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Mazdoor Kisan Shakti Sangathan

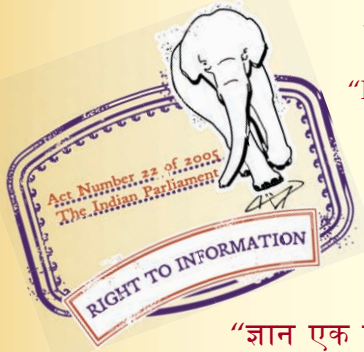
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Jawaharlal Nehru

“Step Out From the Old to the New”

IS 951 (2003): Functional Requirements for Crash Fire Tender for Air Fields [CED 22: Fire Fighting]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

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“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



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भारतीय मानक
हवाई पट्टी पर विमान गिरने पर बचाव
दमकल की कार्यात्मक अपेक्षाएँ
(चौथा पुनरीक्षण)

Indian Standard
FUNCTIONAL REQUIREMENTS FOR CRASH
FIRE TENDER FOR AIR FIELDS
(*Fourth Revision*)

ICS 13.220.10

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

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

This standard was first published in 1960 and revised in 1977 and subsequently in 1987. A lot of development has taken place in the field of civil aviation. 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 for utilizing full capability of ACFT. Producing foam, while the appliance is in motion, is also a desirable feature of the present day appliances.

Another development of 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 l/min, 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.

Dry chemical powder is being used as complimentary extinguishing medium. Halon 1211 has been deleted due to its ozone depletion potential (ODP). However, suitable substitute like Haltror-1 may also be used.

The fourth revision has been taken up on the recommendation of the Ministry of Defence and Airports Authority of India to bring the standard in line with the latest developments at the international level as indicated above.

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

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of specified value in this standard.

*Indian Standard***FUNCTIONAL REQUIREMENTS FOR CRASH
FIRE TENDER FOR AIR FIELDS***(Fourth Revision)***1 SCOPE**

This standard lays down the requirements regarding material, design, construction, workmanship and finish, accessories and equipment of air field crash fire tenders.

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 the standards indicated in Annex A.

3 GENERAL REQUIREMENTS

The air field crash fire tenders (ACFT) shall have a minimum rated water capacity and capability as given at 6.4. The primary extinguishing agent shall be foam with proportioning system. In addition to primary agent, there shall be complimentary extinguishing agent of a dry powder and suitable halon substitute.

4 CLASSIFICATION REQUIREMENTS

4.1 The ACFT shall consist of a water tank of capacity indicated below with necessary fittings:

<i>Class</i>	<i>Self-Defence Water Capacity</i>
	<i>Litres</i>
Class I	Up to 4 500
Class II	4 501 up to 6 500
Class III	6 501 up to 9 000
Class IV	9 001 and above

The primary extinguishing agent shall be either AFFF or protein based with 3 percent or 6 percent foam concentrate. For this purpose a foam tank of required capacity shall have to be provided. A mid-ship mounted pump driven of the vehicle PTO shall be fitted having a minimum output of 4 000 l/min at a delivery pressure 8.5 kg/cm² and suction lift 1.5 m. The pump shall also be capable of minimum output 3 000 l/min at higher pressure of not exceeding 12.5 kg/cm² to suit the monitor output for same suction mode.

4.2 The air field crash fire tender (ACFT) shall be capable of the following minimum performance with the monitor mounted on the roof cabin and two hand-lines on either side:

- a) A minimum output through monitor at pressure not exceeding 12.5 kg/cm² of 3 000 l to give effective monitor throw of 55 m of specified quality foam.
- b) A minimum output of 500 l of foam to each of the hand-lines on either side of the ACFT to give a minimum effective throw specified foam of 25 m at pump delivery pressures not exceeding 8.5 kg/cm² and using 30 m specified hose, and
- c) It shall be possible to operate the monitor and two hand-lines simultaneously at pump delivery pressure of 8.5 kg/cm².

4.3 The foam induction shall be automatic with changes in output required through a combination monitor and hand-lines. The ratio of foam compound induction shall be within a variation ± 0.5 with an induction setting from 3 percent to 8 percent ratio. 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 percent, 6 percent and 8 percent.

4.4 The system of foam production from monitor and hand-lines shall be so designed as to produce satisfactory quality of foam with the following minimum properties:

- a) Minimum expansion ratio, 8;
- b) 25 percent drainage time with protein foam, 2.5 min minimum; and
- c) 25 percent drainage time with AFFF, 3 min minimum.

4.5 It shall be possible for the air field crash fire tender (ACFT) to use water from a separate source of water supply for prolonged use and foam supply through a pick-up tube from drums at ground level.

4.6 The ACFT shall be equipped with self-defence foam nozzles for self protection particularly of the wheels. The angle of the front nozzle shall be so adjusted that a

throw of 6 m with a total coverage of 3 m width is achieved when the front nozzle are operated at minimum 6 kg/cm² pressure and should be capable of sustaining higher pressures up to 12.5 kg/cm². The water tank, foam tank, monitor and self-defence nozzle shall have pneumatically controlled ball valves for operation and control from within the cabin. The hand-lines should have pneumatic as well as manual control. All pneumatic control system shall be used with air supply at pressure available from the vehicle air brake system.

The vehicle air brake shall be tapped so that a minimum air pressure required for the operating vehicle is available all the time and the pneumatic control fire operation actuates when the air pressure in the systems 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 and to the pump shall be achieved through operation of pneumatic control from the cabin as well as from panel board.

4.7 The appliance shall be complete with all accessories and essential operating spares and tools. All accessories positions shall be predetermined on drawing and accessories shall have straps for safe location in addition to mounting brackets, wherever necessary. Where specific items are not required to be supplied, suitable arrangement shall be made for storage and secured; location of such items to suit the air field crash fire tender role. All locking and securing devices shall be of sufficient strength, reliability and shall be of quick opening and closing type for removal of accessories and other items without loss of time.

4.8 The unit shall be designed to be as compact as possible complete with ease of accessibility to all sub-systems for maintenance and repairs. The pump or foam making equipment and controls shall be so arranged that one man can operate foam or water lines from the driver's compartment or pump control panel (except monitor).

5 MATERIAL SELECTION AND TREATMENT

5.1 Material used for construction of the appliances shall be new, unused and free from all defects and imperfection that might affect the serviceability of the finished product. These shall be selected with a view to combine lightness with strength and durability.

5.2 Metals used in the assembly and components shall be of high strength weight ratio where practicable to effect saving in dead weight and thereby increase the payload capacity. Use of dissimilar metals in contact with each other which tends towards electrolytic corrosion shall be avoided and where used shall be compensated for metal plating spraying or by separation with suitable insulating material.

5.3 The appliance is intended for use in tropical conditions with continuous high humidity and heat. This fact shall be given full consideration while selecting material and for this reason use of rubber shall be avoided as far as possible. Wherever, it is unavoidable to use rubber parts, it shall be readily available, as spares.

5.4 Timber shall not be used in body construction.

5.5 All parts, which form waterways or come into contact with foam compound shall be of stainless steel. All metal pipelines shall be of stainless steel. All metal parts exposed to atmosphere shall either be of corrosion resisting material or treated suitably to resist corrosion. All ferrous fasteners shall be galvanized/chrome plated to avoid rusting over prolonged use.

6 WEIGHTS AND DIMENSIONS

6.1 The actual gross vehicle weight (weight of fully staffed, loaded and equipped vehicle) shall not exceed maximum permissible limit weight of chassis by manufacturer.

6.2 The weight shall be distributed as equally as practical over the axles and tyres of the vehicle. The difference of weight between tyres on any axle shall not exceed 5 percent of the average weight on tyre for that axle, and the difference in weight between axles shall not exceed 10 percent of the weight of the heaviest axle. Under no circumstances shall axle and tyre manufacturers ratings be exceeded.

6.3 The centre of gravity of the vehicle shall be kept as low as possible under all conditions of loading.

6.4 Dimensions and other performance requirements shall be as follows:

Acceleration	: For Class 1 0-80 kmph in 25 s and for Class 2 and above 0-80 kmph in 40 s
Maximum speed	: 100 kmph
Minimum angle of approach/departure	: 30°
Inter axle clearance	: 458 mm (minimum) (12° Min)
Under axle clearance	: 305 mm (minimum)
Side slope	: 20 percent
Gradability	: 50 percent
Stability	: 30/28/26/24° (minimum)
Fordability	: 608 mm
Turning circle radius	: Less than 3 lengths of ACFT
Steering pad circle	: 30 m radius at 30 kmph
Articulation	: 300 mm (minimum)
Braking efficiency with full load	: 10.7 m at 32 kmph and 40 m at 64 kmph for Class 1 to 3 and 12 m and 50 m for Class IV

Pump capacity	: 4 000 l/min (minimum) at 8.5 kg/cm ²
Steering	: Right hand drive preferably
Drive	: On all wheels

6.5 Overall height, length and width shall be kept to a minimum consistent with the best operational performance of the vehicle and the designed concept needed to achieve this performance and to provide optimum manoeuvrability and facilitate movement on public highways.

6.6 The vehicle shall be constructed such that a seated driver shall be able to see the ground, 6 m ahead of the vehicle and minimum 15°C above the horizontal without leaving seat. The vision in the horizontal plane shall be 90°C on each side from the straight position on a full forward control.

6.7 Adjustable rear view mirrors with a glass area of not less than 385 cm² shall be provided on each side of vehicle.

7 DESIGN AND CONSTRUCTION

7.1 Chassis

The vehicle shall have an all wheel drive for good mobility over cross-country conditions.

7.2 Engine

7.2.1 The vehicle's engine shall be high speed diesel (HSD) driven and have horse power, torque and speed characteristics to meet and maintain all vehicular performances specified in this standard which shall be certified by the manufacturer for the said application.

7.2.2 Fully laden vehicle shall consistently be able to accelerate maximum speed, as specified, with the engine and transmission at their normal operating temperature varying from +4°C to 50°C and at elevation up to 600 m above mean sea level.

7.2.3 The vehicle shall also be capable of ascending, stopping, starting and continued ascent on a 40 percent grade on dry pavement at a minimum speed of 1.6 to 8 kmph with extinguishing agents being discharged at maximum rated capacity from the turret.

Engine shall meet pollution norms declared by Government of India.

7.2.4 Engine shall be air/water cooled so that stabilized cylinder head and oil temperature remain within the engine manufacturers prescribed limits under all operational conditions and all ambient temperatures between -15°C and 50°C.

7.3 Fuel System

7.3.1 Fuel system shall qualify engine manufacturer's

requirement and shall include fuel pump, fuel filtration and flexible fuel lines, well protected from damage exhaust heat and ground fires.

7.3.2 Accessible filtration shall be provided for each fuel supply line and a drain shall be provided at the bottom of the fuel tank.

7.3.3 Gravity feed fuel tanks are not recommended/ acceptable.

7.3.4 Fuel tank capacity shall not be less than 150 l or for minimum 5 h continuous operation.

7.4 Exhaust System

7.4.1 The size of exhaust system shall be such that undue back pressure is not generated and under no circumstances exhaust gases enter the cabin. The system shall be of high grade, rust-resistant material.

7.4.2 Exhaust system shall be designed so as to protect it from damage that could result from rough terrain. Tail pipe of exhaust system shall be designed to discharge upwards or to the rear of the vehicle and not towards ground nor towards pump control panel operator and shall have rain cover.

7.5 Vehicle Electrical System

7.5.1 The vehicle shall be provided with one of the following systems:

- 12 V electrical and starting,
- 24 V electrical and starting, and
- 12 V electrical and 24 V starting.

7.5.2 The electrical system shall have negative ground including alternator and a fully voltage stabilizer. Alternator shall be at 100 percent of anticipated load at 50 percent engine speed and shall be belt driven by dual belts.

7.5.3 For (a) and (b) above, the curb idle minimum charging rate of the alternator shall be 30 Amp and for 24 V electrical/charging system the rate of alternator shall be 15 Amp.

7.5.4 Batteries shall be secured and well protected against physical injury vibration, water sprays and engine and exhaust heat. When an enclosed compartment is provided for batteries, it shall be well ventilated and batteries, shall be easily accessible for examination, test and maintenance.

7.5.5 The circuits shall be so designed that at no stage of operation, overloading, overheating or short-circuiting and fluctuation of voltage is experienced.

7.5.6 A built-in battery charger shall be provided on the vehicle to maintain full charge on all batteries. Grounded AC receptacle shall be provided to permit a

pull-away connection from local electric power supply to battery charger.

7.5.7 An engine coolant/preheating device shall be provided as an aid to rapid starting and high initial engine performance.

7.5.8 The electrical system shall be insulated waterproofed and protected against exposure from ground fires.

7.5.9 The effect of electromagnetic field of all electrical systems on radio sets shall be suppressed so that it does not interfere with functioning of radio sets.

7.6 Vehicle Drive

7.6.1 Transmission of power from engine to wheels shall be through a torque converter and automatic gear with provision of crawling speed not exceeding 8 kmph without application of brakes. The entire drive train shall be designed to have sufficient capacity to slip the wheels of the static loaded vehicle on surface having a co-efficient of friction between 0.4 to 0.8. A range of gear providing the specified top speed and a gradability of 50 percent shall be provided with sufficient intermediate gears to achieve the specified acceleration.

7.6.2 A transmission cooling system shall be provided to maintain normal oil temperature remains within the transmission manufacturer's prescribed limits under all operational conditions and at all ambient temperatures.

7.6.3 The provision of positive drive to each wheel by means of a fully locked drive line shall be required in order to maximize traction on low friction surfaces. Positive drive may be achieved either by the use of automatic locking and torque proportioning differentials, or may be manually selectable by the seated driver, while the vehicle is in motion, by use of a single control.

7.6.4 All wheel drive on these vehicles shall incorporate a drive to the front and rear axles which is engaged at all times during use. An inter-axle differential shall be installed with automatic or driver selected means of differential locking.

7.6.5 Front and rear axles shall have adequate capacity to carry the maximum imposed load under all intended operating conditions. The variations in axle tread shall not exceed 20 percent of the tyre sectional width at rated load.

7.7 Suspension

The suspension system shall be designed to permit the loaded vehicle to:

- a) travel at the specified speeds over improved surface,

- b) travel at moderate speeds over unimproved surface,
- c) provide diagonally opposite wheel motion 350 mm above ground obstacles without raising the remaining wheels from the ground,
- d) provide at least 50 mm of axle motion before bottoming of the suspension on ground level,
- e) prevent damage to the vehicle caused by wheel movement, and
- f) provide a good environment for the crew when travelling over all surfaces.

7.8 Rims, Tyres and Wheels

7.8.1 Tyres shall be selected to maximize the acceleration speed, braking and manoeuvring capabilities of the vehicle on paved surfaces without sacrificing performance on all reasonable terrain found within the airport boundary.

7.8.2 The purchaser shall provide a tyre description that reflects the off-road performance requirements necessitated by the soil conditions encountered at the operational airport, that may vary from an extremely fine grain soil or clay to an extremely coarse grain soil, sand or gravel in a dry, saturated or frozen condition. Tyres with cross-country tread design shall be offered.

7.8.3 All wheels on the vehicle shall be of the single wheel type with all rims, tyres and wheels of identical size and same tread design.

7.8.4 Rims, tyres, wheel and inflation pressures shall be approved by the respective manufacturer's as having sufficient capacity to meet the specified performance.

7.8.5 Size of tyre should be such to meet all vehicular performances preferably available in India.

7.9 Towing Connection

Four large tow eyes or tow hooks, capable of towing the vehicle without damage shall be mounted, two at the front and two at the rear of the truck and attached directly to the frame structure (chassis).

7.10 Brakes

7.10.1 The braking system shall feature service, emergency and parking brake systems. Service brakes shall have power actuation through air, hydraulic or air over hydraulic.

7.10.2 Service brakes shall be of all wheel type with split circuits so that failure of one circuit shall not cause total service brake failure and shall be able to hold fully loaded vehicle on a 50 percent grade.

7.10.3 The service brakes shall stop the vehicle within 10.7 m from 32 kmph and within 40 m from 64 kmph

on a dry hard appropriately roadway level, free from loose materials and sufficiently wide roadway without any part of vehicle leaving roadway.

7.10.4 The service brakes shall provide one power assisted stop with the vehicle engine inoperative for the stopping distances specified above for each vehicle class.

7.10.5 An emergency brake system shall be provided which is applied and released by the driver from the cabin and is capable for modulation by means of the service brake control.

7.10.6 The parking brake shall be capable of holding the fully loaded vehicle on a 20 percent grade without air or hydraulic assistance.

7.11 Brakes, Air System

7.11.1 When the vehicle is supplied with air brakes, the air compressor shall meet the following criteria:

- a) Compressor shall be engine driven,
- b) Compressor shall have the capacity for quick built-up of required tank pressure to operate the spring brakes and this built-up in pressure shall be accomplished within 12/15 s, and
- c) Compressor shall incorporate an automatic air-drying system immediately downstream from the compressor to prevent condensation build-up in all pneumatic lines.

7.11.2 Service reservoirs shall be provided with a volume at least 12 times the total combined brake chamber volume at full stroke. If the reservoir volume is greater than the minimum required, proportionately longer build-up time shall be allowed using the following formula:

$$\frac{\text{Actual reservoir capacity}}{\text{Required reservoir capacity}} \times 25$$

7.11.3 Reservoirs shall be equipped with air pressure regulator, drain and safety valves.

7.11.4 Provision for charging of air tanks by a pull away electrical connection used to power a vehicle mounted auxiliary compressor would be desirable.

7.11.5 A pull away air connection for charging of air tanks from an external air sources shall be provided.

7.11.6 Visual and audible low air pressure warning devices shall be provided. The low pressure warning device shall be visual and audible from the inside and audible outside of the vehicle.

7.11.7 Provision for mechanism to deactivate parking brakes in cases of pneumatic failure shall be provided to enable movement of ACFT.

7.11.8 Provision of pneumatic service outlets for inflating tyres shall be made from air compressor of ACFT, with a high pressure charging tube of 30 m and nozzle.

7.11.9 Air leakage from pressure system shall not exceed 0.5 kg/cm² so that at no stage the air pressure should reduce less than brake operating pressure in 8 h.

7.12 Steering

7.12.1 The chassis shall be equipped with power assisted steering with direct mechanical linkage from the steering wheel to the steered axle(s) to permit the possibility of manual control in the event of power assist failure.

7.12.2 The power steering shall have sufficient capacity to allow turning the tyres stop-to-stop with the vehicle stationary on a dry level, paved surface and fully loaded with not more than 7 kgf pull on wheel.

7.12.3 The wall-to-wall turning diameter of the fully laden vehicle shall be less than three times the vehicle length.

7.12.4 Vehicle shall be designed preferably for Right Hand Drive system so that driver's left hand is free for operation of controls.

7.13 Cabin

7.13.1 The cabin shall be mounted on the forward part of the vehicle and shall provide seating for 5 persons including driver (two adjustable seats and a long fixed seat for 3 crew members). In addition there shall be instrument panel and equipment as specified without any hindrance to crew.

7.13.2 The cabin shall meet the visibility requirements of the wind. Shield shall be of shatter proof safety glass and all other windows shall be constructed of approved safety glass. The cabin shall be provided with wide gutters to prevent foam and water dripping on the wind shield and side windows. There shall be enough space to keep and to enable the crew except driver to put on protective clothing and breathing apparatus (B.A.) set while on way to a call. The doors in the cabin should be operable at 90° for easy ingress and egress of crew.

7.13.3 The cabin shall be weather proof and shall be fully insulated thermally and acoustically with a fire-resistant material. The cabin may be of the unitized rigid body and frame structure type or it may be a separate unit flexibly mounted on the main vehicle frame. The cabin shall be constructed from materials of adequate strength to ensure a high degree of safety for the crew under all operating conditions including excess heat exposure and in the event of a vehicle rollover accident.

The cabin roof shall be covered with aluminium

chequered sheet in such a way that the entrapment of rain water/foam solution on cabin roof is totally avoided by providing necessary gutters for draining.

7.14 Instruments, Warning Lights and Controls

7.14.1 The minimum number of instruments, warning lights and controls consistent with the safe and efficient operation of the vehicle, chassis and fire fighting system shall be provided. All chassis instruments and warning lights shall be grouped together on a panel in front of the driver. All fire fighting system instruments, warning lights and controls shall be grouped together by function so as to provide ready accessibility as well as high visibility for the driver as well as the crew members.

7.14.2 All Instruments and controls shall be illuminated, with back lighting to be used where practical.

7.14.3 Grouping of both the chassis and fire fighting system instruments, warning lights and controls shall be easily removable as a unit or be on a panel hinged for back access by the use of quick disconnecting fittings for all electrical, air and hydraulic circuits.

7.14.4 The following instruments or warning lights or both shall be provided as a minimum:

- a) Speedometer/Odometer,
- b) Engine(s) tachometer,
- c) Fuel level indicator,
- d) Air pressure indicator,
- e) Engine(s) temperature indicator,
- f) Engine(s) oil pressure indicator,
- g) Voltmeter(s),
- h) Trafficator light,
- j) Transmission(s) oil temperature,
- k) Pump(s) pressure gauge (glycerin filled),
- m) Water tank level indicator,
- n) Foam tank level indicator,
- p) Low air pressure warning,
- q) Headlight beam indicator,
- r) Hazard warning light,
- s) PTO engagement light, and
- t) Oil temperature gauge light.

7.14.5 The cabin shall have all the necessary control within easy reach of the driver for the full operation of the vehicle and the pumping system. The following cabin controls shall be provided:

- a) Accelerator,
- b) Parking brake control,
- c) Steering wheel with directional signal control and horn,
- d) Rake pedal,

- e) Transmission range selector,
- f) Pump control or selector/PTO,
- g) Foam control,
- h) Siren switch(es),
- j) Auxiliary agent control,
- k) Under truck valve control,
- m) Remote turret controls,
- n) Light switches,
- p) Wind shield wiper and washer controls,
- q) Heater — defroster controls,
- r) Master electrical switch,
- s) Engine start/stop control,
- t) Side delivery 'ON/OFF' valve controls, and
- u) Side delivery 'ON/OFF' valve controls.

7.14.6 The following minimum equipment shall be provided in or on the cab:

- a) Heater/defroster;
- b) Driver's suspension seat with vertical, fore and aft adjustment with seat belt;
- c) Crew seats with individual retractable seat belts and grip hand-rails;
- d) Windshield washers appropriate for removing foam;
- e) Windshield wipers appropriate for removing foam;
- f) Siren;
- g) Horn;
- h) Sun visors, interior transparent;
- j) Outside rear view mirrors;
- k) Interior lighting;
- m) P. A. system with Microphone;
- n) R. T. set (VHF-AM) 2 sets; and
- p) Wind shield defrosting (optional).

7.15 Body

7.15.1 The body shall be constructed of materials that provide the lightest weight consistent with the strength necessary for off pavement operation over rough terrain and when exposed to excess heat. The body may be of the unitized with chassis rigid structure type or it may be flexible mounted on the vehicle chassis. It shall also include front and rear fenders or wheel wells, body panel shall be removable where necessary to provide access to the interior of the vehicle.

7.15.2 Access doors shall be provided for those areas of the interior of the vehicle which must be frequently inspected. In particular, access doors of sufficient size and number shall be provided for access to:

- a) engine,
- b) pump,

- c) foam proportioning system,
- d) battery storage,
- e) fluid reservoirs, and
- f) engine oil level indicator.

7.15.3 Suitable lighted compartments shall be provided for storage of equipment and tools to be carried on the vehicle. Compartments shall be water-tight and self-draining.

7.15.4 The working deck of the vehicle shall be adequately reinforced to permit the crew to perform their duties in the turret area, water tank top fill area, foam liquid top fill area and in other areas where access to auxiliary or installed equipment is necessary.

7.15.5 Hand-rails or bulwarks shall be provided where necessary for the safety and convenience of the crew rails and stanchions shall be strongly braced and constructed of a material, which is durable and resists corrosion.

7.15.6 Steps or ladders shall be provided for access to the top fill area. The lowermost steps(s) may extend below the angle of approach or departure or ground clearance limits if it (they) is (are) designed to swing clear. All other steps shall be rigidly constructed. All steps shall have a nonskid surface, with at least 150 mm toe room. Lowermost step(s) shall be no more than 558 mm above ground level when the vehicle is fully laden. Adequate lighting shall be provided to illuminate steps and walkways.

7.15.7 A heavy duty front bumper shall be mounted on the vehicle and secured to the frame structure.

7.15.8 Paint finish shall be 'Fire Red' in colour and shall be resistant to damage from fire fighting agents.

7.16 Fire Fighting Systems and Agents

7.16.1 Foam concentrate conforming to IS 4989 shall be used as primary extinguishing agent and dry powder (ABC type conforming to IS 14609) or suitable halon substitute as complimentary agent. The dry powder shall be foam compatible.

7.16.2 Foam system shall be proportioning type system and the agent shall be provided in separate tank on the vehicle.

7.16.3 All components of foam system including liquid tank, piping fill troughs, screens, valves and delivery connections shall be made of stainless steel.

7.17 Agents Pump and Drives

7.17.1 The water pump shall be made up of bronze/gunmetal and shall be single or multiple stage centrifugal type, designed for dependable emergency service. The vehicle tank and the piping shall be designed to eliminate entrapment of air.

7.17.2 The pump shall be capable of discharging at a rate equal to or more than the total discharge from monitor and two side lines and shall not be less than 4 000 l/min at 8.5 kg/cm² and 3 m static lift pump shall also be capable of minimum output of 4 000 l/min at higher pressure of 10.5 to 12.5 kg/cm² to suit monitor output for same suction.

7.17.3 Pump shall be single/double/multi-stage and closed impeller type where impeller(s) is dynamically balanced to reduce end thrust. Mechanical seal/gland shall be provided capable of running dry up to 1 min without damage.

7.17.4 The pump shall be mid-ship mounted. Pump control panel shall be located on either side of appliance in addition to one positioned at the cabin.

7.18 Pump Drive

7.18.1 The pump drive shall permit operation of pump and simultaneous operation of vehicle and shall not be affected by transmission ratio or clutch operation. The design of drive system shall prevent damage and minimize lurching of vehicle during simultaneous operation, and shall be capable of absorbing maximum torque delivered by engine and vehicle, without causing any stalling of engine and fluctuation of pressure.

7.18.2 The drive shall permit discharge at rated capacity of pump during vehicular speed from 1.6 to 8 kmph in forward as well as reverse gear.

7.19 Suction and Delivery Connection

7.19.1 The suction inlet and delivery outlets of the pump shall be fitted on the pump control panels on both sides of the appliance.

7.19.2 The suction connection shall be provided at suitable location in standard round threads of 125 mm/150 mm diameter and shall be corrosion-resistant. The location of suction inlet should be at lowest possible height preferably not exceeding 1 m from ground level. The inlet shall be provided with chromium plated brass blank cap.

7.19.3 Delivery connection shall be provided at suitable locations, operable from panel board and cabin in standard 63 mm female instantaneous couplings.

7.20 Piping, Couplings and Valves

7.20.1 All piping coupling and valves shall be made of material to prevent corrosive and galvanic action.

7.20.2 All valves shall be quarter-turn in manual operation and shall be easy in operation and free from leakage.

7.20.3 All piping shall be tested at 50 percent above maximum operating pressure for leakage.

7.20.4 Arrangement should be made to prevent overheating of pump at zero discharge and shall actuate automatically.

7.20.5 A drainage system with collector tubing from the low points on pump and piping shall be provided, operable with quarter turn valve.

7.20.6 All piping 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 valves/cock opens/closed shall be clearly marked near each valve/cock.

7.21 Water Tank

7.21.1 Water tank shall have rated capacity as per class and the tank outlets shall be arranged in such a way that 85 percent of rated capacity can be used if the vehicle is standing on:

- a) 20 percent side slope, and
- b) 30 percent ascending/descending slope.

7.21.2 Tank shall be made of stainless steel/glass (GRF) with epoxy coat as the case may be, tank with suitable longitudinal and traverse baffles, which shall permit easy access for internal inspection. The tank shall withstand hydrostatic pressure of 0.3 kg/cm².

7.21.3 Tank shall be provided with hinged lid, a top filling hole with filter of 450 mm size and a drain hole at the bottom.

7.21.4 Over-flow piping shall be arranged in such a way that it releases pressure on overflowing without wasting water during vehicles manoeuvres.

7.21.5 The water tank shall be separate from crew compartment, chassis, engine and easily removable, and shall be mounted on chassis in a manner that the torsional strains during movement are minimum.

7.21.6 Two external tank fill connections shall be provided both sides near operating panel, in standard 63 mm instantaneous coupling, with strainers and non-return valve.

7.21.7 A direct filling connection shall also be provided to fill the tank from open source of supply and shall be of sizes, so as to fill the tank in 2 min at 5 kg/cm² pressure.

7.21.8 Arrangement for lifting the tank without damage should be provided for repair and maintenance, etc.

7.22 Foam Tank

7.22.1 Foam tank shall have capacity of not less than 500 l or for more than 2 refills for water tank.

7.22.2 Tank shall be made of stainless steel/fiber glass (GRF). The tank with its fitment shall be able to withstand a hydrostatic pressure of 0.3 kg/cm².

7.22.3 The tank shall be separate and distinct from the body flexibly mounted on chassis to receive minimum torsion forces during vehicles movements and easily removable as a unit and should be suitably baffled to prevent surging.

7.22.4 The manhole of the tank of 450 mm diameter shall be used for foam filling and shall be clearly marked 'Foam'. Means shall be provided for automatic venting of the foam compound tank when foam is being produced or tank is filled.

7.22.5 The foam compound tube shall be positioned in such a manner that foreign matter or sludge shall not pass into the compound lines. The tube shall be fitted with gauze strainer of corrosion resistant material.

7.22.6 Drain hole at the bottom of sump and a liquid induction connection shall be provided in the tank.

7.22.7 Filling hole with a trough on top shall be connected with a pipe reaching at the bottom to avoid aeration in the liquid.

7.22.8 An external filling connection which can be approached at ground level shall also be provided to receive supply in tank with the help of foam pump.

7.22.9 All pipe lines shall be made of corrosion-resistant material and dissimilar materials that produce galvanic corrosion, shall not be selected where plastic piping is used, it shall be fabricated from un-plasticized resins unless the plasticiser has been proved not to adversely affect the performance characteristics of foam.

7.22.10 All foam piping shall be adequately sized to permit adequate flow and shall be arranged to prevent water entering the foam tank.

7.22.11 Automatic proportioning arrangements shall be provided with 3 percent, 6 percent and 8 percent induction ratio for varying discharge rates and shall not require frequent calibration.

7.23 Foam Monitor

7.23.1 One foam monitor shall be provided on the roof top of cabin, so that it can be operated by a crew member foam cabin as well roof top.

7.23.2 Monitor shall be capable of traversing 270° horizontally and elevating not less than 45° from horizontal axis and depression of 15°.

7.23.3 Monitor shall be capable of discharging total rated water tank quantity in not more than two to three minutes, and shall have a means provided for deflective

pattern of foam dispersal. The discharge rate of monitor shall not be less than 3 000 l/min with expansion ratio of 1 : (8–12).

7.23.4 Range of throw shall be as follows:

Straight stream at 45° elevation not less than 60 m
Disbursed stream at 15° depression

Far point	—	18 m
Width	—	6 m
Near point	—	12 m

7.24 Hand-Lines

7.24.1 ACFT shall have two sidelines on each side, operable from both cabin and panel.

7.24.2 In addition, one first aid hose reel connection shall also be provided, with 100 m rubber hose, tested at 15 kg/cm², with discharge capacity of 120 l/min.

7.24.3 Each side line shall have minimum discharge capacity of 500 l/min at 8.5 kg/cm² pressure on FB 10 X branch with an expansion of not less than 8 and minimum throw of 25 m when either all foam hand-lines are used simultaneously (with monitor not operating) or two of them are used in combination with monitor.

7.24.4 At least 240 m as per IS 636 Type B or equivalent hose with elastomeric coating, 63 mm shall be provided in suitable compartments, made of corrosion-resistant material with quick draining arrangement. These compartments shall not house any other equipment and shall be free from projections.

7.24.5 Auxiliary agent (dry powder) hand-lines shall have open/close nozzle discharge rate of 1.5 kg/s to 3 kg/s with 8 m range. The nozzle should be made of non-ferrous metal or stainless steel.

7.25 Foam Quality

Turret and hand-lines shall be capable of producing and discharging foam conforming to IS 4989 (Part 1).

7.26 Under Truck Nozzle

Minimum four under truck nozzles shall be provided to protect under side of vehicles, tyres and wheels, with at least 3 m wide pattern by each nozzle and a throw of 6 m discharging 400 l/min at operating pressure 6 kg/cm² ground sweep valves shall be controlled from cabin interior within easy reach of driver and a crew member.

7.27 Primer

7.27.1 Primer shall be provided along with pump, which shall have automatic engagement/disengagement provision.

7.27.2 Primer shall be capable of priming a suction column with 7.0 m lift in less than 30 s with indicator.

7.28 Lights and Electrical System

7.28.1 Following electrical gadgets shall be provided:

- Siren of 95 decibel sound output at 100 m ahead and not less than 90° within side at a distance of 100 m, siren shall be mounted on cabin roof top and shall be fully protected from foam spills, rain water, dust and any damage due to monitor rotation;
- A flashing ray light or light bar on cabin roof top;
- A horn;
- Headlights with selective pattern for light beams;
- Dual tail lights and stop lights;
- Signal light for turning, at four corners of vehicles with visual and audible signals;
- Spot light, at both ends of wind shield glass hand adjustable with 152 mm diameter;
- Adequate reflector and markers to indicate overall dimensions of vehicle;
- One reverse light with audible warning at the rear of vehicle;
- Panel lights, top duck light, cabin lights, engine compartment light, tools and equipment compartment lights, shall also be provided;
- Two inspection lamps shall also be provided and provision of additional connection to use these lamps shall be made in various compartments; and
- Two fog lamps. These shall be low mounted in front of the appliance.

7.28.2 All appropriate lights and gadgets detailed above shall be operable from driver's cabin.

7.28.3 Visual indication for different functions of engine, PTO pump, and pneumatic circuits by means of lamps in driver's cabin shall be preferred.

7.29 RT

7.29.1 VHF radio telecommunication, operable on frequency range between 118 MHz to 136 MHz crystal controlled at the Airport SMC frequency. It will be a self-contained transmitting/receiving set, with transmitting power of approximately 3.5 W unmodulated, RX-sensitivity -107 dbm. The equipment shall be suitable for use in all weather condition and shall be provided at suitable location in cabin. It should be operable at 12/24 V batteries and should be made of waterproof construction.

7.29.2 Adequate spares for 3 years and service/repair and spares manual should be provided. All manuals and diagrams should be in English language with

standardized international symbols. The set shall be suitably mounted to resist vehicles vibration and suppress engine noise or any other vehicular electromagnetic induction.

7.29.3 Provision of global positioning system (GPS) is considered desirable for satellite communication and route navigation followed by CFT

7.30 Dry Chemical Powder

7.30.1 One units of 125 kg each dry chemical powder (foam compatible) shall be provided, using dry nitrogen as propellant gas so as to achieve minimum 8 m throw and a discharge rate of 1.5 kg/s.

7.30.2 All pipelines, fittings, containers and gauges shall confirm to relevant Indian Standards.

7.30.3 Nitrogen cylinders shall be certified from department of explosive, and shall have universal filling connections.

7.30.4 Provision shall be made for purging of pipelines after use, depressurization of powder tank and check valve to prevent powder entering gas cylinders.

7.30.5 A means of pressure release in situation of over pressure shall be provided with filling, opening and suitable tight fighting cap. A 30-m long rubber hose confirming to IS 636, with squeeze grip nozzle shall be provided.

7.31 Suitable substitute for Halon 1211 is also recommended as complimentary agent in place of dry chemical powder, in confirmation to required technical guidelines for the media.

7.32 Other Equipment

7.32.1 Public Announcement (PA) equipment, battery operated, transistorized with microphone fitted in the cab and loudspeaker fitted on the roof top of cabin capable of being rotated from cabin.

7.32.2 A spare battery charger.

7.32.3 Instruction book, spare parts catalogue and repair manual.

The appliance shall be supplied complete with equipment detailed in Annex B.

8 MANUFACTURER'S CERTIFICATE AND GUARANTEE

8.1 Manufacture shall provide a certificate for the appliances confirming to all specifications.

8.2 A guarantee shall be furnished by manufacturer for a period of 12 months, for material workmanship and smooth functioning of vehicle from the date of delivery at consignee's place.

8.3 The manufacturer shall be responsible for replacing any parts, which may become unserviceable, due to use of defective and sub-standard materials and bad workmanship, during the period of guarantee, free of all charges.

8.4 Manufacturer shall ensure:

- a) availability and supply of spares at very short notice for at least 10 years,
- b) induction training for selected staff as mutually agreed at a place at suppliers cost in India,
- c) other technical help that may be required at the time of induction, and
- d) after sales service.

8.5 Manuals

The following literature/manuals shall be provided:

- a) *Operators manual* — This manual should contain technical description of the equipment with layout drawings, illustration 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.
- b) *Parts manual* — This manual shall contain fully exploded and illustrated details of the entire 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 of source of supply.
- c) *Repair manual* — This manual shall contain fully illustrated instructions on repair and overhaul of all items supplied against this specification including proprietary items fitted/supplied with details of fitment tolerances, special tools to be used, procedure for dismantling major assemblies.
- d) A complete set of general arrangement drawings showing layout of equipment, piping and fluid controls, electric and structural design shall be also submitted.

9 MARKINGS

Following marking shall be made on the body of the vehicle:

- a) Airport fire service;

- b) Year of manufacture;
 c) Engine and chassis number;
 d) Fire service emblem;
 e) Job or SI No.;
 f) Capacity of pump, water tank, foam tank;
- g) Pump SI No.;
 h) Chassis supplier's name and country of origin;
 j) Left hand drive warning; and
 k) Precautionary instructions.

ANNEX A

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
636 : 1988	Non-percolating flexible fire fighting delivery hose (<i>third revision</i>)	4643 : 1984	cutting pliers (<i>second revision</i>)
704 : 1984	Specification for crow-bars and claw-bars (<i>second revision</i>)	4989	Specification for suction wrenches for fire brigade use (<i>first revision</i>)
903 : 1993	Specification for fire hose delivery couplings, branch pipe, nozzles and nozzle spanner (<i>fourth revision</i>)	(Part 1) : 1985	Specification for foam concentrate (compound) for producing mechanical foam for fire fighting
907 : 1984	Specification for suction strainers, cylindrical type for fire fighting purposes (<i>second revision</i>)	(Part 2) : 1985	Protein foam (<i>second revision</i>)
927 : 1981	Specification for fire hooks (<i>second revision</i>)	5131 : 2002	Aqueous film forming foam (AFFF)
1084 : 1994	Manila ropes — Specification (<i>fourth revision</i>)	5169 : 1986	Specification for dividing breaching with control for fire brigade use (<i>second revision</i>)
2084 : 1991	Code for designation of pig iron (<i>second revision</i>)	5200 : 1998	Specification for hacksaw frames (<i>first revision</i>)
2871 : 1983	Specification for branch type, universal for fire fighting purposes (<i>first revision</i>)	5612	Bold clippers — Specification (<i>first revision</i>)
3582 : 1984	Specification for basket strainers for fire fighting purposes (cylindrical type) (<i>first revision</i>)	(Part 1) : 1997	Specification for hose-clamps hose bandages for fire brigade use
3650 : 1981	Specification for combination side	(Part 2) : 1997	Hose-clamps (<i>first revision</i>)
		5714 : 1981	Hose bandages (<i>first revision</i>)
		14609 : 1999	Specification for hydrant stand pipe for fire fighting (<i>first revision</i>)
			Specification for A, B, C dry powder for fire fighting

ANNEX B

(Foreword, and Clause 7.32.3)

SCHEDULE OF EQUIPMENT TO BE CARRIED ALONG WITH ACFT

<i>Sl No.</i>	<i>Item</i>	<i>IS No.</i>	<i>Quantity</i>	<i>Remarks</i>
(1)	(2)	(3)	(4)	(5)
i)	Armoured suction hose 125 mm diameter complete with round thread couplings 2.5 m long	2410	4 Lengths	—
ii)	Suction strainer for above	907	1 No.	—
iii)	Basket strainer for item 2	3582	1 No.	—
iv)	Suction wrenches	4643	1 Pair	Fixed type
v)	RRL hose, 63 mm and 30 m long with instantaneous coup lines	636	4 Lengths	These are in addition to the 4 lengths connected to the branch pipe
vi)	Hose bandages, rubberized	5612 (Part 2)	12 Nos.	—
vii)	Hose clamps	5612 (Part 1)	6 Nos.	—
viii)	Dual purpose jet diffuser nozzle with hand control and trigger for instantaneous connection	2871	2 Nos.	—
ix)	Light alloy branch pipe	903	2 Nos.	—
x)	Nozzle for light alloy branch pipe sizes:	903		
	a) 12 mm		2 Nos.	—
	b) 19 mm		1 No.	—
xi)	Nozzle spanner	903	2 Nos.	—
xii)	Light alloy dual head stand pipes with instantaneous outlets	5714	1 No.	—
xiii)	Hydrant valve key and bar		1 No.	—
xiv)	Foam making branch pipe (jet and spray)		5 Nos.	—
xv)	Self-contained portable emergency lights working or rechargeable batteries		2 Nos.	—
xvi)	Insulated plier as per IS 3650 rubber gloves pair tested to 20 000 V	3650	2 Nos.	—
xvii)	Cropper bolt	5200	1 No.	—
xviii)	Hacksaw 300 mm adjustable with 6 spare blades each	5169	2 Nos.	—
xix)	Hooks salving	927	1 No.	—
xx)	Sledge hammer 1.8 kg		1 No.	—
xxi)	Crow bar	704	1 No.	—
xxii)	Axe, drift and rescue		1 No.	—
xxiii)	Axe, felling		1 No.	—
xxiv)	Firemen axe with belt fireman and pouches fireman	927	5 Nos.	To be worn by crew on duty
xxv)	Quick release knife	2084	5 Nos.	—
xxvi)	Longline, hemo, manila 50 mm circumference, 30 m long	2080	1 Length	—
xxvii)	Shortline, hemo/manila 50 mm circumference 30 m long	1084	1 Length	—
xxviii)	Hook grab		1 No.	—
xxix)	Powder driven saw		1 No.	—
xxx)	Hydraulic cutter and spreader		1 No.	—
xxxi)	Electric generator 5 kVA (4 stroke petrol driven)		1 No.	—
xxxii)	Breathing Apparatus Set		2 Nos.	—
xxxiii)	Closed proximity suit		2 Nos.	—
xxxiv)	Aluminium extension ladder (10.5 m)		1 No.	—

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