaptor for weatherproof enclosure only	XSN	Snubber
XJM	1/2" NPT 304 SS Cable Entry adaptor for weatherproof enclosure only	XSY	304 / 316 SS Syphon
XBP	Wall Mounting Bracket (for mmH_2O ranges)	XGS	Gauge Saver
XTM	2" Pipe Mounting Brackets with bolts & Nuts	X6B	Oxygen Cleaning
XNH	304 SS Tag Plate	XSP	304 SS Cable Entry Plug
XSC	SS Adaptor for Process Connection	XIS	Range Indicating Scale
XCG	Nickel Plated Brass Weatherproof Cable gland	X2GC	2 Way Gauge Cock
XCI	304 SS Weatherproof Cable gland	X3GC	3 Way Gauge Cock
XCJ	Nickel Plated Brass flameproof Gr.IIA / IIB/ Gr.IIC Cable gland	X2VM	2 Valve Manifold
		X2NV	2 Way Needle Valve

N.FIRE EXTINGUISHER

N.1	Dry Chemical Powder Type- 6 Kgs		
1.0	**Make**	:	Safex Fire Services Ltd
2.0	Type	:	Dry Chemical Powder Type
3.0	Specification	:	As per IS : 15683
4.0	Certification	:	BIS (ISI)
5.0	Capacity	:	6 Kgs
6.0	Operating Temperature	:	-20° C- +50°C
7.0	**Material of Construction**	:	
7.1	Body	:	Mild Steel Sheet (IS :513) 1.5 mm thick
7.2	Valve Body	:	Brass
7.3	Handle	:	Mild Steel (Upper & Lower Lever for Squeezing)
7.4	Neck Ring	:	Mild Steel Pipe
7.5	Check Nut	:	Brass
7.6	Washer (O' Ring)	:	Rubber
7.7	Plunger	:	Brass
7.8	CO2 gas cartridge	:	Seamless mild steel, IS : 4947
7.9	Cartridge holder	:	Brass
7.10	Piercer	:	Stainless Steel
7.11	Spring	:	Steel
7.12	Syphon tube	:	Plastic
7.13	Nozzle and Discharge fitting	:	PVC nozzle & Discharge fitting of M.S.
7.14	Hose	:	Braided PVC
7.15	Dry Powder charge	:	Dry powder shall confirm to IS:4308 (BC) (Sodium bicarbonate base)
7.16	Anticorrosive treatment outside	:	a) Shot Blasting
		:	b) Epoxy Powder Coated from outside Cylinder.
8.0	Painting	:	P.O.Red AS per IS: 5 shade no. 538
9.0	**Dimension**	:	
9.1	Body Dia	:	160 ± 5 mm
9.2	Filler Opening	:	63 mm
9.3	Overall Height	:	490 ± 10 mm

10.0	**Performance Test**	:	
10.1	Test Requirments	:	Hydraulic Pressure test 35 kgf/cm^2
10.2	Working Pressure	:	15 kgf/cm^2
10.3	Bursting Pressure	:	55 kgf/cm^2
10.4	Approval	:	BIS (IS:15683)
10.5	Inspection & Acceptance	:	As per Manufacturer TC



SR NO	DESCRIPTION	MATERIAL
1	VALVE	BRASS
2	HOSE	PVC / RUBBER
3	NECKRING	M.S.
4	CARTRIDGE	M.S.
5	BODY	M.S.
6	SYPHONE	PLASTIC
7	BOTTOM	M.S.
8	CHARGED	BC POWDER

CONSTRUCTION AS PER IS: 15683

LOA NO.
MAIN CONTRACTOR:

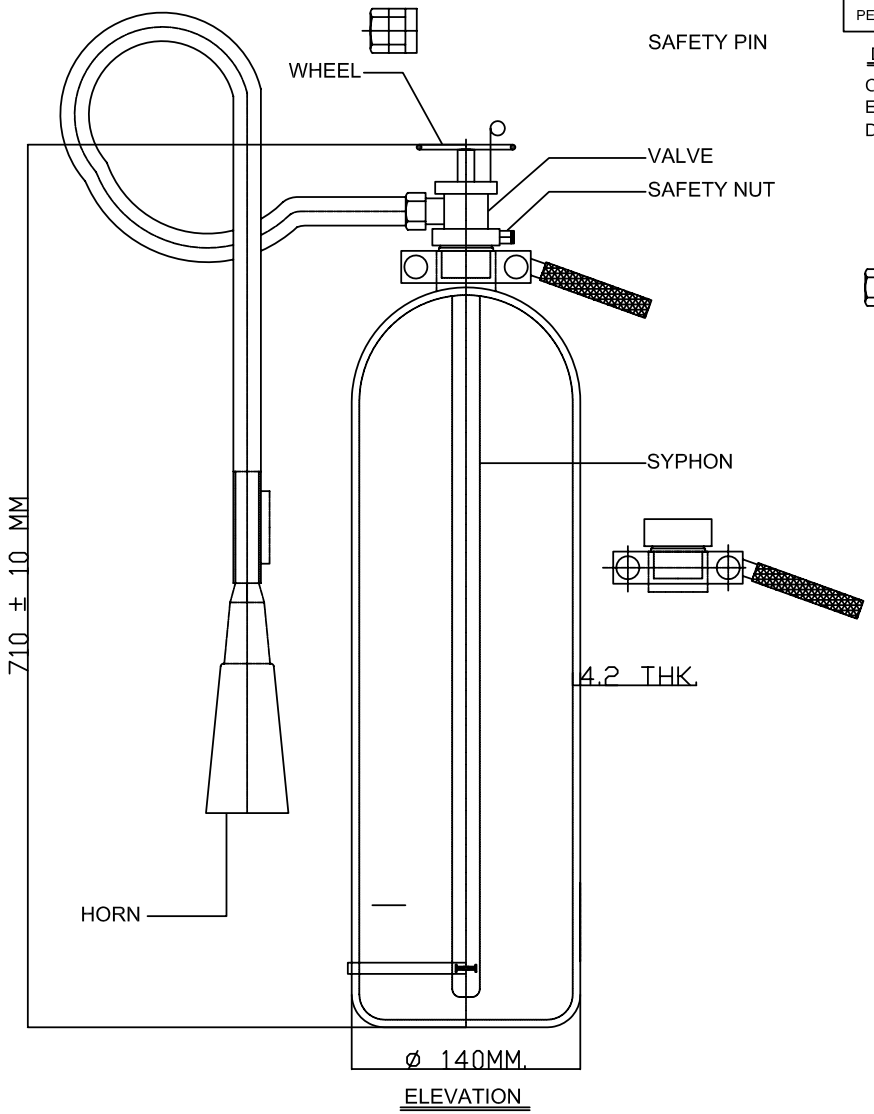
This drawing is the property of M/S.SAFEX FIRE SERVICES Ltd.The contents here in are strictly confidential and not to be Reproduced, copied,Loaned or shown to the third party without our written consent.

For Approval ☐ For Office Use ☐ For Bid Purpose ☐
For Information ☐ For Fabrication ☐ For Erection ☐

Safex Fire Services Ltd.

SCALE N.T.S	CLIENT :		
	P.O.NO.:		
	DATE	SIGN.	TITLE
DRAWN	12.2.11	umm	6KG S/GRP FIRE EXTINGUISHER
CHECKED	12.2.11	kvn	
APPROVED	12.2.11	tja	DRG.NO.SFSL/EX/06-05 REV. 00

N.2	**Carbon Dioxide type -4.5 Kgs**		
1.0	Make	:	Safex Fire Services Ltd
2.0	Type	:	Carbon Dioxide type
3.0	Specification	:	As per IS : 15683
4.0	Capacity	:	4.5 KGS
5.0	**Material of Construction**	:	
5.1	Body	:	Seamless pipe conforming to IS: 7285 ISI. Marked.
5.2	Discharge Valve	:	Wheel type (Conforming to IS : 3224) ISI. Marked
5.3	Syphon Tube	:	Aluminium Conforming to IS : 738
5.4	CO2 Gas	:	As per IS : 15222
6.0	Filling ratio	:	0.667
7.0	Test Pressure of Body	:	250 Kgf/cm^2
8.0	Painting	:	Fire-Red conforming to IS : 5 Shade No. 536
9.0	Height	:	710 +/- 10 mm
10.0	Diameter	:	140 mm.
11.0	Approval	:	CCOE Approved
12.0	Inspection & Acceptance	:	As per Manufacturer TC



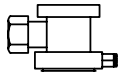
ELEVATION

DESCRIPTION

SAFEX BRAND CO2 TYPE FIRE EXTINGUISHER OF 4.5 KGS. CAP MADE FROM BRAND NEW SEAMLESS DRAWN STEEL CYLINDER WITH HIGH PRESSURE DISCHARGE HOSE WITH HORN AND SUPPLIED COMPLETE WITH INITIAL CHARGE AS PER IS : 15683 SPECIFICATION WITH ISI MARK.

DIMENSION

OVERALL HEIGHT : 710 ± 10 MM.
EMPTY WEIGHT : 12 KGS.
DIA : 140MM.



TECHNICAL SPECIFICATION

BRAND	SAFEX
IS SPECIFICATION	15683
CAPACITY	4.5 KGS
BODY	SEAMLESS PIPE CONFORMING TO IS :7285 ISI MARKED.
DISCHARGE VALVE	CONFORMING TO IS :3224 ISI MARKED (WHEEL TYPE).
SYPHON TUBE	ALLUMINIUM CONFORMING TO IS : 738
HOSE	HIGH PRESSURE WITH STAND HOSE- (BURSTING PRESSURE 150 KG/CM2)
DISCHARGE HORN	NON-CONDUCTOR OF ELECTRICITY LIKE POLYETHYLENE FIBER GLASS.
PAINTING	FIRE RED/P.O. RED CONFORMING TO SHADE NO 536/538 OF IS :5
DISCHARGE TIME	MAX 25 SEC.

NOTE :
1. ALL DIMENSIONS ARE IN MM.
2. MATERIAL : MS.

LOA NO.

MAIN CONTRACTOR:

For Approval ☐ For Office Use ☐ For Bid Purpose ☐
For Information ☐ For Fabrication ☐ For Erection ☐

Safex Fire Services Ltd.

Regd.Office:
202,"A" Dhanraj Industrial Estate,
Sanmit Road,Lower Parel(W),
Post Box No.5214,
Mumbai-400 013.INDIA.

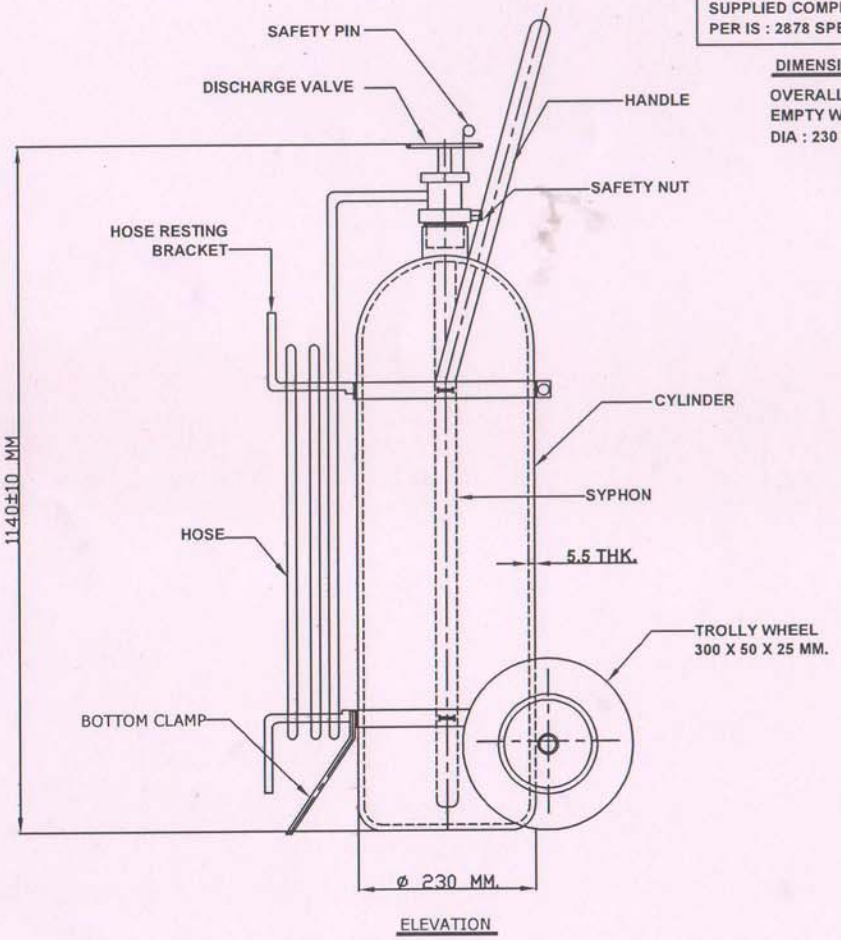
SCALE N.T.S

	DATE	SIGN
DRAWN	14.02.12	UMM
CHECKED	14.02.12	KVN
APPROVED	15.02.12	TJS

TITLE
CO2 TYPE F./EXT. 4.5 KGS CAPACITY.

DRG.NO.: SFSL/EX/CO2 -4.5 REV.00

N.3	**Carbon Dioxide type - 22.5Kgs (Trolley Mounted)**		
1.0	**Make**	:	Safex Fire Services Ltd
2.0	Type	:	Carbon DI-Oxide type
3.0	Specification	:	As per IS : 2878
5.0	Capacity	:	22.5 KGS
6.0	**Material of Construction**	:	
6.1	Body	:	Seamless Pipe Conforming to IS: 7285 ISI. Marked.
6.2	Discharge Valve	:	Wheel type (Conforming to IS : 3224) ISI. Marked
6.3	Syphon Tube	:	Aluminium Conforming to IS : 738
6.4	Hose Control	:	High Pressure Hose (Bursting pressure Min140 KG/SQ .CM) (without Discharge)
6.5	CO2 Gas	:	As per IS:15222
6.6	Painting no. 538/ 536	:	P.O. Red/Fire Red Conforming to Shade of IS : 5
6.7	Height	:	1140 ± 10mm
6.8	Dia	:	230 mm.
6.9	Inspection & Acceptance	:	As per Manufaturer TC



ELEVATION

DESCRIPTION

SAFEX BRAND CO2 TYPE FIRE EXTINGUISHER OF 22.5 KGS. CAP MADE FROM BRAND NEW SEAMLESS DRAWN STEEL CYLINDER WITH HIGH PRESSURE DISCHARGE HOSE WITH HORN AND SUPPLIED COMPLETE WITH INITIAL CHARGE AS PER IS : 2878 SPECIFICATION WITH ISI MARK.

DIMENSION

OVERALL HEIGHT : 1140 ± 10 MM.
EMPTY WEIGHT : 42.5 KGS.
DIA : 230 MM.

TECHNICAL SPECIFICATION

BRAND	SAFEX
IS SPECIFICATION	2878
CAPACITY	22.5 KGS
BODY	SEAMLESS PIPE CONFORMING TO IS :7285 ISI MARKED.
DISCHARGE VALVE	CONFORMING TO IS :3224 ISI MARKED (WHEEL TYPE).
SYPHON TUBE	ALUMINIUM CONFORMING TO IS : 738
HOSE	HIGH PRESSURE WITH STAND HOSE-5M LENGTH.& 10MM ID (BURSTING PRESSURE 140 KG/CM2)
DISCHARGE HORN	NON-CONDUCTOR OF ELECTRICITY LIKE POLYETHYLENE FIBER GLASS.
PAINTING	FIRE RED/P.O. RED CONFORMING TO SHADE NO 536/538 OF IS :5
DISCHARGE TIME	MIN 20 SEC TO MAX 60 SEC.

NOTE :
1. ALL DIMENSIONS ARE IN MM.
2. MATERIAL : MS.

LOA NO,
MAIN CONTRACTOR:

For Approval ☑ For Office Use ☐ For Bid Purpose ☐
For Information ☐ For Fabrication ☐ For Erection ☐

Safex Fire Services Ltd.

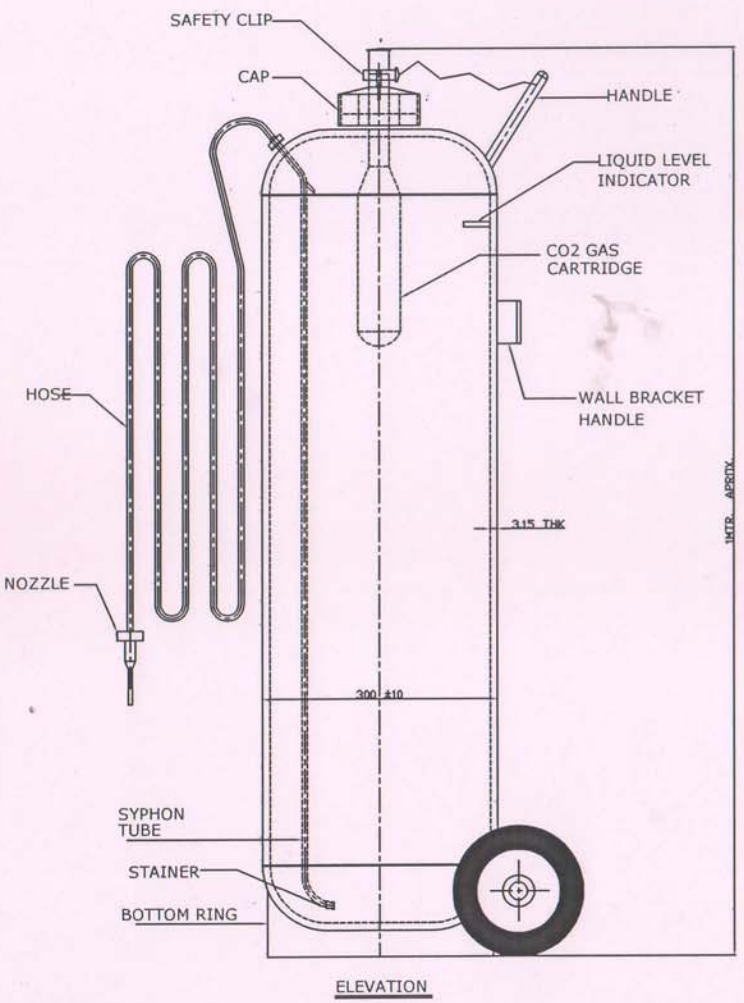
SCALE N.T.S

CLIENT : UTC FIRE & SECURITY INDIA LTD.

P.O.NO.: 20130123 DATE : 03/05/2013

DRAWN			TITLE
CHECKED			CO2 TYPE F./EXT. 22.5 KGS CAPACITY.
APPROVED			DRG.NO.SFSL/EX/CO2 – 22.5KG. REV.

N.4	Mechanical Foam type - 50 Ltrs. (Trolley Mounted)		
1.0	**Make**	:	Safex Fire Services Ltd
2.0	Type	:	Foam Type
3.0	Specification	:	As per IS : 13386
4.0	Certification	:	ISI Mark (B.I.S)
5.0	Capacity	:	50 ltrs.
6.0	**Material of Construction**	:	
6.1	Body	:	Mild Steel (IS :1079) 3.15 mm thick min.
6.2	Cap	:	Leaded tin Bronze (as per IS : 318 Gr.LTB-2)
6.3	Neck Ring	:	Seamless Mild Steel Pipe as per IS : 1239(Part-1)
6.4	Syphon tube	:	Mild steel (IS : 3601)
6.5	Hose	:	PVC having Bursting Pressure 50 Kgf/Cm2
6.6	Washer	:	Rubber (3 mm)
6.7	Plunger	:	Brass
6.8	Piercer	:	Stainless Steel IS:6528
6.9	Cartridge holder & sealing device	:	Leaded tin Bonze IS : 318
7.0	Water	:	47 ltrs.
8.0	AFFF Foam	:	3 ltrs. (AFFF)
9.0	Gas Cartridge	:	300 GMS (As Per IS : 4947)
10.0	Anticorrosive treatment Cyclinder	:	a) Shot Blasting
		:	b) Epoxy Powder Coated from inside & outsite
11.0	Empty Weight	:	45 kgs (Approx)
12.0	Full Weight	:	95 kgs (Approx)
13.0	Painting	:	P.O.Red AS per IS: 5 shade no. 538
14.0	Body	:	300 mm ± 10 mm dia
15.0	Overall Height	:	1 Meter Approx
16.0	Trolly	:	Wheel size 250 X 50 X 25 mm
17.0	**PERFORMACNE TEST**	:	
17.1	Hydraulic test	:	30 kgf/cm2 for 2.5 minutes min.
18.0	Inspection & Acceptance	:	As per Manufaturer TC



ELEVATION

DESCRIPTION

SAFEX BRAND MECHANICAL FOAM TYPE FIRE EXTINGUISHER OF (CO2 PRESSURE) 50 LTR CAP. MADE FROM MS SHEET IS :1079 AND GAS CARTRIDGE IS : 4947 WITH FOAM MAKING NOZZLE AS PER IS : 13386 WITH I.S.I. MARK.

NOTE :
1. ALL DIMENSIONS ARE IN MM.
2. MATERIAL : MS.

TECHNICAL SPECIFICATION

BRAND	SAFEX
IS : SPECIFICATION	13386
CAPACITY	50 LTR
BODY	MILD STEEL PLATE (IS:1079)
CAP	LEADED TIN BRONZE AS PER IS: 318 GRADE LTB-2
GAS CARTRIDGE	300GMS, AS PER IS: 4947
PLUNGER	BRASS
NECKRING	SEAMLESS MILD STEEL PIPE AS PER IS: 1239
WASHER	RUBBER (3.mm)
SNIFTER VALVE	BRASS (IS : 319)
SPRING	STEEL IS: 4454
NOZZLE	PVC NOZZLE
CHARGE	3 LTR (AFFF)
GAS CARTRIDGE	300 GMS IS : 4947
ANTI --CORROSIVE TREATMEMT	a) PHOSPHATING b) EPOXY POWDER COATED FROM INSIDE & OUTSIDE CYLINDER
PAINTING	P.O. RED CONFORMING TO SHADE OF NO.538 IS : 5
THROW OF JET	10 M
% OF DISCHARGE	90 % MIN
BODY DIA	Ø 300 ±10 MM
HANDLE	M.S. Ø 16MM
SYPHONE	M.S. IS: 3601 P-1
HOSE	PVC, HAVING BURSTING PR.50KGF/CM2

LOA NO.
MAIN CONTRACTOR:

For Approval ☐ For Office Use ☐ For Bid Purpose ☐
For Information ☐ For Fabrication ☐ For Erection ☐

Safex Fire Services Ltd.

SCALE N.T.S

CLIENT :

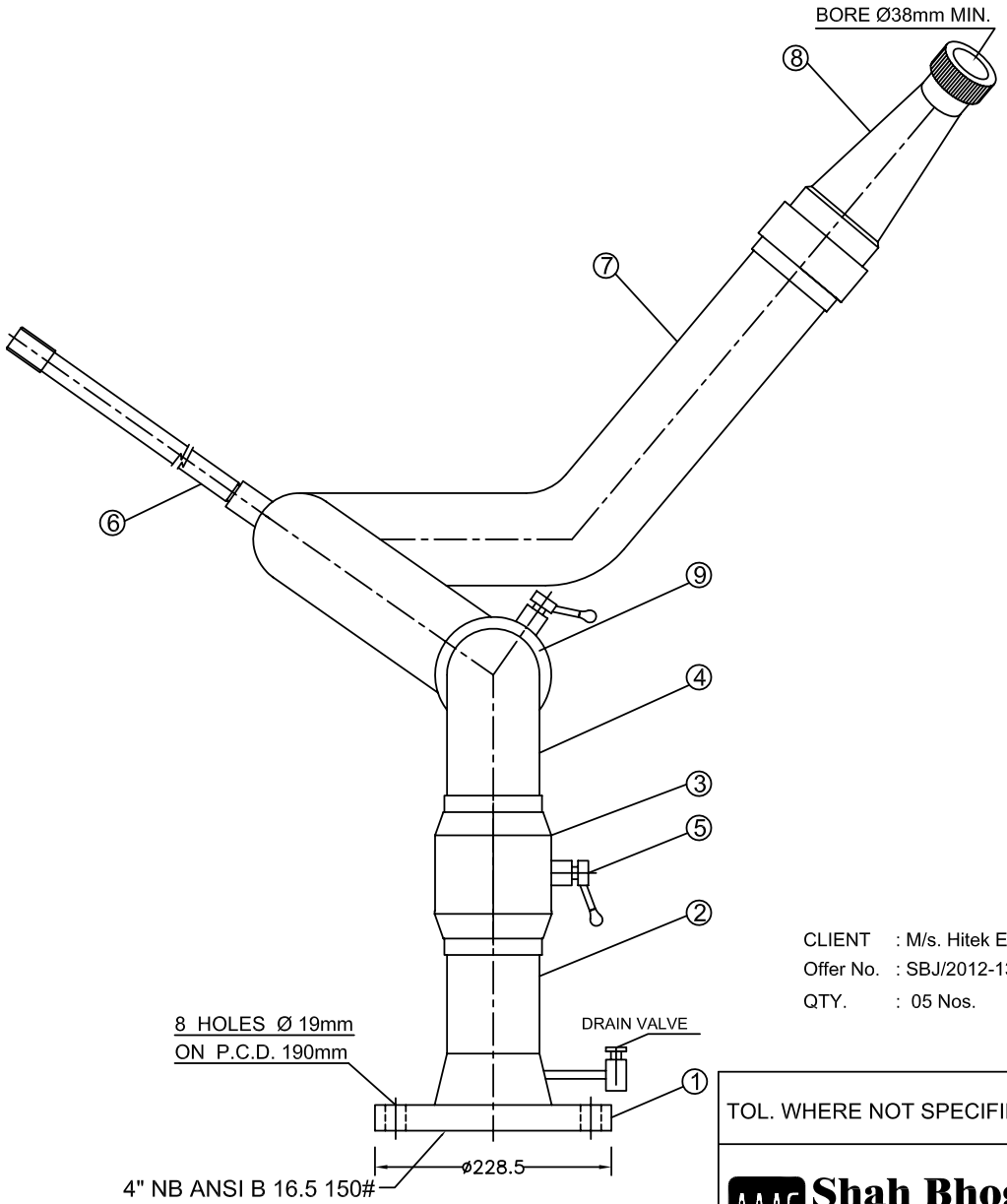
P.O.:

	DATE	SIGN.	TITLE
DRAWN			50 LTR MECHANICAL FOAM TYPE FIRE EXTINGUISHER.
CHECKED			
APPROVED			DRG.NO.: SFSL/EX-50LTR.M/F REV. 00

O. WATER MONITOR

1.0	**MAKE**	:	**SHAH BHOGILAL JETHALAL & BROS.**
2.0	APPROVALS	:	ISI Marked
3.0	TYPE	:	Stand Post Type-1
4.0	DESIGN STANDARDS & DIMENSIONS	:	IS: 8442-1977 (Type-1)
5.0	SIZE	:	100 NB Flanged Inlet (As per ANSI B16.5 #150)
		:	75 MM Size Barrel
6.0	**MATERIAL OF CONSTRUCTION**		
6.1	FLANGE	:	MS IS : 2062
6.2	REDUCER	:	IS : 1239, PART -II
6.3	ELBOW	:	IS:4310
6.4	SWIVEL JOINTS	:	G.M.- IS : 318 LTB - II
6.5	LEVER LOCK	:	BRASS - IS : 291
6.6	WATER BARREL (BODY)	:	M.S.- IS:1239 Part - I
6.7	NOZZLE	:	SS-304
6.8	HANDLE	:	M.S. IS : 1732 (2062)
7.0	**ROTATION**	:	360˚ Horizontal in either direction
			80˚ Upward , 45˚ downward in vertical direction
8.0	**PAINTING / FINISH**	:	M.S Components are hot Dip Galvanised to 0.012 MM
			Body & parts to be painted with 2 caots of Fire Red Oxide as per IS:5, Shade No.536
9.0	**TESTING**		
9.1	HYDRAULIC PRESSURE TEST	:	23 kgf/cm² (FOR 5 minutes) NO LEAKAGE.

9.2	FLOW TEST OF WATER	:	2580 LPM min. @ 7 kgf/cm². Hor.throw of Water 60 mtrs.
			2580 LPM min. @ 7 kgf/cm². Ver.throw of Water 17 mtrs.
			(In still wind condition as Manufacturer works)
10.0	**MARKING ON EQUIPMENT**	:	Marking
			Brand : Shah Bhogilal
			ISI Marked
			Size:75 MM
			Capacity: 2580 LPM @ 7 Kgf/cm²
			Year ; Year of Mfg
11.0	QUANTITY	:	As Per Approved Drawing
12.0	INSPECTION & ACCEPTANCE	:	As Per Manufacturer TC
13.0	GA DRAWING	:	Attached



NOTES :

01. ANTI CORROSIVE TREATMENT & PAINTING :

M.S. COMPONENTS ARE HOT DIP GALVANISED TO 0.012mm AND EXTERNAL PAINTING WITH 2 COATS OF FIRE RED COLOUR AS PER IS:5 SHADE NO. 536

02. PERFORMANCE TEST : DISCHARGE CAPACITY :

2580 LPM MIN. AT A PRESSURE OF 7 KG/CM2.
60 Mtrs. HORIZONTAL THROW AT 30° TRAJECTORY.
(IN STILL WIND CONDITIONS)

03. ROTATION :

360° IN EITHER DIRECTION IN THE HORIZONTAL PLANE & 125° IN THE VERTICAL PLANE (+80°, -45°) WITH SEPERATE LOCKING ARRANGEMENT.

04. HYDROSTATIC PRESSURE TEST : 23 KGF/CM2 for 5 Minutes.

CLIENT : M/s. Hitek Engineering Services.
Offer No. : SBJ/2012-13/J-2566. Dtd.11.09.2012.
QTY. : 05 Nos.

NO.	ITEM DESCRIPTION	MATERIAL
8	NOZZLE	SS 304
7	WATER BARREL	M.S. IS: 1239 PART - I
6	HANDLE	M.S. IS: 1732(2062)
5	LEVER LOCK	BRASS IS:291
4	BENDS (ELBOW)	M.S. IS: 4310
3	SWIVEL JOINT	G.M. IS:318, LTB-2
2	REDUCER	IS:1239, PART-2
1	FLANGE	M.S. IS: 2062

PART LIST

TOL. WHERE NOT SPECIFIED ±0.5mm.	ALL DIM. ARE IN M.M.	DRAWN BY: M.R.GAJJAR	CHECKED BY: M.M.SHAH	SCALE: N.T.S.

AAAG SINCE 1933 **Shah Bhogilal Jethalal & Bros.**
NR. MADHURAM CINEMA, GHEEKANTA ROAD, AHMEDABAD-380 001.

TITLE: **75mm WATER MONITOR STAND POST TYPE-I**

DRG. NO.	DATE:	REV.	SPECN.
SBJ/195/228-3B	14.09.2012.	0	IS:8442

NOTE : DUE TO OUR POLICY OF CONTINUOUS IMPROVEMENT SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

	P. FIRE HOSE WITH COUPLING		
P1	**FIRE HOSE**		
1.0	MAKE	:	Newage
2.0	CONFIRMS TO IS CODE	:	IS: 636, Type-A
3.0	TYPE	:	Fabric Reinforced Rubber Linked woven Jacket Brand:Premier
4.0	QUANTITY	:	As per Approved Drawings
5.0	BURST PRESSURE	:	MIN. 35.7 kg/cm^2 (g)
6.0	PROOF PRESSURE	:	MIN. 21.4 kg/cm^2 (g)
7.0	SIZE	:	63 mm dia
8.0	SIZE & LENGTH	:	63 mm X 15 m long (For External Hydrant)
			63 mm X 7.5 m long (For Internal Hydrant)
9.0	APPROVAL	:	BIS MARKED
10.0	END FITTING	:	Instantaneous Type
11.0	MARKING	:	Mfg. Name , Year of Manufacturing
12.0	INSPECTION & TESTING	:	As per Approved ICL
P2	**HOSE COUPLING S.S**		
1.0	MAKE	:	Newage
2.0	CONFIRMS TO IS CODE	:	Instantaneous Type coupling IS 903
3.0	SIZE	:	63 MM Instantaneous
4.0	DESIGN STANDARD	:	IS:903
5.0	APPROVAL	:	BIS (ISI)
6.0	**MATERIAL OF CONSTRUCTION**	:	
6.1	A. Male & Female Half Coupling	:	SS 304 as per IS 3444 Grade-1
6.2	WASHER	:	RUBBER, IS : 937, TYPE A.
6.3	SPRING	:	SS-304,IS : 6528.
7.0	INSPECTION & TESTING	:	As per Approved ICL
8.0	FINISH	:	POLISH
9.0	HYDROSTATIC TEST PRESSURE	:	21 kg/cm^2
10.0	WORKING PRESSURE	:	7 kg/cm^2
11.0	MARKING	:	ISI marked
12.0	QUANTITY	:	As per Approved Drawing

PREMIER

PREMIER EXTRA

- Polyester Jacketted
- Black Synthetic Epdm Rubber Lining
- Burst Pressure - 50 Kg/cm^2
- Proof Pressure - 30 Kg/cm^2
- Bearing IS : 636:88 Type A Mark
- Length - Upto 60 Mtrs

Salient Features :

Jacket Is Made Of 100% Polyester For Extra Strength

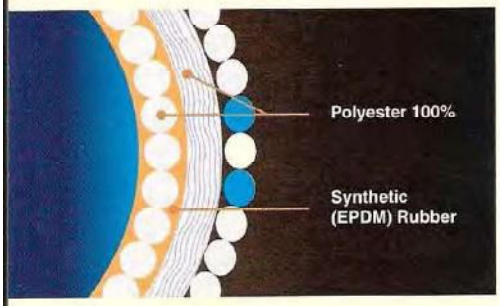
Special Quality Epdm Rubber As Internal Lining To Withstand Heat & Polluted Water

Unaffected By Fungus

Heat & Abrasion Resistant

High Burst Pressure, Yet Quite Flexible Facilitating Operation

Light In Weight, Yet Durable



"Premier Extra" Is Extra Strong And Abrasion Resistant, Having An External Coat Of Red Synthetic Elastomer, Providing Protection Against Moisture, Mildew, Fungus And Contact With Oils. Needs No Drying After Use.

Approvals :

Bureau Of Indian Standards

SPECIFICATION										
Diameter mm. Inches	25 1	38 1.1/2	45 1.3/4	50 2	63 2.1/2	70 2.3/4	76 3	102 4	127 5	152 6
Burst Pressure : kgf / cm^2 / bar psi (Min.)	50 725	50 725	50 725	50 725	50 725	50 725	50 725	42 600	36 525	36 525
Proof Pressure : Kgf / cm^2 / bar psi	30 435	30 435	30 435	30 435	30 435	30 435	30 435	25 360	20 290	20 290
Kink Test Pressure : kgf / cm^2 / bar psi	30 435	30 435	30 435	30 435	30 435	30 435	30 435	25 360	20 290	20 290
Working Pressure : kgf / cm^2 / bar psi	17 250	17 250	17 250	17 250	17 250	17 250	17 250	15 215	12 175	12 175
30m Length Coil Dia: cms.	45	45	45	45	45	45	50	50	55	55
Mass per meter: Gms. (Max.)	200	275	325	350	425	480	525	800	950	1100
Abrasion Resistance : Cycles (Min.) at 7 kgf / cm^2 Pressure	100	100	100	100	100	100	100	100	100	100
Heat Resistance : Sec. (Min.)	8	8	8	8	8	8	8	8	8	8

COLOURS

STANDARD : RED

OPTIONAL : GREEN
(Min. Quantity 3000 Mtrs.)

BLUE

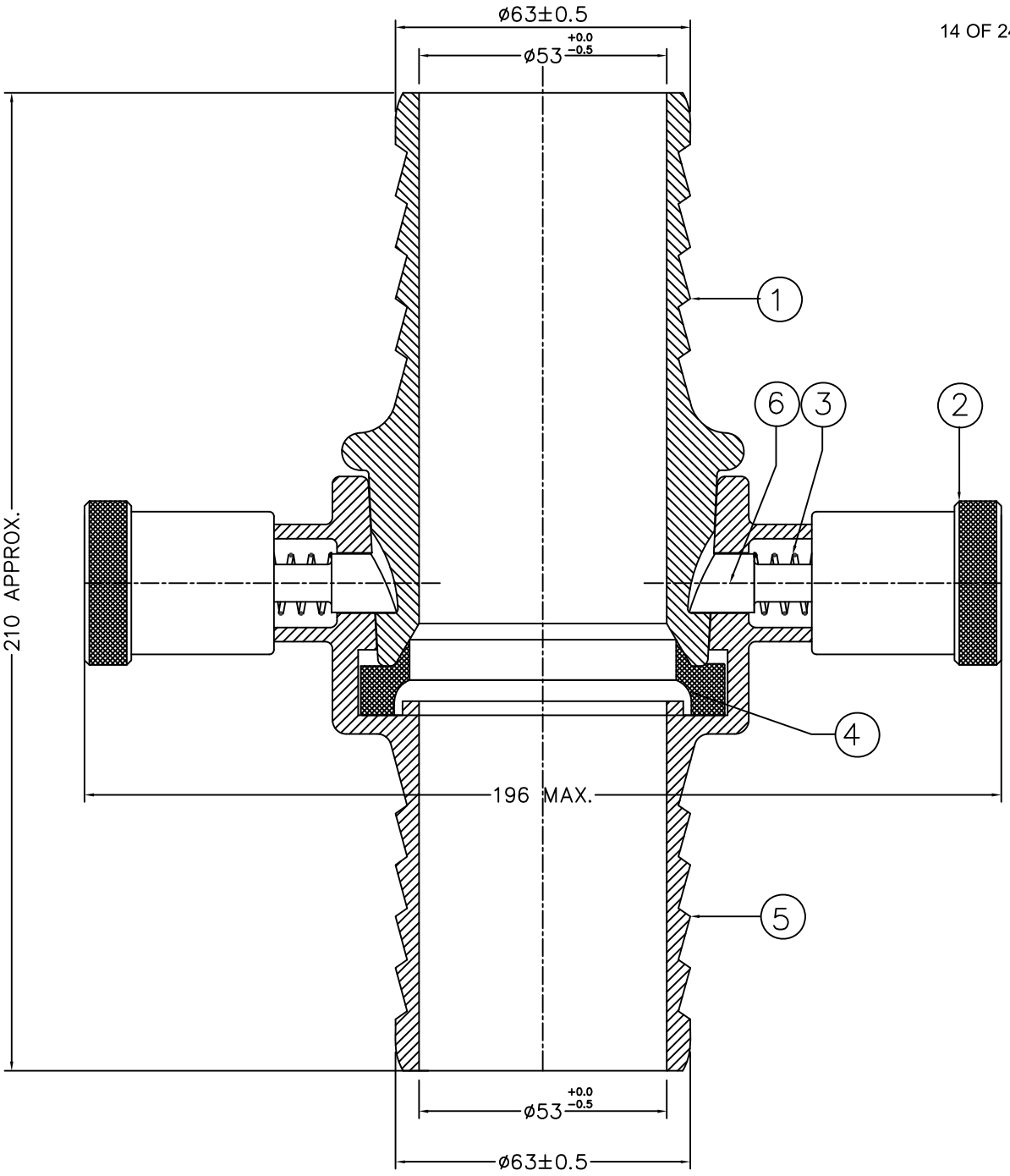
YELLOW

ORANGE

BLACK

NEWAGE FIRE PROTECTION INDUSTRIES PRIVATE LIMITED

HEAD OFFICE:
4, Champaklal Industrial Estate,
Sion (East), Mumbai – 400 022 (India)
Tel: 022 2407 721 / 4351 500
Fax: 022 2407 4229 / 2407 1320
Email: info@newagefireprotection.com
Web: www.newagefireprotection.com



NOTES–

ALL DIMENSIONS ARE IN mm. EXCEPT STATED.

COMPLETE ASSEMBLY TESTED TO HYDRAULIC PRESSURE OF 21 Kg/cm2 FOR A PERIOD OF 2.5 MINUTES SHALL NOT SHOWN ANY SIGN OF LEAKAGE.

ISI MARKED, IS:903

WORKING PRESSURE – 7 KG/CM2.

No.	NAME	MATERIAL SPECIFICATION
6	CAM TOOTH	S.S.–304, IS:3444, Gr.–1
5	FEMALE HALF COUPLING	S.S.–304, IS:3444, Gr.–1
4	WASHER	RUBBER IS:937,TYPE A
3	SPRING	SS–304, IS:6528
2	RELEASE LUG	S.S.–304, IS:3444, Gr.–1
1	MALE HALF COUPLING	S.S.–304, IS:3444, Gr.–1

NEWAGE FIRE PROTECTION INDUSTRIES PVT. LTD.

ADMINISTRATIVE OFFICE :
4, CHAMPAKLAL UDYOG BHAVAN, SION (EAST),
BOMBAY–400 022 (INDIA)

TITLE : DELIVERY HOSE COUPLING 63mm

DRG NO. : NFP–3882	SHEET:	SCALE	DRN.	A.S.G.	
CLIENT :		NTS	CHK.	RENOY	
SPECIFICATION : IS:903 : 1993		REV. 0	Dt.	13/12/11	

TECHNICAL DATA SHEET FOR FPS ITEMS

PROJECT : 1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD	**PACKAGE : FIRE PROTECTION SYSTEM**
MAIN CONTRACTOR : BHEL	
S	
DOC NO. - TB-DS-377-552-01	**REV.0** **PAGE : 76 OF 76**

Q. SOLENOID VALVE

1.0	MAKE	:	ROTEX
2.0	TYPE	:	2/2 NORMALLY CLOSED DIRECTLY ACTING SOLENOID VALVE
3.0	VALVE CODE	:	20126-4-4R-B5-M6+ 24V DC-16-CO-H
	DESIGN DATA	:	
4.0	END CONNECTION	:	1/2" NPT (F)
5.0	MEDIUM	:	WATER
6.0	MEDIUM TEMPERATURE	:	AMBIENT
7.0	OPERATING PRESSURE	:	0-10 BAR
8.0	ORIFICE	:	NW=4MM
9.0	FLOW FACTOR	:	KV=7 LIT/MIN
10.0	SOLENOID INSULATION	:	CLASS "H"
11.0	SOLENOID VOLTAGE	:	24V DC
12.0	SOLENOID ENCLOSURE	:	TERMINAL BOX IP67 SS ENCLOSURE
13.0	SOLENOID CODE	:	20126+24V DC-16-CO-H
14.0	MANUAL ACTUATOR	:	PUSH & TURN TYPE PROVIDED
15.0	POWER CONSUMPTION	:	13 W
16.0	AMBIENT TEMPERATURE	:	70^0C
	MATERIAL OF CONSTRUCTION	:	
17.0	SEAL MATERIAL	:	NBR
18.0	BODY MATERIAL	:	SS-316
19.0	TRIM MATERIAL	:	SS-316
20.0	QUANTITY	:	AS PER APPROVED DRAWING
21.0	INSPECTION/ACCEPTANCE	:	AS PER MANUFACTURERS TEST CERTIFICATE

TECHNICAL DATA SHEETS OF FIRE DETECTION ITEMS

INDEX

FPA-5000 With Functional Modules

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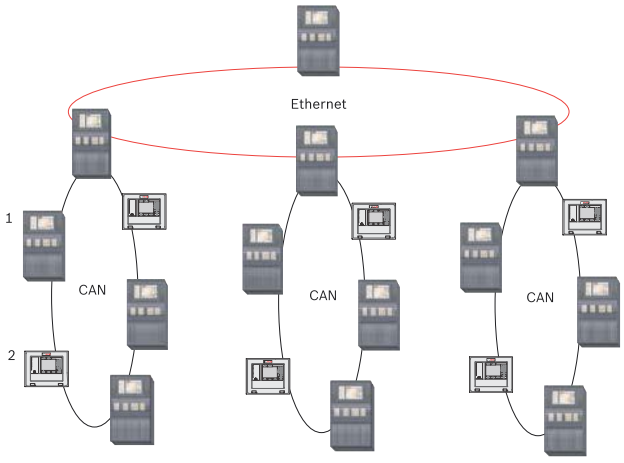
BOSCH
Invented for life

- Modular configuration allowing for easy extension
- Interconnection of up to 32 Panel Controllers, Remote Keypads, and OPC servers
- Multiple CAN loop connection with high-performance Ethernet backbone and redundancy
- Installation and auto-detection of functional modules by simply plugging them into the panel rail
- Connection to BIS Building Integration System via OPC server

Thanks to the modular configuration, the innovative FPA-5000 Modular Fire Panel easily adapts to local circumstances and regulations. Due to the different functional modules, country-specific characteristics are accommodated in the connection just as quickly as the respective alarm handling.
The fire panel is available with two different housings:

- Housing for mounting directly on the wall
- Frame installation housings which are fitted to the mounting frame and can be swiveled.

With the aid of special mounting kits, the housings can be mounted in 482.6 mm (19") cabinets. All housings can be extended with various additional housings for all conceivable applications.
The FMR-5000 Remote Keypad offers the decentralized operation of a control panel or control panel network. Thanks to the external CAN and Ethernet interfaces, several Panel Controllers and Remote Keypads can be interconnected. Using either a single-loop structure or multiple-loop structures with Ethernet backbone, the network can be adapted to nearly every application conditions.



CAN/Ethernet Network

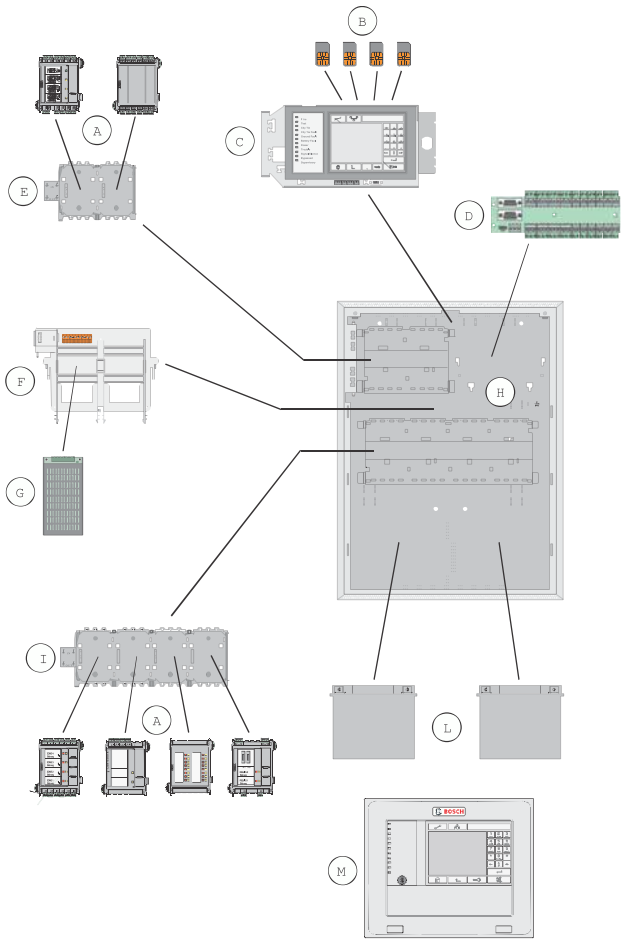
1 Fire panel

2 Remote Keypad

Additionally, the Ethernet interface allows for the connection to a Building Management System (BIS Bosch Building Integration System) via an OPC server. FPA-5000 systems can be connected to the Bosch UGM 2040 Universal Security System and thus, be integrated into a large network system.

The entire fire detection system is configured via a laptop using the FSP-5000-RPS programming software.

System overview



Pos.	Description
A	Functional Modules
B	Address Cards
C	Panel Controller
D	Distributor, optional
E	Panel Rail Short
F	Power Supply Bracket (installed in Frame Installation Housings ex-works)
G	Power Supply
H	Housing (in this case: HCP 0006 A)
I	Panel Rail Long
L	Batteries
M	Remote Keypad

Functions

Operation / processing of messages
The operation and the processing of all messages are easy and intuitive thanks to the ergonomically-designed control panel with its TFT touch-screen offering a menu-driven handling and multi-color display. To that end, there are permanently located keys on the right, bottom, and upper edge of the display as well as variably located virtual keys in the touch-screen area.

Modular Structure of the FPA-5000 Modular Fire Panel
Due to its modular structure, the FPA-5000 Modular Fire Panel provides complete flexibility and thus customized solutions for any application.
Depending on the requirements, the following selection can be made when planning:

1. Housing type: Frame installation or wall-mount
   - Selection of a basic housing
   - Optional Extension Housings
   - Optional Power Supply Housings
   - Optional kits for installation in 482.6 mm (19") racks
2. Operating and Display Unit with Panel Controller
   - Selection from the various language variants
3. Panel Rail
   - Selection according to housing type and/or number of required functional modules
4. Functional modules
   - Selection based on planning and country-specific requirements
5. Power supply
   - Batteries
   - Additional power supply facilities
   - Power Supply Brackets are preinstalled ex-works for Frame Installation Housings
   - For Wall-mount Housings, Power Supply Brackets are selected as needed
6. Additional accessories
   - Front Doors
   - Printer with Frame Installation Housing
   - Cable Sets for special applications

Modules
The functional modules are autonomous, encapsulated units that can be inserted into any control panel slot using "plug-and-play" technology. Thus, the power supply and the data traffic to the control panel are indicated automatically without any additional settings. The module is automatically identified by the control panel and functions in the default operating mode.
Wiring to external components is performed using compact connector/screw terminals.
After a replacement, only the connectors need to be reinserted; extensive rewiring is no longer required.

Module	Description
BCM-0000-B	Battery Controller Module • module that controls batteries and power supply
ANI 0016 A	Annunciator Module • with 16 red and 16 yellow LEDs, freely programmable
LSN 0300 A	LSN improved Module 300 mA • for the connection of an LSN loop with up to 254 LSN improved elements or 127 standard LSN elements, maximum line current 300 mA
LSN 1500 A	LSN improved Modul 1500 mA • for the connection of an LSN loop with up to 254 LSN improved elements, maximum line current 1500 mA, or with up to 127 standard LSN elements, maximum line current 300 mA
FPE-5000-UGM	Interface Module • for the connection to a UGM-2020 System
CZM 0004 A	4 Zone Conventional Module • for the connection of existing conventional peripherals, with four monitored conventional lines
IOS 0020 A	20 mA Communication Module • sports an S20 interface, an RS232 interface and an S1 interface • for a connection with a voice alarm system Plena via RS232
IOS 0232 A	RS232 Communication Module • with two RS323 interfaces • for a connection with a voice alarm system Plena, a printer or laptop
ENO 0000 B	Fire Service Interface Module • for the connection to fire service equipment according to DIN 14675
IOP 0008 A	Input/Output Module • with 8 digital inputs and 8 open collector outputs
RML 0008 A	Relay Module • with 8 relays for low voltage applications
RMH 0002 A	Relay Module • with 2 relays for mains power (250 V) and with feedback inputs (can also be used as an interface to extinguishing systems)
NZM 0002 A	Notification Appliance Zone Module • with two monitored primary lines

Networking

Up to 32 Panel Controllers, Remote Keypads and OPC server can be interconnected within a network. Depending on the application requirements, Panel Controllers and Remote Keypads can be grouped, defined as network node or local node. Within a group, only panel conditions of the same group can be displayed. Regardless of the groups, network nodes allow for the display and handling of all panel conditions. Local nodes display the conditions of the related panel.

When networking via CAN and/or Ethernet interfaces, the following connection topologies are optional:

- Redundant loop via CAN1 and CAN2 (max. 32 nodes)
- Ethernet loop (max. 32 nodes)
- Multiple CAN loops with Ethernet backbone and up to 32 nodes

For networking with optical fibers, you can use various converters. For detailed information on suitable converter types and maximum line lengths, refer to the FPA-5000 Networking Guide (available for download).

Detection Points

The Address Cards activate detection points. The FPA-5000 governs up to 4096 detection points.

Each element and input which, after the programming, is able to set off an alarm requires a detection point. Inputs are considered as detection points if they are programmed accordingly in the FSP-5000-RPS Programming Software.

This applies to all manual call points and automatic detectors as well as to the following modules and interfaces because of their inputs:

Modules	Detection Points
CZM 0004 A	up to 4
IOP 0008 A	up to 8
ENO 0000 B	requires a detection point only if a FSE release element is connected and programmed via the FSP-5000-RPS programming software
Interfaces	**Detection Points**
FLM-420/4-CON	up to 2
FLM-420-I8R1-S	up to 8
FLM-420-I2	up to 2
FLM-420-O8I2-S	up to 2
FLM-420-O1I1	up to 1
FLM-420-RLE-S	up to 2
FLM-420-EOL-2W-W	1 detection point for each interface

The following interfaces do not require the allocation of detection points: FLM-420-NAC, FLM-420-RHV, FLM-420-RLV1, FLM-420-RLV8, FLM-420-O2. Signaling devices and outputs have no detection points!

Certifications and approvals

The provided options according to EN 54-2:1997/A1:2006 include:

- Output to fire alarm devices
- Control of fire alarm routing equipment
  - Output to fire alarm routing equipment
  - Alarm confirmation input from fire alarm routing equipment

- Outputs to fire protection equipment
  - Output type A
  - Output type B
  - Output type C
  - Fault monitoring of fire protection equipment
- Delays to outputs
- Dependencies on more than one alarm signal
  - Type A dependency
  - Type B dependency
- Alarm counter
- Fault warning condition
  - Fault signals from points
  - Total loss of the power supply
  - Output to fault warning routing equipment
- Disabled condition
  - Disablement of adressable points
- Test condition

Region	Certification	
Europe	CE	FPA-5000
	CPD	0786-CPD-20818 FPA 5000
Germany	VdS-S	S205106 BS FPA
	VdS	G 205106 FPA-5000_G205106
	DIBt	Z-6.5-2027 (B) FSA 5000 LSN
	DIBt	Z-6.5-2027 (E) FSA 5000 LSN
Austria	PFB	007/BM-PSys/019/1 FPA-1200/5000 Brandmeldesystem
	PFB	007/BM-PSys/020/1 FPA-1200/5000 Brandfallsteuerzentrale
	PFB	007/BM-PSys/021 FPA-5000 Hierarchie
Belgium	BOSEC	TCC2-894/a FPA 1200_FPA 5000
Switzerland	VKF	AEAI 19197 FPA-1200_FPA-5000 Brandmeldesystem
Czech Republic	TZÚS	080-011414 FPA-5000
Denmark	DANAK	232.264 FPA 5000/1200 system certifikat EN54-13
Hungary	TMT	TMT-32/2005 FPA-5000
Singapore	PSB	022767 FPA-5000
Poland	CNBOP	2662/2008 FPA-5000
	CNBOP	0400/2008 FPA-5000
	MOE	UA1.016.0008784-11 FPA 5000
		4620/DT/2010 FPA-5000

Installation/configuration notes

- Country-specific standards and guidelines must be considered during planning.
- Connection conditions for the regional authorities and institutions (police, fire service) must be maintained.
- It is preferable to use the loop formation owing to the greater security of loop lines compared with stub lines.
- It is possible to combine LSN interface modules and LSN detectors on one loop or stub line.
- For a mixed connection of LSN classic elements and LSN improved elements, a maximum of 127 elements are permitted.
- Existing conventional detectors can be connected to a CZM 0004 A module. A CZM 0004 A module provides four DC primary lines (zones).
- In accordance with EN 54-2, control panels with more than 512 detectors / call points must be connected redundantly. To that end, a second basic housing with a second MPC Panel Controller is used.
- For operation of the fire detection system according to EN 54-13, it is necessary to terminate every stub and T-tap with EOL-modules.

General System Limits

	Max. number
Control Panels/Remote Keypads/OPC server in network	
• Redundant CAN loop	32
• Ethernet loop	32
• Multiple CAN loop with Ethernet backbone	32
• Bus topology	8
Detection points / detector zones	
• Stand-alone	4096
• In network	32512
• In network, per control panel	2032

Limits per Fire Panel

Sets, e.g. bypass group	128
Total number of modules, per control panel	46
Printer	4
Alarm counter (external, internal, revision)	3
Number of entries in the event database	10000
FSP-5000-RPS programming interface	1
Time control channel	20
Time control programs	19
Programming defined days	365
User	200
Access level	4

System Limits Functional Modules

Functional module	Max. number
BCM-0000-B	8
ANI 0016 A	32
LSN 0300 A	32
LSN 1500 A	11
FPE-5000-UGM	4
CZM 0004 A	32
IOS 0020 A	4
IOS 0232 A	4
ENO 0000 B	8
IOP 0008 A	32
RML 0008 A	32
RMH 0002 A	32
NZM 0002 A	8

System Limits for each LSN 0300 A Module

- Up to 254 LSN improved version elements or 127 classic LSN elements can be connected
- Output current
  - LSN 0300 A: up to 300 mA
  - LSN 1500 A: up to 1500 mA
- Cable length
  - LSN 0300 A: up to 1600 m
  - LSN 1500 A: up to 3000 m
- Unshielded cables can be used

Notice
Owing to the FSD (Fire System Designer) programming software, the planning of fire panels in compliance with the limits (e.g. concerning cable length and power supply) is quick and easy.

Installation Notes

- Fire panels can only be installed in dry, clean interior rooms.
- To ensure optimum battery service life, the control panel should only be operated at sites with normal room temperatures.
- The following environmental conditions must be noted:
  - Permissible ambient temperature: -5 °C – 50 °C
  - Permissible relative humidity: Max. 95 %, non-condensing
- Operating and display elements should be located at eye level.
- Frame installation housings require at least 230 mm free space on the right next to the last housing; this space is for swiveling out the attached housing for connection, maintenance, and service.
- Sufficient space should be left underneath and next to the control panel for any possible extensions, e.g. for an additional power supply or an extension housing.
- Do not operate devices showing condensation.
- Only use the mounting materials specified by BOSCH ST. Interference resistance cannot otherwise be guaranteed.
- If connected to a Building Management System (BIS Bosch Building Integration System) via the Ethernet and an OPC server, please verify with the responsible network administrator that in case of a network spanning multiple buildings
  - the network is designed for connections across multiple buildings (e.g. no interference by different potentials of the ground connection)
  - all users are assigned to the network.

Ordering information

BCM-0000-B Battery Controller Module
monitors the power supply of the fire panel and the charging of the batteries
Order number **BCM-0000-B**

ANI 0016 A Annunciator Module
displays the status of 16 individually programmable detection points
Order number **ANI 0016 A**

LSN 0300 A LSN improved Module 300 mA
for connecting an LSN loop with up to 254 LSN improved elements or 127 classic LSN elements, with a maximum line current of 300 mA
Order number **LSN 0300 A**

FLM-420-EOL2W-W EOL Module LSN
for EN 54-13 compliant termination of LSN stubs or T-taps
Order number **FLM-420-EOL2W-W**

LSN 1500 A LSN improved Module 1500 mA
for connecting an LSN loop with up to 254 LSN improved elements with a maximum line current of 1500 mA, or with up to 127 classic LSN elements, with a maximum line current of 300 mA
Order number **LSN 1500 A**

FLM-420-EOL2W-W EOL Module LSN
for EN 54-13 compliant termination of LSN stubs or T-taps
Order number **FLM-420-EOL2W-W**

FPE-5000-UGM Interface Module
for connecting the fire panels FPA-5000 and FPA-1200 to superordinate systems (UGM 2020, FAT 2002/RE, FSM-2000)
Order number **FPE-5000-UGM**

CZM 0004 A 4 Zone Conventional Module
for connecting conventional peripherals; provides four monitored conventional lines
Order number **CZM 0004 A**

FLM-320-EOL2W Conventional EOL Module 2-Wire
for EN 54-13 compliant termination of conventional lines
Order number **FLM-320-EOL2W**

IOS 0020 A 20 mA Communication Module
provides one interface each of S20, RS232 and S1
Order number **IOS 0020 A**

IOS 0232 A RS232 Communication Module
for connecting two devices, e.g. voice alarm system Plena, a laptop or a printer, via two independent serial interfaces
Order number **IOS 0232 A**

ENO 0000 B Fire Service Interface Module
for connecting fire service equipment in compliance with DIN 14675
Order number **ENO 0000 B**

CPA 0000 A Cable Set AT 2000
Used to connect an AT 2000 to the MPC and the ENO 0000 B.
Order number **CPA 0000 A**

IOP 0008 A Input/Output Module
for individual displays or flexible connection of various electrical devices, providing eight independent digital inputs and eight open collector outputs
Order number **IOP 0008 A**

RML 0008 A Relay Module
provides 8 change-over contact relays (type C) for low voltage
Order number **RML 0008 A**

RMH 0002 A Relay Module
provides 2 change-over contact relays (type C) for high voltage, for monitored connection of external elements with feedback
Order number **RMH 0002 A**

NZM 0002 A Notification Appliance Zone Module
for connecting 2 separate notification appliance zone lines, provides 2 monitored primary lines
Order number **NZM 0002 A**

NMC 0000 A Cable HPD/NZM
Used for synchronization in accordance with UL requirements, cable length 90 cm
Order number **NMC 0000 A**

Accessories

FLM-320-EOL2W Conventional EOL Module 2-Wire
for EN 54-13 compliant termination of conventional lines
Order number **FLM-320-EOL2W**

FLM-420-EOL2W-W EOL Module LSN
for EN 54-13 compliant termination of LSN stubs or T-taps
Order number **FLM-420-EOL2W-W**

FDP 0001 A Dummy Cover Plate
For available module slots
Order number **FDP 0001 A**

PSK 0001 A Labelling Strips, Wide
20 sheets each with 6 strips, printable,
for the functional modules BCM-0000-B, LSN 0300 A, LSN 1500 A, CZM 0004 A, NZM 0002 A, RMH 0002 A, CTM 0002 A and ENO 0000 B
Order number **PSK 0001 A**

PSL 0001 A Labelling Strips, Small
20 sheets each with 10 strips, printable, for the ANI I0016 A Annunciator Module
Order number **PSL 0001 A**

TECHNICAL DATA SHEET FOR MULTISENSOR DETECTOR			
Project:1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD		**PACKAGE:-**	
Client : BHEL		**FIRE PROTECTION & DETECTION SYSTEM**	
C			
BHEL DOC NO. :TB-DS-377-552-10		**REV**	**0**
1.0	Manufacturer	BOSCH	
2.0	Model No.	FAP-425-OT	
3.0	Operating Voltage	15 V DC to 33 V DC	
4.0	Current consumption	< 0.55 mA	
5.0	Dimensions		
5.1	With base	Ø 120 x 63.5 mm	
5.2	Without base	Ø 99.5 x 52 mm	
6.0	Weight		
6.1	With packaging	Approx. 115 g	
6.2	Without packaging	Approx. . 75 g	
7.0	Housing material	Plastic, ABS (Novodur)	
8.0	Housing colour	White, similar to RAL 9010,matt finish	
9.0	Detector Base Protection class	IP 44	
10.0	Permissible relative humidity	95% (non-condensing)	
11.0	Permissible air speed	20 m/s.	
12.0	Oprating tempreture	-20 °C to +50 °C	
13.0	Approval	Vds	
14.0	Quantity	As per approved drawing	
15.0	Inspection	ICL	

AVENAR detector 4000

www.boschsecurity.com

BOSCH
Invented for life

- Highly reliable and accurate thanks to Intelligent Signal Processing (ISP)
- Earliest detection of lightest smoke with dual-optical versions (Dual-Ray technology)
- Monitors environment for electromagnetic influence for fast root-cause analysis
- Automatic and manual addressing

AVENAR detector 4000 is a new range of automatic fire detectors featuring a superb accuracy and swiftness in detection. The versions with two optical sensors (dual-optical) are able to detect the lightest smoke. The range includes versions with rotaries, manually and automatically addressable, and versions without rotaries for automatic address setting.

Functions

Sensor technology and signal processing
The individual sensors can be configured manually, or timer-based via the LSN network.
All sensor signals are analysed continuously by the internal evaluation electronics (ISP - Intelligent Signal Processing) and are linked with each other via an inbuilt microprocessor. The link between the sensors means that the combined detectors can also be used where light smoke, steam or dust must be expected during the course of normal operation.
Only if the signal combination corresponds to the characteristics of the application site, selected during the programming, the alarm is triggered automatically. This results in less false alarms.
In addition, the time of the sensor signals on fire and fault detection is analysed, which leads to high detection reliability for each individual sensor.

In the case of the optical and chemical sensor, the response threshold (drift compensation) is actively adjusted. Manual or time-controlled switch-off of individual sensors is required for adjustment to extreme interference factors.

Optical sensor (smoke sensor)
The optical sensor uses the scattered-light method. An LED transmits light to the measuring chamber, where it is absorbed by the labyrinth structure. In the event of a fire, smoke enters the measuring chamber and the smoke particles scatter the light from the LED. The amount of light hitting the photo diode is converted into a proportional electrical signal.
The dual-optical versions use two optical sensors with different wavelengths. The Dual-Ray technology works with an infrared and a blue LED so that lightest smoke is detected fast and reliably (TF1 and TF9 detection).

Thermal sensor (temperature sensor)
A thermistor in a resistance network is used as a thermal sensor from which an analog-digital converter measures the temperature-dependent voltage at regular intervals.
Depending on the specified detector class, the temperature sensor triggers the alarm status when the maximum temperature of 54 °C or 69 °C is exceeded

(thermal maximum), or if the temperature rises by a defined amount within a specified time (thermal differential).

Chemical sensor (CO gas sensor)
The main function of the gas sensor is to detect carbon monoxide (CO) generated as a result of a fire, but it will also detect hydrogen (H) and nitrous monoxide (NO). The sensor signal value is proportional to the concentration of gas. The gas sensor delivers additional information to effectively suppress deceptive values.
Since the service life of the gas sensor is limited, the C sensor shuts down automatically after a maximum of 6 years of operation. The detector will then still operate as a multi-sensor detector with dual-optical and thermal sensor. It is recommended to exchange the detector immediately in order to keep the higher detection reliability of the version with C sensor.

Improved LSN features
AVENAR detector 4000 offers all the features of the improved LSN technology:
- Flexible network structures, including T-tapping without additional elements (no T-tapping feasible for versions without rotaries)
- Up to 254 LSN improved elements per loop or stub line
- Automatic or manual detector addressing, with or without auto-detection
- Power supply for connected elements via LSN bus
- Unshielded fire detection cable can be used
- Cable length up to 3000 m (with LSN 1500 A)
- Backwards compatibility to existing LSN systems and central units
- Monitoring of environmental electromagnetic impact for fast root-cause analysis (EMC values are displayed on the panel)

In addition, the range offers all the established benefits of LSN technology. The panel programming software can be used to change the detection characteristics of the respective room utilization. Each configured detector can provide the following data:
- Serial number
- Contamination level of the optical section
- Operating hours
- Current analog values
  - Optical system values: current measured value of the scattered light sensor; the measuring range is linear and shows different degrees of pollution, from slight to heavy.
  - Contamination: the contamination value shows how much the current contamination value has increased relative to the original condition.
  - CO value: display of the currently measured value (max. 550).

The sensor is self-monitoring. The following errors are indicated on the fire panel:
- Fault indication in the event of the failure of the detector electronics
- Continuous display of contamination level during service
- Fault indication if heavy contamination is detected (instead of triggering a false alarm)

In the event of wire interruption or short-circuit, integrated isolators maintain the functional security of the LSN loop.
In the event of an alarm, individual detector identification is transmitted to the fire panel.

Further characteristics
- A red flashing LED visible 360° indicates the alarm.
- Connection to a remote indicator is possible.
- The strain relief for cables in false ceilings prevents the cables from being unplugged accidentally from the terminals after installation. The terminals for cable cross-sections up to 2.5 mm^2 are very easily accessible.
- The detectors have a dust-repellent labyrinth and cap construction. The chamber maid plug (an opening with closing plug) on the bottom is used to clean the optical chamber with compressed air (not required for the heat detector).
- The detector bases no longer have to be directed due to the centralized position of the individual display. They also have a mechanical removal lock (can be activated and deactivated).

Certifications and approvals

Region	Certification	
Europe	CPR	0786-CPR-21402 FAH-425-T-R
	CPR	0786-CPR-21403 FAP-425-DO-R
	CPR	0786-CPR-21405 FAP-425-DOTC-R
	CPR	0786-CPR-21404 FAP-425-DOT-R
	CPR	0786-CPR-21398 FAP-425-O
	CPR	0786-CPR-21399 FAP-425-O-R
	CPR	0786-CPR-21400 FAP-425-OT
	CPR	0786-CPR-21401 FAP-425-OT-R
Germany	VdS	G214100 FAP-425-O
	VdS	G214099 FAP-425-O-R
	VdS	G214098 FAP-425-OT
	VdS	G214097 FAP-425-OT-R
	VdS	G214101 FAH-425-T-R
	VdS	G214104 FAP-425-DO-R
	VdS	G214103 FAP-425-DOT-R
	VdS	G214102 FAP-425-DOTC-R
Europe	CE	FAP-425

Installation/configuration notes

- Connectable to the fire panels FPA-5000 and FPA-1200 with the improved LSN system parameters
- You can use the DO detectors only with the Panel Controller MPC version B and higher. The Panel Controller MPC version A cannot be connected.

- In LSN classic mode connectable to the LSN fire panels BZ 500 LSN, UEZ 2000 LSN, UGM 2020 and to other panels or their receiver modules with identical connection conditions, although with the previous LSN system parameters
- During planning works, it is essential to adhere to national standards and guidelines.
- The detector can be painted (cap and base) and thereby adapted to the surrounding colour scheme. Note the information in the Painting Instructions.
- Detectors of the 420 series can be replaced by all versions of the AVENAR detector 4000 without re-configuring the panel.

Installation/configuration notes in accordance with VdS/VDE

- The FAP-425-DOTC-R, FAP-425-DOT-R, FAP-425-OT-R, and FAP-425-OT versions are planned in accordance with the guidelines for optical detectors if operated as optical detectors or as combined optical/thermal detectors (see DIN VDE 0833 Part 2 and VDS 2095)
- If occasional deactivation of the optical unit (scattered light sensor) is required, planning must be based on the guidelines for heat detectors (see DIN VDE 0833 Part 2 and VDS 2095)
- When planning fire barriers according to DIBt, note that the heat detector (FAH-425-T-R) must be configured in accordance with class A1R.

Parts included

Detector version	Qty.	Components
FAP-425-O-R	1	Optical smoke detector with rotaries
FAP-425-OT-R	1	Multisensor detector optical / thermal with rotaries
FAH-425-T-R	1	Heat detector (thermal differential / thermal maximum) with rotaries
FAP-425-DO-R	1	Dual-optical smoke detector with rotaries
FAP-425-DOT-R	1	Multisensor detector dual-optical / thermal with rotaries
FAP-425-DOTC-R	1	Multisensor detector dual-optical / thermal / chemical with rotaries
FAP-425-O	1	Optical smoke detector without rotaries
FAP-425-OT	1	Multisensor detector optical / thermal without rotaries

Technical specifications

Electrical

Operating voltage	15 V DC to 33 V DC
Current consumption	< 0.55 mA
Alarm output	Per data word by two-wire signal line
Indicator output	Open collector connects 0 V over 1.5 kΩ through, max. 15 mA

Mechanics

Dimensions	
• Without base	Ø 99.5 x 52 mm
• With base	Ø 120 x 63.5 mm
Housing	
• Material	Plastic, ABS (Novodur)
• Color	White, similar to RAL 9010, matt finish
Weight	Without / With packaging
• FAP-425-DOTC-R	Approx. 85 g / Approx. 130 g
• FAP-425-DO-R, FAP-425-DOT-R	Approx. 80 g / Approx. 120 g
• FAP-O-425-R / FAP-425-OT-R / FAH-425-T-R	Approx. 80 g / Approx. 120 g
• FAP-425-O / FAP-425-OT	Approx. . 75 g / Approx. 115 g

Environmental conditions

Permissible operating temperature	
• FAP-425-DOTC-R	-10 °C to +50 °C
• FAP-425-DOT-R / FAP-425-OT-R / FAH-425-T-R / FAP-425-OT	-20 °C to +50 °C
• FAP-425-DO-R / FAP-425-O-R / FAP-425-O	-20 °C to +65 °C
Permissible storage temperature	
• FAP-425-DOTC-R	-20 °C to +50 °C
• All versions (except for FAP-425-DOTC-R)	-25 °C to +80 °C
Permissible relative humidity	95% (non-condensing)
Permissible air speed	20 m/s.
Protection class as per EN 60529	IP 40, IP 43 detector base with damp room seal

Further characteristics

Response sensitivity	
• Optical part	In accordance with EN54-7 (programmable)

• Thermal maximum part	> 54 °C / >69 °C
• Thermal differential part: • FAH-425-T-R	A2S / A2R / A1 / A1R / BS / BR, in line with EN 54-5 (programmable)
• Thermal differential part: • FAP-425-DOTC-R / FAP-425-DOT-R / FAP-425-OT-R / FAP-425-OT	A2S / A2R / BS / BR, in line with EN 54-5 (programmable)
• Gas sensor	In ppm range
Individual display	LED red
Color code	
• FAP-425-O-R / FAP-425-O	No marking
• FAP-425-OT-R / FAP-425-OT	Black loop
• FAH-425-T-R	Red loop
• FAP-425-DO-R	2 gray concentric loops
• FAP-425-DOT-R	2 black concentric loops
• FAP-425-DOTC-R	2 yellow concentric loops

Planning
Heed local guidelines. They overrule the following limits.

Monitoring area	
• All versions (except for FAH-425-R)	Max. 120 m^2
• FAH-425-T-R	Max. 40 m^2
Maximum installation height	
• All versions (except for FAH-425-R)	Max. 16 m
• FAH-425-T-R	Max. 7.5 m

Ordering information

AVENAR detector 4000 Optical Detector
Analog addressable detector with one optical sensor, manually and automatically addressable.
Order number **FAP-425-O-R**

AVENAR detector 4000 Optical/Thermal Detector
Analog addressable detector with one optical and one thermal sensor, manually and automatically addressable.
Order number **FAP-425-OT-R**

AVENAR detector 4000 Heat Detector
Analog addressable heat detector with one thermal sensor, manually and automatically addressable.
Order number **FAH-425-T-R**

AVENAR detector 4000 Dual-Optical Detector
Analog addressable detector with two optical sensors, manually and automatically addressable.
Order number **FAP-425-DO-R**

AVENAR detector 4000 Dual-Optical/Thermal Detector
Analog addressable detector with two optical sensors and one thermal sensor, manually and automatically addressable.
Order number **FAP-425-DOT-R**

AVENAR detector 4000 Dual-Optical/Thermal/Chemical Detector
Analog addressable detector with two optical sensors, one thermal and one chemical sensor, manually and automatically addressable.
Order number **FAP-425-DOTC-R**

AVENAR detector 4000 Optical Detector, without rotaries
Analog addressable detector with one optical sensor, automatic address setting.
Order number **FAP-425-O**

AVENAR detector 4000 Optical/Thermal Detector, without rotaries
Analog addressable detector with one optical and one thermal sensor, automatic address setting.
Order number **FAP-425-OT**

TECHNICAL DATA SHEET FOR HEATCRITERIA DETECTOR			
Project:1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD		**Package:**	
Client : BHEL		**FIRE PROTECTION & DETECTION SYSTEM**	
C			
BHEL DOC NO. :TB-DS-377-552-10		**REV**	**0**
1.0	Make	BOSCH	
2.0	Model No.	FAH-425-T-R	
3.0	Type	AVENAR detector 4000 heat detector	
4.0	Approvals	CPR, VdS, CE (Approved under VDS as per approved Design basis for fire protection and detection system). [R1]	
5.0	Heat	the temperature sensor triggers the alarm status when the maximum temperature of 540 C or 690 C is exceeded (thermal maximum) ,or if the temperature rises by a defined amount within a specified time (thermal differential)	
6.0	Sensitivity level	Selectable 16 level of Sensitivity through Programming Software.	
7.0	Voltage range	15 V DC to 33 V DC from FDA panel	
8.0	Current rating	<0.55 mA	
9.0	Allowable air velocity	20 m/s (Shall comply up to 600 feet /minute) [R1]	
10.0	Sensitivity adjustment range	Selectable 16 level of sensitivity according to the applicable area.	
11.0	Temperature range	Detectors has max alarm temperature of 69 deg. C and as per EN 54, detectors can operate at 60 deg.C. [R1]	
12.0	Humidity range	0% - 95% ,Non condensing	
13.0	Fixed Temperature	540 C or 690 C, Selected through Programming Software.	
14.0	Rate of Rise	Available	
15.0	Built In Alarm indication	A Red flashing LED visible 360 deg. Indicates the alarm. [R1]	
16.0	Plug In Type detector	Yes. [R1]	
17.0	Number of terminals on detector on mounting base.	[R1]	
18.0	IP class (Ingress protection)	Degree of protection shall be as per EN 60529 i.e IP 40 [R1]	
19.0	Response indicators provided for smoke detectors prov	Yes, Provided. [R1]	
20.0	Number of terminals	7 Numbers [R1]	
21.0	Catalogue enclosed	Yes. [R1]	

AVENAR detector 4000

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Invented for life

- Highly reliable and accurate thanks to Intelligent Signal Processing (ISP)
- Earliest detection of lightest smoke with dual-optical versions (Dual-Ray technology)
- Monitors environment for electromagnetic influence for fast root-cause analysis
- Automatic and manual addressing

AVENAR detector 4000 is a new range of automatic fire detectors featuring a superb accuracy and swiftness in detection. The versions with two optical sensors (dual-optical) are able to detect the lightest smoke. The range includes versions with rotaries, manually and automatically addressable, and versions without rotaries for automatic address setting.

Functions

Sensor technology and signal processing
The individual sensors can be configured manually, or timer-based via the LSN network.
All sensor signals are analysed continuously by the internal evaluation electronics (ISP - Intelligent Signal Processing) and are linked with each other via an inbuilt microprocessor. The link between the sensors means that the combined detectors can also be used where light smoke, steam or dust must be expected during the course of normal operation.
Only if the signal combination corresponds to the characteristics of the application site, selected during the programming, the alarm is triggered automatically. This results in less false alarms.
In addition, the time of the sensor signals on fire and fault detection is analysed, which leads to high detection reliability for each individual sensor.

In the case of the optical and chemical sensor, the response threshold (drift compensation) is actively adjusted. Manual or time-controlled switch-off of individual sensors is required for adjustment to extreme interference factors.

Optical sensor (smoke sensor)
The optical sensor uses the scattered-light method. An LED transmits light to the measuring chamber, where it is absorbed by the labyrinth structure. In the event of a fire, smoke enters the measuring chamber and the smoke particles scatter the light from the LED. The amount of light hitting the photo diode is converted into a proportional electrical signal.
The dual-optical versions use two optical sensors with different wavelengths. The Dual-Ray technology works with an infrared and a blue LED so that lightest smoke is detected fast and reliably (TF1 and TF9 detection).

Thermal sensor (temperature sensor)
A thermistor in a resistance network is used as a thermal sensor from which an analog-digital converter measures the temperature-dependent voltage at regular intervals.
Depending on the specified detector class, the temperature sensor triggers the alarm status when the maximum temperature of 54 °C or 69 °C is exceeded

(thermal maximum), or if the temperature rises by a defined amount within a specified time (thermal differential).

Chemical sensor (CO gas sensor)
The main function of the gas sensor is to detect carbon monoxide (CO) generated as a result of a fire, but it will also detect hydrogen (H) and nitrous monoxide (NO). The sensor signal value is proportional to the concentration of gas. The gas sensor delivers additional information to effectively suppress deceptive values.
Since the service life of the gas sensor is limited, the C sensor shuts down automatically after a maximum of 6 years of operation. The detector will then still operate as a multi-sensor detector with dual-optical and thermal sensor. It is recommended to exchange the detector immediately in order to keep the higher detection reliability of the version with C sensor.

Improved LSN features
AVENAR detector 4000 offers all the features of the improved LSN technology:
- Flexible network structures, including T-tapping without additional elements (no T-tapping feasible for versions without rotaries)
- Up to 254 LSN improved elements per loop or stub line
- Automatic or manual detector addressing, with or without auto-detection
- Power supply for connected elements via LSN bus
- Unshielded fire detection cable can be used
- Cable length up to 3000 m (with LSN 1500 A)
- Backwards compatibility to existing LSN systems and central units
- Monitoring of environmental electromagnetic impact for fast root-cause analysis (EMC values are displayed on the panel)

In addition, the range offers all the established benefits of LSN technology. The panel programming software can be used to change the detection characteristics of the respective room utilization. Each configured detector can provide the following data:
- Serial number
- Contamination level of the optical section
- Operating hours
- Current analog values
  - Optical system values: current measured value of the scattered light sensor; the measuring range is linear and shows different degrees of pollution, from slight to heavy.
  - Contamination: the contamination value shows how much the current contamination value has increased relative to the original condition.
  - CO value: display of the currently measured value (max. 550).

The sensor is self-monitoring. The following errors are indicated on the fire panel:
- Fault indication in the event of the failure of the detector electronics
- Continuous display of contamination level during service
- Fault indication if heavy contamination is detected (instead of triggering a false alarm)

In the event of wire interruption or short-circuit, integrated isolators maintain the functional security of the LSN loop.
In the event of an alarm, individual detector identification is transmitted to the fire panel.

Further characteristics
- A red flashing LED visible 360° indicates the alarm.
- Connection to a remote indicator is possible.
- The strain relief for cables in false ceilings prevents the cables from being unplugged accidentally from the terminals after installation. The terminals for cable cross-sections up to 2.5 mm^2 are very easily accessible.
- The detectors have a dust-repellent labyrinth and cap construction. The chamber maid plug (an opening with closing plug) on the bottom is used to clean the optical chamber with compressed air (not required for the heat detector).
- The detector bases no longer have to be directed due to the centralized position of the individual display. They also have a mechanical removal lock (can be activated and deactivated).

Certifications and approvals

Region	Certification	
Europe	CPR	0786-CPR-21402 FAH-425-T-R
	CPR	0786-CPR-21403 FAP-425-DO-R
	CPR	0786-CPR-21405 FAP-425-DOTC-R
	CPR	0786-CPR-21404 FAP-425-DOT-R
	CPR	0786-CPR-21398 FAP-425-O
	CPR	0786-CPR-21399 FAP-425-O-R
	CPR	0786-CPR-21400 FAP-425-OT
	CPR	0786-CPR-21401 FAP-425-OT-R
Germany	VdS	G214100 FAP-425-O
	VdS	G214099 FAP-425-O-R
	VdS	G214098 FAP-425-OT
	VdS	G214097 FAP-425-OT-R
	VdS	G214101 FAH-425-T-R
	VdS	G214104 FAP-425-DO-R
	VdS	G214103 FAP-425-DOT-R
	VdS	G214102 FAP-425-DOTC-R
Europe	CE	FAP-425

Installation/configuration notes

- Connectable to the fire panels FPA-5000 and FPA-1200 with the improved LSN system parameters
- You can use the DO detectors only with the Panel Controller MPC version B and higher. The Panel Controller MPC version A cannot be connected.

- In LSN classic mode connectable to the LSN fire panels BZ 500 LSN, UEZ 2000 LSN, UGM 2020 and to other panels or their receiver modules with identical connection conditions, although with the previous LSN system parameters
- During planning works, it is essential to adhere to national standards and guidelines.
- The detector can be painted (cap and base) and thereby adapted to the surrounding colour scheme. Note the information in the Painting Instructions.
- Detectors of the 420 series can be replaced by all versions of the AVENAR detector 4000 without re-configuring the panel.

Installation/configuration notes in accordance with VdS/VDE

- The FAP-425-DOTC-R, FAP-425-DOT-R, FAP-425-OT-R, and FAP-425-OT versions are planned in accordance with the guidelines for optical detectors if operated as optical detectors or as combined optical/thermal detectors (see DIN VDE 0833 Part 2 and VDS 2095)
- If occasional deactivation of the optical unit (scattered light sensor) is required, planning must be based on the guidelines for heat detectors (see DIN VDE 0833 Part 2 and VDS 2095)
- When planning fire barriers according to DIBt, note that the heat detector (FAH-425-T-R) must be configured in accordance with class A1R.

Parts included

Detector version	Qty.	Components
FAP-425-O-R	1	Optical smoke detector with rotaries
FAP-425-OT-R	1	Multisensor detector optical / thermal with rotaries
FAH-425-T-R	1	Heat detector (thermal differential / thermal maximum) with rotaries
FAP-425-DO-R	1	Dual-optical smoke detector with rotaries
FAP-425-DOT-R	1	Multisensor detector dual-optical / thermal with rotaries
FAP-425-DOTC-R	1	Multisensor detector dual-optical / thermal / chemical with rotaries
FAP-425-O	1	Optical smoke detector without rotaries
FAP-425-OT	1	Multisensor detector optical / thermal without rotaries

Technical specifications

Electrical

Operating voltage	15 V DC to 33 V DC
Current consumption	< 0.55 mA
Alarm output	Per data word by two-wire signal line
Indicator output	Open collector connects 0 V over 1.5 kΩ through, max. 15 mA

Mechanics

Dimensions	
• Without base	Ø 99.5 x 52 mm
• With base	Ø 120 x 63.5 mm
Housing	
• Material	Plastic, ABS (Novodur)
• Color	White, similar to RAL 9010, matt finish
Weight	Without / With packaging
• FAP-425-DOTC-R	Approx. 85 g / Approx. 130 g
• FAP-425-DO-R, FAP-425-DOT-R	Approx. 80 g / Approx. 120 g
• FAP-O-425-R / FAP-425-OT-R / FAH-425-T-R	Approx. 80 g / Approx. 120 g
• FAP-425-O / FAP-425-OT	Approx. . 75 g / Approx. 115 g

Environmental conditions

Permissible operating temperature	
• FAP-425-DOTC-R	-10 °C to +50 °C
• FAP-425-DOT-R / FAP-425-OT-R / FAH-425-T-R / FAP-425-OT	-20 °C to +50 °C
• FAP-425-DO-R / FAP-425-O-R / FAP-425-O	-20 °C to +65 °C
Permissible storage temperature	
• FAP-425-DOTC-R	-20 °C to +50 °C
• All versions (except for FAP-425-DOTC-R)	-25 °C to +80 °C
Permissible relative humidity	95% (non-condensing)
Permissible air speed	20 m/s.
Protection class as per EN 60529	IP 40, IP 43 detector base with damp room seal

Further characteristics

Response sensitivity	
• Optical part	In accordance with EN54-7 (programmable)

• Thermal maximum part	> 54 °C / >69 °C
• Thermal differential part: • FAH-425-T-R	A2S / A2R / A1 / A1R / BS / BR, in line with EN 54-5 (programmable)
• Thermal differential part: • FAP-425-DOTC-R / FAP-425-DOT-R / FAP-425-OT-R / FAP-425-OT	A2S / A2R / BS / BR, in line with EN 54-5 (programmable)
• Gas sensor	In ppm range
Individual display	LED red
Color code	
• FAP-425-O-R / FAP-425-O	No marking
• FAP-425-OT-R / FAP-425-OT	Black loop
• FAH-425-T-R	Red loop
• FAP-425-DO-R	2 gray concentric loops
• FAP-425-DOT-R	2 black concentric loops
• FAP-425-DOTC-R	2 yellow concentric loops

Planning
Heed local guidelines. They overrule the following limits.

Monitoring area	
• All versions (except for FAH-425-R)	Max. 120 m^2
• FAH-425-T-R	Max. 40 m^2
Maximum installation height	
• All versions (except for FAH-425-R)	Max. 16 m
• FAH-425-T-R	Max. 7.5 m

Ordering information

AVENAR detector 4000 Optical Detector
Analog addressable detector with one optical sensor, manually and automatically addressable.
Order number **FAP-425-O-R**

AVENAR detector 4000 Optical/Thermal Detector
Analog addressable detector with one optical and one thermal sensor, manually and automatically addressable.
Order number **FAP-425-OT-R**

AVENAR detector 4000 Heat Detector
Analog addressable heat detector with one thermal sensor, manually and automatically addressable.
Order number **FAH-425-T-R**

AVENAR detector 4000 Dual-Optical Detector
Analog addressable detector with two optical sensors, manually and automatically addressable.
Order number **FAP-425-DO-R**

AVENAR detector 4000 Dual-Optical/Thermal Detector
Analog addressable detector with two optical sensors and one thermal sensor, manually and automatically addressable.
Order number **FAP-425-DOT-R**

AVENAR detector 4000 Dual-Optical/Thermal/Chemical Detector
Analog addressable detector with two optical sensors, one thermal and one chemical sensor, manually and automatically addressable.
Order number **FAP-425-DOTC-R**

AVENAR detector 4000 Optical Detector, without rotaries
Analog addressable detector with one optical sensor, automatic address setting.
Order number **FAP-425-O**

AVENAR detector 4000 Optical/Thermal Detector, without rotaries
Analog addressable detector with one optical and one thermal sensor, automatic address setting.
Order number **FAP-425-OT**

TECHNICAL DATA SHEET FOR MANUAL CALL POINT				
Project::1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD			**Package:**	
Client : BHEL			**FIRE PROTECTION & DETECTION SYSTEM**	
C				
BHEL DOC NO. :TB-DS-377-552-10			**REV**	**0**
1.0	Manufacturer	:	BOSCH	
2.0	Model No.	:	FMC-210-DM-G-R	
3.0	Dimension	:	135 x 135 x 40 (W x H x D)mm	
4.0	Operating Voltage	:	24 (15 to 33) VDC	
5.0	current consumption	:	0.4 mA	
6.0	Housing colour	:	Red, RAL 3001	
7.0	Housing material	:	Plastic ASA	
8.0	Application	:	Control room/ Cable spreader room	
9.0	Protection Class	:	IP 52	
10.0	Weight	:	Approx. 235g	
11.0	Approval	:	VDS, no. G210095	
12.0	Catalouge	:	Attached	
13.0	Quantity	:	As per approved Drawings	
14.0	Inspection	:	ICL	

FMC-210-DM Double Action Call Points

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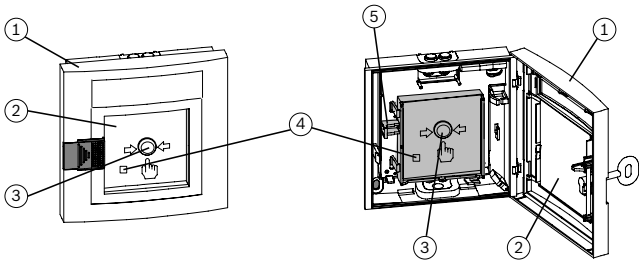
- Adjustment after alarm triggering
- Individual identification thanks to automatic or manual detector addressing
- Indicator LED for alarm or for inspection evaluation
- Query routines with evaluation and multiple transmission
- Maintains LSN loop functions in the event of wire interruption or short-circuit thanks to two integrated isolators

The FMC-210-DM Double-action Call Points are used for manual triggering, and can be used in the Local SecurityNetwork LSN and LSN improved. Form H Manual Call Points are designed for outdoor deployment, form G Manual Call Points are designed for indoor deployment.

Functions



In the event of an alarm, the glass pane (2) is broken first, then the manual call point (3) is pressed hard. This activates the microswitch for alarm triggering and the indicator LED (4) blinks. A mechanism holds the pressed call point down.
The manual call point can be reset with the reset lever (5) or by closing the door of the manual call point (1). The indicator LED (4) goes out.

This does not reset the alarm on the fire panel. Individual call point identification with display of the call point address on the fire panel ensures the quick location of the triggered call point.

Variants
The designs of the manual call points for outdoor and indoor use are identical. The manual call points for indoor use (form G) are available in red, blue, yellow, and green. The manual call points for outdoor use (form H) are available in red and blue.
Form H manual call points are equipped with an especially resistant PC board layered with parylene.

Notice
The key must be ordered separately.

Improved LSN features
The manual call points offer all the features of the improved LSN technology:
- Flexible network structures, including T-tapping without additional elements
- Up to 254 LSN improved elements per loop or stub line
- Automatic or manual detector addressing selectable via rotary switch, in each case with or without auto-detection

- Shielded and unshielded cables can be used
- Cable length up to 3000 m (with LSN 1500 A module)
- Downwards compatibility to existing LSN systems and control panels

Certifications and approvals

Type Number	Complies with
FMC-210-DM-G-R	EN 54-11:2001/A1:2005, EN 54-17:2005
FMC-210-DM-H-R	EN 54-11:2001/A1:2005, EN 54-17:2005
FMC-210-DM-G-Y	EN 12094-3:2003, EN 54-17:2005
FMC-210-EST-G-B	EN 12094-3:2003, EN 54-17:2005

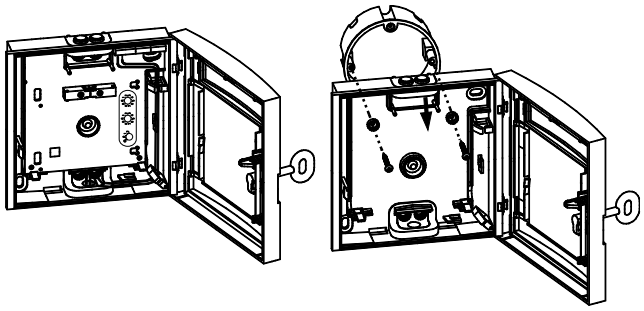
Region	Certification	
Germany	VdS	G 206100 FMC-210_EST-G-B_G206100
	VdS	G 206098 FMC-210_DM-G-R/-H-R_G206098
	VdS	G 206099 FMC-210_DM-G-Y_G206099
Europe	CE	FMC-210-DM-G-B/-H-B/-SM-G-B
	CE	FMC-210_DM-G-R/-H-R/-SM-G-R
	CE	FMC-210-DM-G-Y / EST-G-B
	CPD	0786-CPD-20293 FMC-210-DM-G/H-R
	CPD	0786-CPD-20244 FMC-210-DM-G-Y
	CPD	0786-CPD-20245 FMC-210-EST-G-B
Poland	CNBOP	1505/2013 FMC-210 DM-G-R, FMC-210 DM-H-R
Ukraine	MOE	UA1.016.0070338-11 FMC-210-DM-G-R_FMC-210-DM-H-R_FMC-210-DM-G-R-A
Slovakia	EVPÚ	SK08-ZSV-0071 FMC-210-DM, FMC-210-EST

Installation/configuration notes

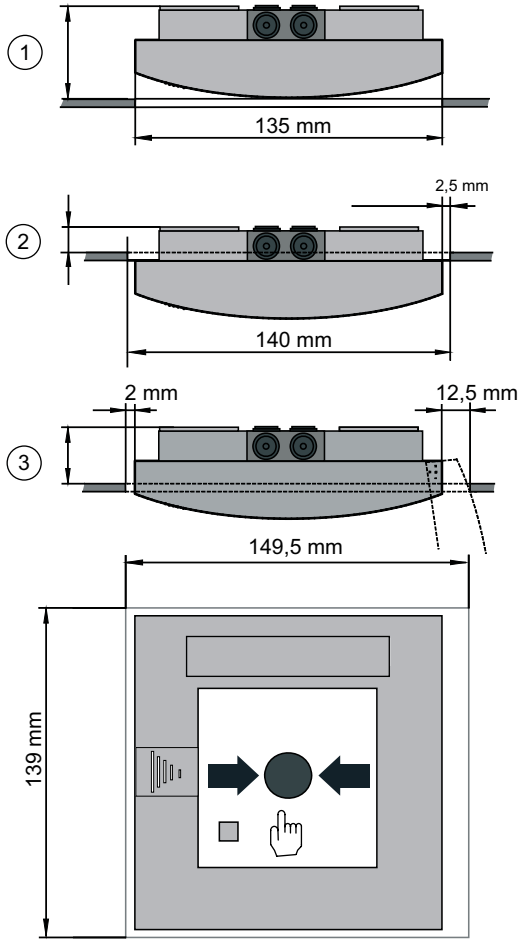
- The device must be mounted visibly along escape and rescue routes (e.g. exits, passageways, stairwells) and be easily accessible.
- An installation height of 1400 mm ±200 mm, measured from the middle of the device to the floor, must be maintained.
- The device must be adequately illuminated by sunlight or another light source (including emergency lighting if present).
- The maximum number of LSN elements that may be connected depends on their current consumption from the LSN data line. The limit values should be taken from the product information supplied with the fire panel used.
- Additional norms, guidelines, and planning recommendations with respect to installation location, etc. must be taken into account (see fire detector manual).
- The regulations of the local fire services must be observed.

Installation

- The cable duct can be surface-mounted or flush-mounted.



- Installation in fire hose cabinets is possible in three ways:



	Installation depth
1	ca. 40 mm
2	14 mm
3	min. 30 mm

Technical specifications

Electrical

Operating voltage (VDC)	24 (15 to 33)
Current consumption (mA)	0.4

Mechanics

Dimensions W x H x D (mm)	135 x 135 x 40
Housing material	Plastic ASA
Colors	Red RAL 3001 Blue RAL 5005 Yellow RAL 1003 Green close to RAL 6002
Weight (g)	Approx. 235

Environmental

Degree of protection (EN 60529) Form H	IP 54
Degree of protection (EN 60529) Form G	IP 52
FMC-210-DM-G-R	EN 54-11
FMC-210-DM-H-R	EN 54-11
FMC-210-DM-G-Y	EN 12094-3
FMC-210-EST-G-B	EN 12094-3
Operating temperature Form H (°C)	-25 to 70
Operating temperature Form G (°C)	-10 to 55

Ordering information

Manual call point indoor, red
Analog addressable manual call point with glass pane for indoor use, indirect alarm triggering (type B), red
Order number **FMC-210-DM-G-R**

Manual call point outdoor, red
Analog addressable manual call point with glass pane for outdoor use, indirect alarm triggering (type B), red
Order number **FMC-210-DM-H-R**

Manual call point indoor, blue
Analog addressable manual call point with glass pane for indoor use, indirect alarm triggering (type B), blue
Order number **FMC-210-DM-G-B**

Manual call point outdoor, blue
Analog addressable manual call point with glass pane for outdoor use, indirect alarm triggering (type B), blue
Order number **FMC-210-DM-H-B**

Manual call point indoor, yellow
Analog addressable manual call point with glass pane for indoor use, indirect alarm triggering (type B), yellow
Order number **FMC-210-DM-G-Y**

Manual call point indoor, green
Analog addressable manual call point with glass pane for indoor use, indirect alarm triggering (type B), green
Order number **FMC-210-DM-G-GR**

FMC-210-EST-G-B Stop dev. Indoor, blue
Analog addressable electronic stop device with glass pane for indoor use, indirect alarm triggering (type B), blue
Order number **FMC-210-EST-G-B**

Accessories

FMX-FSO-LSN foilset operating panel MCP
For the labeling field of manual call points of the series FMC-210, 1 unit = 10 sheets
Order number **FMX-FSO-LSN**

Foil set, transparent
For yellow and blue manual call points of the series FMC-120 and FMC-210, 1 unit = 5 sheets
Order number **FMC-FST-DE**

Spare glass
For manual call points of series DM, DKM, SKM, FMC-120 and FMC-210, 1 unit = 5 spare glasses
Order number **FMC-SPGL-DEIL**

Key for Fire Detectors Types G and H
made of red plastic (ASA)
Order number **FMM-KEY-Form G/H**

FMC-210-DM Double Action Call Points

	Manual call point indoor, red	Manual call point outdoor, red	Manual call point indoor, blue
			
Range of use	indoor	outdoor	indoor
Mounting	surface-mounted/flush-mounted	surface-mounted/flush-mounted	surface-mounted/flush-mounted
Operating voltage (VDC)	24 (15 to 33)	24 (15 to 33)	24 (15 to 33)
Current consumption (mA)	0.4	0.4	0.4
Protection category	IP 52	IP 54	IP 52
Permissible operating temperature (°C)	-10 to 55	-25 to 70	-10 to 55
Color	red RAL 3001	red RAL 3001	blue RAL 5005

	Manual call point outdoor, blue	Manual call point indoor, yellow	Manual call point indoor, green
			
Range of use	outdoor	indoor	indoor
Mounting	surface-mounted/flush-mounted	surface-mounted/flush-mounted	surface-mounted/flush-mounted
Operating voltage (VDC)	24 (15 to 33)	24 (15 to 33)	24 (15 to 33)
Current consumption (mA)	0.4	0.4	0.4
Protection category	IP 54	IP 52	IP 52
Permissible operating temperature (°C)	-25 to 70	-10 to 55	-10 to 55
Color	blue RAL 5005	yellow RAL 1003	green close to RAL 6002

	FMC-210-EST-G-B Stop dev. Indoor, blue
	
Range of use	indoor
Mounting	surface-mounted/flush-mounted
Operating voltage (VDC)	24 (15 to 33)
Current consumption (mA)	0.4
Protection category	IP 52

	FMC-210-EST-G-B Stop dev. Indoor, blue
Permissible operating temperature (°C)	-10 to 55
Color	blue RAL 5005

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1288927243 | en, V17, 30. May 2017

TECHNICAL DATA SHEET FOR INPUT/OUTPUT MODULE			
PROJECT:1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD		**Package:**	
		FIRE PROTECTION & DETECTION SYSTEM	
CLIENT : BHEL			
C			
BHEL DOC NO. :TB-DS-377-552-10		**REV**	**0**
1.0	Manufacturer	BOSCH	
2.0	Model No	FLM[8]420[8]I8R1[8]S	
3.0	Dimension	140 x 200 x 48 (W x H x D)mm	
4.0	LSN input Voltage	15V-33V DC	
5.0	Contact monitoring: Max. current consumption	8 mA	
6.0	Max. current consumption from LSN	5.5 mA	
7.0	Connection	Screw terminals	
8.0	Rel. humidity (%), non-condensing	< 96 %	
9.0	Ambient temperature	- 20° to +65°C	
10.0	housing material	ABS+PC-FR	
11.0	housing Colour	RAL 9003	
12.0	Protection class	IP 54	
13.0	Approval	VDS	
14.0	Quantity	As per approved Drawings	
15.0	Inspection	ICL	
16.0	VDS Approval	G210133	
17.0	CE- Certificate	0786-CPD-21011	

FLM-420-I8R1-S Octo-input Interface Module with Relay

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BOSCH
Invented for life

- Individually selectable monitoring functions (EOL or contact) for the eight inputs each
- Maximum switching capacity 2 A / 30 V DC or 0.5 A / 42.4 V AC
- Maintains LSN loop functions in the event of wire interruption or short-circuit thanks to two integrated isolators
- Easy wiring thanks to pluggable terminal blocks

The FLM-420-I8R1-S Octo-input Interface Module with Relay allows the monitoring of up to eight inputs. Additionally, it features a change-over contact relay for providing a potential-free output contact.
It is a 2-wire LSN element. When connected to the fire panels FPA-5000 and FPA-1200, the interface module offers the enhanced functionality of LSN improved technology.

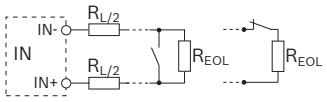
Functions

Monitoring functions of the inputs
The FLM-420-I8R1-S Octo-input Interface Module provides two monitoring functions:
1. Monitoring of a line by an EOL resistor
2. Monitoring of a potential-free contact

The monitoring functions of the eight inputs can be selected individually by setting the corresponding addresses.

Line monitoring with EOL resistor
The monitoring with EOL resistor can be activated individually for each of the inputs. The EOL resistor has a standard resistance of 3.9 kΩ.
The interface module detects

- Standby
- Triggering in the event of a short circuit
- Triggering in the event of line interruption.

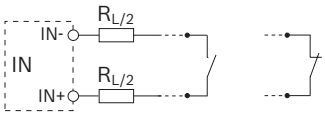


Position	Description
R_{Σ}	Overall line resistance with $R_{\Sigma} = R_{L/2} + R_{L/2} + R_{EOL}$
$R_{L/2}$	Line resistance

The following line conditions will be reliably detected if the overall line resistance is within the specified range:

Line condition	Overall line resistance R_{Σ}
Standby	1500 Ω to 6000 Ω
Short circuit	< 800 Ω
Interruption	> 12 000 Ω

Contact monitoring



The interface module evaluates the operating conditions "open" or "closed". The normal operating condition can be programmed for each input. Contact monitoring has a pulse intensity of 8 mA.

Change-over contact relay

The maximum contact load (resistive load) is 2 A / 30 V DC or 0.5 A / 42.4 V AC.

Address switches

The addresses of the interface modules are set by rotary switches.
In case of a connection to the fire panels FPA-5000 and FPA-1200 (improved version LSN mode), the operator can select automatic or manual addressing with or without auto-detection. In LSN mode classic, connection to the fire panels BZ 500 LSN, UEZ 2000 LSN and UGM 2020 is possible.

Address (A)	Operating mode
0 0 0	Loop/stub in LSN improved version mode with automatic addressing (T-taps not possible)
0 0 1 - 2 5 4	Loop/stub/T-taps in LSN improved version mode with manual addressing
CL 0 0	Loop/stub in LSN classic mode

LSN features

Integrated isolators ensure that function is maintained in the event of a short circuit or line interruption in the LSN loop. A fault indication is sent to the fire panel.

Features of LSN improved version

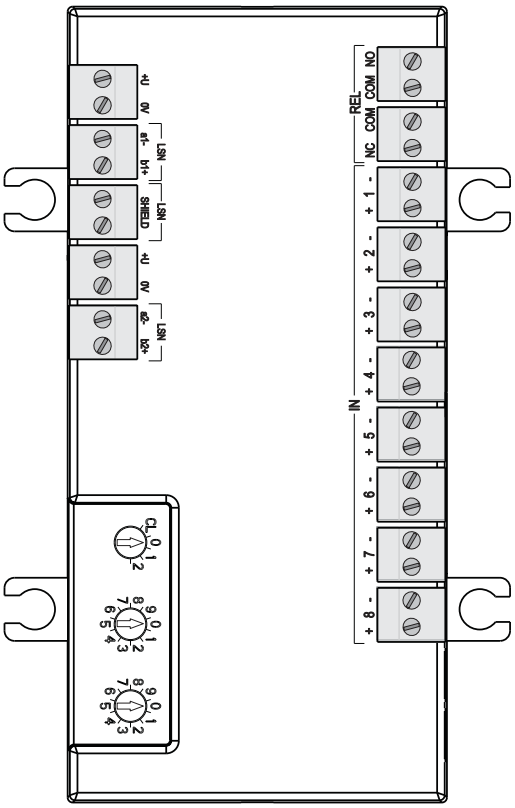
The product have the following features of the improved LSN technology:

- Flexible network structures including T-tapping without additional elements
- Up to 254 LSN improved elements per loop or stub line
- Downwards compatible with existing LSN systems and control panels.

Certifications and approvals

Region	Certification	
Germany	VdS	G 208184 FLM-420-I8R1-S
Europe	CE	FLM-420-I8R1-S
	CPD	0786-CPD-20560 FLM-420-I8R1-S
Ukraine	MOE	UA1.016.0070265-11 FLM-420-I8R1-S

Installation/configuration notes



Description		Connection
	+U | 0V	Auxiliary power supply (support points to loop through)
LSN	a1- | b1+	LSN incoming
LSN	SHIELD	Cable shielding
	+U | 0V	Auxiliary power supply (support points to loop through)
LSN	a2- | b2+	LSN outgoing
IN	1 ... 8: + | -	Input 1 to input 8
REL	NC | COM | COM | NO	Change-over relay (NC contact / COM, COM / NO contact

- Can be connected to the fire panels FPA-5000 and FPA-1200 and the classic LSN control panels BZ 500 LSN, UEZ 2000 LSN and UGM 2020.
- Programming is done with the programming software of the fire panel.
- The LSN connection is established by the two wires of the LSN line.
- The activation of the inputs IN 1...8 has to be carried out electrically isolated from LSN (e. g. with relay contact, pushbutton, etc.).
- The inputs must have a minimum activation time of 3.2 s.

- The maximum cable length of all inputs connected to the loop or stub is 500 m in total. Additionally, all outputs which are not electrically isolated from LSN must be included in the total line length calculation (e.g. peripherals connected via C points). With UEZ 2000 LSN and UGM 2020, the limitation to 500 m applies to each Network Processing Converter (NVU).
- The interface module has terminals blocks to allow a second pair of wires to be looped through to an auxiliary power supply.
- The cables are fed through rubber bushings or PG cable glands.
- The pluggable terminal blocks allow for an easy wiring even if he interface module is built in.
- Use included spacers when mounting on uneven surface.
- For a fire system operation according to EN 54-2, the interface modules used for the activation of fire protection equipment and whose outputs are not monitored, must be installed directly next to or within the device which shall be activated.
- In order to comply with EN50130-4:2011, shielded cable is required for the installation. The shielded cable needs to be applied for:
  - all loops and stubs which are equipped with one or more modules.
  - all inputs which are connected on the module

  The cable shield wire for the LSN cable has to be connected properly according LSN specifications.

Parts included

Type	Qty.	Component
FLM-420-I8R1-S	1	Octo-input Interface Module with Relay, in housing for surface mounting

Technical specifications

Electrical

LSN input voltage (V DC)	15 ... 33
Max. current consumption from LSN (mA)	5.5
Inputs, independent	8
Line monitoring: EOL resistor, nominal (kΩ) Detected line conditions (Ω) with overall line resistance $R_{\Sigma} = R_{L/1} + R_{L/2} + R_{EOL}$	3.9 Standby: 1500 ... 6000 Interruption: > 12000 Short circuit: < 800
Contact monitoring: Max. current consumption (mA)	8
Min. activation time of the inputs IN 1...8 (s)	3.2
Change-over relay, low voltage	NC / COM, COM / NO
Contact load: Max. switching capacity (A / V DC; A / V AC) Min. switching capacity (mA / mV DC; mA / mV AC) Max. frequency (Hz)	2 / 30; 0.5 / 42.4 0.01 / 10; 0.01 / 10 100

Mechanical

Connections	Screw terminals
Rotary switches, number	3
Weight, without/with packing (g)	480 / 800
Dimensions W x H x D (mm)	140 x 200 x 48
Wire gauge (mm^2)	0.6...3.3
Housing material, housing color (RAL)	ABS+PC-FR, RAL 9003
Environmental	
Operating temperature (°C)	-20 ...+65
Storage temperature (°C)	-25 ...+80
Rel. humidity (%), non-condensing	< 96 %
Class of equipment (IEC 60950)	III
Degree of protection (IEC 60529)	IP 54
System limits	
Max. cable length, not electrically isolated from LSN in total (m)	500

Ordering information

FLM-420-I8R1-S Octo-input Interface Module with Relay
2-wire LSN element, allows the monitoring of up to eight inputs, with a change-over contact relay for providing a potential-free output contact, in housing for surface mounting
Order number **FLM-420-I8R1-S**

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1298183563 | en, V6, 01. Mar 2016

TECHNICAL DATASHEET FOR ELECTRONIC HOOTER			
PROJECT:1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD		**Package:**	
		FIRE PROTECTION & DETECTION SYSTEM	
CLIENT : BHEL			
C			
BHEL DOC NO:TB-DS-377-552-10		**REV**	**0**
1.0	Manufacturer	BOSCH	
2.0	Model No	FNM-420-A	
3.0	Operating Voltage	15 V DC to 33 V DC	
4.0	Power consumption	1 mA @ 24 VDC (volume low) 3,9 mA @ 24 VDC (volume high)	
5.0	Volume	101.3 dB(A)/m @ 24VDC	
6.0	Possible tones	DIN 1200-500 Hz at1 Hz, off 10ms Slow Whoop 1200-500 Hz at1 Hz, off 10ms Continuous tone 970 Hz (pulse can be set) Sweden-Tone (150 ms on/ 150 ms off)	
7.0	Protection Class as per EN 60529	IP 42 *	
8.0	Ambient temperature	-25 °C to +70 °C	
9.0	Dimensions	105 x 105 x 95 mm	
10.0	Case colour	red, similar to RAL 3001 white, similar to RAL 9010	
11.0	Case material	Plastic, ABS	
12.0	Weight	Without packaging - 250 g With packageing - 300 g	
13.0	Approval	VDS	
14.0	Quantity	As per approved Drawings	
15.0	Inspection	ICL	

FNM-420-A Sounder Indoor

www.boschsecurity.com

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Invented for life

- Volume of up to 101.3 dB(A)
- Maximum current consumption of less than 3.9 mA
- Up to 100 sounders per LSN loop
- Immediate synchronization
- 32 different tone types can be selected (incl. DIN tone)

The indoor sounders are used independently for signaling an alarm directly at the fire location.

Functions

The device allows to select 32 types of alarm and evacuation tones (including DIN tone 33404, part 3) for different requirements.
You can adjust the sound pressure by five levels according to the operational environment. Depending on the tone type and volume set, the sound pressure varies between 65 dB(A) and 101.3dB(A).
Sounders of the same LSN loop and with the same tone type provide immediate synchronization. The device maintains LSN loop functions in the event of wire interruption or short-circuit thanks to two integrated isolators.
Change of the device settings can be done in the FSP-5000-RPS programming software.

Certifications and approvals

Complies with
- EN 54-3:2001
- EN 54-17:2005

Region	Certification	
Europe	CE	FNM-420-A-WH, FNM-420-A-RD
	CPD	0832-CPD-1006 FNM-420-A-RD_FNM-420-A-WH
Germany	VdS	G 210002 FNM-420-A-WH/-RD
Poland	CNBOP	0912/2011 FNM-420-A-RD -B-RD -A-WH
	MOE	UA1.016.0113309-11 FNM-420-A-WH_FNM-420-A-RD

Installation/configuration notes

- The device is intended for indoor use.
- The current consumption depends on the tone type selected and is maximum 3.9 mA.
- The maximum number of devices on each loop depends on the cable diameter and the total current of the loop.
  Use the Fire System Designer for reliable loop planning.
- This device cannot be used with the FPA-5000 type A panel controller.

Tone types

No.	Tone type	Frequency / modulation	Volume dB(A)	EN 54-3 ** dB(A)
1*	Sweeping tone = DIN tone	1200-500 Hz at 1 Hz, off 10ms	99.0	93.9
2	Sweeping tone	2400-2900 Hz at 50 Hz	98.7	
3	Sweeping tone	2400-2900 Hz at 7 Hz	99.6	
4	Sweeping tone	800/1000 Hz at 7 Hz	99.0	
5	Intermittent tone	1000 Hz at 1 Hz	101.2	
6	Intermittent tone	1000 Hz / 0.25 s on, 1 s off	100.5	
7	Alternating tone	800/1000 Hz at 1 Hz	101.3	
8	Continuous tone	970 Hz	99.1	94.7
9	Alternating tone	800/1000 Hz at 2 Hz	101.0	
10	Intermittent tone	970 Hz / 0,5 s on/off, 3 tones per 4 cycles	99.0	94.0
11	Intermittent tone	2900 Hz / 0,5 s on/off	100.1	
12	Intermittent tone	1000 Hz / 0,5 s on/off	101.2	
13	Sweeping tone	800/1000 Hz at 1 Hz	100.3	
14	Alternating tone	510 Hz/ 610 Hz / 0,5 s on/off	97.8	
15	BMW tone	800 Hz / 60 s on, 10 s off, 3 cycles	95.0	
16	Intermittent tone	2900 Hz at 1 Hz	99.2	
17	Alternating tone	2400/2900 Hz at 2 Hz	99.4	
18	Sweeping tone	2400-2900 Hz at 1 Hz	101.2	
19	Sweeping tone	1400-2000 Hz at 10 Hz	97.3	
20	Sweeping tone	500-1200 Hz / 0.5 s	98.5	
21	Continuous tone	2900 Hz	98.1	
22	Sweeping tone	800/1000 Hz at 50 Hz	99.8	
23	Alternating tone	554 Hz/100 ms + 440 Hz/400 ms	95.7	
24	Slow Whoop	500-1200 Hz in 3,5 s, off 0,5 s	100.1	96.0
25	Intermittent tone	2900 Hz / 150 ms on, 100 ms off	99.6	
26	Continuous tone	660 Hz	97.6	
27	Intermittent tone	660 Hz; 1,8 s on/off	97.6	
28	Intermittent tone	660 Hz / 150 ms on/off	96.4	
29	USA temporal 3 tone ISO 8201	610 Hz	97.7	
30	US Temporal Pattern LF	950 Hz / 0,5 s on/off x 3 then 1,5 s off	95.8	
31	3. Hi/Lo	1000/800 Hz (0,25 s on/ alternate)	100.7	
32	Thyssen Krupp tone	450/650 Hz at 2 Hz	96.5	

* Default setting: tone in line with DIN 33404, part 3
** Results from EN54-3 testing: lowest value at 15 V at maximum volume level, measured on the measurement axis with the highest results. All other measurements are taken ‘on axis’ and are not third party verified. Sound pressure level specified with a tolerance of ±3 dB(A). Constant sound pressure level between 22 V and 33 V operating voltage.

Parts included

Qty.	Components
1	Sounder Indoor
1	Key to open the housing

Technical specifications

Electrical

Operating voltage	15 V DC to 33 V DC
Current consumption	
• Quiescent state	< 1 mA
• Alarm	< 3,9 mA

Mechanics

Connections (inputs/outputs)	0,28 mm² to 2,5 mm²
Dimensions (H x W x D)	105 x 105 x 95 mm
Housing	
• Material	Plastic, ABS
• Color	red, similar to RAL 3001 white, similar to RAL 9010
Weight	
• Without packaging	250 g
• With packageing	300 g

Environmental conditions

Permissible operating temperature	-25 °C to +70 °C
Permissible storage temperature	-25 °C to +85 °C
Protection class as per EN 60529	IP 42 *

* Manufacturer's declaration, not third party approved

Special features

Sound pressure level at a distance of 1 m	max. 101.3 dB(A)
Frequency range	440 Hz up to 2,90 kHz

Ordering information

FNM-420-A-WH Sounder Indoor, white
for signaling an alarm directly at the fire location, for LSN improved technology
Order number **FNM-420-A-WH**

FNM-420-A-RD Sounder Indoor, red
for signaling an alarm directly at the fire location, for LSN improved technology
Order number **FNM-420-A-RD**

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1300804875 | en, V4, 04. Dec 2012

TECHNICAL DATA SHEET FOR MEDIA CONVERTER			
PROJECT:1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD		**PACKAGE:-**	
		FIRE PROTECTION & DETECTION SYSTEM	
CLIENT : BHEL			
C			
BHEL DOC NO. :TB-DS-377-552-10		**REV**	**0**
1.0	Manufacturer	BOSCH	
2.0	Model No.	EL1141-10B-BH	
3.0	Dimension	50 x 110 x 135 (W x H x D)mm	
4.0	Operating Voltage	20 to 30 V DC (terminal block)	
5.0	Overload current protection	present	
6.0	Oprating tempreture	-40 °C to +75 °C	
7.0	Rel. humidity (%), non-condensing	5% to 95%	
8.0	Housing material	Aluminium case	
9.0	Installation	DIN rail (top hat type 35mm),panel, rack mounting	
10.0	Ethernet port	10/100BASE-TX: 1 port100BASE-FX: 1 port	
11.0	Protection class	IP 30	
12.0	Approval	VDS	
13.0	Quantity	As per approved Drawings	
14.0	Inspection	ICL	
15.0	VDS Approval	G210133	
16.0	CE- Certificate	0786-CPD-21011	

Media Converter

www.boschsecurity.com

BOSCH
Invented for life

- DIP switch configuration for "Link-Fault-Pass-Through", link down alarm, speed, duplex mode
- 768K bits buffer memory
- Full wire-speed forwarding rate
- Alarms for power and port link failure by relay output
- Redundant power inputs with Terminal Block and DC Jack

The Ethernet Fibre Optics Converter is used for electric utility automation and accept 10/100 Mbps-Full/Half-duplex, Auto-Negotiation, Auto-MDI/MDIX. The Converter complies with the standard of IEC61850-3, IEEE1613 and EN50121-4.

Functions

Network size – length of cable

Multimode fibre (MM) 50/125 µm	0 - 2000 m, 15 dB Link Budget with 1300 nm, A = 1 dB/km, 13 dB Reserve, B = 800 MHz x km
Multimode fibre (MM) 62.5/125 µm	0 - 2000 m, 15 dB Link Budget with 1300 nm, A = 1 dB/km, 13 dB Reserve, B = 500 MHz x km
Singlemode fibre (SM) 9/125 µm	0 – 40 km, 30 dB Link Budget with 1300 nm, A = 0.4 dB/km, 14 dB Reserve, D = 3.5 ps/(nm x km)

Safety
- UL508

EMI
- FCC Part 15, Class A
  - EN61000-6-4
  - EN55022
  - EN61000-3-2
  - EN61000-3-3

EMS
- IEC61850-3 & IEEE1613: Substation & Power automation Applications
- EN50121-4: Railway Applications
- EN61000-6-2
  - EN61000-4-2 (ESD Standards)
    Contact: + / - 8KV; Criteria B
    Air: + / - 15KV; Criteria B
  - EN61000-4-3 (Radiated RFI Standards)
    35V/m, 80 to 1000MHz; 80% AM Criteria A
  - EN61000-4-4 (Burst Standards)
    Signal Ports: + / - 4KV; Criteria A
    D.C. Power Ports: + / - 4KV; Criteria A
  - EN61000-4-5 (Surge Standards)
    Signal Ports: + / - 2KV; Line-to-Line; Criteria A
    D.C. Power Ports: + / - 2KV; Line-to-earth; Criteria A
  - EN61000-4-6 (Induced RFI Standards)
    Signal Ports: 10Vrms @ 0.15~80MHz; 80% AM Criteria A
    D.C. Power Ports: 10Vrms @ 0.15~80MHz; 80% AM Criteria A
  - EN61000-4-8 (Magnetic Field Standards)
    1000A/m @ 50, 60Hz; Criteria A

Environmental Test Compliance
- IEC60068-2-6 Fc (Vibration Resistance)
  5g @ 10~150KHz, Amplitude 0.35mm (Operation/ Storage/Transport)
- IEC60068-2-27 Ea (Shock)

25g @ 11ms (Half-Sine Shock Pulse; Operation)
50g @ 11ms (Half-Sine Shock Pulse; Storage/ Transport)
- IEC60068-2-32 Ed (Free Fall)
1M (3.281ft.)

Technical specifications

Electrical

Operating voltage	20 to 30 V DC (terminal block)
Power consumption	2.4W MAX. 0.2A@12VDC, 0.05A @ 48VDC
Overload current protection	Present
Reverse polary protection	Present

Mechanics

Material	Aluminium case, IP30
Dimensions	50 x 110 x 135 mm (1.97 x 4.33 x 5.31 inches)
Weight	0.8Kg (1.76lbs.)
Installation	DIN rail (top hat type 35mm), panel, rack mounting

Environmental conditions

Permissible operating temperature	-40°C to 75°C (-40°F to 167°F)
Permissible storage temperature	-40°C to 85°C (-40°F to 185°F)
Ambient relative humidity	5% to 95% (non-condensing)

Interface

Ethernet port	10/100BASE-TX: 1 port 100BASE-FX: 1 port
LED indicators	
• Per unit	Power status (Power 1, Power 2, Fault), link-fault-pass-through
• Per port	10/100TX: Link Activity, full-duplex/collision, speed 100FX: Link/Activity, full-duplex/collision
Relay contact	Relay contact rating with current 1A@30VDC, 0.5A@120VAC
Fibre connector type	SC

Technology

Standards	• IEEE802.3 10BASE-T • IEEE802.3u 100BASE-FX, IEEE802.3x
Forward and filtering rate	• 14,80pps for 10Mbps • 148,810pps for 100Mbps
• Packet buffer memory	768K bits
• Processing type	• Store-and-forward • Half-duplex back-pressure and IEEE802.3x full-duplex flow control

Ordering information

Media Converter MM
Order number **EL1141-10B-BH**

Media Converter SM
Order number **EL1141-B0B-BH**

TECHNICAL DATA SHEET FOR DETECTOR BASE (HEAT DETECTOR AND MULTISENSOR DETECTOR)			
PROJECT:1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD		**Package:**	
		FIRE PROTECTION & DETECTION SYSTEM	
CLIENT : BHEL			
C			
BHEL DOC NO. :TB-DS-377-552-10		**REV**	**0**
1.0	Manufacturer	BOSCH	
2.0	Model No.	MS 400 B	
3.0	Dimension	Ø 120 x 22.7 mm	
4.0	Connection	Power supply (0 V, +V) LSN (a1/a2, b1, b2) C-point Shielding	
5.0	Housing material	Aluminium case	
6.0	Housing colour	Similar to RAL 9010	
7.0	Approval	VDS	
8.0	Quantity	As per approved Drawings	
9.0	Inspection	ICL	
10.0	VDS Approval	G210133	
11.0	CE- Certificate	0786-CPD-21011	

MS 400 Detector Bases

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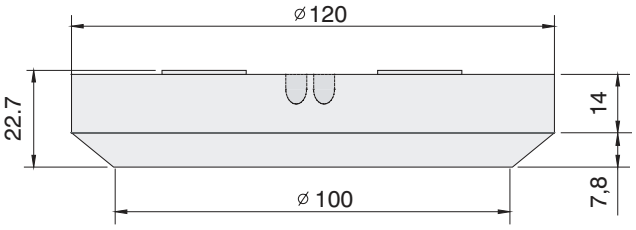
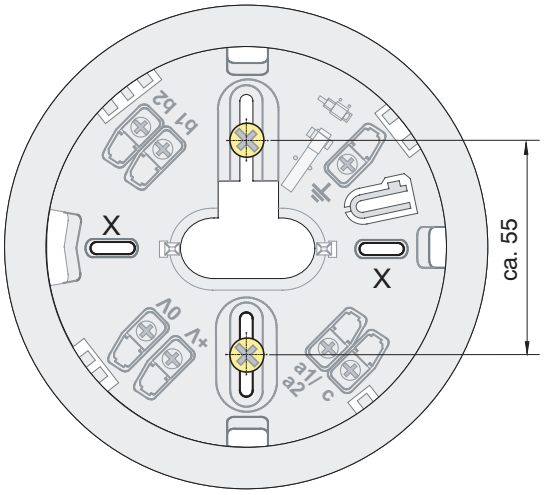
BOSCH
Invented for life

The detector head is installed in the Detector Base MS 400.
The base is suitable for surface-mounted cable feeds as well as for flush-mounted cable feeds, and has separate attachment points for ceiling mount/flush-mounted back boxes. In addition, it fits all standard bore patterns.
The Detector Base made of white ABS plastic (Novodur, color similar to RAL 9010) has a matt finish and seven terminal screws to connect the detector and its features to the fire panel.
Contacts connected to the terminals guarantee a secure electric connection when the detector module is installed. Cables up to 2.5 mm² in diameter can be used.
To protect against unauthorized removal, the detector head can be secured with a variable locking.





Installation/Configuration Notes

Installation information for 400/420 Series Detector Bases

- The drill holes marked with an "X" may only be used to mount the base to flush-mounted back boxes.
- Keep shielded auxiliary wire as short as possible, and make sure this is insulated.

Technical Specifications

Connections	Power supply (0 V, +V) LSN (a1/a2, b1, b2) C-point Shielding
Housing material	ABS (Novodur)
Housing color	Similar to RAL 9010
Dimensions	Ø 120 x 22.7 mm
Weight	72 g

Ordering Information

Order number **MS 400 B**

MS 400 Detector Base
Non-branded detector base for surface-mounted and flush-mounted cable feed
Order number **MS 400**

Accessories

FAA-420-SEAL Damp Room Seal
1 package = 10 pieces
Order number **FAA-420-SEAL**

Represented by:

1259851147 | en, V1, 29. Mar 2012

TECHANICAL DATASHEET FOR RESPONSE INDICATOR					
PROJECT:-PROJECT:1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD			**PACKAGE:-**		
CLIENT : BHEL			**FIRE DETECTION AND PROTECTION SYSTEM**		
C					
BHEL DOC NO. :TB-DS-377-552-10				**REV**	**0**
1.0	Make	:	BOSCH		
2.0	Model No.	:	FAA-420-RI		
3.0	Mounting	:	Suitable for wall / ceiling mounting		
4.0	Current consumption	:	3 mA		
5.0	Permissible wire gauge	:	0.45 mm – 1.4 mm		
6.0	Dimensions	:	85 x 85 x 29 mm		
7.0	Weight	:	45 g		
7.1	Operating temperature	:	-20 °C to +65 °C		
7.2	Permissible relative humidity	:	< 95% (non-condensing)		
	Protection class	:	IP 40		
	Approval	:	VDS		
	quantity	:	As per approved Drawings		
	inspection	:	ICL		
	VDS Approval	:	G210133		
8.0	CE- Certificate	:	0786-CPD-21011		

FAA-420-RI-ROW Remote Indicator

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BOSCH
Invented for life

- 360° view, for both wall mount and ceiling mount
- Easy cabling thanks to cable ties bracket and all direction knock-out holes
- Long life and robust construction housing
- Efficient LED

The remote indicator is used when the automatic detector is installed in a place hidden or not visible, like in closed rooms, false ceilings or walls. It is recommended to mount the remote indicator in corridors or access pathways of the corresponding building sections or rooms.

Certifications and approvals

Region	Certification	
Europe	CPR	0786-CPR-21481 FAA-420-RI-DIN/ FAA-420-RI-ROW
	CE	FAA-420-RI-DIN/-ROW

Installation/configuration notes

- You can connect only one detector per remote indicator. However, it is possible to control more than one detector on an LSN bus via configuring the panel with the Remote Programming Software (RPS) respectively.
- In LSN periphery the sum of all cable lengths between LSN devices and remote indicators as well as between LSN interface modules and conventional devices must not exceed 500 m.
- If you use unshielded cables, the cable length between LSN device (e.g. detector) and remote indicator is restricted to a maximum of 3 m.
- The current has to be externally limited to 30 mA.

Technical specifications

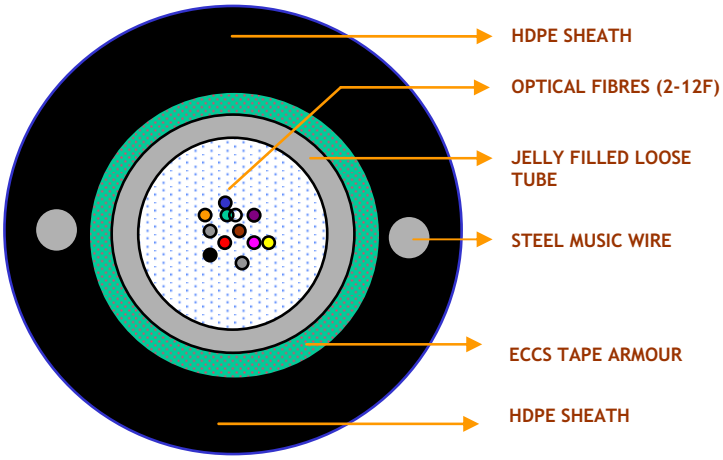
Current consumption (min.)	3 mA
Permissible wire gauge	0.45 mm – 1.4 mm
Dimensions	85 x 85 x 29 mm
Weight	45 g
Operating temperature	-20 °C to +65 °C
Permissible relative humidity	< 95% (non-condensing)
Protection class as per IEC 60529	IP 40

Ordering information

FAA-420-RI-ROW Remote Indicator
For applications where the automatic detector is not visible, or mounted in false ceilings/floors.
Order number **FAA-420-RI-ROW**

TECHNICAL DATASHEET FOR OPTICAL FIBRE CABLE.			
PROJECT:-PROJECT:1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD			**PACKAGE:-**
CLIENT : BHEL			**FIRE DETECTION AND PROTECTION SYSTEM**
C			
BHEL DOC NO. :TB-DS-377-552-10			**REV** **0**
1.0	Make	:	FINOLEX
2.0	Model no.		MLM G652D
3.0	Type	:	04F SINGLE MODE MMAX ARMD
4.0	No. of fibers	:	2F - 12F
5.0	Operating tempreture	:	-20 °C to +60 °C
6.0	Diameter	:	9.0 +/- 0.3 mm
7.0	Weight	:	80 Kg/km
8.0	Pulling Tension IEC		1800
9.0	Crush Load IEC	:	4000 N/100mm
10.0	Bend Radius	:	20D
11.0	Fiber-Type	:	9/125 / G.652D
12.0	Mode-Field	:	9.2 ± 0.4 µm
13.0	Wavelength	:	1310 nm
14.0	Dispersion	:	≤ 3.5 ps/nm-km
15.0	PMD	:	≤ 0.2 ps/km
16.0	CableCut-off Wavelength	:	≤ 1260 nm
17.0	Quantity		As per approved Drawings
18.0	Catalogue		Enclosed

2F-12F Armoured Unitube HDPE Cable – Design: MLM G652D:



Description:

- **Central Loose tube** with jelly compound.
- High quality **Electro Chromium Coated Corrugated Steel tape (ECCS)**
- Armoured design with **Music Quality Steel wire.**
- **HDPE sheath.**

Application:

- **Suitable for Outdoor network System.**
- **Excellent Crush resistant** performance, **light weight, Compact structure.**
- **Export design cable.**

Mechanical & Environment Characteristics:

Operating Temperature	**-20 deg C to +60 deg C**
Storage Temperature	**-40 deg C to +60 deg C**
Jacket Material	**HDPE UV**

Fiber Count	Design	Outer diameter (mm)	Nominal Cable Weight (kg/km)	Pulling Tension IEC 60794-1-2-E1	Crush Load IEC 60794-1-2-E3 (N/100mm)	Bend Radius (mm) IEC 60794-1-2-E11 IEC 60794-1-2-E6
2F - 12F	MLM	9.0 +/- 0.3	80	1800	4000	20D

Color Code:

BL-BLUE	**OR-ORANGE**	**GR-GREEN**	**BR-BROWN**	**GY-GREY**	**WH-WHITE**
RD-RED	**BK-BLACK**	**YE-YELLOW**	**PU-PURPLE**	**PI-PINK**	**NAT-NATURAL**

Characteristics (cabled) Single-Mode – Matched-Cladded optical fibers according to ITU

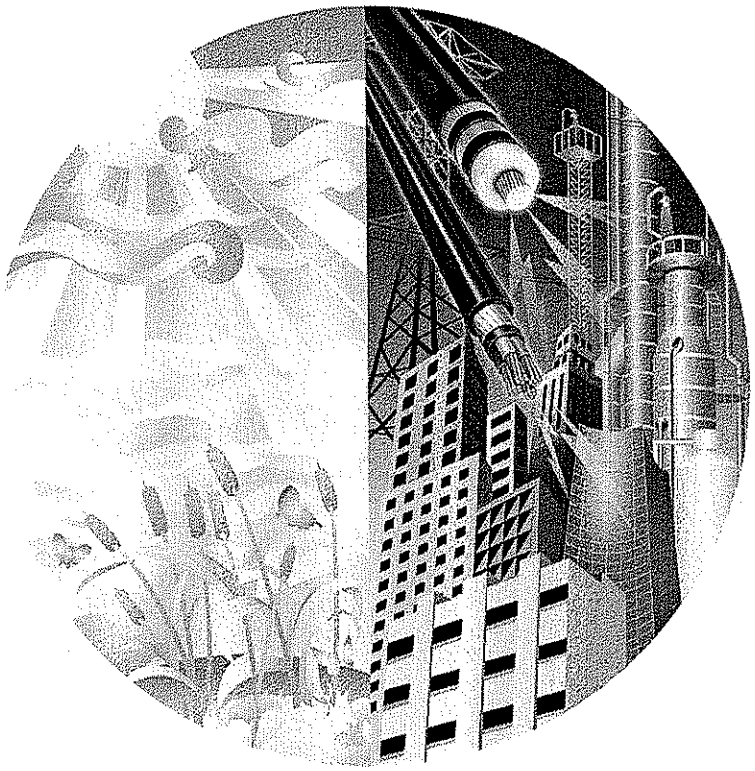
Fiber-Type	Mode-Field/Cladding Diameter (µm)	Wavelength (nm)	Dispersion (ps/(nm-km)	PMD (ps/km)	CableCut-off Wavelength (nm)
9/125 / G.652D	9.2 ± 0.4 125 ± 0.7	1310 1550	≤ 3.5 ≤ 18	≤ 0.2	≤ 1260

TECHNICAL DATA SHEET FOR CONTROL & POWER CABLES (FRLS)					
PROJECT:-:1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD			**PACKAGE:-**		
CLIENT:BHEL			**FIRE DETECTION AND PROTECTION SYSTEM**		
C					
BHEL DOC NO:- TB-DS-377-552-08				**REV**	**0**
Sr. No.	**DESCRIPTION**		**Control cable (2C X1.5 sqmm)**	**Power cable(2C X 2.5 sqmm)**	
1.0	MAKE	:	POLYCAB WIRES PVT LTD.	POLYCAB WIRES PVT LTD.	
2.0	TYPE OF CABLE	:	2XWY	2XWY	
3.0	VOLTAGE GRADE V	:	1100	1100	
4.0	NO OF CORES X SIZE IN SQMM	:	2 X 1.5	2 X 2.5	
5.0	CONDUCTOR	:			
5.1	Material	:	PLAIN ANNEALED COPPER AS PER IS-8130/1984	PLAIN ANNEALED COPPER AS PER IS-8130/1984	
5.2	MAX DC RESISTANCE OF CONDUCTOR AT 20°C (OHM/KM)	:	12.1	7.41	
5.3	SHAPE OF THE CONDUCTOR	:	STANDARD TYPE AS PER IS:8130	STANDARD TYPE AS PER IS:8130	
6.0	INSULATION	:			
6.1	MATERIAL	:	XLPE AS PER IS 7098(PT-1)/88, LATEST	XLPE AS PER IS 7098(PT-1)/88, LATEST	
6.2	NOMINAL THICKNESS(MM)	:	0.7	0.7	
7.0	INNER SHEATH	:	NA	NA	
7.1	MATERIAL	:	EXTRUDED PVC TYPE ST2 AS PER IS:5831/84	EXTRUDED PVC TYPE ST2 AS PER IS:5831/84	
7.2	MINIMUM THICKNESS	:	0.3	0.3	
8.0	ARMOURING	:			
8.1	MATERIAL	:	GALVANISED STEEL	GALVANISED STEEL	
8.2	TYPE OF ARMOURING	:	ROUND WIRE	ROUND WIRE	
8.3	NOMINAL SIZE OF ARMOUR(MM)	:	1.4	1.4	
9.0	OUTER SHEATH	:			
9.1	MATERIAL	:	FRLS PVC TYPE ST2 AS PER IS:5831/84	FRLS PVC TYPE ST2 AS PER IS:5831/84	
9.2	THICKNESS(MM)	:	1.24(Min)	1.24(Min)	

TECHNICAL DATA SHEET FOR CONTROL & POWER CABLES (FRLS)					
PROJECT:-:1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD			**PACKAGE:-**		
CLIENT:BHEL			**FIRE DETECTION AND PROTECTION SYSTEM**		
S					
BHEL DOC NO:-TB-DS-377-552-08				**REV**	**0**
Sr. No.	**DESCRIPTION**		**Control cable (2C X1.5 sqmm)**	**Power cable(2C X 2.5 sqmm)**	
10.0	ELECTRICAL PARAMETERS	:			
10.1	MAX. A.C. RESISTANCE OF CONDUCTOR AT 90˚ C (OHM/KM)	:	15.4	9.45	
10.2	CALCULATED CABLE RESISTANCE(OHM/KM)	:	0.105	0.0978	
10.3	IMPEDENCE OF CABLE(OHM/KM)	:	15.4	9.45	
10.4	APPROX. CABLE CAPACITANCE(MFD/KM)	:	0.17	0.19	
11.0	MAXIMUM CONDUCTOR TEMPERATURE UNDER NORMAL OPERATING CONDITION	:	90˚C	90˚C	
12.0	MAXIMUM CONDUCTOR TEMPERATURE AT TEMINATION OF SHORT CIRCUIT	:	250˚C	250˚C	
13.0	SHORT CIRCUIT RATING OF CONDUCTOR FOR THR DURATION OF 1 SEC(KA)	:	0.21	0.26	
14.0	CONTINEOUS CURRENT CARRYING CAPACITIES	:			
14.1	IN GROUND AT 30˚C(A)	:	27	32	
14.2	IN AIR AT 40˚C (A)	:	25	30	
15.0	APPROX.OVERALL DIAMETER OF CABLE (MM)	:			
a	FOR 2 CORE	:	10	13.5	
16.0	APPLICABLE STANDARD	:	IS 8130/84, IS 7098 PART1/88,IS 5831/84,IS 3975/88	IS 8130/84, IS 7098 PART1/88,IS 5831/84,IS 3975/88	
17.0	MINIMUM BANDING RADIUS	:	12 TIMES OVERALL DIAMETER	12 TIMES OVERALL DIAMETER	
18.0	MAX. TENSILE STRENGTH	:			
18.1	FOR CABLE PULLED STRENGTH(NEWTONS)	:	9 X D^2 D IS THE CABLE OD IN MM	9 X D^2 D IS THE CABLE OD IN MM	
18.2	FOR CABLE PULLED WITH PULLING EYES(N)	:	150	375	
19.0	COLOUR OF OUTER SHEATH	:	BLACK	BLACK	
20.0	CATALOUGE	:	AS ATTACHED	AS ATTACHED	
21.0	INSPECTION	:	AS PER APPROVED QAP	AS PER APPROVED QAP	

POLYCAB WIRES PVT LTD

TECHNICAL DETAILS



LT XLPE CABLES

POLYCAB®

Table –1

**Conductor Technical Information for Single Core and Multicore cables conforming to IS-8130/'1984 (Stranded –Class-2) Copper & Aluminium Conductors.

Nominal Size of Conductor	Minimum No.of wires				Max. D.C. Resistance at 20°C		A.C. Resistance at 90°C	
	Non Compacted		Compacted Round /Shaped		Plain Copper	Aluminium	Plain Copper	Aluminium
Sq.mm	CU.	ALU.	CU.	ALU.	Ohm/Km	Ohm/Km	Ohm/Km	Ohm/Km
1.5 *	3	3	-	-	12.1	18.1	15.5	23.17
2.5 *	3	3	-	-	7.41	12.1	9.48	15.5
4 *	7	3	-	-	4.61	7.41	5.90	9.48
6 *	7	3	-	-	3.08	4.61	3.94	5.90
10 *	7	7	6	-	1.83	3.08	2.34	3.94
16	7	7	6	6	1.15	1.91	1.47	2.44
25	7	7	6	6	0.727	1.20	0.930	1.54
35	7	7	6	6	0.524	0.868	0.671	1.11
50	19	19	6	6	0.387	0.641	0.495	0.82
70	19	19	12	12	0.268	0.443	0.343	0.567
95	19	19	15	15	0.193	0.320	0.247	0.410
120	37	37	18	15	0.153	0.253	0.196	0.324
150	37	37	18	15	0.124	0.206	0.159	0.264
185	37	37	30	30	0.0991	0.164	0.127	0.210
240	61	37	34	30	0.0754	0.125	0.0965	0.160
300	61	61	34	30	0.0601	0.100	0.0769	0.128
400	61	61	53	53	0.0470	0.0778	0.0602	0.10
500	61	61	53	53	0.0366	0.0605	0.0468	0.0774
630	91	91	53	53	0.0283	0.0469	0.0362	0.060
800	91	91	53	53	0.0221	0.0367	0.0283	0.0470
1000	91	91	53	53	0.0176	0.0291	0.0225	0.0372

* These sizes can be manufactured with solid conductor having single strand.
** Conductor meeting requirements of IEC-228 and BS 6360 can also be manufactured.

POLYCAB®

Table-2

Comparative Current Ratings of 650/1100 Volts Multicore heavy duty PVC Insulated Cables & XLPE Insulated Cables. (3 , 3.5 & 4 Core Unarmoured / Armoured PVC Sheathed Cables with Aluminium Conductor.

Nominal Size Of Cable	3,3.5&4 Core PVC Insulated & Sheathed cables as per IS-1554(Part-1)1988			3,3.5&4 Core XLPE Insulated & Sheathed cables as per IS-7098 (Part-1)1988		
	In Ground	In Air	Approx Voltage Drop	In Ground	In Air	Approx Voltage Drop
Sq.mm	Amp	Amp	mv/amp / mtr	Amp	Amp	Mv/amp/ mtr
16	60	51	4	73	70	4.2
25	76	70	2.5	94	96	2.7
35	92	86	1.8	113	117	1.9
50	110	105	1.3	133	142	1.4
70	135	130	0.93	164	179	0.99
95	165	155	0.68	196	221	0.72
120	185	180	0.54	223	257	0.58
150	210	205	0.46	249	292	0.48
185	235	240	0.38	282	337	0.39
240	275	280	0.28	326	399	0.31
300	305	315	0.25	367	455	0.26
400	335	375	0.20	420	530	0.21

Table-3

Comparison of Short Circuit Rating for 1 Second duration for * PVC & XLPE Insulated Cables ** with Copper and Aluminium Conductors.(Current in kAmps)

Nominal Size	PVC Insulated		XLPE Insulated	
Sq.mm	Copper	Aluminium	Copper	Aluminium
1.5	0.173	-	0.21	-
2.5	0.283	-	0.36	-
4	0.46	0.303	0.57	0.38
6	0.690	0.455	0.86	0.57
10	1.15	0.758	1.40	0.94
16	1.84	1.21	2.30	1.5
25	2.88	1.90	3.60	2.40
35	4.03	2.65	5.0	3.3
50	5.75	3.79	7.10	4.70
70	8.05	5.31	10.0	6.6
95	10.90	7.2	13.6	9.0
120	13.80	9.10	17.10	11.30
150	17.3	11.40	21.40	14.2
185	21.3	14.02	26.40	17.50
240	27.6	18.20	34.3	22.6
300	34.5	22.80	42.90	28.3
400	46.00	30.40	57.10	37.7
500	57.5	38	71.4	47.2
630	72.5	47.25	90	59.4
800	92.0	60.0	114.3	75.5
1000	115.0	75	142.9	94.3

* PVC Type 'A' Insulation as per IS-5831/'84.

** PVC Cables as per IS-1554 (Part-1)-1988.

** XLPE Cables as per IS-7098 (Part-1)-1988.

1). Max. Conductor Temperature during operation PVC 70°C XLPE 90°C

2).Max.Conductor Temperature During Short circuit. 160°C 250°C

Formula relating Short Circuit Rating with duration

$It = \frac{Ish}{\sqrt{t}}$ Where

It = Short Circuit Rating for t Seconds.

t = duration in seconds

Ish = Short Circuit rating for 1 second.

POLYCAB

TABLE - WD 11

"POLYCAB" 650/1100 Volts Multicore Control Cable with Solid Copper Conductor of size 1.5 Sq.mmXLPE Insulated , Unarmoured , Armoured Cable conforming to IS 7098 PART - 1/1988

Solid & Stranded $ WEIGHT AND DIMENSIONS

Number of Cores	Nominal Thickness of XLPE Insulation	Minimum Thickness of PVC Inner Sheath	*Unarmoured Cable*			*Formed Wire/ Strip Armoured Cable*				*Round Wire Armoured Cable*				Current Rating.		*Normal Delivery Length.
			Nominal Thickness of PVC Outer Sheath	Approx. Overall Diameter of Cable.	Approx. Weight of Cable.	Nominal Dimension of GI Flat Strip.	MinimumThickness of PVC Outer Sheath	Approx. Overall Diameter of Cable.	Approx. Weight of Cable.	Nominal Dimension of GI Round Wire.	Minimum Thickness of PVC Outer Sheath	Approx. Overall Diameter of Cable.	Approx. Weight of Cable.	In Ground.	In Air	
No. s	mm	mm	mm	mm	Kg./Km	mm	mm	mm	Kg./Km	mm	mm	mm	Kg./Km	Amps.	Amps.	Mtrs.
2	0.7	0.3	1.8	10	140	-NA-	-NA-	-NA-	-NA-	1.4	1.24	12.5	370	33	29	1000
3	-do-	0.3	1.8	10.5	160	-NA-	-NA-	-NA-	-NA-	1.4	1.24	13	390	25	22	1000
4	-do-	0.3	1.8	11.5	200	-NA-	-NA-	-NA-	-NA-	1.4	1.24	13.5	415	25	22	1000
5	-do-	0.3	1.8	12.5	225	-NA-	-NA-	-NA-	-NA-	1.4	1.24	14.5	465	24	21	1000
6	-do-	0.3	1.8	13.5	250	-NA-	-NA-	-NA-	-NA-	1.4	1.24	15.5	500	22	19	1000
7	-do-	0.3	1.8	13.5	260	-NA-	-NA-	-NA-	-NA-	1.4	1.24	15.5	520	21	18	1000
8	-do-	0.3	1.8	14.5	280	-NA-	-NA-	-NA-	-NA-	1.4	1.24	16.5	580	20	18	1000
9	-do-	0.3	1.8	15.5	315	-NA-	-NA-	-NA-	-NA-	1.4	1.24	17.5	630	19	17	1000
10	-do-	0.3	1.8	17	340	-NA-	-NA-	-NA-	-NA-	1.4	1.24	18.5	655	18	16	1000
12	-do-	0.3	1.8	17.5	390	-NA-	-NA-	-NA-	-NA-	1.4	1.24	19	720	17	15	1000
14	-do-	0.3	1.8	18	430	-NA-	-NA-	-NA-	-NA-	1.4	1.4	20	825	16	14	1000
16	-do-	0.3	1.8	18.5	475	4 x 0.80	1.4	19	750	1.6	1.4	21	925	16	14	1000
19	-do-	0.3	1.8	19.5	540	-do-	-do-	20	815	1.6	1.4	22	1010	15	13	1000
21	-do-	0.3	2.0	20.5	600	-do-	-do-	21	900	1.6	1.4	23	1150	14	12	500
24	-do-	0.3	2.0	22.5	665	-do-	-do-	23	1000	1.6	1.4	25	1250	13	12	500
27	-do-	0.3	2.0	23	750	-do-	-do-	23.5	1050	1.6	1.4	25.5	1330	13	11	500
30	-do-	0.3	2.0	23.5	820	-do-	-do-	24	1125	1.6	1.4	26	1400	12	11	500
33	-do-	0.3	2.0	24	910	- do-	-do-	25	1225	1.6	1.4	27	1475	12	10	500
37	-do-	0.3	2.0	25	975	- do-	-do-	26	1325	1.6	1.4	28	1550	11	10	500
44	-do-	0.3	2.0	28	1150	- do-	-do-	28.5	1500	1.6	1.56	30.5	1850	11	9	500
52	-do-	0.3	2.0	29	1300	- do-	1.56	30.5	1700	1.6	1.56	32	2050	10	9	500
61	-do-	0.4	2.2	31	1500	- do-	1.56	32	1950	2	1.56	34.5	2550	9	8	500

$ The Weight and Dimensions of Cables with Stranded conductor will be comparatively more than that of Solid conductor,whereas all other parameters are same..

The above data is approximate and subject to manufacturing tolerance.

* Delivery Length tolerance is ± 5 % .Length more than normal as per customer request.

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Table - 4

CAPACITANCE

Approximate Capacitance (Microfarads/km) 1.1 kV XLPE Cables.

Nominal Area of Conductor in sq.mm	Single Core		Two Core	Three , Three & Half and Four Core
	Unarmoured	Armoured		
1.5	0.19	-	0.051	0.15
2.5	0.24	-	0.058	0.18
4	0.29	-	0.065	0.22
6	0.34	-	0.071	0.25
10	0.43	0.32	0.081	0.31
16	0.51	0.38	0.088	0.36
25	0.49	0.38	0.089	0.41
35	0.57	0.44	0.096	0.47
50	0.58	0.46	0.098	0.50
70	0.63	0.51	0.10	0.53
95	0.73	0.59	0.11	0.61
120	0.74	0.61	0.11	0.63
150	0.73	0.61	0.11	0.60
185	0.69	0.59	0.11	0.60
240	0.74	0.64	0.11	0.63
300	0.80	0.69	0.12	0.67
400	0.83	0.70	0.12	0.67
500	0.83	0.71	0.12	0.69
630	0.87	0.75	0.11	0.73
800	0.92	0.78	-	-
1000	0.94	0.81	-	-

Table - 5

REACTANCE

Approximate Reactance At 50 Hz (Ohms-/km) 1.1 kV XLPE Cables.

Nominal Area of Conductor in sq.mm	Single Core		Multicore
	Unarmoured	Armoured	
1.5	0.155	-	0.107
2.5	0.142	-	0.0985
4	0.132	-	0.0927
6	0.123	-	0.0884
10	0.114	0.134	0.0837
16	0.108	0.125	0.0808
25	0.103	0.120	0.0805
35	0.0986	0.114	0.0783
50	0.0937	0.108	0.0750
70	0.0900	0.102	0.0740
95	0.0865	0.100	0.0724
120	0.0841	0.0968	0.0712
150	0.0839	0.0941	0.0716
185	0.0836	0.0932	0.0718
240	0.0813	0.0900	0.0710
300	0.0795	0.0881	0.0705
400	0.0787	0.0873	0.0704
500	0.0779	0.0859	0.0702
630	0.0785	0.0843	0.0698
800	0.0755	0.0826	-
1000	0.0752	0.0825	-

POLYCAB®

CURRENT RATINGS

POLYCAB RECOMMENDATIONS FOR CURRENT RATINGS:

The current rating of power cable is defined by the maximum intensity of current (amperes) which can flow continuously through the cable, under permanent loading conditions, without any risk of damaging the cable or deterioration of its electrical properties.

The value given in the tables are valid for one circuit in a three phase system under conditions specified . For grouping cables rating factors must be used.

The current carrying capacities mentioned in **POLYCAB** technical data are intended as a guide , to assist operating engineers in selecting cables for safety and reliability.

Basic assumptions and conditions of installation :-

* Ambient Ground Temperature : 30 ° C
* Ambient Air Temperature : 40 ° C
* Depth of cable burial : 1.0 m
* Thermal resistivity of soil : 150 ° C. Cm/W

Single core cables are installed as indicated in the table . Spacing between cables in flat formation is as indicated.

For three and four core cables, it is usual to assume the same current carrying capacity for four cores cables as for three core cables . Our calculated values are based actually on three cores cables. These values are suitable with enough accuracy also for four cores cables in most cases. Only for large four core cables in air the values may be found to be too conservative , due to the large cable surface and consequent high heat dissipation factor .

To obtain the maximum current carrying capacity of a cable operating at different conditions from the standard. Various rating factors are to be multiplied , as follows :-

$I_a = K \quad I_s$ in amperes

Where ;

I_a : Current rating at actual operating conditions (amperes)

I_s : Current rating at standard operating conditions (amperes)

K : Rating factor as , applicable.

TECHNICAL DATASHEET FOR OPTICAL FIBRE CABLE.					
PROJECT:-PROJECT:1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD			**PACKAGE:-**		
CLIENT : BHEL			**FIRE DETECTION AND PROTECTION SYSTEM**		
C					
BHEL DOC NO. : TB-DS-377-552-08				**REV**	**0**
1.0	MAKE	:	AP Sensing		
2.0	Module number for cable in cable gallery areas	:	S2000A		
3.0	Construction	:	FRNC outer sheath		
		:	Aramid fibers		
		:	Tight-buffered fibers		
4.0	Fibre	:	MM 50/125 µm		
	Cable Ø	:	4.0 mm		
	Weight	:	17 kg/km		
	Min. bending radius	:	20xD mm (with tensile)		
		:	15xD mm (without tensile)		
5.0	Max. crush resistance:	:	100 N/cm		
6.0	Max. tensile strength	:	1000 N (short term)		
		:	800 N (long term)		
7.0	Operating temperature	:	-40°C to +85°C		
8.0	Installation temperature	:	-5°C to +50°C		
9.0	Short-term temperature	:	-50°C to +150°C		
10.0	Location	:	Cable gallary		
11.0	Approval agency	:	UL		
12.0	Acceptance	:	AS PER ICL		
13.0	QTY.	:	AS PER APPROVED DWG		

TECHNIACAL DATA SHEET FOR CONTROLLER			
PROJECT: 1 x 800 MW KOTHAGUDAM TPS – 400KV SWITCHYARD			**PACKAGE:**
CLIENT: BHEL			**FIRE DETECTION & PROTECTION SYSTEM**
C			
BHEL DOC NO: TB-DS-377-552-08			
SR.NO	**SPECIFICATION**		
A	Make	:	AP SENSING
B	DTS Specification – Typical Performance	:	N4387B-001
1	Distance range	:	1 km
2	Minimum Sampling interval	:	0.25
3	Spatial resolution	:	0.5 m to 8.0 m (adjustable)
4	Channel options	:	2
5	Measurement time	:	10 s to 30 s (adjustable)
6	Available measurement modes	:	Single ended; Dual ended (loop, incl. fiber break recovery, not with channel option N4387B-100)
7	Laser class (IEC 60825-1:2007	:	1M (eye-safe)
8	Average laser output power	:	< 20 mW
9	ATEX certification	:	EX II (1) GD; I M2
C	**Interfaces**	:	
1	Optical connector	:	E2000 APC 8° angled; 50/125 µm graded index MM
2	Number of channels	:	2 (N4387B-200)
3	Computer interface	:	USB, Ethernet (LAN)
4	Communication protocol	:	SCPI; Modbus TCP (N4387B-060)
5	Relay board	:	4 inputs, 44 outputs (volt-free contacts)
6	Power supply	:	10 V to 30 V DC
7	Power consumption	:	17 W typically, at 20 °C ambient temperature; <40 W (entire operating conditions)
D	**Housing & Environmental Conditions**	:	
1	Operating temperature range	:	-10 °C to +60°C
2	Storage temperature range	:	-40 °C to +80°C
3	Operating humidity range	:	0% to 95% r.h.
4	Dimensions (H x W x D)	:	88 x 448 x 364 mm (19" rack mount) h
5	Weight	:	9 kg (rack mount)
E	**Approval**	:	UL
F	**acceptance**	:	as per ICL
G	**qty.**	:	As per approved dwg

Linear *Heat* Series Sensor Cables

In close cooperation with leading cable manufacturers, AP Sensing offers a wide range of sensor cables. Besides the "Safety" and "Steel" models described here there are many specialty cables available for specific applications.

Sensor Cable Safety S2000A

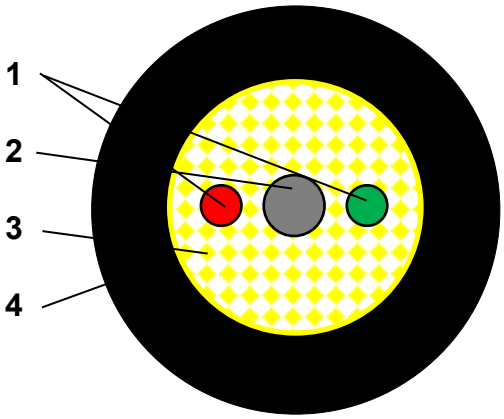
A fast-responding sensor cable with a tight buffered fiber. Compact dimensions, high flexibility and good bending behavior. High tensile strengths due to the Aramid yarns. These cables have a halogen-free and flame-retardant cable sheath.

Sensor Cable Steel S2002A

Fast-responding armored sensor cable with stainless steel loose tubes and outer sheath. High tensile strength, high crush resistance. Longitudinally and laterally water tight. Excellent rodent protection. These cables have a halogen-free and flame-retardant cable sheath.

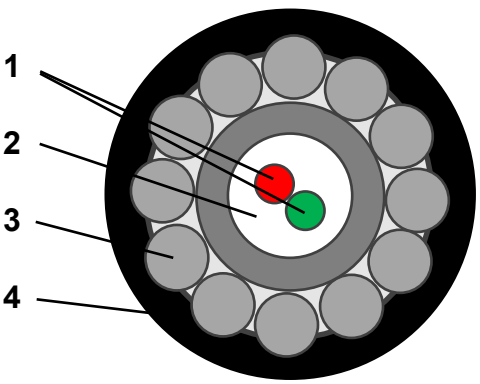
Sensor Cable Safety

1) Acrylate coated fibers
2) GRP strength member
3) Aramid yarn
4) FRNC outer sheath



Sensor Cable Steel

1) Acrylate coated fibers
2) Gel free stainless steel tube, 316L
3) Stainless steel wires, 316L
4) FRNC outer sheath



	Sensor Cable Safety (S2000A)	**Sensor Cable Steel (S2002A)**
Construction:	FRNC outer sheath Aramid fibers Tight-buffered fibers	FRNC outer sheath Stainless steel wires Gel-free stainless steel loose tube fibers with primary coating
Fiber:	MM 50/125 µm (MM 62.5/125 µm)	MM 50/125 µm (MM 62.5/125 µm)
Cable Ø:	4.0 mm	3.8 mm
Weight:	17 kg/km	25 kg/km
Min. bending radius:	20xD mm (with tensile) 15xD mm (without tensile)	20xD mm (with tensile) 15xD mm (without tensile)
Max. crush resistance:	100 N/cm	960 N/cm
Max. tensile strength:	1000 N (short term) 800 N (long term)	1500 N (short term) 1100 N (long term)
Operating temperature:	-40°C to +85°C	-40°C to +85°C
Installation temperature:	-5°C to +50°C	-5°C to +50°C
Short-term temperature:	-50°C to +150°C	-50°C to +150°C

Cables are delivered in the requested length.

Both cables comply with standards:

IEC 60331-25[1]; IEC 620332-1/-2/-3-24; IEC 60754-2; IEC 60793; IEC 60794-1-2; IEC 61034-2; EN 187000 VdS approved.

[1] Functional integrity of the sensor cable tested for 2 hours at 750°C, furthermore in tunnel fire testing it has been demonstrated that the functional integrity of the cable was maintained for several minutes with temperatures exceeding 1000°C.

Pre-assembled connectors

(S2000A-001: safety / S2002A-001: steel)

To reduce deployment cost and time, pre-assembled pigtails are optionally available. These enable a quicker and easier installation, with no need to organize a fusion splicer and splice box to connect the sensor cable to the DTS. Pigtails are supplied with E2000 8°angled connectors. For safe transportation they are covered with a flexible protective tube when shipped.

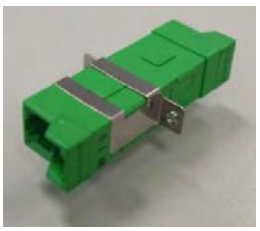
Pigtail with optical connector

(S2008A: 5 m / S2006A: 30 m)

E2000 8°angled connectors are available in 2 lengths for splicing to the sensor fiber (either to connect to the DTS, or for termination).

E2000 APC Adapter (S2011A)

Used to connect two E2000 APC connectors.



Sensor tube cutting tool (S2010A)

Recommended to cut the stainless steel tube, to properly remove the cable sheath and splicing the pigtail to the sensor fiber.

Specialty cables

In addition to these standard cables, special cables are available for extremely high and low temperature ranges and corrosive atmospheres. Special color requirements can also be met.

www.apsensing.com
info@apsensing.com

Linear Heat Series N4387B

Specifications

Each DTS instrument must pass defined test limits and is individually tested before shipping. This ensures that every DTS unit will meet or exceed the specifications in this datasheet. Adhering to our stringent quality control measures guarantees optimal performance and a long product life.

DTS Specifications

	Linear Power Series N4387B					
Instrument option	**-001**	**-002**	**-004**	**-006**	**-008**	**-010**
Distance range	1 km	2 km	4 km	6 km	8 km	10 km
Minimum Sampling interval	0.25					
Spatial resolution	0.5 m to 8.0 m (adjustable)					
Channel options	1 (N4387B-100) 2 (N4387B-200, up to 8 km) 4 (N4387B-400, up to 6 km)					
Measurement time	10 s to 30 s (adjustable)					
Available measurement modes	Single ended; Dual ended (loop, incl. fiber break recovery, not with channel option N4387B-100)					
Laser class (IEC 60825-1:2007	**1M (eye-safe); (!) Invisible Laser Radiation, do not view directly with optical instruments.**					
Average laser output power	< 20 mW					
ATEX certification	EX II (1) GD; I M2					

Interfaces	
Optical connector	E2000 APC 8° angled; 50/125 µm graded index MM
Number of channels	1 (N4387B-100); 2 (N4387B-200); 4 (N4387B-400)
Computer interface	USB, Ethernet (LAN)
Communication protocol	SCPI; Modbus TCP (N4387B-060)
Relay board	4 inputs, 44 outputs (volt-free contacts)
Power supply	10 V to 30 V DC
Power consumption	17 W typically, at 20 °C ambient temperature; <40 W (entire operating conditions)

Housing & Environmental Conditions	
Operating temperature range	-10 °C to +60 °C
Storage temperature range	-40 °C to +80 °C
Operating humidity range	0 % to 95 % r.h.
Dimensions (H x W x D)	88 x 448 x 364 mm (19" rack mount) 500 x 400 x 150 mm (IP55 / IP66 outdoor housing)
Weight	9 kg (rack mount) 17 kg (IP55 / IP66 outdoor housing)

Product specifications and descriptions in this document are subject to change without notice and are not binding to AP Sensing.

CERTIFICATE OF COMPLIANCE

Certificate Number	20130604 -S24945
Report Reference	S24945 -201 10415
Issue Date	2013 -June -04

Issued to:

APSENSING GMBH
HERRENBERGER STR 130
71034 BOEBLINGEN GERMANY

This is to certify that representative samples of

HEAT -AUTOMATIC FIRE DETECTORS;
HEAT -ACTUATED DEVICES FOR SPECIAL APPLICATION
Fiber Optic Linea r Heat Detector
Model N4387B

Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety:

UL521 Heat Detectors for Fir e Protective Signaling Systems
CAN/ULC -S530 -M91 Heat Actuated Fire D etectors for Fire Alarm Systems

Additional Information:

See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Listing Mark for the US and Canada should be considered as being covered by UL's Listing and Follow -Up Service meeting the appropriate requirements for US and Canada.
The UL Listing Mark for the US and Canada generally in cludes: the UL in a circle symbol with "C" and "US" identifiers: c(UL)us the word "LISTED"; a control number (may be alphanumeric) assigned by UL; and the product category name (product identifier) as indi cated in the appropriate UL Directory .

Look for the UL Listing Mark on the product.

William R. Carney

William R. Carney, Director, North American Certification Programs

UL LLC