**SECTION D 11 – Internal Firefighting Works**

**TECHNICAL SPECIFICATIONS**

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**ECTION D 11 – Internal Firefighting Works**

**TECHNICAL SPECIFICATIONS**

# C.1 General Requirement

1.1 Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install wet riser fire hydrant system, down comer system, sprinkler system, fire extinguishing hand held appliances as required as per approved

1.2 Without restricting to the generality of the foregoing, the work shall include but not limited to the following: -

a) Piping for wet riser hydrant systems

b) Landing valves, canvas hose pipes, hose reels, hose cabinets & connections to mains.

c) Isolation valves, non-return valves, installation valves, flow control switches and accessories.

d) Installation of fully charged and tested fire extinguishing hand appliances CO2 water, CO2 gas, ABC dry chemical powder type conforming to IS:15683 as required by these specifications and/drawings.

1.3 All materials shall be new of the best quality conforming to the specifications and subject to the approval of the Owner/PMC.

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

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

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

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

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

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

# C.2 Standard

|  |  |
| --- | --- |
| 2.1 | The equipment and pipes covered in this specification shall comply with following latest Indian Standards  IS: 903 - 1993 Suction hose couplings branch pipe, nozzles  IS:636-1988 Non-percolating flexible firefighting delivery hose  IS: 15683 Portable fire extinguishers  IS: 8423: 1977 Controlled percolating hose for fire fighting  IS 13039:1991 Code of practice for provision and maintenance of external hydrant system  Nation Building Code 2016 PART IV  NFPA  Local Fire Authority |

# C.3 Fire hydrants

**C.3.1** **Internal hydrants**

Contractor shall provide on each landing and other locations as per fire norms, one single headed gunmetal oblique landing valves with 63 mm dia outlet mounted on a common 80 mm inlet conforming to I.S.5290-1969. Landing valve shall have flanged inlet and instantaneous type outlets..

Contractor shall provide for each internal fire hydrant station two numbers of 63 mm dia. 15 m long rubberized fabric linen hose pipes with gunmetal male and female instantaneous type coupling machine wound with G.I. wire (hose to I.S. 636 Type 2 and couplings to I.S. 903 with I.S. Certification), fire hose reel conforming to IS:884, gunmetal branch pipe with nozzle I.S. 2871 and Fire man's axe conforming to IS: 926.

Each hose box shall be conspicuously painted with the letters "FIRE HOSE".

**C.3.2 Branch Pipe**

The branch pipe shall be constructed from gun metal alloy to IS: 903 and finished to a smooth polish. The branch pipe shall be able to give straight stream and shall be BS marked. The branch pipe shall be tested to 20 Kg/cm2 pressure. The inlet bore shall be 63mm dia for quick coupling joint to the Hose and the nozzle side shall be 20mm dia.

**C.3.3** **Fire hose reels**

Contractor shall provide standard fire hose reels with 19 mm dia high pressure of approved make or equivalent rubber hose 36.5 m long with gunmetal nozzle and control valve, shut off valve, all mounted on circular hose reel of heavy duty mild steel construction and cast iron brackets. Hose reel shall be connected directly to the wet riser. Hose reel shall conform to IS: 884-1969 and rubber hose to IS: 5132.

**C.3.4 Hose Cabinets**

All internal fire hydrants shall be enclosed in M.S. glazed cabinet. Hose cabinets shall be fabricated from 16 gauge M.S. sheet of fully welded construction with hinged double front door partially glazed with locking arrangement stove enamelled fire red paint with "FIRE HOSE" written on it prominently. Suitable glass 5.5 mm thick duly fitted by heavy duty gasket.

# C.4 Pipes

All pipes within and outside the building in exposed locations and shafts including connections buried under floor shall be M.S. pipes confirming to IS:1239 Heavy Class.

# C.4.1 Pipe Fittings

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

Screwed fittings shall be approved type malleable or cast iron with reinforced ring on all edges of the fittings suitable for screwed joints.

Grooved Victaulic Fittings above 50 mm shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12 (FireLock®), forged steel conforming to ASTM A-234, Grade WPB 0.375" wall (9,53 mm wall), or fabricated from Std. Wt. Carbon Steel pipe conforming to ASTM A-53, Type F, E or S, Grade B. Fittings provided with an alkyd enamel finish or hot dip galvanized to ASTM A-153

Forged steel fittings of approved type with "V" groove for welded joints. / couplings.

Fabricated fittings shall be not being permitted for pipe diameters 50 mm and below. When used, they shall be fabricated, welded and inspected in workshops whose welding procedures/ coupling have been approved by the TAC as per TAC rule 4102 for applicable to hydrant System under the supervision of Owner/PMC. For "T" connections, pipes shall be drilled and reamed. Cutting by gas or electrical welding will not be accepted.

**C.4.2 Jointing**

1. **Screwed (50 mm dia pipes and below)**

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

1. **Grooved (65 mm dia and above)**

Joints between M.S. pipes and fittings shall be with Victaulic Grooved method.

**Victaulic Mechanical Couplings for Joining Carbon Steel Pipe**

Victaulic Mechanical Couplings: Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. Mechanical Coupling bolts shall be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A- 449 and A-183, minimum tensile strength 110,000 psi (758450 kPa) as provided standard Victaulic

Rigid Type:

1) “Installation Ready” rigid joints shall be Victaulic FireLock® EZ Style 009H and Style 107H which are designed for direct “stab” installation onto grooved pipe without prior disassembly of the coupling. Housings shall be cast with offsetting, angle-pattern bolt pads.

2) Standard rigid joints shall be Victaulic Style 005 (FireLock® 005) or 07 (Zero-Flex®). Housings shall be cast with offsetting, angle pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13.

3) Rigid couplings shall require visual pad-to-pad verification of complete installation. Tongue and recess type couplings which require the use of a torque wrench to achieve the exact required gap between housings are not permitted.

Flexible Type: Use in seismic areas where required by NFPA 13.

1) “Installation Ready” rigid joints shall be Victaulic Style 177 Quick Vic™, in sizes 2”(DN50) through 6”(DN150), which shall be designed for direct “stab” installation onto grooved pipe without prior disassembly of the coupling. .

2) Standard flexible couplings shall be Victaulic Style 004, 75, or 77

Flange Adapters: For use with grooved end pipe and fittings, for mating to ANSI Class 125 / 150 flanges. Victaulic Style 741 or 744. For mating to ANSI Class 300 flanges use Victaulic Style 743

Victaulic Hole-Cut Branch Outlets:

A Bolted Branch Outlet:

1. Branch reductions on 2"(DN50) through 8"(DN200) header piping. Bolted branch outlets shall be manufactured from ductile iron conforming to ASTM A-536, Grade 65-45-12, with synthetic rubber gasket, and heat treated carbon steel zinc plated bolts and nuts conforming to physical properties of ASTM A-183. Victaulic Style 920 / 920N.

2. Header connections for sprinklers, drop nipples, sprigs, gauges, and drains on 1-1/4” through 2-1/2” header piping. Outlets shall be manufactured from ductile iron conforming to ASTM A-536, Grade 65-45-12, with synthetic rubber gasket, and heat treated carbon steel zinc plated bolts and nuts conforming to physical properties of ASTM A-183. Victaulic FireLock Outlet Tee Style 922.

B. Strapless Outlet:

1/2"(DN15) or 3/4"(DN20) NPT outlet on 4" (DN100) and larger header sizes rated for 300 PSI (2065 kPa). Victaulic Style 923.

1. **Flanged**
2. Flanged joints shall be provided on:
3. Straight runs not exceeding 30 m on pipe lines 80 mm dia and above.
4. Both ends of any fabricated fittings e.g. bend tees etc. of 65 mm dia or larger diameter.
5. For jointing all types of valves, appurtenances, pumps, connections with other type of pipes, to water tanks and other places necessary and required as per good engineering practice.
6. Flanges shall be as per I.S. with appropriate number of G.I. nuts and bolts, 3 mm insertion neoprene gasket complete.
7. **Unions**

Approved type of dismountable unions on pipes lines 65 mm and below in similar places as specified for flanges.

**C.4.3 Excavation**

1. Excavation for pipe lines shall be in open trenches to levels and grades shown on the drawings or as required at site. Pipe lines shall be buried to a minimum depth of 1.2 meter or as shown on drawings.
2. Wherever required contractor shall support all trenches or adjoining structures with adequate timber supports.
3. On completion of testing and pipe protection, trenches shall be refilled with excavated earth in 15 cms layers and consolidated.
4. Contractor shall dispose off all surplus earth within a lead of 200 m or as directed by Owner/PMC

**C.4.6 Anchor Thrust Blocks**

1. Contractor shall provide suitably designed anchor blocks in cement concrete to encounter excess thrust due to water hammer & high pressure.
2. Thrust blocks shall be provided at all bends & tees & such other location as determined by the Owner/PMC.
3. Exact location, design, size and mix of the concrete block shall be approved by the Owner/PMC prior to execution of work.

# C.5 Valves

**C.4.1 Gunmetal Valves**

1. Valves 65 mm dia & below shall be heavy gunmetal full way valves or globe valves conforming to I.S. 778-1971 class II with female screwed ends. Valves shall be carry I.S. certifications mark.
2. All valves shall be approved by the Owner/PMC before they are allowed to be used on work.

**C.4.2 Butterfly Valves/Sluice Valves**

UL/FM Global approved, 300 psi (2065 kPa), grooved ends, polyphenylene sulfide (PPS) coated ductile iron body (ASTM A-536, Grade 65-45-12). Ductile iron disc, synthetic rubber encapsulated suited for the intended service, with integrally cast stem. Complete with weatherproof actuator and pre-wired supervisory switches. Victaulic Series 705 FireLock® or Series 707 FireLock® developed for fire pump metering test lines per NFPA 20 and rooftop test units

A 1. 2-1/2”(DN65) through 12”(DN300) Sizes OS&Y Gate Valves: 250 psi (1725 kPa), grooved ends. Ductile iron body conforming to ASTM A-536, cast iron yoke and hand wheel conforming to ASTM A-126-B; EPDM coated ASTM A-126-B cast iron disc; ASTM B16 brass rising stem; flanged and epoxy coated cast iron bonnet; EPDM o-ring stem seals and body gasket. Victaulic Series 771

A 2. 2-1/2” (DN65) through 12” (DN300) Sizes NRS Gate Valves: 250 psi (1375 kPa), grooved ends. Ductile iron body conforming to ATSM A-536, bronze mounted; EPDM coated ASTM A-126-B cast iron disc; ASTM B- 16 brass non-rising stem; flanged and epoxy coated cast iron bonnet; EPDM o-ring stem steals and body gasket. Victaulic Series 772

**C.4.3** **Non-return valves (Check Valves)**

2"(DN50) through 3"(DN75) Sizes Spring Assisted: Black enamel coated ductile iron body, ASTM A-536, Grade 65-45-12, non-slam tilting disc, stainless steel disc and spring, brass shaft, 365 psi (2517 kPa). Victaulic Series 717H.

4”(DN100) through 12”(DN300) Sizes Spring Assisted: Black enamel coated ductile iron body, ASTM A-536, Grade 65-45-12, elastomer encapsulated ductile iron disc suitable for intended service, stainless steel spring and shaft, welded-in nickel seat, 250 psi (1725 kPa). Victaulic Series 717. Designed to accept a riser check kit. Victaulic Series 717R.

**C.4.4** **Air valves**

25 mm dia screwed inlet cast iron single acting air valve conforming to IS: 14845, shall be provided on all high points in the system or as shown on drawings.

**C.4.5** **Orifice Flanges**

Orifice flanges fabricated from 6 mm thick stainless steel plate shall be provided to reduce pressure on individual hydrants to restrict the operating pressure to 3.5 kg/cm2 and allow a discharge of 560 lpm. The contractor shall submit design of the orifice flanges for approval before installation.

**C.4.6 Drain Valve**

50 mm dia black steel pipe conforming to IS: 1239 (heavy class) with 50 mm gunmetal full way valve shall be provided for draining any water in the system in low pockets.

**C.4.7 Pressure Gauge**

Pressure gauge conforming to IS 3624-1987 shall be provided near all connections to hydrant system and where required. Pressure gauge shall be 100 mm dia gunmetal Bourden type with gunmetal isolation cock, tapping and connecting pipe and nipple. The gauge shall be installed at appropriate level and height for easy readability.

# C.5 Pipe protection

1. All pipes above ground and in exposed locations shall be painted with one coat of zinc chromate primer and two or more coats of synthetic enamel paint of approved shade.
2. Pipes in chase or buried underground shall be painted with two coats of zinc chromate primer and wrapped with one layer of 4 mm thick PYPKOAT multilayer sheet as per standard manufacturer's specifications.

# C.6 Pipe Supports

1. All pipe clamps and supports shall be galvanised steel and When fabricated from M.S. steel sections, the supports shall be factory galvanised before use at site. Welding of galvanised clamps and supports will not be permitted.
2. Pipes shall be hung by means of expandable anchor fastener of approved make and design (Dash Fasteners or equivalent). The hangers and clamps shall be fastened by means of galvanised nuts and bolts. The size/diameter of the anchor fastener and the clamp shall be suitable to carry the weight of water filled pipe and dead load normally encountered.

# C.7 Pipe Spacing Table

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | <----------------------- Pipe commercial | | | | | dia | ------------ | ---🡪 |
| **S. No.** | **Pipes & Position** | 15/20 | 20/25 | 32/40 | 50 | 75/80 | 100/110 | 150/160 | 200 |
| 1 | **Vertical** |  |  |  |  |  |  |  |  |
| 1.1 | GI /MS | 2.4 | 2.4 | 3 | 3.6 | 4.5 | 4.5 | 5.4 | 5.4 |
| 1.2 | CI Pipes IS 1729/3989 | x | x | <------------------------- 3 m --------- | | | | ----------- | ----🡪 |
| 1.3 | CI Heavy Duty IS 1536 | x | x | <---------------------- 3.6 m -------- | | | | ----------- | -----🡪 |
| 1.4 | uPVC SWR Systems | x | x | 0.5 | 0.7 | 0.9 | 0.9 | 1.0 |  |
| 1.5 | uPVC Water Supply |  |  |  |  |  |  |  |  |
| 1.6 | Polybutylene | <--- As per manufacturer’s Recommendations | | | | | ----------- | ---------- | -----🡪 |
| 1 | **Horizontal** |  |  |  |  |  |  |  |  |
| 1.1 | GI /MS | 2.0 | 2.0 | 2.4 | 3.0 | 3.6 | 4.0 | 4.5 | 4.5 |
| 1.2 | CI Pipes IS 1729/3989 |  |  | <------------ 3 m ------------------> | | | |  |  |
| 1.3 | CI Heavy Duty IS 1536 |  |  |  |  | 3.0 | 3.6 | 3.6 | 4.5 |
| 1.4 | uPVC SWR Systems |  |  |  | 1.2 | 1.8 | 1.8 | 1.8 |  |
| 1.5 | uPVC Water Supply |  |  |  |  |  |  |  |  |
| 1.6 | Polybutylene | <-As per manufacturer's recommendations---> | | | | |  |  |  |

# C.8 Sprinkler Heads

Sprinkler heads shall be quartzoid bulb type with gunmetal body fully approved and having current certification of the fire laboratory of the C.B.R.I. Roorkee, Underwriter’s laboratory (UL) and under the approved certified list of the Fire Office Committee (FOC) of U.K. or NFPA of USA. Any one of the certification as acceptable to the local fire authorities obtained prior to the procurement and approved and accepted by the Owner/PMC.

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

Following type of sprinklers shall be used:

**S.No. Type of Sprinkler Temp rating**

a) Pendent /Upright type 68°C

b) Sidewall 68°C

Spacing and coverage of sprinkler shall be in accordance with risk classification of area in which they are installed, design density and TAC regulation.

**Spare Sprinklers**

Provide a lockable enamel painted steel cabinet including following type of spare sprinklers

a) Pendent /Upright type 20

b) Sidewall 10

The cabinet should also contain one pair of wrenches (of each size of the same are different) for the sprinklers. Spare sprinklers shall be of the same specifications as that of the original sprinklers specified.

# C.9 Flexible Connector

Providing and fixing flexible connectors consisting of flexible core 1.0 mtr. in length of corrugated stainless steel tubing under the braid, (Braiding to be SS-304, tubing to be SS-304) for minimum working pressure rating of 200 PSI to be installed at connections from branch pipes to pendant sprinklers below false ceiling as per specification of the manufacturers.

# C.10 Flow Switch

Flow switch shall have a paddle of suitable width to fit within the pipe bore. The terminal box shall be mounted over the paddle / pipe through a connecting socket. The switch shall have potential free contact of suitable rating with N.O or N.C position as required. The switch shall be able to trip and make / break contact on the operation of a single sprinkler head. The terminal box shall have connections for wiring to the Annunciation panel. The seat shall be stainless steel. The flow switch enclosure shall have IP:65 protection.

The flow switch shall work at a minimum flow rate of 100 LPM. Further, it shall have a ‘Retard’ to compensate for line leakage or intermittent flows.

# C.11 Water Curtain Nozzle

Water curtain nozzle shall be supplied & shall have a 63mm male inlet connection & it would be able to generate a water curtain of 160 degrees to the arc size of 7 meters. Water curtain nozzle shall be hydraulically tested and shall bear IS approvals.

# C.12 Deluge Valve

Providing and fixing 100 mm NB deluge valve (UL listed) suitable for a rated working pressure of 12.3 Kg.cm² with hydraulic wet pilot trim, water gong, including connection to the main supply line, manifold, detection line, nozzle system. The item would include of deluge valve, hydraulic trim 100mm water gong bell and all connections and gauges complete in all respects as required.

# C.13 Installation Valve

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

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

Installation valve shall comprise of a cast iron sluice valve with gunmetal trim, pressure gauge, double seated clapper check valves as alarm valve with pressure gauge, test valve and orifice assembly and drain pipe with pressure gauge, bye pass on check valve to regulate differential pressure and false alarm, turbine water gong including all accessories necessary and required and as supplied by original equipment manufacturer and required for full and satisfactory performance of the system

# C.14 Hand held Fire extinguishing devices

Fire extinguishers shall conform to the Indian Standard Specifications and shall be with ISI approved stamp as revised and amended up to date.

Fire extinguishers shall be installed as per Indian Standard "Code of Practice for Selection, Installation and Maintenance of Portable First Aid Appliances" I.S.15683.

Hand appliances shall be installed in readily accessible locations with the appliance brackets fixed to wall by suitable anchor fasteners.

Each appliance shall be provided with an inspection card indicating the date of inspection, testing, change of charge and other relevant data.

All appliances shall be fixed in a true workmanlike manner truly vertical and at correct locations.

# C.15 Testing

All piping in the system shall be tested to a hydrostatic pressure of 1.5 times the working pressure or 14 kg/sq.cm (whichever is more) without drop in pressure for at-least 2 hours.

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

All test should be done as per relative IS Code.

**C.16 GAS SUPPRESSION SYSTEM**

1. **SCOPE OF TENDER**

Fire suppression system is fire detection and quenching system. This is proposed for flooding entire equipment & server room with Novec 1230. The Cylinder Valve Assembly must be UL/FM approved with Seamless CCOE approved cylinder and an undertaking from manufacturer must be submitted with the tender to comply the same.

1. **SYSTEM DETAILS**
2. The amount of FK-5-1-12 to be for provided shall be the amount required to obtain a uniform (minimum) design concentration Class 4.7% required to extinguish the fire at minimum anticipated temperature with the risk and as required by NFPA 2001, 2012 Edition with a hold time for 10 minutes. The system design shall not exceed 10% for normally occupied areas, adjusted for maximum area temperature anticipated with provision for room evacuation before agent release. The system provided shall be Main and 100% reserve.
3. Necessary warning signs shall be displayed in and near such risk (entry and exit) envisaged for clean agent Gas suppression.
4. The Pipe used should be MS, ASTM Schedule 40.
5. The Cylinder to be pressurized at 34.5 Bar and Cylinder Valve Assembly must be UL/FM Listed.
6. Each cylinder shall have pressure gauze and low pressure switch to provide visual and electrical supervision of the cylinder pressure. The low pressure switch shall be wired to the control panel to provide audible and visual trouble alarm in the event of drop of pressure at 20 Bars and below. The pressure gauze shall be colour coded to provide an easy, visual indication of cylinder pressure.
7. Furnish a welded steel bracket with each cylinder assembly for holding the cylinders in a saddle with a front bracket place that secures the cylinders depending on installation requirements.
8. The cylinder shall have pressure relief provisions that automatically operate before the internal nominal pressure exceeds 60 Bars.
9. **Extinguishing Agent:**

FK-5-12 (Dodecafluoro-2-Methylpentan-3 One – CF2CF2C(I)CF(CF3)2. The Agent shall not contain any Hydrofluorocarbons (HFC).

The manufacture of Agent FK – 5 – 12 should give a 20 year of warrantee against any regulatory bans from Environment agency. The Agent must be UL/FM approved.

1. Comply with requirements of the authorities having jurisdiction.
2. Filling facility should be UL Listed / PESO approved.
3. **Design Criteria for NOVEC 1230**

|  |  |  |
| --- | --- | --- |
| 1. Standard Code | : | NFPA-2001 (Latest Addition) |
| 1. Temperature of Risk | : | 20oC to 27oC |
| 1. Design Concentration | : | 4.7% |
| 1. Flooding Factor | : | As per Manufacturer |
| 1. Discharge Time | : | 10 Seconds |
| 1. Design Pressure | : | Upstream of pressure reducer 34.5 Bars |
| 1. Design Pressure | : | Downstream of pressure reducer as per calculation |
| 1. Cylinder Capacity | : | 34 Ltr., 80 Ltr., 120 Ltr., 150 Ltr. |
| 1. Nozzle Type | : | 360o / 180oC |
| 1. Altitude correction factor | : | As per Manufacturer |
| 1. Hold Period | : | 10 Minutes |

1. **SUBMITTALS**:

The Contractor must submit mechanical Working Drawing showing Pipe, Pipe Size, Bends, Reducer, Splits, Tee Connection, Valves, Fittings, supports etc. which should be supported with Hydraulic Flow Calculation. The Hydraulic Flow Calculation Software must be UL/UDS/FM approved.

1. **Sequence of Operation**
2. **Activation of the First Smoke Detector (the crossed-zoned laser detector)**
3. Illuminate the respective circuit lamp on the control unit.
4. Energize a pre-alarm audible alarm bell.
5. Treatment remote alarm to the building Fire Alarm Panel.
6. Activation of the Second Smoke Detector (the cross-zoned laser detector).
7. Illuminate the respective circuit lamp on the control unit.
8. Energize an evacuation audible alarm horn device.
9. Shut down the stand-alone air conditioning units serving the protecting area.
10. Closes the supply and exhaust / return dampers serving the protected area.
11. Activates a time delay mechanism which delays release of the clean agent for up to 20 seconds from the time the 2nd loop is activated. The Fire Suppression clean agent is released at the end of the time delay interval unless a “dead man” type abort switch is operated between the 1st and 2nd detection loops. A timed out system discharges upon abort disengagement unless the system is cleared and reset.
12. **Discharge of the Fire Suppression Clean Agent.**
13. Operates strobe light outside the protected area.
14. The system may be activated by manual discharge switches located in the protected area. Operation of a manual discharge switch causes immediate discharge of the fire suppression agent and causes alarm and shut-down devices to operate the same as if the system had operated automatically operation of a manual discharge switch overrides all time delay and abort system devices in the system.

**C.17 In Direct Low Pressure Protection System for Dry Type Transformer.**

Transformer Protection System: This includes Supply, Installation, Testing and Commissioning of FK-5-1-12 (Dodecafluoro-2-Methylpentan-3one), Novec-1230 gas Suppression system in accordance with the Contract Documents.

1. **Scope of Work**:
2. The scope covers Design, Supply, Installation, Testing and Commissioning of Automatic clean agent based indirect fire suppression system for Dry Type Transformer enclosure complete with storage cylinders, indirect valves, detection tubing as per NFPA-2001 including its safety guidelines with respect to “Hazards to Personnel”, electrical clearance and environmental factors in line with environmental considerations of Kyoto Protocol.
3. Provide all engineering design and materials for a complete agent suppression system including FK-5-1-12 storage cylinders with steel bracket, extinguishing agent, detection tube, cylinder valve and associated accessories including but not limit to; adaptors, pressure switch, tube fittings, discharge hose and Nozzle etc., required for complete operation of system.
4. The system shall be a Clean Agent pre-engineered automatic indirect Fire Suppression System and shall be UL/FM.
5. All necessary safety requirements such as warning signs, discharge alarm shall be part of system.
6. The necessary nomenclature such as pressurization level, agent volume, gross/net weight of cylinder shall be clearly marked on cylinder.
7. Prior to supply of material at site. Contractor must submit following documents for approval of Engineer-in-charge.
8. Drawing in A-4 size, clearly showing the panel, routing of tube inside the panel, location and fixing arrangement of cylinder & system components.
9. All doors and holes in the enclosed/equipment’s should be closed or sealed to maintain the tightness of enclosure.
10. **System Description**:
11. The detection tube shall be fixed with cylinder valve at top of cylinder. The tube shall be pressurized with dry nitrogen. In case of reach of pre-determined temperature (100-120oC), the tube shall rupture gas shall be released from tube over the protected area.
12. The System shall be self-contained and have its own non-electric automatic detection system, which when actuated shall automatically release the suppression agent into the transformer cabinet.
13. The System shall detect, control and extinguish the fire and also simultaneously give audio visual indication on the control panel.
14. When the temperature of Fire Trace Tube installed inside the Cabinet will increase to above 100-degree C or the detection tube comes in the direct contact of flame, the tube shall burst and initiates ILP Valve which allows the diffusion of extinguishing medium which is Clean Agent gas through strategically placed pipes and nozzles.
15. The system shall be designed for in direct discharge of extinguishing agent through the pipes and nozzle when the tube rupture occurs. The Diameter of tube for direct discharge shall be as per manufacturer recommendations.
16. The pressure switch shall be provided for necessary indication of discharge of gas.
17. The Extinguishing Agent shall be stored in cylinder as liquefied compressed gas, super pressurized with dry nitrogen at 195 psi.
18. The cylinder shall be equipped with brass valve, pressure gauge (to monitor agent pressure) and isolation valve for maintenance purposes. The cylinder bracket shall be of steel construction with quick release clamp.
19. Design, fabricate, certify and stamp containers in accordance with the requirements of NFPA (DOT). Containers shall be standard model and size of ease of replacement and addition.
20. With system activation, a signal should be generated via Audio Visual Alarm installed at convenient location as per Engineer-in-Charge.
21. The system must be filled in a UL Listed or FM approved filling station in India.
22. **System Components:**

The bidder shall provide an under taking from Principle Manufacturer of CE marked product they intent to install, that manufacturer will fully support the bidder for this specific project.

1. Cylinder of steel construction with standard red epoxy paint finish. Cylinders shall be accompanied by original manufacturers test certificate confirming the contents of the cylinder.
2. The cylinders shall be from reputed Manufacturers only. Cylinders shall be super pressurized with dry nitrogen to an operating pressure and temperature as per manufacturer recommendations.
3. Each cylinder shall have pressure gauze and low pressure switch to provide visual and electrical supervision of the cylinder pressure. The low pressure switch shall be wired to the Audio Visual Alarm to provide audible and visual trouble alarm in the event of drop of pressure. The pressure gauze shall be colour coded to provide an easy, visual indication of cylinder pressure.
4. Furnish a welded steel bracket with each cylinder assembly for holding the cylinders in a saddle with a front bracket piece that secures the cylinders.
5. Cylinder shall be provided with a certificate provided by the company who charge with the FK-5-1-12 gas mixture. The certificate shall be secured around the cylinder with chain fastener.
6. The Detection Tube, CE marked to be Red Colour and pressurized at 195 Bar. The Detection Tube to rupture between (100-120oC).
7. The Detection Tube, LPCB/UL/CE approved to be Red Colour and pressurized at 195 Bar. The Detection Tube to rupture between (100-120oC).
8. The cylinder should be DOT approved as per DOT 4B specs.
9. The Pressure Switch should be CE Marked having NO/NC contact.
10. The Discharge Pipe should be high pressure braided hose with heavy duty adopters. The nozzle should be made of Brass/Gun Metal and should have 180/360-degree discharge pattern.
11. **Extinguishing Agent**

**FK-5-1-12 (Dedecafluoro-2-Methylpentan-3 One – CF2CF2C (O) CF (CF3)2**

1. The agent shall not contain any Hydrofluorocarbons (HFC).
2. The ozone depletion potential should be zero.
3. The Global warming potential should be equal to or less than 1.
4. The Extinguishing Agent should be UL Listed/ FM approved.
5. The extinguishing agent should be filled in an UL Listed or FM approved filling station.
6. **Installation**
7. The system shall be installed on basis of approved drawing.
8. The installation / final connections shall carry out in direct supervision of representative of Manufacturer/authorized distributors.
9. Cylinder shall be located so that they are not subjected to mechanical, chemical or other damage.
10. All system components shall be capable of withstanding heat of fire and severe weather conditions.
11. Detection Tube to be properly secured inside the panel by Clips/Tie etc.
12. The Detection Tube outside the panel should be protected in flexible conduit.
13. Inspection certificate should be pasted on cylinder clearly marking next due date of inspection.

**C.18 ELECTRICAL PANEL PROTECTION SYSTEM**

Electrical Panel Protection System: This includes Supply, Installation, Testing and Commissioning of FK-5-1-12 (Dodecafluoro-2-Methylpentan-3one), Novec-1230 gas Suppression system.

1. **Scope of Work**:
2. Supply, Installation, Testing and Commissioning of clean Agent (Novec 1230) Fire Suppression system designed to provide a uniform concentration within the electrical panels in accordance with NFPA 2001.
3. Provide all engineering design and materials for a complete agent suppression system including FK-5-1-12 storage cylinders with steel bracket, extinguishing agent, detection tube, cylinder valve and associated accessories including but not limit to; adaptors, pressure switch, tube fittings etc., required for complete operation of system.
4. All necessary safety requirements such as warning signs, discharge alarm shall be part of system.
5. The necessary nomenclature such as pressurization level, agent volume, gross/net weight of cylinder shall be clearly marked on cylinder.
6. Prior to supply of material at site. Contractor must submit following documents for approval of Engineer-in-charge.
7. Drawing in A-4 size, clearly showing the panel, routing of tube inside the panel, location and fixing arrangement of cylinder & system components.
8. All doors and holes in the enclosed/equipment’s should be closed or sealed to maintain the tightness of enclosure.
9. **System Description**:
10. The detection tube shall be fixed with cylinder valve at top of cylinder. The tube shall be pressurized with dry nitrogen. In case of reach of pre-determined temperature (100-120oC), the tube shall rupture gas shall be released from tube over the protected area.
11. The pressure switch shall be provided for necessary indication of discharge of gas.
12. The Extinguishing Agent shall be stored in cylinder as liquefied compressed gas, super pressurized with dry nitrogen at 195 psi.
13. The cylinder shall be equipped with brass valve, pressure gauge (to monitor agent pressure) and isolation valve for maintenance purposes. The cylinder bracket shall be of steel construction with quick release clamp.
14. The cylinder should be DOT approved as per DOT 4B specs.
15. The detection tube shall be installed throughout the compartments of panel. The location and spacing of tube shall be above the hazard, to be protected.
16. In case of fire, the tube shall rupture at a point. The rupture of tube shall result in formation of discharge point and release the agent in uniform pattern.
17. With system activation, a signal should be generated via Audio Visual Alarm installed at convenient location as per Engineer-in-Charge.
18. The system must be filled in a UL Listed or FM approved filling station in India.
19. **System Components:**

The bidder shall provide an under taking from Principle Manufacturer of CE marked product they intent to install, that manufacturer will fully support the bidder for this specific project.

1. Cylinder of steel construction with standard red epoxy paint finish. Cylinders shall be accompanied by original manufacturers test certificate confirming the contents of the cylinder.
2. The cylinders shall be from reputed Manufacturers only. Cylinders shall be super pressurized with dry nitrogen to an operating pressure and temperature as per manufacturer recommendations.
3. Each cylinder shall have pressure gauze and low pressure switch to provide visual and electrical supervision of the cylinder pressure. The low pressure switch shall be wired to the Audio Visual Alarm to provide audible and visual trouble alarm in the event of drop of pressure. The pressure gauze shall be colour coded to provide an easy, visual indication of cylinder pressure.
4. Furnish a welded steel bracket with each cylinder assembly for holding the cylinders in a saddle with a front bracket piece that secures the cylinders.
5. Cylinder shall be provided with a certificate provided by the company who charge with the FK-5-1-12 gas mixture. The certificate shall be secured around the cylinder with chain fastener.
6. The Detection Tube, CE marked to be Red Colour and pressurized at 195 psi. The Detection Tube to rupture between (100-120oC).
7. The Detection Tube, LPCB/UL/CE approved to be Red Colour and pressurized at 195 Bar. The Detection Tube to rupture between (100-120oC).
8. The cylinder should be DOT approved as per DOT 4B specs.
9. The Pressure Switch should be CE Marked having NO/NC contact.
10. **Extinguishing Agent**

**FK-5-1-12 (Dedecafluoro-2-Methylpentan-3 One – CF2CF2C (O) CF (CF3)2**

1. The agent shall not contain any Hydrofluorocarbons (HFC).
2. The ozone depletion potential should be zero.
3. The Global warming potential should be equal to or less than 1.
4. The Extinguishing Agent should be UL Listed/ FM approved.
5. The extinguishing agent should be filled in an UL Listed or FM approved filling station.
6. **Installation**
7. The system shall be installed on basis of approved drawing.
8. The installation / final connections shall carry out in direct supervision of representative of Manufacturer/authorized distributors.
9. Cylinder shall be located so that they are not subjected to mechanical, chemical or other damage.
10. All system components shall be capable of withstanding heat of fire and severe weather conditions.
11. Detection Tube to be properly secured inside the panel by Clips/Tie etc.
12. The Detection Tube outside the panel should be protected in flexible conduit.
13. Inspection certificate should be pasted on cylinder clearly marking next due date of inspection.