



भारतीय मानक ब्यूरो

(उपभोक्ता मामले, खाद्य एवं सार्वजनिक वितरण मंत्रालय, भारत सरकार)

BUREAU OF INDIAN STANDARDS

(Ministry of Consumer Affairs, Food & Public Distribution, Govt. of India)

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व्यापक परिचालन मसौदा

हमारा संदर्भ : सीईडी 22:03/टी-08

17 मई 2024

तकनीकी समिति : अग्नि शमन विषय समिति, सीईडी 22

प्राप्तकर्ता :

- सिविल अभियांत्रिकी विभाग परिषद, सीईडीसी के सभी सदस्य
- अग्नि शमन विषय समिति, सीईडी 22 और इसकी उपसमितियों के सभी सदस्य
- रुचि रखने वाले अन्य निकाय।

महोदय/महोदया,

निम्नलिखित मानक का मसौदा संलग्न है:

प्रलेख संख्या	शीर्षक
सीईडी 22(25685)WC	अग्निशमन दल के उपयोग के लिए जल टेंडर — कार्यात्मक अपेक्षाएं (चौथा पुनरीक्षण) (आईएस 948 एवं आईएस 6067 का अतिक्रमण) का भारतीय मानक मसौदा [आईसीएस 13.220.10]

कृपया इस मसौदे का अवलोकन करें और अपनी सम्मतियाँ यह बताते हुए भेजे कि यह मसौदा प्रकाशित हो तो इन पर अमल करने में आपको व्यवसाय अथवा कारोबार में क्या कठिनाइयाँ आ सकती हैं।

सम्मतियाँ भेजने की अंतिम तिथि: 17 जून 2024

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धन्यवाद।

भवदीय

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द्वैपायन भद्र

वैज्ञानिक ई एवं प्रमुख

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WIDE CIRCULATION DRAFT

Our Reference: CED 22:03/T-08

17 May 2024

TECHNICAL COMMITTEE: FIRE FIGHTING SECTIONAL COMMITTEE, CED 22

ADDRESSED TO:

1. All Members of Civil Engineering Division Council, CEDC
2. All Members of Fire Fighting Sectional Committee, CED 22 and its Subcommittees
3. All others interested.

Dear Sir/Madam,

Please find enclosed the following draft:

Doc No.	Title
CED 22(25685)WC	Draft Indian Standard Water Tender for Fire Brigade Use — Functional Requirements (<i>Fourth Revision of IS 950</i>) (<i>Superseding IS 948 and IS 6067</i>) [ICS: 13.220.10]

Kindly examine the attached draft and forward your views stating any difficulties which you are likely to experience in your business or profession, if this is finally adopted as National Standard.

Last Date for comments: 17 June 2024

Comments if any, may please be made in the enclosed format and emailed at ced22@bis.gov.in or sent at the above address. Additionally, comments may be sent online through the BIS e-governance portal, www.manakonline.in.

In case no comments are received or comments received are of editorial nature, kindly permit us to presume your approval for the above document as finalized. However, in case comments, technical in nature are received, then it may be finalized either in consultation with the Chairperson, Sectional Committee or referred to the Sectional Committee for further necessary action if so desired by the Chairperson, Sectional Committee.

The document is also hosted on BIS website www.bis.gov.in.

Thanking you,

Yours faithfully,

Sd/-

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Encl: As above

BUREAU OF INDIAN STANDARDS**DRAFT INDIAN STANDARD FOR COMMENTS ONLY**

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Draft Indian Standard

WATER TENDER FOR FIRE BRIGADE USE — FUNCTIONAL REQUIREMENTS

(Fourth Revision of IS 950) (Superseding IS 948 and IS 6067)

(ICS 13.220.10)

**Fire Fighting Sectional
Committee, CED 22****Last Date for Comments:
17 June 2024**

FOREWORD

(Formal clauses shall be added later).

Water tender is a vital firefighting apparatus designed to transport and supply water providing firefighters with the essential resource to extinguish flames and cool hot spots. These vehicles are indispensable for ensuring a continuous water supply during firefighting operations, particularly in rural or remote regions. Equipped with large-capacity tanks, water tenders can carry thousands of litres of water, which can be swiftly deployed to the scene of a fire. They come with pump, hoses, and other essential equipment to support fire extinguishing efforts.

This standard was first published in 1959 and revised in 1970, 1980, and 2012. Subsequent to the publication of this standard, the Indian Standards IS 948: 1983 'Functional requirements for water tender type 'A' for fire brigade use (*second revision*)' and IS 6067: 1983 'Functional requirements for water tender type 'X' for fire brigade use (*first revision*)' shall be withdrawn. The 2012 revision was based on the experience gained and availability of new designs and accessories; inclusion of higher capacity of pump and water tank; incorporation of coupling details between pump and tank; provisions of water/foam monitor; and inclusion of telescopic light mast and alternator units. Also, details pertaining to body work, storage, pipelines, and values were elaborated then. In this revision, the following major changes have been made:

- a) Title of the standard has been modified to 'Water Tender for Fire Brigade Use — Functional Requirements (*fourth revision*)' from 'Functional Requirements for Water Tender, Type B for Fire Brigade Use (*third revision*)'.
- b) IS 948: 1983 'Functional requirements for water tender type 'A' for fire brigade use (*second revision*)' and IS 6067: 1983 'Functional requirements for water tender type 'X' for fire brigade use (*first revision*)' has been amalgamated into this revision.
- c) General requirements of water tender have been modified to cover higher capacity of pumps installed in vehicles that are adhering to latest central motor

vehicle (CMV) rules.

- d) Capacity and sizes of water tanks has been increased to suit latest vehicle chassis sizes.
- e) Pump performance data have been updated to reflect requirements of newly included pumps.
- f) Pump tests have been updated to include thermal relief valve tests and pressure relief valve test.
- g) Reference to automotive industry standards have been included at relevant places.
- h) Design and construction of electrical system have been updated.
- j) List of accessories to be fitted on fire tender vehicles have been updated.
- k) Various pump testing procedures and test methods have been added.
- m) Informatory Annex L on 'Summary of Formulae and Other Data' has been added.
- n) Informatory Annex M on 'Metrication' has been added.

A list of accessories and equipment which do not form part of this appliance and most of which are normally required to assist in operation of the appliance is given in Annex B for information and guidance.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Draft Indian Standard***WATER TENDER FOR FIRE BRIGADE USE — FUNCTIONAL REQUIREMENTS***(Fourth Revision of IS 950) (Superseding IS 948 and IS 6067)***1 SCOPE**

This standard lays down the requirements regarding material, design and construction, workmanship and finish, accessories and equipment of water tender for fire brigade use.

2 REFERENCES

The standards listed at Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated at Annex A.

3 GENERAL REQUIREMENTS

3.1 The appliance (fire tender) shall incorporate a high-pressure and low-pressure fire pump of:

- a) 1 800 lpm at 0.7 MPa (7 kg/cm²) and 300 lpm at 3.5 Mpa (35 kg/cm²) capacity;
or
- b) 2 000 lpm at 0.7 MPa (7 kg/cm²) and 300 lpm at 3.5 Mpa (35 kg/cm²) capacity;
or
- c) 3 000 lpm at 0.7 MPa (7 kg/cm²) and 300 lpm at 3.5 Mpa (35 kg/cm²) capacity;
or
- d) 4 000 lpm at 0.7 MPa (7 kg/cm²) and 300 lpm at 3.5 Mpa (35 kg/cm²) capacity.

3.2 The appliance shall carry a water tank between 2 000 litres to 16 000 litres capacity (depending upon the type of chassis material of construction of the superstructure/tank, etc). It shall carry an extension ladder and shall be capable of towing a trailer pump. In addition, where required by the purchaser, one of the following water monitors shall also be incorporated:

- a) 1 500 lpm at 0.7 MPa (7 kg/cm²)
- b) 1 900 lpm at 0.7 MPa (7 kg/cm²)
- c) 2 270 lpm at 0.7 MPa (7 kg/cm²) or 2650 lpm at 0.7 MPa (7 kg/cm²)
- d) 3 030 lpm at 0.7 MPa (7 kg/cm²) or 3785 lpm at 0.7 MPa (7 kg/cm²)

3.3 The water tender shall be fabricated in a manner to confirm to the following characteristics:

- a) Gross vehicle weight shall be as per central motor vehicle rules (CMVR) 1989.
- b) The appliance shall be capable of being started from rest on a gradient of

1 to 4.

- c) When travelling at 48 km/h on a level dry surface the foot brake shall be capable of stopping the vehicle within a distance of 15 m from the point at which the brake is applied. The hand brake shall be capable of holding the fully laden appliance on a dry surface gradient of 1 in 4 when in neutral gear.
- d) The chassis shall meet prevailing emission norms and shall comply with the provisions of motor vehicle act 1988 and central motor vehicle rules 1989.
- e) The power to weight ratio of the vehicle shall be 8 to 10 HP per tonne for all category of the chassis.
- f) All chassis above 12 tonne gross vehicle weight (GVW) shall be fitted with automatic transmission.

4 MATERIAL

4.1 The choice of material to be used in the construction of the appliance shall be made with a view to combining lightness with strength and durability. The following choice of materials shall be followed:

<i>Appliance</i>	<i>Material</i>
Pump casing and low-pressure impeller	Lead tin bronze (grade LTB 2 of IS 318) or high strength light aluminium alloy grade 4450 of IS 617 (duly heat treated and hard anodized) or stainless-steel (grade X04Cr18Ni10Ti of IS 6603).
High-pressure impeller	- do -
Impeller neck ring	Lead tin bronze (grade LTB 2 of IS 318) or high strength light aluminium alloy grade 4450 of IS 617 (duly heat treated and hard anodized) or stainless-steel (grade X04Cr18Ni10Ti of IS 6603) or polymer-based material.
Pump shaft	Stainless steel (grade X04Cr18Ni10Ti of IS 6603).
Pump bearing housing	Grey cast iron (grade FG 260 of IS 210).
Pump panel	Aluminium sheets (IS 737) or stainless-steel sheet (IS 6911) or fibre reinforced polymer (FRP) / glass reinforced polymer (GRP).

4.2 Lubricating nipples shall be provided, wherever necessary.

5 DESIGN AND CONSTRUCTION

5.1 Auxiliary Cooling System

5.1.1 The engine shall be provided with auxiliary cooling system to permit its continuous stationery running without overheating. Indirect cooling system shall be incorporated, if necessary, which shall be of the open circuit type discharging water to the waste.

5.1.2 The operating temperature of the engine cooling water shall preferably be

thermostatically controlled and shall be maintained within the temperature range specified by the chassis manufacturer.

5.1.3 The oil in the oil sump shall be prevented from overheating.

5.2 Electrical System

5.2.1 A red pilot lamp, indicating when the batteries are being charged from an external supply, shall be provided.

5.2.2 All-important electrical circuits shall have separate fuses suitably indicated and shall be grouped into a common fuse box located in an accessible position in driver's cab and fitted with means for carrying spare fuses. The wiring shall be single pole and shall not be exposed to the atmosphere. Conduits shall be used, wherever necessary. The wire selected shall be of suitable size for different circuits considering the current consumption of that circuit with minimum 20 percent higher capacity. All the wires shall necessarily be copper conductor with proper insulation.

5.3 Water Tank

5.3.1 The capacity of the water tank shall be between 2 000 and 16 000 litres capacity (depending upon the type of chassis used).

5.3.2 The choice of material for the water tank shall be:

- a) *For tanks up to 7 000 litres capacity* — tank body and baffles shall be of minimum 3.15 mm thick, and the tank bottom plate shall be minimum 4 mm thick, both shall be made of stainless-steel grade 316 L (X02Cr17Ni12Mo2) as per IS 6911.
- b) *For tanks more 7 000 litres capacity* — tank body and baffles shall be of minimum 4 mm thick, and the tank bottom plate shall be minimum 5 mm thick mild steel sheets, both shall conform to IS 2062. The tank made of mild steel shall be treated suitably for anti-corrosion.

5.3.3 The tank shall be suitably mounted on the chassis in a manner keeping in view the proper load distribution on the axles.

5.3.4 A full-length runner from behind the driver cabin till end of chassis frame shall be provided and made of ISMC 100 (100 mm × 50 mm × 5 mm) (see IS 808) for the water tank up to 7 000 litres capacity and ISMC 150 (150 mm × 75 mm × 5.7 mm) for the water tank above 7 000 litres capacity suitably fixed to the chassis frame with 6 mm thick mild steel plate and bolted to chassis frame wherever holes are available in the chassis frame.

5.3.5 The tank shall be suitably baffled with minimum two numbers of baffles fitted longitudinally and two numbers of baffles fitted transversely for tank up to 7 000 litres capacity and minimum two numbers of baffles fitted longitudinally, and three numbers of baffles fitted transversely for tank more than 7 000 litres capacity to prevent surge when the vehicle is breaking, cornering, or accelerating for.

5.3.6 The baffles shall be arranged in a manner to facilitate the passage of a man throughout the tank for cleaning purpose.

5.3.7 The tank shall be mounted on minimum three cross members to counter act the stresses caused by chassis flexion and shall be so secured that it can be easily removed. The water tank shall be provided with minimum six chairs, three on either side for mounting the tank on the runner and chassis frame.

5.3.8 Water tank up to 7000 litres capacity shall be fixed on the runner with heavy duty single metacone mountings and Water tank more than 7000 litres capacity shall be fixed on the runner with heavy duty dual metacone mountings.

5.3.9 Suitable eyes shall be provided on the shell of the tank to enable it to be lifted from the vehicle for repairs/ replacement as and when required.

5.3.10 The tank shall be fitted with a suitably sized overflow pipe. Two 63 mm instantaneous hydrant connections, incorporating a ball valve and strainer, shall be provided for filling the tank through 75 mm bore pipe work. Suitable size pipeline shall be taken from the tank to the suction inlet of the pump incorporating quick action spherical type valve as per IS 13095. Drain plugs or drain cocks shall be provided, wherever necessary.

5.3.11 The open end of the overflow pipe shall be taken down to a point well below the chassis without affecting the effective ground clearance when fully loaded and shall discharge away from the wheels.

5.3.12 The following can be provided for filling the water tank:

<i>Water Tenders (pump capacity)</i>	<i>Hydrant Connections and Pipework</i>
up to 2 000 lpm	Minimum two 63 mm instantaneous hydrant connections, incorporating a ball valve and strainer, shall be provided for filling the tank through 100 mm bore pipe work.
3 000 lpm and 4 000 lpm	Minimum four 63 mm instantaneous hydrant connections, incorporating a ball valve and strainer, shall be provided for filling the tank through 75 mm bore pipe work (maximum two inlets in one side).

5.3.13 For the mild steel plates used for the tank, they shall be given adequate anti-corrosive treatment by shot blasting from inside and outside and then epoxy treatment shall be given which shall consist of one coat of primer with two coats of finish.

5.3.14 LED/digital level indicator shall be installed at pump control panel. Level Indicator shall be provided with $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and full level indication or with indicators of the percentage of water.

5.3.15 The tank shall have a bolted manhole of 450 mm diameter of the same material

as that of the tank and shall have a gun metal (see IS 10742) threaded ring and cap of 300 mm diameter for filling the water tank from the top. The manhole cover shall be made from 5 mm thick plate.

5.3.16 The tank shall be connected with the pump and hose reel and valve(s) shall be provided in such a way that any of the following operations are possible:

- a) Hydrant — tank;
- b) Hydrant — reel;
- c) Tank — pump — high-pressure hose reels;
- d) Tank — pump — low-pressure hose reels; and
- e) Hydrant — pump — low-pressure hose reel and off.

5.4 Hose Reels

5.4.1 Two high-pressure hose reels shall be provided and mounted so as to be accessible for use from either side of the appliance. The hose shall be prevented from kinking. The hose shall be light weight PVC nylon braided hose and the working pressure of hose shall not be less than 4 Mpa (40 kg/cm²). The high-pressure hose reels shall hold not less than 30 m of hose in one length, terminating in high pressure fog/jet trigger type gun connected by quick connect couplings. The fog gun shall be made of stainless steel or aluminium alloy. The inlet connection shall be of 20 mm and shall have a leak proof rotating type hose connector. The gun shall be of constant flow type and shall have a discharge capacity of 150 lpm approximately. Provision shall be made in the gun controls to achieve combat mode (straight jet) or a fog shield in split second. The gun shall have the ability to work on pressure for 2 MPa to 4 MPa (20 kg/cm² to 40 kg/cm²) without affecting discharge pattern. Weight of gun shall not be more than 4 kg.

5.4.2 The hose reel shall be of electrically rewinding type 12 / 24 V. The hose reel side plates and drum shall be made from aluminium or Stainless steel

5.4.3 Plumbing between the pump and hose reel shall have clean and unobstructed water way of not less than 25 mm throughout.

5.5 Pump

5.5.1 A centrifugal high-pressure and low-pressure pump shall be mounted at rear of the appliance. The low-pressure and high-pressure sections of the pump may be either multi-stage or single-stage type. Anti-friction bearings external to the casing be provided to avoid any bearings within the pump casing. The gland shall be of the mechanical self-adjusting type.

5.5.2 The impeller(s) of the low-pressure section shall be closed type and shall be dynamically balanced. The impeller(s) of the high-pressure sections shall be closed or regenerative type. A drain cock plug shall be provided at the bottom of the casing in a way to prevent the cock being opened due to vibrations. Studs, etc, used in the

pump casing coming in contact with the water shall be stainless steel. The castings shall be without any blow holes, internal cracks, etc. The interior of the casting shall be smooth finished. The castings shall withstand the hydraulic pressure as given in **5.5.11**.

5.5.3 The pump along with the controls shall be placed in a closed locker provided with openable doors or aluminium roller shutter.

5.5.4 The pump shall be coupled to the prime mover of the chassis through a power take-off (PTO) capable of transmitting full torque of the engine used for the appliance or a side mounted PTO of suitable torque and ratio.

All propeller shafts and all fittings used for coupling the PTO, pump, etc, shall be of the suitable size and type required for driveline as used by the chassis manufacturer for the drive line and all shall be dynamically balanced. Any changes in the original driveline of the chassis shall be approved by the chassis manufacturer.

The PTO shall have a suitable gear ratio to maintain the engine rpm of maximum torque and power range as recommended by the chassis manufacturer to achieve the output required from pump.

A cooling coil made of copper pipe shall be provided in the bottom of the PTO casing in case a split shaft PTO is used for driving the pump.

5.5.5 A control lever or switch for engaging and disengaging the pump shall be provided in the driver's cab.

5.5.6 The pump shall be designed to give its rated output with an engine and pump input at shaft speed safe enough to operate the engine. The pump capacity shall be:

- a) 1 800 lpm at 0.7 MPa (7 kg/cm²) and 300 lpm at 3.5 Mpa (35 kg/cm²) capacity;
or
- b) 2 000 lpm at 0.7 MPa (7 kg/cm²) and 300 lpm at 3.5 Mpa (35 kg/cm²) capacity;
or
- c) 3 000 lpm at 0.7 MPa (7 kg/cm²) and 300 lpm at 3.5 Mpa (35 kg/cm²) capacity;
or
- d) 4 000 lpm at 0.7 MPa (7 kg/cm²) and 300 lpm at 3.5 Mpa (35 kg/cm²) capacity.

5.5.7 The design of the pump shall be such that the normal pressure and high-pressure stages can be operated simultaneously. Simple mechanism shall be provided to change over from normal pressure to high pressure, preferably a single lever operation.

5.5.8 A thermal relief valve (TRV) shall be fitted on the pump discharge side which will control the water temperature within the pump below 48 °C (or 80 °C – this version shall be used only when there is good operational reason) when the pump is operating in high rpm with close discharge. The water discharged from the TRV shall be either taken back to water tank or safely piped away to waste with metallic pipe.

5.5.9 The pump housing shall have provision to connect normal pressure hose reel and cooling water line. The pump shall give performance as given in Table 1, when working with strainers (except basket strainer) at $27\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

5.5.10 Allowances for output of the pump

- a) One percent for every $2.5\text{ }^{\circ}\text{C}$ rise in water temperature,
- b) Four percent for every 300 m above mean sea level, and
- c) No allowance shall be made for humidity up to 75 percent. However, deduction at the rate of 1 percent of every 5 percent change in humidity shall be made when humidity changes from 75 percent to 95 percent.

Table 1 Pump Performance Data
(Clause 5.5.9)

SI No.	Output lpm	Pressure MPa (kg/cm ²)	Lift m	Remarks
(1)	(2)	(3)	(4)	(5)
i)	2 000 / 3 000 / 4 000 / 6 000	0.7 (7)	3	When working through two 2.45 m lengths of specified suction hose.
ii)	1 600 / 2 400 / 3 200 / 4 800	0.88 (8.8)	3	When working through two 2.45 m lengths of specified suction hose.
iii)	720 / 950 / 1 400 / 2 100	0.7 (7)	7	When working through 9.8 m, that is four 2.45 m lengths of specified suction hose.
iv)	300	3.5 (35)	3	When working through two 2.45 m lengths of specified suction hose.

5.5.11 Pump Test

5.5.11.1 The pump shall be run for a period of three hours non-stop delivering the rated output at 0.7 MPa (7 kg/cm²) and for one hour at 3.5 MPa (35 kg/cm²) with a lift of 3 m at normal temperature and pressure conditions (NTP).

5.5.11.2 During the test, the water shall not be replenished for the cooling system and the temperature of the engine oil shall not exceed the engine manufacturer rated temperature for continuous working. The engine shall show no sign of stress during the test. The temperature of the cooling water (radiator water) tank shall not exceed the engine manufacturer rated temperature for continuous working.

5.5.11.3 The PTO sump oil temperature shall not exceed 100 percent of the manufacturers recommended temperature for the grade of oil used. The pump casing and impeller shall be subjected to hydraulic pressure of 2.1 MPa (21 kg/cm²) for 10 min to detect leakage, perforation, etc.

5.5.11.4 Various pump testing procedures and test methods shall be as per Annex C to Annex K.

5.5.11.5 *Thermal relief valve (TRV) test*

After priming the pump from open well let the pressure within the pump build up to 0.7 MPa (7 kg/cm²), this shall be followed by engaging the pump in high-pressure mode. Now close all the delivery outlets (including the engine cooling valve) then throttle the engine so as to maintain a high pressure of 3 MPa to 3.5 MPa (30 kg/cm² to 35 kg/cm²) let the pump heat up until the TRV opens automatically and hot water comes out of it; Measure the temperature of this hot water. This temperature shall not exceed the specified value (48 °C or 80 °C). Slowly open the delivery valve to allow fresh cold water to enter the pump. The TRV must close automatically once the ambient temperature is reached by the pump.

5.5.11.6 *Pressure relief valve (PRV) test*

After priming the pump from open well let the pressure within the pump build up to 0.7 MPa (7 kg/cm²), this shall be followed by engaging the pump in high-pressure mode, now close all the delivery outlets (including the engine cooling valve) then throttle the engine so as to increase the high pressure until the PRV opens automatically and the pressure should not be more than 4 MPa (40 kg/cm²) The PRV must close automatically once pressure is less than 4 MPa (40 kg/cm²).

5.6 Suction Inlet and Delivery Valves

5.6.1 The pump shall have suction inlet(s) having 100 mm to 150 mm standard suction connection (see IS 902) with internal strainer(s) and blank cap(s). The strainer(s) shall be retained firmly when in use but shall be easily removable. The mesh size of the pump inlet screen shall be smaller than the outlet size of the impeller.

5.6.2 The pump shall be provided with one delivery valve for every 1 000 lpm pump output having 63 mm standard hose couplings (see IS 903) with screwed wheel type quick closing clack valve (see IS 4928). Blank caps fastened with chains and incorporating means to relieve pressure between the valve and the cap shall be provided one for each delivery valve.

5.6.3 *High-Pressure Filter*

In case of regenerative impeller, the water going to high-pressure impeller suction shall be filtered before entering into the high-pressure impeller. A filter capable of filtering particle size up to 0.75 mm or less shall be used. This filter shall be of stainless steel and shall be easily accessible for cleaning.

5.7 Primer

5.7.1 The primer shall be capable of lifting water at least 7.0 m (measured from water level to the centre of pump) in not more than 24 s when connected with 100 mm suction hose and 36 s when connected with 140 mm to 150 mm suction hose and shall

preferably be fully automatic. The allowance shall be 300 mm for every 300 m elevation above mean sea level and 1 percent for every 2.5 °C rise in water temperature.

5.7.2 In the case of water ring or reciprocating primer or rotary primer, engagement and disengagement shall be automatic. If the primer is of the reciprocating type, means shall be provided to automatically limit the speed of engine while the primer is engaged.

5.7.3 The primer shall be constructed of gun metal, light alloy, or stainless steel.

5.8 Pipelines and Valves

5.8.1 All pipelines shall be of stainless-steel grade X04Cr19Ni9 (SS 304) [see IS 1762 (Part 2)] and all valves up to 50 mm size shall be 3-piece design grade SS 304 stainless steel ball valves. All valves above 50 mm shall be standard butterfly valves.

5.8.2 All piping shall be sized to have minimum pressure drop and achieve the required pressure and flow at various locations.

5.8.3 All piping shall be seamless and designed for 10 percent over the maximum pressures encountered in the pipe.

5.8.4 The piping shall be flanged for ease of maintenance. Flanges shall have 'O' ring sealing. However, flange joints shall be kept to minimum.

5.8.5 All lines shall be hydraulically tested at 1.5 times of the design pressure and pressure shall be held for 2 h. In no case the lines shall be tested below 2.5 MPa (25 kg/cm²).

5.8.6 All lines shall be suitably supported to provide rigidity and avoid vibrations.

5.8.7 All lines less than 50 mm size shall be socket welded to matching rating fittings.

5.8.8 All lines above 50 mm size shall be butt welded with full penetration welds.

5.8.9 All bolts, nuts, and washers used shall be of stainless steel.

5.9 Control Panel

5.9.1 Adequately illuminated control panel shall be provided and positioned as follows:

- a) Rear mounted pump — One control panel at the rear of the appliance;
- b) Midship mounted pump

5.9.2 The control panel shall be located near the pump and shall include the following:

- a) Throttle control for engine; push buttons Integrated with vehicle engine management system and the same should be approved by the chassis manufacturer.
- b) The control panel shall be LCD type touch screen and shall have following

displays and controls:

- 1) Low pressure gauge
 - 2) High Pressure gauge
 - 3) Vacuum gauge
 - 4) Engine coolant water temperature gauge
 - 5) Engine oil pressure gauge
 - 6) Engine rpm
 - 7) Pump rpm
 - 8) Engine speed Idle
 - 9) Water level indicator
 - 10) PTO warning lamp
- c) Control for primer
 - d) Control for pump compartment light
 - e) Control for auxiliary cooling system (if required)
 - f) Hydrant to tank connection with non-return valve (NRV)

5.10 Body Work and Stowage

5.10.1 Cabin

5.10.1.1 Enclosed accommodation for six persons shall be provided in the driver cab-cum-crew compartment including the driver and the in-charge of the crew.

5.10.1.2 In case the chassis is of the cowl type, the complete cabin shall be manufactured by the body fabricator as per the following specifications:

- a) The front-end structure, cowl shall be original and shall be retained as supplied with the chassis.
- b) The size of driver-cum-crew cabin shall be:

Length of cabin	:	2 200 mm to 2 400 mm.
Width of cabin	:	2 200 mm to 2 480 mm.
Internal height	:	Not more than 1 700 mm.
- c) The driver-cum-crew cabin shall be fabricated in continuation and in line. The under frame cross members shall be fabricated and made from ISMC 100 (100 mm x 50 mm x 5 mm) for chassis up to GVW of 12 tonnes and above, and ISMC 75 (75 mm x 40 mm x 4.8 mm) for chassis less than GVW of 12 tonnes.
- d) Each cross member shall be secured to the runner running full length of the chassis frame with suitable mounting plates. The runner shall be fixed to the chassis frame.

- e) The complete superstructure of the cabin shall be made of X04Cr19Ni9 (SS 304) [see IS 1762 (Part 2)] square tube of 30 mm × 30 mm × 1.6 mm. The superstructure shall be strengthened specifically on the members where the doors and window frames are to be fitted and also on the other members by providing brackets and the gusset plates securely fitted.
- f) The flooring of the driver cum crew cabin shall be fabricated out of SS 304 angles of 40 mm × 40 mm × 4 mm thick which shall be properly welded/ bolted to the cross members.
- g) The complete Internal and external panelling of driver-cum-crew cabin, including doors shall be of 1.6 mm aluminium sheet with all the joints riveted and bided.
- h) The flooring of the driver-cum-crew cabin shall be fabricated from 3 mm aluminium chequered plates except over the mudguard arches which shall be of 2 mm aluminium chequered plate rigidly fixed to the under frame by means of nuts and bolts or riveting. Trap doors for topping up wherever necessary shall be provided.
- j) The driver-cum-crew cabin shall be equipped with full four doors, one for driver, one for officer in the front and two at the rear for the crew members.
- k) All the doors shall be fitted on the super structural members each hung upon the two/three numbers of coach type hinges and handles.
- m) For all the above windows toughened glass shall be provided and windscreen glass shall conform to relevant AIS standards.
- n) The wind screen shall be 5 mm thick laminated safety glass curved type single piece with EPDM rubber beading.

5.10.1.3 If the chassis is of the cabin type, suitable extension of the original cabin shall be done to accommodate the crew members as specified above. Due care shall be taken to ensure that the cabin extension is done completely as per the chassis manufacturers recommendations and suitably strengthened to take the additional loads where required.

5.10.1.4 One roof light shall be provided in the driver's cabin dwell vision and external rear view mirrors shall be fitted to the cab. The rear-view mirrors shall comply to AIS 001 and shall be installed as per AIS 002.

5.10.2 Seats

5.10.2.1 Both the seats (driver and officer in charge) shall be independent and fully adjustable for horizontal as well as vertical adjustments. The officer in charge and crew shall have individual seating, with each seat fitted with brackets for placement of breathing apparatus in an upright position. The seats shall be able to accommodate all types of self-containing breathing apparatus (SCBA) sets. The seats shall have integrated seat belts. The safety belt (seat belt) shall comply to AIS 005. The crew seat shall meet the requirements of AIS 023.

5.10.2.2 Below the crew seat, two lockers shall be provided. One locker for battery box to accommodate two 12 V 13 plates batteries and another for keeping accessories. The extra length of battery cable shall be provided by manufacturer.

5.10.2.3 The crew seat shall be rigidly fixed to floor by means of nuts and bolts, running full width of the vehicle suitable for sitting five firemen, covered with 75 mm × 50 mm cushion latex foam rubber upholstered in good quality foam leather of approved shade.

5.10.2.4 Suitable locker space shall be provided below the crew seat.

5.10.3 Rear Body

5.10.3.1 The rear body shall be fabricated in continuation and in line of the crew cabin. The under frame cross members shall be fabricated and made of ISMC 100 (100 mm × 50 mm × 5 mm) for chassis up to GVW of 12 tonnes, and ISMC 75 (75 mm × 40 mm × 4.7 mm) for chassis with GVW of less than 12 tonnes.

5.10.3.2 The mild steel runner of 100 mm × 50 mm × 5 mm size shall be provided over the chassis member for the uniform distribution of load over the chassis. Each cross members shall be secured to the chassis frame.

5.10.3.3 The complete superstructure shall be made of X04Cr19Ni9 (SS 304) [see IS 1762 (Part 2)] square tube of 30 mm × 30 mm × 1.6 mm. The superstructure shall be strengthened specifically on the members where the doors and lockers are to be fitted and also on the other members by providing brackets and the gusset plates securely fitted.

5.10.3.4 The flooring shall be fabricated out of SS 304 angles of 40 mm × 40 mm × 4 mm thick which shall be properly welded / bolted to the cross members.

5.10.3.5 The complete Internal and external panelling including doors (if any) shall be of 1.6 mm aluminium sheet with all the joints riveted and bided.

5.10.3.6 The flooring shall be fabricated from 3 mm aluminium chequered plates except over the mudguard arches which shall be of 2 mm aluminium chequered plate rigidly fixed to the under frame by means of nuts and bolts or riveting. Trap doors for topping up wherever necessary shall be provided.

5.10.4 Super Structure

5.10.4.1 The cab and lockers shall be of composite construction with sufficient rigidity and reinforcement and shall be kept as light as possible.

5.10.4.2 The structure/framework shall be of welded constructions and made from 2 mm thick mild steel pressed sections and square tubes. The angles and channels used shall be of minimum 3 mm thickness. The complete structure material shall be treated for anti-corrosion by zinc plating. The plating thickness shall not be less than

20 microns. Two coats of epoxy paint shall be applied to the completely welded structure.

5.10.4.3 The structure shall be designed to avoid any vibration/rattling/deformation in the intended usage of the vehicle.

5.10.4.4 The entire rear deck of the vehicle and locker floor shall be covered with minimum 3 mm thick aluminium chequered plates. All the lockers' sides and complete rear of the vehicle shall be covered with minimum 2 mm thick aluminium sheets / chequered plates.

5.10.4.5 All lockers provided above the chassis frame shall be covered with aluminium roller shutters. The roller shutters shall be made from double layer aluminium extruded profiles with suitable side guide channels. All aluminium profiles use shall be proper anodized with the thickness of each profile not more than 30 mm. The opening roller shutters shall be done by means of the bar type handle provide. This shall be self-locking type so that while vehicle is moving, the shutters do not open accidentally during movement of vehicle. Roller shutter profile/panel links shall be interconnected with rubber/plastic/PVC sealing to make the roller shutter watertight when close. The roller shutter winding rolls shall be between 45 mm to 60 mm in diameter.

5.10.4.6 Suitable lockers with doors shall be provided below the chassis frame depending upon the availability of space on the chassis / requirement of the fire services. All lockers shall be provided with LED lights.

5.10.4.7 All lockers above chassis floor shall be covered with aluminium roller shutters. The roller shutters shall be made from extruded aluminium sections with panel, one on each side of appliance will have a locking arrangement. Other doors shall be suitable roller, spring, guide channels, etc. All aluminium sections used shall be properly anodized. The roller shutters shall be rolled inwards underneath the roof giving unobstructed access to the equipment lockers and the firefighting material. These roller shutters shall open in every position of the vehicle even in rough terrain. Guide rails shall support the shutters over entire length on both sides to make them absolutely torsion free. The roller shutters shall have a sturdy lock, preventing accidental opening during movement of vehicle. Roller shutters shall be made of hollow rectangular shaped aluminium links which shall be interconnected with rubber/plastic/PVC profiles sealing the roller shutter watertight when closed. These roller shutters shall be durable, maintenance free, weather and corrosion resistant.

5.10.4.8 Suitable storage space shall be provided to store four 2.5 m lengths of suction hoses in convenient location.

5.11 Miscellaneous

5.11.1 A suitable bumper shall be provided at the rear rigidly fixed to the super structural members by means of nuts and bolts, fabricated from ISMC 100 (100 mm × 50 mm × 5 mm).

5.11.2 Two cat ladders made of stainless-steel round or square pipe of 25 mm diameter shall be provided.

5.11.3 Two numbers of 25 mm diameter aluminium pipe railing with sufficient number of aluminium double socket brackets shall be provided to the rear body over the deck.

5.11.4 A heavy-duty towing hook shall be provided and fitted the rear bumper by means of nuts and bolts.

5.11.5 Quick removable type wire mesh guard made from 25 mm × 25 mm size mild steel galvanised wire mesh of 1.6 mm covered in mild steel angle frame shall be provided to all the glasses of driver-cum-crew cabin.

5.12 Provision for Stowage of Equipment

For all water fittings like branch pipes, etc, quick release type couplings are provided which enables the operator to locate the desired equipment instantly and thereby save valuable time at the time of fire. These couplings also ensure that none of the item damage the internal panelling and thereby increase the life of vehicle. Suitable clamps, brackets, holders, etc are provided for all other items.

5.13 Cable Winch (Optional)

An electrically operated cable winch of six tonnes capacity shall be provided. The winch unit shall be complete with minimum 5.5 HP 12 V dc series wound electric reversible motor for increased pulling power, rope drum, and 27 m heavy duty galvanized EIPS wire rope with replaceable self-locking clevis hook and shall be mounted on the front bumper of the vehicle with suitable strong supports.

5.14 Telescopic Light Mast or Inflatable Emergency Lighting System (Optional)

5.14.1 A telescopic lighting system shall be provided consisting of pneumatic telescopic mast with four numbers of 80 W LED floodlight 24 V DC and mast mounting bracket assembly.

5.14.2 The telescopic mast shall be manufactured from fully anodized aluminium 6063 T6 alloy tubes, corrosion proof even in presence of sea fog and with at least 3.5 mm thickness.

5.14.3 The telescopic mast should be extremely strong and designed with not more than three sections and equipped with special keyway and anti-rotation key placed on the ring between each section to eliminate any backlash between all the sections, the purpose is to prevent the mast from rotating on its axis in case of impact force or unbalanced load.

5.14.4 The telescopic mast shall have minimum diameter of 90 mm on the main tube. The top section of the mast should not be more than 65 mm. It shall be complete with foot plate with up to six fixing holes for bolts.

5.14.5 The mast must be equipped with internal spiralled electrical cable with seven

wires with a section each of 1.5 mm² and wires will be shielded.

5.14.6 The extended height of the telescopic mast shall be minimum 6 000 mm from ground level. The retracted height of mast shall be maximum 2 100 mm.

5.14.7 The pneumatic controller board with pressure regulator shall be provide for mast extension and retraction.

5.14.8 The working pressure of the telescopic mast must be between 1.5 bar to 2.5 bar.

5.14.9 The operational temperatures range shall be between - 40 °C and + 60 °C, with air safety release valve. Each mast section must be provided with a water drainage hole to drain water out from the internal sections.

5.14.10 The telescopic mast should be mounted behind the driver's cabin and should be internally mounted with suitable brackets.

5.14.11 The Light Mast will have four numbers of 80 W LED 24 V, DC floodlight projectors in weatherproof shock resistant aluminium IP67 casing. The total floodlight efficiency must at least 28 000 lumens.

5.14.12 The mast shall be manually turntable and lockable by means of a hand wheel fitted on the mast allowing 360° movements.

5.15 Ladder Gallows

Gallows shall be provided to carry a 13.5 m aluminium trussed type triple extension ladder. The design shall be such that the ladder can be released without difficulty from a reasonably accessible position and shall embody rollers to permit easy withdrawal by one man. Means shall also be provided for locking the ladder when stowed.

5.16 Tool-Kit Container

A specially fitted recessed tray for the normal kit of tools, carried on the appliance, shall be provided.

5.17 Stability

The stability of the appliance shall be such that when under fully equipped and loaded conditions (but excluding crew), if the surface on which the appliance stands is tilted to either side, the point at which overturning occurs is not passed at an angle of 27.5° from the horizontal.

6 WORKMANSHIP AND FINISH

6.1 All parts of the appliance shall be of good workmanship and shall have streamlined finish.

6.2 The appliance shall be painted fire red colour conforming to Shade No. 536 of IS 5. The paint shall conform to 2932 and shall be polyurethane type.

7 INSTRUCTION BOOK, ACCESSORIES AND EQUIPMENT

7.1 Instruction Book or Books

The chassis maintenance manual shall also be provided with the vehicle.

7.1.1 General Instructions

The following description of the pump shall be included in the instruction handbook:

- a) General description;
- b) Range of usable ambient temperature;
- c) Design and function of the pump, including important data (for example number of stages, shaft seal, primer materials, drainage, lubrication points);
- d) Maximum operating pressure;
- e) Information of operating controls;
- f) Design, function, and use of safety protection devices;
- g) Shut off valves and pump connections;
- h) Additional descriptions for accessories;
- j) Cross-sectional drawing of the pump or exploded diagram; and
- k) Maximum angle of inclination of operation.

7.1.2 Maintenance and Servicing

The following instruction for maintenance and servicing of the pump shall be included in the instruction handbook:

- a) Maintenance intervals and scope.
- b) Maintenance procedures and inspections.

7.2 Accessories

The following accessories shall be provided in addition to those normally fitted on modern commercial vehicles:

- a) *Fog lamps* — Two.
- b) *Multicolour lights (red / white / blue)* — Situated on the head of the driving compartment.
- c) *Tools* — All tools required for normal routine maintenance of the appliance which are not included in the kit for the chassis.
- d) *Siren* — Battery operated.
- e) *Search light* — Adjustable to give flood or beam light, mounted in a convenient position but capable of being readily disconnected and mounted on a tripod away from the appliance, complete with tripod and with not less than 30 m of TRS cable on a reel mounted on the appliance.
- f) *Spotlight* — Adjustable, mounted in a convenient position on the near side of

the driving compartment.

- g) *Inspection lamp* — Protected type on wander lead with plug. A socket shall be provided in the control panel in the driver's cab for plugging in the lamp.
- h) Rear reflectors.
- j) Cab, instrument panel and locker, light.
- k) Public address system.

8 MARKING

Each appliance shall be clearly and permanently marked with the following information:

- a) Manufacturer's name, or trademark, if any;
- b) Serial number of the pump body and year of construction;
- c) Capacity of pump, in lpm;
- d) Capacity of water tank, in litre;
- e) Nominal speed, in rpm of the pump;
- f) Transmission ratio of the power take off;
- g) Working pressure, in MPa (kg/cm²);
- h) Direction of rotation of the pump shall be indicated by an arrow and this shall be permanently marked on the pump body; and
- i) Lubrication points, drainage devices, etc, shall be colour coded.

ANNEX A
(Clause 2)**LIST OF REFERRED INDIAN STANDARDS**

<i>IS No.</i>	<i>Title</i>
5 : 2007	Colours for ready mixed paints and enamels (<i>sixth revision</i>)
273 : 1990	Specification for picks and beaters (<i>fourth revision</i>)
318 : 1981	Specification for leaded tin bronze ingots and castings (<i>second revision</i>)
513 : 2008	Specification for cold-rolled low carbon steel sheets and strips (<i>fifth revision</i>)
617 : 1994	Specification for aluminium and aluminium alloy ingots and castings for general engineering purposes (<i>third revision</i>)
636 : 2018	Non-percolating flexible fire fighting delivery hose — Specification (<i>fourth revision</i>)
703 : 1999	Axes — Specification (<i>second revision</i>)
704 : 1984	Specification for crowbars and claw-bars (<i>second revision</i>)
737 : 2008	Wrought aluminium and aluminium alloy sheet and strip for general engineering purposes (<i>fourth revision</i>)
841 : 1983	Specification for steel hammers (<i>second revision</i>)
884 : 1985	Specification for first-aid hose reel for fire fighting (<i>first revision</i>)
901 : 1988	Specification for couplings, double male and double female, instantaneous pattern for fire fighting (<i>third revision</i>)
902 : 1992	Specification for suction hose couplings for fire fighting purposes (<i>third revision</i>)
903 : 1993	Specification for fire hose delivery couplings, branch pipe, nozzles, and nozzle spanner (<i>fourth revision</i>)
904 : 1983	Specification for 2-way and 3-way suction collecting heads for fire fighting purposes (<i>second revision</i>)
905 : 1988	Specification for delivery breechings, dividing and collecting instantaneous pattern for fire fighting purposes (<i>second revision</i>)
906 : 1988	Specification for revolving branch pipe for fire fighting (<i>third revision</i>)
907 : 1984	Specification for suction strainers, cylindrical type for fire fighting purposes (<i>second revision</i>)
910 : 1980	Specification for combined key for hydrant, hydrant cover and lower valve (<i>second revision</i>)
927 : 1981	Specification for fire hooks (<i>second revision</i>)
952 : 1986	Specification for fog nozzle for fire brigade use (<i>first revision</i>)

<i>IS No.</i>	<i>Title</i>
1084 : 2005	Manila ropes — Specification (<i>fourth revision</i>)
1931 : 2000	Engineer's files — Specification (<i>third revision</i>)
2097 : 2012	Specification for foam making branch pipe and foam inductor (<i>second revision</i>)
2171 : 1999	Specification for portable fire extinguishers, dry powder (cartridge type) (<i>fourth revision</i>)
2871 : 2012	Branch pipe, universal for fire fighting purposes — Specification (<i>first revision</i>)
2932 (Part 1) : 2013	Enamel, synthetic, exterior (a) Undercoating, (b) Finishing — Specification: Part 1 Domestic and decorative applications (<i>fourth revision</i>)
3582 : 1984	Specification for basket strainers for fire fighting purposes (cylindrical type) (<i>first revision</i>)
4571 : 1977	Specification for aluminium extension ladders for fire brigade use (<i>first revision</i>)
4643 : 1984	Specification for suction wrenches for fire brigade use (<i>first revision</i>)
4770 : 1991	Specification for rubber gloves for electrical purposes (<i>first revision</i>)
4927 : 1992	Unlined flax canvas hose for fire fighting — specification (<i>first revision</i>)
4928 : 1986	Specification for delivery valve for centrifugal pump outlets (<i>first revision</i>)
5098 : 1969	Specification for crosscut and rip saws
5131 : 2002	Dividing breaching with control for fire brigade use — Specification (<i>second revision</i>)
5612	Specification for hose-clamps and hose bandages for fire brigade use
(Part 1) : 1977	Hose clamps (<i>first revision</i>)
(Part 2) : 1977	Hose bandages (<i>first revision</i>)
5714 : 1981	Specification for hydrant standpipe for fire fighting (<i>first revision</i>)
6149 : 1984	Specification for single-ended open-jaw adjustable wrenches(<i>first revision</i>)
6603 : 2001	Stainless steel bars and flats- Specification (<i>first revision</i>)
6911 : 2017	Stainless steel plate, sheet, and strip specification (<i>first revision</i>)
8423 : 1994	Specification for controlled percolating hose for fire fighting (<i>first revision</i>)

<i>IS No.</i>	<i>Title</i>
8442 : 2008	Stand post type water and foam monitor for fire fighting (first revision)
10245 (Part 2) : 1994	Respiratory protective devices — specification : Part 2 Open circuit breathing apparatus (first revision)
13095 : 1991	Butterfly walls for general purposes

ANNEX B
(Foreword)**SCHEDULE OF EQUIPMENT TO BE STOWED IN THE APPLIANCE**

<i>Sl No.</i>	<i>Item</i>	<i>Quantity</i>
1.	Aluminium Triple extension ladder 13.5 m (As per IS 4571 / JCDD 12/1)	1
2.	Rubber lined delivery hose of 50 mm internal diameter according to Type A of IS 636 in 30 m or 15 m length fitted with 50 X 63 mm delivery hose couplings made from corrosion resistance steel as per IS 3444 Gr I.	600 m
3.	Hose clamps [see IS 5612 (Part 1)]	25
4.	Hose bandages [see IS 5612 (Part 2)]	25
5.	Hose slings	20
6.	Hose straps	20
7.	Suction hose (Heavy duty) of PVC of 100 mm internal diameter in 2.5 m lengths fitted with 100 mm to 150 mm suction hose coupling (see IS 902)	10 m
8.	3-way suction collecting head 100 mm to 150 mm size (see IS 904)	1
9.	Suction wrenches for 100 mm to 150 mm suction coupling (see IS 4643)	2
10.	Suction strainer 100 mm to 150 mm size (see IS 907)	1
11.	Basket strainer (cylindrical type) (see IS 3582)	1
12.	Dividing breeching with (see IS 5131) Control instantaneous pattern 63 mm	1
13.	Collecting breaching instantaneous pattern 63 mm (see IS 905)	1
14.	Hydrant- stand pipe - two way (see IS 5714)	1
15.	Double female coupling (see IS 901)	2
16.	Hydrant connection 63mm double armoured hose 1 m long with 63 mm female instantaneous pattern delivery couplings at both ends (see IS 901)	2
17.	Combined key for hydrant, hydrant cover and lower valve (see IS 910)	2
18.	Fog nozzle with extension applicator with fog head (see IS 952)	1
19.	Hand controlled branch for 63 mm size hose coupling	1
20.	Branch pipe, universal (see IS 2871)	1
21.	Branch with revolving head (see IS 906)	1
22.	Branch pipe (see IS 903)	4

<i>Sl No.</i>	<i>Item</i>	<i>Quantity</i>
23.	Nozzle of sizes 12 mm, 16 mm, 20 mm, and 32 mm (two each) (see IS 903)	10
24.	Adaptor for 100 mm to 150 mm suction female screw coupling and 63 mm male instantaneous	2
25.	Adaptor double female instantaneous pattern 63 mm	2
26.	Adaptor double male instantaneous pattern 63 mm	2
27.	Nozzle spanners (see IS 903)	2
28.	Rechargeable torch intrinsically safe LED type of minimum 5000 Lumens and weight not more than 2 kg.	2
29.	Rechargeable flashlights clip on type minimum 1000 Lumens and weight not more than 250 grams.	6
30.	Self-contained positive pressure breathing apparatus with carbon composite cylinder (compressed air type) complete with spare cylinder of minimum 45 min duration [see IS 10245 (Part 2)]	5 set
31.	Portable fire extinguisher, dry powder type, 10kg (see IS 15683)	1
32.	Foam making branch FB-5X with pick up tube (see IS 2097)	1
33.	Lowering line 50 mm hemp or terylene, 40 m long having two ends spliced in and one end with a running noose (see IS 1084)	1
34.	Long line – 50 mm manila, 30 m long (see IS 1084)	1
35.	Short line – 50 mm manila, 15 m long (see IS 1084)	1
36.	First aid box for 10 persons	1
37.	Rubber gloves (in case) (see IS 4770)	2 pair
38.	Asbestos gauntlets (in case)	1 pair
39.	Axe, large (see IS 703)	1
40.	Spade	1
41.	Pick axe (see IS 273)	1
42.	Crow bar of 1650mm length and diameter of 25 mm (see IS 704)	2
43.	Sledge hammer, 6.5 kg (see IS 841)	1
44.	Carpenter's saw, 60cm (see IS 5098)	1
45.	Spanner, adjustable, 30cm long handle (see IS 6149)	1
46.	Door breaker	1
47.	Hydraulic jack with handle - 20 tonne	1
48.	Fire hook (see IS 927)	1
49.	Tool kit consist of fixed spanner set (6 mm to 32 mm), ring spanner set (6 mm to 32 mm), insulated plyer, screwdriver 10", ball pein hammer	1 set

<i>Sl No.</i>	<i>Item</i>	<i>Quantity</i>
50.	Grease gun	2
51.	Oil feeder	1
52.	Can oil — 2 litres	1
53.	Funnel for oil or fuel filling	1
54.	Petrol chain Saw machine with 600 mm guide bar length	1
55.	Hose ramp (rubber) as per BIS 30-tonne capacity	4
56.	Hand operated combi tool	1
57.	Hook Ladder as per BIS	1

The purchaser can add any other items of equipment that may be required by the department.

ANNEX C
(Clause 5.5.11.4)

SUCTION LINE FOR TESTS

C-1 APPARATUS

C-1.1 Construct a suction line (see Fig. 1) consisting of hard rubber / PVC suction hose pipe of nominal diameter as specified, adjusted to fit the pump. Connect the suction line using a standard suction spanner.

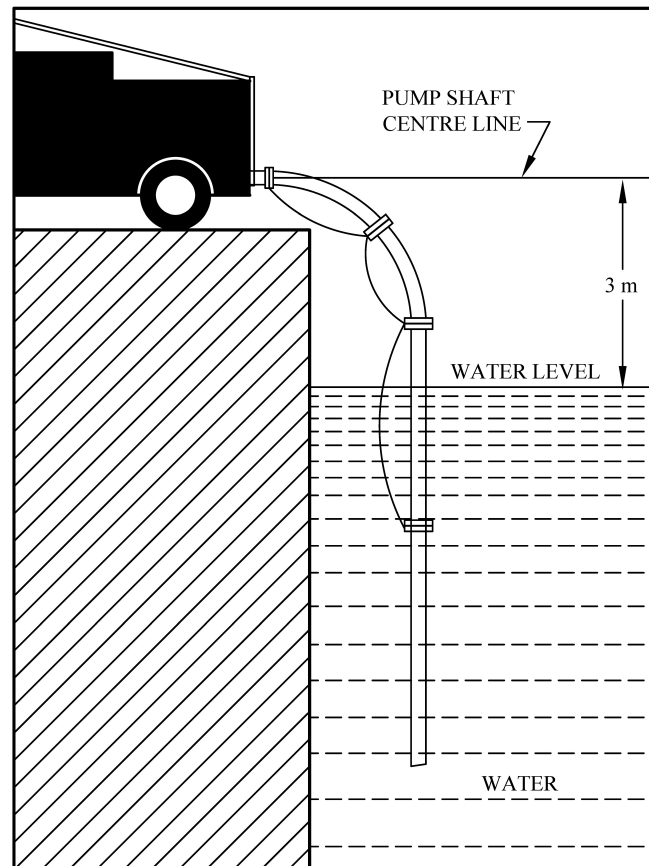


FIG. 1 SUCTION LINE

C-1.2 The internal diameter of the pipe shall be selected in accordance with the nominal delivery rate Q_n as specified in Table 1.

Table 1 Pipe dimensions
(Clause A-1.2)

SI No.	Nominal Delivery Rate, Q_n l/min	Internal Diameter, D mm
(1)	(2)	(3)
i)	2000	100
ii)	3000	140
iii)	4000	140
iv)	6000	150

C-2 The suction lift (vertical distance between centre line of the pump shaft and water level of 3 m) shall be kept taking all performance trials of pump.

C-3 PERMISSIBLE DEVIATIONS OF MEASUREMENTS

C-3.1 The permissible deviation of test measurements shall be within the following limits:

<i>Parameter</i>	<i>Required Value for Test</i>	<i>Deviation Allowed</i>
Geodetic suction height	3 m	± 5 cm
Local air pressure	760 mmHg (1 atm)	± 3 mbar
Water temperature	27 °C	± 1 °C

C-3.2 Values shown in the above Table can only be attended at sea level. So as altitude increases, correction (deduction) shall be done in these values as said below:

a) Allowances for output:

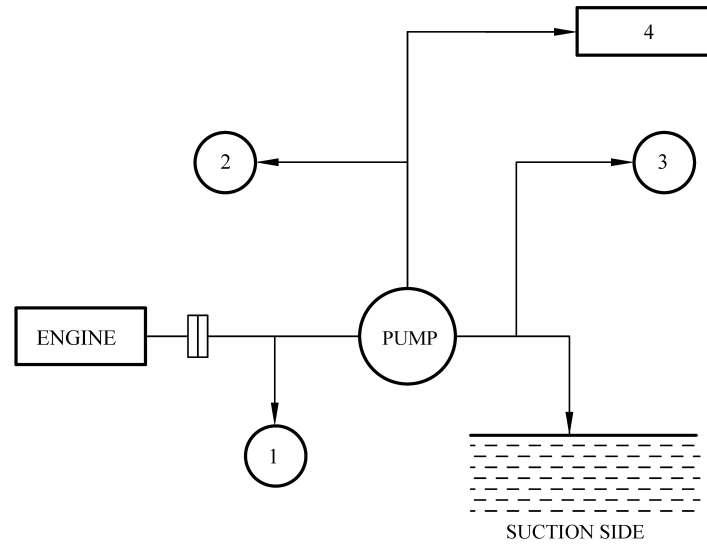
- 1) One percent for every 2.5 °C rise in water temperature.
- 2) Four percent for every 300 m above mean sea level.
- 3) No allowances shall be made for humidity up to 75 percent. However, an allowance at the rate of 1 percent for every 3 percent change in humidity shall be made when humidity ranges from 75 to 90 percent.

b) Allowances for lift:

- 1) 300 mm for every 300 m above mean sea level, and
- 2) One percent for 2.5 °C rises in water temperature.

ANNEX D
(Clause 5.5.11.4)**PRESSURE MEASUREMENTS**

D-1 Fit measuring instruments to measure pump RPM, pressure on delivery side, pressure in suction side and flow, in accordance with Fig. 2



- 1 Tachometer
- 2 Pressure gauge to measure discharge pressure.
- 3 Pressure gauge to measure suction pressure.
- 4 Flow measurement unit to measure flow.

FIG. 2 PRESSURE MEASUREMENTS

D-2 The pressure measurement points shall be the connection points for the pressure gauges on the pump as specified by the manufacturer. Pressure gauges shall be calibrated, and manufacturer shall carry a valid calibration certificate of the same.

ANNEX E
(*Clause 5.5.11.4*)

MEASUREMENT OF DELIVERY RATES

E-1 Measure the delivery rate with a flow meter or V-Notch (see IS 9108 for V-Notch) at measurement point shown in Fig. 2.

E-2 For measurement, the pump manufacturer shall equip the pump with connection couplings and design of which shall be mutually agreed.

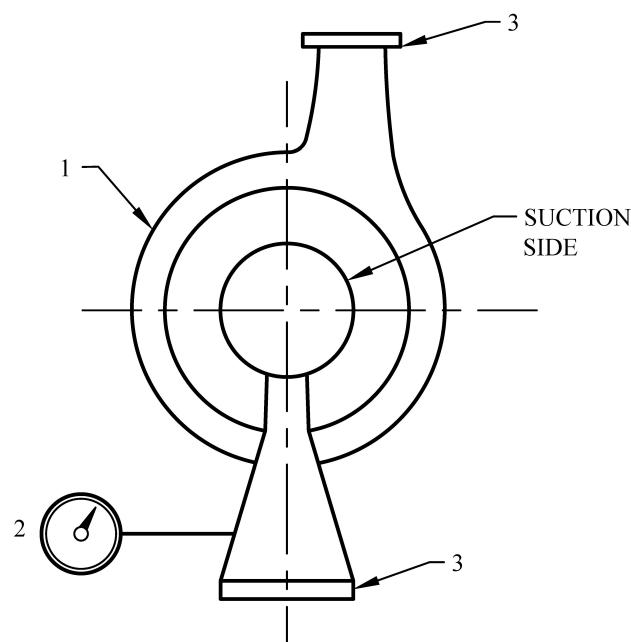
E-3 Measurement instrument must have been calibrated and manufacturer shall carry a valid calibration certificate of the same.

ANNEX F
(Clause 5.5.11.4)**DRY SUCTION TEST**

F-1 Carry out the test using the following apparatus:

- a) Prime Mover (driving motor/engine);
- b) Pressure gauge;
- c) Blank cap/shut off device;
- d) Timing device with seconds display; and
- e) Set up the apparatus for the test as shown in Fig. 3.

NOTE: The primer and driving motor/engine are not shown in Fig.3.



- 1 Pump
- 2 Pressure gauges to measure suction side pressure
- 3 Shut off device/blank cap

FIG. 3 DRY SUCTION TEST

F-2 PROCEDURE FOR DRY SUCTION TEST

F-2.1 Close all pump inlets and outlets. Prime (evacuate) the pump for 30 s in accordance with the manufacturer's instructions. Measure and record the pressure attained in the inlet section after priming is completed, the primer shall be capable of generating a maximum vacuum of not less than -0.8 kg/cm^2 (600 mm of Hg) in the inlet section within thirty seconds. Stop the pump and check for next sixty seconds for fluctuations in vacuum gauge/compound gauge. The deviation of the attained pressure shall not exceed 0.1 kg/cm^2 (75.0 mm of Hg) within a period of sixty seconds.

F-2.2 The primer and the pump mechanical seal shall be able to withstand a run of four minutes at 2400 RPM with the pump running without water.

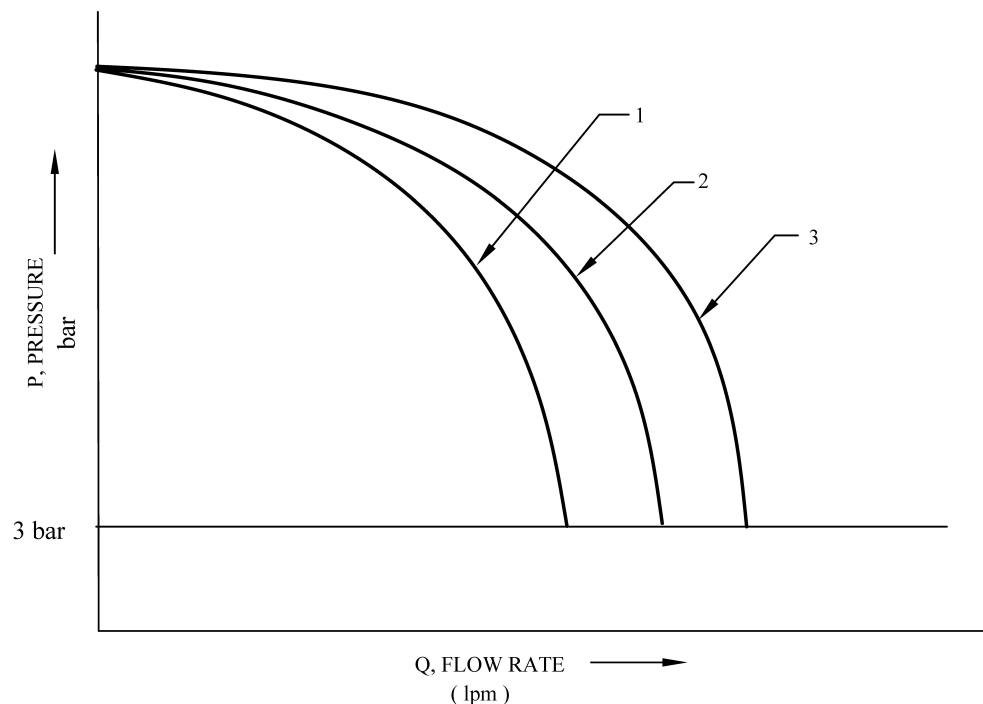
ANNEX G
(Clause 5.5.11.4)

PERFORMANCE TEST

G-1 Carry out a performance test using the following apparatus:

- a) Prime Mover (driving motor/engine),
- b) Pressure gauge;
- c) Flow meter;
- d) Tachometer;
- e) Throttle
- f) Suction line conforming to Annex C.

Set up the test apparatus as shown in Fig. 2. The number and location of the measuring points shall allow the determination of a characteristic curve as shown in Fig. 4.



KEY

- P Delivery pressure
Q Delivery rate
- 1 Characteristic curve for nominal geostatic suction height of 4.5 m
 - 2 Characteristic curve for nominal geostatic suction height of 3.0 m
 - 3 Characteristic curve for nominal geostatic suction height of 1.5 m

FIG. 4 PUMP CHARACTERISTIC CURVES AT DIFFERENT SUCTION HEIGHTS

Measure the range P-Q beginning with the closing pressure.

G-2 Check the guarantee points specified below and record together with the corresponding pressures in the inlet section.

G-2.1 Guarantee Points

- a) At a geodetic nominal suction height of 3 m, the nominal delivery pressure and nominal delivery rate shall conform to following Table:

<i>Nominal Delivery Pressure</i> bar	<i>Nominal Delivery Rate</i> l/min	<i>Limit Pressure</i> bar	<i>Closing Pressure</i> bar
7	2000	14	10 to 17
7	3000	14	10 to 17
7	4000	14	10 to 17
7	6000	14	10 to 17

The measured speed shall not deviate from the nominal speed by more than ± 5 percent.

- b) At a geodetic suction height of 7 m, and nominal delivery pressure, the delivery rate shall be at least 0.5 times nominal delivery rate.
- c) At a geodetic suction height of 3 m, a delivery pressure of 1.2 times nominal delivery pressure and speed under the maximum speed the delivery rate shall be at least 0.5 times nominal delivery rate.

G-3 The pump shall be deemed to pass the performance test if the measured values of delivery pressure and delivery rate conform to the values specified in above Table. The guarantee points described in above Table shall be included in Fig. 4.

ANNEX H
(Clause 5.5.11.4)

ENDURANCE TEST

H-1 Carry out an endurance test with the following apparatus:

- a) Prime mover (driving motor/Engine),
- b) Pressure gauges;
- c) Tachometer;
- d) Flow meter;
- e) Throttle
- f) Suction line as described in Annex C;
- g) Working hour meter;
- h) Thermometer; and
- j) Set up the apparatus as shown in Fig. 2.

H-2 Carry out the endurance test at 3 m suction height.

H-3 The test duration shall be as follows:

- a) *For high-low pressure pumps (multi-pressure pumps)* — Run low pressure pump for three hours without any interruption and high-pressure pump for one hour without any interruption. The test parameters at an interval of 30 min shall be recorded as per the following Table:

Time	Flow	Pressure	Ambient Temperature	Pump rpm	Engine rpm	Engine Cooling Water Temperature	Engine Oil Pressure

ANNEX J
(Clause 5.5.11.4)

PRESSURE TESTS

J-1 Carry out a static pressure test using the following apparatus:

- a) Prime mover (driving motor/engine);
- b) Pressure pump;
- c) Pressure gauges;
- d) Tachometer;
- e) Timing device (display in seconds); and
- f) Shut off device.

Set up the apparatus as shown in Fig. 2 and Fig. 3.

J-2 Static Pressure Test

J-2.1 Fill the pump with water. Fully vent the pump, close the shut off device, and increase the pressure to the static test pressure up to 21 kg/cm².

J-2.2 Keep the static test pressure 21 kg/cm² constant for next 10 min without operating pump.

J-3 Check for leakage or damage during the test.

ANNEX K

(Clause 5.5.11.4)

PRIMER TEST

K-1 Carry out a primer test using the following apparatus:

- a) Prime mover (driving motor/engine),
- b) Pressure gauges;
- c) Tachometer;
- d) Timing device (display in seconds);
- e) Suction line as described in Annex C.
- f) Set up the apparatus as shown in Fig. 1 and Fig. 2.

K-2 Carry out a 4 min run with the primer at suction speed (suggested 2000 rpm to 2500 rpm) and the pump running with its inlet section open.

K-3 Determine the priming time three times in succession at suction height 7 m and record the average. Do not perform any manual readjustment or refilling operations on the primer during the measurements. Priming time shall be as specified in **K-6.1**.

NOTE — For priming time see also Annex F.

K-4 For automatic primers (for example, pressure-responsive primers), measure the cut-off and reengagement pressure in the outlet section (Pa). Cut of primer pressure shall not exceed by 2.5 kg/cm².

K-5 SUCTION INLET AND DELIVERY VALVES

K-5.1 The Pump shall have suction inlet(s) having 100 mm to 150 mm standard suction connection (see IS 902) with internal strainer(s) and blank cap(s). The strainer(s) shall be retained firmly when in use but shall be easily removable. The mesh size of the pump inlet screen shall be smaller than the outlet size of the impeller.

K-5.2 The pump shall be provided with two delivery valves for the 2000 lpm pump and 4 delivery valves for 3000/4000 lpm pump having 63 mm standard hose couplings (see IS 903) with screwed wheel type quick closing clack valve (see IS 4928). Blank caps fastened with chains and incorporating means to relieve pressure between the valve and the cap shall be provided one for each delivery valve. In the case of midship mounted pump, two/four delivery valves shall be provided at each panel.

K-5.3 High-pressure Filter

In case of regenerative impeller, the water going to high-pressure impeller suction shall be filtered before entering into the high-pressure impeller. A filter capable of filtering particle size up to 0.75 mm or less shall be used. This filter shall be of stainless steel and shall be easily accessible for cleaning.

K-6 PRIMER

K-6.1 The primer shall be capable of lifting water at least 7 m (measured from water level to the centre of pump) in not more than 24 seconds when connected with 100 mm suction hose and 36 seconds when connected with 140 mm suction hose and shall be preferably fully automatic. The allowance shall be 300 mm for every 300 m

elevation above mean sea level and 1 percent for 2.5 °C rise in water temperature.

K-6.2 In the case of water ring type primer, means shall be provided to automatically disengage the primer when the pump is primed. Where required header tank complete with isolating valve enabling antifreeze solution to be used in the circuit. If the primer is of the reciprocating type, means shall be provided to automatically limit the speed of engine while the primer is engaged.

K-6.3 The primer shall be constructed of Gun Metal / light alloy casting, shall have stainless steel shaft, and shall be fitted with suitable lubricated bearing depending upon the type of primer.

K-6.4 In the case of reciprocating type primer, the selection of materials shall be made with a view that no major part is required to be replaced in course of service and the material used for these parts shall be phosphor bronze and stainless steel depending upon their respective strength and use. The caps of primer and springs shall be properly secured. The primer lever if provided shall be easily accessible from the operator(s) position.

K-6.5 In the case of reciprocating type, the primer shall be preferably designed with a view to prime when the pump is running at speed of 1000 to 2500 rpm.

K-6.6 In the case of Exhaust type, the primer shall be preferably designed with a view to prime when the pump is running at speed of 1 000 to 1 500 rpm.

K-7 GENERAL INSTRUCTIONS

K-7.1 The following description of the pump shall be included in the instruction handbook:

- a) A general description.
- b) The range of usable ambient temperature.
- c) The design & function of the pump, including important data (for example, number of stages, shaft seal, primer materials, drainage, lubrication points)
- d) The range of usable fluid temperatures.
- e) The maximum operating pressure.
- f) Information of operating controls.
- g) Design, function & use of safety protection devices.
- h) Shut off valves & pump connections.
- j) Additional descriptions for accessories.
- k) Additional Descriptions for accessories.
- m) Cross-sectional drawing of the pump or exploded diagram.

K-7.2 The maximum angle of inclination of operation.

- a) *Installation/Assembling*

The following instructions for installation / assembling shall be included in the

installation handbook:

- 1) Instructions for installer/ fabricator to make a complete risk assessment for the final fire tender.
- 2) Initial installation instructions.
- 3) Data on installation site including
 - i) Space requirements for operation & maintenance.
 - ii) Inspection instruction before start of installation.
 - iii) Details of base / foundation.
 - iv) Installation of pump assembly
 - v) Correct installation of safety devices & control system.
 - vi) Correct installation of pressure relief valve, thermal relief valve or other devices in accordance with pressure containing parts & components of the pump if not supplied the pump manufacturer.
 - vii) Adjustable safety devices shall be contained in enclosures that can only be opened by use of tools.

b) *Maintenance and servicing*

The following instruction for maintenance and servicing of the pump shall be included in the instruction handbook.

- 1) Maintenance intervals and scope.
- 2) Maintenance procedures and inspections, including
 - i) Consumable items list of spare parts & special tools.
 - ii) Monitoring during operations
 - iii) Dry preventive action to be taken, (for example, regarding parts subject to wear lubrication, sealing medium.)
 - iv) Warning on risks arising from incorrect adjustment of safety devices.
 - v) Warning on risks arising from removing the pump inlet screen.
 - vi) Tightening of fasteners.

K-8 MARKING

Pumps shall be fitted with a metallic identification plate, or shall be permanently marked on the pump body with the following information:

- a) The name or trademark of the manufactured authorized representative.
- b) Serial number of the pump body and year of construction.
- c) Nominal speed in revolutions per minute.
- d) The transmission ratio of the pump gear.
- e) Working pressure in kg/cm².
- f) The direction of rotation of the pump shall be indicated by an arrow and this shall be permanently marked on the pump body.
- g) Lubrication points, drainage devices, etc. shall be colour coded.

ANNEX L (Foreword)

SUMMARY OF FORMULAE AND OTHER DATA

L-1 APPROXIMATE FIRE GROUND CALCULATION

Loss of pressure due to height = 0.1 bar for each meter rise

Capacity of pond or lake (m³) = [surface area (m²) x average depth (m)]

Capacity of circular tank (litres) = 800 × Diameter of tank (m) × Depth (m)

L-2 HYDRAULIC FORMULAE

$$\text{Capacity of Hose (litre/m)} = \frac{8}{10000} \times \text{nozzle diameter in mm (approx.)}$$

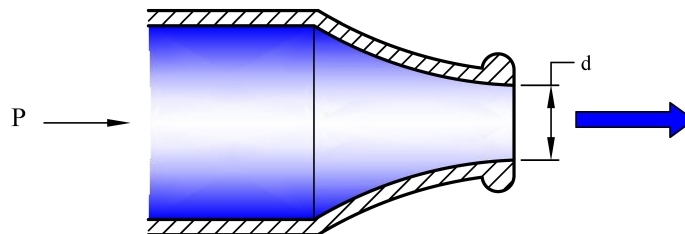
$$\text{Head, H (metre)} = \text{Pressure in bar} \times 10 \text{ (approx.)}$$

$$\text{Water Power (WP), watt} = \frac{100 \times \text{Discharge (lpm)} \times \text{Pressure (bar)}}{60}$$

$$\text{Brake Power (BP), watt} = \frac{\text{WP}}{E} \times 100$$

$$\text{Percentage Efficiency (E)} = \frac{\text{WP}}{\text{BP}} \times 100$$

$$\text{Nozzle Discharge (L)} = \frac{2 d^2 \sqrt{P}}{3}$$



$$\text{Horse Power (H.P.)} = \frac{\text{Discharge (lps)} \times \text{Head (metre)}}{75 \eta}$$

L-3 HYDRAULIC DATA:

1 litre of water has a mass of = 1 kg

1 litre of water exerts a downward force = of approx. 10 Newton

1 cubic meter of water exerts a downward force (N) = of approx. 10 kN

1 meter head of water equals = approx. 0.1 bar

1 bar pressure of water equals = approx. 10 m head

L-4 CONSTANTS

g (acceleration due to gravity) = 9.81 m/s²

Normal atmospheric pressure at 20 °C = 1.013 bar

Normal atmospheric pressure at 20 °C = 10.3 metre head of water

π (Pi) = 3.1416

$\pi/4 = 0.7854$

Circumference of a circle = πd

L-5 AREAS

Circle = $[\pi/d^2]/4$

L-6 VOLUMES

Circular tank (cylinder) = $\frac{\pi \cdot \text{depth} \cdot d^2}{4}$

L-7 CAPACITY MEASURED IN LITRES

Capacity of a container in litres = Volume (in cubic metres) \times 1000

ANNEX M
(Foreword)**METRICATION****M-1 LIST OF SI UNITS FOR USE IN THE FIRE SERVICE**

Quantity and basic or derived SI unit and symbol	Approved unit of measurement	Conversion factor
Length meter (m)	kilometre (km) meter (m) millimetre (mm)	1 mile = 1.609km 1 yard = 0.914m 1 foot = 0.305m 1 inch = 25.4 mm
Area square meter (m ²)	square kilometre (km ²) square meter (m ²) square millimetre (mm ²)	1 mile ² = 2.590 km ² 1 yard ² = 0.836 m ² 1 foot ² = 0.093m ² 1 inch ² = 645.2 mm ²
Volume cubic meter (m ³)	cubic meter (m ³) litre (l)	1 cubic foot = 0.028 m ³ 1 gallon = 4.546 litres 1 m ³ = 1000 litre
Flow cubic meter per second (m ³ /s)	cubic meter per second (m ³ /s) litres per minute (l/min)	1 foot ³ /s = 0.028 m ³ /s 1 gallon/min = 4.546 lpm 1 m ³ /min = 1000 lpm
Mass kilogram (kg)	kilogram (kg) ton (t) Pounds (lb)	1 lb = 0.454 kg 1 tonne = 1000 kg
Power watt (W) (= 1 J/s = 1 Nm/s)	kilowatt (kW) watt (W)	1 horsepower = 0.746 kW 1 foot lb force/second = 1.356W
Pressure newton/metre ² (N/m ²)	bar millibar (m bar) Meter head	1 atmosphere = 1.013 bar 1 inch Hg = 33.86 m bar 1 meter head = 0.0981 bar 1 foot head = 0.305 metre head
