

**Name of work: New football Stadium at Medical College Ground Kozhikkode-Addl. Electrical works(Substation, Wet Riser & Miscellaneous works)**

**SPECIFICATION FOR INDOOR UNITISED PACKAGE SUBSTATION: -**

**1. GENERAL**

- 1.1 System HT: 11 KV, 3 phase, 3 wire, 50 HZ, 350 MVA
- 1.2 System LT: 433 V, 3 phase, 4 wire, 50 HZ, 35 MVA
- 1.3 Unitised package substation shall consist of **one no. Main incoming module with TOD meter and 1 no. out going module arranged on side of the main incoming module and completely interconnected with epoxy encapsulated copper bus bars and control wiring with minimum 1.5 sq.mm / suitable size PVC insulated multi strand copper conductor cable.**
- 1.4 The main incoming module shall consist of one no. HT Air break load break switch, one set of HT metering equipment comprising resin cast C.Ts. & dry type PT and TOD meter. The TOD meter shall be provided in a separate enclosure with sealable door having see through window. The epoxy encapsulated bus bar arrangement shall be suitable for modular extension of the main incoming module to the out going modules on either side.
- 1.5 The out going module shall consist of one no. HT Air break load break switch, one no. Resin cast dry type transformer and one no. **MCCB** completely interconnected with epoxy encapsulated copper bus bars.
- 1.6 The metal clad housing of the unitised substation shall be self standing, fabricated out of CRCA sheet steel (**2 mm thick** for the side covers and **2.5 mm** for doors) suitable for indoor mounting with necessary doors, windows and tinned copper earthing strip of **32 mm x 5 mm** size and mounted on a common skid base frame made out of inter connected M.S. channel. Door interlocks with micro switch to prevent access to live terminals by tripping of HT load break switch when the door is opened shall be provided. Enclosure shall be of compartmentalised type so as to form separate cubicle for HT portions, Transformer portion and LT portion etc. Panel shall be provided with gland plates of 3 mm thick sheet steel for termination of incoming and out going cables and earth strips directly from bottom of the cubicle.
- 1.7 The enclosure shall be fabricated in accordance with IS 2147 with protection class **IP23 for transformer portion** and **IP 54 for other portions**. The panel frame work, covers, partition plates, doors etc. after fabrication shall be chemically cleaned, derusted, passivated and painted. The painting shall include one or more coat of primer and two coats of **epoxy painting** of light grey shade.

The modular arrangement shall comprise the followings:

**2 MAIN INCOMING MODULE**

It shall consist of:-

- 2.1 One No. indoor metal enclosed 11 KV, 630 Amps ,26.2 KA breaking capacity triple pole HT airbreak load break switch manufactured as per IS9920 and with unique arc quenching facility suitable for 3 phase, 3 wire, 50 Hz, effectively earthed neutral system **with earth switch** interlocked with main switch etc.
- 2.2 3 nos. 11KV, 10A HT HRC fuses
- 2.3 1 no. Emergency trip push button (mechanical)
- 2.4 1 set of 2 N/O + 2 N/C aux. Contacts
- 2.5 1 No. 24 V DC shunt trip coil with assembly with healthy trip test push button and lamp indication (white).
- 2.6 1 no. ON indication lamp RED & 1 no. OFF indication lamp GREEN for main switch suitable to work on 24 V DC. (DC supply shall be wired from power pack cum battery charger provided in the out going module. A control contactor with 230V AC coil and 2NO+2NC contacts shall also be provided with suitable wiring , to ensure 24V DC supply with charger backup indicating lamps and shunt trip coils, when Transformer is working)
- 2.7 1 set of insulated busbar interconnection arrangement with bus bar coupling arrangement to out going module which will be mounted on the side of the main incoming module

- 2.8 Space heater of 80 Watt rating suitable to operate on 230V, 1 phase, 50Hz, AC supply with necessary thermostat control complete with 1 no, SPN MCB, contactor, etc with interconnections with multi strand copper conductor (supply shall be wired from the LT side of the out going module)
- 2.9 1 No. cable termination arrangement suitable to receive 1 No. **3 x 300** sq.mm XLPE HT cable from bottom.
- 3.0 HT metering equipment comprising
- 3.1 2 nos.\*\* / 5 Amps (\*\*as required by the Engineer-in-charge) ratio epoxy resin cast CT.s having class 0.5 accuracy for TOD meter with minimum 15 VA burden and thermal current rating to meet the requirements of the panel.
- 3.2 One No. 11 KV/110 V ratio, 3 phase, 3 limb epoxy resin cast dry type horizontal draw out type potential Transformer of 100 VA per phase rated burden and class 0.5 accuracy, HV & LV fuses for feeding various instruments with sealing arrangements on the LT side fuses
- 3.3 One No. 3 phase 3 wire unbalanced load AC SOLID STATE TOD METER of class 0.5 accuracy, 30 Min. integrating period operated through CTs, PTs (5amps, 110 volts consisting
1. KWH meter with MD in KW.
  2. KVAH Meter with MD in KVA
  3. KVARH indicator with class 1 accuracy

Note: All test terminals shall be brought to a suitable test terminal block on the front and provision shall be made for sealing the CTs and PTs and front cover from tampering.

- 3.4 The TOD meter shall be mounted at normal view level with top of the meter with in 1.8m from bottom of the panel.

### 3. OUT GOING MODULE

The outgoing module shall consist of the following in modular arrangement:-

#### **Dry Type Transformer GENERAL DATA:**

- 3.2.1 No. of transformer : 1 Nos.
- 3.2.2 Type of Transformer : Resin cast (class F / H) dry type
- 3.2.3 No. of phases : 3
- 3.2.4 Frequency : 50 Hz.
- 3.2.5 Double wound/ Auto : Double wound
- 3.2.6 Winding material : Copper.
- 3.2.7 Type of cooling : AN.
- 3.2.8 Rated KVA : **160 KVA**
- 3.2.9 Rated voltage : HV side 11KV  
MV side 433
- 3.2.10 Taps required :  $\pm 2.5$  %,  $\pm 5$  % on HV side.
- 3.2.11 Tapping operation : OFF load tap changing links
- 3.2.12 Vector Group : DYn 11
- 3.2.13 Neutral : Neutral to be brought out separately on MV side for earthing.
- 3.2.14 Diagram required : Yes.
- 3.2.15 Parallel operation : Suitable for parallel operation.
- 3.2.16 Transformer size limitation & constructional data :

- i) Type of installation : In door
- ii) Terminal details : HT : by busbars from main incoming module.  
LT : by bus bars to ACB.

iii) Fittings and accessories required:

Lifting lugs, name plate, terminal marking plate, bi-directional rollers, earthing lugs, winding temperature indicator and alarm and trip contact (one thermistor for warning and one thermistor for tripping of HT breaker when permitted temperature is exceeded) with junction box, contactors / relays etc. The temperature indicator shall be externally mounted for easy monitoring.

#### OTHER DETAILS

- 3.2.17 Temperature rise : Temperature rise of the Transformer above the cooling air temperature when tested at the rated KVA shall not exceed the limit in Table 4 of IS 11171/ 1985 reaffirmed in 1991.
- 3.2.18 General : The transformer shall be suitable for continuous run and for all type of loads with high efficiency. The supplier should give sufficient spacing between various terminals so that it can be properly terminated.

### 3.3 LT Side

LT cubicle shall consist of the following:

- 3.3.1 1 No 415 V, 400 A, 50KA breaking capacity 4 Pole MCCB with Thermal magnetic release and , earth fault release etc. along with all accessories suitable for 400KVA dry type Transformer..
- 3.3.2 Cable termination arrangement suitable to connect 1 runs of 3 ½ core 185 sq.mm. LT outgoing cable from the rear bottom entry.
- 3.3.3 Necessary Bus bar interconnections for ACB panel with secondary terminals of the transformer.

## 4. GENERAL SPECIFICATIONS FOR M.V.PANEL

### CONSTRUCTION FEATURES:

#### 1 GENERAL:

1.1 MV switchboard shall be extensible type, sheet steel cubicle indoor floor mounting, dead front freestanding type. The design shall be totally enclosed completely dust tight and vermin proof. The sheet steel used shall be 16G thick, gaskets of 3mm thick shall be used between all adjacent units and beneath all covers to render the joints effectively dust proof. Sheet steel work shall be machine made and shall be of high quality. All openings and cut outs in the doors shall be free from burrs, weld runs shall be made smooth. All sheet surfaces shall be free from dents and hammer marks. A base channel of 100 mm x 50 mm x 5 mm size painted black shall be provided to prevent corrosion of the sheet steel cubicle and to facilitate cleaning of floors, for convenience of operation and in case of cable termination, there shall be a gap of at least 200mm between the floor level and the bottom most unit.

1.2 Structure of frame work and enclosure shall be such as to require a minimum number of screws visible from outside. The frame work shall be made of steel sheet folded to impart strength, which will also serve as continuous barrier between logically arranged switch board compartments. Compartment and cable space shall be based on modular construction.

1.3 The switchboard shall be easily extensible and shall have a high degree of flexibility. The arrangement shall be logically compact and neat. Each module shall be fitted with individual dust proof door provided with insulated thumb screws. The switch board shall have a uniform height and depth. The panel shall have a flush appearance. The maximum operating height shall not exceed 1800mm. Adequate lifting facilities shall be provided for each shipping section to facilitate handling and transport.

The compartment door shall be so interlocked that it shall not be possible to open the door with the switch in closed position. The total height of the panel board should not exceed 2000mm in all respects.

1.4 Out-going links from feeders shall be rigidly supported and suitably extended in cable chamber for ease of cable connection. Cable lugs and links shall be covered by insulating shields. Barriers shall be provided between the modules accommodating equipment associated with the out going circuits. All vertical sections shall have a covering at the bottom so that entry of dust, rats and vermin is not possible.

## 2. CIRCUIT BREAKER PANEL

The circuit breaker shall be MCCB in order to eliminate fire and explosion risk. The Circuit breaker shall be robust and compact in design.

## 3. HEAVY DUTY COMPOSITE UNITS OF SWITCHES AND FUSES:

All switches shall be suitable for operation from the front. The rating of switches and fuses shall be as specified. Out going feeders shall be neatly arranged in different compartments. Normally switches for individual feeders shall be accommodated in separate modules.

## 4. BUS BARS

Three phase and neutral Bus bars made of aluminum alloy shall be provided of rating as specified. Bus bars shall be housed in separate bus bar chambers. Horizontal bus bars shall extend throughout the length of panels. The bus bars shall be suitably braced to withstand the fault level and shall be supported on unbreakable non-hygroscopic FRP/ SMC sheets rigidly held to the framework of the chamber. Bus bar chamber shall have a separate bolted cover with hinges at one side and means shall be provided to identify the various phases of the bus bars. Vertical bus bars shall be arranged as close to the units as possible. The connections between horizontal bus bars and vertical bus bars shall be short and neat. Long link connections requiring careful bracing etc. are not preferred.

## 5. CABLE COMPARTMENTS

A full height compartment running behind the vertical modules shall be provided for easy termination of all incoming and out going cables entering either from top or from bottom. Adequate supporting arrangements shall be provided for the cables wherever necessary. The cable compartment shall have its own hinged cover, which can be removed for easy access during cabling. Alternatively, for small capacity MV panel with SDFUs, cable compartment may be provided for front side termination arrangement.

## 6. INTERCONNECTIONS AND CONTROL WIRING

Switch board shall be completely factory wired ready for connecting to the equipment. Power connection of the circuit shall be done by Aluminum flats or by adequate size of PVC insulated stranded copper wires. Control wiring shall be done by PVC insulated wires of minimum size of 1.5 sq.mm copper. All control wiring shall be fitted with identification ferrule at each end and not more than two connections shall be made at any one terminal. The wires shall be arranged and supported in such a manner that there shall be no strain on the terminations.

## 8. TERMINAL ARRANGEMENTS:

The terminals shall be of adequate current rating and size to suit individual feeder requirements and mounted in cable compartment. Tap off connections at the bus bars shall be made with nuts, bolts and washers. Bus bars shall not be threaded for terminating wire connections.

## 9. CABLE ENTRY

The switch board shall be designed to facilitate aluminium conductor PVC cable entry from top or bottom as the case may be. Removable sheet steel gland plate suitable for cable glands as specified shall be fitted at the top or bottom.

## 10 INDICATING INSTRUMENTS:

The indicating instruments shall be of reputed make conforming to the relevant IS. The arrangement of the instruments shall be logical. The size of the instrument shall be as required.

#### 11. LABELS:

Engraved PVC labels shall be provided on all the incoming and outgoing feeder compartments. The exact legend to be engraved will be furnished.

#### 12. EARTHING BUSBARS :

The earth busbar shall be copper and of appropriate size as specified.

#### 13. PAINTING:

All sheet metal work shall undergo a process of degreasing, pickling in the acid, cold rinsing, phosphating, passivating and then be sprayed with high corrosion resistant primer. The panel shall be baked in an oven. The finishing treatment shall be by application of two coats of synthetic paint of approved shade by spray. Alternatively panel may be of powder coated.

### **SPECIAL CONDITIONS OF CONTRACTS (for Sub Station Works)**

#### 1. PROGRAMME FOR EXECUTION:

The firm shall supply detailed programme to Engineer-in-charge for execution of contract within 10 days of award of work. The programme shall contain details about submission of drawing, supply of materials, tentative dates for installation and commissioning.

#### 2. STORES AND SAFETY:

All the stores and materials required for the satisfactory completion of the work shall be arranged at work site by the contractor from his own sources. Lockable space for storing the materials may be provided on request from the contractor. However, safe custody of material stored at site will be the responsibility of the contractor.

#### 3. COORDINATION AT SITE:

At the site of work more than one agency may be working. Full cooperation shall be extended to other agencies during progress of work. Further, work shall be carried out in such a way so that it may not cause abnormal noise and hindrance to the officers of the department engaged in erection as well to normal routine work.

#### 4. COMPLETION DRAWINGS:

The firm shall supply three sets of drawings/documents within 30 days after completion of the work as detailed below, neatly arranged in folders.

- Installation drawing giving complete details of the entire equipments including foundation.
- Line diagram of power supply/distribution through Substation.
- Schematic diagram of HT Panel, Transformer, Bus trunking indicating clearly the sizes of Bus bars, switch gears, circuit breakers, metering & protection equipments, cable & Bus trunking entry points.
- Electrical drawing giving switch gear capacity, protective fuses, control wiring etc.

#### 5. DOCUMENTS FOR ELECTRICAL INSPECTION:

- In addition to the above, drawings/documents in the folder form required for the Electrical Inspection shall also be supplied.

#### 6. GUARANTEE AND DEFECT LIABILITY:

- The guarantee shall be valid for twelve months after successful commissioning Or 18 months from the date of supply of equipment whichever is earlier. The contractor shall guarantee that all equipments shall be free from any defect due to the defective material and or bad workmanship and also the equipments shall work satisfactorily with performance and efficiencies not less than the guaranteed values.
- Any part found defective during this period shall be replaced free of cost by the contractor. The service of the contractor's personnel if required during this period shall be made available free of cost to the department.

- The contractor shall depute his representative within 36 hours of notification of the defect by the department.
- A joint report shall be prepared by the representative of department and firm regarding nature of defects and remedial action required. Time schedule for such action shall also be finalised.
- In case the contractor fails to depute his representative within 36 hours of notification of the defect or fails to cause remedial action within reasonable time as decided during joint inspection, the department may proceed to do so at the contractors risk and expenses and without prejudice to any other right.
- The manufacturer of Transformers and HT Switch Gears shall back up the above guarantee and a certificate to this effect from the respective manufacturers shall also be furnished.

#### 7. NOT COVERED UNDER GUARANTEE

- Consequential losses and damages.
- Parts subject to normal wear and tear such as Electrical contacts.
- Failure of parts due to the corrosive atmosphere.
- Consumables like oil, grease etc unless loss is due to the defective material or workmanship.

#### 8. TESTING AT SITE:

The firm shall carry out the following tests at site and submit record to Engineer-in-charge.

- Megger test between phases, neutral and earth.
- Earth resistance test at all Earth stations.
- Relay test and their setting.
- Functional test of all switch gears and circuit breakers.
- Ratio test of transformer.

#### 9. CO-ORDINATION WITH ELECTRICAL INSPECTOR

The firm shall coordinate and liaise with the Electrical Inspector/ Inspecting authority for timely inspection of the substation. The firm shall make appropriate arrangements including attending the points suggested by the inspector, successfully and to his satisfaction for getting a clear approval of the Inspector.

#### 10. CO-ORDINATION WITH KSEB- TMR UNIT.

The firm shall coordinate and liaise with the meter testing division of KSEB for timely calibration of metering equipment of the substation. The firm shall make appropriate arrangements including attending the points suggested by the KSEB meter testing Division, successfully and to his satisfaction for getting a clear approval.

#### **LIST OF MAKES FOR UNITIZED PACKAGED SUBSTATION**

TRANSFORMER : Kirloskar/ INTRANS

CT-PT UNIT.

INTRANS/ Biecco Lawrie/ Crompton/ Jyothi/ Voltas/ NGEF/ Kiloskar .or any other make approved by KSEB.

PIN/ DISC IINSULATOR

Jayashree/ Kiran/ Pactil/ Atlas .

AB SWITCH & DO FUSE

National/ Kiran/ pactil/ .

LIGHTNING ARRESTOR

Atlas/ GE/ Elaro/ LAMCO.

TOD Meter L&T or any make approved by KSEB.

CABLE ISI mark

SDF/ CONTACTOR

Seimens/ GE/ Schneider/ Havells/ L&T/ C&S  
ACB

L&T, Control& Switch gear/GE/ Siemens..

LBS

Intrans/Megawin/Kirloskar.

CAPACITORS

Crompton/ L&T/ GE/ Universal Electric.

APFC Relay

Syntron/ Beluke/ Crompton/ Trinity Electronics/ L&T.

LT CT Kappa/ L&T/ AE/ IMP/ MECO ..

AMMETER & VOLT METER

AE/ IMP/ Indotech/ Rishab/ Meco / Enercon..

FIRE EXTINGUISHER

ISI mark

RUBBER MAT

ISI mark

CABLE JOINT KIT

Raychem / M-seal / DENSON

## **SPECIFICATION FOR WETRISER SYSTEM FOR FIRE FIGHTING**

### **SECTION -1**

#### **I. GENERAL**

##### **1. Scope**

The general specifications cover the details of equipments, inspection as may be necessary before dispatch/ delivery at site, installation, testing and commissioning, and handing over in working condition of the Wet Riser System for fire fighting.

##### **2. Related documents**

In the event of any discrepancy between these specifications and inter connected contract documents the technical requirements as per the schedule of work shall be followed and deem to be having overriding value.

##### **3. Definition of terms**

The definition of terms is in accordance with the relevant Indian standards. The list of relevant Indian Standards is given in Appendix. I

##### **4. System engineering**

General: The Scope of Wet Riser System shall generally comprise the supply, installation, testing and commissioning of the following:-

- a) Electric motor driven fire pump.
- b) Diesel engine driven fire pump
- c) Pressurisation pump set.
- d) Water charged pipelines and air vessel(s).
- e) Yard hydrants and landing hydrants including landing valves, hose pipes, hose reels, branch pipe, nozzles.
- f) Electric power and control panel.
- g) All Cabling ( Power cable , control cable and Battery charging cable) with suitable size of copper conductor PVC sheathed armoured cable excluding cable from main LT panel to wet riser control panel .
- h) Earthing – Extending the earthing from the wetriser control panel to all equipments in the pump room as per Standards.
- i) Miscellaneous items like pressure switches, flow switches, turbine type alarm, level indicator, fire brigade connections etc.
- j) Minor building works.

##### **5. Locations and Requirements**

A. Underground Static Storage Tank and pump House:--

Following aspects shall be considered in deciding the location of the underground static water storage tank and the wet riser pump house:-

- a) Easy accessibility for fire fighting operations:
- b) Proximity of fire pump house to the static tank.

- c) Ease in bringing and removing equipment.
- d) Pump house not being prone to flooding by rain water or subsoil water:
- e) Protection of the pump house from any falling masonry and the like occasioned by fire:
- f) Adequate ventilation for engine aspiration and to limit the temperature rise in pump house on continuous operation:
- g) Aesthetics.

The pump house should preferably be located at least 6 m away from the building to be protected. Where this is not possible, this shall be enclosed with suitable masonry structure as a part of the building to prevent spread of fire into the pump room and provide safe operation.

The fire pump house should be located such that the suction for the pump is flooded. Where this is not practicable, the pump house may be constructed with negative suction for pumps, with suitable automatic priming arrangement. The size of the fire pump house should be 5.5mx 8mx 3.5m, where engine driven fire pump, electric motor driven fire pump, and pressurisation pump are installed.

The capacity and design of the static tank shall be in accordance with the provisions of National Building code part IV-Fire protection and the local Byelaws, as applicable.

**B.External piping and Hydrant:-** External hydrants shall be located within 2 to 15m from the building to be protected such that they are accessible and may not be damaged by vehicles. A spacing of about 40m between hydrants is generally adopted.

**C. The Wet Riser Shaft:-** The wet riser shafts shall be located on the following considerations:-

- a) Easy accessibility to the fire fighting personnel:
- b) Feasibility to cover the floor areas in the fire fighting operation, using standard hose reels of 2 Nos 15 m for water Jet.
- c) Segregated from electrical installations-Normally one riser for every 1000 sq.m or part thereof floor area in each floor is found to be adequate.

For multistoried building more than 24m high calling for more than one riser, additional width shall be suitably provided.

**D. Power Supply Arrangements:-** The provisions of National Building Code Part IV and the local by-laws, if any, shall be complied with in deciding the arrangement of electric power supply to the fire pump house. The feeder to the power and control panel in the wet riser pump house shall be controlled by a HRC fuse switch unit/circuit breaker with overload and short circuit protection, having a continuous current rating of 600% the full load current of the fire pump electric motor. The switch gear controlling the fire pump at the power and control panel in the wetriser pump house shall be continuously rated to at least 250% of the full load current of the fire pump motor, and with short circuit protection only, and without any overload protection. The feeds shall be independent, protected by a circuit breaker without under voltage/No volt protection.

## **6. Conformity with statutory Act, Rules Regulations, Standards and Safety Codes**

Indian Electricity Act and Rules. All electrical work in connection with installation wet riser system shall be carried out in accordance with the provision of Indian Electricity Act 1910 and the Indian Electricity Rules, 1956 amended up to date.

- i. **Indian Standards:** - The wet riser system equipment, materials, accessories and their installation shall confirm to relevant Indian Standards as listed in Appendix I amended up to date and also to the National Building Code part IV Fire protection. Certain requirements of NBC as abstracted are given in Appendix II.
- ii. **Fire Regulations:** - The installation shall be carried out in conformity with the local Fire Regulations and Rules there under where ever they are in force. Provisions in local bye-laws if any, shall be complied with.
- iii. **Other Acts and Rules-** The installation shall also comply with the following:
  - 1) Indian Petroleum Act, 1937 and Petroleum Rules, 1974 wherever applicable.
  - 2) Any other Acts or Rules in force.



### **7. Works to be arranged NGS:-**

- a) Unless otherwise mentioned in the tender specifications, the following works shall be carried out by NGS.
- b) Construction of pump house, underground tank for wet risers, terrace tank, and shaft for wet riser wherever required.
- c) Provision of 3 phase electric power for operation of small tools, welding sets etc. to the contractor free of charge.
- d) Provision of free storage space during the contract period. However locking as well as watch and ward arrangement shall be the responsibility of the contractor.
- e) Free water supply necessary for installation, testing and commissioning.
- f) Termination of the main cable from MV panel for electric power supply in the incoming switchgear of the power cum control panel of wet riser system.

### **8. Works to be done by the contractor: -**

In addition to the supply, installation, testing and commissioning of all equipments and materials as per schedule of work, the following works shall be deemed to be included within the scope of work to be executed by the contractor, whether or not indicated in the schedule of work.

- a) All minor building work, such as cutting and making good the damages, grouting of foundation, for equipment, support, for external hose cabinets, valves chambers etc.
- b) Provision of supports and clamps for equipments, pipes cables etc. and suitable concrete anchor blocks.
- i. Small wiring including inter-connection etc. necessary to comply with the regulations as well as proper and trouble free operation of the equipment inclusive of all accessories.
- ii. Tools and tackles required for handling and installation.
- iii. Necessary testing equipment for commissioning.
- iv. Watch and ward of equipment and materials and/or installation till their handing over to BSNL.
- v. Trench in ground for cables and water lines of wet riser installation including refilling.
- vi. Provision of earthing sets and loop earthing of equipments.
- vii. Approval from local Fire Authorities as may be required as per local bye-laws.

### **9. Site Conditions.**

All the equipment and their installation shall be suitable for the environmental condition encountered at the location.

### **10. Inspection of site and collection Data**

The Tenderer shall be deemed to have examined the tender documents, detailed specification, data etc., and relevant to have visited the site or ascertained all relevant details for offering suitable equipment and for installation work. He shall be fully responsible for the system suitable equipment and for installation work. He shall be fully responsible for the system design.

### **11. Inter Changeability**

All smaller equipment, materials, removable parts of similar equipment etc. shall be inter changeable with each other.

### **12. Information to be supplied by the tenderer.**

The tenderer shall furnish with tender, the schematic diagram of the installation proposed. Performance particulars including the specified overload performance, for the engine and electric motors and characteristic curves for the pumps shall be furnished with the offer. Any other data and technical particulars, printed pamphlets, test certificates, etc. considered necessary by them for proper evaluation of their offers shall also be given with the tender.

### **13. Completeness of the tender.**

All fittings, unit assemblies accessories, hardware foundation bolts, terminal blocks for connections, cable glands and miscellaneous materials and accessories of items of work which are useful and necessary for efficient assembly and working of the equipment shall be deemed to have been included within the scope of the work in the tender and within the overall details for complete item whether they have been specifically mentioned or not.

### **14. Data manuals and drawing to be furnished by contractor**

A. **After Award of work:** - The contractor shall submit the following drawings within a fortnight of the award of work, for approval by the Engineer in charge.

- a) General arrangement drawing showing location of fire pump, pressurisation pump, wet riser, air vessel, valves etc of the riser system complete with dimensions and clearances.
- b) Details of foundation for equipment and weight of assembled equipment.
- c) Piping schematic.
- d) Control and protection schematics, wiring diagrams and control wiring diagrams showing the sequence of operation.
- e) Details of external and internal hydrants and their installation.
- f) Details of masonry works such as valve chamber, hose cabinet support etc.,
- g) Bar Chart indicating general program for supply, installation, testing and commissioning and handing over and also the related works to be done by other agencies to ensure timely completion.
- h) Any other drawing or data that may be necessary for the work.

B. The above drawing shall be furnished in 3 sets to the Engineer in charge. One set will be returned with comments and approval. The drawings shall be modified incorporating the modification indicated by the department and 5 sets of corrected Drawings shall be given in 15 days time.

C. Before Commencement of Installation: - The contractor shall also furnish 3 copies of detailed installation, operation and maintenance manuals of manufacturers for all items of equipment together with all relevant data sheet, spare parts catalogue, repairs assembly and adjustment procedure etc.

#### **15. Quality of Materials and Workmanship.**

All parts of equipment shall be of such design, size and material as to function satisfactorily under all rated conditions of loading and operation. All components of the equipment shall have adequate factor of safety. Materials/Components which are not covered by standards laid down by Indian Standard Institution shall be got approved from the Engineer in charge before use on the work.

The entire work of fabrication assembly and installation shall conform to sound engineering practice and on the basis of "fail safe" design. The mechanical parts subjects to wear and tear shall be of easily replaceable type.

The construction shall be such as to facilitate ease of operation, inspection, maintenance and repairs. All apparatus shall also be designed to ensure satisfactory operation under working condition as specified.

All connection and contacts shall be designed to minimise the risk or the accidental short circuit caused by animals, birds, and vermin. Surfaces that are in contact with oil shall not be galvanized or cadmium plated.

#### **16. Inspection, testing at Manufacturer's works**

The contractor shall furnish such facilities as will be necessary for inspection of the equipments before despatch at his or his associated works and also for witnessing such tests, as are done at the works, if so required by the Engineer in charge, and will also give sufficient notice regarding the dates proposed for such tests of inspecting agency.

#### **17. Test Certificates:**

Copies of all documents of routine and type test certificate of the equipment carried out at the manufacturer's premises shall be furnished to the Engineer in charge along with the supply of the equipment.

#### **18. Despatch of Materials and Storage:-**

The contractor shall commence work as soon as the drawing submitted by him is approved. The contractor should despatch all materials to site in consultation with the Engineer in charge where suitable lockable storage accommodation shall be made available to him temporarily. For this purpose the programme of despatch of materials shall be framed, keeping in view of the building progress so that suitable storage accommodation can be made available to the contractor. Safe custody of all machinery and equipment supplied by the contractor shall be his own responsibility till the final taking over by BSNL.

#### **19. Care of Buildings: -**

Care shall be taken, while handling/installing the equipment to avoid damage to the building. On completion of the installation, the contractor shall arrange to repair all damages to the building caused during installation so as to bring to the original condition. He shall also arrange to remove all unwanted waste materials from pump room and other areas used by him.

#### **20. Painting and Protection:-**

All equipment supplied shall be given final coat of paint over the primer after necessary treatment at the work before despatch. All damages to painting during transport and installation shall be set right or repainted to the satisfaction of the Engineer in charge before handing over.

**21. Completion Drawings:-**

Three sets of completion drawings comprising the following drawings shall be submitted by the contractor while handing over the installation.

- a) Equipment installation drawings giving complete details of the entire equipment.
- b) Electrical and control wiring drawings for the entire Electrical equipment showing cable sizes equipment capacities, switch gears rating, control components, control wiring etc.
- c) Schematic diagram of the entire installation.

**22. Final Inspection and Testing:-**

When the installation is complete, the agency shall arrange with the engineer in charge/Inspector for inspection and testing of the installation, test results obtained shall be recorded and installation shall not be accepted until the Engineer in charge/Inspection Officer is satisfied about its compliance with the requirement of these specifications. It shall be the responsibility of the contractor to get the installation inspected and passed by the local authorities concerned, as may be required by the local bye laws, including payment of necessary inspection fee.

**23. Guarantee:-**

Certifying the contractor shall guarantee the entire wet riser installation as per specifications. All equipment shall be guaranteed for one year from the date of acceptance against unsatisfactory performance or break down due to defective design, manufacture and installation. The installation shall be covered by the conditions that whole installation or any part therefore defective within one year from the date of taking over shall be replaced or repaired by the contractor free of charges decided by **NGS**. The warranty shall cover the following:-

- a) Quality, strength and performance of materials used.
- b) Safe mechanical and electrical stress on all parts under all specified conditions of operation.
- c) Satisfactory operation during the maintenance period.
- d) Performance figures and other particulars as specified by the tenderer under schedule of guaranteed technical particulars.

**24. After sales services: -**

The contractor shall ensure adequate and prompt after sales service in the form of maintenance personnel and spares as and when required with a view to minimizing the breakdown period. Particular attention shall be given to ensure that all spares are easily available during the normal life of the installation.

**The firm shall provide free maintenance for 12 months from the date of successful acceptance testing.** This shall include four periodical inspections. During these visits, the firm shall inspect the system, adjust necessary controls if required and satisfy the Engineer in charge that the system is in working condition.

The security deposit withheld by **NGS** will be released after four successful visits by the firm during maintenance and guarantee period of 12months. **5 percent** of the security deposit may be deducted for not performing each such visit.

The firm shall conduct functional test of the system by operating the equipments control relays etc. during quarterly periodical inspection visits. The functional test conducted during such visits shall be done in the presence of the Engineer – in-charge. The report thereafter shall be jointly signed.

## SECTION-2

### FUNCTIONAL REQUIREMENTS

**Scope: -**

The section covers the detailed functional requirements of the wet riser system, including the associated components viz, pressurization pump.

- 1) Normally one electric pump and one diesel pump will be installed in the pump house. Where standby diesel generating set of adequate capacity is available, or where duplicate electric supply from two independent sources is available, the provision of diesel engine driven pump set may be dispensed with; and an additional electric motor pump set may be provided, with the approval of the local authority.
- 2) The pump shall only be direct coupled to the prime movers.
- 3) There shall be a test valve, operation of which will simulate the operation of the Landing valve/ External Hydrant. This will enable testing the healthiness of the equipment, availability and its control. Where the wet riser pump is situated below ground level the test valve shall be located outside the pump house.
- 4) Operation of test valve or operation of any yard or landing hydrant shall initiate, through fall of water pressure to a pre-set value in the system (about 1kg/cm<sup>2</sup>), operation of fire pumps in the sequence indicated in section 2, sl no. 7 (Operating sequence), provided the control panel status for both the fire pumps is at "automatic" position.
- 5) An electric pressurization pump shall be installed in the fire pump house, to re-pressurise the system automatically due to gradual fall in the wet riser as a result of any leakage.
- 6) The pressurization pump shall automatically start, when set to auto-status, when the water pressure in the wet riser system falls to a pre-set value (about 0.35 kg/cm<sup>2</sup> below the normal system pressure) and shut down when the system pressure reaches the set value. Both the limits shall be adjustable on the appropriate controls in the pump room.
- 7) Operating sequence:**
  - a) First the electric fire pump will start by the sudden fall of pressure in the system due to operation of the pressure switch and feed the water to the system.
  - b) If within a pre-set period the electric pump has not come up to speed and the pump has not started pumping water, the control system shall shut down the electric pump and initiate the start up of the standby pump. The main electric pump shall then be locked out. The above sequence shall also operate if water is not pumped due to any reason such as failure of electric supply.
  - c) Should the electric fire pump fail during operation, the adjustable timer shall initiate start up of the standby diesel pump and lock out the electric pump. An audiovisual alarm shall also be given.
  - d) If within a preset period the standby pump fails to start or fails to develop adequate pressure, the control system shall shut down the standby pump and lock it out and give an audiovisual indication to that effect as the control panel.
- 8) Automatic pressurization pump where provided shall be shut down automatically when the fire pump, electric or diesel, is operating. Necessary integration of pipe work and controls shall be provided for the purpose. A timer may be employed where necessary to distinguish between slow fall of pressure due to system leaks and sudden fall of pressure due to fire duty by opening of valves and thus prevent parallel start up of both pressurization and fire pumps.
- 9) The power and control panel for the system shall incorporate the following functional requirements.**
  - a) The control panel shall have status selection, for each of the pumps for "automatic" as well as 'manual' operation.
  - b) Pumps when under 'manual' status shall be operated manually through relevant push buttons.

- c) The fire pumps once started shall not be stopped automatically except due to low water level in the underground storage tank.
- d) The fire pumps shall be locked out for operation both for 'manual' & 'automatic' operations, once the low water control operates and furnish an audio and visual alarm on the panel. The audio alarm can be silenced by accepting the alarm. The visual alarm shall be individual for each equipment. It shall be flashing type and on acceptance remain steady. A reset button shall be provided for each pump for returning the pump for fire duty.
- e) Overload or under voltage/no volt trip devices for electric fire pump shall not be provided in the starter. Tell-tale lamps to indicate the availability of power shall be provided.
- f) Once tripped, the electric fire pump shall remain locked out for operation irrespective of the position of its operational status selection switch. Lock out indication shall be available on the panel.
- g) Return to normal operation availability shall be feasible only by manual re-set of locked out units by operation of appropriate push buttons.
- h) When fire pumps are brought into operation an audible tone from turbine type alarm operated by water flow in the mains shall be provided to indicate the healthiness of the system. The healthy running alarm shall not be silenced till the fire pump is shut down, but the tone may be mellowed by the operator if required. Alarm for failure and lock out of any pump shall be distinct from 'healthy' alarm Failure alarms shall be loud and can be silenced on acceptance.
- 10) Terminal facilities for repeat indication of various audio and visual indications on a slave panel at a remote location shall be available.

### SECTION 3

#### ELECTRIC FIRE PUMP

##### 1. Scope

This section covers the details of requirements of the motor, starter and pump for the electrically operated fire pump.

##### 2. General

The electric fire pump shall be suitable for automatic operation complete with necessary electric motor and automatic starting gear, suitable for operation on 415 volts, 3 phase, 50 HZ A.C system, Both the motor and the pump shall be assembled on a common bed plate, fabricated MS channel type.

##### 3. Drive

The pump shall be only direct driven by means of flexible coupling. Coupling guard shall also be provided.

##### 4. Fire pump

a) The fire pump shall be horizontal split casing centrifugal type. It shall have a capacity to deliver 2280 lpm as specified, developing adequate head so as to ensure a minimum pressure of 3.5 kg per sqcm at the highest and the farthest out let. The delivery pressure at pump outlet shall be not less than 7kg per sqcm in any case. The pump shall be single stage or multistage as specified.

b) The pump shall be capable of giving a discharge of not less than 150% of the rated discharge at a head of not less than 65% of the rated head. The shut off head shall be within 120% of the rated head.

c) Bearing of the pump shall be effectively seated to prevent loss of lubricant or entry of dust or water.

d) The pump shall be provided with a plate indicating the suction lift, delivery head, discharge speed and number of stages.

e) The pump casing shall be designed to withstand 1.5 times the working pressure.

##### 5. Motor

The motor shall be squirrel cage A.C induction type suitable for operation on 415 volts 3 phase 50 Hz system. The class of insulation shall be B. The synchronous speed shall be 1500 RPM as specified. The motor shall be rated for continuous duty and shall have a horse power rating necessary to drive the

pump at 150 percent of its rated discharge with at least 55 percent rated head. The motor shall conform to I.S 325-1978.

## SECTION 4

### DIESEL FIRE PUMP

#### 1. Scope

This section covers the details of requirements of the standby fire pump, operated by a diesel engine.

#### 2. General

The diesel pump set shall be suitable for automatic operation complete with necessary automatic starting gear, for starting on sealed maintenance free battery system and shall be complete with all accessories. Both engine and pump shall be assembled on a common bedplate of minimum 4mm thick fabricated mild steel channel type.

#### 3. Drive

The pump shall be only direct driven by means of a flexible coupling. Coupling guard shall also be provided. The speed shall be 1500 RPM as specified.

#### 4. Fire Pump:

a) The fire pump shall be horizontal split casing centrifugal type. It shall have a capacity to deliver 2280 lpm as specified, developing adequate head so as to ensure a minimum pressure of 3.5 kg. Per sqcm at the highest and the farthest outlet. The delivery pressure at the pump outlet shall be not less than 7 kg. per sq.cm. in any case. The pump may be single stage or multi stage as specified. The pump shall be capable of giving a discharge of not less than 150% of the rated discharge at a head of not less than 65% of the rated head. The shut off head shall be within 120% of the rated head.

b) The pump casing shall be of cast iron to grade FG 200 to IS 210 and parts like impeller shaft sleeve, wearing-ring etc. shall be of non-corrosive metal like bronze/brass/gun metal. The shaft shall be of stainless steel.

c) The pump shall be provided with mechanical seal.

d) The pump casing shall be designed to withstand 1.5 times the working pressure.

e) Bearings of pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water.

#### 5. Diesel Engine

a) **Environmental conditions**-The engine shall be required to operate under the conditions of environment at site.

b) **Engine Rating**- The engine shall be cold starting type without the necessity of preliminary heating of the engine cylinders or combustion chamber (for example, by wicks, cartridge, heater plugs etc). The engine shall be multi cylinder/vertical 4 stroke cycle, water-cooled, diesel engine, developing suitable HP at the operating speed specified to drive the fire pump. Continuous capacity available for the load shall be exclusive of the power requirement of auxiliaries of the diesel engine, and after correction for altitude, ambient temperature and humidity for the specified environmental conditions. This shall be at least 20% greater than the maximum HP required to drive the pump at its duty point. It shall also be capable of driving the pump at 150% of rated discharge at 65% of rated head. The engine shall be capable of continuous non-stop operation for 8 hours and at least 3000 hours of operation before major overhaul. The engine shall have 10% overload capacity for one hour in any period of 12 hours continuous run.

The engine shall accept full load within 15 seconds from the receipt of signal to start. The diesel engine shall conform to BS 649/IS 1601/IS 10002: all amended upto date.

c) **Engine Accessories**- The engine shall be complete with the following accessories:-

- i. Fly wheel dynamically balanced.
- ii. Direct coupling for pump and coupling for pump and coupling guard.
- iii. Radiator with hoses, fan, water pump, drive arrangement and guard.
- iv. Corrosion Resister.
- v. Air cleaner, oil bath type/Dry type.
- vi. Fuel service tank support semi-rotary pump and fuel oil filter with necessary pipe work.
- vii. Pump for lubricating oil and Lub oil filter.

- viii. Sealed maintenance free starting battery (2x12V)
- ix. Residential type Exhaust silencer with necessary pipe work extended up to outside of the pump house.
- x. Governor
- xi. Instrument panel housing all the gauges, including Tachometer, hour meter and starting switch with key (for manual starting).
- xii. Necessary safety controls.
- xiii. Winterisation arrangement, where specified.

Fuel tank shall be of welded steel construction (3mm. Thick) and of capacity sufficient to allow engine to run on full load for at least 12 hours. The tank shall be complete with necessary floor mounted supports, level indicator (protected against mechanical injury) inlet, outlet, overflow connections and drain plug and piping to the engine fuel tank. The outlet should be so located as to avoid entry of any sediments into the fuel line to the engine.

Semi rotary hand pump for filling the daily service tank together with hose pipe 5 mtr. Long with a pot valve etc, shall also form part of the scope of work.

#### **6. Starting system-**

The starting system shall comprise necessary batteries (2x12v), 24 volts starter motor of adequate capacity and axle type gear to match with the toothed ring on the fly wheel by metallic relay protection to protect starting motor from excessively long cranking runs suitably integrated with engine protection system shall be included within the scope of the work.

The capacity of the battery shall be suitable for meeting the needs of the starting system. (2 Nos 180 AH sealed and maintenance free battery)The battery capacity shall be adequate for 10 consecutive starts without recharging with cold engine under full compression. The batteries should be installed on a suitable size of MS angle iron stand

The Battery charger with boost and trickle charging facility ( constant current and constant voltage type) also with suitable stand.

The scope shall cover all cabling terminals, initial charging etc.

#### **7. Exhaust System:-**

The exhaust system shall be complete with silencer suitable for outdoor installation, and silencer piping including bends and accessories needed for a run of not more than 5 meter from the engine manifold. (Adjustment rates for extra lengths shall also be given). The total back pressure shall not exceed the engine manufacturer's recommendation. The exhaust piping and silencer shall be suitably clad with Fibre glass, wool, chicken wire mesh and Aluminum sheet.

#### **8. Engine shut down mechanism:-**

This shall be manually operated and shall return automatically to the starting position after use.

#### **9. Governing system:-**

The engine shall be provided with an adjustable governing to control the engine speed within 5% of its rated speed under all conditions of load upto full load. The governor shall be set to maintain rated pump speed at maximum pump load.

#### **10. Engine Instrumentation:-**

Engine instrumentation shall include the following:-

- i. Lub oil pressure gauge.
- ii. Lub. Oil temperature gauge.
- iii. Water pressure gauge.
- iv. Water temperature gauge
- v. Tachometer.
- vi. Hour meter.

The instrumentation panel shall be suitably resident mounted on the engine.

**11. Engine Protection Devices:-** Following engine protection and automatic shut down facilities shall be provided:-

- Low Lub oil pressure.
- High cooling water temp.
- High lub. Oil temperature.
- Over speed shut down.

**12. Pipe work:-** All pipe lines with fittings and accessories required shall be provided for fuel oil, lub oil and exhaust systems, copper piping of adequate sizes shall be used for Lub. Oil and fuel oil. M.S. piping shall be used for exhaust.

**11. Battery charger:-** Necessary float and boost charger shall be incorporated in the control section of the power and control panel, to keep the battery under trim condition. Voltmeter to indicate the state of charge of the batteries shall be provided.( for control panel battery)

## SECTION 5

### **AUXILIARY PUMPING EQUIPMENT**

#### **1. Scope**

This section covers the details of requirements of the auxiliary equipment necessary for the operation of the fire pump and the wet-riser system. Pressurisation pump shall be installed in all installations.

#### **2. General**

The pump shall be suitable for automatic operation complete with necessary electric motor and automatic starting gear, suitable for operation on 415 volts 3 phase 50 HZ, AC system. Both the motor and the pump shall be assembled on a common base plate, fabricated mild steel channel type or cast iron type.

#### **3. Drive**

The pump shall be directly driven from the electric motor. Flexible coupling and coupling guard shall be provided for pressurisation pump.

#### **4. Auxiliary pumps**

The discharge of the pressurisation pump shall be 10% of rated discharge of the main fire pump. The head at this discharge shall be about 90% of the main fire pump.

Pressurisation pump shall be horizontal split casing type, single stage or multi-stage as specified. The pump casing shall be of cast iron and parts like impeller, shaft sleeve, wearing ring etc. shall be of non-corrosive metal like bronze, brass or gun metal. The shaft shall be of stainless steel.

Bearings of the pump shall be effectively seated to prevent loss of lubricant or entry of dust/water. The pump casing shall be designed to withstand 1.5 times the working pressure.

#### **5. Motor.**

The motor shall be squirrel cage. A.C induction type suitable for operation on 415 volts 3 phase 50 HZ system. The class insulation shall be B. The synchronous speed shall be 3000 RPM as specified. The motor shall conform to IS 325-1978 and rated for continuous duty.

#### **6. Motor Starter**

The motor starter shall be automatic Star Delta type for motor of jockey pump and DOL type for motor of main pumps with overload trip, but without under voltage/no volt trip. An independent single phasing preventor shall be provided for each motor. The unit shall include ammeter of suitable range on the one line to indicate the current with current transformer as necessary. Starter shall conform to IS 1822-1967. The starter shall be integrated in the power and control panel for the wet riser system.



## SECTION 6

### PIPING FOR WET RISER SYSTEM

#### 1. Scope

This section covers the details of requirement of piping used in wet riser system, including the associated auxiliary equipment.

#### 2. General

The wet riser system piping shall comprise galvanised iron pipe work as specified, with necessary GI fittings and accessories. GI pipe with taraplast may also be used, where unavoidable to connect the underground piping system to the riser in the form of distant piece.

The wet riser piping system shall remain pressurised at all times during operation, and as such the piping work shall be carried out to withstand the same.

#### 3. Pipes and Pipe work

- i. G.I pipes and accessories, and fittings shall be of "Heavy class" conforming to IS 1239 part 1/1974 and part 11/1979, hot dip galvanised to Grade I as per IS 4736-1968.
- ii. G.I. pipes for automatic priming arrangement overflow, & drain connection shall be heavy class conforming to IS:1239 part I/1974 and part II/1979.
- iii. The pipe size shall be as specified. However, the size of the initial delivery pipe shall in any case not be less than the internal diameter of the delivery outlet of the pump. The suction pipe shall be sized such that the water velocity therein at rated pump discharge is not more than 90 m/min for negative suction and 100 m/min for positive suction arrangement.
- iv. The joint between a C.I pipe and a G.I pipe shall be of flanged type.
- v. Packing sheets between flanges shall be of rubber or asbestos compound and shall withstand test pressure of 1-1/2 times the working pressure in the pipe line.

#### 4. Air Vessel and Air Release Valve

Air vessel on top of the priming tank shall be fabricated of at least 8 mm thick steel to withstand the pressure, with dished ends and supporting legs. This shall be of 250 mm dia, 1.2 M high. This shall be complete with necessary flange connection to the piping and air release valve with necessary piping to meet the functional requirement of the system. The air vessel shall be of continuous welded construction and galvanised to I.S 4736-1968. This shall be tested for twice the working pressure.

#### 5. Valves, guages and orifice plates

- i. Sluice valves above 65 mm shall be of cast iron body and bronze/gunmetal seat. They shall conform to type PN 1.6 of IS 780-1980, valves up to 65 mm shall be of gunmetal construction. Valve wheels shall be of right hand type and have an arrow head engraved or cast thereon showing the direction for turning open closing.
- ii. Non return valves shall be of cast iron body and bronze/gunmetal seat. They shall conform to Class I of IS:5312 and have flanged ends. They shall be swing check type in horizontal runs and lift check type in vertical runs of piping. They shall not be spring loaded type.
- iii. Pressure gauge of suitable range shall be installed on the discharge side of each pump Vacuum gauge shall be provided on suction side for pumps with negative suction. The dial size shall be 150 mm. The guages shall be with necessary cocks.
- iv. Orifice plates shall be of 6 mm thick stainless steel to reduce pressure on individual hydrants to operating pressure of 3.5 kg/sq cms. Design of the same shall be given by the contractor as per location and pressure condition of each hydrant.

#### 6. External yard Hydrants.

- i. External Yard Hydrants shall be of "Stand Post" type conforming to IS : 908-1975 and comprise stand post for single outlet, duckfoot bend, flange riser and single headed brass/gunmetal valve conforming to type A of I.S 5290-1977.

ii. The stand post column shall be GI heavy grade. The internal diameter at the top shall be at least 80 mm.

iii. The outlet shall be angled towards ground, with instantaneous spring lock type gunmetal female coupling of 63 mm dia for connecting to hose pipe.

### **7. Internal Hydrants**

i. The internal hydrant outlet shall comprise “double headed double outlet gunmetal landing valve” conforming to type ‘B’ of IS 5290-1977. Separate valves one on each of the two heads shall form part of the landing valve construction.

ii. A cap with chain is provided on one head of the outlet which will have an instantaneous pattern female coupling for connecting to hose pipe, adapter on the other head for first lid hose reel connection.

iii. The landing valve shall be fitted to a Tee connection on the wet riser at the landing.

### **8. First Aid hose reel equipment**

i. First aid hose reel equipment shall comprise reel, hose guide fixing bracket, hose tubing globe valve, stop cock and nozzle. This shall conform to IS 884-1969 the hose tubing shall conform to IS:1532-1969.

ii. The hose tubing shall be 20 mm dia and 36.5 m long. The nozzle and globe valve shall be of 20 mm size.

iii. The fixing bracket shall be of swinging type. Operating instructions shall be engraved on the assembly.

### **9. Hose Pipes, branch pipes and nozzles**

a) Hosepipe.

i. Hose pipes shall be rubber lined woven jacketed and 63 mm in diameter. They shall conform to type 2 (Reinforced rubber lined) of IS 636-1979. The hose shall be sufficiently flexible and capable of being rolled.

ii. Each run of hose pipe shall be complete with necessary coupling at the ends to match with the landing valve or with another run of hose pipe or with Branch pipe. The couplings shall be of instantaneous spring lock type.

#### **b) Branch pipes:-**

Branch pipe shall be of copper, gunmetal or aluminum alloy 63 mm dia and be complete with male instantaneous spring lock type coupling for connection to the hose pipe. The branch pipe shall be externally threaded to receive the nozzle.

#### **c) Nozzle:-**

The nozzle shall be of copper or gunmetal, 20 mm in (internal) diameter. The screw threads at the inlet connection shall match with the threading on the branch pipe. The inlet end shall have a hexagonal head to facilitate screwing of the nozzle on to the branch pipe with nozzle spanner.

d) End coupling branch pipes, and nozzles shall conform to IS:903-1985.

e) Two hoses of 15m length with couplings shall be provided with each external (yard) hydrant. Two hoses of 7.5m/15m length, as specified, with coupling shall be provided with each internal hydrant. One nozzle and one branch pipe with coupling shall be provided with each yard hydrant and internal hydrant.

### **10. Hose Cabinet**

i. The hose cabinet to accommodate the hose, pipes, branch pipe nozzle and the hydrant outlets shall be fabricated from 1.6 mm thick sheet steel. In case of internal hydrants this shall accommodate the hose reel equipment also. This shall have lockable, centre opening glazed doors.

Where the niche for wetriser is provided with shutters, separate hose cabinet as above may be dispensed with. This shall be specified in the scope of work.

- ii. The scope of work includes provision of masonry or steel frame structure, as specified for installation.
- iii. The hose cabinet shall be painted red and stove enameled.

### 11. Fire Brigade inlet Connections

- i. One set of 4 way collector head Fire Brigade connection shall be provided near the gate or near the pump house, and individual wet risers as specified.
- ii. This shall comprise 4 instantaneous male inlet couplings, plugs and chains pump house and 2 way at other locations.
- iii. The inlet to the wet riser shall be with 150 mm dia sluice valve and non-return valve. The scope shall include necessary reducers, tees bends and special fittings as required.
- iv. Necessary enclosure of sheet metal with support shall be provided, as in the case of hose cabinets.

### 12. Hydraulic Siren

A siren shall be provided in the system, to indicate the flow of water in the wet riser system. This shall be turbine type.

## SECTION-7

### POWER AND CONTROL PANEL AND OTHER CONTROL COMPONENTS

#### 1. SCOPE

This section covers the detailed requirements of the power and the control panel for the wet riser system, and also for the various control components in the system.

#### A POWER AND CONTROL PANEL

##### Constructional Requirements

**a. General Features:-** The power and control panel shall be totally enclosed, free standing, floor mounted cubicle type, fabricated out of sheet steel not less than 2 mm thick. Where necessary, additional stiffening shall be provided by angle iron frame work. General construction shall be of compartmentalization and sectionisation such as mains incomer, electric fire pump, diesel fire pump, pressurisation pump and control, so that there is no mix up of power and control wiring and connections in the same sections as far as possible. The panel shall be front operated type with all connections accessible from the front. Front doors shall be hinged type. Back doors shall be hinged type or removable type for inspection. The door hinges shall be of connected type. The doors shall be provided with quick fixing doors knobs with indication. The general arrangement of the panel shall be got approved before fabrication. The cubicle construction shall be to IP 21 as per IS:2147.

**b. Cable entries and gland plates:-** All cable entries shall be through gland plates which are removable and sectionalised. Necessary compression type glands shall also be provided. Where heavy cables are brought and terminated, suitable clamps shall be incorporated to relieve the stress on the glands due to the weight of the cable. Cable entries may be from top or bottom depending on the equipment layout and cable scheme as approved.

**c. Busbar and Connections:-** The busbars shall be air insulated, and of aluminum of high conductivity electrolytic quality (grade E 91 E to IS:5082) and of adequate cross section. Current density shall not exceed 130 amps per sq.cm. All connections to individual, circuits from the busbars shall preferably be with solid connections. The busbars and the connection shall be suitably covered with PVC sleeves or colored in an approved manner. Busbars shall be suitably supported using non hygroscopic insulated supports such that they may stand 50 KA RMS symmetrical current for one second. High tensile bolts and spring washers shall be provided at bus bar joints.

**d. Earthing Arrangement:-** GI strip 25 mm x 5 mm shall be run at the rear of the board, bonding all the sections suitably. 2 Nos earth terminals shall be provided at the ends of the GI strip for connection to earth system. Earth terminals shall be with a flexible loop and the hardware shall be of G.I or passivated and plated iron. Necessary loop earthing for the equipment is also to be done by the contractor.

**e. Terminal Blocks and Small Wiring:-** Terminal blocks shall be of heavy duty type and generally not less than 15 amps 250 V grade upto 100 V and 600V grade for the rest of the functions. They shall be easily accessible for maintenance. All control wiring inside the panel shall be with PVC insulated copper conductor of 2.5 sq. mm size and 600 V grade conforming to IS: 694-1977. Suitable colour coding may be adopted. Wiring harness shall be neatly formed and run preferably function wise, and as far as possible segregated voltage wise. Identification ferrules shall be used at both ends of the wire.

**f. Instruments and lamps:-** All indication lamps and instruments shall be flush mounted type in front of the panel. The voltmeter and ammeters shall be of size 96 sq.mm conforming to clause 1.5 of IS.1248 for accuracy.

Current transformers shall be provided with ammeters, wherever necessary. Indicating lamps to indicate the availability of electric supply shall be provided at the incoming section. Necessary indication lamps for alarm indications and battery charging shall be provided in the respective sections.

All indicating lamps and voltmeter shall be protected with HRC cartridge type fuse.

**g. Labels:-** All internal components shall be provided with suitable identification labels suitably engraved labels shall be fixed at the panel for all switches, instruments, push buttons, indicating lamps etc.

**h. Painting:-** The entire panel shall be given a primer coat of red lead after degreasing and phosphating treatment, and 2 coats of final paint of approved shade before assembly of various items or alternately finished with electrostatic powder coating.

## 2) Equipment Requirements

**a. General:-** The power and control panel shall comprise individual section for the various equipments of the system and controls, in a combined cubicle type design. Where particularly specified, totally independent panels for each equipment shall be provided in cubicle design, and the main electric panel and the individual panels in such a case shall incorporate isolating arrangement of appropriate capacity. All switch fuse/fuses switch units shall be to AC 23 duty to IS:4064.

**b. Incomer Section:-** The incomer section shall comprises the followings and accommodate in their respective compartments as detailed in sub head ( c ),(d),(e),(f) &(g)-

- i) Switch Fuse unit with HRC fuses, ammeter, voltmeter, selector switch, set of phase indication lamps and fuses. (Fuse rating to suit consideration (iii) below)
  - ii) Aluminium busbars.
  - iii) SFU/TP & N outgoing switch fuse unit with HRC fuses for electric fire pump. (Fuse rating to take continuously 250% of full load current of fire pump motor).
  - iv) SFU/TP & N outgoing switch fuse units with HRC fuses for pressurisation pump and for local lighting control.
  - v) SFU/TP & N switch fuse unit with HRC fuses for Battery charger unit control.
  - vi) SFU/TP&N with HRC fuses for priming pump
  - vii) SFU/TP & N switch fuse unit with HRC fuses outgoing (spares, as specified).
- Lot:- Terminal blocks, inter-connections, label etc, as necessary.

### **c. Electric Fire pump section:-**

This section shall incorporate the following facilities.

- i. SFU/TP & N isolator.
- ii. Control system components and equipment such as relays, contactors, timers etc., for automatic operation.
- iii. Starter Unit, Current Transformer and ammeter.
- iv. Indication lamps, their fuses, terminal blocks, pushbuttons, control and selector switches etc., as required.
- v. Pump lock out devices due to faults or abnormalities as specified.
- vi. Visual/audio alarms indications and communication facility as specified.
- vii. Necessary inter-connection control and power cable work: cable glands lugs and internal wiring and connection etc.

**d. Engine section:-** The engine section shall incorporate the following facilities:-

- i. Control system components and equipment such as relays, contractors, timers etc., for automatic operation.

- ii. Instruments, indicator lamps, fuses, terminal blocks, push buttons, control and selector switches as required.
- iii. Engine shut down and block out devices due to faults or abnormalities as specified
- iv. Visual/ audio alarms indications and annunciator facility as specified.
- v. Inter-connection control and power cable work, cable glands, lugs all internal wiring and connections etc.,

**e. Auxiliary pump Sections:-** Each of the auxiliary pump section for pressurisation pump shall incorporate the following:-

- i. SFU/TP & N isolator.
  - ii. Control system components such as relays, timers, contactors, etc as are necessary for functional requirements.
  - iii. Starter unit, current transformer and ammeter.
  - iv. Indication lamps fuses, terminal blocks, push buttons, selector switch etc as required.
  - v. Inter-connections, power and control cable work, cable glands, lugs, internal wirings and connections.
- f. Priming pump section :-** SFU and its controls

**g. Control Section:-**

This section shall incorporate the following:-

- i. Control components integrating the various sections, so as to satisfy the functional requirements.
- ii. Battery charger unit with boost/float charge facility with voltmeter, capable of independently charging 2 sets of batteries at a time.
- iii. Visual/Audio alarms, not covered in individual sections.
- iv. Lamps healthy test facility
- v. Instruments, indicating lamps, push buttons, fuse terminal blocks etc, as are required.
- vi. Test facility to simulate operation of hydrant.

## **B. OTHER CONTROL COMPONENTS**

### **1) Pressure Switch**

Pressure Switches shall be provided for switching on and off the pressurisation pump at preset pressure and also for switching on the fire pump at preset pressure. Being the main component for initiating the signal for the operation of the pumps the pressure switches shall be totally reliable, sturdy in construction and of long life. The pressure settings shall be adjustable.

### **2) Low water level indicator and switch.**

To prevent the dry running of fire pumps due to emptying of the static tank, a water level indicator and switch shall be provided. This shall trip the electric motor or stop the diesel engine, as the case may be when the water level goes below a preset level. This shall also furnish a distinct low water level audio visual alarm. This should indicate the level of water at different stages in the power and control panel.

### **3) Power supply for controls**

In order to ensure that the control system remains operational at all times, the control system shall be designed for 24 V DC operation, fed from 24 V sealed maintenance free battery. This shall be independent of the starting battery for the engine i.e. battery shall remain trickle charged at all times from the common battery charger at the control section. Alternatively, maintenance free battery can be used.

## **SECTION 8**

### **ELECTRICAL WORK AND EARTHING**

#### **1. Scope**

This section covers the detailed requirements of electrical works including earthing for the wet riser installation.

2. Electric power supply shall be terminated in the incoming switch gear of the power and Control Panel by **NGS**. All further connection to the various components of the wet riser system shall be the

responsibility of the contractor, for a complete and working system, satisfying all the functional requirements.

3. The scope shall particularly include the following.

a. Power and Control panel(s)

b. All inter-connections with multi-core armoured copper cables of size as approved between various control units and control panel(s).

c. All power cable connections with multi-core armoured aluminium cables of size as approved between panels, motors etc., either clamped on wall, run on cable trays or laid in duct etc., as the case may be. Trays clamps, supports and all labour shall be inclusive within the quoted cost.

d. Necessary loop earthing.

e. The work shall be carried out conforming to CPWD General Specifications for Electrical work part I (Internal) 1972 amended upto date and Part II(External) 1974 amended up to date.

## SECTION 9

### INSTALLATION AND TESTING

#### 1. SCOPE

This section covers the requirements of installation of the various components of the wet riser system.

2. A Survey of the site of work shall be made by the contractor before preparation of the detailed drawing for submission to the Engineer in charge for approval. The installation shall be carried out strictly in accordance with the approved drawing.

3. The scope of installation work shall include the following, whether or not expressly mentioned in the schedule of work:

i. Cement concrete (1:2:4 mix) foundation for all pump sets.

ii. Vibration isolation arrangement for all pump sets.

iii. Filling up the hole in flooring with cement concrete, after laying the wet riser pipes.

iv. Necessary supports for pipes in the Wet riser pump room.

v. Necessary supports and clamps for wet riser plumbing inside the building.

vi. Supporting bracket/frame work for the fuel oil tank of the engine.

vii. Excavation of the earth, consolidation and refilling after laying of wet riser piping .

viii. Provision of necessary brick base or intermediate supports, as required in approved manner in case of soils which are not strong enough to support the pipe, thereby likely to cause differential settlement.

ix. Necessary anchor block of ample dimensions in 1:2:4 cement concrete at all bends, Tee connections, foot of the wet riser and other places as required to stand the pressure thrusts in pipes.

x. Necessary masonry work/ steel work for supporting hose cabinets near external (Yard) hydrants.

xi. Valve chambers of approved design with external (yard) hydrants as per item in schedule.

xii. Ground level hydrants of approved design, where specified.

xiii. Cutting and making good the damages for the installation work of the wet riser system.

xiv. Strainers and foot valves for pumps with negative suction, and strainers for pumps with positive suction.

xv. All the required control piping, exhaust piping from engine, oil piping for fuel oil and lubricating oil for the engine, drain piping from the pumps to the drain point in the pump room, overflow piping from priming tank to the sump. The piping work shall include all necessary fittings, valve and accessories for effective functional requirements.

xvi. Inter-connecting cable work with controls, control panel, batteries etc. including battery leads.

xvii. Orifice plates at individual hydrants, as required.

#### 4. Pipe work associated with diesel engine.

i. Pipe works for fuel system oil system and exhaust system shall be complete with all necessary fittings and accessories and all required supports. clamps hangers etc. for a complete work.

ii. Fuel feed is by gravity and the fuel tank shall be located at least 60 cm above the fuel injection pump.

iii. Fuel pipe of copper shall not be soldered but brazed or welded.

iv. No valves or cocks shall be provided in the fuel feed line to the engine from the fuel tank.

v. Precautions shall be taken to prevent any air locks in any part of the fuel system. No air relief cock shall be permitted and where inescapable, screwed plugs shall be provided for the purpose.

The installation of the fuel supply system shall be such that a completely primed condition is maintained, free from air lock.

vi. Filters shall be provided in fuel and lube oil circuits at locations that are easily accessible for maintenance.

### 5. Wet riser Pipe work:

1. The suction line for each pump shall be independent
  2. No sluice valve shall be provided in suction line, where the pump is located above the water level in the sump: foot valve and strainer shall however be provided
- Sluice valve shall be provided in suction line, where the pump is located below the water level in sump; strainer at the suction end shall be provided.
  2. Each external (Yard) hydrant shall be controlled by a sluice valve at ground level.
3. Sluice valve and non return valve shall be provided at the ground floor level for each vertical riser.
5. Sluice valves shall be kept in open position and the scope of work includes provision of necessary leather strap and pad lock: so as to prevent unauthorised closing of valve.
6. The installation work includes provision of all clamps, supports anchors etc., Spacing between vertical supports shall not exceed 1.5m clamps shall be provided on either side of the Tee joints for internal hydrants. Necessary anchors/thrust pads shall be provided as approved at locations of bends, Tees etc. as required, within the scope of work.
7. Under ground pipes of the wet riser system shall be laid 1 m below ground level and at least 2m away from the face of the buildings. The run of piping shall be preferably along roads and foot-paths and shall not be under building. Where specifically indicated to cross buildings, these shall be laid in masonry trenches with removable covers (trenches and covers to be made by NGS) with cut off valves at the entry and exit points.
8. Where provision of G.I pipe below ground become inescapable as indicated in 6.1, it shall be protected from soil corrosion by two coats of coal tar hot enamel paint and 2 wraps of reinforced fibre glass tissue or bitumenised hessian.
9. Each CI pipe/ G.I pipe shall be subjected to hydraulic pressure test before installation, in presence of the Engineer-in-Charge or his authorised representative.
10. External(yard) hydrants shall be located to have the outlet at about 1 m above ground level.
11. External(yard) hydrants shall be located at least 2m away from the face of the buildings but not more than 15m and shall be accessible.
12. Where external hydrants below ground level are specifically indicated in tender specifications, they shall be enclosed in masonry or cast iron structure of size 75 cm square and 8 cm above ground level. The hydrants shall be within 8 cm from the top of the enclosure.
13. Necessary facility for draining the riser pipe shall be provided at ground floor level with 40mm size sluice valve.
14. Internal hydrants at each floor shall be located at about 1 m above floor level.
15. Valve chambers shall be of least 1 m square metre in size, with cover as per item in Schedule.

### 6. Hoses and Hose cabinets

- a) All hose shall be numbered and a record submitted with completion plan. The number and length shall be easily recognizable on each hose pipe.
- b) External hose boxes shall be installed such that the hose is not exposed to sun rays.

### 7. Painting

- a) Painting of the entire wet riser piping over the Ground shall be done with an anti corrosive primer and 2 coats of approved paint. The colour shall be red to shade No.536 of Is. 5/1961. Paint shall conform to IS 2932/1964.
- b) The pumps and engine shall be painted after installation with a coat of approved paint to similar shade as per original supply.

### 8. Testing of the system

- 1) After laying and jointing, the entire piping shall be tested to hydrostatic test pressure. The pipes shall be slowly charged with water so that the air is expelled from the pipes. The pipes shall be allowed to stand full of water for a period of not less than 24 hours and then tested under pressure. The test pressure shall be at least 1.5 times the operating pressure. The test pressure shall be applied by means of manually operated test pump or by a power driven test pump to be provided by the contractor. In either case precautions shall be taken to ensure that the required test pressure is not exceeded.
- 2) The open end of the piping shall be temporarily closed for testing.
- 3) Test shall be conducted on each pump set after completion of the installation with respect of delivery head, flow and B.H.P. The test shall be carried out by the contractor at his own cost except for water and electricity which shall be provided by **NGS** free.

4) All leaks and defects in different joints noticed during the testing and before commissioning shall be rectified to the satisfaction of engineer-in-charge.

5) Testing of fittings/equipments shall be carried out either at site or at works in the presence of the representative of the Engineer in charge. Test certificates shall also be furnished by the contractor. The contractor shall facilitate inspection at the factory of the equipment by BSNL officials.

6) The automatic operation of the system, for the various functional requirements and alarms as laid down in this specification shall be satisfactorily carried out in the presence of the Engineer-in-charge.

Necessary trained manpower and equipment for testing by the **NGS/Consultant** officials shall be provided for all tests. After physical completion of the installation, the whole system shall be tested in accordance with the operational requirements in the presence of the Engineer in charge or his representative. Results obtained shall be recorded and submitted to the Engineer in charge in prescribed forms as per IE rules. Subsequently the whole installation shall be got inspected and passed by the local authorities as required. Necessary fees shall be paid by the firm.

Generally besides ascertaining the adequacy of sizes for the switch gears like current carrying capacity, rupturing capacity, voltage range, rigidity of supports etc. the following test shall be carried out.

Light power control wiring	: continuity, polarity, earth continuity and installation
Cables	: Installation, continuity before and after laying with suitable rated Megger.
Switch gears	: functioning, rigidity of contactors safety interlocks and fuse ratings.
Relays, cutouts and meters	; Settings, contacts. The safe operating zones and unsafe operating zones may be indicated.
Earthing	: Earth resistance values for individual and total system.

**Approval by local bodies**

***It shall be the responsibility of the contractor to obtain the approval of drawings and to get the installation inspected and passed by the concerned agencies, as may be necessary as per local bye laws.***



## APPENDIX I

**LIST OF INDIAN STANDARDS**

- |  |                     |
|--|---------------------|
| 1) Three phase induction motors (fourth revision)<br>(With Amendment No. I)  | IS: 325-1978        |
| 2) Specification for fire fighting hose (rubber lined or rubberized<br>fabric lined woven jacketed) (second revision)                                | IS: 636-1979        |
| 3) PVC insulated cables for working voltages upto and including<br>1,100 volts(second revision)(with Amendment No.1)                                 | IS:694-1977         |
| 4) Copper alloy gate, globe and check valves for water works<br>purposes(third revision)   | IS:778-1980         |
| 5) Sluice valves for water works purposes(50 to 300 mm) size   | IS: 780-1980        |
| 6) Specification for first-aid hose reel for fire fighting<br>(for fixed installation)(with Amendment No.1)  | IS:884-1969         |
| 7)Code of practice for installation and maintenance of induction<br>motors(revised)(with Amendment No.I)   | IS:900-1965         |
| 8). Specification for couplings, double male and double<br>female, instantaneous pattern for fire fighting (second revision)<br>(with AmendmentNo.1) | IS:901-1975         |
| 9). Specification for fire hose delivery couplings branch pipe<br>nozzle and nozzle spanner(second revision) (with<br>Amendments Nos.1 to 3)         | IS:902-1974         |
| 10. Specification for fire hose delivery couplings branch pipe<br>nozzles and nozzles spanner(second revision)<br>(with Amendments No 1 to3)         | IS:903-1975         |
| 11. Specification for two way and three way suction collecting<br>heads for fire Fighting purposes(revised) (with<br>Amendments Nos 1& 2)            | IS:904-1965         |
| 12. Specification for delivery breachings, dividing and collecting<br>Instantaneous pattern, for fire fighting purposes(second revision)             | IS:905-1980         |
| 13. Specification for branch with revolving head for fire fighting<br>Purposes(second revision)  | IS:906-1972         |
| 14. Specification for suction strainers cylindrical and shoe type, for<br>Fire fighting purpose (revised)(with Amendment No.I)                       | IS:907-1975         |
| 15. Specification for fire hydrant, stand post type (second revision)  | IS:908-1975         |
| 16. Specification for underground fire hydrant, sluice valve type<br>(second revisions)(with Amendment Nos 1 to 4)                                   | IS:909-1975         |
| 17. Specification for washers for water fittings for fire fighting purpose<br>(revision) (with Amendment No.I)                                       | IS:937-1965         |
| 18. Mild steel tubes, tubular and other wrought steel fittings<br>Part I mild steel tubes (fourth revision)<br>(with Amendment No.1)                 | IS:1239(Part I)1979 |

Part II	IS:1239 (Part II)1969
19. Direct acting electrical indicating instruments (first revision) (with Amendments Nos 1 to 4)	IS:1248-1968
20. Horizontal centrifugal pumps for clear cold, fresh water (second revision)	IS:1520-1980/9137
21. 1960 serge blue, worsted (superceded by IS:2319). Serge (second revision) (with Amendment No.I)	IS:2319-1978
22. Vertically cast iron pressure pipes for water, gas and sewage (first revision)(with Amendment Nos 1 to 3)	IS:1537-1976
23. Cast iron fitting for pressure pipes for water, gas & sewage (second revision) (with Amemdment Nos 1 to 4)	IS:1538-1976
24. PVC insulated (heavy duty) electric cables For working voltages up to and including 1100 V (second revision) (with Amendment Nos 1 to 3)	IS:1554(Part I) 1976
25.A performance of constant speed internal combustion engines General purposes size A4	IS:16011-1960
26. Code of pratice for fire safety of buildings (General) Fire Fighting equipment and its maintenance (with Amendment NO 1)	IS:1648-1961
27. Degrees of protection provided by enclosures for low voltage Switch gear and control gear	IS:2147-1962
28. Methods of sampling and test (Physical and chemical) for water Used in industry(with Amendments Nos. 1 to 3)	IS:3025-1964
29. Pressure and vacuum gauges (first revision)	IS:3624-1979
30. Code of practice for installation of internal fire hydrants in Multistorey buildings	IS:3844-1966
31. Air brake switches, air break disconnectors, air break switch Disconnectors and fuse combination units for voltages not exceeding 1000V AC or 1200 V DC General requirements (first revision)	IS: 4064 IS: 4064(Part I)1978
32. Determination of particle size of powder by air elutriation methods	IS:4691-1968
33. Hot-dip zinc coating on steel tubes(with Amendment No 1)	IS:4736-1968
34. Wrought aluminum and aluminum alloys, bars, rods, tubes and sections for electrical purposes(with Amendment No 1)	IS:5082-1969
35. Specification for landing valves (first revision) (with Amendments No.1 and 2)	IS:5290-1977
36. Swing check type reflux (non return) valves part-I single door pattern (with Amendment Nos 1 and 2)	IS:5312(Part I)1969
37. Hydrant, stand-pipe for fire fighting (with Amendment No.1) CPWD –5(a)	IS:5714-1970
38. Direct-on-line AC starters	IS: 8544(Pt.I)1977
39. Star Delta Starter	IS: 8544(Pt.II)-1977

40. Rheostatic rotar starters, Section-2 additional requirements for AC rheostatic rotar controllers  
IS:8544(Pt.III/sec.2) 1979
41. Reduced voltage DC starters; two step auto transformer starter  
IS 8544 (Pt.IV) 1979
42. Factory-built Assemblies of switchgear & controlgear for voltages Upto & including 1000V a.c or 1200 V. d.c  
PART-II-Particular requirements for Busbar trunking systems (Busways)  
IS:8623(Pt.II-1980)
43. Performance requirements for constant speed compression Ignition(diesel) engines for General purposes sizes A4 (above 20KW)  
IS:10002-1981

## APPENDIX II

**TYPICAL FIRE FIGHTING INSTALLATIONS/REQUIREMENTS**

Note-1 Where more than one riser is required because of large floor area, the quantity of water recommended shall be proportionally increased.

Note-2. A minimum of two hydrants shall be provided within the courtyard.

Note-3, Wet riser is an arrangement for fire fighting within the building by means of vertical rising mains not less than 100mm internal dia with hydrant outlets and hose reel on each floor/landing and a fire pump, gate and non return valve over the under ground static tank. A fire service inlet at ground level fitted with a non return valve shall also be provided with rising main for charging it by fire services pump in case of failure of static fire pump over the underground static tanks.

Note-4 The performance of pumps shall be at revolutions per minute not exceeding 3000.

Note-5 The quantities of water shall be exclusively for the fire fighting and shall not be utilized for domestic or other use.

Note- 6 Size of the wet riser shall be as under (internal diameter) :

Pump Discharge	Suction Dia( mm)	Delivery Dia(mm)
450 LPM	50	50
900LPM	75	50
1400 LPM	100	100
2280 LPM	150	150
2850 LPM	200	150
4540 LPM	250	200

Note-7 A facility to boost up water pressure in the riser directly from the mobile pump shall also be provided on the wet riser system with a suitable fire service inlets (collecting head with 2 numbers of 63mm inlets for 100mm rising main and 4 numbers of 63 mm inlets with check valves for 150mm dia rising main) with check valves and gate valves.

Note-8 Internal diameter of rubber hose for hose reel shall be (minimum 12mm.) A shutoff branch with nozzle of 5mm size shall be provided.

Note-9 An arrangement of alternative source of power supply shall be provided to drive pumps, etc, in case of failure of normal power supply.

## APPENDIX III

**APPENDIX TO BE FILLED BY THE AGENCY WHILE QUOTING**

## Schedule of Technical Particulars

SI No.	Particulars	Guarantee Date
--------	-------------	----------------

**I. ELECTRIC FIRE PUMP****A Motor**

Make

Frame size

Type

Protection type

Insulation class

Electrical Particulars  
(Voltage/No of phase/ frequency  
I.S conforming to:

H.P

Speed.

**B.Pump**

Sale and catalogue number

Type

3.Frame size

Discharge

Total head at full discharge

BHP absorbed (a) at rated head and discharges

C) at 150% of rated discharge and 65% of rated head

Casing material

Impeller material

Shaft material

No. of stages

Type of drive

Type of sealing

**II DIESEL FIRE PUMP****A. Diesel Engine**

1. Make & model number

Type

HP

Speed

No. of cylinders

IS/BS Standard conforming to:

Type of cooling

Fuel consumption at full load

Overload capacity

10. Isolation efficiency

**B. Pump**

Make and catalogue number

Type

Frame size

Discharge

Total head at full discharge

BHP absorbed (a) at rated head and discharge

(b) at 150% of rated discharge and 65% of rated head

Casing Material

Impeller material

Shaft material

10.No. of stages

Type of drive

Type of seal

**III PRESSURISATION PUMP****A Motor**

Make

Frame size Type

Type

Protection type

Insulation class

Electrical particulars (voltage/No.of phase/frequency)

I.S conforming to:

HP

Speed

### **B. Pump**

Make and catalogue number

Type

Frame size

Discharge

Total head at full discharge

BHP absorbed

Casing Material

Impeller material

Shaft material

10.No. of stages

Type of drive

Type of seal

### **IV. PIPES**

Make

Class

I.S. conforming.....for pipes &.....for fittings

#### **B. Galvanised Iron pipe**

Make

Class

I.S. conforming.....for pipes &.....for fittings

### **V VALVES**

#### **A. SLUICE VALVES**

Make

Class

I.S. conforming to:

B. Non-return Valve

Make

Class

I.S. conforming to:

#### **VI. HOSE PIPE**

Make

Diameter

I.S. conforming to

#### **HOSE REEL**

Make

Length

Dia

I.S conforming to:

#### **VII. HOSE CABINET** (Indicate separately for internal hydrants)

Size (LxBxH)

Thickness of sheet steel used

#### **VIII. AIR VESSEL**

Dia

Length

Material

Thickness of material

Pressure for which tested

#### **IX ELECTRIC CONTROL PANEL**

Make

Make of switch fuse unit used

Thickness of sheet metal used

Make of contactors

Make of cables and size of cables for different motors.

#### **LIST OF MAKES FOR WET RISER SYSTEM**

Hose Reel                      ISI Marked

Hose Pipe                      ISI Marked



Diesel Engine for fire pump	Cummins/ Ruston/ Escorts/ Koel/ Caterpillar Ashok Leyland/ Greaves/ Volvo Penta (200-500 kVA)
Pumps	Kirloskar/ t/ KSB/ Crompton/ WASP
Motor	ABB/GE/Crompton/ siemens/ KEC/(energy)
Efficient motors as per IS 12615/ 1984 for motors below 37 kW)	
Starter	L&T/ GE/ Siemens /GE Power Control
TPN Switches and HRC fuse	L&T/ Siemens/ GE Power Controls / Havells/ H-H Elecon/ Crompton/ Standard
MCCB	L & T/ Siemens/ Control & Switchgear/ Crompton/ GE Power controls
Indicating Lamps	AE/ Siemens/ Vaishno/ L&T/ IMP/ Rass Control/ Tecknic/ Crompton / Kaycee
Ammeter/Voltmeter	AE/ Meco/ IMP/ Universal/ Rishabh/ Kaycee/ Enercon
Selector Switch	L&T/ AE/ Vaishno/ IMP/ Thakoor/ Kaycee/ Reco/ Selzer/ Rasscontrol
CT	: AE/ IMP/ MARSHAL/ PACTIL/ KAPPA/ L&T/ Ashmor/ Indcoil/ Waco/ Meco/
Battery	Exide/ Stanford/ Standard/ Pace Setter/ Amco/ NICCO/ Crompton Greaves/ Furukawa/ Prestolite/ Amara Raja/ Hitachi/
GI/ MS pipe	ISI mark pipes of BST/ TATA/ ATL/ ITC/ ATC/ IIA/ JST/ ITS/ JINDAL/ ZENITH/ GSI/ TTA.
AVM Pads : Dunlop/ Poly Bond/ Cori Rubber.	
Rubber Matting	: Any brand name with ISI mark
Cables ISI mark	
a) Upto 1.1kV	: With ISI mark
b) above 1.1kV	: With ISI mark
Single phasing preventer	: Siemens/ L&T/ Minilac/ Zerotrip
SANT/ Leader/ Trishul/ Fountain ISI mark/ Annapurna Fiebig/ H- Guru/ Pricol	
Fire extinguishers	ISI marked

## **SPECIFICATIONS FOR FIRE DETECTION SYSTEMS**

### **1. DESIGN AND SELECTION**

Detectors that are normally used are broadly covered in two categories, heat and smoke type. Smoke type is again of 2 types, i.e, photo electric and ionization.

Ionization or photoelectric detector shall be provided in the areas which are normally free from smoke. Heat detectors shall be provided for the areas like kitchen, battery room etc. which are prone to smoke.

The area to be protected by ionization and photoelectric detectors shall be generally in accordance with the standards laid down below. Additional detectors if any shall be provided as per user's requirement.

- a) Each detector shall cover an area not exceeding 25 sq.m. in the case of air conditioned equipment rooms.
- b) Each detector shall cover an area not exceeding 40sq.m in case of non air-conditioned technical rooms.
- c) Each detector shall cover an area not exceeding 50sq.m in case of room having no equipment.
- d) Each detector shall cover an area not exceeding 10sq.m when provided above false ceiling or below false flooring or over fully covered cable network.
- e) Area separated by beams having depth of minimum 450mm shall have separate detectors irrespective of area.
- f) Maximum horizontal distance between centre to centre of heat detectors and smoke detectors when provided in corridors shall not exceed 10 metres.
- g) Detectors shall be installed above the racks at a distance not exceeding 4metres between detectors in case of electronic exchanges. (high risk areas).

Ionization and photoelectric type smoke detectors shall be provided in the ratio of 1:1 for mixed monitoring purposes.

Each heat detector shall cover an area not exceeding 40 sq.m.

Each return air opening in the AC plant room shall be provided with one duct detector. The detector shall be ionization type smoke detector fitted inside the sampler boxes.

Each room including electrical rising main room shall necessarily be provided with at least one detector irrespective of its area.

Signals from detectors which are normally not visible like in false ceiling or false flooring and R/M shafts shall be extended in the shape of response indicators to a suitable location which is easily visible.

A minimum of 2 speakers for audible alarm and/or public announcement shall be provided on each floor and at least one speaker shall be provided on terrace.

Each detector shall be numbered zonal wise such as Z09/N-10 wherein Z09 indicates zone number nine and N-10 indicates detector number 10 in that zone.

All the cables and wires shall be tagged or labeled with ferrules for proper identification at the terminal end.

### **2. DETECTORS**

1. All detectors shall be 100% solid state, without moving parts, vibration and shock proof.
2. The detectors shall be rotary plugging type for easy removal and bases shall be original version (non local make) and shall be interchangeable.
3. Detectors shall be sensitive and quick acting to detect fire in the smoldering stage.
4. Detectors shall have response indicator with provision for extending remote indicator. And shall have protection against reverse polarity and voltage surges
5. The detectors shall be grouped in Zones and connected to the control unit.
6. The Detector used shall be ensured by the tenderer for reliability, stability and fire performance as per site environments.

#### **Photoelectric Detectors:**

1. It shall be based on light scattering principle.
2. It shall comprise a solid state LED and light speed light sensing photodiode (PD) with a sensing chamber etc.
3. Upon triggering alarm, the detector circuit should latch and the external LED shall glow continuously.

4. It will be sensitive to detect the fire in the smoldering stages also.
5. The detector shall be of non-polarised type.
6. The detector shall be operated at 24 Volt (Max) and shall be of low voltage type.
7. The coverage area of each detector shall be approximately 80 Sqm.
8. The make of the base assembly of the detector shall be the same of that of the head assembly.
9. The **heat detector** shall be of rate of rise of temperature type and shall be of 135 degree rating.

### 3. **Manual call point:**

The manual call point box shall be aluminum or MS construction electrostatic painted with fire red and mounted at 1.2m above floor level.

The box shall be provided with front glass ( minimum 30sq.cm.) and gasket to make it completely vermin and dust proof along with hammer and chain. On breaking the glass cover, the push button shall be released by similar spring action so that it gives fire indication on control panel. The points will be so located to ensure that one or other call box shall be readily accessible to all occupants of the floor without having to travel more than 22.5 metres.

It will have the facility to test check the working of the call point without breaking the glass by use of a key. The MCP will have a plastic sheet on the glass to prevent damage to hand on shattering of glass.

The glass front cover shall have a write up, "BREAK GLASS IN CASE OF FIRE".

### 4. **Response Indicator :**

1. It shall be housed in a box made from 16 SWG MS sheet and shall be painted red.
2. Front cover shall have marked "FIRE"
3. The response indicator shall be lit by means of red colour twin LEDS.
4. The response indicators for the detectors below the false floor shall be installed with top at 300mm above false floor at nearby wall/ column or directly on false floor by making suitable cut out and covered with thick glass. For detectors above false ceiling, the response indicators shall be installed either right below on the false ceiling or on the nearby wall/ column with bottom 300mm below false ceiling. Alternatively all response indicators shall be located at convenient places as approved. The cover plate of the response indicators shall also boldly display the detector number to which they correspond.

### 5. **Sounders**

1. It shall be of electronic solid state type speaker having continuous dual tone audible alarm for evacuation.

2. It shall be of 3 watts rating and suitable for wall mounting and shall incorporate Sounder card and inside a metallic box.

3. It shall be mounted 2.4metres above floor level. The **Sounders** shall be suitable for and audible range of 80dB at 1m with a frequency range of 500Hz to 1000 Hz.

### 6. **Micro processor based control panel :**

The purpose of introducing Microprocessor based control panel in fire detection system is to make the panel more compact by reducing the number of components, minimizing false alarms and the quantity of cable required, better reliability and making it more user friendly. Hence the concept of Public address system and local control panel has been discarded. However the essential features of local control panel have been included in the Microprocessor based panel.

#### **GUIDELINES FOR DESIGN:**

1 (I) The transistors used in the circuits shall be derated by as much as 50% and shall operate at only 25% of their wattage to safeguard against thermal run-away.

(II) No resistance shall be working at more than  $1/3^{\text{rd}}$  of its rated wattage and shall give good stability and resistance to moisture, vibration, temperature and dust.

1. The standby power supply should be capable of maintaining the system in normal operation for a period of not less than 48 hours after the failure of normal mains supply after which sufficient capacity would remain to provide full load operation for at least 1 hour. The full load would be defined as that caused by the operation of all the alarm sounders operating simultaneously, operation of a detector in atleast 25 percent of zones (with a minimum of two zones) and the

operation of the fault indicator. The operation of trigger devices in further zones should not result in cancellation of fire alarms existing at that time.

2. The printed circuit board and all the components in the panel shall be suitably protected against atmospheric corrosion.
3. Circuit and design of the panel shall be such that the operation (or) failure of one indicator does not prevent the proper and independent operation of other indications.
4. All the devices in a zone viz. detector, sounders, manual call points shall be operated on the same two wires of the zone.

5. Where the panel is used with the conventional systems, the Microprocessor based control panel must be compatible with the conventional main control panel as well as local control panel and detectors of approved makes.

### **General:-**

The panel shall be fabricated from 16 gauge (1.6mm) CRCA sheet completely dust and vermin proof with neoprene gasket, wall mounting and front openable type with hinged door.

The panel shall have glass door enclosure with lock and key arrangement.

Suitable knockouts shall be provided for terminations of conduits and cable glands.

The panel shall be powder coated with Siemens Gray finish (paint code: RAL 7032)

All components and their wiring shall be arranged so as to be conveniently attended to from the front of the panels.

All indicating lamps shall be LED type and of the following colours. The zone indicator indicating FIRE should consist of two LED's.

- (a) FIRE warning indicator should be clearly labelled and coloured red.
- (b) FAULT warning indicator should be clearly labelled and coloured amber with provision for identifying open/short separately.

The feather touch switches and indicating lamps shall be located in the front fascia of the panel and shall be unambiguously labelled.

The primary alarm circuit shall be solid-state.

The PCB's shall be easily removable. The connections to the PCB's shall be through interface cord of plug-in-type.

An audible signal along with its silencing switch shall be provided on the control panel.

The earthing terminal shall be provided on the frame of control panel.

The panel shall have ventilating louvers with wire mesh.

Laminated wiring diagram shall be pasted at a suitable place inside the panel.

### **FEATURES:**

1. The control panel shall continuously monitor OPEN, SHORT leads in each zone, Fire detectors / Manual call point with audio alarm distinct for FIRE/FAULT and shall visually indicate FIRE/FAULT in corresponding zone.
2. For multistoried building separate panel may be installed on each floor with individual power supply and batteries to reduce the interdependence of one panel over the other panel. However a repeater panel may be provided at the ground floor with sounder to indicate the FIRE/FAULT condition at various floors.
3. The manual controls for switching OFF/ON, MAINS/STANDBY power provided shall not be accessible to outsiders. Necessary provision shall be provided accordingly by the contractor.
4. The panel shall have the following visual indications for
  - (a) System ON-Green
  - (b) Standby ON - Green
  - (c) Charger ON – Green
  - (d) Isolation of a zone for testing purpose
5. Audio visual indication shall be provided for the following :-
  - (i) The operation of Fire detector in any zone
  - (ii) Short circuit or disconnection of leads in any zone
  - (iii) Failure or disconnection of normal power supply
  - (iv) Failure or disconnection of standby power supply
  - (v) Failure or disconnection of battery charging equipment
  - (vi) Battery voltage low
  - (vii) Common indication for earth fault in the panel / zone
6. The panel shall have the following supervisory facilities:-
  - (i) Switch for acknowledgement
  - (ii) Switch for manual reset of panel after normal of Fire condition.

7. Means shall be provided in the panel to prevent battery from discharging through the charging equipment in the event of its breakdown or failure.
8. (I) Facilities shall be provided to test the zones individually by simulating Fire and Fault condition. On test mode the panel shall automatically reset after a predetermined time, once the fault (or) fire is cleared. The testing authority shall be able to test continuously all the zones without the necessity of resetting the panel every time.
  - (II) Each zone shall be capable of isolation for maintenance (or) test purposes leaving the remaining zones in healthy condition so that fire and fault detection in other zones is not affected.
  - (III) Facility for testing all the LEDs shall also be available.
9. Fuses shall be provided for AC, DC and charger circuit as close to the source of supply in an easily accessible place.
10. The user shall be able to acknowledge the Fire/Fault audiovisual alarm and reset the panel directly without the use of any password or key.
11. Only on test condition, fire and fault shall reset automatically. On actual conditions also Fault shall reset after clearance automatically. The FIRE alarm should not be silenced automatically. The operation of the silencing switch should automatically result in an audio/visual signal being given in the panel until the FIRE alarm is reset.
12. Silencing the sounder shall not prevent fire alarm being activated in any other zone simultaneously
13. Any fault signal including fault testing which the panel might be experiencing shall not prevent the fire alarm being given if any detector activates at the same time in other zones.
14. When fire is detected, the corresponding zone LEDs shall flash when the alarm is first signaled and will glow steadily after the silence button is pressed.
15. Three NO and NC contacts shall be provided for remote monitoring.
16. When a FIRE is detected, all alarms in all zones will give continuous dual tone for Evacuate condition.
17. It shall be possible to program on the panel for isolating the power supply to zones for maintenance purposes.

## **POWER SUPPLY**

### **1. The power supply to the panel will be made available from the DB**

2. The entire system shall be suitable to operate on 230Volts $\pm$ 10%, 50Hz single phase AC supply.
3. The power supply unit shall consist of solid-state power rectifier of adequate capacity so as to provide 12/24 V stabilized DC power as output while receiving 230Volts  $\pm$ 10%, 50Hz single phase AC supply.

### **11. ADDITIONAL SPECIFICATION FOR INSTALLATION**

1. The direction of built in response indicator to the detection shall be each towards the entrance of the room.
2. The entire electrical cable shall be fire resistant.
3. The detector shall be connected by a two-wire system.
4. Cable connected to detectors shall be given S loop for both sides of the detector, sounder panels, dampers etc. Appropriate glands and rubber gasket shall be provided for cable, which enters junction box.
5. Manual controls shall be so located that no accidental operation takes place.
6. All the cables and wires shall be tagged for proper identification. Wires shall be identified by ferrules and cables by colour bands at 3mm distance.
7. All the manual controls shall be clearly labeled to indicate mode of operation and their function.
8. Main control panel shall be installed beyond the access of unauthorised persons approved by the Engineer-in-charge.

**LIST OF MAKES FOR FIRE DETECTION WORKS**

1	HEAT DETECTORS	NITTON/ APPOLLO/ CHEMTRON/ HOCHIKI/
		EDWARD/ WORMALD/ FENWAL/
2	SMOKE DETECTOR IONIZATION TYPE	VIJAY/ APPOLLO/ CEREBRUS/ HOCHIKI/
		EDWARD/ WORMALD/ FENWAL/ NITTON
3	SMOKE DETECTOR PHOTOELECTRIC TYPE	NITTON/ APPOLLO/ CEREBRUS/ HOCHIKI
		EDWARD/ WORMALD/ FENWAL/ VIJAY
4	FIRE PANELS	MATHER & PLATT/ MELTRON/ STEELAGE
		INDUSTRIES (MINIMAX)/ VIJAY/ SAFEWAY
		SECURITY SYSTEM MUMBAI/ CARMEL AND
		RAVAL ELECTRONICS CO. CHENNAI/ NAVEEN
		SYSTEM CHENNAI/ ALERT FIRE SERVICE
		BANGALORE
5	P A SYSTEM	AHUJA/ PHILIPS/ MOTWANI/ AKG
6	HOOTER	VAISHNO/ AHUJA/ AGNI/ PHILIPS/ MOTWANI
7	PVC INSULATED COPPER CONDUCTOR CABLE	ISI MARK
8	BATTERY (LEAD ACID SEALED AND MAINTENANCE FREE)	EXIDE/ STANFORD/ FURUKAWA/ AMCO/ PACE
		SETTER/ NICCO/ PRESTOLITE/ AMAR RAJA/
		STANDARD/ CROMPTON GREAVES/ HITACHI

9	CONDUIT	ISI MARK