

# Metropolitan Waterworks and Sewerage System Regulatory Office (MWSS-RO)

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Balara Filtration Complex, Katipunan Road, Balara, Quezon City



## MWSS-RO Building

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Balara Filtration Complex, Katipunan Road, Balara, Quezon City

## Technical Specifications - Fire Protection

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# Contents

1. Fire Protection General Requirement.....	1
2. Standpipes.....	6
3 Fire Extinguisher.....	15
4. Automatic Fire Sprinkler System.....	17
5. Pumps.....	29
6. Controller.....	35

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## **FIRE PROTECTION GENERAL REQUIREMENTS**

### Part 1 - GENERAL

#### 1.1 Intent:

It is the intent of this specification to define the standards of components system forming part of the fire protection system installation. All work carried out shall conform to these standards and shall include all components required by statutory authorities.

#### 1.2 Description Of Work

The work includes providing new fire protection systems for the proposed building. The equipment, materials installation, workmanship, inspection and testing shall be in strict accordance with the required advisory provisions of national fire protection association standards, fire code of the philippines and national building code except as modified herein. The work includes the following:

- A. Complete wet pipe and standpipe system. System shall be complete including automatid fire sprinkler system, fire pump, fire department connection, valves, hose, hose valves, hose cabinet, etc.
- B. Painting of pipe work and equipment.
- C. Testing and commissioning.
- D. Provision of operating instructions and maintenance manuals.
- E. Training of the building's maintenance staff for proper operation of the entire system.

The contractor shall be responsible for coordinating his work with the various trades as necessary to avoid conflicts and to insure the installation of all work within the available space. Requirement for portable fire extinguisher shall comply with the local fire department policy.

#### 1.3 Qualification Of Installer:

The contractor shall submit with the bid data for approval showing that the contractor has successfully installed fire extinguishing systems, and equipment of the same type and design as specified herein.

The contractor shall submit the following:

- 1. Contractor's organizational chart and name of personnel.
- 2. Financial statement
- 3. List of fire protection projects that have been completed and contract amount.
- 4. Company profile

indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months.

#### 1.4 Work done by others:

- A. All building works including beams, floor and wall penetrations for pipework, etc. The contractor shall be responsible for setting out penetrations to insure conformity with installation requirements.
- B. Provision of flashing upstands (concrete) for pipework penetrations through floor slabs and roof. The contractor shall provide all necessary flashing collars.
- C. Provision of concrete base and foundation for equipment except otherwise indicated. The sub-contractor shall submit shop drawings prior to implementation of the bases and foundations.
- D. All power supply up to the equipment control panels.

#### 1.5 Submittals:

Submit shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system as specified in each individual section, and obtain approval from the consultant before procurement, fabrication, or delivery to the job site. Approval of submittal shall not relieve the contractor of the responsibility of inspecting such material or equipment for defects or non-conforming with the specifications. Partial submittals are not acceptable and will be returned without review. Submittals shall include the manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, industry, and technical society publication references, years of satisfactory service, and other information necessary to establish contract compliance of each item the contractor proposes to provide. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval.

- a. Shop drawings: drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment, and equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, and other items that must be shown to assure a coordinated installation. Drawings shall indicate adequate clearance for operation, maintenance, and replacements of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted.
- b. Manufacturer's data: submittals for each manufactured item shall be of manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.

- c. Manufacturer's installation instructions: where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

#### 1.6 Operation And Maintenance Manual:

Furnish an operation and maintenance manual as required for each item of equipment as specified in each individual section. Furnish 5 copies of the manual bound in hardback binders or an approved equivalent. Furnish one complete manual to the consultant for review and approval within 90 calendar days after the equipment is approved, but at least 60 calendar days prior to field acceptance testing of the equipment or system. Furnish the remaining manuals at least 60 calendar days before the contract is completed. Inscribe the following identification on the cover: the words operation and maintenance manual, the name and location of the equipment or the building and the name of the contractor. The manual shall include the names, addresses, and telephone numbers of each contractor installing equipment, and of the local representatives for each item of equipment. The manual shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in. The manual shall include: wiring and control diagrams with data to explain detailed operation and control of each item of equipment, a control sequence describing start-up, operation and shutdown, description of the function of each principal item of equipment; the procedure for starting; the procedure for operating; shutdown instructions; installation instructions; maintenance instructions; lubrication schedule including type, grade, temperature range, and frequency; safety precautions, diagrams, and illustrations; test procedures performance data and parts list. The parts list for equipment shall indicate the sources of supply, recommended spare parts, and the service organization which is reasonably convenient to the project site. The manual shall have complete information on the equipment, controls, accessories, and associated appurtenances provided.

#### 1.7 Posted Operating Instructions:

Furnish approved operating instructions for each system and principal item of equipment as specified in each individual section for the use of the operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal item of equipment. Operating instructions shall be printed or engraved, and shall be framed under glass or in approved laminated plastic and posted where directed. Operating instructions shall be attached to or posted adjacent to each principal item of equipment and include directions for start-up, proper adjustment, operating lubrication, shutdown, safety precautions, procedure in the event of equipment failure, and other areas as recommended by the manufacturer of each item of equipment.

### 1.8 Delivery and Storage:

Equipment and materials shall be handled, stored, and protected to prevent damage before and during installation in accordance with the manufacturer's recommendations. Damaged or defective items shall be replaced.

### 1.9 Standards Products/Service Availability:

- a. Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products, which are of similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for two (2) years prior to bid opening.
- b. Service support: the equipment items shall be supported by service organizations. The contractor shall submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
- c. Manufacturer's nameplate: each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

### 1.10 Safety Requirements:

- a. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, rotating parts, and other power transmission apparatus, located so that any person can come in close proximity thereto, shall be fully located or properly guarded. Points of operation, ingoing nip points, and machinery producing flying chips and sparks shall be guarded.

### 1.11 As-built drawing:

After completion, but before final acceptance of the work, furnish a complete set of as-built drawings of each system for record and occupancy permit purposes. The contractor professional engineer shall sign the as-built drawing in applying for occupancy permit.

## Part 2 : Execution

### 2.1 Installation:

Equipment, materials, installation and workmanship shall be in accordance with the applicable standard of the national fire protection association.

### 2.2 Acceptance Of The Work:

The consultant shall witness the formal test and approve all systems before they are accepted by the owner.

### 2.3 Guarantee:

All equipment and installation shall be guaranteed for one (1) year from the date of acceptance against failure of components resulting from normal use or factory defects. Any parts of the system or equipment that becomes defective during the term of guarantee shall be repaired or replaced by the contractor at his own expense.



## STANDPIPES

### Part 1 – General

#### 1.1 Description

- A. System design and manufacturer's products shall be in accordance with the required and advisory provisions of NFPA 14, except as modified herein. System shall include materials, accessories and equipment inside and outside of the building necessary to provide the system complete and ready for use.
- B. Provide all labor, material, equipment and appliances, and perform all operations for the work as outlined in the specifications and delineated on the drawings for the installation of complete system. All work shall be performed in strict accordance with these specifications and the drawings. Secure and pay for permits, fees and inspections required for the approval of wet/dry standpipe systems.
- C. Contractor for this work shall be held to have read all of the tender requirements, the general conditions, and in the execution of work he will be bound by all of the conditions and requirements therein.
- D. Related documents

Drawings and general provisions of the contract, including general and supplementary conditions and division 1 specification sections, apply to this section.

#### 1.2 Quality Assurance

- A. All materials and equipment shall be produced in a plant of recognized reputation and regularly engaged in the production of pipes and/or equipment conforming to the specified standards. A single manufacturer shall produce all the pipe of the same type supplied for the work. Materials and equipment shall be new, of makes and kinds specified herein, or as indicated on the drawings, without exception.
- B. All material and work to be in accordance with applicable portions of the latest revisions and editions of the following standards unless otherwise indicated.
  - 1. NFPA 13 Standard for the Installation of Sprinkler Systems
  - 2. NFPA 14 Standard for the Installation of Standpipe and Hose Systems
  - 3. NFPA 20 Standard for the Installation of Stationary Fire Pumps for Fire Protection
  - 4. NFPA 72 National Fire Alarm Code
  - 5. ASTM American Society for Testing Materials
  - 6. ANSI American National Standards Institute
  - 7. AWWA American Water Works Association
  - 8. UL Underwriters Laboratories inc.
  - 9. FM Factory Mutual
  - 10. NFPA 101 Life Safety Code
  - 11. NFPA 10 Standard for Portable Fire Extinguishers

12. NFPA 22 Standard for Water Tanks for Private Fire Protection
13. Local codes and regulations
14. FM global data sheet

- C. All equipment shall be UL-listed and FM approved.
- D. The complete fire protection installation shall be made by an approved installer, specializing fire protection work, having not less than five (5) years experience in installing systems of comparable size.
- E. Contractor shall submit proof of valid license to perform work in the Philippines.
- F. If any of the requirements of the above are in conflict with one another or with the requirements of these specifications, the most stringent requirement shall govern.

### **1.3 Related Documents**

- A. Contractor will be responsible to carry out the commissioning requirements these include, but are not limited to, commissioning, enhanced commissioning, preparation of a detailed O&M manual, and detailed training of the employer's personnel.
- B. Drawings and general provisions of the contract, including general and supplementary conditions and division 1 specification sections, apply to this section.

## Part 2 – Products

### **2.1 Pipe & pipe fittings**

- A. Pipe
  1. Pipe shall be black carbon steel pipe ,schedule 40, conforming to the latest standard specification for welded steel pipe of the ASTM A-53. For underground installation, pipe shall be protected against corrosion.
- B. Fittings
  1. Fittings shall be welded, threaded, or grooved-end type.
  2. Threaded fittings shall be made of malleable iron in conformance to ANSI B16.3.
  3. Welded fittings shall be made of factory-made wrought steel in conformance to ANSI B16.9 or flange in conformance to ANSI B16.5.
  4. Underground fittings shall be protected against corrosion.
  5. Rubber gasketed grooved-end pipe and fittings with shall be permitted in pipe sizes 40 mm (1.5 inch) and larger. Fittings shall be UL listed or FM approved for use in dry & wet standpipe systems. Fittings, mechanical couplings, and rubber gaskets shall be supplied by the same manufacturer.

## **2.2 Fire hose**

- A. Fire hose shall be of the type approved by local authority.
- B. Rubber hose shall be continuous, non-kinking reinforced rubber complying with BS 3169 or approved equivalent. Connection of hose to both outlet bulb assembly and to nozzle shall be by steel cadmium plated hose clips.
- C. The reel shall be of rigid construction using at least 2.0mm pressed steel. It shall rotate freely on leak proof bearings and be fitted with pivoted nylon rollers to allow easy run-out of the hose.
- D. The approved nozzle shall be chrome-plated brass of 6.5mm bore. It shall be adjustable for jet or spray pattern with complete shut-off.
- E. Where the residual pressure at outlet on a hose connection available for occupant use exceeds 6.9 bars (100 psi), an approved pressure regulating device using pressure reducing valve or discs shall be provided to limit the residual pressure at the flow required.

## **2.3 Fire Hose Valve**

- A. Landing valve shall be of the type approved by local fire dept.
- B. The landing valve shall comply with the requirements of BS 5041 part 2 or approved equivalent. They shall be a purpose-made fitting with flange to BS 4504 or BSP screwed inlet, instantaneous female coupling outlet fitted with a removable brass plug secured by a chain handwheel.
- C. Every fire hose valve shall incorporate pressure reducing valve or discs to prevent the outlet under flow conditions to maximum pressure required by local fire dept.
- D. The fire hose valve shall be closed by turning the handwheel in a clockwise direction and the direction of opening shall be permanently marked on the operating wheel by an embossed arrow and the word "open".

## **2.4 Fire Hose Cabinet**

Provide recessed, semi recessed, or surface-mounted cabinets. Cabinets shall be prime grade, cold-rolled, reannealed, process-leveled, furniture steel. Fabricate cabinet from 20 gauge steel and door and trim from 18 gauge steel. Provide fully welded joints ground smooth. On each jamb, provide at least two anchors or reinforcements spaced approximately 610 mm/ 24 inches apart for building in or attaching the cabinets to adjacent construction. Doors shall be flush hollow metal type with fully welded joints ground smooth and full glazed opening. Provide door with continuous hinge, latch and pull. Hinge door for 180 degree opening. Glass shall conform to ASTM C1036 and shall be type II (flat wired glass), class 1 (clear), form 1 (wired, polished both sides), quality q 8 (glazing quality), diamond or square wire mesh, 6.35 mm 1/4 inch thick. Factory finish cabinet inside and out with one coat of enamel applied over a primer. Interior finish color shall be white. Exterior finish color shall be as per architectural design group. Cabinet shall have sufficient interior space to store one fire extinguisher.

## **2.5 Valves**

- A. Gate valves  
UL listed, bronze body, OS&Y, rising stem, flanged ends, 3,000 KP listed for

fire protection service.

B. Check valves

provide FM-approved or UL-listed standard swing-check valves with elastomer-disc seat.

**2.6 Fire Department Connection**

A. All fire department connections (FDC) shall be equipped with a single 100 mm “hydra storz” quick-connect fitting with a 30-degree down angle and suite to couplings of local fire brigade department.

B. Words “sprinkler and hydrant” cast-in on escutcheon.

**2.7 Auto Ball Drip**

A. 20 mm bronze with both ends threaded.

B. Install in horizontal position, pipe to spill over floor drain.

**2.8 Drains**

A. Provide valves and/or plugs at base of risers and other locations required for complete drainage of system.

**2.9 Hose Valve Assemblies**

A. Polished brass angle body, polished trim and red cast iron wheel handle, 2,000 KPa.

**2.10 Hangers And Supports**

A. Hangers and supports shall be provided and installed for all piping as required by this specification and all authorities having jurisdiction over the work, and shall be approved by the MEPF consultant. Support piping independently from structure.

B. All hangers and supports shall be made of steel or other durable and non-combustible materials. Wood, wire, or perforated strap iron shall not be used as permanent hangers or supports. Hangers that penetrate finished ceilings shall be provided with a chrome or nickel plated escutcheon plate manufactured by Grinnell, or approved equal.

C. Hangers and supports shall be installed so as not to interfere with the free expansion and contraction of piping, and all nuts and bolts shall be drawn up tight.

D. Except where specified elsewhere, hangers for pipes shall be adjustable wrought steel, clevis type, similar to Grinnell figure no. 260, or approved equal. Hangers shall be complete with bolts, rod and two nuts for each bolt. The diameter of hanger rods shall be as follows:

<u>Pipe size</u>	<u>Diameter of rod</u>
20 mm – 50 mm	10 mm
65 mm – 85 mm	13 mm
100 mm – 125 mm	16 mm
150 mm	20 mm

- E. Small tubing to gauges, controls, or other equipment installed on any apparatus shall be secured in place with bolted clips.
- F. All vertical piping shall be firmly supported by riser clamps properly installed to relieve weight from fittings and piping at base of risers. Vertical pipes shall have riser clamps not to exceed 4.5 m spacing.
- G. Where required, furnish and install heavy anchorage to the pipe against movement from expansion and contraction and secure the approval of the mepf consultant for the method of installing the anchorage before the work.
- H. Horizontal piping shall be supported at intervals not greater than 3 m spacing and at all changes of direction.
- I. Where static pressure exceeds 350 KPa, provide support to prevent upward movement at the end of branch lines and arm-overs where sprinklers are below ceilings, where required by NFPA 13.

### **2.11 Pipe Sleeves**

Furnish, install and be responsible for the location of proper sleeves for all pipes passing through floor, walls, partitions or other building construction. Where sleeves occur in concrete construction, they shall be set before concrete is poured.

Set sleeves and anchors in a suitable manner so that they will not become displaced. Sleeves for piping passing through walls and floors in concealed spaces shall be cut flush with walls or floor. All sleeves shall be schedule 40 galvanized steel pipe, and of such a size as to permit piping and piping insulation to pass through sleeve.

- B. Sleeves passing through foundation walls or exterior walls, or where seepage may occur, shall be thoroughly waterproofed by removing all loose material and caulking with oakum and lead wool tightly around pipe or exterior as well as interior surface. Finish off interior surface with cement. Finish off exterior surface with two layers of felt, mopped on with hot asphalt, making for an absolutely waterproof installation. All waterproofing must be performed before any backfilling is done.
- C. On all pipes passing through fire rated walls and ceilings, in finished areas, and where pipes are exposed to view, furnish and install plates on each side of the wall, grinnell no. 13 chrome- or nickel-plated, or approved equal. Plate shall be large enough to cover sleeve opening and pass insulation. Clamp plate firmly to pipe by means of setscrews.
- D. Sleeves passing through walls and floors between rooms shall be filled from both ends of sleeve with fireproof insulation material of a fire rating equal to that of the wall or floor.

### **2.12 Identification**

- A. Painting finish (type, quality, and colour) to all fire protection pipework shall comply with the requirements of local code.
- B. All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

## Part 3 – Execution

### 3.1 General

- A. Install a complete combined fire standpipe system with all piping, valves, hangers, signs, valves, tests, etc., as indicated on drawings and as specified herein.
- B. Furnish and install all drain piping, flushing, connections, drain plugs, drain valves, etc., at drain points and all low points.
- C. Seal all valves, not provided with tamper switches, in open position by approved means.
- D. Piping shall be run parallel to walls and beams. Before finalizing the location of any piping, consult with other trades so as to avoid interfering with their work.
- E. Care shall be exercised in the installation of the piping so that the system will drain by gravity, back through branches.
- F. All electrical devices associated with and/or listed within this section including power and control wiring with the exception of main source of power from the building's electrical system shall be the sole responsibility of the contractor. This shall include but is not limited to conduit, wiring, termination of wiring, etc.

### 3.2 Training

- A. Provide instruction of the employer's personnel:
  - 1. Instruct the employer's personnel in proper starting sequences, operation, shutdown and maintenance procedures, including normal and emergency procedures.
  - 2. Instruction shall be by personnel skilled in operation of equipment. Instructions for major equipment shall be provided by equipment manufacturers' representatives.
  - 3. Instructions on automatic controls shall be by manufacturer's representative.

### 3.3 Tests

- A. General:
  - 1. The entire works shall be fully tested in stages as the work proceeds and on completion of work as applicable.
  - 2. To provide during normal working hours, all necessary labours, instruments, equipment, materials, fuel, power and maker's representatives, to carry out such tests as may be necessary to satisfy the mepf consultant that the installation meets the requirement and intent of the specification as well as such tests required by local fire dept.
  - 3. All tests shall be made in the presence of the mepf consultant or his representative or any inspecting authority.
  - 4. Tests described hereinafter and including all tests prescribed by the authority having jurisdiction shall be carried out. Any tests proved unsatisfactory shall be repeated to the satisfaction of the inspecting parties.
  - 5. To provide skilled technicians/professional mepf consultant to commission the plant and associated controls to the satisfaction of the mepf consultant. The skilled technicians/professional mepf consultant will be required to demonstrate the correct procedures in starting and stopping the plant, running the various items of equipment under automatic and manual control and the correct maintenance of the plant.

6. Water flow rates of all equipment shall be adjusted to design conditions. Complete results of adjustments shall be recorded and submitted.
- B. On-site testing and commissioning:
1. Two months prior to completion, submit a detailed programme for conducting on-site acceptance tests and commissioning for the mepf consultant's approval.
  2. Start up, operate, test and adjust the systems in accordance with the agreed programme. The setting shall be supervised by the mepf consultant, who shall remain on site until he thinks that the equipment are operating satisfactorily and accepted. Advise and co-ordinate with the manufacturer's representatives so that all testing is carried out according to the agreed programme.
  3. The whole installation shall be given the following tests to bring the plant into running order. The mepf consultant shall be given reasonable notice together with a copy of recorded test results, not less than seven (7) days, regarding the nature of tests, the time and location. Acceptance tests will only be witnessed by the mepf consultant when the submitted tests results are found satisfactorily.
  4. All instruments, tools, materials and labour required to perform these tests shall be provided.
  5. Before the tests are carried out, remove connected equipment and components which are liable to damage under test, and shall provide and fix all the necessary gauges, blanking flanges, etc.
  6. During system erection, the following tests shall be carried out:
    - a. Hose reels
      - 1) The manufacturer's recognised test certificate for the hose reels shall be submitted to the mepf consultant for scrutiny and approval before their installation on site.
      - 2) The mepf consultant shall select at random hose for site testing conforming to the local authority requirements.
    - b. Pipework load tests
      - 1) The mepf consultant shall select at his discretion any section of pipework for the following load tests as recommended in NFPA.
      - 2) Hangers shall be capable of withstanding the test loadings given in the NFPA rules.
      - 3) When installed and subjected to the test loadings, the hanger shall not rupture, pull out, distort or otherwise be damaged and hangers shall not show permanent distortion resulting in a change in level or material position of the pipe to be supported in excess of 8 mm. If in-situ tests are conducted, appropriate safety precautions must be taken.
  7. Prior to the system start-up, the following inspection, tests and pre-commissioning treatment shall be carried out:
    - a. Tanks and level switches
      - 1) The tanks shall be thoroughly cleaned with water and drained before city mains supply will feed in.

- 2) Also before city mains supply will feed in, the level switch shall be simulated for the various cut-in and cut-out settings.
- b. Pressure switches
- 1) The testing equipment arrangement for pressure switches and pressure gauges shall be as shown on the drawings or of an approved equivalent.
  - 2) The testing equipment shall be suitable for nominal working pressure of 2.5 MPa (PN 25) conforming to the bs, e.g. The pipework shall conform to bs 1387:1967 table 3 for class c heavy galvanized mild steel tube.
  - 3) The pressure settings corresponding for pump cut-in (lamp and buzzer energised) and pump cut-out (lamp and buzzer de-energised) and reset differentials shall be tested by applying the hand jacking pump or by opening the test valve.
  - 4) The pressure gauges to be tested shall be connected as shown on the drawing in lieu of the pressure switch. The gauges to be tested shall be regarded acceptable when the pressure readings of all three gauges are the same throughout the jacking pressure range varied by applying the hand pump.
- c. Flow switches
- 1) The testing equipment for the flow switches shall be as shown on the drawings or of an equivalent approved by the mepf consultant.
  - 2) The calibration test equipment shall provide a flow of 1 l/s over the vane of the flow switch in the direction shown, to be confirmed by the direct reading flow meter.
  - 3) The flow switch contacts shall make with energisation of the lamp and the buzzer, upon a flow not greater than 1 l/s flowing over the vane in the correct direction.
- d. Hydrostatic tests
- 1) All parts of the water circuit shall be filled with water before hydrostatic pressure testing, and pump running tests for verification of pressure and flow rate, are conducted.
  - 2) The hand jacking pump shall be applied to increase the system pressure to 2 times the working pressure or 1.5 times the working pressure plus 350 KPa whichever is the lower but in any case not less than 700 KPa. The pressure shall be maintained for a period not less than 24 hours.
  - 3) Where any section of pipework or equipments unable to withstand the maximum pipework test pressure, it shall be isolated during the pipework test then that section of pipework or equipment shall be re-tested at the appropriate test pressure.
  - 4) The working pressure for various systems shall be as shown on the drawings.
  - 5) Before performing the hydrostatic test, the fire hydrant, standpipe and hose reels system component shall be fulfilled:
    - a) All isolating gate valves shall be closed.
    - b) All hose nozzles shall be opened.



- c) All isolating valves shall be closed.
- d) The pump isolating valves shall be opened.
- e. Cleaning, flushing and pre-treatment
  - 1) Prior to start-up and satisfactorily hydraulic testing, clean the entire installation including all fittings and pipework and the like after installation and keep them in a new condition. All pumping systems shall be flushed and drained at least once through to get rid of contaminating materials. All pipes shall be rodded when necessary to ensure clearance of debris, cleaning and flushing shall be carried out in sections as the installation becomes completed.
  - 2) All strainers shall be inspected and cleaned out or replaced.
  - 3) When the entire systems are reasonably clean, a pre-treatment chemical shall be introduced and circulated for at least 8 hours. Warning signs shall be provided at all outlets during pre-treatment. The pre-treatment chemical shall:
    - a) Remove oil, grease and foreign residue from the pipework and fittings.
    - b) Pre-condition the metal surfaces to resist reaction with water or air.
    - c) Establish an initial protective film.
    - d) After pre-treatment, the system shall be drained and refilled with fresh water and left until the system is put into operation.
    - e) Details and procedures of the pre-treatment shall be submitted to the mepf consultant for approval.

### **3.4 Cleaning and adjusting**

- A. Brush and clean all work prior to concealing, painting and acceptance. Perform in stages if directed.
- B. Painted or exposed work soiled or damaged: clean and repair to match adjoining work before final acceptance.
- C. Remove debris from inside and outside of materials and equipment.
- D. Flush out piping after installation.
- E. Adjust valves and automatic control devices
- F. Disinfections
  - 1. Disinfect underground water mains after installation and test in accordance with:
    - a. **AWWA standard C-60.**
- G. The general contractor shall provide written proof of testing to the mepf consultant.

### **3.5 Demonstration**

- A. Engage a factory authorized service representative to train employers' maintenance personnel to adjust, operate, and maintain the standpipe system.
- B. Video record all training sessions and provide recordings to employer's representative.

## **FIRE EXTINGUISHERS**

### **PART 1 - General**

#### **1.1 Related documents**

- A. Drawings and general provisions of the contract apply to this section.

#### **1.2 Summary**

- A. Section includes portable, hand-carried and ceiling mounted clean agent fire extinguishers as specified including mounting brackets for fire extinguishers.

#### **1.3 Submittals**

- A. Product Data: for each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product schedule: for fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function.
- C. Operation and Maintenance data: for fire extinguishers to include in maintenance manuals.
- D. Warranty: Sample of special warranty.

#### **1.4 Quality assurance**

- A. NFPA compliance: fabricate and label fire extinguishers to comply with NFPA 10, "portable fire extinguishers."
- B. Fire extinguishers: listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
  - 1. Provide fire extinguishers approved, listed, and labeled by FMG.
- C. preinstallation conference:
  - 1. review methods and procedures related to fire extinguishers including, but not limited to, the following:
    - a. Schedules and coordination requirements.

#### **1.5 Coordination**

- A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

#### **1.6 Warranty**

- A. Special warranty: manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
  - a. failure of hydrostatic test according to NFPA 10.
  - b. Faulty operation of valves or release levers.
2. Warranty period: one (1) year from date of substantial completion.

## **PART 2 - Products**

### **2.1 Portable, Hand-Carried Fire Extinguishers**

- A. Clean agent type in steel container UL rated 1-a; 10-bc; c, 10 lbs (4.5 kg) nominal capacity in chrome-plated brass container, with pressure indicating gauge.

### **2.2 Mounting Brackets**

- A. Mounting brackets: manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
- B. Identification: lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by architect.
  1. Identify bracket-mounted fire extinguishers with the words "fire extinguisher" in red letter decals applied to mounting surface.

orientation: horizontal.

## **PART 3 - Execution**

### **3.1 Examination**

- A. Examine fire extinguishers for proper charging and tagging.
  1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 Installation**

- A. General: install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
  1. mounting brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.
- B. Mounting brackets: fasten mounting brackets to surfaces, square and plumb, at locations indicated.

## Automatic Fire Sprinkler System (AFSS)

### Part 1 – General

#### 1.1 Description

- A. Comply with general requirements and all documents referred to therein.
- B. Provide all labor, material, equipment and appliances, and perform all operations for the work as outlined in the specifications and delineated on the drawings for the installation of complete combined fire standpipe and sprinkler system. All work shall be performed in strict accordance with these specifications and the drawings. Secure and pay for permits, fees and inspections required for the approval of fire standpipe and sprinkler systems. Perform hydraulic calculations, and file the shop drawings and the calculations with factory mutual and the building authorities.
- C. General contractor for this work shall be held to have read all of the tender requirements, the general conditions, and in the execution of work he will be bound by all of the conditions and requirements therein.
- D. Following is a brief outline and description of the work included, but shall not be considered as complete and all inclusive:
  - 1. Pipe and fittings
  - 2. Joints
  - 3. Hangers and supports
  - 4. Pipe sleeves
  - 5. Valves
  - 6. Fire department connections and auto ball drips
  - 7. Sprinkler cabinets
  - 8. Identification tags
  - 9. Tests
  - 10. Sprinkler heads
  - 11. Water flow switches
  - 12. Fire extinguishers
  - 13. Tamper switches
  - 14. Fire pumps and jockey pumps

#### 1.2 System descriptions

- A. System design and manufacturer's products shall be in accordance with the required and advisory provisions of NFPA 13 except as modified herein. System shall include materials, accessories and equipment inside and outside of the building necessary to provide the system complete and ready for use.
- B. Provide all labor, material, equipment and appliances, and perform all operations for the work as outlined in the specifications and delineated on the drawings for the installation of complete system. All work shall be performed in strict accordance with these specifications and the drawings. Secure and pay for permits, fees and inspections required for the approval of wet/dry standpipe systems.
- C. Contractor for this work shall be held to have read all of the tender requirements, the general conditions, and in the execution of work he will be bound by all of the conditions and requirements therein.

### **1.3 Quality Assurance**

- A. All materials and equipment shall be produced in a plant of recognized reputation and regularly engaged in the production of pipes and/or equipment conforming to the specified standards. A single manufacturer shall produce all the pipe of the same type supplied for the work. Materials and equipment shall be new, of makes and kinds specified herein, or as indicated on the drawings, without exception.
- B. All material and work to be in accordance with applicable portions of the latest revisions and editions of the following standards unless otherwise indicated.
  - 2. NFPA 13 standard for the installation of sprinkler systems
  - 3. NFPA 14 standard for the installation of standpipe and hose systems
  - 4. NFPA 20 standard for the installation of stationary fire pumps for fire protection
  - 5. NFPA 72 national fire alarm code
  - 6. ASTM american society for testing materials
  - 7. ANSI american national standards institute
  - 8. AWWA american water works association
  - 9. UL underwriters laboratories inc.
  - 10. FM factory mutual
  - 11. IBC international building code 2003
  - 12. IFC 2003 international fire code
  - 12. NFPA 10 standard for portable fire extinguishers
  - 13. NFPA 22 standard for water tanks for private fire protection
  - 14. Local codes and regulations
  - 15. FM global data sheets
- G. All equipment shall be UL-listed and FM approved.
- H. The complete fire protection installation shall be made by an approved installer, specializing in sprinkler and fire protection work, having not less than five (5) years experience in installing systems of comparable size.
- I. General contractor shall submit proof of valid license to perform work in the philippines.
- J. If any of the requirements of the above are in conflict with one another or with the requirements of these specifications, the most stringent requirement shall govern.

## Part 2 – Products

### **2.1 Pipe & pipe fittings**

- A. Pipe
  - 1. B.i. pipes, schedule 40 as indicated, conforming to the latest standard specification for welded steel pipe of the ASTM A-53 and ASTM a-135 (ERW).

2. Provide piping, 50 mm smaller: black steel pipe ASTM A53/ASTM A-135 (ERW) schedule 40 with black cast-iron, malleable iron threaded

B. Fittings

1. Fittings shall be welded, threaded, or grooved-end type.
2. Threaded fittings shall be made of malleable iron in conformance to ANSI b16.3.
3. Welded fittings shall be made of factory-made wrought steel in conformance to ANSI b16.9 or flange in conformance to ANSI b16.5.
4. Rubber gasketed grooved-end pipe and fittings with shall be permitted in pipe sizes 40 mm 1.5 inches and larger. Fittings shall be UL listed or FM approved for use in dry & wet standpipe systems. Fittings, mechanical couplings, and rubber gaskets shall be supplied by the same manufacturer.

2.2 Riser Alarm Equipment

Ensure riser alarm equipment is UL listed or FM approved for fire protection use.

a. Wet pipe alarm check valve

Provide wet-pipe alarm check valve, complete with standard accessories and trim necessary to give an alarm and includes pressure gauges, retard chamber, testing provisions, water motor alarm and all necessary intercomponent piping, fittings, and valves.

**2.2 Valves**

A. Gate valves

1. UL listed, FM approved, bronze body, OS&Y, rising stem, flanged ends, 3,450 KPa.
2. Valves 50 mm and smaller, bronze to ASTM B61 solid wedge and screw ends. OS & Y
3. Valves 65mm and larger, iron body bronze, OS & Y solid wedge, flanged ends, 1400 KPa w.o.g except for residential express riser and fire pump valve assembly that should be 3240 KPa W.O.G.

B. Check valves

1. UL approved, FM approved
2. Valve 50mm and smaller, bronze to ASTM B61 designed for both horizontal vertical mounting replaceable composition disc and seat ring, screwed cap and end, 1400 KPa W.O.G.
3. Valves 65mm and larger, iron body, UL, FM approved, MSI AWWA bronze disc and seat ring, bolted cap to either horizontal or vertical mounting, flange ends 3413 KPa W.O.G except for residential express riser that should be 3240 KPa W.O.G.

C. Butterfly valves

UL-listed and FM approved, indicating type with supervisory monitoring switches, ductile iron body.

D. Provide tamper switches for all valves controlling flow in fire sprinkler systems.

- E. Tamper switches to be installed and adjusted by general contractor.
- F. Provide valve bypass on valves 150 mm and larger. Pressure rating of bypass valve shall be equal to the pressure of the main valve.
- G. Provide 300 mm wide wrought iron or steel ladder for valves with operating mechanism located more than 2 m above a floor or landing.

**2.3 Fire Department Connection**

- A. All fire department connections (fdc) shall be equipped with a single 100 mm “hydra storz” quick-connect fitting with a 30-degree down angle and suite to couplings of local fire brigade department.
- B. Words “sprinkler and hydrant” cast-in on escutcheon.

**2.4 Auto Ball Drip**

- C. 20 mm bronze with both ends threaded.
- D. Install in horizontal position, pipe to spill over floor drain.

**2.5 Drains**

- A. Provide valves and/or plugs at base of risers and other locations required for complete drainage of system.

**2.6 Hangers And Supports**

- E. Hangers and supports shall be provided and installed for all piping as required by this specification and all authorities having jurisdiction over the work, and shall be approved by the mepf consultant. Support piping independently from structure.
- F. All hangers and supports shall be made of steel or other durable and non-combustible materials. Wood, wire, or perforated strap iron shall not be used as permanent hangers or supports. Hangers that penetrate finished ceilings shall be provided with a chrome or nickel plated escutcheon plate manufactured by grinnell, or approved equal.
- G. Hangers and supports shall be installed so as not to interfere with the free expANSion and contraction of piping, and all nuts and bolts shall be drawn up tight.
- H. Except where specified elsewhere, hangers for pipes shall be adjustable wrought steel, clevis type, similar to grinnell figure no. 260, or approved equal. Hangers shall be complete with bolts, rod and two nuts for each bolt. The diameter of hanger rods shall be as follows:

<u>Pipe size</u>	<u>Diameter of rod</u>
20 mm – 50 mm	10 mm
65 mm – 85 mm	13 mm
100 mm – 125 mm	16 mm
150 mm	20 mm

- J. Small tubing to gauges, controls, or other equipment installed on any apparatus shall be secured in place with bolted clips.
- K. All vertical piping shall be firmly supported by riser clamps properly installed to relieve weight from fittings and piping at base of risers. Vertical pipes shall have riser clamps not to exceed 4.5 m spacing.
- L. Where required, furnish and install heavy anchorage to the pipe against movement from expansion and contraction and secure the approval of the mepf consultant for the method of installing the anchorage before the work.
- M. Horizontal piping shall be supported at intervals not greater than 3 m spacing and at all changes of direction.
- N. Where static pressure exceeds 650 KPa, provide support to prevent upward movement at the end of branch lines and arm-overs where sprinklers are below ceilings, where required by NFPA 13.

## **2.7 Pipe Sleeves**

furnish, install and be responsible for the location of proper sleeves for all pipes passing through floor, walls, partitions or other building construction. Where sleeves occur in concrete construction, they shall be set before concrete is poured.

Set sleeves and anchors in a suitable manner so that they will not become displaced. Sleeves for piping passing through walls and floors in concealed spaces shall be cut flush with walls or floor. All sleeves shall be schedule 40 galvanized steel pipe, and of such a size as to permit piping and piping insulation to pass through sleeve.

- B. Sleeves passing through foundation walls or exterior walls, or where seepage may occur, shall be thoroughly waterproofed by removing all loose material and caulking with oakum and lead wool tightly around pipe or exterior as well as interior surface. Finish off interior surface with cement. Finish off exterior surface with two layers of felt, mopped on with hot asphalt, making for an absolutely waterproof installation. All waterproofing must be performed before any backfilling is done.
- C. On all pipes passing through fire rated walls and ceilings, in finished areas, and where pipes are exposed to view, furnish and install plates on each side of the wall, grinnell no. 13 chrome- or nickel-plated, or approved equal. Plate shall be large enough to cover sleeve opening and pass insulation. Clamp plate firmly to pipe by means of setscrews.
- D sleeves passing through walls and floors between rooms shall be filled from both ends of sleeve with fireproof insulation material of a fire rating equal to that of the wall or floor.

## **2.8 Alarm Switches**

- A. Provide paddle type alarm switches for wet pipe systems. Provide alarm pressure switches for dry-pipe systems.
- B. Water flow alarm switches shall be UL listed reliable model a or similar with pneumatic retard mechanism.
- C. Provide flow detection and valve closed interface with the fire alarm system.



## **2.9 Floor Control Valve Assembly**

- A. Prefabricated, UL-listed and FM approved assembly consisting of a grooved end body, flow switch, inspectors test valve and pressure gauge.
- B. Provide a check valve at each connection to the riser.
- C. Provide check valve at drain before connection to drain riser.
- D. Provide flow detection and valve closed interface with the fire alarm system.

## **2.11 Identification**

- A. Signs, charts and tags shall be provided as described in NFPA 13 (standard for the installation of sprinkler systems).
- B. Painting finish (type, quality, and colour) to all fire protection pipework shall comply with the requirements of local code authority.
- C. All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

## **2.12 Sprinkler**

- A. Heads are automatic glass bulb type. Ensure heads in finished areas below suspended ceilings are concealed chrome-plated brass. Cover plate of baked enamel finished to match ceiling. Ensure heads in areas without ceiling are upright type. Sprinkler heads shall be rated ordinary temperature.

## **2.13 Sprinkler Cabinets**

- A. Provide spare sprinkler emergency cabinet and spare stock of sprinklers heads conforming to NFPA 13 (standard for the installation of sprinkler systems). The general contractor shall provide no less than 24 spare heads of each type and/or temperature rating.
- B. Cabinet shall be constructed of 22-gauge steel with prime coat and manufacturer's baked enamel finish in color selected by the meepf consultant. Cabinet(s) shall be located in fire pump room(s). Final location shall be as directed by the meepf consultant.

## **Part 3 – Execution**

### **3.1 General**

- A. Install a complete combined fire standpipe and sprinkler system with all piping, valves, hangers, signs, valves, tests, etc., as indicated on drawings and as specified herein.
- B. Furnish and install all drain piping, flushing, connections, drain plugs, drain valves, etc., at drain points and all low points.
- C. Seal all valves, not provided with tamper switches, in open position by approved means.
- D. Flushing connections shall conform, to NFPA 13 (standard for the installation of sprinkler systems). Include pressure gauges and 25mm inspector's test connections.
- E. Piping shall be run parallel to walls and beams. Before finalizing the location of any piping, consult with other trades so as to avoid interfering with their work.
- F. Care shall be exercised in the installation of the piping so that the system will drain by gravity, back through branches.
- G. All electrical devices associated with and/or listed within this section including

power and control wiring with the exception of main source of power from the building's electrical system shall be the sole responsibility of the general contractor. This shall include but is not limited to conduit, wiring, termination of wiring, etc.

### **3.2 Training**

- A. Provide instruction of the employer's personnel:
  - 1. Instruct the employer's personnel in proper starting sequences, operation, shutdown and maintenance procedures, including normal and emergency procedures.
  - 2. Instruction shall be by personnel skilled in operation of equipment. Instructions for major equipment shall be provided by equipment manufacturers' representatives.
  - 3. Instructions on automatic controls shall be by manufacturer's representative.

### **3.3 Tests**

- A. General:
  - 1. The entire works shall be fully tested in stages as the work proceeds and on completion of work as applicable.
  - 2. To provide during normal working hours, all necessary labours, instruments, equipment, materials, fuel, power and maker's representatives, to carry out such tests as may be necessary to satisfy the MEPF consultant that the installation meets the requirement and intent of the specification as well as such tests required by NFPA 13 and local code authority.
  - 3. All tests shall be made in the presence of the meepf consultant or his representative or any inspecting authority.
  - 4. Tests described hereinafter and including all tests prescribed by the authority having jurisdiction shall be carried out. Any tests proved unsatisfactory shall be repeated to the satisfaction of the inspecting parties.
  - 5. To provide skilled technicians/professional meepf consultants to commission the plant and associated controls to the satisfaction of the meepf consultant. The skilled technicians / professional meepf consultants will be required to demonstrate the correct procedures in starting and stopping the plant, running the various items of equipment under automatic and manual control and the correct maintenance of the plant.
  - 6. Water flow rates of all equipment shall be adjusted to design conditions. Complete results of adjustments shall be recorded and submitted.
- B. On-site testing and commissioning:
  - 1. Two months prior to completion, submit a detailed programme for conducting on-site acceptance tests and commissioning for the mepf consultant's approval.
  - 2. Start up, operate, test and adjust the systems in accordance with the agreed programme. The setting shall be supervised by the mepf consultant, who shall remain on site until he thinks that the equipment are operating satisfactorily and accepted. Advise and co-ordinate with the manufacturer's representatives so that all testing is carried out according to the agreed programme.

3. The whole installation shall be given the following tests to bring the plant into running order. The mepf consultant shall be given reasonable notice together with a copy of recorded test results, not less than seven (7) days, regarding the nature of tests, the time and location. Acceptance tests will only be witnessed by the mepf consultant when the submitted tests results are found satisfactorily.
4. All instruments, tools, materials and labour required to perform these tests shall be provided.
5. Before the tests are carried out, remove connected equipment and components which are liable to damage under test, and shall provide and fix all the necessary gauges, blanking flanges, etc.
6. During system erection, the following tests shall be carried out:
  - a. Hose reels
    - 1) The manufacturer's recognised test certificate for the hose reels shall be submitted to the MEPF consultant for scrutiny and approval before their installation on site.
    - 2) The MEPF consultant shall select at random hose reel for site testing conforming to the local code requirements.
  - b. Pipework load tests
    - 1) The mepf consultant shall select at his discretion any section of pipework for the following load tests as recommended in NFPA.
    - 2) Hangers shall be capable of withstanding the test loadings given in the NFPA rules.
    - 3) When installed and subjected to the test loadings, the hanger shall not rupture, pull out, distort or otherwise be damaged and hangers shall not show permanent distortion resulting in a change in level or material position of the pipe to be supported in excess of 8 mm. If in-situ tests are conducted, appropriate safety precautions must be taken.
7. Prior to the system start-up, the following inspection, tests and pre-commissioning treatment shall be carried out:
  - a. Tanks and level switches
    - 1) The tanks shall be thoroughly cleaned with water and drained before city mains supply will feed in.
    - 2) Also before city mains supply will feed in, the level switch shall be simulated for the various cut-in and cut-out settings.
  - b. Pressure switches
    - 1) The testing equipment arrangement for pressure switches and pressure gauges shall be as shown on the drawings or of an approved equivalent.
    - 2) The testing equipment shall be suitable for nominal working pressure of 2.5 MPa (PN 25) conforming to the BS, e.g. The pipework shall conform to BS 1387:1967 table 3 for Class C heavy galvanized mild steel tube.
    - 3) The pressure settings corresponding for pump cut-in (lamp and buzzer energised) and pump cut-out (lamp and buzzer de-

energised) and reset differentials shall be tested by applying the hand jacking pump or by opening the test valve.

- 4) The pressure gauges to be tested shall be connected as shown on the drawing in lieu of the pressure switch. The gauges to be tested shall be regarded acceptable when the pressure readings of all three gauges are the same throughout the jacking pressure range varied by applying the hand pump.
- c. Flow switches
- 1) The testing equipment for the flow switches shall be as shown on the drawings or of an equivalent approved by the mepf consultant.
  - 2) The calibration test equipment shall provide a flow of 1 l/s over the vane of the flow switch in the direction shown, to be confirmed by the direct reading flow meter.
  - 3) The flow switch contacts shall make with energisation of the lamp and the buzzer, upon a flow not greater than 1 l/s flowing over the vane in the correct direction.
- d. Hydrostatic tests
- 1) All parts of the water circuit shall be filled with water before hydrostatic pressure testing, and pump running tests for verification of pressure and flow rate, are conducted.
  - 2) The hand jacking pump shall be applied to increase the system pressure to 2 times the working pressure or 1.5 times the working pressure plus 350 KPa whichever is the lower but in any case not less than 700 KPa. The pressure shall be maintained for a period not less than 24 hours.
  - 3) Where any section of pipework or equipments unable to withstand the maximum pipework test pressure, it shall be isolated during the pipework test then that section of pipework or equipment shall be re-tested at the appropriate test pressure.
  - 4) The working pressure for various systems shall be as shown on the drawings.
  - 5) Before performing the hydrostatic test, the following system component shall be fulfilled:
    - A) For sprinkler system
      - I. All gate valves shall be closed fully except the valves around the check meter position which shall be opened.
      - II. All the main stop valves and the subsidiary stop valves shall be opened or closed in order to provide isolated water tight sections for the hydrostatic pressure testing.
      - III. The pressure switches shall be isolated by the relevant valves or cocks.
      - IV. The test and the drain valves shall be closed.
      - V. The sprinkler inlet isolating valve shall be closed.
- e. Cleaning, flushing and pre-treatment
- 1) Prior to start-up and satisfactorily hydraulic testing, clean the entire installation including all fittings and pipework and the like after

installation and keep them in a new condition. All pumping systems shall be flushed and drained at least once through to get rid of contaminating materials. All pipes shall be rodded when necessary to ensure clearance of debris, cleaning and flushing shall be carried out in sections as the installation becomes completed.

- 2) All strainers shall be inspected and cleaned out or replaced.
  - 3) When the entire systems are reasonably clean, a pre-treatment chemical shall be introduced and circulated for at least 8 hours. Warning signs shall be provided at all outlets during pre-treatment. The pre-treatment chemical shall:
    - a) Remove oil, grease and foreign residue from the pipework and fittings.
    - b) Pre-condition the metal surfaces to resist reaction with water or air.
    - c) Establish as initial protective film.
    - d) After pre-treatment, the system shall be drained and refilled with fresh water and left until the system is put into operation.
    - e) Details and procedures of the pre-treatment shall be submitted to the mepf consultant for approval.
- f. Electrical tests
- 1) Electrical tests shall comply with the current edition of iee regulations and requirements enforced by local authorities.
  - 2) Electrical insulation tests, earth electrode resistance test and cost amenity test shall apply to busbars, isolators and other equipment and wiring where applicable.
  - 3) A 500V DC instrument shall be used to check the insulation resistance. The reading shall not be less than 1 mega-ohm in all instances.
  - 4) Function simulation tests shall be performed to ensure that the systems have been installed to the control requirements as described in the specification therein.
- g. Electrical coupling
- 1) The direct coupling of the pump drivers shall be dismantled before the pump motor control panel is energised.
  - 2) Demonstrate to the mepf consultant of acceptable clearances of the coupling alignment for ensuring satisfactory power transmission.
  - 3) The coupling shall not be re-mated again till the correct motor rotation has been demonstrated with power drawn from the energised pump motor control panel.
- h. Preliminary commissioning checks:
1. Ensure that all equipment is thoroughly cleaned, lubricated and checked for serviceability before setting to work. Particular attention is drawn to the removal of building debris from the pipework systems.
  2. Special attention is drawn to the need for thoroughly flushing out all pipework systems to ensure that all foreign matter is removed.

3. All automatic controls and safety devices shall be inspected and checked for service ability before the working fluid or electricity is applied to the system.

i. Commissioning:

1. When the various installations have been completed and the preliminary commissioning checks carried out, the general contractor shall set to work, regulate and calibrate all system in the entire installation. Special attention shall be paid to the following items:

2. That all valves, switches, controls, etc. Are regulated and capable of proper operation and in the case of isolation valves that they are capable of tight shut off.

3. That all apparatus is silent in accordance with the requirements of this specification.

4. That all instruments are correctly calibrated and read accurately.

5. That all services are tested in accordance with the details in the relevant clauses of this specification.

6. Operate pumps, pressure reducing sets, etc. To ensure that all control systems are functioning correctly and are properly set, sequenced or interlocked.

j. Final acceptance tests:

1. Following commissioning of the entire installation, and prior to issue of taking over certificate. The general contractor shall carry out final acceptance tests in accordance with a programme to be agreed with the meepf consultant.

2. Should the results of the acceptance tests show that plant, systems and/or equipment fail to perform to the efficiencies or other performance figures as given in this specification, the general contractor shall adjust, modify and if necessary replace the equipment without further payment in order that the required performance can be obtained.

3. Where acceptance tests are required by the relevant authorities having jurisdiction, these tests shall be carried out by the general contractor prior to the issue of taking over certificate to the acceptance of the authorities.

**3.4 Alarms**

A. All pump alarms, both local and remote, shall be tested upon operation of sprinkler system.

**3.5 Cleaning And Adjusting**

A. Brush and clean all work prior to concealing, painting and acceptance. Perform in stages if directed.

B. Painted or exposed work soiled or damaged: clean and repair to match adjoining work before final acceptance.

C. Remove debris from inside and outside of materials and equipment.

D. Flush out piping after installation.

E. Adjust valves and automatic control devices

F. Disinfections

1. Disinfect underground water mains after installation and test in accordance with NFPA 24.

### **3.6 Demonstration**

A. Engage a factory-authorized service representative to train employer's maintenance personnel to adjust, operate, and maintain wet pipe sprinkler system.

# PUMPS

## Part 1 General

Except as modified in this section or on the drawings, install fire pumps in conformance with NFPA 20, NFPA 70 and NFPA 72. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification governs. Devices and equipment for fire protection service must be UL fire prot listed or FM approved.

### 1.1 Related documents

- a. drawings and general provisions of the contract apply to this section.
- b. Contractor will be responsible to carry out the commissioning requirements specified in this sections and other sections referenced. These include, but are not limited to, commissioning, enhanced commissioning, preparation of a detailed o&m manual, and detailed training of the employer's personnel.

### 1.2 Summary

- A. Section includes:
  1. Vertical turbine fire pumps.
  2. Fire pump accessories
  3. Pressure maintenance pump

### 1.3 Performance Requirements

- A. Seismic performance: fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

- B. Pump equipment, accessory, and specialty pressure rating: 175 psig (1200 KPa) minimum unless higher pressure rating is indicated below.

1. Pump discharge, risers	350 psi
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### 1.4 Submittals

- A. Product data:

for each type of product indicated. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
- B. Shop drawings: for fire pumps, motor drivers, and fire-pump accessories and specialties. Include plans, elevations, sections, details, and attachments to other work.



C. Dimensioned outline drawings of equipment unit: identify center of gravity and locate and describe mounting and anchorage provisions.

D. Product certificates: for each fire pump, from manufacturer.

E. Operation and maintenance data

### **1.5 Quality Assurance**

A. Electrical components, devices, and accessories: listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. NFPA compliance: comply with NFPA 20, "installation of stationary pumps for fire protection."

### **1.6 Coordination**

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## **PART 2 PRODUCTS**

### **2.1 General requirements for pumps**

A. Factory-assembled and -tested fire-pump and driver unit.

B. Base: fabricated and attached to fire-pump and driver unit with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.

D. Finish: red paint applied to factory-assembled and -tested unit before shipping.

### **2.2 Fire Pumps**

Fire pump shall be electric motor driven vertical turbine type. Fire pump shall furnish not less than 150 percent of rated flow capacity at not less than 65 percent of rated net pressure. Pump shall be vertical turbine type fire pump. Pump shall be automatic start and manual stop. Pump shall conform to the requirements of UL 448. Fire pump discharge and suction gauges shall be oil-filled type

Motors, controllers, contactors, and disconnects shall be provided, as specified herein. Motor shall conform to nema mg 1 design b type. Integral size motors shall be the premium efficiency type in accordance with nema mg 1. Motorwattage/horsepower shall be of sufficient size so that the nameplate wattage/ horsepower rating will not be exceeded throughout the entire published pump characteristic curve. The motor and fire pump controller shall be fully compatible.

### **2.3 Fire Pump Accessories And Specialties**

A. Check valve.

check valve shall be clear open, swing type check valve with flange or threaded inspection plate.

B. Pressure relief valve

pressure relief valve shall be pilot operated or spring operated type conforming to NFPA 20. A means of detecting water motion in the relief lines shall be provided where the discharge is not visible within the pump house

C. Circulating relief valve

an adjustable circulating relief valve shall be provided for each fire pump in accordance with NFPA 20.

D. Gate valve & control valve

gate valves and control valves shall be outside screw and yoke (o.s.&y.) Type, supervised which open by counterclockwise rotation. Butterfly-type control valves are not permitted

E. Tamper switch/supervisory switch

the suction control valves, the discharge control valves, valves to test header and flow meter, and the by-pass control valves shall be equipped with valve tamper switches for monitoring by the fire alarm system

F. Hose valve manifold assembly:

Construct header of steel pipe. Provide ASME B16.5, class 150 flanged inlet connection to hose valve manifold assembly. Provide approved bronze hose gate valve with 65 mm/ 2.5 inch national standard male hose threads with cap and chain; locate one meter/3 feet above grade in the horizontal position for each test header outlet. Welding shall be metallic arc process in accordance with ASME b31.1.

## 2.4 Pressure Sensing Line

a completely separate pressure sensing line shall be provided for each fire pump and for the jockey pump. The sensing line shall be arranged in accordance with figure a-7-5.2.1. Of NFPA 20. The sensing line shall be 13 mm /1/2 inch brass tubing complying with ASTM b135m ASTM b135. The sensing line shall be equipped with two restrictive orifice unions each. Restricted orifice unions shall be ground-face unions with brass restricted diaphragms drilled for a2.4 mm/3/32 inch. Restricted orifice unions shall be mounted in the horizontal position, not less than1.5 m / 5 feet apart on the sensing line. Two test connections shall be provided for each sensing line. Test connections shall consist of two brass13 mm/1/2 inch globe valves and8 mm/ 1/4 inch gauge connection tee arranged in accordance with NFPA 20one of the test connections shall be equipped with a0 to 2100 KPa/ 0 to 300 psiwater oil-filled gauge. Sensing line shall be connected to the pump discharge piping between the discharge piping control valve and the check valve

## 2.5 Flowmeter System

A. Description: UL-listed or FM-approved, fire-pump flowmeter system with capability to indicate flow to not less than 175 percent of fire-pump rated capacity.

B. Pressure rating: 350 psig (2413 KPa).

- C. Sensor: annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.
- D. Permanently mounted flowmeter: compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter. Include bracket or device for wall mounting.
  - 1. Tubing package: nps 1/8 or nps 1/4 (dn 6 or dn 10) soft copper tubing with copper or brass fittings and valves.
- E. Portable flowmeter: compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter and with two 12-foot- (3.7-m-) long hoses in carrying case.

## **2.5 Pressure Maintenance Pump ( Jockey Pump)**

pressure maintenance pump shall be electric motor driven, submersible type with non-metallic impellers, diffusres and bearing spiders, stainless stell bowl, casing, suction screen, discharge head, motor adapter, hexagonal shflt and built in check valve capable of delivering the requiried flow.

## **PART 4 - Execution**

### **4.1 Examination**

- A. Examine equipment bases and anchorage provisions, with installer present, for compliance with requirements and for conditions affecting performance of fire pumps.
- B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **4.2 Installation**

- A. Pump installation standard: comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
  - 1. Equipment mounting: install fire pumps on concrete bases. Comply with requirements for concrete bases.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
  - 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.

- B. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.
- C. Support piping and pumps separately so weight of piping does not rest on pumps.
- D. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in division 13 section "fire-suppression standpipes." division 13 section "wet-pipe fire-suppression sprinklers."
- E. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in division 13 section "fire-suppression standpipes." division 13 section "wet-pipe fire-suppression sprinklers."
- F. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.
- G. install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.
- H. Electrical wiring: install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical installer.
- I. Wiring method: conceal conductors and cables in accessible ceilings, walls, and floors where possible.

#### **4.3 Alignment**

- A. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.
- B. Align piping connections.
- C. Align pump and driver shafts for angular and parallel alignment according to hi 1.4 and to tolerances specified by manufacturer.

#### **4.4 Connections**

- A. Comply with requirements for piping and valves as specified in drawings
- B. Install piping adjacent to pumps and equipment to allow service and maintenance.
- C. Connect relief-valve discharge to drainage piping or point of discharge.
- D. Connect flowmeter-system meters, sensors, and valves to tubing.
- E. Connect fire pumps to their controllers.

#### **4.5 Identification**

- A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

#### **4.6 Field quality control**

- A. Test each fire pump with its controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in division 13 section "controllers for fire-pump drivers."
- B. manufacturer's field service: engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. perform tests and inspections.
  - 1. manufacturer's field service: engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. tests and inspections:
  - 1. After installing components, assemblies, and equipment including controller, test for compliance with requirements.
  - 2. Test according to NFPA 20 for acceptance and performance testing.
  - 3. Leak test: after installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 4. Operational test: after electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to employer.

#### **4.7 Startup service**

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

#### **4.8 Demonstration**

- A. Engage a factory-authorized service representative to train employer's maintenance personnel to adjust, operate, and maintain fire pumps.

# PUMP CONTROL PANEL

## PART 5 - General

### 5.1 Related documents

- A. drawings and general provisions of the contract, apply to this section.
- B. Contractor will be responsible to carry out the commissioning requirements specified in this sections and other sections referenced. These include, but are not limited to, commissioning, enhanced commissioning, preparation of a detailed o&m manual, and detailed training of the employer's personnel.

### 5.2 Summary

- A. Section includes:
  - 1. Full-service, reduced-voltage controllers rated 600 v and less.
  - 2. Limited-service controllers rated 600 v and less.
  - 3. Controllers for motor driven fire pumps.
  - 4. Remote alarm panels.
  - 5. Low-suction-shutdown panels.
  - 6. Jockey pump control panel

### 5.3 Definitions

- A. ats: automatic transfer switch(es).
- B. Ecm: electronic control module.
- C. Mccb: molded-case circuit breaker.
- D. N.o.: normally open.

### 5.4 Performance requirements

- A. seismic performance: fire-pump controllers and alarm panels shall withstand the effects of earthquake motions determined according to asce/sei 7.
  - 1. the term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

### 5.5 Submittals

- A. product data: for each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop drawings: for each type of product indicated. Include dimensioned plans, elevations, sections, details, and attachments to other work, including required clearances and service spaces around controller enclosures.
  - 1. Show tabulations of the following:

- a. Each installed unit's type and details.
  - b. Enclosure types and details for types other than nema 250, type 2.
  - c. Factory-installed devices.
  - d. Nameplate legends.
  - e. Short-circuit current (withstand) rating of integrated unit.
  - f. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices.
  - g. specified modifications.
- 2. Detail equipment assemblies and indicate dimensions, weights, loads, method of field assembly, components, and location and size of each field connection.
  - 3. Schematic and connection diagrams: for power, signal, alarm, and control wiring and for pressure-sensing tubing.
- C. qualification data: for qualified testing agency.
  - D. seismic qualification certificates: for each type of product indicated, from manufacturer.
    - 1. Basis for certification: indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - 2. Dimensioned outline drawings of equipment unit: identify center of gravity and locate and describe mounting and anchorage provisions.
    - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
  - E. product certificates: for each type of product indicated, from manufacturer.
  - F. manufacturer's factory test reports of fully assembled and tested equipment.
  - G. Source quality-control reports.
  - H. field quality-control reports.
  - I. Operation and maintenance data: for each type of product indicated to include in emergency, operation, and maintenance manuals. In addition to items specified in division 1 section "operation and maintenance data," include the following:
    - 1. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
    - 2. manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor-based logic controls.

## 5.6 Quality assurance

- A. testing agency qualifications: member coMPany of an nrtl.
- B. Source limitations: obtain fire-pump controllers and all associated equipment from single source or producer.
- C. Electrical components, devices, and accessories: listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- D. Comply with standards of authorities having jurisdiction pertaining to materials and installation.
- E. Comply with NFPA 20 and NFPA 70.
- F. IEEE compliance: fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in division 16 section "vibration and seismic controls for electrical systems."

#### **5.7 Delivery, storage and handling**

- A. store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- B. If stored in areas subject to weather, protect controllers from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; connect factory-installed space heaters to temporary electrical service.

#### **5.8 Project conditions**

- A. environmental limitations:
  - 1. Ambient temperature rating: not less than 40 deg f (5 deg c) and not exceeding 122 deg f (50 deg c) unless otherwise indicated.
  - 2. Altitude rating: not exceeding 6600 feet (2011 m) unless otherwise indicated.
- B. interruption of existing electric service: notify employer no fewer than seven days in advance of proposed interruption of electric service, and comply with NFPA 70e.

#### **5.9 Coordination**

- A. Coordinate layout and installation of controllers with other construction including conduit, piping, fire-pump equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels. Ensure that controllers are within sight of fire-pump drivers.
- B. coordinate sizes and locations of concrete bases with actual equipment provided.

#### **5.10 Extra materials**

- A. furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Indicating lights: two of each type and color of lens installed; two of each type and size of lamp installed.
  - 2. Auxiliary contacts: one for each size and type of magnetic contactor installed.
  - 3. Power contacts: three for each size and type of magnetic contactor installed.
  - 4. Contactor coils: one for each size and type of magnetic controller installed.
  - 5. Relay boards: one for each size and type of relay board installed.
  - 6. Operator interface: one microprocessor board(s), complete with display and membrane keypad.



## **PART 6 - Products**

### **6.1 Full-service controller**

- A. method of starting:
  - 1. pressure-switch actuated.
    - a. water-pressure-actuated switch and pressure transducer with independent high- and low-calibrated adjustments responsive to water pressure in fire-suppression piping.
    - b. System pressure recorder, electric ac driven, with spring backup.
    - c. programmable minimum-run-time relay to prevent short cycling.
    - d. Programmable timer for weekly tests.
  - 2. magnetic controller: wye-delta (closed trANSItion) type.
  - 3. Solid-state controller: reduced-voltage type.
  - 4. Emergency start: mechanically operated start handle that closes and retains the motor run contactor independent of all electric or pressure actuators.
- B. method of stopping: non-automatic shutdown.
- C. capacity: rated for fire-pump-driver horsepower and short-circuit-current (withstand) rating equal to or greater than short-circuit current available at controller location.
- D. method of isolation and overcurrent protection: interlocked isolating switch and nonthermal mccb; with a common, externally mounted operating handle, and providing locked-rotor protection.
- E. Door-mounted operator interface and controls:
  - 1. Monitor, display, and control the devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used.
  - 2. Method of control and indication:
    - a. Microprocessor-based logic controller, with multiline digital readout.
    - b. Membrane keypad.
    - c. Led alarm and status indicating lights.
  - 3. Local and remote alarm and status indications:
    - a. controller power on.
    - b. Motor running condition.
    - c. Loss-of-line power.
    - d. Line-power phase reversal.
    - e. Line-power single-phase condition.
  - 4. Audible alarm, with silence push button.
  - 5. Nonautomatic start and stop push buttons or switches.
- F. Optional features:
  - 1. extra output contacts:
    - a. One n.o. contact(s) for motor running condition.

- b. One set(s) of contacts for loss-of-line power.
  - c. One each, form c contacts for high and low reservoir level.
2. Local alarm bell.
  3. Door-mounted thermal or iMPact printer for alarm and status logs.
  4. Operator interface communications ports: usb, ethernet, and rs485.
- G. ats:
1. Complies with NFPA 20, UL 218 and UL 1008.
  2. Integral with controller as a listed combination fire-pump controller and power transfer switch.
  3. Automatically transfers fire-pump controller from normal power supply to alternate power supply in event of power failure.
  4. Allows manual transfer from one source to the other.
  5. alternate-source isolating and disconnecting means: integral molded-case switch, with an externally mounted operating handle.
  6. alternate-source isolating and disconnecting means: mechanically interlocked isolation switch and circuit breaker rated at a minimum of 115 percent of rated motor full-load current, with an externally mounted operating handle; circuit breaker shall be provided with nonthermal sensing, instantaneous-only short-circuit overcurrent protection to comply with available fault currents.
  7. Local and remote alarm and status indications:
    - a. normal source available.
    - b. Alternate source available.
    - c. In normal position.
    - d. In alternate position.
    - e. Isolating means open.
  8. Audible alarm, with silence push button.
  9. Nonautomatic (manual, nonelectric) means of transfer.
  10. engine test push button.
  11. Start generator output contacts.
  12. Timer for weekly generator tests.
  13. Generator tests.

## 6.2 ATS

- A. general requirements for standalone ats:
1. Complies with NFPA 20, UL 218 and UL 1008.
  2. Listed by an nrtl for fire-pump service.
  3. Automatic and nonautomatic operation.
  4. Separate from controller and individually listed as a fire-pump-controller power transfer switch.
  5. Automatically transfers fire-pump controller from normal power supply to alternate power supply in event of power failure.
  6. Allows manual transfer from one source to the other; factory assembled, wired, and tested.
- B. capacity: rated for fire-pump-driver horsepower and short-circuit-current (withstand) rating equal to or greater than short-circuit current available at ats location.

- C. alternate-source isolating and disconnecting means: integral molded-case switch, with an externally mounted operating handle.
- D. Alternate-source isolating and disconnecting means:
  - 1. Mechanically interlocked isolation switch and circuit breaker rated at a minimum of 115 percent of rated motor full-load current.
  - 2. Externally mounted operating handle.
  - 3. Circuit breaker provided with nonthermal sensing, instantaneous-only, short-circuit overcurrent protection.
  - 4. Equipped with a voltage surge arrester.
- E. Door-mounted operator interface and controls:
  - 1. Monitor, display, and control devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used.
  - 2. Method of control and indication:
    - a. Microprocessor-based logic controller, with multiline lcd readout. Membrane keypad.
    - b. Led alarm and status indicating lights.
  - 3. Local and remote alarm and status indications:
    - a. normal source available.
    - b. Alternate source available.
    - c. In normal position.
    - d. In alternate position.
    - e. Isolating means open.
  - 4. Audible alarm, with silence push button.
  - 5. Nonautomatic (manual, nonelectric) means of transfer.
  - 6. engine test push button.
  - 7. Start generator output contacts.
  - 8. Timer for weekly generator tests
- F. Optional features:
  - 1. extra output contacts:
    - a. One each, form a; isolating means open.
    - b. One each, form c; in normal or alternate position
  - 2. Door-mounted thermal or iMPact printer for alarm and status logs.
  - 3. Operator interface communications ports: usb, ethernet, and rs485.

### 6.3 Remote Alarm Panels

- A. general requirements for remote alarm panels: comply with NFPA 20 and UL 218 listed by an nrtl for fire-pump service.
- B. general requirements for remote alarm panels: factory assembled, wired, and tested.
- C. supervisory and normal control voltage: source.

- D. audible and visual alarm and status indications:
1. Driver running.
  2. Loss of phase.
  3. Phase reversal
  4. Supervised power on.
  5. Common trouble on the controller.
  6. If retaining second option in subparagraph above, insert list of required alarms in first subparagraph below.

controller connected to alternate power source.

- E. Audible and visual alarm and status indications: manufacturer's standard indicating lights;

1. Controller main switch turned to the off or manual position.
2. Supervised power on.
3. Common trouble on the controller or engine.
4. If retaining second option in subparagraph above, insert list of required alarms in first subparagraph below.
5. Common pump room trouble.

controller connected to alternate power source.

- F. Audible alarm, with silence push button.

- G. pump remote start push button.

#### **6.4 Low-Suction-Shutdown Panels**

- A. general requirements for low-suction-shutdown panels:
1. Listed by an nrtl for fire-pump service.
  2. Factory assembled, wired, and tested.
  3. Prevents automatic start of fire pump, and shuts down automatically started fire pump, on low-suction pressure.
  4. Automatic reset.

- B. Operation: integral pressure switch.

- C. supervisory and normal control voltage: source.

- D. include audible and visual alarms and status indications, with silence push button, for the following conditions:

1. Control power available.
2. Low-suction pressure.
3. Normal-suction pressure.

#### **6.5 Enclosures**

- A. Fire-pump controllers, ats, remote alarm panels, and low-suction-shutdown panels: nema 250, to comply with environmental conditions at installed locations and NFPA 20.

1. indoor, dry and clean locations: type 1 (iec ip10).
  2. Indoor locations subject to dripping noncorrosive liquids: type 2 (iec ip11).
  3. Indoor locations subject to dust, falling dirt, and dripping noncorrosive liquids: type 12 (iec ip12).
- B. Enclosure color: manufacturer's standard "fire-pump-controller red"
- C. Nameplates: comply with NFPA 20; complete with capacity, characteristics, approvals, listings, and other pertinent data.
- D. Optional features:
1. floor stands, 12 inches (305 mm) high, for floor-mounted controllers.
  2. Space heater, with thermostat.
  3. Tropicalization.

## 6.6 Source quality control

- A. Testing: test and inspect fire-pump controllers according to requirements in NFPA 20 and UL 218.
1. Verification of performance: rate controllers according to operation of functions and features specified.
- B. fire-pump controllers will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

## 6.7 Jockey Pump Control Panel

Pressure maintenance pump controller shall be arranged for automatic and manual starting and stopping and equipped with a "manual-off-automatic" switch. The controller shall be completely prewired, ready for field connections, and wall-mounted in a nema type 2 drip-proof enclosure. The controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments for automatic starting and stopping. A sensing line shall be provided connected to the pressure maintenance pump discharge piping between the control valve and the check valve. The sensing line shall conform to paragraph, pressure sensing line. The sensing line shall be completely separate from the fire pump sensing lines. An adjustable run timer shall be provided to prevent frequent starting and stopping of the pump motor. The run timer shall be set for [2] minutes

## PART 7 - Execution

### 7.1 Examination

- A. Examine areas and surfaces to receive equipment, with installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine equipment before installation. Reject equipment that is wet or damaged by moisture or mold.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## **7.2 Controller examination**

- A. install controllers within sight of their respective drivers.
- B. connect controllers to their dedicated pressure-sensing lines.
- C. wall-mounting controllers: install controllers on walls with disconnect operating handles not higher than 79 inches (2006 mm) above finished floor, and bottom of enclosure not less than 12 inches (305 mm) above finished floor unless otherwise indicated. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with division 16 section "hangers and supports for electrical systems."
- D. floor-mounting controllers: install controllers on 4-inch (100-mm) nominal-thickness concrete bases, using floor stands high enough so that the bottom of enclosure cabinet is not less than 12 inches (305 mm) above finished floor. Comply with requirements for concrete bases specified in division 3 section "cast-in-place concrete"
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
  - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- E. seismic bracing: comply with requirements specified in division 16 section "vibration and seismic controls for electrical systems."
- F. Temporary lifting provisions: remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- G. comply with nema ics 15.

## **7.3 ATS installation**

- A. wall-mounting ats: install ats on walls with disconnect operating handles not higher than 79 inches (2006 mm) above finished floor, and bottom of enclosure not less than 12 inches (305 mm) above finished floor unless otherwise indicated. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For ats not on walls, provide freestanding racks complying with division 16 section "hangers and supports for electrical systems."
- B. floor-mounting ats: install ats on 4-inch (100-mm) nominal-thickness concrete bases, using floor stands high enough so that the bottom of enclosure cabinet is not less than 12 inches (305 mm) above finished floor. Comply with requirements for concrete bases specified in division 3 section "cast-in-place concrete"

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
  2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
  3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. seismic bracing: comply with requirements specified in division 16 section "vibration and seismic controls for electrical systems."
- D. Temporary lifting provisions: remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

#### **7.4 Remote Alarm And Low-Suction-Shutdown Panel Installation**

- A. install panels on walls with tops not higher than 72 inches (1829 mm) above finished floor unless otherwise indicated. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For ats not on walls, provide freestanding racks complying with division 16 section "hangers and supports for electrical systems."

#### **7.5 Power wiring installation**

- A. install power wiring between controllers and their services or sources, and between controllers and their drivers. Comply with requirements in NFPA 20, NFPA 70, and division 16 section "conductors and cables."
- B. Comply with neca 1.

#### **7.6 Control and alarm wiring installation**

- A. install wiring between controllers and remote devices and facility's central monitoring system. Comply with requirements in NFPA 20, NFPA 70, and division 16 section "control-voltage electrical power cables."
- B. install wiring between remote alarm and low-suction-shutdown panels and controllers. Comply with requirements in NFPA 20, NFPA 70, and division 16 section "control-voltage electrical power cables."
- C. Install wiring between controllers and the building's fire-alarm system. Comply with requirements specified in division 13 section "digital, addressable fire-alarm system."
- D. Bundle, train, and support wiring in enclosures.
- E. Connect remote manual and automatic activation devices where applicable.

#### **7.7 Identification**

- A. Comply with requirements in NFPA 20 for marking fire-pump controllers.

- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification in NFPA 20 and as specified in division 16 section "electrical identification."

## 7.8 Field quality control

- A. testing agency: employer will engage a qualified testing agency to perform tests and inspections.
- B. manufacturer's field service: engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. perform tests and inspections.
  - 1. manufacturer's field service: engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. acceptance testing preparation:
  - 1. Inspect and test each component:
    - a. Inspect wiring, components, connections, and equipment installations. Test and adjust components and equipment.
    - b. Test insulation resistance for each element, component, connecting supply, feeder, and control circuits.
    - c. Test continuity of each circuit.
  - 2. verify and test each electric-driver controller:
    - a. Verify that voltages at controller locations are within plus 10 or minus 1 percent of motor nameplate rated voltages, with motors off. If outside this range for any motor, notify employer before starting the motor(s).
    - b. Test each motor for proper phase rotation.
  - 3. Operational test: after electrical circuitry has been energized, start units to confirm proper unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Field acceptance tests:
  - 1. Do not begin field acceptance testing until suction piping has been flushed and hydrostatically tested and the certificate for flushing and testing has been submitted to employer and authorities having jurisdiction.
  - 2. Prior to starting, notify authorities having jurisdiction of the time and place of the acceptance testing.
  - 3. Engage manufacturer's factory-authorized service representative to be present during the testing.
  - 4. Perform field acceptance tests as outlined in NFPA 20.
- F. controllers will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports.



## **7.9 Startup service**

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

## **7.10 Adjusting**

- A. adjust controllers and battery charger systems to function smoothly and as recommended by manufacturer.
- B. Set field-adjustable switches, auxiliary relays, time-delay relays, and timers.
- C. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to substantial completion.
- D. Set field-adjustable pressure switches.

## **7.11 Protection**

- A. temporary heating: apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.
- B. Replace controllers whose interiors have been exposed to water or other liquids prior to substantial completion.

## **7.12 Demonstration**

- A. engage a factory-authorized service representative to train employer's maintenance personnel to adjust, operate, and maintain controllers, remote alarm panels, and to use and reprogram microprocessor-based controls within this equipment. Engage a factory authorized service representative to train employers' maintenance personnel to adjust, operate, and maintain the engine generator.
- B. Video record all training sessions.