Indian Standard

FUNCTIONAL REQUIREMENTS FOR CRASH FIRE TENDER FOR AIRFIELDS

(Third Revision)

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Indian Standard

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(Third Revision)

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(*Continued on page* 2)

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(*Continued from page* 1)

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(*Continued on page* 26)

Indian Standard

FUNCTIONAL REQUIREMENTS FOR CRASH FIRE TENDER FOR AIRFIELDS

(Third Revision)

0. FOREWORD

0.1 This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards on 1 June 1987, after the draft finalized by the Fire Fighting Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 This standard was first published in 1960 and revised in 1969 and 1977. A lot of development has taken place in the field of civil aviation in the past 8 years. Larger and faster aircraft have been introduced besides ever increasing frequency of aircraft movements. The trend is towards still larger and faster aircraft. This has necessitated the use of large capacity fire fighting appliances for aircraft crash fire fighting, which shall be fast moving, have a high rate of discharge and shall require the minimum of crew. Producing foam, while the appliances is in motion, is also a desirable feature of the present day appliances.

0.3 Another development in the aircraft crash fire fighting technique is increased reliance on the use of monitor(s) for initial attack, the use of hand-lines being relegated to extinguish residual small fires or licks of flame; soil and terrain at aerodromes, however, require that hand-lines are also capable of producing a minimum combined discharge rate of 2 000 litres per minute, so that fire extinguishing operations are not impeded in circumstances where the appliance cannot approach close enough to the crashed aircraft to enable the monitor(s) to be used.

0.4 Halon 1211 has replaced carbon-dioxide and dry chemical powder as supplementary fire extinguishing medium, because it is much more effective than CO_2 and dry chemical powder. Halon can handle engine fires as well as tyre fires effectively.

0.5 The third revision has been taken up on the recommendation of the Ministry of Defence and Directorate General of Civil Aviation to bring the standard in line with the latest developments at the international level

0.6 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 Appendix B for information and guidance.

0.7 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 : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard lays down the requirements regarding material, design, construction, workmanship and finish, accessories, and equipment of crash fire tenders (pneumatic wheeled type)

2. GENERAL REQUIREMENTS

2.1 The appliance shall carry 6 500 l of water and 800 l of foam compound for foam production, a mid-ship mounted pump capable of delivering not less than 4 000 l of water per minute at minimum pressure of 0·85 MN/m² (8·5 kgf/cm²) and 3 000 l of water per minute at 1·05 to 1·25 MN/m² (10·5 to 12·5 kgf/cm²), supplementary extinguishing agent (*see* Appendix A) a first-aid hose reel and other required accessories.

2.2 The appliance shall be capable of the following minimum performance with the monitor mounted on the roof of the cabin and 2 hand-lines on either side.

2.2.1 A minimum output through monitor at pressure not exceeding 1·25 MN/m² (12·5 kgf/cm²) of 3 000 l to give effective monitor throw of foam of minimum 55 m.

2.2.2 A minimum output of 500 l of water-foam solution through each of the two hand-lines, on either side of the crash tender to give a minimum effective throw of a jet of foam of 25 m at pump delivery pressure not exceeding 0·85 MN/m² (8·5 kgf/cm²) and using 30 m of hose.

2.2.3 It shall be possible to operate the monitor and the two hand-lines at the pump delivery pressure of 1 MN/m² (10 kgf/cm²).

2.2.4 It shall be capable of producing foam while the appliance is creeping or moving without any drop in foam output.

*Rules for rounding off numerical values (*revised*).

2.3 The monitor and the hand-lines shall 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 foam compound conforming to IS : 4989 (Part 1)-1985* to give the performance indicated in **2.2.**

2.4 The foam induction shall be automatic, with change in output required through a combination of monitor and hand-lines. The ratio of the foam compound induction shall be within a variation of $\pm$ 0·5, with induction ratio not exceeding 6 percent. The induction ratio once fixed shall maintain this limit of variation for the entire range of inductor setting. Around the pump, proportionator shall be used with clearly marked induction ratios varying from 3 to 8 percent.

2.5 The system of foam production from monitor and hand-lines shall be so designed as to produce satisfactory the minimum expansion ratio of 8.

2.6 A first-aid hose reel service shall be provided on the appliance with 60 m hose, fed from the water supply available on the appliance.

2.7 It shall be possible for the appliance to use water from a separate source of water supply and foam supply through a pick up tube from drums at ground level.

2.8 The appliance shall be equipped with self-defence foam nozzles for self-protection, particularly of the wheels. The angle of front nozzles shall be so adjusted that a throw of 6 m with a total coverage of 6 m width is achieved.

2.8.1 The water tank, foam tank, monitor, side lines and self-defence nozzles shall have pneumatically controlled ball valves for operation and control from within the cabin. It shall be possible to switch over to manual control by isolating pneumatic control system. All pneumatic control systems shall be used with air supply at pressures available from the vehicle air brake system. The vehicle air brake shall be tapped for the pneumatic control system with a regulator valve so that the minimum air pressure required for operating the vehicle is available all the time and the pneumatic control for fire operation actuates when the air pressure in the system exceeds this minimum level. In case of any leakage in the pneumatic control system, the vehicle operation shall not be adversely affected. Opening and closing valves to the monitor, hand-lines and to the pump shall be achieved through operation of pneumatic controls from the cabin.

*Specification for foam concentrate (compound) for producing mechanical foam for fire fighting : Part 1 Protein foam (*second revision*).

2.9 The supplementary agent shall consist of Halon 1211 cylinders mounted on the rear side of the equipment with a common header, a 30 m hose reel and a telescopic extension applicator, with necessary mounting and control to give the performance as specified.

2.10 Lever type, quarter turn, ball valves shall be used for water tank to water pump, butterfly valve could be used, if suitable ball valve is not available. All levers for normal operation of the valves shall operate in a vertical plane with levers and linkage arranged in such a manner that the pulling of the levers downwards, towards the operator, would open the valve and pushing away from the operation would close the valve.

2.11 The appliance shall be designed to be as compact as possible, compatible with ease of accessibility to all service parts. The pump/foam making equipment and controls shall be so arranged that one man can operate foam or water lines from the driver's compartment of pump control panel (except monitor) as required.

3. MATERIAL SELECTION AND TREATMENT

3.1 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.

3.2 Timber shall not be used in body construction.

3.3 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.

3.4 All parts which form waterways or come into contact with water shall be of corrosion resisting materials or suitably treated for corrosion resistant once. All metal pipe lines shall be hot dipped/galvanized. All metal parts exposed to atmosphere shall either be of corrosion resisting material or treated suitably to resist corrosion. All metal fasteners shall be galvanized/chrome plated to avoid rusting.

4. DESIGN AND CONSTRUCTION

4.1 Chassis

4.1.1 The vehicle shall have an all wheel drive for good mobility over cross country conditions. The gross vehicle weight (GVW) rating of the chassis to be used shall exceed the actual gross weight of fully loaded vehicle by atleast 500 kg.

NOTE — The weight of vehicle for all purposes is its gross weight with all fire fighting and rescue equipments, full load of extinguishing agents, full load of fuel and complete personnel complement. The pay load of the superstructure shall be in the range of 13 500 kg.

4.1.2 The vehicle shall have single tyre of uniform size. The tyre size should preferably be 14·00 × 20.

4.1.3 The under-clearance of the chassis shall be sufficient to permit the maximum mobility on soft ground and rough terrain. In order to ensure good cross country performance, the following minimum characteristics should be met :

Angle of approach	30° *Min*
Angle of departure	30° *Min*
Interaxle clearance angle	12° *Min*
Under chassis clearance	320 mm
Side slope	20 percent both ways
Gradability	35 percent
Turning circle radius	12 m *Max*
Fordability not less than	600 mm
Articulation	300 mm

Acceleration from 0 to 80 km/h with full pay load in maximum of 40 seconds.

Maximum speed of 100 km/h

Stability 28° both ways.

Braking efficiency — maximum 9m from a speed of 32 km/h with full load.

4.1.4 *Engine* — The vehicle shall be diesel driven and able to develop sufficient power to achieve the required rate of acceleration of 80 km h in 40 seconds and a maximum speed of 100 km/h, when fully laden. The acceleration time shall be achieved on ambient temperature varying from 0 to 50°C and at elevation up to 600 m without engine preheating.

4.1.4.1 The engine shall be equipped with a governor which shall be set at not more than the maximum permissible rev/min recommended for the engine at no load.

4.1.4.2 Each engine shall be equipped with a complete and separate starting system of 24 V type. An alternator and rectifier capable of delivering a minimum of 30 A at 24 V shall be provided.

4.1.5 *Power Take-Off* — When the pump is powered by the vehicle engine, it should be driven through a suitable mechanical power take-off

(PTO). The PTO should be so designed that it transmits the full requirements of power for driving the pump. The power transmission should be uninterrupted even though the transmission gear may be shifted or the clutch released or the transmission is placed in any of its speed ranges. Provision shall be made in the design of the drive system or control to prevent damage to the drive on lurching of the vehicle when the transmission is shifted from neutral to either forward or reverse speed ranges while simultaneously pumping.

4.1.5.1 When a power take-off pump drive is used, there shall be sufficient engine power both to operate the pump at the required rate of discharge estimated at 134 kW (180 hp) and to propel the vehicle while creeping.

4.1.6 Radio suppression of the electrical system, which is sufficient to assure positive operation of radio equipment without interference, shall be provided.

4.1.7 *Vehicle Drive* — The drive shall provide that transmission of power from the engine fly-wheel to the wheels of vehicle with such multiplication of torque that the vehicle is capable of travelling at the specified acceleration and speed. The transmission shall either be automatic or manual. In the latter case, the system shall not have more than six forward gears (eight for synchro mesh gear box) and one reverse gear. In the case of automatic transmission, the operation of pump at its rated rev/min should not affect the creeping capability of the vehicle.

4.1.8 The suspension system shall be designed to allow the vehicle loaded or unloaded, to travel at high speeds over road surfaces or over

that not more than 7 kg pull is required on the steering wheel in order to turn the steering wheel from lock-to-lock with engine running.

4.1.10 Fuel tank shall be of not less than 200 litres capacity. It shall be of rugged construction securely located and easy for maintenance.

4.1.11 The vehicle shall be equipped with sufficient capacity compressor with reservoir to ensure supply of dry air for brakes and pneumatic

controls of crash fire tender. Fail safe device shall be provided for proper operation and safety. Air reservoir and pressure tapping shall be so arranged as to ensure adequate air supply, and independent functioning of air brakes and pneumatic controls even with leakage failure of one or the others. Moisture trap and drainage shall be provided to ensure supply of dry air to the system.

4.2 Water Tank

4.2.1 A water tank of 6 500l capacity shall be mounted on the chassis in a manner keeping in view the proper load distribution on the axles. It shall be fabricated out of mild steel sheet of thickness not less than 5 mm at base and not less than 3 mm for the remaining portion; it shall be treated with corrosion resisting compound. Epoxy treatment should be given to inside of water tank for corrosion resistance. The epoxy treatment shall consist of 2 coats of primer with two coats of finish. Inside surface shall be prepared by sand blasting before painting. The tank shall withstand hydrostatic pressure of 0·3 bar. It shall be suitably baffled to prevent surge while the vehicle is accelerating, cornering and braking. The design of the baffles shall be such as to afford clear water way of the entire content of the tank to flow into the pump and also provide access to all the compartments for repair and maintenance. Water tank should be fabricated in such a manner that epicoating and repair of epicoating is possible by suitably positioning the baffles or by providing bolted baffles which can be removed when required. All bolting shall be done with stainless steel. The tank shall be so designed and mounted as to bring the centre of gravity of the appliance as low as possible. It shall be flexibly mounted to prevent the tank's distortion due to chassis flexure. The mounting shall permit full contents of the tank to flow to the pump.

4.2.2 Four lifting eyes shall be provided on the shell of the tank to enable the tank to be lifted off the vehicle for repairs/replacement as necessary.

4.2.3 The tank shall be fitted with manhole-cum-filling orifice of 450 mm dia on top of the tank fitted with removable strainer. The manhole shall be quick opening type and shall be clearly marked 'Water'. The drain pipe shall be of not less than 63 mm diameter with a quick action spherical type valve. The end of drain pipe shall be fitted with male coupling so that water could be drained away from the vehicle by using delivery hose fitted with female end connection. A 5 m hose with end connection shall be used for this purpose.

4.2.4 One overflow pipe of not less than 100 mm internal diameter shall be fitted to the tank. The discharge end of the overflow pipe shall be taken down to a point well below the chassis without reducing the effective ground clearance when fully loaded, and shall discharge away from the

wheels. The pipes shall be designed to ensure that water shall overflow through these pipes only whilst refilling the tank, but no water shall overflow through these pipes when the appliance is in motion or standing on uneven ground, and/or brakes are applied to the moving appliance.

4.2.5 Four filling pipes (hydrant connections), each with an internal diameter of not less than 63 mm, shall be fitted to the tank. Each of these shall be fitted with a 63 mm instantaneous male coupling conforming to IS : 903-1984* incorporating a strainer. Two of these inlets shall be fitted on each side of the pump control panels. Foolproof arrangements shall be made to prevent pressurization of the water tank while refilling through the filling pipes. The inlets of the filling pipes shall be fitted on or near the pump control panels. Non-return valves should be provided to ensure that the water from tank does not flow back through the filling pipes. Each filling connection shall be fitted with ball valves.

4.2.6 Tube type water level indicators for the water tank shall be fitted on or near the pump control side panels. The tube type water level indicators shall be properly located on a rigid frame with protective covering and level marking alongwith isolating valve and breather holes to avoid damage, provided for isolation in case of breakage and undue spilling when vehicle is on the move.

4.2.7 Suitable arrangements should be provided for self-filling of water tank directly from the pump through a 50-mm GI pipe, isolating ball valve and flexible coupling hose.

4.2.8 The connection between the tank and the pump shall not be less than 150 mm. The draw-off shall be protected by a wire screen filter and shall preferably be also fitted with an anti-vortex device. Arrangements shall be made for venting the tank to the atmosphere when water is being drawn from it.

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

4.2.10 The plumbing shall be reasonably accessible for maintenance purposes. Drain cocks shall be provided, where necessary, and controls for these shall be readily accessible and so arranged as to prevent the cocks from being opened by vibration. The direction in which the valve/cock opens/closes shall be clearly marked near each valve cock.

*Specification for fire hose delivery couplings branch pipe, nozzles and nozzle spanner (*third revision*).

4.3 Hose Reel

4.3.1 One first-aid hose reel shall be provided and mounted so as to be accessible for use from left side of the appliance. Swivelling guide rollers shall be fitted, where necessary, to prevent the tubing from kinking.

4.3.2 The reel shall be provided with not less than 60 m of 19 mm tubing terminating in a dual-purpose shut-off nozzle. The hose reel shall conform to IS : 884-1985*. Range of throw from hose reel nozzle shall be 10 m minimum. The working pressure of the tubing shall not be less than 1·4 MN/m² (14 kgf/cm²).

4.3.3 The reel shall be provided with friction brakes to prevent over-run of tubing without affecting easy run of the reel, either while pulling out for use or during fast motion of the vehicle. It shall be possible to de-clutch the brakes for rewinding. Design shall be reliable, have adjustment for wear and for friction force to suit the end use.

4.3.4 Flow to the reels should be controlled by manually operated ball type valves located suitably for ease in operation.

4.4 Pump

4.4.1 The pump shall preferably be made of any suitable alloy, compatible with aqueous film forming foam and protein foam compound, with stainless steel shaft suitable for use with brakish water. The pump shall be capable of delivering not less than 4 000 l/min of water at a pressure not less than 0·85 MN/m² (8·5 kgf/cm²) and 3 000 l/min of water at a pressure range of 1·05 to 1·25 MN/m² (10·5 to 12·5 kgf/cm²), when operated from a suction lift of 1·5 m. The pump shall be of single stage/double stage and closed impeller type where the impeller is hydraulically balanced to reduce any thrust. The pump shaft shall preferably be designed to run on two deep grooved ball bearings lubricated by oil bath to ensure long and trouble-free service. A mechanical seal/gland shall be provided which shall be capable of running dry for 1 min without damage. The pump design shall be such that

of the appliance.

*Specification for first-aid hose-reel for fire fighting (*first revision*).

4.4.4 A removable strainer and chromium plated blank cap shall be provided for the suction inlets for the pump.

4.4.5 The suction inlet of minimum 125 mm diameter shall be fitted with round thread connection (*see* IS : 902-1974*).

4.4.6 The delivery outlets of the pump shall terminate in 63 mm female instantaneous coupling with blank cap (*see* IS : 903-1984†) and means for relieving pressure between the valve and the cap. The standard 63 mm female instantaneous coupling shall be in accordance with IS : 903-1984†. Two delivery outlets shall be provided on each side control panel. These outlets shall be controlled pneumatically from the cabin. They will also be provided with manual over-rides on each side control panel.

4.4.7 Plumbing, if any, for deliveries and the monitor, shall be adequate in dimension to ensure that it shall feed adequately the foam producing mixture at its maximum rates of output.

4.5 Primer — The primer shall be capable of a suction lift of 7 m in not more than 30 seconds using 100 mm suction hose.

4.6 Foam Equipment

4.6.1 *Foam Compound Tank* — A foam compound tank of 800 l capacity shall be mounted on the chassis, in addition to the water tank and as a separate and distinct unit which can be removed separately for replacement.

4.6.1.1 The foam compound tank shall be of rigid type. Rigid tanks shall be of stainless steel welded construction. The shell thickness shall be minimum 2 mm except the base which shall be 2·5 mm.

4.6.1.2 The foam tank shall have its top dished with funnelling arrangement provided to enable easy filling from 20 l drum. Suitable stainless steel sharp-edged puncturing device shall be provided at the foam tank filling mount for puncturing foam compound drum for facilitating quick filling of the foam compound directly from the drum into the tank without spillage and undue frothing. Funnelling arrangement shall be extended for delivery of the foam near the bottom of the tank to avoid frothing. The tank shall be suitably baffled to prevent surge while the vehicle is accelerating, moving on uneven ground or brakes are applied to the moving appliance. The design of the tank shall incorporate a removeable pump fitted with a drain valve. The foam compound draw-off tube shall be positioned in such a manner that foreign matter or

*Specification for suction hose couplings for fire fighting purposes (*second revision*).
†Specification for fire hose delivery couplings branch pipe, nozzles and nozzle spanner (*third revision*).

sludge shall not pass into the compound lines. The draw-off tube shall be fitted with gauge strainer of stainless steel, suitable mesh size and adequate straining area. The tank top shall be removable or of welded construction with a manhole of 450 mm diameter with quick opening cover and it shall be ensured that the joint between the top and the body of the tank is leak-proof. Rigid tank shall be flexible mounted, unless attached to a rigid structure. The tank shall be separate and distinct from the body and shall be easily removable as a unit. Tube type foam compound level indicators shall be provided on either side near the control panels.

4.6.1.3 The manhole of the tank shall be used for foam filling, which shall have a stainless steel strainer incorporated in the design. The total screening area of strainer shall be adequate to permit quick filling of foam compound into the tank. The manhole cover shall be clearly marked 'Foam'. The tank, with its fitments, shall be able to withstand a hydraulic test pressure of 0·3 bar without permanent deformation.

4.6.1.4 Means shall be provided for automatic venting of foam 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 not get clogged during use of appliance. All attachments shall be so designed as to avoid foam compound spillage during mobility.

4.6.1.5 The draw-off tube shall be connected to the foam compound proportionator/inductor and pump, as necessary, and an automatic flow control valve shall be incorporated in it so as to maintain a constant induction rate of not more than 8 percent with varying foam output. The plumbing for this purpose shall have a clear and unobstructed passage of not less than 50 mm throughout without any restriction 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.

4.6.1.6 A suitable 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.

4.6.1.7 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. The pick-up tube shall have puncturing straining device and quick action ampling to the system.

4.6.2 *Foam Compound Proportionator/Inductor* — Automatic proportioning arrangements shall be provided where the preset induction ratio of foam compound/water solution and flow of water are automatically varied merely by opening and closing of monitor/handlings. This shall be achieved without any complex system of linkages that may be susceptible to distortion due to chassis flexion. The system shall be reliable and

vehicle to be capable of operation by one man in an emergency. The monitor shall be capable of traversing through 360° (±180°) in a horizontal plane, elevating from horizontal to 45° and depressing from horizontal to not less than 15° and fully rotating in both directions. The monitor shall be fitted with a deflector to enable it to lay a wide carpet of foam for quick coverage of spill fires when necessary. The change from jet to spray shall be instantaneous by the operation of a simple lever from within the cab. The monitor shall be so positioned on the roof of the cab that the foam produced could be directed towards a fire at a minimum of 12 m ahead of the cab when the monitor is at its maximum depression from horizontal.

4.6.3.2 The monitor should be of the self-aspirating type with a flow rate of atleast 3 000 l/min of water at a pressure range of 1·05 to 1·25 MN/m² (10·5 to 12·5 kgf/cm²); it shall have an expansion ratio of not less than 8, using foam compound conforming to IS : 4989 (Part 1)-1985* at an induction rate specified in **2.4**. The maximum output of monitor at this condition, however, shall not exceed 3 500 l/min.

4.6.3.3 The aggregate foam solution discharge shall not be less than 4 000 l/min through a combination of monitor and 2 hand-lines or 3 000 l/min through monitor only. The appliance shall be capable of yielding 3 000 l/min through monitor while it is creeping.

4.6.3.4 The monitor shall be capable of projecting the foam discharge to an effective distance of not less than 55 m in still air when operated at pressure range of 1·05 to 1·25 MN/m² (10·5 to 12·5 kgf/cm²) in a straight jet pattern without dripping.

4.6.4 *Hand-lines*

4.6.4.1 Four hand-lines, two on either side of the appliance, shall be provided. These shall terminate in foam making branch pipes, fitted

*Specification for foam concentrate (compound) for producing mechanical foam for fire fighting : Part 1 Portein foam (*second revision*).

with spray/jet attachments, and preferably also fitted with hand control.

4.6.4.2 The hand-lines shall be stowed in quick release clamps or lockers as close as possible to the pump operating panel. The hoses for hand-lines shall have an internal diameter of 63 mm, in lengths of 30 m each and conforming to Type II of IS : 636-1979*. Non-ferrous wires shall be used for binding coupling and hoses.

4.6.4.3 The controls for the hand-lines outlets shall be of the pneumatic type ball valve and fitted to the cabin control panel. In addition to these, manual controls shall also be provided and fitted close to the stowage position of the hand-lines.

4.6.4.4 *Supplementary extinguishing system* — The supplementary extinguishing system shall be two 50 kg Halon 1211 cylinders complete with hose reel and applicator according to details in Appendix A. The entire system should be firmly mounted on the appliance and should have easy accessibility for quick operation and normal maintenance of the equipment.

4.6.4.5 *Ladder/stretcher ladders* — A 7·5 m extension ladder according to IS : 4571-1977† shall be mounted on suitable gallows fitted with rollers and designed to facilitate easy and quick removal of the ladder by one man from the rear of the appliance. The head lock on the gallows shall be positive in action. No equipment shall be so positioned as to interfere with easy and independent removal of the extension ladder. In addition, two light hollow stretcher ladders shall be mounted separately on the appliance in such a way that these could be easily, quickly and independently removed when required.

4.7 Instruments and Controls

4.7.1 Adequately illuminated pump operating control panels shall be provided on either side of the appliance. Each of these shall include the following :

a) Auxiliary throttle control for the engine;

b) Pump pressure gauge calibrated at 0 to 2·5 MN/m² (25 kgf/cm²);

c) Compound gauge calibrated as follows:

1) Pressure from 0 to 2·5 MN/m² (25 kgf/cm²), and

2) Vacuum from 0 to 760 mm of mercury;

*Specification for fire fighting hose (rubber lined, or rubberized fabric lined, woven-jacketed) (*second revision*).

†Specification for aluminium extension ladders for fire brigade use (*first revision*).

d) Tube type gauge for water tank;

e) Tube type gauge for foam tank;

f) Two 63-mm male instantaneous hydrant connection with ball control valves;

g) Suction inlet of pump of minimum 125 mm dia with isolating valve control;

h) Two 63-mm female instantaneous delivery outlets (*see* IS : 5290-1983*) of pump (for hand-lines) with manual over-side of control (pneumatic control of these to be in cabin);

j) First-aid hose reel valve control (on port side);

k) Control valve for self-filling of water tank from pump (on port side);

m) Control for using auxiliary foam compound pick-up tube (on port side);

n) Halon 1211 equipment operating control (on Halon 1211 system);

p) Control for flushing out the foam making equipment and its plumbing, if required; and

q) Control valve for draining of pump casing (on port side).

4.7.2 The following controls shall be provided in the cabin :

a) Hand throttle with arrangement to lock it in any position, when required;

b) Pressure gauge calibrated to 2·5 MN/m^2 (25 kgf/cm^2);

c) Water tank isolating pneumatic valve control;

d) Foam tank pneumatic valve control;

e) Pneumatic valve control for monitor operation;

f) Pneumatic valve controls for independent operation of four foam hand-lines with visual indication;

g) Pneumatic valve control for self-defence foam nozzles;

h) Pneumatic circuit isolating control;

j) Switches for operation of siren, fog lamps, reversing light, airfield obstruction light, revolving beacon light, searchlight and spot light;

k) Engine revolution counter;

m) Engine temperature and lubrication oil temperature gauge;

n) Engine oil pressure gauge or a warning glow lamp;

p) Battery charging meter with a warning glow lamp;

*Specification for landing valves (*second revision*).

q) Air pressure gauge for the braking systems with warning device;

r) Fuel tank contents gauge calibrated in litres;

s) Odometer calibrated in km;

t) Speedometer calibrated in km; and

u) PTO engagement indicator.

NOTE — All pressure/vacuum gauges shall have 100 mm dial.

4.8 Body Work

4.8.1 *Cab* — Accommodation for 5 men, including the driver, shall be provided in a fully enclosed flexibly mounted crew compartment having four doors. The design of the cab shall be such that it shall afford maximum possible vision for the crew and shall ensure adequate ventilation to avoid discomfort to crew under tropical conditions. Adequate lighting in the cab shall be provided. Hinged doors shall be provided on the sides of the appliance giving ready access to driver and crew. The doors should open outwards, these shall be hung forward, and have locks with double catch striking plates. These shall not be liable of being opened inadvertantly from the inside. Non-slip steps and grab rails/handles shall be provided to assist the driver and crew to get in and out. The design of the steps should facilitate very quick entry and exit from cabin. If required, the steps should be bolted to avoid fouling if the cab is of tilting type. Driver's seat shall be adjustable. All glasses fitted to window shall be splinter proof safety glass. The construction of the cab shall be such that the roof shall support the weight of one man without damage and undue deflection. Dual sun visors and long arm outside fitting rear view mirrors shall be fitted to the cab. The cab design shall provide protection from heat, rain, dust, noise, etc. All structure shall be painted with rust preventive paints of minimum two coats. The inside of body shall be lined with smooth sheet work with anodized aluminium beading.

4.8.2 The cab shall be designed such that comfortable sitting and enough head room is provided for the crew to be ready for fire fighting operation on reaching the site. Care should be taken to provide access to engine elements requiring regular attention without resorting to tilting of the cab. Space for proper location and brackets for providing accommodation to essential accessories such as breathing apparatus, communications set, fire suits, etc, shall be provided in the cabin for efficiency and ease in operation. All controls shall be conveniently located for operation, if necessary, by the driver alone. All essential operating instructions, identification of controls, indication instruments shall be provided inside the cabin alongwith necessary circuitry, besides providing similar details on either side of the control panel as operationally

necessary. Location of controls and operating levers shall ensure satisfactory, positive action and safety of the operators.

4.8.3 Lockers and other suitable accommodation shall be provided for all equipment given in Appendices A and B. Lockers having external access shall be weather-proof and self-draining to release all water following washdown. Lockers shall be accessible from ground level to a man of average height (1·67 m). Doors/lockers shall open in such a manner that they offer no injury hazard to the personnel in the open position and any stays or supports can be released by one man to close the doors. All lockers shall be fitted with internal lighting which shall be capable of being automatically switched 'on' and 'off' by opening and closing of the doors/lids. A master switch for isolating the locker lighting circuit shall also be fitted in the driving compartment.

4.8.4 Grab rails and non-slip steps shall be provided to give access to the roof of the appliance, and for easy and speedy removal and mounting of ladders. Access to the top shall be provided from the two sides immediately behind the cabin and also from the rear through suitably designed ladder. All walk-ways including the steps shall have aluminium chequered plates suitably mounted at appropriate locations.

4.8.5 No part of the body work shall reduce the ground clearance for less than 32 cm or increase the overall width of the vehicle to more than 2·50 m. The highest part of the appliance with the extension ladder and the monitor mounted on it shall not exceed 3·60 m. The construction of superstructure shall not reduce the angles of approach and departure below 30°. All construction of cab and fittings shall ensure that inside is free from leakage to foam solution and rain water.

[redacted]

have streamlined finish.

5.2 The appliance shall be painted 'Fire Red' (*see* shade No. 536 of IS : 5-1978*) on the outside with the Fire Service insignia painted in gold and black.

*Colours for ready mixed paints and enamels (*third revision*).

5.3 The driving compartment, crew's compartment and inside of lockers shall be painted cream. Lockers shall be finished in shadow board painting to show the position of each piece of equipment.

5.4 All other parts except engine shall be painted black.

5.5 Necessary anti-corrosion and priming coats shall be applied before painting.

5.6 The paint shall conform to IS : 2932-1974*.

6. LITERATURE, ACCESSORIES AND EQUIPMENT

6.1 Literature — The following literature shall be provided (one set with each equipment or as specified).

a) *User Hand Book* — This book shall contain technical description of the equipment with layout drawings, illustrations and performance capabilities with instruction to user for commissioning the equipment for use, and operation with limitations and precautions to be observed, normal maintenance and field repairs, lubrication schedule with grades of lubricants to be used, fault finding guide, storage instructions and warning plates against possible wrong use. For independently mounted equipment, for example, battery charger, supplementary extinguishers, rescue tools, radio telephone set and other accessories, independent chapters can be added to the main book.

b) *Illustrated Part Identification Manual* — This manual shall contain fully explained and illustrated details of the entire chassis and superstructure, and all carried sub-assemblies, suitably grouped for easy identification of each and separately demandable spare for replacement, as required, will include details of bought out items with part number and source of supply.

c) *Workshop Manual* — This manual shall contain fully illustrated instructions on repair and overall of all super-structure items with details of fitment, tolerances, special tools to be used, procedure for dismantling and assembly checks.

6.2 Accessories — The following accessories shall be installed, in addition to those normally fitted on the chassis :

a) *One Electrically Operated Siren — 24 Volts* — To be mounted externally;

*Specification for enamel, synthetic, exterior (a) undercoating, (b) finishing (*first revision*).

A-2.2 The two Halon cylinders are connected to a common header with isolating and non-return valves so that one or the other cylinder could be removed for inspection, weighing or re-charging. The cylinders shall be fitted with manually operated lever type valves for discharging the liquid with pressure gauge and high pressure safety device. The cylinders are to be securely mounted and suitably supported on the appliance for high acceleration and severe cross country application. The common header and connections shall be mild steel tubes with anti-corrosion treatment adequately proportioned to give a factor of safety of 3 against maximum cylinder pressure of 2 MN/m² (20 kgf/cm²). The common header shall also be securely located within easy reach for operation and shall have quarter-turn ball valves for isolating one cylinder or the other. The cabin housing this arrangement shall carry operating instructions with a general arrangement diagram. Cylinder pressure gauges shall be of such size and so located as to facilitate easy reach from ground. The cylinder shall incorporate the pressure-relief valve, a well protected discharge valve with necessary dip tube assembly. The discharge valve, the tube assembly and all other plumbing shall be capable of discharging the liquid Halon 1211 at the minimum specified rate. The valves, adoptors and other connections which come in contact with Halon shall be of material conforming to IS : 3224-1979*.

A-2.3 Applicators — The far end of the hose shall be connected to a hand applicator of telescopic extension type, 1·5 m long. The applicator shall be capable of withstanding all the working pressure in closed as well as extended position. A quarter-turn ball valve shall be incorporated in the barrel of the applicator to enable stoppage and control of discharge of the extinguishing agent.

A-3. CHARGING

A-3.1 The cylinder shall be pressurized with dry nitrogen to a pressure of 1·5 MN/m² (15 kgf/cm²) at 20°C. It should be pressurized with dry nitrogen, 5 kg minimum.

A-4. PERFORMANCE DATA

A-4.1 The complete assembly shall be pressure tested for pressure, soundless of the joint and connections to a pressure of 2 MN/m² (20 kgf/cm²) after 10 winding and un-winding operations. Any leakage and readjustment shall require re-testing. The discharge is required to pass through a common header, hose reel and applicator and shall be as under :

a) Duration of discharge 30 to 35 s/cylinder

*Specification for valve fittings for compressed gas cylinders excluding liquefied petroleum gas (LPG) cylinders (*second revision*).

b) Rate of discharge — 1·5 kg/second, *Min*

c) Throw of jet — 6 m, *Min*

A-5. PAINTING

A-5.1 All ferrous components of the system shall be protected against atmospheric and chemical corrosion with minimum 2 coats of primer and 2 coats of paints (*see* IS : 2932-1974*).

A-6. INSTRUCTIONS

A-6.1 Instructions covering operation, maintenance, over hauling and illustrated spare parts shall be provided with system.

APPENDIX B

(*Clauses* 0.6, 2.1 *and* 4.8.3)

SCHEDULE OF EQUIPMENT TO BE CARRIED WITH THE CRASH TENDER

Sl No.	*Item*	*Quantity*
1.	Armoured suction hose 100 mm dia complete with round thread couplings 2·5 m long (*see* IS : 3549-1983† and IS : 902-1974‡)	4 length
2.	Suction strainer for above (*see* IS : 907-1984§)	1 No.
3.	Basket strainer for item 2 (*see* IS : 3582-1984‖)	1 No.
4.	Suction wrenches (*see* IS : 4643-1984¶)	1 Pair
5.	Hose, 63 mm and 30 m long with instantaneous couplings (*see* Type II of IS : 636-1979** and IS : 903-1984††)	4 length

*Specification for enamel, synthetic, exterior (a) undercoating, (b) finishing (*first revision*).

†Specification for water suction and discharge hose of rubber, heavy duty (*first revision*).

‡Specification for suction hose couplings for fire fighting purposes (*second revision*).

§Specification for suction strainers, cylindrical type, for fire fighting purposes (*second revision*).

‖Specification for basket strainers for fire fighting purposes (cylindrical type) (*first revision*).

¶Specification for suction wrenches for fire brigade use (*first revision*).

**Specification for fire fighting hose (rubber lined, or rubberized fabric lined, woven-jacketed) (*second revision*).

††Specification for fire hose delivery couplings branch pipe, nozzles and nozzle spanner (*third revision*).

6.	Hose bandages [*see* IS : 5612 (Part 2)-1977[1]]	12 No.
7.	Hose clamps (*see* IS : 5612 (Part 1)-1977[2])	6 No.
8.	Dual propose jet and diffuser nozzle with instantaneous connection (*see* IS : 2871-1983[3])	2 No.
9.	Branch pipe (*see* IS : 903-1984[4])	2 No.
10.	Nozzle of sizes (*see* IS : 903-1984[4])	2 No.
	a) 12 mm	1 No.
	b) 19 mm	1 No.
11.	Nozzle spanner (*see* IS : 903-1984[4])	2 No.
12.	Dividing breechings (*see* IS : 5131-1986[5])	1 No.
13.	Dual head stand pipes (*see* IS : 5714-1981[6])	1 No.
14.	Hydrant valve key and bar (*see* : IS 910-1980[7])	1 No.
15.	Fire extinguisher, dry powder type 9 kg capacity suitable for fighting metal fires in charged condition with applicator (*see* IS : 11833-1986[8])	2 No.
16.	Self-contained portable emergency lights working on rechargeable batteries	2 No.
17.	Insulated plier with rubber gloves pair tested to 20 000 volts (*see* IS : 3650-1981[9])	2 Sets
18.	Copper bolt (*see* IS : 5200-1969[10])	1 No.
19.	Hacksaw 300 mm adjustable with 5 spare blades each (*see* IS : 5169-1969[11])	2 No.
20.	Sledge hammer 5 kg (*see* IS : 841-1983[12])	1 No.
21.	Hooks (*see* IS : 927-1981[13])	1 No.

[1]Specification for hose-clamps and hose-bandages for fire brigade use : Part 2 Hose-bandages (*first revision*).
[2]Specification for hose-clamps and hose-bandages for fire brigade use : Part 1 Hose-clamps.
[3]Specification for branch pipe, universal, for fire fighting purposes (*first revision*).
[4]Specification for fire hose delivery couplings branch pipe, nozzles and nozzle spanner (*third revision*).
[5]Specification for dividing breeching with control, for fire brigade use (*first revision*).
[6]Specification for hydrant, stand-pipe for fire fighting (*first revision*).
[7]Specification for combined key for hydrant, hydrant cover and lower valve (*second revision*)
[8]Specification for dry powder fire extinguisher for metal fires.
[9]Specification for combination side cutting pliers (*second revision*).
[10]Specification for bolt clippers.
[11]Specification for hacksaw frames.
[12]Specification for steel hammers (*second revision*).
[13]Specification for fire hooks (*second revision*).

22.	Crow bar (*see* IS : 704-1984*)	1 No.
23.	Axe, drift and rescue (*see* IS : 273-1983†)	1 No.
24.	Axe, felling (*see* IS : 703-1966‡)	1 No.
25.	Fireman's axe with belt firemen and pauches firemen (*see* IS : 926-1970§)	5 No.
26.	Quick release knife (*see* IS : 5486-1985‖)	5 No.
27.	Longline, hemp/manila 50 mm circumference, 30 m long (*see* IS : 1084-1983¶)	length
28.	Shortline, hemp/manila 50 mm circumference, 15 m long (*see* IS : 1084-1983¶)	length
29.	Lifting and pulling machine, 3 tonnes (*see* IS : 5604-1984**)	1 No.
30.	Hook grab	1 No.
31.	First-aid box	1 No.
32.	Blanket smothering	2 No.
33.	VHF radio telephone set	1 set
34.	Motorized barrel transfer pump	1 set
35.	Hydraulic rescue tools	1 set
36.	Compressed air positive pressure type breathing apparatus, 30 minutes working duration [*see* IS : 10245 (Part 2)-1982††]	1 No.
37.	Fire proximity suits complete with head wear, hand wear and foot wear	2 No.

*Specification for crow-bars and claw-bars (*second revision*).
†Specification for picks and beaters (*third revision*).
‡Specification for axes (*revised*).
§Specification for fireman's axe (*first revision*).
‖Specification for quick-release knife (*first revision*).
¶Specification for manila ropes (*third revision*).
**Specification for hand operated universal gearless pulling and lifting machines (*first revision*).
††Specification for breathing apparatus : Part 2 Open-circuit breathing apparatus.

(*Continued from page* 2)

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