

QUALITY ASSURANCE

AND

CONTROL SYSTEM MANUAL

TECHNICAL SPECIFICATION

FOR FIRE FIGHTING WORKS

SUBMITTED BY

UNITED **CONTRACTING** WORKS **PVT. LTD.**

QUALITY POLICY

1. Manufacturing, Delivering and Installing products that meet Purchaser's needs with consistent to total quality and in time by conforming to agreed quality plan based on established Quality System Standards.
2. Ensuring that all personnel at all levels in the Company and at all times understand and participate in achieving quality as their / our prime concern by deploying optimum resources and facilities including Safety Work procedures and work instructions for achieving Company's goal with professionalism.
3. Encouraging creativity for systems and procedures improvement to stay in the front line of progress.
4. Giving always high priority to the quality of manufacturing, delivering and installing services as well as instilling confidence in the Purchasers which is fundamental to UNITED CONTRACTING WORKS PVT LTD succes

PREAMBLE :

This manual covers UNITED CONTRACTING WORKS PVT. LTD. quality Policy and objective reassuring top Management's commitment to quality, quality management, quality planning, quality flow chart, quality system, quality assurance and control, quality improvement, management review, corrective action plan, indicative inspection and test plan of equipments / materials in respect of manufacture and supplies as well as erection / installation, testing, pre commissioning and commissioning.

QUALITY POLICY AND OBJECTIVE :

Quality policy is intended to be consistent with UNITED CONTRACTING WORKS PVT. LTD. policy, clearly understood, implemented and maintained with demonstration of commitment from top Management, exhibiting quality intentions and directions of UNITED CONTRACTING WORKS PVT. LTD. leading to consistence of conformance company wide.

QUALITY POLICY : Vide separate sheet attached.

QUALITY OBJECTIVES :

Quality objectives are set by top Management in order to encourage quality improvement and to achieve and to sustain UNITED CONTRACTING WORKS PVT. LTD. reputation for quality at competitive prices in UNITED CONTRACTING WORKS PVT. LTD. working and operations Company wide.

STATEMENT OF OBJECTIVES OF QUALITY POLICY SYSTEM :

The guidelines and procedures stated herein in this quality assurance and control system manual have been established with a new to ensure compliance and adherence to the principles of sound engineering and construction practice and to the requirement of client's / consultant's technical specifications.

The Head of QA/QC Department is hereby assigned the responsibility and authority to monitor the activities of all participating groups in UNITED CONTRACTING WORKS PVT. LTD. in order to ensure implementation of these procedures as committed by Management.

In this endeavor, the Head of QA/QC Department reports to the top Management (M.D.)

The Management of UNITED CONTRACTING WORKS PVT. LTD., in approving these procedures, gives its unqualified support to the observance and adherence; to strictest quality procedures, for all aspects of UNITED CONTRACTING WORKS PVT. LTD. suppliers, service and works.

QUALITY MANAGEMENT :

The functions are objectives of UNITED CONTRACTING WORKS PVT. LTD. quality management is to have quality planning, quality assurance and control interlinking with an organizational structure the various resources and actions concerning quality, ensuring implementation of quality planning, monitoring and improving quality as per UNITED CONTRACTING WORKS PVT. LTD. stated quality objectives.

The Functions are :

- i. Quality management is as aspect of overall management function that determines and implements quality policy and also assures quality to customers.
- ii. Quality must become the first objective for all executives like Managers and Employees.
- iii. Implementation of quality policy.
- iv. Initiating quality improvement which is a continuous activity.
- v. Line Managers to set the objectives for quality improvement and quality targets.
- vi. Involving shop floor staff in quality improvement programme.
- vii. Documenting customer's benefits as well as UNITED CONTRACTING WORKS PVT. LTD. benefits.
- viii. Educating, training and creating awareness to all and in all fields.
- ix. Working on quality cost.
- x. Motivational programme for above.

Quality management shall clearly indicate the line of authority and line of command / communication (Time Management Policy). Quality management shall also provide enough resources essentially required for the implementation of quality policy and achieving of quality objectives such as :

- i. Clarifying the distinction and inter-relationships among the principal quality concepts.
- ii. Providing guidelines for the selection and use of a standard that can control the quality internally and externally to assure the quality.

The responsibilities are :

- i. Initiating actions to prevent the occurrence of non conformity (of product / service), ensuring preventive actions to avoid recurrence of problems but at the same time not sacrificing the ability to identify and to respond to and correct failure whenever they occur.

- ii. Initiating, recommending and providing solutions through designed channels.
- iii. Verifying the implementation of solutions.
- iv. Controlling further processing, delivery or installation on non-conforming product / service until the deficiency or unsatisfactory condition is corrected.
- v. Defining acceptance criteria and procedures.
- vi. Regularly reviewing for conformance, verification of results and acceptance of results.

QUALITY PLANNING :

The different functions of quality, planning as envisaged by UNITED CONTRACTING WORKS

P.V.T. U.P.P. Preparation, issue and updating of guidelines in quality assurance.

- ii. Preparation of updated detailed inspection instructions including check lists and formats for all stages of materials / equipment components and assembly for product acceptance.
- iii. Planning of inspection of equipment where in involves :
 - a. Assessing the requirement of various measuring instruments, gauges etc along with desired / needed accuracy.
 - b. Designing special instruments, if so called for.
- iv. Designing sampling schemes for vendors / suppliers / sub contractors performance evaluation, approval and enlistment.
- v. Developing quality surveillance (i.e. vigilant supervision), procedures for manufacturing / sub contracting operations.
- vi. Developing a scheme of periodic calibration of gauges and measuring instruments.
- vii. Collaboration with product design group and design review, whenever called for.
- viii. Developing schemes for Quality Audit and procedures to be followed.
- ix. Developing necessary training procedures in regard to quality.

QUALITY CONTROL FLOW CHART :

Quality control flow chart is to establish a flow chart for ensuring quality in supplies, services and erection works relating to various activities starting right from raw materials up to final production / manufacture in respect of supplied and thereon to services, erection / installation, testing, pre commissioning, mechanical completion and commissioning by indicating / fixing responsibilities of

concerned person, group of persons or Department, flow of information, inspection, notices, witnessing the tests / inspection, making / keeping / maintaining documents / records / test certificates etc. to achieve smooth and orderly inspection, orderly / uninterrupted progress of works, early / corrective / remedial actions / mechanisms to control rejections as well as to avoid non conformance.

QUALITY SYSTEM :

Quality system as envisaged by UNITED CONTRACTING WORKS PVT. LTD. is the collective adequate plans for ensuring a product, process and services satisfying given needs.

Quality system emphasizes the identification and elaboration of comprehensive and thorough set of elements that are to be included in the quality control effort.

Quality system design calls for the means by which stated quality policies and objectives might be acceptable and so structured in order to function and to provide proper confidence to purchaser, producer, supplier and service provider.

Quality system shall :

- a. Be well understood and be effective
- b. Ensure that product or service satisfy customer's expectation / needs.
- c. Emphasize on problem prevention rather than depending upon detection after occurrence.

Quality system is structured as under :

- a. Quality responsibility and authorities.
- b. Organization structure
- c. Resources and personnel
- d. Operational procedure
- e. Documented quality policy and procedure
- f. Documented quality training, education and developing awareness.
- g. Quality plans
- h. Quality records.
- i. Quality manual.

Quality system as envisaged by UNITED CONTRACTING WORKS PVT. LTD. is also the organizational structure, procedures / process / resources for improving quality management with internal quality system audits planned and implemented for verifying whether quality activities comply with planned arrangement and to determine the effectiveness.

Quality Audit is scheduled on the basis of status and importance of activity and results of audit is to be documented and to be brought to the notice of higher officers for taking corrective actions on the deficiencies found by the audit.

QUALITY ASSURANCE AND CONTROL :

Quality assurance as envisaged by UNITED CONTRACTING WORKS PVT. LTD. is all those planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality.

For effectiveness of quality assurance, it requires continuing evaluation of factors that affect the adequacy of design or specifications for intended applications as well as verification of and audit of products, services and installations.

Quality assurance provides guarantee for delivering products and services of desired quality and also builds confidence with evidence and demonstration.

Quality assurance accomplishes the objectives such as :

- a. Achieving and sustaining quality so as to meet continuously purchaser's stated or implied needs.
- b. Documentation if both for customer's benefit and for UNITED CONTRACTING WORKS PVT. LTD. own benefit. Quality assurance is a system of activities with a purpose to provide assurance that quality control (QC) is in fact being implemented effectively and making sure that quality control is in fact doing what it should.
Quality assurance is also an effective system for integrating the programs of quality development, quality maintenance and quality improvement made by various groups in the organization.

The objective of Quality Assurance System is to ensure with a system of controls conformity of various equipments, materials, services and erection / installation to relevant standards, specifications drawings and technical requirements intended to be mutually agreed between UNITED CONTRACTING WORKS PVT. LTD. and owner / client / consultant (as the case may be thereby indicating the organizational approach).

QUALITY CONTROL

Quality Control as envisaged by UNITED CONTRACTING WORKS PVT. LTD., has dual aims (i) to maintain quality level consistently and (ii) at the same time bring improvement in quality level.

Quality Control is the regulatory process through which actual quality performance is measured, compared with Standards and acting on the difference.

Quality Control is the operational techniques and objectives used to fulfil and sustain the requirements and needs of quality.

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Quality Control involves operational techniques and activities aimed at monitoring and eliminating causes of unsatisfactory performance at relevant stages of Quality Loop in order to results in economic effectiveness.

QUALITY CONTROL AND QUALITY IMPROVEMENT

UNITED CONTRACTING WORKS PVT. LTD. recognizes that quality control generally revolves around in inspection, application of statistical aspects and views of customers, but factually revolts around management's commitment, manufacturing process, quality of product design and at the same time revolves around customer satisfaction which is supreme. Variance is the main source under control and attempting to minimize variance is aiming to maintain quality and eliminating waste by focusing on process and always looking for discrepancies between design specifications in the entire cycle of operation.

Conformity of equipments, materials, services, field erection / installation to the specified quality level are ensured by controlling the quality of purchased items at manufacturer's / supplier's factory or shop as well as at site / field construction ranging from source surveillance to final inspection.

As regards **QA/QC** at project site, construction activities in particular, the objective is to instill confidence such that required measures are taken by **UNITED CONTRACTING WORKS PVT. LTD.** to achieve the desired quality as per technical specifications, plans, engineering drawings etc. through indicative inspection and test plans marking the stages / milestones intended to be witnessed by client / consultant.

UNITED CONTRACTING WORKS PVT. LTD. however, recognizes that client / consultant may have their own surveillance on all activities of **UNITED CONTRACTING WORKS PVT. LTD.** to assure quality and control quality because **QA/C** is the process of assuring quality in one time installation for maximum operating period of a plant / facility Defect free, High reliability, Safety, Long life, minimum down time with documentary proof / evidence (with back up records / certificates) with signature of authorised / designated person) based on sound engineering and construction practices and having performed as per declared / stated objectives.

MANAGEMENT REVIEW :

Quality system will be periodically reviewed by **UNITED CONTRACTING WORKS PVT. LTD.** Management to ensure suitability and effectiveness and records of such reviews will be maintained. Management reviews will include assessment of results of Internal Quality System Audits carried out by **UNITED CONTRACTING WORKS PVT. LTD.** personnel having direct

CORRECTIVE ACTION PLAN :

Corrective action plan envisaged are :

- a. Investigating the causes of non-conformance and corrective action needed to prevent reoccurrence.

- b. Analyzing all processes, work operations, quality records, quality concessions / relaxation, service reports and customer complaints to detect and to eliminate potential causes on non-conformance.
- c. Initiating preventive actions to deal with the problem causing risks.
- d. Strictly applying controls to ensure that corrective actions are effectively implemented.

INDICATIVE INSPECTION AND TEST PLANS (I.T.P.)

The indicative inspection and Test Plans (I.T.P.) submitted by **UNITED CONTRACTING WORKS PVT. LTD.** for both equipments (at shop) and construction (at site) activities shall be finally approved by client / consultants and these are detailed as follows :

- Details of all the stages / milestones are to be examined by the quality control personnel of **UNITED ENGINEERING WORKS**, related documents prepared, maintained and submitted to owner's / client's or their authorised inspectors.

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JOB PROCEDURES / WORK INSTRUCTION WITH CHECK LISTS, INSPECTION AND TESTS

These are separately detailed and stated for equipment wise and work wise as per Annexure enclosed herewith.

INSPECTION AND TEST PLAN / SCHEDULE

Inspection and Test Plan / Schedule is to list out various Inspection / Tests to be performed for each equipment and work of a system or part of system and to specifically identify.

- i. To be witnessed by client's / consultant's Inspectors and UNITED CONTRACTING WORKS PVT. LTD. jointly and records / certificates to be generated / maintained by UNITED CONTRACTING WORKS PVT. LTD..
- ii. To be performed and witnessed by UNITED CONTRACTING WORKS PVT. LTD. only but certificates to be generated / maintained by UNITED CONTRACTING WORKS PVT. LTD..

CHECK LIST, INSPECTION AND TEST

Once the inspections and tests plan / schedule is established, checking of stage-wise activities is to be done and recorded in a **FORMAT** furnishing the check / test date, items checked / tested and signature or Inspector / Agency.

One sheet of statement is to be prepared for identifiable equipment or work and to be submitted to client's / consultant soon and when all the items of check lists (at this stage) by client's / consultant are liquidated (called punch list at this stage).

- iii. The Client's / consultant's Inspector may inspect, witness and review any or all stages of work at manufacturing shop / factory or at site (field) as the case may be and as deemed necessary for establishing quality assurance.
- iv. The Review stages (R, Random Witness Stages (RW) and Hold / witness stages (HW) by client's consultant's Inspector shall be clearly earmarked in the approved I.T.P. during bidding phase for any work, if so called for.
- v. The client's / consultant's Inspector shall ensure that the specified stages (R, (RW), (HW) as per approved I.T.P. is carried out without any delay.
- vi. A notice of about 3 (three) calendar days for witnessing / inspection and a notice of about 7 (seven) days for Hold / Witness shall be given by UNITED CONTRACTING WORKS PVT. LTD. to client's / consultant's Inspectors and no notice need be given by UNITED CONTRACTING WORKS PVT. LTD. for Random Witness unless specifically asked by client's / consultant.
- vii. Hold stages are considered as critical intermediate stages in manufacturing and testing of any item of equipment or work wherein UNITED CONTRACTING WORKS PVT. LTD. is obliged to arrange inspection by client's / consultant and UNITED CONTRACTING WORKS PVT. LTD. without proceeding further with the

work past the hold and without its being duly witnessed (except by getting prior permission and written approval).

- viii. However, in the case of Witness stage, UNITED CONTRACTING WORKS PVT. LTD. may proceed with the work past the hold and witness stage only with prior agreement with client's /consultant's Inspector that the Inspector would not attend witnessing such inspection by may review later the Test Results so generated.
- ix. UNITED CONTRACTING WORKS PVT. LTD. recognizes that the client's / consultant may reserve their rights of Technical Auditing of Quality Assurance System being observed / practiced by UNITED CONTRACTING WORKS PVT. LTD. will submit UNITED CONTRACTING WORKS PVT. LTD. Quality Assurance Organization and depute specific qualified Inspectors for attending to all stages earmarked for conducting the inspection and tests as per Approval Inspection and Test Plan.

TECHNICAL SPECIFICATIONS. FOR FIRE FIGHTING WORKS

Division 1. General Instructions

Fire suppression works specified in the tender have to be executed in accordance with:

The rules and regulations of Local Fire Authority as per the statutory regulations applicable for obtaining the occupation certificate from the Local Development / Fire Authority.

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Applicable norms laid down by the National Building Code of Bureau of Indian Standards (B.I.S.) shall be followed as applicable.

All materials used in the works shall have Bureau of Indian Standards or UL/FM valid certification stamped, marked or cast on the material in an acceptable and approved manner.

It is the contractor's responsibility to ensure the competence of design to meet the above requirements.

Drawings issued with the tenders are schematic and indicate the concept. Contractor shall make his shop drawings on basis of Architectural and Interior design drawings issued by the Engineer-in-Charge/Project Management Consultant. Work will be executed only as per approved shop drawings.

Quantities in the tender document are approximate worked out on the tender drawing issued.

Contractors are invited to highlight any aspects of the contract document that may need revision or reconsideration before the work is started. He must furnish details of any variations in the specifications or the quantities that may be necessary for him to comply with the Code and statutory requirements. These maybe identified and approval of the Project managers to be taken before the start of the work.

2. System Design

2.1 Fire suppression system for the building is based on the concept of "total protection" by the wet riser hydrant and sprinkler system for the entire premises with excepted areas identified on the drawings or as instructed by the Project Managers.

Water Storage & Pump House

A static underground RCC water storage tank in two compartments having gross water storage capacity as specified in relevant drawing will be provided. The tank will be provided with manholes, inserts, and puddle flanges, ladders inside and outside the tanks by the civil contractor or plumbing and fire contractor if specified.

One overhead water storage tank of specified capacity on the terrace as secondary water source for the sprinkler system will be provided on the terrace.

Configuration and operating conditions of pumps are given in the Specifications.

Wet Riser Hydrant System

The building will be provided with a wet riser system. Hydrants are fed from a M.S. pipe of diameter as specified in drawing. The fire line will be provided with adequate no. of isolation valves to enable at least a part of the main to provide water in case a section is under repairs.

External fire hydrants will be provided from the same line feeding tower blocks and basement. Hydrants shall be located at least 2.5 m away from the building or as shown on drawings. Internal wet risers for the building shall be connected to the main with a non return valve and a three way fire brigade inlet connection with isolation butterfly valve for each wet riser connection.

Hydrant stations and cabinets shall be provided at all designated locations inside and along with the external hydrants. The hydrant stations shall be located in cabinet as per drawings and specification and will contain all items described in the BOQ and specifications.

Sprinkler System

The entire building is protected with automatic sprinkler system with permitted exceptions e.g. electrical switch rooms, power transformers and D.G. rooms as identified. 2.4.2 Types of sprinklers to be used shall be as given in specifications, BOQ and approved by the Project Managers

Pumping System

The pumping system shall provide the water supply and pressure to the wet riser fire and sprinkler mains. Diesel Engine will be a common stand by.

Provide a full bore test valve on the by pass line with rate of flow meter on the common pump header to discharge in the water tank if shown on drawings. Also provide an isolation valve on headers outlet to each circuit to enable pressure setting and testing of pumps.

End of Division 1. General Instructions

Division 2. Fire Hydrant & Automatic Sprinkler System

1 Scope of work

Wet riser fire hydrant system (internal & external)

Automatic sprinkler system

Fire hydrant & sprinkler pumps.

Valves, suction and delivery connections and headers.

Hand appliances.

Pipe protection, painting, sleeves & minor civil works other than specifically mentioned in the tender.

Electrical installations.

Specialized protection as specified.

Testing and commissioning.

2.0. General Requirements

All materials shall be new of the best quality conforming to the specifications and subject to the approval of the Project Managers.

Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

Pipes shall be securely fixed to walls, and ceilings by suitable clamps at intervals specified. Only approved type of anchor fasteners shall be used for RCC ceilings and walls.

Valves and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.

3 Pipes

All pipes within and outside the building in exposed locations and shafts including connections buried under floor shall be M.S. Pipes as follows:

Pipes 150 mm dia and below IS: 1239 Heavy Class

Pipe 200 mm dia and above IS 3589 of thickness specified.

PIPE FITTINGS.

Pipes and fittings means tees, elbows, couplings, flanges, reducers etc. And all such connecting devices that are need to complete the piping work in its totality.

Fabricated fittings shall not be permitted for pipe diameters 50 mm and below.

JOINTING

Screwed (50 mm dia pipes and below)

Joint for black steel pipes and fittings shall be metal-to-metal thread joints. A small amount of red lead may be used for lubrication and rust prevention. Joints shall not be welded or caulked. (With screwed GI fittings)

Welded (65 mm dia and above)

Joints between M.S. and pipes and fittings shall be made with the pipes and butt welded fittings having "V" groove and welded with electrical resistance welding in an approved manner. The welding machine shall be 3 Phase of required current and capacity. In case operation joint is unavoidable due to constraint of space or any other reason approval is to be obtained from project manager.

Flanges.

Flanged joints shall be provided on:

- a) For jointing all types of valves, appurtenances, pumps, connections with other type of pipes, to water tanks and other places necessary as per good engineering practices.
- b) Flanges shall be as per I.S.6392-1971, Table 17/18 with appropriate number of G.I. nuts and bolts, half threaded of the specified make with 3 mm insertion neoprene gasket complete.

PIPE PROTECTION

All pipes above ground and in exposed locations shall be painted with one coat of Red Oxide Primer and two or more coats of Synthetic Enamel Paint of approved shade after surface preparations.

All black steel pipes under floors or below ground or slab penetration shall be provided with protection against corrosion by application of 100mm wide and 4mm thick layer of corrosion resistant material as specified along with primer over the pipe, as per manufacturer's specifications.

PIPE SUPPORTS

All pipes shall be adequately supported from ceiling or walls from existing/new inserts fasteners by Structural clamps fabricated from M.S. Structure's e.g. Rods, Channels, Angles and Flats as per details given in drawings and specifications. All clamps shall be painted with one coat of red lead and two coats of black Enamel paint after surface preparation.

Where inserts are not provided, the Contractor shall provide anchor fasteners. Anchor fastener shall be fixed to walls and ceilings by drilling holes with Electrical drill in an approved manner as recommended by the manufacturer of the fasteners.

TESTING

All pipes in the system shall be tested to a hydraulic pressure of 1.5 times of the working pressure or minimum of 15 Kg/Cm² without drop in the pressure for at least 2 hours.

Rectify all leakages, make adjustment and retest as required.

4 Excavation

Excavation for pipe lines shall be in open trenches to levels and grades shown on the drawings or as required at site. Pipe lines shall be buried to a minimum depth of 1.2 meter or as shown on drawings.

Wherever required contractor shall support all trenches or adjoining structures with adequate timber supports.

On completion of testing and pipe protection, trenches shall be refilled with excavated earth in 15 cm. layers and consolidated.

Contractor shall dispose off all surplus earth within a lead of 200 m or as directed by Project Manager.

5 Anchor Thrust Blocks

- a) Contractor shall provide suitably designed anchor blocks in cement concrete as specified to encounter excess thrust due to water hammer & high pressure.
 - b) Thrust blocks shall be provided at all bends & tees & such other location as determined by the Project Manager.
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- c) Exact location, design, size and mix of the concrete block shall be approved by the Project Manager prior to execution of work.

6 Valves

Ball Valves

- a) Valves 40 mm dia & below shall be full bore type heavy type nickel plated Brass body screwed type full bore, with chromium plated brass balls, PTFE Teflon seating and gland packing tested to a hydraulic pressure of 20 kg/sq cm including coupling and gunmetal handle conforming to B.S. 5351 with female screwed ends.
- b) All valves shall be approved by the Project Manager before they are allowed to be used on work.

Butterfly Valves (Slim seal type)

Butterfly Valves shall be cast iron body and shall be of class P.N. 1.6 tested to 20 kg/cm² or PN 2.0 tested for 30 kg/sqcm with following details :-

- a) Disc shall be S.S. 304.
- b) The shaft shall be EN-8 Carbon Steel with low friction nylon bearings.
- c) The seat shall be drop tight constructed by bonding resilient elastomer inside a rigid backing.
- d) Built in flanged rubber seals.
- e) Actuator to level operated for valves above ground shall be lever operated upto 150mm dia. and gear operated above 150 mm. dia. And T Key operated for valves below ground.
- f) Built in flanges for screwed on flanged connections.

Manufacturer's details on fixing and installation will be followed.

Non Return Valves (NRV)

- a) Non return valves will be used at location to allow flow only in one direction and prevent flow in the opposite direction.
- b) Non-return valves shall be dual plate check valve with cast iron body and S.S disc, S. Steel pin and hinges, nitrile/neoprene seal, suitable for horizontal/vertical line installation conforming to relevant codes.

Air vessel / Air Cushion tank.

a) Air vessel shall be having size and capacity indicated in schedule of quantities. It shall be provided at the delivery header in pump house (as specified). The tank shall be complete with 20mm dia. Brass pressure relief valve, Stop Valve (20mm dia), Drain valve (20mm dia) and pressure gauge including 20mm dia. Mild Steel Galvanised pipes and fittings, unions, etc. for fixing pressure switches as required to complete the work as per site conditions.

6.5 Air Vessel shall be measured by numbers and shall include Pressure Relief Valve, Pressure Gauge, and Globe Valves for testing and draining, M.S. Clamps, Pipes, Fittings, Tees Elbows Union and all other items required completing the work unless separately specified in bill of quantities.

Orifice Flanges

Provide orifice flanges fabricated from 6 mm thick stainless steel plate 304 ,18/8 grade to reduce pressure on individual hydrants to restrict the operating pressure to 3.5 - 7 Kg/sq.cm. And allow a discharge of 560 lpm.

Drain Valve

Provide 25 mm dia black steel pipe to IS: 1239 (heavy class) with 25 mm Ball valve for draining any water in the system in low pockets.

Inspection & testing assembly

Inspection and testing of the sprinkler system shall be monolithic valve with built in sight glass. The drain pipe beyond the valve upto the drainage point shall be measured with the pipe.

6.9. Pump test assembly

Provide on the main fire sprinkler header a 150 mm dia (if specified) bye pass valve located in an accessible manner along with a rate of flow rotometer calibrated in lpm and able to read 200 % of the rated pump capacity. The delivery shall be connected to the fire tank.

Pressure Gauge

Pressure gauge shall be provided near all connections to hydrant system and 3/8" dia ball valves with copper siphon assembly of sprinkler system and where required. Pressure gauge shall be 150 mm dia gunmetal Bourdon type with gunmetal isolation cock, tapping and connecting pipe and nipple. The gauge shall be installed at appropriate level and height for easy readability.

7 Hydrant/valve chambers

Contractor shall provide suitable brick masonry chambers in cement mortar 1:5 (1 cement: 5 coarse sand) on cement concrete foundations 150 mm thick 1:5:10 mix (1 cement: 5 coarse sand: 10 graded stone aggregate 40 mm nominal size) 12 mm thick cement plaster inside and outside finished with a floating coat of neat cement inside with cast iron surface box approved by fire brigade including excavation, back filling complete if specified.

Valve chambers shall be 120x120 cm. for depths up to 100 cm.

8 Flow switch

- a) Flow switches shall be provided on sectional mains and branch lines of sprinkler systems where indicated on drawings, or necessary and required and directed by the Project Manager.
- b) Flow switch should be suitable to actuate for opening of a single sprinkler and shall be suitable for connection to a central annunciation panel.

9 Fire brigade connections

Provide as shown on drawings separate gunmetal 4 way collecting head with four 63 mm instantaneous type inlets with built in check valves and 150 mm dia outlet connected to the fire and sprinkler main. Collecting head shall be installed on a stand post and provided with horizontal C.I. non return valve and location to be approved by Project Manager. Provide etched gunmetal label plates with 50mm height letter. The plates should be firmly fixed to the FB connection and any support system.

10 Fire hydrants

External hydrants

- a) Contractor shall provide external hydrants. The hydrants shall be controlled by a cast iron butterfly valve installed in underground lockable chambers or above ground as specified. Hydrants shall have instantaneous type 63 mm dia outlets. The hydrants shall be single outlet conforming to I.S.908-1975 with flanged riser of required height to bring the hydrant to correct level above ground.
- b) Contractor shall provide for each external fire hydrant two number of 63 mm dia. 15 m long EPDM lined hose pipe with S.S male and female instantaneous type Couplings machine wound with COPPER wire (hose to I.S. 636 Type 2 and couplings to I.S. 903 with I.S. certification),
S.S branch pipe with nozzle to
I.S. 903.

Internal hydrants

- a) Contractor shall provide on each landing and other locations as shown on the drawings one or two numbers of single headed S.S landing valve with 63 mm dia outlet mounted on a common 80 mm inlet (I.S.5290-1969). Landing valve shall have flanged inlet and instantaneous type outlets as shown on the drawings.
- b) Instantaneous outlets for fire hydrants shall be of standard pattern approved and suitable for fire brigade hoses.
- c) Contractor shall provide for each single outlet internal fire hydrant valves with two numbers of 63 mm dia. 15 m long EPDM lined fabric hose pipes with S.S male and female instantaneous type coupling machine wound with copper wire (hose to I.S. 636 Type 2 and couplings to I.S. 903 with I.S. Certification), fire hose reel, SS branch pipe with nozzle I.S. 903 and Fire man's axe.
- d) Each hose box shall be conspicuously painted with the letters "FIRE HOSE".

11 Fire hose reels

Contractor shall provide standard fire hose reels with 20 mm dia high pressure Dunlop rubber hose 36.5 m long with gunmetal nozzle and control valve, shut off valve, all mounted on circular hose reel of heavy duty mild steel construction and cast iron / MS brackets. Hose reel shall be connected directly to the wet riser. Hose reel shall conform to IS: 884-1969 and rubber hose to IS: 5132 Type II or nylon braided poly propylene pipe of approved make.

12 Hose Cabinets

Provide hose cabinets for all internal fire hydrants. Hose cabinets shall be fabricated from 16 gauge M.S. sheet of fully welded construction with hinged double front door partially glazed with locking arrangement, stove enameled fire red paint with "FIRE HOSE" written on it prominently.(Size as given in the Bill of Quantities).or as specified in Bill of Quantity as directed by PMC.

13 Pipe protection

- a) All pipes above ground and in exposed locations shall be painted with one coat of zinc chromate primer and two or more coats of synthetic enamel paint of approved shade after surface preparations
- b) Pipes in chase or buried underground or penetration through slab shall be painted with two coats of zinc chromate primer and wrapped with one layer of 4 mm thick corrosion resistant multi layer sheet as per standard manufacturer's specifications.

14. Installation Valve

Installation valves shall be installed on the sprinkler circuits as shown on the drawings.

Contractor shall submit his detailed shop drawings showing the exact location, details of installation of the valve and alarm in all its respects.

Installation valve shall comprise of a 150 mm dia vertical alarm valve complete with 50 mm dia drain and 15mm dia test valve with a provision to install water operated turbine alarm and an electrical alarm bell. The cost shall include double seated clapper check valves as alarm valve with pressure gauge and orifice assembly and drain pipe with bye pass on check valve to regulate differential pressure and false alarm, one water operated turbine alarm motor including all accessories necessary and required and as supplied by original equipment manufacturer and required for full and satisfactory performance of the system.

15 Sprinkler Heads

Sprinkler heads shall be provided at 3.0m. C/c spacing and where curtain is proposed @ 2.0m. c/c. The spacing shall however be in conformity with the drawings and properly co-ordinated with electrical fixtures, ventilation ducts, grills, etc.

Sprinkler heads shall be quartzite bulb type with a temp. Rating of 68deg quick response with CP gunmetal body fully approved by Underwriter's laboratory UL/ FM.

Sprinkler heads shall be installed in conformity with approved shop drawings and in co-ordination with electrical fixtures, ventilation ducts, cable galleries and other services along the ceiling.

15.3.1 Following type of quick response sprinklers shall be used:

Sl.No	Type of Sprinkler	Temp rating
1.	Pendant, upright or side wall	68 °C high pressure
2.	Special application side wall type with throw suitable for Room size of 5 m length (Extended throw type)	68 °C high pressure
3.	Pendent type quick response (Concealed or semi recessed)	68 °C high pressure

16 Testing

All piping in the system shall be tested to a hydrostatic pressure of 1.5 times the working pressure without drop in pressure for at-least 2 hours.

Rectify all leakages, make adjustments and retest as required and directed.

17 Cables

Contractor shall provide control cables from supervisory valves and switches to the annunciation panels if supervisory switches are proposed.

All control cables shall be copper conductor PVC insulated armored and PVC sheathed 1100 volt grade.

All cables shall have stranded conductors. The cables shall be in drums as far as possible and bear manufacturer's name.

All cable joints shall be made in an approved manner as per standard practice.

18. Cable Trays

18.1 All cables shall be routed in approved locations in coordination with all other services in a proper manner.

18.1.1 Cable trays shall be of galvanized / powder coated steel and hung from the ceiling by galvanized rods supported by appropriate size and type of expandable expansion fasteners drilled into the slabs and walls by an electric drill.

19 Annunciation Panel

- a) Provide one solid state electronic annunciation panel, fully wired with visual display unit to indicate:
- b) Flow condition in any flow indicating valve
- c) The panel should give a visual and audible alarm for any of the above conditions.
- d) The panel should be standard manufacturer's factory made. All details shall be submitted with the tender.

20. Measurement

Mild steel pipes shall be measured per linear metre of the finished length and shall include all fittings, flanges, and welding, jointing, clamps for fixing to walls or hangers, anchor fasteners, painting and testing complete in all respects.

Sluice, Butterfly and full way valves, check valves, installation valves, air valves & flow switches shall be measured by numbers and shall include all items necessary and required for fixing and as given in the specifications and bill of quantities.

Fire hydrants, hose reels, fire brigade connections, orifice flanges shall be measured by number and include all items given in the specifications and bill of quantities.

Fire hose and boxes specified shall be measured by number and include all items given in specifications and Bill of Quantities.

Fire extinguishers shall be measured by number and shall include full charge.

Spare sprinkler cabinets with spare sprinklers specified and spanners shall be measured as per actual item given in the specifications and Bill of Quantities.

Sprinkler heads shall be measured by numbers.

Cables and cable trays shall be measured per linear meter shall include clamps, hangers, anchor fasteners complete in all respects.

End of Division 2: Fire Hydrant & Automatic Sprinkler System.

Division 3. Fire Pumps & Ancillary Equipment

1. Scope of Work

Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install electrically operated and diesel driven pumps as required by the drawings and specified hereinafter or given in the schedule of quantities.

The pumps and ancillary equipment shall include the following:-

- a) Electrically operated and diesel driven pumps with motors, base plates and accessories.
- b) Alarm system with all accessories wiring and connections
- c) Pressure gauges with isolation valves & piping, bleed and block valves.
- d) M.S. pipes, valves, suction strainers, delivery headers & accessories.
- e) Foundations, vibration eliminator pads and foundation bolts, flexible connector with unit control.

2 General Requirements

Pumps shall be installed true to level on suitable concrete foundations. Base plate shall be firmly fixed by foundation bolts properly grouted in the concrete foundations.

Pumps and motors shall be truly aligned by suitable instruments.

All pump connections shall be standard flanged type with appropriate number of bolts. In case of non standard flanges companion flanges shall be provided with the pumps.

Manufacturer's instructions regarding installation, connections and commissioning shall be followed with respect to all pumps and accessories.

a) Contractor shall provide necessary test certificates and performance charts with NPSH requirement of the pumps from the manufacturer. The Contractor shall provide facilities to the Project Manager or their authorized representative for inspection of equipment during manufacturing and also to witness various tests at the manufacturer's works without any cost to the owners.

b) Each pump shall be provided with a 150 mm dia pressure gauge, isolation cock and connecting piping, bleed and block valve.

~~c) Provide vibration eliminating pads and connectors for each pump.~~

The Contractor shall submit with this tender a list of recommended spare parts for two years of normal operation and quote the prices for the same.

3 Fire, Sprinkler & Jockey Pumps

Pumping Sets

- a) Pumping sets shall be single/double stage horizontal split case centrifugal single outlet with cast iron body and bronze dynamically balanced impellers. Connecting shaft shall be stainless steel with bronze sleeve and grease lubricated bearings in the case of jockey pump it will be multistage horizontal / vertical pumps.
- b) Pumps shall be connected to the drive by means of spacer type couplings which shall be individually balanced dynamically and statically.

The coupling joining the prime movers with the pump shall be provided with a sheet metal guard.

Pumps shall be provided with approved type of multi spring mechanical seals.

3.3.1 Pumps shall be capable of delivering not less than 150% of the rated capacity of water at a head of not less than 65% of the rated head. The shut off head shall not exceed 120% of the rated head.

3.1.2 The pump shall meet the requirements of the Tariff Advisory Committee and the unit shall be design proven in fire protection services.

4 Electric drive

Electrically driven pumps shall be provided with totally enclosed fan cooled induction motors. For fire pumps the motors should be rated not to draw starting current more than 3 times normal running current.

Motors for fire protection pumps shall be at least equivalent to the horse power required to drive the pump at 150% of its rated discharge and shall be designed for continuous full load duty and shall be design proven in similar service. Capacity of the motors should be capable to handle at zero head and high head.

Motors shall be wound for class B insulation and winding shall be vacuum impregnated with heat and moisture resistant varnish glass fiber insulated.

Motors for fire pumps shall meet all requirements and specifications of the Tariff Advisory Committee.

Motors shall be suitable for 415 + 10% volts, 3 phase 50 cycles a/c supply and shall be designed for 38 deg C ambient temperature. Motors shall conform to I.S. 325.

Motors shall be designed for two start system.

Motors shall be capable of handling the required starting torque of the pumps.

Contractor shall provide inbuilt heating arrangements for the motors for main pumps to ensure that motor windings shall remain dry.

Speed of the motor shall be compatible with the speed of the pump.

5 Diesel Engine

Diesel engine shall be of 6 cylinders with individual head assemblies. The engine shall be water cooled and shall include heat exchanger and connecting piping, strainer, isolating & pressure reducing valves, bye-pass line complete in all respects.

Engine shall be direct injection type with low noise and exhaust emission levels.

The speed of the engine shall match the pump speed for direct drive.

The engine shall be capable of being started without the use of wicks, cartridge heater, plugs or either at engine room temperature of 7deg.C. and shall take full load within 15 seconds from the receipt of the signal to start.

The engine shall efficiently operate at 38 deg.C ambient temperature at 50 meters above mean sea level.

Noise level of the engine shall not exceed 105 DBA (free field sound pressure) at 3 meters distance.

The engine shall be self starting type upto 4deg C and shall be provided with one 24 volts heavy duty DC battery, starter, cut-out, battery leads complete in all respects. One additional spare battery shall be provided. The battery shall have a capacity of 180 to 200 ampere hours and 640 amps cold cranking amperage.

A battery re-charger of 10 to 15 amperes capacity with trickle and booster charging facility and regulator shall be provided.

The engine shall be provided with an oil bath or dry type air cleaner as per manufacturer's design.

Engine shall be suitable for running on high speed diesel oil.

The system shall be provided with a control panel with push button starting arrangement also and wired to the engine on a differential pressure gauge.

The entire system shall be mounted on a common structural base plate with anti vibration mountings and flexible connections with unit control on the suction and delivery piping.

One self supported one day oil tank fabricated from 5 mm thick MS sheet electrically welded with a capacity of 8 hours working load but not less than 200 lit shall be provided. Level indicating gauge glass on the day oil tank and low fuel level indication on the control panel shall also be provided.

One exhaust pipe with suitable muffler (residential type) to discharge the engine gases to outside open air as per site conditions shall be provided along with mineral wool insulators and aluminum sheet cladding of not less than 22 gauge.

All other accessories fittings & fixtures necessary and required for a complete operating engine set shall be provided.

3.16 Contractor shall indicate special requirements, if any, for the ventilation of the pump room.

5.17 The materials of construction for the major components are as

follows: Casting	:	Cast iron
Impeller	:	
Bronze		
Shaft	:	
EN-8		
Wear Rings	:	
Bronze		
Gland Packing	:	Graphite
Asbestos		
Type of Bearing	:	Ball bearing/Roll
Bearing Type of coupling	:	Flexible
couplings		

5.18 Instrumentation

The diesel engine shall be provided with the following instrumentation:

- a) Temperature indicator in cooling water inlet and outlet
 - b) Temperature indicator in lubricating oil outlet from the oil cooler
 - c) Pressure gauge for lubricating oil system
 - d) Speed indicator
 - e) Lubricating oil sump level indicator
 - f) Fuel oil tank level indicator
 - ~~g) Voltmeter and ammeter in battery charging circuit~~
-

h) Cooling water high temperature alarm

i) Oil pressure low alarm

A local instrument panel shall be provided with the engine for mounting all the above instruments and annunciation.

5.19 Pumps and motor engine shall be mounted on a common base frames fabricated from M.S. structural and placed in suitable concrete foundations with the help of approved cushy foot mountings (Anti-vibration pads) to avoid vibrations. The anti vibration pads shall be of heavy duty type.

6 Air Vessel

Provide one air vessel fabricated from 10 mm M.S. plate with dished ends and suitable supporting legs. Air vessel shall be provided with a 100 mm dia flanged connection from pump, one 25 mm dia each for drain with valve and pressure relief valve one gunmetal water level gauge and 15 mm sockets for pressure switches. The vessel shall be 450 mm dia x 2000 mm high and tested to 20kg/sq cm pressure or 1.5 times the working pressure whichever is more.

The fire pumps shall operate on drop of pressure in the mains as given in Para 6.3 below. The pump operating sequence shall be arranged in a manner to start the pump automatically but should be stopped manually by starter push buttons only.

Operating conditions for fire & sprinkler pumps.

a) Operating pressure	MDH (max. design head of pump)	
	CUT IN	CUT OUT
b) Jockey pump	1 kg/sq cm less than MDH	Max head
c) Fire Electric Pump Hydrant	2 Kg/sq cm less than MDH	manual
c) Fire Electric Pump Sprinkler	2.5 Kg/sq cm less than MDH	manual
d) Diesel Engine Driven Pump	3 kg/sq cm less than MDH	manual

As Per Item 6.3 Pressure to be adjusted as per height of the building/as per site requirement.

Notes:

- a) Jockey pump shall start and stop through pressure switch automatically.
- b) Jockey pump shall stop when main pump starts.
- c) Main pumps shall start automatically on fall of pressure but stopping shall be manual.

7. Vibration Eliminators

Provide on all suction and delivery lines double flanged reinforced neoprene flexible pipe connectors along with unit control. Connectors should be suitable for a working pressure of each pump and tested to the test pressure given in the relevant head. Length of the connector shall be as per manufactures details.

Valves

All valves shall be PN 1.6 OR PN 2 as specified in the BOQ. Valves above 150 mm. will be gear operated.

8. Measurements:

Fire, sprinkler pumps shall be measured by numbers and shall include all items as given in the specifications and schedule of quantities.

Air vessel, fire alarm, installation valve, Butterfly valves, non return valves, vibration eliminators, flanges and suction strainer shall be measured by numbers and shall include all items as given in the schedule of quantities and specifications.

Pump headers, shall be measured per linear metre and shall include all items given in the specifications and schedule of quantities.

End of Division 3: Fire Pumps & Ancillary Equipment

Division 4 Commissioning and Guarantees

1 Scope of work

Work under this section shall consist of pre-commissioning, commissioning, testing and providing guarantees for all equipment, appliances and accessories supplied and installed by the contractor under this contract.

2 General requirements:

The rates quoted in this tender shall be inclusive of the works given in this section.

Contractor shall provide all tools, equipment, metering and testing devices required for the purpose.

On award of work, contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and installed under this contract.

3 Pre-commissioning

On completion of the installation of all pumps, piping, valves, pipe connections, and water level controlling devices the contractor shall proceed as follows:-

A Fire protection system:

- i) Check all hydrant valves and close if any valve is open. Also check that all suction and delivery connections are properly made.
- ii) Test run and check rotation of each motor and correct the same if required.

B Pipe work

- i) Check all clamps, supports and hangers provided for the pipes.
- ii) Fill up pipes with water and apply hydrostatic pressure to the system as given in the relevant section of the specifications. If any leakage is found, rectify the same and retest the pipes.

4 Commissioning & testing

A. Fire hydrant system

- i) Pressurize the fire hydrant system by running the jockey pump and after ~~attaining the required pressure after releasing the trapped air. Shut off pump automatically~~

- ii) Open by-pass valve and allow the pressure to drop in the system. Check that the jockey pump cuts-in and cuts out at the pre-set pressures. If necessary adjust the pressure switch for the jockey pump. Close bye-pass valve.
- iii) Open hydrant valve and bye pass valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump should cut-in at the pre-set pressure and should not cutout automatically on reaching the normal line pressure. The main fire pump should stop only by manual push button. However the jockey pump should cut-out as soon as the main pump starts.
- iv) Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump.
- v) When the fire pumps have been checked for satisfactory working on automatic controls, open five hydrant valves simultaneously and allow the hose pipes to discharge water into the fire tank to avoid wastage. The electrically driven pump should run continuously for eight hours so that its performance can be checked.
- vi) Check each landing valve, male and female couplings and branch pipes for compatibility with each other. Any fitting which is found to be incompatible and does not fit into the other properly shall be replaced by the contractor. Landing valves shall also be checked by opening and closing under pressure.

B. Sprinkler system:

- i) Start the pump and develop the required pressure in the sprinkler pipes.
- ii) Open the test valve to test the automatic starting of the pump. If necessary, make necessary adjustments in the setting of pressure switch. The sprinkler fire alarm should also operate when the test valve is open.
- iii) After satisfactory operation of the pump the contractor shall set up mock fire and test the system.

C. Handing over

- 1) All commissioning and testing shall be done bythe contractor to the complete satisfaction of the Project Manager, and the job handed over to the Project Manager, or his authorized representative.
- 2) Contractor shall also hand over, to the Project Manager, all maintenance & operation manuals and all other items as per the terms of thecontract.

D. Guarantees

- 1) The contractor shall submit a warranty for all equipment, materials and accessories supplied by him against manufacturing defects, malfunctioning or under capacity functioning.
- 2) The form of warranty shall be as approved by the Project Manager.
- 3) The warranty shall be valid for a period of one year from the date of commissioning and handing over.
- 4) The warranty shall expressly include replacement of all defective or under capacity equipment. Project Manager may allow repair of certain equipment if the same is found to meet the requirement for efficient functioning of the system.
- 5) The warranty shall include replacement of any equipment found to have capacity lesser than the rated capacity as accepted in the contract. The replacement equipment shall be approved by the Project Manager.

End of Division 4 : Commissioning & Guarantees

Division 5 : Electrical Installations

1 Scope

The scope of this section comprises of fabrication, supply, erection, testing and commissioning of electric control panels, wiring and earthing of all air conditioning equipment, components and accessories, including supply, installation and wiring of remote control-cum-indicating light panel.

2 General

Work shall be carried out in accordance with the Specifications, Local Rules, Indian Electricity Act 1910 as amended upto date, and rules issued thereunder, Regulations of the Fire Insurance Company and relevant BIS Code of Practice.

3 Wiring System

All power wiring shall be carried out with 1100 volts grade FR PVC insulated, armored, overall PVC sheathed aluminum conductor cables for sizes above 6 sq mm. Sizes 6 sq mm and below the power wiring shall be of copper conductor only. Cables shall be sized by applying proper rating factor. All control wiring shall be carried out by using 650 volts PVC insulated copper conductor wires in race ways or in conduit. Minimum size of control wiring shall be 1.5 sq.mm PVC insulated FR copper conductor wires. Minimum size of conductor for power wiring shall be 4 sq.mm 1100 volts grade PVC insulated copper conductor wires in conduit.

4 Construction Features.

The control panel shall be metal enclosed sheet steel cubicle, indoor type, dead front, floor mounting / wall mounting type. The control panel shall be totally enclosed, and vermin proof. Gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust proof. Control panels shall be arranged in multi-tier formation. All doors and covers shall be suitable for double padlocking .All mild steel sheets used in the construction of control panels shall be 14 SWG thick for floor mounted and 16 SWG for wall mounting and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet metal shall be seam welded, all welding slag grounded off and welding pits wiped smooth with Plumber metal.

All panels and covers shall be properly fitted and square with the frame and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with hank nuts. Self threading screws shall not be used in the construction of control panels. Base channel of 75 mm x 75 mm x 5 mm thick shall be provided at the bottom. Minimum clear space of 200 mm between the floor of control panel and bottom most unit (MCB or Bus Bar) shall be provided.

The control panels shall be of adequate size with a provision of 25% spare space to accommodate possible future additional switch gear. Knockout holes of appropriate size and number shall be provided in the control panels in conformity with the location of incoming and outgoing conduits / cables. All equipment such as meters and indicating lamps etc. shall be

located adjacent to the unit with which it is associated and care shall be taken to achieve a neat and symmetrical arrangement.

Facility shall be provided for termination of cables from top of the control panel. Clamps shall be provided to support the weight of the cables. All power wiring inside the control panel shall be colour coded and control wiring ferruled for easy identification. Circuit diagram showing the arrangement of circuits shall be pasted on the inside of panel door and covered with transparent plastic sheet and all labeling shall be provided in engraved anodized aluminium / bakelite strips on the front face of the panel board.

5 Circuit Compartment

Each circuit breaker, contactor and relay shall be housed in a separate compartment and shall have steel sheets on top and bottom of compartment. Sheet steel hinged lockable door shall be duly interlocked with the breaker in the 'ON' position. Safety interlocks shall be provided to prevent the breaker or contactor from being drawn out when the breaker is in 'ON' position. The door shall not form an integral part of the draw out portion of the panel. Sheet steel barriers shall be provided between the tiers in a vertical section.

6 Instrument Accommodation

Adequate space shall be provided for accommodating instruments, indicating lamps, control contactors and control fuses etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker and bus bar.

7 Bus Bars and Bus Bar Connections

The bus bar and interconnections shall be of aluminum and of rectangular cross sections suitable for full load current for phase bus bars, and half rated current for neutral bus bar and shall be extensible on either side. The bus bars and interconnections shall be insulated with PVC sleeve / tapes and shall be color coded. Alternatively special insulating paints / materials may be used for the purpose.

All bus bars shall be supported on unbreakable, on hygroscopic insulated supports at regular intervals, to withstand the forces arising in case of short circuit in the system.

All bus bars shall be provided in separate chamber and properly ventilated. All bus bars connections, in main control panels shall be done by drilling holes with cadmium plated / hot dipped galvanized bolts, nuts and washers.

All bus bars connections in smaller control panels shall be done by drilling hole and connecting by brass bolts and nuts.

All connections between the bus bar and breaker, and between breaker and contactor shall be through copper strips of proper size to carry rated current and shall be insulated with PVC sleeves.

8 Raceways

A horizontal race way with screwed covers shall be provided at the top to take interconnecting control wiring between different vertical sections.

9 Cable compartments

Cable compartment of adequate size shall be provided in the control panels for easy termination of all incoming and outgoing cables entering from bottom or top. Adequate and proper supports shall be provided in cable compartments to support cables.

10 Indications

1. 'ON' lamps shall be provided on all outgoing feeders.
2. Cable alley and bus chamber shall be identified on all panels.

11 Rubber Mat

Rubber mat shall be provided to cover the full length of front of all panels and rear of panels where back space shall be available for working from the rear.

12 Materials

All materials shall be of the best quality complying with the BIS (Bureau of Indian Standards) specifications. Materials used shall be subject to the approval of the Owner's site representative and samples of the same shall be furnished where required.

a) Moulded Case Circuit Breaker

MCCB shall comprise of switching mechanism, contact system, arc extinguishing device and the tripping unit, Contained in a Compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stress. Switching mechanism shall be of Quick Make- Quick Break type and the trip command shall override all other commands. MCCB shall employ maintenance free contact system to minimise the let thru `energies while handling abnormal currents.

The handle position shall give positive indication of 'ON' 'OFF' or tripped. MCCB shall conform to IS- 2516 (Part I & II/Sec.1) 1985.

b) Miniature Circuit Breaker

Miniature circuit breakers shall be quick make and break type, and shall conform to Relevant Indian Standards. The housing shall be heat resistant and having a high impact strength. The fault current shall not be less than 9 KA at 230 V and shall be BIS approved. MCBs shall be flush mounted and shall be provided with trip free manual operating lever and 'ON' and 'OFF'

indications. The contacts shall be provided to quench the arc immediately. MCB shall be provided with magnetic thermal releases for over current and short circuit protection. The over load or short circuit device shall have a common trip bar in the case of D P, TP and TPN miniature circuit breakers.

c) Rotary Switches

Switches upto 60 amps shall be rotary type with compact and robust construction, built up from one or more stacks with contacts and a positioning mechanism with stop as required. Rotary switches shall have HRC fuse fittings of appropriate rating.

d) Selector Switch

Where called for, selector switches of rated capacity shall be provided in control panels, to give the choice of operating equipment in selective mode.

e) Starters

Each motors shall be provided with a starter of suitable rating. Starters shall be in accordance with relevant BIS Codes. All Star Delta and ATS Starters shall be fully automatic.

Starters contactors shall have 3 main and 2 Nos. NO / NC auxiliary contacts and shall be air break type suitable for making and breaking contact at minimum power factor of 0.35. For design consideration of contactors the starting current of connected motor shall be assumed to be 6 times the full load current of the motor in case of direct-on-line starters and 3 times the full load current of the motor in case of Star Delta / Reduced Voltage Starters. The insulation for contactor coils shall be of class "B". Operating coils of contactors shall be suitable for 230 / 415 +10% volts AC, 50 cycles supply system. The contactors shall drop out when voltage drops to 90% of the rated voltage. The housing of the contactors shall be heat resistant and having high impact strength. Each starter shall have thermal overload protection on all three phases.

f) Over Load Relays

Contactors shall be provided with a three element, positive acting ambient temperature compensated time lagged hand-reset type thermal over load relays with adjustable setting. Hand-reset button shall be flush with the front door for resetting with starter compartment door closed. Relays shall be directly connected for motors upto 35 HP capacity. C.T operated relays shall be provided for motors above 35 HP capacity. Heater circuit contactors may not be provided with overload relays.

g) Current Transformers

Current transformers shall be of accuracy class I and suitable VA burden for operation of the connected meters and relays. These shall be resin bonded and epoxy coated.

h) Single Phase Preventers

Single phase preventers shall be provided as per Bill of Quantities and shall be in conformity with relevant BIS Standards. Single phase preventers shall act when the supply voltage drops down to 90% of the rated voltage or on failure of one or more phases.

i) Time Delay Relays

Time delay relays shall be adjustable type with time delay adjustment from 0-180 seconds and shall have one set of auxiliary contacts for indicating lamp connections.

j) Indicating Led (22 mm dia) and Metering

All meters and indicating lamps shall be in accordance with BS 37 and BS 39. The meters shall be flush mounted and draw out type. The indicating lamp shall be of LED type. Each main panel shall be provided with voltmeter 0-500 volts with three way and off selector switch, CT operated ammeter of suitable range with three Nos. CTs of suitable ratio with three way and off selector switch, phase indicating lamps, and other indicating lamps as called for. Each phase indicating lamp shall be backed up with 5 amps fuse. Other indicating lamps shall be backed up with fuses as called for.

k) Toggle Switch

Toggle switches, where called for, shall be in conformity with relevant BIS Codes and shall be of 5 amps rating.

l) Push Button Stations

Push button stations shall be provided for manual starting and stopping of motors / equipment as called for. Green and Red colour push buttons shall be provided for 'Starting' and 'Stopping' operations. 'Start' or 'Stop' indicating lamps shall be provided for push buttons. Push buttons shall be suitable for panel mounting and accessible from front without opening door, Lock lever shall be provided for 'Stop' push buttons. The push button contacts shall be suitable for 6 amps current capacity.

m) Conduits

Conduits shall be of mild steel and shall be Hard drawn, stove enameled inside and outside with minimum wall thickness of 1.6 mm for conduits upto 32mm diameter and 2 mm wall thickness for conduits above 32 mm diameter. GI pull wires shall be installed in the conduit while laying the conduit.

n) Cables

M.V.cables shall be PVC insulated aluminum conductor and armored cables conforming to BIS Codes. Cables shall be armored and suitable for laying in trenches, duct, and on cable trays as required. M.V Cables shall be termite resistant. Control cables and indicating panel cables shall be multi core PVC insulated copper conductor and armored cables.

o) Wires

1100 volts grade PVC insulated copper conductor wires in conduit shall be used. 13 Cable

Laying Cable shall be laid generally in accordance with BIS Code of Practice. Cables shall be laid on 14 gage perforated MS sheet cable trays, and cable drops / risers shall be fixed to ladder type cable trays fabricated out of steel angle. Access to all cables shall be provided to allow cable with draw /replacement in the future. Where more than one cable is running, proper spacing shall be provided to minimize the loss in current carrying capacity. Cables shall be suitably supported with Galvanized saddles when run on walls / trays. When buried, they shall be laid in 350 mm wide and 750 mm deep trench and shall be covered with 250 mm thick layer of soft sifted sand & protected with bricks, tiles. Special care shall be taken to ensure that the cables are not damaged at bends. The radius of bend of the cables when installed shall not be less than 12 times the diameter of cable. 1.1KV cable shall be buried 600 mm below ground level.

14 Drawings

Shop drawings for control panels and wiring of equipment showing the route of conduit/cable shall be submitted by the contractor for approval of Project Managers/ Consultant before starting the fabrication of panel and starting the work. On completion, four sets of complete "As-installed" drawings incorporating all details like, conduits routes, number of wires in conduit, location of panels, switches, junction/pull boxes and cables route etc. shall be furnished by the Contractor.

15 Testing

Before commissioning of the equipment, the entire electrical installation shall be tested in accordance with relevant BIS Codes and test report furnished by a qualified and authorized person. The entire electrical installation shall be got approved by Electrical Inspector and a certificate from Electrical Inspector shall be submitted. All tests shall be carried out in the presence of Supervisor.

16 Painting

All sheet steel work shall undergo a process of degreasing, thorough cleaning, and painting with a high corrosion resistant primer. All panels shall then be backed in an oven. The finishing treatment shall be by application of synthetic enamel paint of approved shade.

17 Labels and Tags

Engraved PVC labels shall be provided on all incoming and outgoing feeders switches. Circuit diagram showing the arrangements of the circuit inside the control panel shall be pasted on inside of the panel and covered with transparent plastic sheet. All cables terminations at panels and at equipments shall be provided with tags as approved by Project Managers.

18 All panels to have provision for padlocking and all MCCB's / MCB's to have provision for locking in off position.

19 Measurement of Electrical Control Panels

Panels shall be counted as number of units. Quoted rates shall include as lump sum (NOT measurable lengths) for all internal wiring, power wiring and earthing connections from the control panel to the starter and to the motor, control wiring for inter-locking, power and control wiring for automatic and safety controls, and control wiring for remote start/stop as well as indication as per the specifications. The quoted rate for panel shall also include all accessories, switchgear, fuses, contactors, indicating meters and lights as per the specifications.

End of Division 5: Electrical Installations

16.0 Technical Data for Fire Fighting System.

It is the sole responsibility of the contractor to select the pump/motor to meet the requirements specified in the tender. Contractor is asked to fill up all the dates given below.

1. Fire Hydrant & Sprinkler System.

1.1	Pumps	Elec. Driven Fire /Sprinkler Pump	Diesel Driven Jockey Pump
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Makes
Model No.
Rated Discharge (LPM)
Rated Head (M)
Speed (RPM)
No. of Stages
Efficiency at rates
Capacity & head
KW required at rated
Capacity & head
KW required at 150%
Rated discharge
Shut off head (M)

Material of Construction

- a) Body
 - b) Impeller
 - c) Shaft
- A) Whether pump is capable of discharging 150% of rated capacity at a head not less than 65% of rated head.
- B) Whether the motor is capable to handle the zero head of pumps.

1.2 Pipes

Make
Class (upto 150mm dia)
Thickness (200mm dia and above)
Painting details
for above ground
& exposed pipes
Wrapping & coating
Whether ISI marked

1.3	Fitting	Forged Fittings (up to 50 mm dia.)	Butt welded Fittings (65 mm dia & above.)
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Type		
Make		
Material		
Type of ends		
Pressure rating		
Whether ISI marked		

1.4 Dual/Disk Butterfly Valves

Make & Type
Type of ends
Material of construction
Test Pressure
Provided with all Accessories including gear system as per relevant IS
Whether ISI marked/
TAC approved

1.5	Engine/Motors	Engine	Main Pump	Jockey Pump
	Make			
	Type & Model			
	No			

Frame Size
Speed (RPM)
Rated Cap.
(KW)
Efficiency (%)

1.6 Control Panel (MCC)

Manufacturer
Dimensions
Type of construction
& mounting
Sheet Metal Enclosure
 a) Material
 b) Thickness
Electrical Rating
Make of
starters/
Contactors
 Rating of Contactors
 Size & material of Bus bar
 Annunciation system
Approx. weight
Painting details
Whether all equipment/
Components as per
Specification included

1.7 Dual / Disk Type Non Return Valves

Make & Type
Type of ends

Material of construction
Test Pressure
Provided with all
Accessories including
gear system as per
relevant IS
 Whether ISI marked/
TAC approved

1.8 Dual / Disk Type Non Return Valves

Make , Type , Model
Type of ends

Whether
confirm to to &
marked IS:778

1.9 Dual / Disk Type Non Return Valves

Make & Type
Material of construction
Details of Flange

O.D. (MM)
P.C.D (MM)
No. of Holes
Whether ISI marked/
TAC approved

1.10	Hose Pipe	C.P. Hose	RRL. (Type-A)
1.10.1	Make		
1.10.2	Test Pressure		
1.10.3	Dia (MM)		
1.10.4	Length (M)		
1.10.5	Material of couplings		
1.10.6	Where hose & Couplings ISI marked		

1.11 Branch Pipes & Nozzles

1.11.1 Make
1.11.2 Material
1.11.3 Dia. of Coupling
1.11.4 Dia of Nozzle
1.11.5 Where ISI marked

1.11 Branch Pipes & Nozzles

1.11.1 Make
1.11.2 Material
1.11.3 Dia. of Coupling
1.11.4 Dia of Nozzle
1.11.5 Where ISI marked

1.12 Branch Pipes & Nozzles

Make
Material
Thickness of sheet
Thickness of glass
Whether Rubber Gasket
Provided
Painting Details

1.13 First Aid Hose Reel

Make & Material
a) Drum
b) Hose
Size of Hose
(Dia x length)
Hose test pressure
Size & material of
Nozzle
Size & material of
Shut off valve
Whether complete unit
strictly confirms to
and marked IS:884
TAC approved

1.14 Pressure Gauge

Make & Type
Dial size (mm)
Range (kg/cm.sq.)
Whether ISI marked/
TAC/UL approved

1.15 Sprinkler Head	Conventional Pendant / Upright	Side wall	Concealed
Make Material Type of sensing Element & temperature Rating (C) Orifice size (MM) Type (UPRIGHT/PENDENT/ CONVENTIONAL/SIDEWALL /EXTENDED RANGE) Whether listed / Approved by UL/FH			

1.16	Wet Alarm Valve
1.16.1	Make
1.16.2	Material
1.16.3	Size (MM
1.16.4	Whether provided with electric bell, test valve, drain valve, & all other training connection
1.16.5	Whether approved hydraulic alarm motor & gong provided
1.16.6	Whether valve & alarm Motor & gong listed/ approved by UL/FM/FOC/TAC

End of Division 7: Technical Data for Fire Fighting System