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 22:3/टी-24 **07 अगस्त 2024**

तकनीकी समिति : अग्नि शमन विषय समिति, सीईडी 22

प्राप्तकर्ता :

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

महोदय/महोदया,

निम्नलिखित मानक का मसौदा संलग्न हैं:

प्रलेख संख्या	शीर्षक
सीईडी 22(25719)WC	अग्निशमन दल के लिए झाग टेंडर — कार्यात्मक अपेक्षाएं (*आई एस 10460 का पहला पुनरीक्षण*) 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 कठिनाइयां आ सकती हैं।

सम्मतियाँ भेजने की अंतिम तिथि: 06 सितंबर 2024

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यह प्रालेख भारतीय मानक ब्यूरो की वेबसाइट **www.bis.gov.in** पर भी उपलब्ध हैं।

धन्यवाद।

भवदीय
ह/-
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संलग्न: उपरलिखित

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WIDE CIRCULATION DRAFT

Our Reference: CED 22:03/T-24 **07 August 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(25719)WC	Draft Indian Standard Foam Tender for Fire Brigade Use — Functional Requirements (*First Revision of IS 10460*) *[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: 06 September 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 Chairman, Sectional Committee or referred to the Sectional Committee for further necessary action if so desired by the Chairman, Sectional Committee.

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

Thanking you,

Yours faithfully,

Sd/-

Dwaipayan Bhadra
Scientist 'E' & Head
Civil Engineering Department
Email: ced22@bis.gov.in
Phone: +91-11 2323 5529

Encl: As above

FORMAT FOR SENDING COMMENTS ON THE DOCUMENT

[Please use A4 size sheet of paper only and type within fields indicated. Comments on each clause/sub-clause/ table/figure, etc, be stated on a fresh row. Information/comments should include reasons for comments, technical references and suggestions for modified wordings of the clause. **Comments through e-mail to ced22@bis.gov.in shall be appreciated**.]

Doc. No.: CED 22(25719)WC **BIS Letter Ref**: CED 22:03/T-24

Title: Draf Indian Standard Foam Tender for Fire Brigade Use — Functional Requirements *(First Revision of IS 10460)*, [ICS: 13.220.10]

Last date of comments: **06 September 2024**

Name of the Commentator/ Organization: _____

Sl No.	Clause/ Para/ Table/ Figure No. commented	Type of Comment (General/ Technical/ Editorial)	Comments/ Modified Wordings	Justification of Proposed Change
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NOTE- Kindly insert more rows as necessary for each clause/table, etc

BUREAU OF INDIAN STANDARDS

DRAFT STANDARD FOR COMMENTS ONLY

(Not to be reproduced without the permission of BIS or used as an Indian Standard)

Draft Indian Standard

FOAM TENDER FOR FIRE BRIGADE USE — FUNCTIONAL REQUIREMENTS

(*First Revision of IS 10460*)

(ICS: 13.220.10)

Fire Fighting	**Last Date for Comments:**
Sectional Committee, CED 22	**06 September 2024**

FOREWORD

(*Formal clauses shall be added later*)

A number of Indian Standards on fire fighting appliances of different capacities using various media for use in towns and rural areas are available. There are also standards covering large capacity fire fighting appliances for aircraft-crash fire fighting, built on special chassis which are being imported as the type of chassis required is not available in this country. This standard is intended to cover the use of indigenously produced chassis.

The appliance conforming to this standard is intended primarily for use in petrochemical complexes, oil refineries or storages and heavy industries where large quantities of oils or petroleum products are being used as fuel for lubrication purposes.

The provision of monitor on the top of appliance has been made to make the appliance more versatile and reliable in attacking fires safely from a distance. Hand lines have their own advantages in industrial complexes to deal with spillage and running fires and also at places which cannot be attacked by the monitor.

Though the appliance is basically for fighting fires with foam yet keeping in view the effectiveness of dry powder on fires involving electrical and other connected equipment used in handling and processing flammable oils, the provision of dry powder system has been made in the standard as supplementary fire extinguishing medium.

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 C for information and guidance. The appliance shall also conform to statutory rules in regard to height clearance framed by Transport Authority.

In this first revision, the following major changes have been incorporated:

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

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, 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 specified value in this standard.

BUREAU OF INDIAN STANDARDS

DRAFT STANDARD FOR COMMENTS ONLY

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Draft Indian Standards

FOAM TENDER FOR FIRE BRIGADE USE — FUNCTIONAL REQUIREMENTS

(*First Revision of IS 10460*)

1 SCOPE

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

2 REFERENCES

The standards listed in 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 these standards.

3 GENERAL REQUIREMENTS

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

a) 1800 litre/min at 7 kg/cm^2 and 300 litre/min at 35 kg/cm^2 capacity; or
b) 2000 litre/min at 7 kg/cm^2 and 300 litre/min at 35 kg/cm^2 capacity; or
c) 3000 litre/min at 7 kg/cm^2 and 300 litre/min at 35 kg/cm^2 capacity; or
d) 4000 litre/min at 7 kg/cm^2 and 300 litre/min at 35 kg/cm^2 capacity; or
e) 6000 litre/min at 7 kg/cm^2 and 300 litre/min at 35 kg/cm^2 capacity.

3.2 The appliance shall carry a water tank of between 2000 litres to 16000 litres capacity (depending upon the type of chassis and material of construction of the superstructure / tank etc) and a foam tank of between 500 litres to 8000 litres capacity and connected equipment for foam production depending upon the type of chassis and material of construction of the superstructure / tank etc) and also supplementary extinguishing agent (*see* Annex B).

3.3 The foam tender shall be fabricated in a manner so as to conform to the following characteristics:

a) Gross vehicle weight shall be as per clause 93 of CMVR 1989.
b) Acceleration from 0 to 65 km/h in 40 s - standing start through gears (fully laden).
c) The appliance shall be capable of being started from rest on a gradient of 1 in 4.

d) 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.

e) The chassis shall meet prevailing emission norms and shall comply with the provisions of motor vehicle act 1988 and central motor vehicle rules 1989.

f) Power to weight ratio – The power to weight ratio of the vehicle shall not be less than 10 HP per tonne.

j) All chassis above 12 tonne GVW shall be fitted with automatic transmission.

3.4 The appliance shall be capable of delivering not less than 1 800 l/min of water foam solution converted into foam through a combination of monitor and side lines and not less than 900 l/min of water foam solution converted into foam through the side lines alone when the monitor is not in use or not less than 900 l/min of water converted into foam through the monitor alone.

3.4.1 The monitor and the hand lines should employ the self-aspirating type of foam production system where aeration is done at the branch pipe. The expansion ratio of the foam produced shall not be less than eight times with the use of the foam compound as prescribed in IS 4989to give the performance indicated in **3.4**.

3.4.2 The foam induction may be automatic or manual, if one branch is in operation, all further addition and removal of branches shall automatically adjust the rate of foam compound induction within variation of 0.5 percent, the induction ratio not exceeding 6 percent.

3.5 The supplementary agent used for fire fighting shall be dry chemical powder (*see* Annex B).

3.6 The unit shall be designed to be as compact as possible, compatible with ease of accessibility to all service parts. The pump and foam making equipment controls shall be so arranged that one man can operate foam or water lines from the pump control panel.

3.7 Lever type valve controls shall be preferred throughout unless these are impracticable in any case.

4 MATERIAL SELECTION AND TREATMENT

4.1 The choice of materials to be used for the construction of the appliance shall be made with a view to combine lightness with strength and durability.

4.2 Timber shall not be used in body construction.

4.3 The appliance is intended for use in tropical conditions with constant high humidity and heat. This shall be given full consideration while selecting the materials and, for this reason, use of rubber or other similar materials shall be avoided as far as possible.

When it is unavoidable, the parts made out of these materials shall be easily replaceable and shall be easily available.

4.4 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 cooling system to permit its continuous stationary running without overheating. Indirect cooling system shall be incorporated, 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 trickle type battery charger shall be provided for recharging the battery *in situ*. 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 a 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 litres 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 and the tank bottom plate shall be minimum 4 mm 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 and the tank bottom plate shall be minimum 5 mm mild steel sheets as per IS 2062. The tank made of mild steel shall be treated suitably for anti-corrosion.

5.3.3 For the mild steel plates used for the tank, the same 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.

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

5.3.5 A full length runner from behind the driver cabin till end of chassis frame shall be provided and made out of ISMC 100 mm × 50 mm × 5 mm for the water tank up to 7000 litres capacity and ISMC 150 mm × 75mm × 5mm for the water tank above 7000 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

5.3.6 The tank shall be suitably baffled with minimum 2 numbers of baffles fitted longitudinally and 2 numbers of baffles fitted transversely for tank up to 7000 litres capacity and minimum 2 numbers of baffles fitted longitudinally, and 3 numbers of baffles fitted transversely for tank more than 7000 litres capacity to prevent surge when the vehicle is breaking, cornering or accelerating for.

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

5.3.8 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.

5.3.9 Water tank up to 7000 litres capacity shall be fixed on the runner with heavy duty single metacone mountings and water tank of more than 7 000 litres capacity shall be fixed on the runner with heavy duty dual metacone mountings.

5.3.10 Suitable eyes shall be provided on the shell of the tank to enable the tank to be lifted off the vehicle for repairs or replacement as necessary.

5.3.11 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 threaded ring and cap of 300 mm diameter for filling the water tank from the top. The filler cap shall be clearly marked ‘water’ preferably cast in metal. The manhole cover shall be made from 5 mm thick plate. Drain plugs or drain cocks shall be provided, wherever necessary.

5.3.12 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.

5.3.13 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.

5.3.14 LED/digital type level indicator shall be installed at pump control panel. Level Indicator shall be provided with ¼ , ½, ¾, and full level indication or with indicators of the percentage of water.

5.3.15 The tank shall be connected to the pump and hose reel in such a manner that pressurization of water tank or water tank-pump connection is not possible when pumping water from an outside source of supply.

5.3.16 The plumbing between the pump and the hose reel shall have a clear and unobstructed water way of not less than 25 mm throughout without any obstruction.

5.4 Hose Reels

5.4.1 Two high pressure hose reels capable of discharging water and foam 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 40 kg/cm^2. The high-pressure hose reels shall hold not less than 50 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. Suitable attachment having aeration facility for foam expansion shall be provided for discharging foam when required. 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 litre/min 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 20 kg/cm^2 to 40 kg/cm^2 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.

5.5 High- and Low-Pressure Fire Pump

5.5.1 A centrifugal high- and low-pressure pump shall be mounted at rear of the appliance. The low- 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 so as 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 pump casing and impeller shall be subjected to a hydraulic pressure of 21 kg/cm^2 to detect leakage, performance, etc.

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 capable of transmitting full torque of the engine used for the appliance or a side mounted power take-off (PTO) of suitable torque and ratio.

5.5.5 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.

5.5.6 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.

5.5.7 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.

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

5.5.9 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) 1800 litre/min at 7 kg/cm^2 and 300 litre/min at 35 kg/cm^2 capacity; or
b) 2000 litre/min at 7 kg/cm^2 and 300 litre/min at 35 kg/cm^2 capacity; or
c) 3000 litre/min at 7 kg/cm^2 and 300 litre/min at 35 kg/cm^2 capacity; or
d) 4000 litre/min at 7 kg/cm^2 and 300 litre/min at 35 kg/cm^2 capacity or
e) 6000 litre/min at 7 kg/cm^2 and 300 litre/min at 35 kg/cm^2 capacity

5.5.10 *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 X04Cr19Ni9 of IS 6603).

5.5.11 *High 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 X04Cr19Ni9 of IS 6603).

5.5.12 *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 X04Cr19Ni9 of IS 6603) or polymer-based material.

5.5.13 *Pump Shaft* — Stainless steel (grade X04Cr19Ni9 of IS 6603).

5.5.14 *Pump Bearing Housing* — Grey cast iron (grade FG 260 of IS 210).

5.5.15 *Pump Panel* — Aluminium sheets (IS 737) or stainless-steel sheet (IS 6911) or fibre reinforced polymer (FRP) / glass reinforced polymer (GRP).

5.5.16 *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.

5.5.17 The pump shall give performance as given in Table 1, when working with strainers (except basket strainer) at 27 ± 5°C.

Table 1 Pump Performance Data
(*Clause* 5.5.17)

Sl No.	**Output** lpm	**Pressure** kg/cm^2	**Lift** m	**Remarks**
(1)	(2)	(3)	(4)	(5)
i)	2000 / 3000 / 4000 / 6000	7	3	When working through two 2.45 m Lengths of specified suction hose
ii)	1600 / 2400 / 3200 / 4800	8.8	3	When working through two 2.45 m lengths of specified suction hose
iii)	720 / 950 / 1400 / 2100	7	7	When working through 9.8 m, that is four 2.45 m lengths of specified suction hose
iv)	300	35	3	When working through two 2.45 m lengths of specified suction hose

5.5.18 *Pump Test*

5.5.18.1 The pump shall run for a period of three hours non-stop delivering the rated output at 7 kg/cm^2 and for one hour at 35 kg/cm^2 with a lift of 3 m at NTP.

5.5.18.2 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.

5.5.18.3 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 21 kg/cm^2 for 10 minutes to detect leakage, perforation, etc.

5.5.18.4 Various pump testing procedures and test methods are given in Annex D to Annex L.

5.5.18.5 *Thermal relief valve (TRV) test*

The TRV shall be tested as follows- After priming the pump from open well let the pressure within the pump build up to 7 kg/cm^2, this shall be followed by engaging the pump in HP mode, now close all the delivery outlets (including the engine cooling valve) then throttle the engine so as to maintain a high pressure of 30 kg/cm^2 to 35 kg/cm^2 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 temp. shall not exceed the specified value (48 ºC or 80 ºC). Slowly open the delivery valve so as to allow fresh cold water to enter into the pump. The TRV must close automatically once the ambient temperature is reached by the pump.

5.5.18.6 *Pressure relief valve (PRV) test*

The PRV shall be tested as follows- After priming the pump from open well let the pressure within the pump build up to 7 kg/cm^2, this shall be followed by engaging the pump in HP 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 40 kg/cm^2 The PRV must close automatically once pressure is less than 40 kg/cm^2.

5.5.19 The pump shall be mounted at the rear of the appliance.

5.5.20 The suction inlet and delivery outlets of the pump shall, as far as possible, be fitted on or near the pump control panel(s).

5.5.21 A removable strainer and blank cap shall be provided for the suction inlet(s) for the pump.

5.5.22 The suction inlet shall be fitted with a standard round thread connection of 100 mm size conforming to IS 902.

5.5.23 The pump shall be provided with one delivery valve for every 1000 litre/min 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.

5.5.24 *Pipelines and Valves*

5.5.24.1 All pipelines shall be of stainless-steel grade SS 304 and all valves up to 50 mm size shall be 3 piece design grade 304 stainless steel ball valves. All valves above 50 mm shall be standard butterfly valves.

5.5.24.2 The piping shall be flanged for ease of maintenance. Flanges shall have ‘O’ ring sealing**.** However, flange joints shall be kept to minimum.

5.5.24.3 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 25 kg/cm^2.

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

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

5.6 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 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 2.5 °C rise in water temperature.

5.6.1 In the case of water ring or reciprocating primer or rotary primer, engagement and disengagement shall be automatic.

5.6.2 If the primer is of the reciprocating type, means shall be provided to automatically limit the speed of engine while the primer is engaged.

5.6.3 The primer shall be constructed of gun metal/ light alloy/stainless Steel.

5.7 Foam Equipment

5.7.1 A foam tank of between 500 litres to 8000 litres capacity and connected equipment for foam production depending upon the type of chassis and material of construction of the superstructure / tank etc). The choice of material for the foam tank shall be as follows:

a) Tank body and baffles shall be of minimum 3.15 mm.
b) The tank bottom plate shall be minimum 4 mm stainless steel (grade 316L/ X02Cr17Ni12Mo2 conforming to IS 6603)

5.7.1.1 The foam compound tank shall be of rigid type and shall be of stainless steel welded construction.

5.7.1.2 The tank shall have a filling orifice of not less than 150 mm diameter with a removable strainer fitted to it. The strainer shall be of such material as shall not be affected by constant contact with foam compound and its total screening area shall be adequate to permit quick filling of foam compound into the tank. The filler cap shall be clearly marked ‘FOAM’ preferably by pressing, casting, or embossing.

5.7.1.3 The tank shall be suitably baffled to prevent surge while the vehicle is in motion or standing on uneven ground or brakes are applied to the moving appliance. The design of the tank shall incorporate a removable sump fitted with a drain valve. The foam compound draw-off tube shall be positioned in the centre of the sump in such a manner that foreign matter or sludge shall not pass into the compound line. The draw-off tube shall be fitted with a gauge strainer of suitable material, mesh, size, and

adequate straining area. The tank top shall be removable, and it shall be ensured that the joint between the top and the body of the tank is leakproof.

5.7.1.4 Means shall be provided for automatic venting of the foams compound tank when the foam is being produced or the tank is being filled. This shall not be incorporated with the cap. The device employed shall be as simple as possible and shall not get clogged easily during normal use of the appliance.

5.7.1.5 The draw-off tube shall be connected to the foam compound proportionator/inductor and pump, as necessary, and automatic flow control valve shall be incorporated in it so as to maintain a constant induction rate of not more than 6 percent with varying foam output. The plumbing for this purpose shall have a clear and unobstructed passage of not less than 50 mm throughout and shall:

a) be as short as possible;
b) be capable of being easily dismantled for internal cleaning;
c) be provided with means of thorough flushing after use; and
d) not form ‘U’ bend or abrupt angle at any portion and be capable of being drained easily without dismantling.

5.7.1.6 A suitable electrically operated motorised transfer pump shall be provided for transferring foam compound from drums to the foam compound tank without causing any frothing in the tank. Necessary connection shall also be provided for transferring the foam compound through this pump.

5.7.1.7 Provision shall also be made for drawing foam compound into the foam producing system from an external source through a pick-up tube while producing foam.

5.7.2 Foam compound proportionator or inductor automatic proportionating arrangement shall be provided where the induction ratio of foam compound/water solution and flow of water are automatically varied as desired merely by opening and closing the monitor or hand lines. This shall be achieved without any complex system of linkage that may be susceptible to distortion due to chassis flexion. The system shall be reliable and shall not require frequent calibration checks.

5.7.3 *Water/Foam Monitor (see IS 8442)*

5.7.3.1 A water / foam monitor shall be mounted on the top of the appliance in such a manner that it can be manually operated by a member of the crew. The monitor shall be capable of traversing through 360º in a horizontal plane, elevating from horizontal to 45° and depressing from horizontal to not less than 15° and fully rotating in both directions.

5.7.3.2 The monitor capacity shall be as per Table 2.

5.7.3.3 The monitor shall be capable of projecting the foam discharge to an effective distance as per the Table 2.

Table 2 Monitor Performance
(*Clauses* 5.7.3.2 and 5.7.3.3)

Sl No.	Pump Capacity	Size	Operating Pressure range	Flow Range in lpm	Inlet Flange NB	Performance (at 7 kg/cm^2 pressure)	
						Flow lpm	Range m
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	For vehicles fitted with 2 000 lpm capacity fire pump	75 mm	Not less than 7 kg/cm^2	1 800	100	Not less than 1800	Not less than 45
ii)	For vehicles fitted with 3 000 lpm fire pump	75 mm	Not less than 7 kg/cm^2	2 500	100	Not less than 2500	Not less than 55
iii)	For vehicles fitted with 4 000 lpm fire pump	100 mm	Not less than 7 kg/cm^2	3 800	100	Not less than 3800	Not less than 65
iv)	For vehicles fitted with 6 000 lpm fire pump	150 mm	Not less than 7 kg/cm^2	5 500	150	Not less than 5500	Not less than 75

5.7.3.4 The monitor shall be capable of traversing through 360° in horizontal plane, + 75° and - 15° in vertical plane.

5.7.3.5 The detailed specification of the monitor is as below:

a) *Body* — Barrel of stainless steel, gun metal swivel joint for horizontal and vertical motion manual operation
b) *Rotation* — 360°
c) *Elevation* — 90º (+75° and -15°)

5.7.3.5.1 *swivel joint*

a) *Material* — Gun Metal
b) *Gear wheel* — LTB Grade 2 of IS 318
c) *Worm* — Stainless Steel/LTB Grade 2 of IS 318

5.7.3.5.2 *self-induction nozzle*

a) *Material of construction* — Aluminium alloy conforming to IS 617.
b) *Type of foam used* — As per customer requirements as the risk of hydrocarbon or alcohol — AFFF 3 percent or AR AFFF 3 percent respectively.
c) *Foam expansion* — *Min* 1:4
d) *Fog (curtain)* — 160°
e) *K factor* — 100

Semi fog for tank cooling, dissipation of vapour and gases at a distance of 10 m and above.

5.7.3.5.3 *flange*

a) *Material* — SS 304
b) *Specification* — DN150 (*see* IS 1538)
c) *Welding* — Radiography type
d) *Working pressure* — 7 kg/cm^2 to 10 kg/cm^2
e) *Painting* — As per IS 5 (2 coats of red enamel paint)

5.8 Control Panel

5.8.1 Adequately illuminated control panel shall be provided and positioned at the rear of the appliance.

5.8.2 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 shall 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) Foam level indicator
    11) 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 NRV

g) Control for water / foam monitor

h) Control for high pressure hose reel

5.9 Body Work and Stowage

5.9.1 Cabin 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.

5.9.2 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 out of rolled ISMC M.S. channel of 100 mm × 50 mm × 5 mm for chassis up to 12 ton and above GVW and for chassis less than 12 tonne GVW the size of the ISMC M.S. channel shall be of 70 mm × 40 mm × 5 mm

d) 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.

e) 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.

f) The complete superstructure of the cabin shall be made out of SS 304 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.

g) 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.

h) 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.

j) 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.

k) 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.

m) All the doors shall be fitted on the super structural members each hung upon the two/three numbers of coach type hinges and handles.

n) For all the above windows, 5 mm. thick laminated safety glasses shall be provided.

p) The wind screen shall be 5 mm thick laminated safety glass curved type single piece with EPDM rubber beading.

q) However, if the chassis is of the cabin type, suitable extension of the original cabin shall be done to accommodate the crew members as specified below. 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.

5.9.2 *Seats*

5.9.2.1 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-contained breathing apparatus (SCBA) sets. The seats shall have integrated seat belts. The safety belt (seat belt) shall comply to AIS 005.

5.9.2.2 The crew seat shall meet the requirements of automotive industry standards (AIS) standards. Suitable locker space shall be provided below the crew seat.

5.9.3 *Rear Body*

5.9.3.1 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 out of rolled ISMC M.S. channel of 100 mm × 50 mm × 5 mm for chassis up to 12 tonne and above GVW and for chassis less than 12 tonne GVW the size of the ISMC M.S. channel shall be of 70 mm × 40 mm × 5 mm.

5.9.3.2 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.

5.9.3.3 The complete superstructure shall be made out of SS 304 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.

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

5.9.3.5 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.

5.9.3.6 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.

5.9.3.7 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.

5.9.3.8 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.

5.9.4 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.

5.9.4.1 All aluminium profiles use shall be proper anodized with the thickness of each profile not more than 30 mm.

5.9.4.2 The opening roller shutters shall be done means of the bar type handle provide.

5.9.4.3 This shall be self-locking type so that while vehicle is moving, the shutters do not open accidently during movement of vehicle.

5.9.4.4 Roller shutter profile/panel links shall be interconnected with rubber/plastic/PVC sealing to make the roller shutter watertight when close.

5.9.4.5 The roller shutter winding rolls shall be between 45 mm to 60 mm in diameter.

5.9.4.6 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 all over led lights.

5.9.4.7 *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.

5.9.5 Hose Suitable storage space shall be provided to store min. four 2.5 m lengths of suction hoses of same size as that of the pump suction inlet at convenient location.

5.10 Telescopic Light Mast

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

5.10.2 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.

5.10.3 The telescopic mast shall be extremely strong and designed with not more than 3 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.

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

5.10.5 The mast must be equipped with internal spiralled electrical cable with 7 wires with a section each of 1.5 mm^2 and wires will be shielded.

5.10.6 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.

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

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

5.10.9 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.

5.10.10 The telescopic mast shall be mounted behind the driver’s cabin and shall be internally mounted with suitable brackets.

5.10.11 The light mast will have four 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.

5.10.12 The mast shall be manually turnable and lockable by means of a hand wheel fitted on the mast allowing 360° movement.

5.10.13 The total weight of the complete mast system not more than 30 kg.

5.11 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.

5.12 Tool Kit Container

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

5.13 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 30 degree 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 in fire red colour conforming to Shade No. 536 of IS 5. The paint shall conform to IS 2932.

7 INSTRUCTION BOOK, ACCESSORIES AND EQUIPMENT

7.1 Instruction Book or Books

Instruction book(s) for the guidance of the user(s) including both operating and normal maintenance procedure shall be supplied. The book(s) shall include an itemised and illustrated spare parts list giving reference numbers of all the wearing parts.

7.2 Accessories

7.2.1 The following accessories shall be provided with the 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.

j) *Siren* — Battery operated.

k) *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.

m) *Spot light* — Adjustable, mounted in a convenient position on the near side of the driving compartment.

n) *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.

p) Rear reflectors

q) *Wind screen-washer* — Fitted in a suitable location with controls in driving compartment.

r) All warning lights shall be SAE CLASS I CERTIFIED

s) The vehicle shall be provided with LED perimeter light — white colour

t) Public address system shall be integrated with the multicolour lights.

8 MARKING

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

a) Manufacturer's name, or trade-mark, if any;

b) Serial number of the pump body and year of construction;

c) Capacity of pump, in l/min;

d) Capacity of water tank, in litre;

e) Nominal speed, in rev/min;

f) Transmission ratio of the PTO;

g) Working pressure, in kg/cm^2;

h) Direction of rotation of the pump shall be indicated by an arrow and this shall be permanently marked on the pump body; and

j) Lubrication points, drainage devices, etc, shall be colour coded.

ANNEX A
(*Clause* 2)

LIST OF REFFRED STANDARDS

IS No.	*Title*
5 : 2007	Colours for ready mixed paints and enamels (*sixth revision*)
273 : 1990	Picks and beaters — Specification (*fourth revision*)
318 : 1981	Specification for leaded tin bronze ingots and castings (*second revision*)
617 : 1994	Cast aluminium and its alloys — Ingots and castings for general engineering purposes — Specification (*third revision*)
636 : 2018	Non-percolating flexible fire fighting delivery hose — Specification (*fourth revision*)
703 : 1999	Axes — Specification *(second revision)*
704 : 1984	Specification for crow–bars and claw–bars (*second revision*)
737 : 2008	Wrought aluminium and aluminium alloy sheet and strip for general engineering purposes — Specification (*fourth revision*)
841 : 1983	Specification for steel hammers (*second revision*)
902 : 1992	Suction hose couplings for fire fighting purposes — Specification (*third revision*)
903 : 1993	Fire hose delivery couplings, branch pipe, nozzles and nozzle spanner — Specification (*fourth revision*)
905 : 1980	Specification for delivery breechings, dividing and collecting, instantaneous pattern, for fire fighting purposes (*second revision*)
906 : 1988	Specification for revolving branch pipe for fire fighting (*third revision*)
907 : 1984	Specification for suction strainers, cylindrical type for fire fighting purposes (*second revision*)
910 : 1980	Specification for combined key for hydrant, hydrant cover and lower valve (*second revision*)
927 : 1981	Specification for fire hooks (*second revision*)
952 : 2012	Fog nozzle for fire brigade use — Specification (*second revision*)
1084 : 2005	Textiles — Manila ropes — Specification (*fifth revision*)
1538 : 1993	Cast iron fittings for pressure pipes for water, gas and sew age — Specification (*third revision*)

IS No.	*Title*
2062 : 2011	Hot rolled medium and high tensile structural steel — Specification (*seventh revision*)
2871 : 2012	Branch pipe, universal for fire fighting purpose — Specification (*second revision*)
2932 (Part 1) : 2013	Enamel, synthetic, exterior: (a) Undercoating (b) Finishing - Specification — Part 1 for domestic and decorative applications (*fourth revision*)
3444 : 1999	Corrosion resistant high alloy steel and nickel base castings for general applications — Specification (*third revision*)
3582 : 1984	Basket strainers for fire fighting purposes (cylindrical Type) (*first revision*)
4308 : 2019	Dry chemical powders for fire fighting — BC, ABC and D types — Specification (*third revision*)
4643 : 1984	Specification for suction wrenches for fire brigade use (*first revision*)
4770 : 1991	Rubber gloves — Electrical purposes — Specification (*first revision*)
4928 : 1986	Specification for delivery valve for centrifugal fire pump outlets (*first revision*)
4989 : 2018	Foam concentrate for producing mechanical foam for fire fighting — Specification (*fourth revision*)
5098 : 1969	Specification for cross — Cut and rip saws
5131 : 2002	Dividing breeching with control for fire brigade use— Specification (*second revision*)
5612 (Part 1) : 1977	Specification for hose — Clamps and hose — Bandages for fire brigade use: Part 1 Hose–clamps (*first revision*)
5612 (Part 2) : 1977	Specification for hose — Clamps and hose — Bandages for fire brigade use: Part 2 Hose–bandages (*first revision*)
6603 : 2001	Stainless steel bars and flats — Specification (*first revision*)
6911 : 2017	Stainless steel plate, sheet and strip — Specification (*second revision*)
10245 (Part 2) : 1994	Respiratory protective devices — Specification Part 2 self-contained open circuit breathing apparatus (*second revision*)
13095 : 2020	Butterfly valves for general purposes (*first revision*)

ANNEX B

(*Foreword*, *Clauses* 3.2 *and* 3.5)

SUPPLEMENTARY EXTINGUISHING AGENT

B-1 DETAILS OF DRY CHEMICAL POWDER

B-1.1 The total quantity of supplementary agent shall not be less than 150 kg of dry powder and shall conform to (*see* IS 4308).

B-1.2 The dry powder system shall comply with the following minimum requirements.

B-1.2.1 The dry powder system shall comprise of two self contained units, each having a capacity of 75 kg of dry powder.

B-1.2.2 The expellant employed for the dry powder units shall be nitrogen. The capacity of the nitrogen cylinders employed for this purpose shall be adequate to ensure complete discharge of the dry powder contents at a rate of not less than 2.25 kg/s from each unit. A well-designed pressure control system shall be provided to regulate the pressure of nitrogen gas and maintain a constant powder discharge pressure throughout the operation of the unit.

B-1.2.3 The dry powder unit shall have a discharge outlet fitted with not less than 22 m of minimum 25 mm bore hose terminating in a trigger control shut-off nozzle, capable of producing either a straight jet or fan-spray pattern of discharge. The range of jet shall be not less than 12 m.

B-1.2.4 The hose and nozzle shall be stowed suitably in lockers on either side of the appliance to facilitate speedy runout on arrival at an accident.

ANNEX C
(Foreword)

SCHEDULE OF EQUIPMENT TO BE SUPPLIED WITH THE APPLIANCE

Sl No.	*Item*	*Quantity*
1)	Aluminium triple extension ladder 13.5 m (as per JCDD 12/1)	1
2)	Suction hose (heavy duty) of PVC of suitable diameter to suit the pump suction inlet in 2.5 m lengths fitted with suction hose coupling (see IS 902)	4 lengths
3)	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 resistant steel as per IS 3444 Gr I (qty 600 metres)	10 lengths
4)	Suction strainer for item 2 (*see* IS 907)	1
5)	Basket strainer for item 2 (*see* IS 3582)	1
6)	Dividing breaching made of light alloy (*see* IS 5131)	2
7)	Collecting breeching made out of light alloy (*see* IS 905)	2
8)	Suction wrenches (*see* IS 4643)	1 pair
9)	Long line, 50 mm circumference, 30 m long (*see* IS 1084)	2 lengths
10)	Short line, 50 mm circumference, 15 m long (*see* IS 1084)	2 lengths
11)	Hose bandages, rubberised [*see* IS 5612 (Part I)]	12
12)	Hose clamps [*see* IS 5612 (Part II)]	6
13)	Hydrant valve key and bar (*see* IS 910)	1 set
14)	Fog nozzle (*see* IS 952) with extension applicator with fog head.	1
15)	Hand controlled branch for 63 mm size hose coupling.	1
16)	Branch pipe, universal (*see* IS 2871)	1
17)	Branch with revolving head (*see* IS 906)	1
18)	Branch pipe (*see* IS 903)	4
19)	Nozzle of sizes 12 mm, 16 mm, 20 mm, 25 mm and 32 mm (two each) (*see* IS 903) a) Adaptor for suction - female to screw coupling and 63 mm male instantaneous.	10 2 2 2

Sl No.	*Item*	*Quantity*
	b) Adaptor double female instantaneous pattern 63 mm. c) Adaptor double male instantaneous pattern 63 mm.	
20)	Nozzle spanners (*see* IS 903)	2
21)	Rechargeable torch intrinsically safe LED type of min. 5000 Lumens and weight not more than 2kgs . – 2 nos	2
22)	Rechargeable flash lights clip on type minimum 1 000 Lumens and weight not more than 250 grams – 6 nos	2
23)	Self-contained positive pressure breathing apparatus with carbon composite cylinder (compressed air type) complete with spare cylinder of min. 45 minute duration [*see* IS 10245 (Part 2)] – 5 nos	1 set
24)	First aid box for 10 persons	1
25)	Rubber gloves (in case) (*see* IS 4770)	2 pair
26)	Axe, large (*see* IS 703)	1
27)	Spade	1
28)	Pick axe (*see* IS 273)	1
29)	Crow bar of 1650mm length and diameter of 25mm (*see* IS 704) – 2 nos	1
30)	Sledge hammer, 6.5 kg (*see* IS 841)	1
31)	Carpenter's saw, 60 cm (*see* IS 5098)	1
32)	Hydraulic jack with handle - 20 tonne	1
33)	Fire hook (*see* IS 927) 1	1
34)	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
35)	Petrol chain Saw machine with 600 mm guide bar length – 1 no	1
36)	Hose ramp (rubber) as per BIS 30 ton capacity – 4 nos	4
37)	Hand operated combi tool – 1 no Combi tool with integrated Hand operated pump The Minimum spreading force at the tips in closed position shall not be less than 2.5 tons. Maximum spreading force shall not be less than 20 tons. The handle and not the head	1

Sl No.	*Item*	*Quantity*
	shall be able to be rotated to 180 degree. Spreading distance at the tips shall not be less than 260 mm. It should be capable of Cutting 24 mm steel bars (average hardness of steel 500 to 550 Mpa or 55 Hrc) The maximum cutting force shall not be less than 250 kN and the weight of ready to use unit should not be more than 11 kgs.	
38)	Hook ladder as per BIS – 1 no	1

ANNEX D
(Clause 5.5.18.4)

SUCTION LINE FOR TESTS

D-1 APPARATUS

D-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.

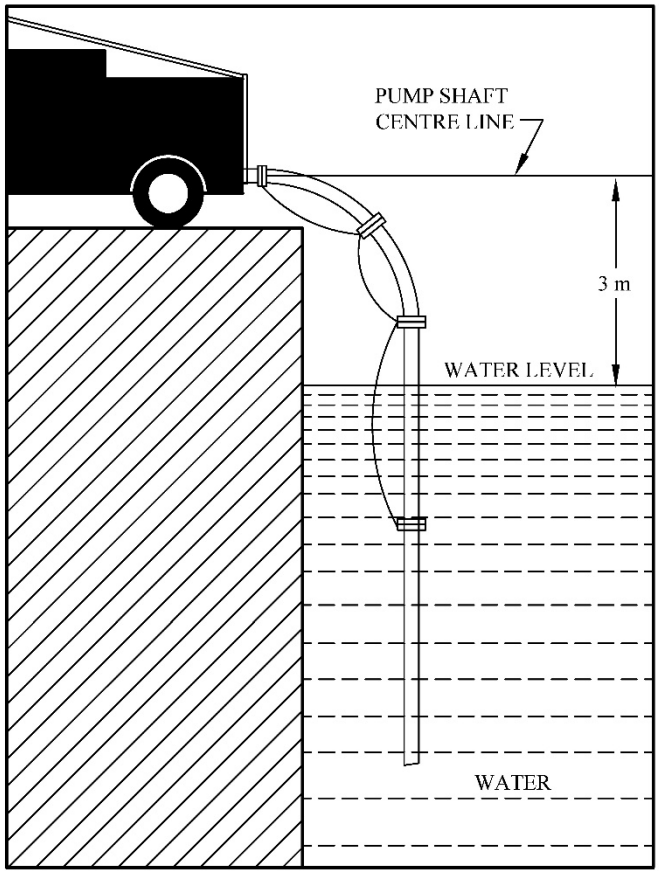


FIG. 1 SUCTION LINE

D-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* D-1.2)

Sl 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

D-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.

D-3 PERMISSIBLE DEVIATIONS OF MEASUREMENTS

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

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

D-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:

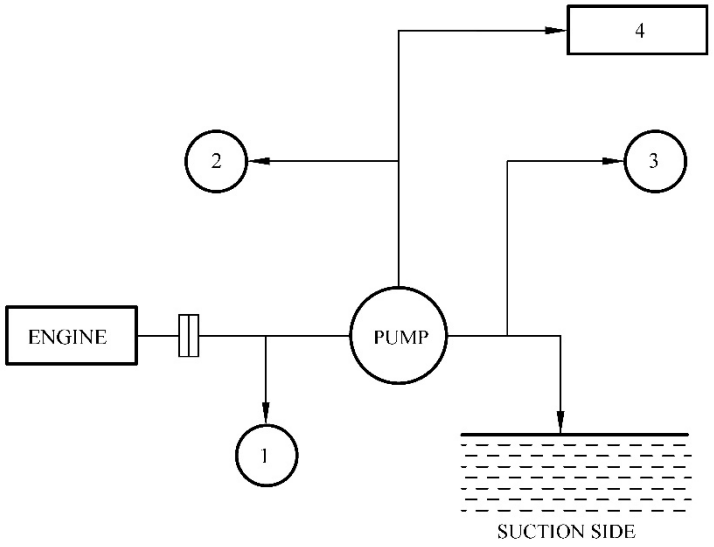
a) Allowances for output:
   1) One percent for every 2.5 °C rise in water temperature.
   2) Four percent for every 300 m above mean sea level.
   3) No allowances shall be made for humidity up to 75 percent. However, an allowance at the rate of 1 percent for every 3 percent change in humidity shall 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 E
(*Clause* 5.5.18.4)

PRESSURE MEASUREMENTS

E-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

E-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 F

(*Clause* 5.5.18.4)

MEASUREMENT OF DELIVERY RATES

F-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.

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

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

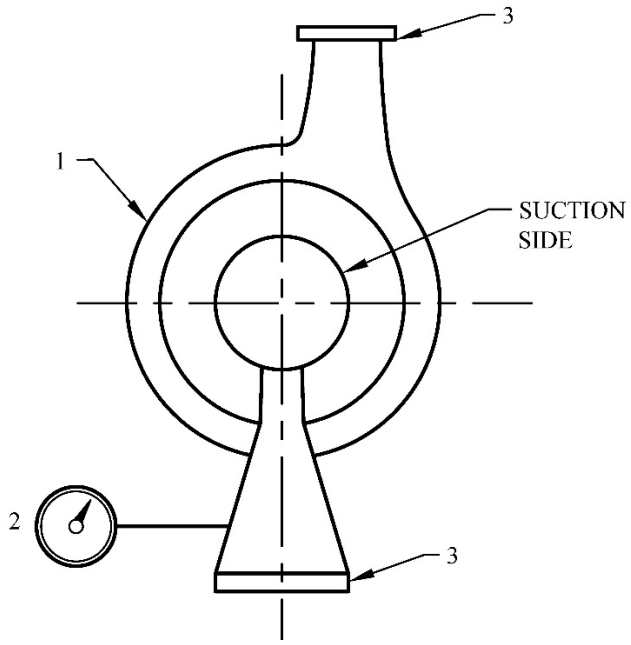
ANNEX G
(*Clause* 5.5.18.4)

DRY SUCTION TEST

G-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

G-2 PROCEDURE FOR DRY SUCTION TEST

G-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.

G-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.

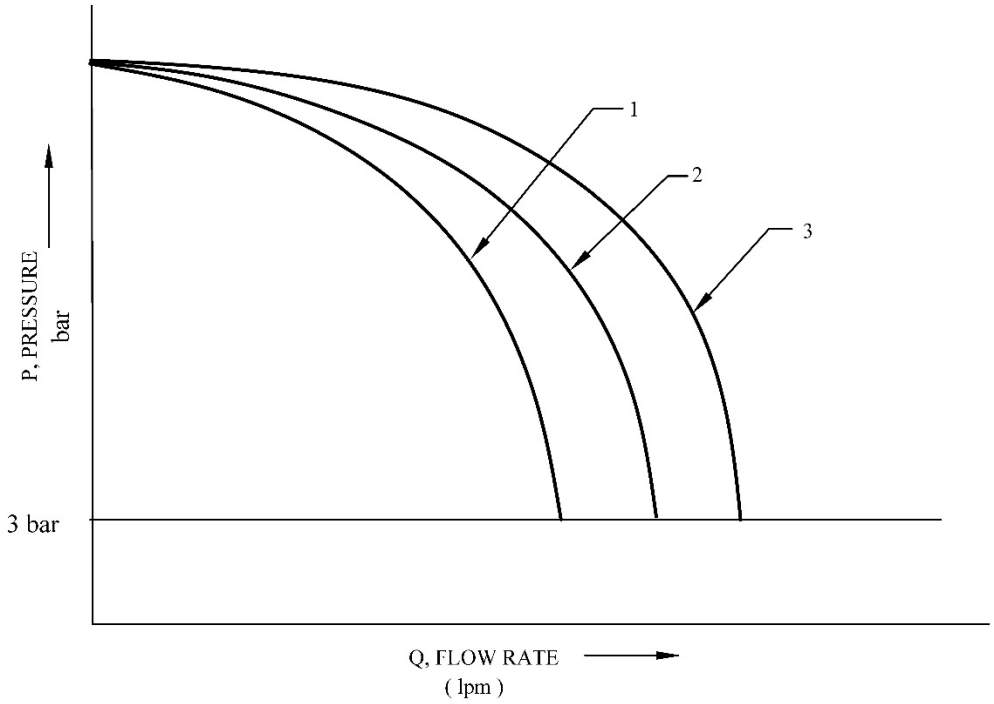
ANNEX H
(*Clause* 5.5.18.4)

PERFORMANCE TEST

H-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.

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

H-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:

Nominal Delivery Pressure bar	*Nominal Delivery Rate* l/min	*Limit Pressure* bar	*Closing Pressure* 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.

H-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 J
(*Clause* 5.5.18.4)

ENDURANCE TEST

J-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.

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

J-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 K
(*Clause* 5.5.18.4)

PRESSURE TESTS

K-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.

K-2 Static Pressure Test

K-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/cm^2.

K-2.2 Keep the static test pressure 21 kg/cm^2 constant for next 10 min without operating pump.

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

ANNEX L
(*Clause* 5.5.18.4)

PRIMER TEST

L-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.

L-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.

L-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.

L-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/cm^2.

L-5 SUCTION INLET AND DELIVERY VALVES

L-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.

L-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.

L-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.

L-6 PRIMER

L-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.

L-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.

L-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.

L-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.

L-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.

L-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.

L-7 GENERAL INSTRUCTIONS

L-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.

L-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.

L-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/cm^2.

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 M
(*Foreword*)

SUMMARY OF FORMULAE AND OTHER DATA

M-1 APPROXIMATE FIRE GROUND CALCULATION

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

Capacity of pond or lake (m^3) = [surface area (m^2) x average depth (m)]

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

M-2 HYDRAULIC FORMULAE

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

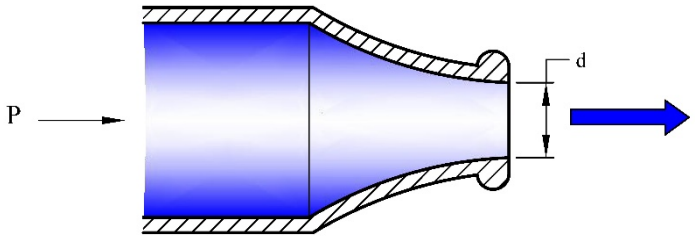
$$\text{Head, H (mitre)} = \text{Pressure in bar} \times 10 \quad \text{(approx.)}$$

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

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

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

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



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

M-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

M-4 CONSTANTS

g (acceleration due to gravity) = 9.81 m/s^2

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

π/4 = 0.7854

Circumference of a circle = πd

M-5 AREAS

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

M-6 VOLUMES

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

M-7 CAPACITY MEASURED IN LITRES

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

ANNEX N
(*Foreword*)

METRICATION

N-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 (1)	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 (W) watt (kW)	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

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