FIRE PROTECTION & FIRE FIGHTING SYSTEM

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Engineering Department

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FIRE PROTECTION

AND FIRE FIGHTING SYSTEM

1. SCOPE :

This specification covers design, engineering, supply, delivery, erection, testing and commissioning of fire protection and firefighting system for switchyard equipment, pump house, Control Room Buildings, Diesel Generator room etc. at different Sub-station.

This specification covers the design and performance requirement of -

a) Fire Detection & Alarm System.
b) Portable Fire Extinguishers and Wheel/Trolley mounted Fire Extinguisher
c) Hydrant System, High velocity water (H.V.W) Spray System
d) Main Fire pump, Jockey pump and Diesel Engine with stand by pump.

The system design and equipment shall conform in all respects to high standard of engineering, design and workmanship. The system design shall also conform to TAC/NFPA norms.

2. STANDARDS :

Fire equipment, design and layout of fire protection system shall conform to the latest edition of the following standard as well as this specification.

i.	IS:1646	:	Code of practice for fire safety of buildings (General: electrical installation)
ii.	IS :1647	:	Code of practice for fire fighting of buildings
iii.	IS:1648		Code of practice for fire fighting of buildings, fire fighting equipment and its maintenance.
iv.	IS:2189	:	Code of practice for erection, installation and maintenance of automatic fire detection and alarm.
v.	IS:2190	:	Selection, installation and maintenance of first aid fire extinguisher code of practice.
vi.	IS:2546	:	Specification for galvanized mild steel fire bucket
vii.	IS:13386	:	Specification for fire extinguisher 50 litre capacity
viii.	IS:10658	:	Specification for Higher Capacity Dry Powder Fire Extinguisher (Trolley Mounted)
ix.	IS:15683	:	Portable fire extinguishers
x.	Tariff Advisory Committee Manual.		
xi.	National Fire Protection Authority of America Manual.		

All components are to be supplied from WBSETCL approved vendor list available at Company's portal.

3. DEVIATIONS :

Normally the offer should be as per Technical Specification without any deviation. If any modification felt necessary to improve performance, efficiency and quality of equipment, the same must be mentioned in the 'Modification schedule' with reasons duly supported by documentary evidences and advantages. Such modifications suggested may or may not be accepted, but the same must be submitted along with Pre-Bid Queries. The modifications not mentioned in Schedule will not be considered.

4. HYDRANT SYSTEM:

Hydrant System of fire protection essentially consists of a large network of pipe, combination of underground and over ground fed with pressurized water to a number of hydrant valves inside the switchyard as well as outside switchyard. These hydrant valves are to be located at strategic locations near buildings, Transformers, and Reactors and other electrical equipment. Hose Pipe of suitable length and fitted with standard accessories like branch pipes, nozzles etc. are to be kept in Hose Boxes. In case of emergency these hoses are to be coupled to the respective hydrant valves through instantaneous coupling and jet of water is to be directed to the equipment under fire hydrant protection. Design of hydrant network shall cover the following:

(a) Control room building
(b) Pump House, Stores, D.G. Set Building.
(c) Total switchyard area including future portion and all power transformer and reactors

Provision of Hose Reel in conjunction with wet Riser shall be made at each floor level of Control Building / GIS Building conforming relevant I.S. Specification.

Hydrant System shall be designed in ring formation along the periphery covering entire switchyard area.

Warning plate is to be kept near all the hydrant points. Water shall be sprayed only after checking that the power to the transformer &reactor has been made off and no live parts is there within 20 metre distance from the person using the hydrant.

a) The scope of work includes - complete earthwork (i.e. excavation, back filling etc.) of entire piping, construction of valve pits, pipe support and fixing structures.

b) The equipment offered shall comply with the latest revision of relevant Indian Standard at the time of tendering.

c) Ambient temperature for design of all equipment shall be considered as 50°C.

d) The Contractor shall prepare detailed layout and piping drawing based on approved switchyard layout drawing.

e) **Fire hydrant layout shall be designed considering entire switchyard area (both present and future portion). Capacity of pump-motor, pipe sizes etc. are to be considered accordingly.**

f) Provision shall be kept in piping layout for its extension for the future bays on both sides of the switchyard.

g) **Fire hydrant piping layout shall be designed in such a way that future bay extension can be possible without shifting of existing pipe arrangement**.

h) **In case of 400KV switchyard, the system shall be designed considering provision of High velocity water spray system for two more 400 KV future transformer.**

5. HIGH VELOCITY WATER SPRAY (HVWS) SYSTEM:

HVWS type fire protection essentially consists of a network of projectors and an array of heat detectors around 400 KV Power Transformer and 400 KV Bus Reactor to be protected from fire. On operation of one or more heat detectors, water under pressure is to be directed to the projector network through a Deluge Valve from the pipe network laid for this automatic operation system. Wet detection initiation system shall be employed for automatic operation.

The system shall be designed in such a way that the same can be extended to protect two more 400 KV Transformer to be installed in future. However design consideration shall be on the basis of considering only one Transformer of highest MVA/MVAR rating will be on fire at a time. The system shall be designed to have a suitable pressure and suitable water quantity/hr. at the farthest transformer/reactor location as per approved layout drawing.

The minimum Electrical clearance values between the Emulsifier system pipe work and live parts of the protected 400 KV Transformers/reactor are to be maintained as furnished below.

1.	420 KV Bushing	:	3500 mm
2.	245 KV Bushing	:	2150 mm
3.	145KV Bushing	:	1300 mm.
3.	52 KV Bushing	:	630 mm
4.	36 KV Bushing	:	320 mm.

Minimum water pressure available at the farthest and /or highest projector on the equipment protected shall be 3.5 kg/cm^2. However water pressure available at any projector shall not exceed 5.00 kg./cm ^{2}.

Contractor has to specify applied rate of water in LPM /M ^{2} of the surface area of the entire 400 KV transformer/Reactor. Area of transformer/reactor shall be calculated considering radiator, conservator, bottom surface of transformer/reactor etc.

Deluge Valve shall be provided in conjunction with H.V.W spray system. Normally Deluge Valve shall be closed watertight. On fall of water pressure due to opening of one or more heat detector the valve shall open and water shall rush to the spray water network through the open Deluge Valve. The valves shall be manually reset to initial position after completion of entire operation. One water motor gong is to be provided with each Deluge Valve for audible alarm. The alarm will be initiated when water is tapped through the water motor after passing the Deluge Valve.

Each Deluge Valve shall be provided with a local panel for the purpose of manual electrical operation of the valve. Additionally latch is to be provided for local operation.

High velocity spray nozzles (Projector): High velocity water spray system shall be designed and installed in order to discharge water in the form of a conical spray consisting of droplets of water traveling at high velocity which shall strike the burning surface of 400 KV Transformer/Reactor with sufficient impact to ensure the formation of an emulsion. At the same time the spray shall also be able to efficiently cut off oxygen supply and provide sufficient cooling.

Minimum set point of the heat detectors used in HVW Spray System shall be specified by the Contractor. However, the optimum rating shall be suggested by the Contractor as per the attainable maximum and minimum temperature at site.

6. WATER SUPPLY SYSTEM:

Water for hydrant and High Velocity Water Spray System (where applicable) shall be supplied with the help of one electrical motor driven main pump and another standby diesel engine driven pump. The diesel engine driven stand by pump shall operate when the header pressure is low or the motor driven pump fails to start. One number diesel engine of suitable rating is also to be provided for this purpose.

Two numbers water storage tanks of suitable capacity shall be constructed. The capacity of the pump and storage tank shall be guided by the norms of TAC (Tariff Advisory Committee Manual) and relevant specification.

The whole system will be kept pressurized with the help of air vessel of adequate capacity and jockey pumps with motors. Jockey pump shall take care, if there is any minor leakage. One set of which shall be provided by the contractor as standby. The pumps and air vessel with all auxiliary equipment will be located in fire water pump house.

Annunciation of the hydrant and HVW spray system shall be provided in fire water pump house, repeated in control room and provision for integrating the same with SAS. The capacity of air vessel shall be adequate and to be specified by the vendor.

Operation of all the pumps shall be automatic and shall be brought into operation at preset pressure. Fire pumps can be stopped manually only. Manual start/stop provision shall be provided in local control panel. Compound system i.e. both hydrant and HVSW shall comprise of Reservoir, Suction pipes, composite piping system delivery pipe etc. up to common intake point. Piping for hydrant as well as HVWS shall be teed off from power intake or suitable point of the delivery pipe for hydrant as well as HVWS system. Pipe sizes and layout shall be designed by the contractor for successful operation of the entire firefighting system (considering future portion also).

Outdoor piping of the system in general shall be laid above ground with proper supports. However, at road - rail - cable trench crossing, in front of buildings, places for movement of crane & shifting of equipment and at other places where above ground piping is not advisable, the pipes shall be laid underground. Such location shall be finalized during detailed engineering.

The offered horizontal centrifugal pumps along with drives and accessories shall meet the requirement of TAC.

Each pump is to be provided with a nameplate having all important technical particulars.

The hydrant system shall be designed to maintain minimum pressure of 3.5 Kg/Sq. cm at the farthest point considering operation of two hydrants simultaneously.

Surface of all overground pipes shall be thoroughly cleaned of mill scale, rust etc. by wire brushing. Thereafter one coat of red lead primer of best quality (IS marked) shall be applied. Finally, two coats of synthetic enamel paint of best quality (IS marked) shall be applied.

Pipes to be buried underground shall be provided with protection against soil corrosion by coating and wrapping with two coats of Coal tar hot enamel paint and two wraps of reinforced fibre glass tissue. The total thickness of coating and wrapping shall not be less than 3 mm. Alternatively, corrosion resistance tapes can also be used for protection of pipes against corrosion. Coating and wrapping shall be in line with IS : 10221

Hydrant System shall be designed in ring formation along the periphery of switchyard area.

7 POWER SUPPLY, CONTROL & ANNUNCIATION PANELS (for hydrant and HVWS system):

Power supply will be from two different source of A.C. Distribution Board located in control room building. These two sources will be terminated at the incomer panel located in pump house. The changeover arrangement will be there to select either source. The control supply for local control panels, annunciation panels, battery charger units etc. shall be fed from the AC and DC distribution boards located at fire pump room.

The following panels shall be under the scope of supply of contractor with all accessories required for entire control and annunciation towards fulfillment of scheme.

a) Panel for - motor driven fire water pump, Jockey pump, diesel engine driven fire water pump - to be located in fire water pump house. These panels shall be equipped with manual switch, start-stop push button, starter, thermal overload relay, indicating lamp etc.
b) Panel for battery charger - to be located in fire water pump house
c) AC & DC distribution board
d) Annunciation panel - One to be located in fire water pump house and another in Control room building. Indicating lamp for power supply 'ON' and for ON/OFF status of each motor shall be incorporated. Annunciation windows shall contains -
    i) Electric motor driven fire water pump running
    ii) Electric motor driven fire water pump fail
    iii) Diesel engine driven fire water pump running
    iv) Diesel engine driven fire water pump fails to run
    v) Fire in transformer/reactor
    vi) Fire fighting system in operation
    vii) Fire in smoke detection system
    viii) Spare

All control and annunciation panel shall be made of sheet steel having 3 mm. thick. **Cable entries shall be from bottom with supply of suitable removable gland plate** and cable glands.

All indoor panel wiring and bus wiring for A.C & D.C supplies shall be under the scope of the contractor. All wiring shall be carried out with 1100V grade PVC insulated, multi core, 2.5 sq.mm. or above stranded copper wires.

Spare contacts of all auxiliary relays, timers and switches shall be wired up to terminal blocks. A minimum gap of 100 mm. shall be maintained in between two sets of terminal block. Terminal blocks shall have at least 20% spare terminal.

Suitable grounding arrangement with copper bus of suitable sizes at both ends is to be provided.

Space heater, lights, control selector switches, push buttons, indicating lamps, fuses, contactors, relays, timer, indicating instruments/Annunciation etc. shall be within the scope of supply. All the item shall be of best quality and from reputed manufacturers.

Finishing paint on outside of all panels shall be of shade 692 (smoke grey) of IS:5 and that for inside of panels shall be glossy white.

All the control and annunciation panel shall be subject to all routine and acceptance tests as per relevant Indian Standard. Routine & acceptance Test Reports are to be submitted to WBSETCL.

8 CONTROL AND INTERLOCK SYSTEM:

a) Electric Motor Driven Fire Water Pump.

Pump should start automatically under any of the following condition:
i) HVW spray or Hydrant system header pressure low.
ii) Operation of any deluge valve.
Pump should be stopped manually only. Arrangement shall be there so that pump can be started manually in case of requirement.

b) Diesel Engine Driven Standby Pump

The pump should automatically start under any of the following condition.
i) Header Pressure low.
ii) Electric motor operated fire water pump fails to start.
iii) Pump should be stopped manually only.
iv) Arrangement for manual starting of pump is also to be made from local control panel.

c) Jockey Pump

Jockey pump shall start automatically when water pressure in header falls below the set value. Jockey pump shall stop automatically when the pressure is normal. **Two numbers Jockey pump (as main & standby mode) shall be considered for Sub-Station area more than 10 acres.**

9 HORIZONTAL CENTRIFUGAL PUMPS:

a) The material of the various components shall conform to the applicable IS and any other relevant international Standards. Service to be provided by Horizontal centrifugal pumps shall be as per TAC regulation.

b) The pump set shall be suitable for continuous operation at any point within the "Range of Operation". All the centrifugal pumps shall be Indoor located.

c) The pump motor set shall be designed in such a way that no damage will occur due to reverse flow through the pump.

d) Pumps shall have a continuously rising head capacity characteristic from the specified duty point toward shut off point the maximum being at shut off point.

e) During starting under reverse flow condition the motor shall be capable of bringing the pump to rated speed at normal direction with 90 % rated voltage at motor terminals.

f) All rotating components shall be statically and dynamically balanced.

g) Routine and acceptance tests of horizontal centrifugal pump shall be conducted as per provisions in relevant standard.

10 DIESEL ENGINE:

a) The diesel engine shall be of multi cylinder type four stroke cycle with mechanical (airless) injection cold starting type.

b) The continuous engine break horse power rating at the site condition shall be at least 20% greater than the requirement at the duty point of pump at rated RPM.

c) Rated output of the engine should fulfill the requirement of firefighting system (present scope as well as future provision).

d) Both automatic and manual starting shall be possible. Normally automatic starting shall be employed.

e) The offered diesel engine shall be with special features so that it can be started within a very short period against full load after a considerable period of idleness.

f) Batteries shall be used only for starting the diesel engine and shall be always kept under fully charged condition. Battery shall be associated with battery charger unit having air-cooling arrangement. Both trickle charging and boost charging arrangement are to be provided.

g) Automatic cranking shall be effected by D.C motor having high starting torque to overcome full engine compression. The automatic starting arrangement shall include a 'Repeat Start' feature. The battery capacity shall be adequate for 10 (ten) consecutive starts without recharging with a cold engine under full compression.

h) Contractor shall indicate the required battery voltage and battery capacity in Ampere-Hour at (10) hour discharge rate basis. The battery voltage at any time during operation shall not be less than the minimum voltage required for operation of D.C. loads.

i) Provision for Automatic as well as manual charging of Battery shall be kept. The boost charger shall have sufficient capacity to restore a fully discharged Battery to a state of full charge.

j) The governor shall offer following features :

i) Engine should be provided with an adjustable governor capable of regulating engine speed within 5% of its rated speed under any condition of load between shut-off and maximum load conditions of the pumps. The governor shall be set to maintain rated pump speed at maximum pump load.

ii)Engine shall be provided with an over speed shut-down device. It shall be arranged to shut-down the engine at a speed approximately 20% above rated engine speed and for manual reset, such that the automatic engine controller will continue to show an over speed signal until the device is manually reset to normal operating position.

iii) The governor shall be suitable for operation without external power supply.

k) **Fuel System**:

The diesel engine will run-on High-Speed Diesel. The engine shall be provided with fuel oil tank having adequate capacity to hold sufficient fuel oil for a minimum of six (6) hours of full load run. The fuel oil tank shall preferably be mounted near the engine.

The fuel oil tank shall be of welded steel constructed to relevant standards for mild steel drums.

The fuel tank shall be designed in such a way that the sludge and sediment settles down to the tank bottom and is not carried to the injection pump. A small sump shall be provided and fitted with drain plug to take out sludge/sediment and to drain oil. Adequate hand holes (greater than 80 mm. Size) shall be provided to facilitate maintenance.

Pipeline carrying fuel oil shall be gradually sloped from the tank to the injection pump. Any valve in the fuel feed pipe between the fuel tank and the engine shall be placed adjacent to the tank and it shall be locked in the open position. A filter shall be incorporated in this pipeline in addition to other filters in the fuel oil system. Pipe joints shall not be soldered and plastic tubing shall not be used. Reinforced flexible pipes may be used.

A manual fuel pump shall be provided for priming and releasing of air from the fuel pipelines.

11 MAIN MOTOR & STANDBY MOTOR:

The fire fighting main motor and standby motor shall be of 3 –phase 400 V squirrel cage type induction motor and suitable for continuous duty in the specified ambient temperature of 50°C. Rating of motor shall be decided by the bidder as per stipulated norms of TAC and fire fighting system requirement. Calculation of motor rating is to be furnished during detailed engineering. Motors to be installed outdoor or semi-outdoor shall have hose proof enclosure and shall be equivalent to IP –55 as per IS:4691. For indoor type the enclosure shall be dust proof as per IS : 4691. Offered motors shall be TEFC (totally enclosed fan cooled) type and suitable for full voltage direct-on-line starting. Starting current at rated voltage shall not exceed six times of the rated full load current subject to tolerance as per IS:325.

Maximum permissible temperature rise under running condition shall be as per IS:325.

Motor shall be capable of running at 80% of rated voltage for 5 minutes with rated load commencing from hot condition and able to develop rated full load torque for 1 second if supply voltage drop to 70% of rated voltage.

Motor shall be capable of withstanding electro-dynamic stresses and heating imposed if it is started at a voltage of 110% of the rated voltage.

Rating plate with all particulars as per stipulation of IS:325 is to be provided.

All routine and acceptance test reports are to be submitted.

After installation and commissioning at site, the motors along with the driven equipment shall be subject to tests. If any abnormality/defects observed during testing, necessary rectification/replacement to be made free of cost.

12 HEAT & SMOKE /FIRE DETECTORS AND SPRAY NOZZLES:

a) Suitable fire detection system using smoke detectors, heat detectors, Optical beam Smoke Detector shall be provided for entire Control Room Building & GIS building.

b) Fire detector shall be provided on both below and above false ceiling.

c) Coverage area of each smoke detector shall not be more than 80 m^2. and that of heat detectors shall not be more than 40 m^2.

d) The cabling for the detectors shall be concealed with proper route marking.

e) Manual call points (Break Glass Alarm Stations) shall be provided at strategic location in Control room & GIS building as well as 400KV Transformers & 400KV Reactor. Manual Call point near Transformer & Reactor shall be housed with box & front glass to avoid ingress of water.

f) Heat detectors to be used in HVW Spray system shall be tested type. Temperature rating of heat detectors shall be selected by the Contractor taking into consideration the environment in which the detectors shall operate. Minimum set point is to be specified by the contractor.

g) Integral non-ferrous strainers shall be provided in the HVWS projectors ahead of the orifice to arrest higher size particle, which are not allowed to pass through the projector.

h) The set point for smoke and heat detectors shall be selected after giving due consideration for ventilating air-velocity and cable insulation. The set point shall be adjustable.

i) Fire detectors shall be equipped with an integral LED, so that it shall be possible to know which of the detectors has been operated.

j) The detectors, which are to be placed in the space above the false ceiling or in the floor void, shall not have the response indicators on the body but shall be provided with remote response indicators.

k) Smoke/heat detector system shall be provided with proper capacity battery and battery charger for its operation during failure of power.

i) Fire Notice for Fire Fighting and evacuation from the building shall be displayed at all strategic locations.

13 Portable And Wheel/Trolley Mounted Fire Extinguishers:

The following types of fire extinguishers shall be supplied.

66 KV	Control Room Building	Co_2 type 4.5 Kg/5 Kg DCP type 5 Kg as per IS- 15683 9 lit sand bucket as per IS - 2546	4 nos each type
	SW. Yard	Wheel/ Trolley mounted DCP type, 25 Kg as per IS - 10658 Wheel / trolley mounted foam type, 45/60 lit as per IS - 13386 9 lit sand bucket as per IS - 2546	Extinguisher-2 nos. of each type Sand Bucket- 4 nos. per Switchyard of each voltage level
132 KV	Control Room Building	Co_2 type 4.5 Kg/5 Kg DCP type 5 Kg as per IS- 15683 9 lit sand bucket as per IS - 2546	Co2- 6 nos. DCP-4 Nos. Sand Bucket- 4 nos.
	SW. Yard	Wheel/ Trolley mounted DCP type, 25 Kg as per IS - 10658 Wheel / trolley mounted foam type, 45/60 lit as per IS - 13386 9 lit sand bucket as per IS - 2546	Extinguisher-2 nos. of each type Sand Bucket- 4 nos. per Switchyard of each voltage level
220 KV	Control Building	Co_2 type 4.5 Kg/5 Kg & DCP type 5 Kg as per IS- 15683 9 lit sand bucket as per IS - 2546	Co2- 8 nos. DCP-6 Nos. Sand Bucket- 4 nos.
	SW. Yard	Wheel/ Trolley mounted DCP type, 25 Kg as per IS - 10658 Wheel / trolley mounted foam type, 45/60 lit as per IS - 13386 9 lit sand bucket as per IS - 2546	Extinguisher-2 nos. of each type Sand Bucket- 4 nos. per Switchyard of each voltage level

400 KV	Control Room Building	CO_2 type 4.5 Kg/5 Kg DCP type 5 Kg as per IS- 15683 9 lit sand bucket as per IS - 2546	CO2- 16 nos. DCP-8 Nos. Sand Bucket- 12 nos.
	SW. Yard	Wheel/ Trolley mounted DCP type, 25 Kg as per IS - 10658 Wheel / trolley mounted foam type, 45/60 lit or as per IS - 13386 9 lit sand bucket as per IS - 2546	Extinguisher-3 nos. of each type Sand Bucket- 8 nos. per Switchyard of each voltage level
Office Building / Residential Quarter / Store & others		CO_2 type 4.5 Kg/5 Kg as per IS- 15683 9 lit sand bucket as per IS - 2546	CO2 - 3 nos. per floor Sand Bucket- 4 nos. per building

All the offered extinguisher shall be of reputed make & ISI marked.

Instructions for operation of extinguisher shall be on its body itself and shall be supplied with initial charge and all required accessories.

Clamps for mounting on walls or Columns shall be within the scope of supply.

All extinguishers shall be supplied with painting as per relevant IS.

Report of all shop tests of each type of fire extinguisher shall be submitted beforehand.

14 SITE TESTS AFTER INSTALLATION:

Following site tests shall be conducted up to the satisfaction of WBSETCL.

a) All piping and valves after installation will be tested hydraulically at pressure of 1.5 times that of the maximum attainable pressure in the system to check against leak tightness.

b) All manually operated valves/gates shall be operated throughout 100% of the travel and these should function without any trouble whatsoever to the satisfaction of the employer.

c) All pumps shall be run with the specified fluid from shut off condition to valve wide open condition Head developed will be checked from the discharge pressure gauge reading. During the test the pumps and drives shall run smoothly without any undue vibration, leakage through gland, temperature rise in the bearing parts, noise, flow pulsation etc.

d) All pressure vessels should be tested hydraulically at the specified test pressure singly or in the system.

e) Visual check on all structural components, welding painting etc.

f) Automatic starting of all the fire pumps by operating the test valves.

g) Automatic operation of the jockey pump.

h) Operation of the automatic Control Valve by operating the test valve and remote operating of solenoid valve.

i) Operation of the entire annunciation system.

j) After installation at site, the complete HVW spray protection and hydrant system shall be subject to tests to show satisfactory performance as per relevant standard/code.

k) All the detectors installed shall be tested for actuation by bringing a suitable source of heat/smoke near the detector and creating a stream of hot air/smoke over the detector.

l) The contractor shall rectify at his own cost any defect detected during tests and retesting shall be done till satisfactory results are obtained.

15 TESTING AND INSPECTION :

Successful bidder is to submit routine test report of Pump and other major before inspection**.**

The equipment shall be tested as per relevant IS & manuals.

All acceptance tests as per latest issue of relevant IS shall be conducted in presence of representative of WBSETCL at manufacturer's works. Routine and Acceptance tests shall be carried out for all motors, Pumps, Diesel engine, Control Panel & all other accessories to be used for Fire Protection System.

16 OPERATION & MAINTENANCE MANUAL :

Six sets of Operation & Maintenance manual in respect of Pump, Motors, Diesel engine, Diesel generator, smoke & heat detectors & all other accessories shall be supplied before dispatch.

17 ERECTION AND MAINTENANCE TOOLS AND EQUIPMENT :

One set of all special tools and equipment required for installation, testing, operation and maintenance of all Pumps, Motors, Diesel engine and all other accessories shall be supplied.

18 CONTRACT DRAWINGS AND CATALOGUE :

In the event of placement of Letter of Award (LOA), the contractor is to submit six (6) copies of detailed design and layout drawing of hydrant system, emulsifier scheme drawings, fire detection system, annunciation schemes and other relevant documents. Literature/Catalogue of fire extinguisher, pump, motor, detectors, valves, pipes and other major materials shall be submitted for approval. Detailed drawings of soak pit, sump pit shall be also submitted for approval.