

**ENGINEERING AND EQUIPMENT STANDARD**  
**FOR**  
**FIRE FIGHTING TRUCKS AND PUMPS**

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## 0. INTRODUCTION

This Standard has been compiled to specify various fire trucks and pumping units used in the oil refineries, chemical plants, gas plants and wherever applicable such as in production units, exploration, oil terminals, distributions and affiliated industries. This standard covers a number of basic fire trucks equipped with selection of fire fighting systems.

Depending upon the risk of the plants, the size of the area and fixed fire fighting installations or facilities, the fire trucks and fire equipment shall be so designed or selected to give satisfactory performance and to act quickly, and thus reducing loss of lives, injuries and damages.

This Standard will eliminate the use of similar types of trucks and equipment which have different operational and maintenance procedures and is divided into the following sections:

- |                    |  |
|--------------------|--|
| <b>Section I</b>   | Engineering Standard Specification of Major Fire Fighting Trucks   |
| <b>Section II</b>  | Various Fire Fighting Systems for Installation on Major Fire Fighting Trucks   |
| <b>Section III</b> | Proposed Standard Specification of General Purpose and Major Foam Tender Fire Fighting Trucks  |
| <b>Section IV</b>  | Standard Specification of Auxiliary Fire and Emergency Vehicles comprising of the following: <ul style="list-style-type: none"><li>1) Foam Liquid Dispensing Truck</li><li>2) Dry Chemical Powder Fire Extinguishing Truck</li><li>3) Twin Agent Fire Extinguishing Truck</li><li>4) Water Tender</li><li>5) Emergency Service and rescue Vehicles</li><li>6) Hydraulic Boom</li></ul> |
| <b>Section V</b>   | Brief Description and List of Proposed Types of Fire Fighting Trucks   |
| <b>Section VI</b>  | Portable, Trailer Mounted and Fixed Fire Fighting Pumps  |
| <b>Section VII</b> | Material Procurement Standard  |



## 1. SCOPE

This Standard describes the minimum engineering and material requirements for all types of fire fighting trucks, emergency vehicles and fire pumps utilized in Iranian Petroleum and affiliated industries and gives general concepts for the manufacturing design of vehicles and relevant material and equipment which have been installed on them.

The application of this Standard would make uniformity in the design of equipment, their operation and maintenance, and also will facilitate the training of fire fighting personnel.

## 2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The editions of these Standards and Codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in Standard Codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor.

### BSI (BRITISH STANDARD INSTITUTION)

SUPPLEMENT TO BS 5000	"Pressure Vessels"
BS- 336-6391	"Fire Hose Couplings and Ancillary Equipment"

### ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)

ANSI-B 16.5	"Pipe Flanges and Fittings"
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### ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

ISO-2954	"Mechanical Vibration of Rotating Reciprocating and Machinery Equipment"
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### DIN (DEUTSCHES INSTITUT FÜR NORMUNG EV.)

DIN-50049	"Documents for Material Tests"
DIN-14690	"Fire Fighting Equipment"
DIN-49462/49463	"Splash Proof and Water Tight Multiple Socket Outlets"
DIN-45639	"Inside Noise of Motor Vehicle"
DIN-6270	"Internal Combustion Engine"

### IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSION)

IEC-529 (IP-Code)	"Degree of Protection Provided by Enclosures"
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## 3. DEFINITIONS AND TERMINOLOGY

For the purpose of this Standard, the following definitions shall be used.

### Fire Fighting Truck

Applies to fire fighting vehicle, fire engine and automotive fire apparatus.

### F. L. C.

Foam-Liquid Concentrate.

**Fire Fighting Crew**

Professional fire fighters of 3 to 6 men.

**Aqueous Film Forming Foam**

Also known as AFFF is a mixture of fluorocarbon and hydro-carbon surfactants.

**Fluoro-Protein Foam Compound**

Conventional protein foam modified by the addition of fluorocarbon surfactants.

**High Risk Areas**

Include Refineries, Petrochemical Plants, Production Facilities Gas plants and other related installation which provision of manned or retained fire stations are approved by IPI.

**IPI (IRANIAN PETROLEUM INDUSTRIES)****Dry Powder**

Fire extinguishing agent in fine form primarily of Sodium bicarbonate or urea base potassium bicarbonate (MONNEX or PURPLE K) (see Note) with added material to produce water repellency and free flowing characteristics.

**Note:**

Monnex and purple K are trade names.

**Premix Foam**

Foam liquid mixed with water in proportion of six to ten percent.

**4. UNITS**

This standard is based on International System of Units, (SI) except where otherwise specified.

**5. CATEGORIES**

The fire fighting vehicles used in petroleum industries are categorized by its load, liquid pumping capacity and its pressure therefore the following categories can be used.

- 1) A major fire fighting truck with water and foam tanks in excess of 5000 L and pumping capacity of over 4000 L/min. at 7 bar.
- 2) General purpose or medium size fire truck with water and foam liquid tank capacity of 3000 to 5000 L and pumping capacity of 2000 to 4000 L/min at 7 bar.
- 3) Auxiliary fire trucks such as fire fighting boom, foam- liquid or water tenders, dry powder and twin agents trucks.
- 4) Light vehicles include three types as follows:

- a) Light fire fighting vehicles with foam-water capacity of 1000 L and pumping capacity of 800 L/min. at 7 bar;
- b) Emergency combined rescue vehicles.
- c) Emergency equipment carrier.

**Notes:**

- 1) For major fire fighting and general purpose trucks at least one ton of weight of personnel and other equipment should be added.
- 2) For light vehicles at least 500 kg of weight of other equipment and personnel should be added.
- 3) Fire fighting trucks used in Oil, Gas and Petrochemical Industries are generally designed and manufactured in accordance with the nature of services required, therefore all parts shall be strong enough to withstand the expected general requirements with the minimum maintenance when under full load.

## SECTION I

### 6. FIRE FIGHTING TRUCKS, DESIGN SPECIFICATIONS

#### 6.1 General

**6.1.1.1** The purpose of the fire fighting trucks for petroleum industries is to carry fire fighters, foam-liquid, Fire fighting chemicals and equipment to the scene of fire and inject F.L.C. into water stream, generating foam and utilizing chemical for fire fighting. The water required can be taken from fire water main, open water or other sources such as water tanks.

**6.1.1.2** Design specification in this section includes major and general purpose fire trucks and the following main equipment shall be installed.

- A water pump for boosting the pressure of water taken from water main or from other sources.
- A.F.L.C. tank
- A.F.L.C. pump
- Water inlet and outlet manifold
- Orifices and instruments for water flow measurement and F.L.C. lines and instrumentation to enable ratio control of these flows for making water/foam solution.
- Dry chemical fire extinguishing system
- Premix water/foam system and hose reel equipment used for first aid fire fighting operation or twin agent foam/dry chemical extinguishing system

The specific requirements which are stated in this section gives general concepts for the design of fire fighting trucks together with fire fighting system that can be installed on the vehicles.

#### 6.2 The Vehicle

The fire-fighting vehicle shall be designed for industrial purposes and in compliance with modern engineering practices. It is also essential to meet Iranian traffic regulations for overall weight, axle weight, power/weight ratio, lighting, etc. and this should be stated in the exchange of information with the manufacturer. The vehicle shall function primarily on a fire water circuit (from hydrants) with a pressure of 6 to 16 bar. Certain vehicles shall, however, also be provided with facilities and equipment for suction from open water.

The vehicle shall be so constructed to assist visual inspection, maintenance and repair. All equipment shall be located so that it will be readily accessible. Fire-fighting systems shall be simple and easy to operate, to facilitate training of personnel and use in an emergency.

The installation of mechanical, electrical, pneumatic and hydraulic components shall be located in such a way that dismounting or repair is not obstructed by the chassis structure or any other component, and electrical wiring and pneumatic tubing is not damaged during operating of the vehicle. The electrical system shall be dustproof and waterproof to at least a minimum of IEC publication 529 (IP. code) all instruments shall be of marine-type construction.

The vehicle shall also be driven on a steering pad around a circle of 30 m radius. The steering wheel rotation shall increase with increasing speed to ensure the vehicle does not exhibit oversteer characteristics.

### 6.2.1 Dimensions

Underchassis clearance of the vehicle shall permit mobility in soft soils and rough terrain. The following shall be minimum dimensions:

Angle of Approach	20°
Angle of Departure	20°

Interaxle clearance Angle 20° with 458 mm minimum clearance at midwheel base.

Underaxle clearance 330 mm under axle differential housing bowl.

Overall height, length, and width of the vehicle shall be held to a minimum consistent with the best operational performance of the vehicle and the design concepts needed to achieve this performance and to provide optimum maneuverability and facilitate movement on the roads.

The vehicle shall be constructed such that a seated driver, having an eye height of 800 mm, shall be able to see the ground 6 m ahead of the vehicle and have vision up to 15° above the horizontal plane without leaving the driver's seat. The vision in the horizontal plane shall be at least 90° on each side from the straight ahead position.

### 6.2.2 Weights

The actual gross vehicle weight of the fully staffed, loaded, and equipped vehicle ready for service shall not exceed the manufacturer's gross vehicle weight rating.

The weight shall be distributed as equally as practical over the axles and tires of the fully laden vehicle. The difference in weight between tires on any axle shall not exceed 5 percent of the average tire weight for that axle, and the difference in weight between axles shall not exceed 10 percent of the weight of the heaviest axle. The front axle shall not be the heaviest axle. Under no circumstances shall axle and tire manufacturer's ratings be exceeded.

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

Single rear axle is generally recommended, but double axle may be specified.

### 6.2.3 Chassis

**6.2.3.1** The vehicle shall be able to carry all of the equipment specified and to tow at least a trailer. The chassis shall be provided with towing connections at the rear and two pull/push connections at the front, the additional forces when using these connections shall be specified.

**6.2.3.2** The vehicle shall be suitable for use in areas as specified by the IPI authorities. It should have a wheel base of approximately 4 to 4.50 m and be between 2.40 and 2.50 m wide.

**6.2.3.3** Fenders and guards shall be braced and firmly secured. Proper clearance shall be provided for chains.

**6.2.3.4** The steering mechanism for nondriving front axles shall be capable of turning the front wheels to an angle of at least 30 degrees to either right or left. Power or power assist steering shall be provided on all fire trucks.

**6.2.3.5** The transmission and clutch shall be of such type as to operate smoothly and effectively under all conditions of service.

**6.2.3.6** The chassis shall be equipped with:

- Wheels fitted with radial tyres suitable for wet roads.
- Fuel tank, 200 litres minimum capacity with the possibility of refilling during operation (fitted on the inside of the chassis).

- Air pressure vessel if necessary fitted on the inside of the chassis.
- Stabilizers on front and rear axles.

## **6.2.4 Engine**

### **6.2.4.1 Diesel**

Unless otherwise specified the engine shall be diesel and shall have horsepower, torque, and speed characteristics to meet and maintain all specified vehicular performance characteristics in this standard. The engine manufacturer shall certify that the installed engine is approved for this application.

The fully laden vehicle shall consistently be able to accelerate from 0-80 km/h on dry level concrete pavement within the time specified in Table 1. Maximum speed shall not be less than 100 km/h.

**TABLE 1**

<b>CLASS</b>	<b>MINIMUM F.L.C. OR WATER CAPACITY (LITERS)</b>	<b>ACCELERATION TIME (0-80 km/h) IN SECONDS</b>
1	4,000	25
2	6,000	30
3	10,000	40
4	12,000 AND OVER	45

The above acceleration times shall be achieved with the engine and transmission at their normal operating temperatures at any ambient temperature varying from -18°C to 58°C and at elevations of 600 m above sea level unless a higher elevation or lower minimum temperature is specified.

### **6.2.4.2 Fuel systems**

The fuel system supplied by the engine manufacturer shall be of sufficient size to develop the rated power. The manufacturer shall supply fuel lines and fuel filters in accordance with the engine manufacturer's recommendations. To prevent engine shutdown due to fuel contamination, dual filters in parallel, with proper valving so that each filter can be used separately, may be desired.

Fuel tanks shall not be installed in a manner that permits gravity feed.

A dry type air filter shall be provided. Air inlet restrictions shall meet the engine manufacturer's recommendations. Air inlet shall be protected to prevent water and burning embers from entering the air intake system. The manufacturer shall provide an air restriction, indicator, mounted in the cab, visible to the driver.

An engine governor shall be installed which will limit the speed of the engine under all conditions of operation to that speed established by the engine manufacturer; this shall be the maximum no-load governed speed. A tachometer shall be provided on the instrument panel in the driving compartment for indicating engine speed.

### **6.2.4.3 Gasoline engines**

Fuel lines and filters and/or strainers of an accessible and serviceable type, as recommended by the engine manufacturer, shall be provided. The filters or strainers shall be of a type which can be serviced without disconnecting the fuel line. Where two or more fuel lines are installed, separate fuel pumps operating in parallel with suitable check valves and filtering devices shall be provided. The fuel line(s) shall be so located or protected as not to be subjected to excessive

heating from any portion of a vehicle exhaust system. The line(s) shall be protected from mechanical injury. Suitable valves and drains shall be installed. The carburetor(s) of a gasoline engine shall be nonadjustable, with the exception of the idle setting, of sufficient size to develop the rated power, and so located as not to be subjected to pocketing of vapor or excessive heating. Automatic choke shall be provided. The gasoline feed system shall include an electrically operated fuel pump located within or adjacent to the fuel tank.

### **6.2.5 Fuel tank**

**6.2.5.1** For light vehicles, the fuel tank shall not be less than 100 liter capacity. The capacity for apparatus with pumping equipment shall be of a size which shall permit the operation of the pumping for not less than 3 hr. when operating at rated pump capacity. A suitable method of venting and means for draining directly from the tank shall be provided. The tank fill opening shall be conspicuously labeled as to the type of fuel used.

**6.2.5.2** When a large capacity fuel tank is desired the capacity specified by purchaser in Special Provisions shall be supplied.

**6.2.5.3** Only one fuel tank is to be furnished where rated tank capacity is 150 Litres or less. The fuel gage shall indicate the proportionate amount of fuel in the tank system at any time.

**6.2.5.4** Tank and fill piping shall be so placed as to be protected from mechanical injury, and not be exposed to heat from exhaust or other source of ignition. Tank shall be so placed as to be easily removable for repairs.

Automatic engine shutdown systems shall not be provided, but auto overspeed protection by means of shut down valve in air intake system in case of ignition of flammable gases shall be provided.

### **6.2.6 Exhaust system**

The exhaust piping and discharge outlet shall be so located as to not expose any portion of the vehicle to excessive heating. Exhaust pipe discharge shall not be directed toward the pump operator's position. Silencing devices shall be provided. Exhaust back pressure shall not exceed the limits specified by the engine manufacturer. Where parts of the exhaust system are exposed so that they are likely to cause injury to operating personnel, suitable protective guards shall be provided. Spark arrestors shall be also provided and the exhaust system shall be of high-grade rust resistant materials.

### **6.2.7 Engine cooling systems**

An adequate cooling system of sufficient capacity shall be provided such that overheating will not occur during stationary use in tropical areas and during prolonged fire fighting under full operational conditions of both water and foam pumps (max. ambient temperature shall be specified).

The cooling fluid shall be a high-efficient cooling medium with an anti corrosion additive.

Radiator shutters, when furnished for cold climates, shall be of the fail safe automatic type, and shall be designed to open automatically upon failure.

Adequate and readily accessible drain cocks shall be installed at the lowest point of the cooling system, and at other such points as are necessary to permit complete removal of the coolant from the system. Drain cocks shall not open accidentally due to vibration.

The radiator shall be so mounted as not to develop leaks due to ordinary running and operating nor be twisted or strained when the apparatus operates over uneven ground. Radiator cores shall be compatible with commercial anti-freeze solutions and of straight tube construction for easy mechanical maintenance.

The cooling system shall be provided with an automatic thermostat for rapid engine warming.

### 6.2.8 Brakes

**6.2.8.1** Fire trucks brakes shall be of the most efficient and fail safe system. Brake performance shall comply with applicable regulations at the date of manufacture.

The braking shall feature service, emergency, and parking brake systems. Service brakes shall be power actuation air, hydraulic, air over hydraulic. Expanding shoe and drum brakes or caliper disc brakes or the most reliable type shall be furnished. A brake chamber shall be provided for each wheel and shall be mounted so that no part of the brake chamber projects below the axle.

**6.2.8.2** Service brakes shall be of the all-wheel type with split circuits so that failure of one circuit shall not cause total service brake failure.

**6.2.8.3** The service brakes shall be capable of holding the fully loaded vehicle on a 50 percent grade.

**6.2.8.4** As a minimum requirement the service brakes shall be capable of bringing the fully laden vehicle to complete stop within 10.7 m from 32 km/h, and within 40 meters from 64 km/h by actual measurement on substantially hard surface road that is free from loose material, oil or grease.

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

**6.2.8.6** The service brakes shall provide one power assisted stop with the vehicle engine inoperative, for the stopping distances specified above for the vehicle.

**6.2.8.7** An emergency brake system shall be provided which is applied and released by the driver from the cab and is capable of modulation by means of the service brake control. With a single failure in the service brake system of a part designed to contain compressed air or brake fluid, other than failure of a common valve, manifold, brake fluid housing, or brake chamber housing, the vehicle shall stop in no more than 88 m from 64 km/h without any part of the vehicle leaving a dry, hard, approximately level roadway with a width equal to the vehicle width plus 110 cm.

**Note:**

**Newly developed service braking system shall be considered.**

### 6.2.9 Brakes-air system

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

- a) the compressor shall be engine driven;
- b) the compressor shall have capacity sufficient to increase air pressure in the supply and service reservoirs from 5 to 7 bars when the engine is operating at the vehicle manufacturer's maximum recommended revolutions per minute (rpm) in a maximum of 25 seconds;
- c) the compressor shall have the capacity for quick build-up of tank pressure from 0.35 bars to the pressure required to release the spring brakes, and this build-up in pressure shall be accomplished within 12 seconds;
- d) the compressor shall incorporate an automatic air drying system immediately downstream from the compressor to prevent condensation build-up in all pneumatic lines.

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

**6.2.9.3** Service air reservoirs shall be provided. The total of the service air reservoir volume shall be 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.



**6.2.9.4** Air reservoirs shall be equipped with drain and safety valves.

**6.2.9.5** If specified provision shall be made for charging of air tanks by a pull away electrical connection used to power a vehicle-mounted auxiliary compressor.

**6.2.9.6** When specified by the purchaser, a pull away air connection for charging of air tanks from an external air source shall be provided.

#### **6.2.10 Gears & power take-off**

- Synchro-mesh gearbox shall be fitted with a switch to operate the reversing lights and, when specified, an on-off buzzer. If an oil cooler is to be supplied, a connection for a temperature indicator/alarm will also be required.

- PTO (Power Take-Off) transmission for the booster pump shall be selected to transmit the torque and power required by the booster (and foam) pumps when rotating at the required engine speed with all discharge branches completely open.

- PTOs should preferably operate electrically/pneumatically from the driver's cabin and, when specified, from the operating panel. A manually operated PTO may be specified when required.

#### **6.2.11 Steering**

**6.2.11.1** 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.

**6.2.11.2** The power steering shall have sufficient capacity to allow turning the tires stop-to-stop with the vehicle stationary on a dry, level, paved surface and fully loaded.

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

#### **6.2.12 Cabin**

**6.2.12.1** The cabin shall provide seating for a minimum of driver plus one crew member including individually adjustable, suspension-type driver's seat and space for all instrument controls and equipment specified without hindering the crew. Additional crew of 3 to 4 will be seated in a separate crew compartment.

Wide opening doors shall be provided on each side of the cabin with necessary steps and handrails to permit rapid and safe entrance and exit from the cabin. Cabin design shall take into consideration the provision of ample space for the crew to enter and exit the cabin and carry out normal operations while wearing full protective equipment.

**6.2.12.2** The cabin shall meet the visibility requirements of clause 6.2.1. Interior cabin reflections from exterior and interior lighting shall be minimized. The windshield shall be of laminated or shatter-proof safety glass with upper 20-30% tinted green. The windshield shall be fitted with at least two wide arc wiper having two speeds and electrically operated washing system with at least two nozzles 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 windshield and side windows. There shall be a quick opening passage providing access to the roof monitor.

The driver's cabin shall be fitted with a sunscreen fitted above the windscreen on the outside.

Two adjustable sunshades having a minimum length of 380 mm and a minimum width of 130 mm are also required on the inside.

**6.2.12.3** The crew cabin shall be weatherproof, 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 roll-over accident.

**6.2.12.4** The framework of the cabin shall be built up from sections mounted on shock absorbers and be of such construction, that harmful stresses will not occur during normal use and the crew will be offered maximum protection in the case of accidents.

The cabin shall be equipped with driving mirrors on the right and left hand side of the vehicle which shall also be suitable as parking mirrors. The mirrors shall be adjustable, free from vibration and fastened in such a way that they cannot move out of position under normal driving conditions.

Provision shall be made for mounting radio and telephone. Operation of radio-telephone shall be from the cabin and so mounted permitting quick servicing and replacement. Suitable shielding shall be provided to permit radio operation without undue interference.

Adequate measures shall be incorporated for:

- Protection of the crew during a frontal collision;
- protection of head and neck of the crew in the event of a rear collision;
- strength of the doors, the door frame, locks and hinges during a sidelong collision;
- solidity of the seat attachments;
- strength of the seat mounting and security of the seat safety belts.

The maximum noise level (under full load conditions) shall be 85 dB.

### **6.2.13 Floor**

The floor of the cabin shall be treated with an anti-resonance material. The floor of the driver's compartment shall be covered with a loose wear-resistant profiled rubber sheet fitted with a foam plastic underlayer, protected with a water-proof layer.

The floor of the crews compartment shall be covered with a minimum ripped sheet or other equivalent non-slip material.

The lower part of the doors shall be covered on the inside up to a height of about 150 mm above the floor with aluminum sheet kicking plates. The doors shall be treated internally with an anti-resonance material and be protected from corrosion. The windows shall be weatherproofed with rubber strips.

Drain holes shall be fitted in the lower side of the doors. The door handles shall be made of non-corrosive material; they shall not protrude or have openings facing forward.

### **6.2.14 Instruments, warning lights, and controls**

**6.2.14.1** 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 that accessibility is maintained.

**6.2.14.2** All instruments and controls shall be illuminated, with backlighting to be used where practical.

**6.2.14.3** Groupings of both the chassis and fire fighting system instruments, warning lights, and controls shall be easily removable and be on a panel hinged for back access by the use of quick disconnect fittings for all electrical, air, and hydraulic circuits.

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

- a) Speedometer/odometer;
- b) Engine tachometer;
- c) Fuel level;
- d) Air pressure;
- e) Engine temperature;
- f) Engine oil pressure;
- g) Voltmeter;
- h) Water tank level;
- i) Foam tank level;
- j) Low air pressure warning;
- k) Headlight beam indicator;
- l) Clock.

**6.2.14.5** The cabin shall have all the necessary controls within easy reach of the driver for the full operation of the vehicle. The fire pump instruments shall be provided at the rear over the pump.

## **6.2.15 Electrical system and devices**

### **6.2.15.1 General**

Overall covering of conductors shall be of moisture-resistant type. All connections shall be made with lugs or terminals mechanically secured to the conductors. Wiring shall be thoroughly secured in place and suitably protected against heat, oil, and physical damage where required. Wiring shall be colored or otherwise coded.

Lighting equipment shall be installed in conformity with IPI (Iranian Petroleum Industries) transport standards and shall include the following:

- a) Headlights with upper and lower driving beams. A control switch, which is readily accessible to the driver, shall be provided for beam selection. Fog lights with protectors against flying stones shall also be fitted at the front of the vehicle.
- b) Dual taillights and stoplights.
- c) Turn signals, front and rear, with a steering column mounted control and a visual and audible indicator.  
A four-way flasher switch shall be provided.
- d) Spotlight, 152 mm minimum on both left and right sides of the windshield, hand adjustable type, with controls for beam adjustment inside the truck cabin.
- e) Adequate reflectors, and marker and clearance light, shall be furnished to describe the overall length and width of the vehicle.
- f) Engine compartment lights, nonglare type, arranged to illuminate both sides of the engine with individual switches located in the engine compartment.
- g) Lighting shall be provided for all top deck working areas.
- h) At least one back-up light and an audible alarm installed in the rear of the body.
- i) A flashing red beacon or alternate red and white flashing lights shall be mounted on the top deck and visible 360° in horizontal plane. Mounting of beacon shall also provide good visibility. A control switch shall be provided on the instrument panel in the cabin for control of the beacon.

**6.2.15.2** A warning siren shall be provided having a sound output of not less than 100 decibels. The siren shall be mounted to permit maximum forward sound projection, but shall be protected from foam dripping from the monitor or water splashed up by the tires.

**6.2.15.3** A horn shall be provided and shall be mounted at the front part of the vehicle with the control positioned such that it is readily accessible to the driver.

**6.2.15.4** Two searchlights 100 W (HALOGEN) 24 V with 30 meters reeled cable and tripod shall be mounted over the crew compartment. The search lights can be removed and fixed on tripod.

**6.2.15.5** There shall be two 12 volt batteries connected in parallel 200 amp hr capacity each at 20 hr rate. Idle minimum charging rate of the alternator shall be 30 amp.

The electrical system shall have negative ground including transistorized alternator and a fully transistorized voltage regulator. The alternator shall be rated at 100 percent of anticipated load at 50 percent engine governed speed, and if belt driven shall be driven by dual belts.

**6.2.15.6** Batteries shall be securely mounted and adequately protected against physical injury and vibration, water spray, and engine and exhaust heat. When an enclosed battery compartment is provided, it shall be adequately ventilated and the batteries shall be readily accessible for examination, test, and maintenance.

**6.2.15.7** Battery capacity and wiring circuits provided, including the starter switch and circuit and the starter to battery connections, shall meet or exceed the manufacturer's recommendations. A master battery disconnect switch shall be provided.

**6.2.15.8** 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.

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

**6.2.15.10** The electrical system shall be insulated, waterproofed and protected against exposure from ground fires.

**6.2.15.11** Dashboard shall contain the following switches:

- Red revolving beacons with halogen lamps and a two-tone siren;
- driving lamps and fog lamps;
- floodlights;
- compartment cabinets lighting (as a master switch);
- map reading-light;
- heating element in the cooling system, when applicable;
- heating and air conditioning;
- electrical main switch (inside the cabin with a second switch outside for emergency use).

**6.2.15.12** Lighting, installed over the water booster pump and elsewhere so that all gages, operating handles, operating panels and their surroundings are properly illuminated.

This lighting shall be switched on and off by a control switch in the driver's cabin and also from the control panel for operations at the rear, the lighting in the storage cabinets shall operate automatically on opening and closing of doors and shutters. Light fittings in compartments shall be to marine standard. All lighting shall be protected against mechanical damage.

**6.2.15.13** Weather-protected sockets for a portable floodlight at each side of the driver's cabin and at each side of the chassis. The sockets shall be 2-pole, screwed connections, in accordance with DIN 14690. Material shall be aluminum, brass or stainless steel, plugs should also be supplied for:

- A red, or other color when specified revolving beacon at left and right-hand side.
- An adjustable from passenger position searchlight.
- A double-tone siren of noise level 100 dB min. at 5 m.



installed on top of the driving cabin

- A red, or other color, when specified revolving beacon at the rear of the vehicle, normally positioned on the left.
- Two adjustable floodlights.
- A connection for trailer lighting, 24 V DC.
- A connection with 24-core, or as otherwise specified, screened cable for operating the cab-mounted mobilphone from the operating panel.
- All electric cables and wiring installed on the chassis shall be run in metal conduit.

#### **6.2.16 Ventilation**

Air vents shall be distributed across the overall width of the dashboard (in order to "demist" the windscreen) , with adjustable outflow openings on the left-hand and right-hand side of the dashboard. The vehicle shall be fitted with a blower having at least two speeds. A high-capacity ventilation system and defroster with defroster fan shall also be provided.

#### **6.2.17 Heating and air conditioning**

The cabin shall be equipped with an adjustable heating system capable of achieving and maintaining a temperature of  $15^{\circ}\text{C} \pm 2^{\circ}\text{C}$  inside the cabin within 20 minutes, when the outside temperature is  $-15^{\circ}\text{C}$ , unless otherwise specified. When specified the cabin shall also be equipped with an air conditioning system which will require a battery of increased capacity.

#### **6.2.18 Vehicle drive**

**6.2.18.1** A range of gears providing the specified top speed shall be provided with sufficient intermediate gears to achieve the specified acceleration.

**6.2.18.2** All-wheel drive on these vehicles shall incorporate a drive to the front and rear axles which is engaged at all times during the intended service.

#### **6.2.19 Superstructure**

The equipment compartments water and foam tanks, pumps and powder units shall be attached to the chassis beams by a method which will prevent harmful influence, ensure flexibility of the body work superstructure and help to provide a better road grip for the wheels.

The fabrication of the superstructure shall conform to the specification of the chassis.

## **6.2.20 Suspension**

**6.2.20.1** 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 25 cm above ground obstacles without raising the remaining wheels from the ground;
- d) provide at least 5 cm of axle motion before bottoming of the suspension on level ground;
- e) prevent damage to the vehicle caused by wheel movement; and
- f) provide a good environment for the crew when traveling over all surfaces.

## **6.2.21 Wheels, tires, and rims**

**6.2.21.1** Vehicles shall be required to have off-highway mobility while meeting the specified paved surface performance.

**6.2.21.2** Tires shall be selected to maximize the acceleration, speed, braking, and maneuvering capabilities of the vehicle on paved surfaces without sacrificing performance on all reasonable terrains.

**6.2.21.3** The client shall provide a tire description that reflects the off-road performance requirements necessitated by the soil conditions encountered. Soil conditions 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 shall be considered.

To optimize floatation under soft ground conditions, tires of larger diameter or width, or both, than are needed for weight carrying alone shall be specified. Similarly, the lowest tire pressure compatible with the high speed performance requirements shall also be specified.

**6.2.21.4** Front wheels shall be single, and rear wheels dual. All tires shall be of pneumatic truck type. For light vehicles rear wheels may be of single.

**6.2.21.5** Each load-bearing tire and rim of the apparatus shall carry a weight not in excess of the recommended load for intermittent operation for truck tires or the size used.

## **6.2.22 Body**

**6.2.22.1** 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 flexibly mounted on the vehicle chassis. It shall also include front and rear fenders parts of body panels shall be removable where necessary to provide access to the interior of the vehicle.

**6.2.22.2** 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.

Other areas requiring access for inspection or maintenance shall be either open, or have removable panels.

### 6.2.23 Miscellaneous

**6.2.23.1** Suitable, lighted compartments shall be provided for convenient storage of equipment and tools to be carried on the vehicle. Compartments shall be weathertight and self-draining.

**6.2.23.2** A working deck shall be provided and shall be adequately reinforced to permit the crew to perform their duties in the roof, foam monitor area, cabin hatch area, water tank top fill area, foam liquid top fill area, and in other areas where access to auxiliary or installed equipment is necessary.

**6.2.23.3** Handrails 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.

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

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

**6.2.23.6** The entire vehicle and components except for chromeplated, stainless steel and aluminum material, shall receive a full anti-corrosion treatment including an internally injected anti-corrosion fluid or wax oil. The entire underside of the vehicle including the inside of the mud guards shall be protected.

Finishing paint shall be as follows:

- Exterior of body: fire brigade red;
- Front and rear bumper: white;
- Mud guards and wheel hubs black;
- Both cabin doors shall be provided with emblems and the unit name, sign-writing details shall be supplied;
- Suction and discharge water lines: olive green;
- Suction and discharge FLC lines: yellow;
- Powder pipe: white.

Each coat of paint shall have a thickness of 50-75  $\mu\text{m}$  and the total thickness shall at least be 120  $\mu\text{m}$ .

All irregularities in painted surfaces shall be rubbed down before the application of the finishing. Aluminum door shutters of all compartments shall not be painted.

The battery compartment shall be coated with an acid-resistant 2-component paint.

The manufacturer shall specify in his proposal the full paint procedure.

### 6.2.24 Equipment cabins

**6.2.24.1** Two cabins of minimum depth of 550 mm shall be provided in each sides of the foam tank, for the storage of portable fire fighting equipment. The cabins must be of roller shutters which are self closed, in all positions.

**6.2.24.2** Separate compartement in both sides of the vehicle shall be provided each containing of seven minimum fire hoses. The hoses shall be of high pressure standard, 25 meters length and 70 mm Dia as specified in IPS-M-SF-107.

### 6.2.25 Identification

The manufacturer shall provide a stainless steel identification plate engraved with the following information:

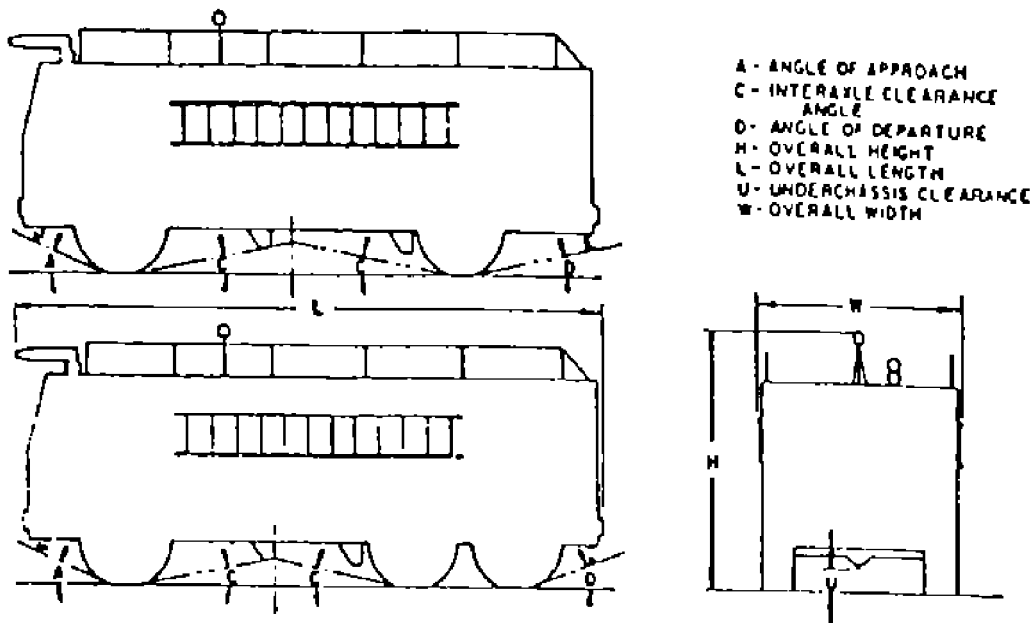
- Order number
- Serial number

- Delivery date
- Supplier's name and country of manufacture.

The plate shall be attached at the rear of the vehicle and be clearly visible.

Modifications to chassis members and/or to the drive angle of PTO's, as originally determined by the supplier, shall be in accordance with the chassis specification unless otherwise approved in writing.





To Assist in interpreting the various measurements, this diagram shows the recommended methods for figuring the angles, length, width, height, and underchassis clearance for fire fighting vehicles.

## **SECTION II**

### **7. FIRE-FIGHTING SYSTEMS FOR INSTALLATION ON THE FIRE-FIGHTING VEHICLE**

#### **7.1 General**

Depending on the application, the vehicle shall be provided with a water foam system, a dry powder system or both. The minimum requirements for each system are given below.

When the vehicle is fully loaded with a full crew and the major items of equipment, chemicals and water, it shall be possible to add at least 500 kg of portable equipment, without exceeding 95% of the permissible load on the chassis. The manufacturer shall provide the detailed load calculations for the vehicle and for each axle, so that compliance with the above requirement can be checked.

The overall load shall be equally distributed over the front and rear axles and symmetrically distributed over the right and left-hand side wheels.

Under all circumstances the rear axle shall never be subjected to more than 75% of the total load.

Under full load conditions the chassis should be in the horizontal position, any expected deviation from horizontal shall be specified with the load calculations. This shall be indicated as a difference in weight at the axle positions in mm for both the fully loaded and the unloaded conditions.

The manufacturer shall also indicate the expected deviation in the loaded condition, but without the weight of water and foam.

The type of water hose couplings shall be:

- Instantaneous in accordance with BS 336.

However, unless otherwise specified, the couplings for suction from open water and for powder hose connections should be Storz or round thread.

Hose coupling size for normal duties	65 mm
For suction from open water	75-100-125-150 mm

#### **7.2 Fire-Fighting Water and Foam System**

The water/foam system shall include at least the following:

- Water supplied from hydrants through the vehicle manifold, by-passing the booster pump, with the addition of foam agent.
- Water supplied from hydrants via the booster pump to the discharge connections with the facility to add foam agent at each individual discharge connection.
- Water taken by suction from open water via the booster pump to the discharge connections, with the facility to add foam agent at each individual discharge connection.
- Each discharge connection shall be suitable for water and for foam solution.
- Foam agent shall be added via proportioners in each individual discharge, the foam percentage to be manually adjustable between 0 and 6 percent.
- Delivery of foam agent under pressure to fixed-installed systems.

- Foam supply source from the tank to fixed-installed foam pumps or inductors.
- When a water and foam tank is installed on the vehicle the water, with or without adding foam agent, shall be passed via the booster pump to the discharge connections.
- When specified it shall be possible to drive the vehicle with a speed of 5 km/h on a road of given slope, when both the water and foam pumps are operating.

The above design criteria shall be met by using approved equipment and components in an efficient manifold arrangement.

### 7.3 Water Pump Performance Requirements

#### 7.3.1 Capacity

- a) The rated capacity of the fire pump used shall be 1000, 2000, 3000, 4000, 5000 and 6000 L/min.
- b) Unless otherwise specified the pump shall deliver as the minimum requirement the percentage of the rated capacity shown below at the pressures indicated :
  - 100 percent of rated capacity at 7 bar net pump pressure
  - 70 percent of rated capacity at 10 bar net pump pressure
  - 50 percent of rated capacity at 15 bar net pump pressure
- c) for higher pressure upto 50 bar with lower output may be specified for H.P. hose reels with mist/spray nozzle.

#### 7.3.2 Suction capability

**7.3.2.1** When dry, the pump shall be capable of taking suction and discharging water with a lift of 3 m in not less than 30 sec. through 6 m of suction hose of appropriate size, and not over 45 sec. for pumps of 6000 L/min or larger capacity.

**7.3.2.2** The pump vendor shall certify that the fire pump is capable of pumping rated capacity at 7 and 10 bar net pump pressure, from draft, through 6 m of suction hose with strainer attached, under conditions as stipulated below.

- An altitude specified above sea level;
- Atmospheric pressure (corrected to sea level);
- Water temperature of 15.6°C.

The suction system shall be designed for efficient flow at the pumping rates. The pump suction line(s) shall be of large diameter and shortest length consistent with the most suitable pump location.

There shall be a drain at the lowest point with a valve for draining all of the liquid from the pumping system when desired. Suction lines and valves shall be constructed of corrosion-resistant materials.

#### 7.3.3 The type and other requirements

The pump shall be of the centrifugal type, fitted at the rear of the chassis except when otherwise required, and be installed in such a way that there will be no axial force on the driving shaft, when in operation. Cross couplings shall be considered for this purpose.

The water booster pump shall be driven by a power take-off (PTO), have a separate automatic priming system and be able to fulfill the characteristics given in clause 7.3.1.

The material of the pump casing and casing wear rings should preferably be of copper alloy to ASTM B 584-No. C 90500 with impeller and wear rings of copper alloy to ASTM B 148-No. C 95800.

The shaft material shall be Monel K-500, with a sleeve of ANSI 316, Colmonoy 6 coated. Proposed equivalent materials shall be subject to approval by the client authority.

The manufacturer shall advise on the type of glands, bearings and the material used as standard.

To safeguard the pump casing, a thermal relief valve, shall be installed in the line-up discharging to atmosphere. The capacity shall be such that when all discharge connections are closed, the water temperature will not exceed 60°C under full load.

The manufacturer shall provide a copy of the pump test curves as certified by an independent institute.

#### **7.3.4 Pump controls**

**7.3.4.1** Provision shall be made for quickly and easily placing the pump in operation. The lever or other devices shall be marked to indicate when in pumping position.

**7.3.4.2** Any control device used in power train between the engine and pump shall be arranged so that it cannot be unintentionally knocked out of the desired position.

**7.3.4.3** Where the pump is driven with chassis transmission in neutral, in that propelling power can be applied to the wheels, while pumping, a device shall be provided by which the chassis transmission can be positively held in neutral.

**7.3.4.4** A name plate indicating the chassis transmission control lever position to be used for pumping shall be provided in the cabin and located so that it can be easily read from drivers position.

**7.3.4.5** Means shall be provided for controlling the speed of the pump.

**7.3.4.6** A priming device shall be provided, it shall function at engine speed not exceeding the maximum no load governed speed and developing a vacuum of 50 Cm Hg at an altitude of 600 m. The priming device shall be controllable at the pump operating position.

**7.3.4.7** All pumping controls and devices shall be installed so as to be protected against mechanical injury or the effect of adverse weather condition upon their operation.

#### **7.4 Water Tank**

A water tank shall have a minimum capacity of 2500 L (700 Gall) for G.purpose fire truck and to be independent of the body or compartment and shall be equipped with suitable mechanical method for lifting tank out of the body.

##### **7.4.1 Construction**

**7.4.1.1** The tank shall be constructed of stainless steel or fiberglass. The tank shall have longitudinal and transverse baffles. The construction and connections shall be made to prevent the possibility of galvanic corrosion of dissimilar metals.

**7.4.1.2** The tank shall be equipped with easily removable manhole covers over the tank discharge. Tanks shall be designed to permit access within each baffled compartment of the tank for internal and external inspection and service. The tank shall have drain valves.

**7.4.1.3** Provisions shall be made for necessary overflow and venting. Venting shall be sized to permit agent discharge at the maximum design flow rate without danger of tank collapse, and shall be sized to permit rapid and complete filling without pressure build-up. Overflows shall be designed to prevent pressure build-up within the tank from overfilling and to prevent the loss of water from the tank during normal maneuvering, and to direct the discharge of overflow water directly to the ground.

The water tank shall have a sufficient number of swash partitions.

**7.4.1.4** The water tank shall be mounted in a manner that limits the transfer of the torsional strains from the chassis frame to the tank during off-pavement driving. The tank shall be separate and distinct from the crew compartment, engine compartment and chassis, and easily removable as a unit.

**7.4.1.5** The water tank shall be equipped with at least one top fill opening of not less than 13 cm internal diameter. The top fill shall be equipped with an easily removable strainer of 6 mm mesh construction. The top fill opening shall be equipped with a cap designed to prevent spillage.

#### **7.4.2 Tank fill connection(s)**

**7.4.2.1** Tank fill connection(s) shall be provided in a position where they can be easily reached from the ground.

**7.4.2.2** The connection(s) shall be provided with strainers of 6 mm mesh and shall have check valves or be so constructed that water will not be lost from the tank when connection or disconnection is made.

**7.4.2.3** The tank fill connection(s) shall be sized to permit filling of the water tank in two minutes at a pressure of 5.5 bar at the tank intake connection.

### **7.5 Hose Reels**

**7.5.1** Hose reels shall have a minimum internal diameter of 2 Cm and shall have a minimum acceptance test pressure of 50 bar and meet the requirements of IPS-M-SF-109.

**7.5.2** Hose reels shall be equipped with a shutoff type nozzle designed to discharge both foam and water at a minimum discharge rate of 150 L/min. each nozzle shall have minimum foam discharge patterns from dispersed stream of 4.5 m width and 6 m range, to a straight foam stream with 10 m range. High pressure fog/mist-spray nozzle to be provided and be changeable with foam branch .

**7.5.3** Each reel shall be designed and positioned to permit removal by a single person from any position in a 170° horizontal sector. Each reel shall be equipped with a friction brake to prevent hose from unreeling when not desired. The nozzle holder, friction brake, rewined controls and manual valve control shall be accessible from the ground.

**7.5.4** Flow to each reel shall be controlled by a manually operated quarter turn ball type valve. Two hose reels of 50m each equipped with rewined mechanism shall be provided and fixed on the either side at the rear of the vehicle.

### **7.6 Foam System**

#### **7.6.1 Materials**

All components of the foam system including the foam-liquid tank, piping, fill troughs, screens, etc., shall be made of materials resistant to corrosion by the foam-liquid concentrate, foam-water solution, and water.

#### **7.6.2 Foam liquid concentrate tank**

a) Foam-liquid concentrate tanks shall be of rigid type. The tank shall be designed for compatibility with the foam concentrate being used and resist all forms of deterioration which could be caused by the foam concentrate.

b) Tanks shall be designed to permit access within each baffled compartment of the tank for internal and external inspection and service. Drain connection shall be installed to flush out the bottom of the sump.

- c) The tank outlets shall be located above the bottom of the sump and shall provide continuous foam-liquid concentrate to the foam proportioning system.
- d) If separate from the water tank, the foam-liquid tank shall be mounted in a manner that limits the transfer of the torsional strains from the chassis frame to the tank, during off-pavement driving. The tank shall be separate and distinct from the crew compartment, engine compartment, and chassis, and shall be easily removable as a unit.
- e) A top fill trough shall be equipped with a stainless steel 6 mm mesh screen and container openers to permit emptying 20 L foam-liquid concentrate containers into the storage tank at a rapid rate regardless of water tank level. The trough shall be connected to the foam liquid storage tanks with a fill line designed to introduce foam-liquid concentrate near the bottom of the tank so as to minimize foaming within the storage tank.
- f) Tank fill connection shall be provided in a position where it can be easily reached from the ground to permit the pumping of foam-liquid concentrate into the storage tank. The connection shall be provided with strainers of 6 mm mesh, and shall have check valves or be so constructed that foam will not be lost from the tank when connection or disconnection is made.
- g) The tank shall be adequately vented to permit rapid and complete filling without the build-up of excessive pressure and to permit emptying the tank at the maximum design flow rate without danger of collapse. The vent outlets shall be directed to the ground to prevent spillage of foam-liquid concentrate on vehicle components.

### 7.6.3 Foam-liquid concentrate piping

- a) The foam-liquid concentrate piping shall be of material resistant to corrosion. Care shall be taken that the combinations of dissimilar metals that produce galvanic corrosion are not selected or that such dissimilar metals are electrically insulated. Where plastic piping is used, it shall be fabricated from unplasticized resins unless the stipulated plasticizer has been shown not to adversely affect the performance characteristics of the foam-liquid concentrate. The plastic pipe may be reinforced with glass fibers.
- b) The foam-liquid concentrate piping shall be adequately sized to permit the maximum required flow rate and shall be arranged to prevent water from entering the foam tank.

### 7.6.4 Foam/liquid pump

This pump should be of the positive displacement or centrifugal type and work independently of the water booster pump (driven by a PTO or other source). The pump shall be able to fulfill the characteristics given in Table 3 and be able to inject, foam-liquid into the water stream at a pressure of 0.7 to 4 bar above the maximum water pressure, delivered by either the water booster pump or the fire water mains.

The pump shall also be able to transfer foam-liquid from drums or storage tank into the foam/liquid tank of the vehicle and vice versa.

The line-up shall be provided with a relief valve (set pressure equal to the design pressure of the pump) allowing full flow discharge into the foam liquid tank without overheating the pump or exceeding the specification of the piping system. The pump shall be able to fulfill the characteristics given in Table 2.

The material of the foam pump housing and rotors should preferably be stainless steel type ANSI 304 or 316, with a type ANSI 316 stainless steel shaft.

The manufacturer shall give the direction of rotation of the drive shaft, the type of glands and bearings and the materials used as standard.

Proposed alternative materials shall be subject to approval by the client.

The manufacturer shall provide a copy of the pump curves.

**TABLE 2 - FOAM/LIQUID PUMP OUTLET**

<b>PURPOSE</b>	<b>SOURCES</b>	<b>DISCHARGE</b>	<b>MINIMUM LPM</b>	<b>DISCHARGE PRESSURE (BAR)</b>
DELIVERY FOAM LIQUID	DIRECT FROM TANK	TO OTHER FOAM STORAGE TANK	400	2.5
DITTO	SUCTION FROM DRUMS (SUCTION HEIGHT 1.5 M)	TO STORAGE TANK	120	2
DELIVERY TO FOAM PROPORTIONER	DIRECT FROM TANK	FOAM PROPORTIONING SYSTEM	100 TO 400	2 BAR ABOVE THE EXPECTED INLET WATER PRESSURE (8 TO 12 BAR)

TABLE 3 - CHARACTERISTICS OF FOAM/LIQUID PUMP

APPLICATION	SOURCE OF WATER SUPPLY	WATER RATE IN l/min.		WATER PRESS. bar		FOAM AGENT RATE IN l/min.		
		min.	max.	SUCTION	DISCH	min.	max. 1% SETTING	6% SETTING
FOAM SOLUTION OR WATER	DIRECT FROM HYDRANTS (BY-PASSING) THE BOOSTER PUMP	400	7800	6-12		4	78	468
DITTO	FROM HYDRANTS VIA THE BOOSTER PUMP	400	4500	6-12	11.16 PUMP DIFF. HEAD 5 BAR	4	45	270
DITTO	SUCTION FROM OPEN WATER VIA THE BOOSTER PUMP	400	2400	1.5 m SUCTION HEIGHT	10	4	24	144
DITTO	SUCTION FROM WATER TANK ON VEHICLE VIA THE BOOSTER PUMP	400	2400		10	4	24	144
FOAM CONCENTRATE TO DISCHARGE (16 BAR)	—		—			4	—	500

## 7.7 Foam-Water Tank Accessories

The tank volume should be as large as possible, but shall at least contain the volume as specified. In any combination of FLC and water the ratio shall be 1:6 with a tolerance of 5%.

The tank and all tank components shall be of stainless steel or alternative materials, subject to approval.

The tank shall be provided internally with sufficient baffles, but baffle sizes and spacing shall allow for cleaning and inspection. It shall have an expansion dome with a volume of 3% of the tank volume, the dome shall be provided with a manhole of minimum diameter 500 mm fitted with a quick release lock.

The tank shall also be provided with 2 pressure/vacuum valves of sufficient capacity, and with hand-operated ball valves for tank outlet-and-filling. These valves shall be readily accessible. The p/v valves shall be installed in the middle of the tank to avoid clogging of the valves as a result of the acceleration and braking of the vehicle. The size shall be suitable for a filling rate of 1200 LPM. An open overflow shall be fitted to release under the vehicle in the case of overfilling. The location of the overflow shall be such that the overflow liquid will not fall on any part of the chassis.

The water tank filling connections shall be equipped with a level indicator visible at rear of vehicle and a low-level audible alarm which will be activated when a level of 10% FLC is reached. The level indicator type shall also provide a good indication with dark brown colored foam compound.



Special attention should be given to the design to prevent damage to the tank during filling and possible surging at the point of overflow at high filling rates. Provision shall be made to refill the foam liquid tank by foam liquid transporting truck.

## 7.8 Foam Control System

The foam proportioning system shall be designed such that foam agent can be added at each individual discharge connection.

It shall be possible to manually set the foam percentage at zero and proportionally between 1 to 6% preferably continuously or in 1% steps.

The in-line proportioners shall be calibrated in the actual manifold on the vehicle as follows:

- Calibration at water rates of 200 L upto 1200 L/min at each delivery;
- foam setting normally 3 to 6%;
- required accuracy within 0 and plus 0.3%.

## 7.9 Line-Up and Piping Design of the Water/Foam System

The line-up shall be in accordance with the relevant flow scheme for the specified vehicle, see Appendices A and B. Drain valves, vent valves and valved flushing connections shall be provided to ensure proper flushing of all components.

The size of the piping shall be such that the velocity will not exceed 2.8 m/s in the suction lines and 6 m/s in the discharge and return lines.

All components and the piping shall have a minimum working pressure of 16 bar and shall be able to withstand a test pressure of 1.5 times the maximum working pressure.

The piping, fittings and other components of the system shall be stainless steel.

## 7.10 Operating and Control Panel-Water/Foam

The main operating and control panel shall be mounted at the rear of the vehicle.

The width of the panel shall be 600-800 mm approximately and consist of the following sections arranged from top to bottom and incorporate as a minimum the following indicators:

- a) The panel shall be installed at an angle such that a standing operator can easily read the instruments, at an eye level position between 1500-1800 mm. All illuminated lamps with colored lenses shall be clearly visible in full sunshine;
- b) All elements shall be conveniently grouped and clearly identified;
- c) The panel shall be constructed from oil-resistant material suitable for outdoor tropical sun-exposed conditions; Indicating lamps; shall give signal that brakes blocked, power take off (PTO) 1 and/or PTO 2 are engaged;
- d) The electrical instruments including the wiring of sections shall be installed in a weatherproof box with marine-type enclosures for indicators and lamp fittings;

The applied wiring terminations shall be vibration proof.

For a typical lay-out at the panel see Appendix C.

### 7.11 Adjustable Foam/Water Monitor

The foam/water monitor shall be mounted at the rear of the vehicle or over the cab. It shall be able to turn 360 degrees horizontally in both directions and rise vertically from -30 degrees depression up to +80 degrees elevation. The monitor shall be provided with adjustable deflectors.

When operated as a water jet, the jet shall be able to reach the ground at a distance of not more than 8m at each side of the vehicle. When operated with low-expansion foam the width of the foam blanket shall be 4m minimum at the close throwing distance.

Position setting shall be done by a lever or other acceptable methods, however, locking of the monitor in any desired position shall be possible.

The foam/water solution discharge rate should be approximately 2000 L/min at a water pressure of 10 bar but may, unless otherwise specified, be up to 4000 L/min. The minimum throw length with foam shall be approximately 50 meters, while under these conditions no foam shall fall on the ground within 20 m.

The monitor shall be operable from a fixed platform with swing down type handrails of height 700 to 900 mm. The water and foam supply shall be manually controlled and be operable near the monitor on the platform, a pressure gage shall also be fitted near the monitor. The maximum vehicle height normally is not more than 3500 mm, the type of monitor will be specified if required. Hydraulic operation and oscillating type shall be supplied if specified.

The monitor and the bearings shall be of aluminum bronze material with a stainless steel or aluminium alloy barrel and deflector.

Required foam expansion ratios shall be 8 to 10%.

### 7.12 Foam System-by-Passing Water Pump

Four to six inlets and four to six outlets valved manifold shall be provided on either side of the vehicle inlets with instantaneous male and outlets with instantaneous female couplings. At each outlets foam proportioner with control lever shall be fixed. In this system when pressure of water is sufficient, water by-passing the water pump, will be mixed by FLC when the F.L.C pump is engaged by P.T.O. The FLC pressure should be 0.7 to 4 bar above the water pressure. When the water pump is required to boost the pressure, water will pass through the water pump. (Appendix A and B).

### 7.13 Round the Pump Foam Proportioner

In the areas where generally water pressure is not sufficiently high, the water tank mounted on truck is used for initial fire fighting. Foam proportioning system may be of Round-The pump type and foam pump is not necessary. If water hydrant is available water passing through the water tank will be boosted by the pump. Differential pressure between suction and discharge through ejector cause the FLC to flow to the suction and boost the required pressure for making foam. A control lever will control percentage of FLC mixing with water. By this system FLC can be used either from FLC tank or through 3 or 4 cm pick-up tube using FLC containers.

### 7.14 Valves

All hand-operated valves should be of the ball type, either flanged or with wafer type valve bodies installed between flanges. For sizes up to 65 mm valve bodies and trims shall be of stainless steel type ANSI 304. Valves 75 mm and larger shall be carbon steel to ASTM A 216 WCC or WCB with maximum carbon content of 0.25% and trim of stainless steel type ANSI 304.

The flanges shall have CAF gaskets and stud bolts to ASTM A 193 B7 with hexagonal nuts to ASTM A 194 GP 2H.

Material certificates equivalent to DIN 50049 type 3.1 B are required for a pressure-containing parts. The foam proportioners and the bypass of the foam control valve shall be installed at the rear discharge connections, be easily adjustable and with dial settings clearly visible

## **7.15 Extinguishing Dry Powder Systems**

### **7.15.1 General**

The fire-fighting vehicle can be equipped with dry powder units, depending on the type of vehicle and its application. The system should consist of the following :

- Dry powder tank with charging system
- Nitrogen or dry air cylinders for expellent gas and flushing function
- Hose reels with powder hose and trigger nozzle
- Control inspection and operating panel
- Dry powder monitor

### **7.15.2 Dry powder**

Urea-based potassium bicarbonate (Monnex) shall normally be used.

#### **Notes:**

- 1) A container will hold 70% by weight of "Monnex" compared to other dry powder.
- 2) Monnex (purple k) are trade names of potassium bicarbonate base dry powder.

### **7.15.3 Powder vessel design**

The system including pressure vessels and expellent gas cylinders shall be designed and manufactured in accordance with the relevant British Standards No. 5430 Part 3.

A formal approval certificate for the vessels is required signed by a pressure vessel Inspecting Authority.

All inlet and outlet connections shall be flanged. Each vessel shall have a relief valve of sufficient capacity to ensure that the maximum pressure will not exceed the maximum operating pressure by more than 15%. A manhole or inspection nozzle of 150 mm or larger shall be provided on the tank. Lifting lugs shall also be fitted.

After full discharge the remaining quantity of powder in the vessel shall be less than 7% of the charge.

### **7.15.4 Line-up and piping design of the dry powder system**

The line-up shall be in accordance with the relevant flow scheme (Appendix E).

All valves shall be of the ball type, suitable for dry powder and manually operated. The pipe system, branches, T-pieces and bends shall be smooth and have minimum resistance to the flow of dry powder. The fluid velocity shall not exceed 4 m/s. Leak valves and non-return valves shall be fitted in the nitrogen/compressed air expellant gas and control gas systems so that all switch functions can be carried out correctly.

Each cylinder shall be provided with its own valve and be connected to a high-pressure manifold, a manually operated valve should preferably be fitted in the manifold. The pressurized system shall be pressure-tested at 1.5 times the maximum working pressure.

A gage shall be installed to indicate the pressure.

#### 7.15.5 Expellant gas cylinder

Sufficient dry nitrogen or air shall be available to empty each powder tank fully and to flush all piping. The working pressure of the dry powder tank should be at least 14 bar with a maximum of 16 bar. The cylinder contents shall have a reserve of 30% in order to deal with possible small leakages during intermittent operation and to carry out control function.

Pressure regulator shall be so designed that it will automatically reduce the normal cylinder pressure and hold the expellant gas pressure at the designed operating pressure of dry chemical container. Charging time of the vessel shall be less than 15 seconds.

#### 7.15.6 Powder gun, powder hose, hose reels

The dry powder hose shall have a smooth bore of not less than 25 mm diameter and be 30m long. The safe working pressure of the hose shall be two times the working pressure of the powder tank and its bursting pressure 3 times. The powder gun shall have an output of 1.8 kg/s.

The hose reel shall have the least possible resistance so that the hose can be unrolled under pressure and not jam, a manual rewind mechanism shall be provided. The hose reels shall have hose gliders and a brake blocking device.

The system shall be such that each powder tank is provided with one hose reel and a valved manifold connection.

The hand nozzle shall be of sea-water-resistant aluminum bronze.

#### 7.15.7 Control and operating panel powder systems

A control/inspection and operating panel shall be fitted next to or near each powder unit comprising of:

Flushing valve for each hose, pressure gages for expellant gas working pressure and a push button to discharge the tank.

### 7.16 Premix Foam System

**7.16.1 General** Premix foam system is mixture of 6 to 10% of preferably AFFF, FFFP or alcohol resistance foam liquid mixed with water and used as quick initial fire fighting means for class B fires. The system is in two forms:

#### a) Gas expelled

The tank shall be of rigid high pressure construction pressurized by air or Nitrogen and released into two high pressure hose reels terminated to foam making branch nozzles. The tank capacity in this system shall be up-to 500 L. This premix system is generally used simultaneously with dry chemical fire extinguishers (see flow chart on Appendix E).

#### b) Pump expelled

In fire trucks with foam liquid pump having suction inlet from the premix tank (60 mm) and outlet to hose reels; by using the pump, premix liquid will be boosted through 2 hose reels passing through foam making nozzles. Premix foam can also be pressurized by fire truck water pump if specified. (see Appendix A and Appendix B). When premix liquid is used, the tank also can be refilled either by FLC or premix. The capacity of the tank depends on the class of the vehicle.

### 7.16.2 Twin agent

Systems of this type combine the rapid fire extinguishing capabilities of dry chemical powder (as well as their ability to extinguish-three dimensional fires) with the sealing and securing capabilities of foam and are of particular importance for protection of flammable liquid hydrocarbon hazards.

This system may be self-contained and the application of each agent is separately controlled so that the agents may be used individually.

**7.16.3** The supplier of dry chemical and foam liquid to be used, in the system shall confirm that their products are mutually compatible and satisfactory for this purpose. Limitations imposed on either of the agents alone shall also be applied to the combined agent system.

**7.16.4** Minimum delivery rates for protection of hazard shall be the ratio of dry chemical discharge rate and AFFF discharge rate (kg dry chemical-liter/s AFFF). Foam liquid shall be in the range of 0.6:1 to 5:1 LPS.

**7.16.5** The equipment mounted on the fire truck shall be capable of operation for a period of at least 30 seconds for each agent. For this system twin hose reels must be fixed between dry powder tanks and premix foam tank.

Premix-foam system can also be used and pressurized by foam and water pump. Therefore provision shall be made for the foam pump suction inlet valve connected to the premix tank. Premix foam system can also be pressurized by nitrogen gas. In this system pressure regulators shall be fitted to release the excess pressure from the tank and the capacity of pressurized tank shall not exceed more than 500L.

## 7.17 Compartment for Miscellaneous Equipment

### 7.17.1 Hose compartment

Hose compartment shall be fabricated from non corrosion material and shall be designed to drain effectively and shall be smooth and free from projections. Hose compartment must be provided on right side of the vehicle and shall not be more than 160 cm above the ground. No other equipment shall be mounted or located in hose compartment where it will obstruct the removal of the hose.

### 7.17.2 Miscellaneous equipment

The following fire equipment shall be carried in major and general purpose fire trucks as mentioned hereunder. They shall not be supplied unless specified by client. Selection should be made from the list to suit the types of the vehicles. It may also be necessary to specify other types of equipment when required:

- 16 length of 70 mm dia 25 meter fire hose each with instantaneous 65 mm couplings;
- 5 length of 45 mm dia 25 meter fire hose each with instantaneous 65 mm couplings;
- 4 length of appropriate size of suction hose with round thread couplings, one of them with metal strainer;
- 2 pairs of suction spanners for suction hoses;
- 1 portable foam/water monitor light alloy chrome plated manually operated, mountable on separate base plate (LPM to be specified).
- 1 suction collecting head round thread with instantaneous male inlet with spring loaded check valve;
- 2 dividing breaching inlets male, and outlets female couplings;
- 2 Nos 4 cm pick-up tubes with round thread or storz couplings for filling of foam liquid to the trucks foam tank from drums;

- 2 length of 15 meter 4 cm hose with round thread or storz couplings as specified for pumping foam from FLC dispensing vehicle to the fire truck tank;
- 4 water fog/jet nozzles brass, chrome plated adjustable;
- 2-10 kg CO<sub>2</sub> fire extinguishers;
- 2-12 kg dry powder fire extinguishers;
- 5 fireman axes;
- 4 sets of breathing apparatus air type (back-pack) with 4 spare cylinders (to be carried in crew compartment);
- 4 light alloy foam branches aluminum alloy, anodized, capable of discharging 400 LPM (water/FLC solution) at 7 Bars with deflector;
- 2 as above 200 LPM (water/FLC solution) at 7 Bars with deflector;
- 1 as above 800 LPM at 7 Bar;
- One aluminum (2 sections) ladder 8 meters (if required);
- 4 nos safety torches;
- One first aid kit;
- One portable hailer;
- Two cutting axes;
- Two 1½ cm cotton rope 25 meters;
- Ten hose couplings and 5 suction coupling gaskets;
- 3 short handle shovels;
- 1 tool box;
- 1 pair of rubber gloves (anti electric shock);
- 1 portable gas detector;
- 1 crowbar;
- 1 ejector pump;
- 1 polarized battery recharging receptacle mounted on rear of the truck;
- 1 removable search light tripod;
- 1 fire approach or entry suit.

### **SECTION III PROPOSED STANDARD SPECIFICATION OF MAJOR FOAM TENDER AND GENERAL PURPOSE FIRE FIGHTING TRUCKS FOR REFINERIES AND OTHER HIGH RISK AREAS**

#### **MAJOR FOAM TENDER**

##### **a) Truck**

Chassis, engine, brakes, steering, cabin (driver +2) instruments control electrical system, vehicle drive, super-structure, body, equipment cabin, etc are specified in Section 1.

##### **b) Fire Fighting System**

The following fire fighting system as specified in Section II shall be mounted on fire truck.

- |  |                   |
|--|-------------------|
| 1) Water booster pump 6000 LPM at 7 bar. | Ref. Clause 7.3   |
| 2) F.L.C booster pump 400 LPM            | Ref. Clause 7.6.4 |
| 3) Foam-liquid tank 5000 L               | Ref. Clause 7.6.2 |

- 4) Two 250 kg dry powder extinguishing with one hose reel. Ref. Clause 7.15
- 5) Foam/water monitor 3000 LPM at 10 bar (water/FLC solution) mounted over drivers cabin Ref. 7.12.
- 6) Foam system by-passing water pump six inlets and six outlets manifold as specified in Clause 7.13 and illustrated in Appendix A.
- 7) Foam ejector proportioning system. Ref. Appendix A and Clause 7.8.
- 8) Foam control. Ref. 7.8
- 9) Line-up and piping design of water/foam. Ref. Clause 7.9.
- 10) Operating and control panel water/foam. Ref. 7.10 and Appendix C.
- 11) Miscellaneous equipment. Ref. Clause 7.18.2

## **GENERAL PURPOSE FIRE TRUCK**

### **a) Truck**

Chassis, engine, brakes, steering, extended cabin, electrical, instruments control system, vehicle drive, superstructure, body, equipment and etc. are specified in Section I.

### **b) Fire Fighting System**

The following fire fighting system as specified in Section II shall be mounted:

- 1) Water booster pump multipressure 3000 LPM at 7 bar. Ref. Clause 7.3
- 2) FLC booster pump 400 LPM. Ref. Clause 7.6.4
- 3) Water tank 2500 L. Ref. Clause 7.4
- 4) Hose reels. Ref. Clause 7.5
- 5) Twin foam liquid tank 500 L FLC and 500 L premix\*. Ref. Clause 7-16 and Appendix (A)
- 6) Foam water tank accessories Ref. Clause 7.7
- 7) Foam control proportioner Ref. Clause 7.8
- 8) Operating and control panel-water-foam Ref. Clause 7.10
- 9) Foam/water monitor 2000 LPM at 10 bar. Ref. Clause 7.11
- 10) Foam system by-passing water pump, (Four inlet and four outlet manifold) Ref. Clause 7.12
- 11) Extinguishing dry powder system 2 × 250 kg one hose reel. Ref. Clause 7.15
- 12) Miscellaneous equipment Ref. Clause 7.17.2.

#### **Notes\*:**

- 1) The type of foam used in premixed section to be of AFFF-FFFP or alcohol resistance type as required.
- 2) The twin tank can also be used as FLC tanks.

## **SECTION IV SPECIFICATION FOR AUXILIARY FIRE FIGHTING AND EMERGENCY VEHICLES**

### **8. THE TYPES**

Auxiliary fire fighting vehicles comprises of the following units:

- 1) Foam liquid dispensing truck;
- 2) Dry powder extinguishing truck;
- 3) Twin agent extinguishing truck;
- 4) water tender;
- 5) Emergency service vehicles;
- 6) Hydraulic boom.

## **8.1 Foam Liquid Dispensing Truck**

### **8.1.1 Main items**

- a) Foam concentrated liquid tank 6000 to 8000 Liters;
- b) Foam transfer pump;
- c) Foam monitor;
- d) Control panel;
- e) Miscellaneous equipment.

### **8.1.2 General**

The chassis, engine, body, vehicle drive are specified in Section 1.

The cabin will be of tilted single cabin for driver and two crew members.

The foam liquid pump, proportioner, and related system shall be in accordance with clauses 7.6.4, 7.9 and 7.13 and Appendix (A).

### **8.1.3 Foam liquid tank**

Foam concentrated tank to be of 6000 to 8000 liters capacity and with all its components shall be made of stainless steel.

The tank shall also be provided with 2 pressure/vacuum relief valves of sufficient capacity, and with hand-operated ball valves for tank outlet and filling. These valves shall be readily accessible. The p/v valves shall be installed in the middle of the tank to avoid clogging of the valves as a result of the acceleration and braking of the vehicle. The size shall be suitable for a filling rate of 1200 LPM. An open overflow discharge shall be fitted to release under the vehicle in the case of overfilling. The location of the overflow discharge shall be such that the overflow discharge liquid will not fall on any part of the chassis.

The tank filling connections shall be provided with strainers. These connections and the tank drain shall be fitted with hose couplings and blank caps attached by chain.

The tank shall be equipped with a level indicator (visible at rear of vehicle) and a low-level audible alarm which will be activated when a level of 10% foam compound concentrate is reached. The level indicator type shall also provide a good indication with dark brown colored foam compound.

The size of the nozzles shall be such that the velocity will not exceed 2.8 m/s in the suction nozzles and 6 m/s in the supply and return nozzles.

The suction nozzle in the tank shall extend to 30 mm inside the tank to avoid sediment build-up in the suction piping.

However the foam liquid storage tank shall be provided with:

- an inlet with an internal filling tube.
- an outlet which prevents sludge from overflowing in the pump.



- a sump with bolted cover-plate incorporating the sludge drain.
- a gage tube to measure the tank contents.
- a breather valve to prevent excessive under-pressure or over-pressure.

#### 8.1.4 Foam monitor

Vehicle shall have a foam monitor positioned over the drivers cab. The total foam solution discharge rate shall be of 2000 LPM at 10 bar. Manual foam monitor control shall be accessible to both driver and crew member.

The foam monitor shall be capable of being elevated at least 45° above the horizontal and capable to discharge within 6 meters in front of the vehicle. The foam monitor shall be also capable of being rotated not less than 90° to either side, total traverse not less than 180°.

The monitor shall be of manual or hydraulic type as specified.

#### 8.1.5 Control panel

The control pannel shall be mounted at the rear of the vehicle and consist of the following:

- a) Foam liquid level indicator.
- b) Foam discharge and inlet rate.
- c) Water inlet pressure gage.
- d) Foam transfer pump pressure gage.
- e) Foam proportioning levers.
- f) Engine lub oil temperature.
- g) Battery charging current.
- h) Engine temperature.
- i) Engine throttle control lever.

The panel shall be installed at an angle as such that standing operator can easily read instruments at an eye level position.

#### 8.1.6 Equipment to be carried

The following ancillary fire equipment shall be carried in two suitable compartments:

- 6 length of 65 mm standard fire hose;
- two 4 cm pich-up tubes with round thread or storz connections;
- four foam branches with water foam liquid solution discharging rate 400 LPM at 7 bar with deflector made of aluminum alloy anodized;
- two fog/spray nozzles brass crome plated, adjustable;
- two 4 cm filling hoses with round thread or storz couplings, each 15 meters;
- two 12 kg dry powder fire extinguishers.

#### 8.1.7 Foam proportioning system

Six inlet valve, three on each side and six outlet valves at the rear of the vehicle shall be provided, all inlet and outlet valves shall be of quick opening ball valve made of gun metal crome plated.

Adjustable 0-6% foam proportioners to be provided at each outlet and foam monitor.

**8.1.8 Foam liquid piping** - As specified in Clause 7.6.3.

**8.1.9 Foam liquid pump** - As specified in Clause 7.6.4 and Table 2.

**8.1.10 Foam control system** - As specified in Clause 7.8.

When pressurized water is supplied from hydrant through the vehicle manifold, foam agent is added from the foam liquid pump to the proportioning system and foam/water solution passes through air/foam making branch pipes or foam monitors.

The foam pump discharge connections can be used to replenish the FLC tank of other fire trucks or other fixed foam systems.

## **8.2 Dry Powder Fire Extinguishing Truck**

### **8.2.1 Main items**

- the vehicle;
- extinguishing dry powder system;
- dry chemical powder;
- powder vessels;
- line-up and piping;
- expellant gas;
- powder gun, powder hose and hose reels;
- manually operated powder monitor;
- control and operating panel.

### **8.2.2 The vehicle**

Chassis, engine, body and other related equipment shall meet the standard specification as given in Section I and powder vessel, line up and piping, expellant gas cylinders, powder gun, powder hose reels, control and operating panel as given in Section 2 Clause 7.15.

### **8.2.3 Extinguishing dry powder system**

The fire-fighting vehicle can be equipped with dry powder units, depending on the type of vehicle and its application. The capacity depending on risk factor and class of fire shall be up to 3000 kg in 3 stages. The system should consist of the following:

- dry powder tanks with charging system.
- nitrogen cylinders for expellant gas and flushing function.
- hose reels with powder hose and trigger nozzle.
- dry powder monitor.
- dry powder manifold, to be connected to external dry powder extinguishing system.

### **8.2.4 Dry powder**

Urea-based potassium bicarbonate shall normally be used. Other types of dry powder may be considered when specified.

### **8.2.5 Manually adjustable powder monitor**

If a powder monitor is required, it shall be installed on the vehicle in such a way that the powder stream shall hit the ground approximately 8 m from each side or in front of the bumper of the vehicle.

The powder monitor shall be manually operated and its capacity shall be selected between 20 and 50 kg/s with a throw between 30 and 50 meters respectively.

The monitor shall be horizontally adjustable over 140° or each side from the straight forward position. The vertical elevation depends on its installation on the vehicle, but shall be at least 90° from the most downward position.

An operating handle shall be installed at the monitor to open and close the quickacting main pneumatic valve of the powder tank.

The monitor shall be equipped with a reliable locking and braking device and a cover on the barrel attached by chain to prevent water entry.

The monitor shall be operable from a fixed platform with swing down type handrails.

## **8.3 Combination of Dry Powder and Premix Foam, (Twin Agent)**

### **8.3.1 Main items**

- the vehicle;
- extinguishing twin agents as specified in Clause 7.16.2.

### **8.3.2 The vehicle**

The chassis, engine, body, vehicle drive, etc are specified in Section 1.

The vehicle shall be suitable for use in areas as specified.

The driving cabin shall be tilted type and contain seats for 3 persons.

### **8.3.3 Superstructure**

The nitrogen/air cylinders compartment and foam premix and powder units shall be fastened to the chassis by a method which will prevent harmful influence, ensure higher flexibility of the body work superstructure and help to provide a better road grip for the wheels. Electrical system shall be of dust proof and waterproof and fit for tropical conditions when this is required. Revolving beacon, siren and two search lights should be provided over the drivers cabin.

### 8.3.4 Flow chart

The following informations concerning the fire equipment loaded on trucks A & B should be considered:

EXTINGUISHING CAPACITY	TRUCK "A"	TRUCK "B"
DRY POWDER	250 kg	500 kg
PREMIX FOAM	UNIT 250 L	UNIT 500 L
HOSE	1 HOSE REEL WITH 25 m TWINNED HOSE FOR EACH UNIT	1 HOSE REEL WITH TWINNED HOSE FOR EACH UNIT
DISCHARGE RATE: (POWDER) (PREMIX)	APPROX 2 kg/s 200 LPM	2 × 3.5 kg/s 2 × 200 LPM
DISCHARGE RANGE: (POWDER) (PREMIX)	10 METERS 20 METERS	10 METERS 20 METERS
EXPELLANT GAS SYSTEM (POWDER)	N <sub>2</sub> CYLINDERS 20 dm <sup>3</sup> -150 bar	

### 8.3.5 Extinguishing powder/foam installation

The vehicle shall be equipped with the following depending on the area of fire risk.

- one to four extinguishing powder unit
  - one to four premix foam unit
  - twin high-pressure hose 25 mm diameter × 25 m long wound on a hose reel mounted at the rear of the vehicle
  - nitrogen cylinders of sufficient capacity for emptying the dry powder and foam tanks.
- { of either 250 or 500 kg, see under "A" and "B" of the  
 flow chart above  
 250 or 500 L

The hose reel shall have the least possible resistance and should be such that the hose can be unrolled under pressure and not jammed. It shall be possible to operate any length of unrolled hose. The twin hose shall have combined trigger nozzles with capacities for discharging the powder and foam.

## 8.4 Water Tender

### 8.4.1 Main items

- the vehicle;
- water tank;
- water pump;
- hose reels;
- miscellaneous fire fighting equipment.

### 8.4.2 The vehicle

The chassis, body, engine, vehicle drive, steering, brakes and electrical system are to be as specified in Section 1.

The cabin shall provide seating for driver plus one crew member. Search lights, siren and flashing beacon shall be provided and the cabin to be of tilted type.

#### **8.4.3 Water tank**

The tank shall have the capacity of 6000 to 8000 L and shall be made of galvanized steel and internally protected against corrosion. The tank shall be provided with internal traverse baffles and dome having manhole opening with quick release lock. The tank shall be provided with:

- An inlet with an internal tube;
- an outlet to the pump suction;
- sump with bolted cover and drain pipe;
- a breather valve to prevent excessive pressure;
- a gage tube to measure the water content.

#### **8.4.4 Water pump**

The booster pump shall be of centrifugal multi-pressure type capable of pumping 2000 L/min. at 7 bar and 1000 L/min. at 15 bar.

The pump to be driven by engine P.T.O. and shall be mounted behind the driver's cab provided with control pannel at right side.

One suction connection and two outlet instantaneous valve connections shall be provided.

Two high pressure hose reels also to be fixed, one on each side at the rear. Two separate 6.5 cm filling valved connection shall also be provided, one on each side.

#### **8.4.5 Compartment**

- Compartment for 5 length of 70 mm and 5 length of 45 mm hoses with 65 mm standard couplings shall be provided on either side.
- Four suction hoses of 3 meter length 10 cm Dia, two on each side shall also be housed, one of the suction hoses with metal strainer.
- Compartment for the following equipment shall also be provided.
- 5 No 20 L foam compound containers preferably (film forming) and two 200 LPM portable foam branches and 2 cm pick up tube connections round thread.
- Two fog/spray control nozzles.
- Two sets of breathing apparatus in sustained position in drivers cab with two spare cylinders.
- Two shovels-two picks, two axes and a tool kit.
- Two sets of fire men protective clothing.
- Two 12 kg dry powder fire extinguishers.

## 8.5 Emergency Service Vehicles

### 8.5.1 Emergency combined rescue vehicle

#### 8.5.1.1 Main items

- Lighting set with reeled cable;
- hose reels;
- fire fighting equipment;
- cutting saw and tools;
- resuscitation and breathing apparatus;
- miscellaneous rescue equipment.

#### 8.5.1.2 The Vehicle

The vehicle shall be of light type, four wheel drive and with suspension that can be used in rough roads and on soft soil at temperature of -25°C to 60°C, with the following details:

- The cabin shall provide seating for driver plus 2, with air conditioning and heating system.
- Exhaust system shall be of spark arrestor type.
- Hydraulic steering.
- The engine can be petrol driven with 150 L fuel tank and 100 L spare tank the fuel system shall meet the specification of Clause 6.2.4.3.
- Towing connection behind the chassis and winch provided in front of the chassis with 30 meter pulling wire (2 tons).
- Manual transmission.
- Electrical system 12 volts;
- Warning siren of 95 db and revolving beacon;
- Provision to be made for mounting radio operated from the cab;
- Spot lights (150 mm) on both left and right side over the cab and hand adjustable type for beam selection;
- Emergency rescue equipment.

#### 8.5.1.3 Lighting set

Lighting set if specified shall be provided behind the cab, driven by engine P.T.O with 10 to 20 kw output at about 25/50 volts. One search light of 30 cm dia with suitable halogen bulb shall also be provided.

Two sockets for temporary emergency lighting up to 3 kw, one cutting saw with 50 m reel cable if specified.

All electrical system shall be flame proof in accordance with IPS-E-EL-110 and dust-proof. Cable of 100 meter with halogen bulbs should be provided for emergency lighting.

#### 8.5.1.4 Rescue equipment

Rescue equipment consisting of cutting, pulling and other devices as specified by client shall be maintained.

### 8.5.1.5 Miscellaneous Fire, and safety Equipment

The following miscellaneous fire and emergency equipment shall be carried in the vehicle.

- 2 Dry chemical fire extinguishers of 12 kg;
- Two sets of breathing apparatus back-pack with two spare cylinders;
- One set of oxygen resuscitator with two spare cylinders;
- One explosimeter or gas alarm;
- One first aid kit;
- One 8 meter extension aluminum ladder mounted over the vehicle if specified.
- One cutting axe;
- Two shovels, short handles;
- Two fire man axes;
- A tool kit;
- 2 safety torches;
- Three road stops (reflecting orange/red);
- Three reflecting flags;
- Two automatic flushing beacons (portable);
- Loud speaker;

### 8.5.2 Emergency fire and rescue equipment carrier

#### 8.5.2.1 Main items and list of equipment

This vehicle is used to carry extra equipment which might be required for serious emergencies and in addition can be used in rescue operation. Depending on the nature of risk the following list of equipment is to be carried. Suitable compartment should be made available for such equipment and be so arranged, not to obstruct their removal. The engine, chassis, cabin, and superstructure shall meet the specifications given in section one.

- 50 length of fire hoses 25 m with standard couplings
- 10 length of fire hoses of 45 mm Dia × 25 m with standard couplings
- 6 sets of breathing apparatus back-pack type;
- 12 Nos. of spare cylinders for above;
- 2 sets of Resuscitator with spare cylinders;
- 6 shovels and 6 picks;
- 2 cotton rope 100 meters 1½ cm Dia;
- sets of gaskets;
- two water spray-jet branch pipe 600 LPM at 7 bar;
- two portable foam/water monitors;
- two collecting & two dividing breechings;
- four air foam making branch pipe 800 LPM;
- a complete large size tool box;
- 10 red flags and road stoppers;
- 6 firemen protective clothing;
- 6 pairs rubber boots;
- 2 gas alarms (transportable detector)
- 5 sets red beacon;
- 1 first aid box;
- 2 fire approach or entry suits (Ref IPS-M-SF-475);
- 2 pairs of insulated rubber gloves;
- 2 portable lighting sets (if required);
- 2 portable light weight pumping sets 300 to 500 LPM (if required) complete with suction hoses.

Special rescue equipment which shall be kept in separate compartement

- 1) Oxy/butane or acetylene cutting tools kit.
- 2) Winch to be provided in front bumper with 50 m pulling wire of 3 to 4 tons.
- 3) Rescue equipment as specified.

### **8.5.3 Fire & emergency light vehicle**

#### **8.5.3.1 The vehicle**

The vehicle shall be of four wheel drive and have suspension, power and torque that can be used in rough roads and soft soil in temperature and altitude as specified and with the following details.

- The cabin shall provide seating for driver plus one, with air conditioning and heating system;
- the engine shall be petrol driven well known with 150 L fuel tank;
- towing connection mounted behind chassis for towing a trailer of 1½ ton;
- manual transmission;
- electrical system 2 × 12 volts batteries with high efficiency alternator;
- warning siren (95 dB) and one revolving beacon;
- 2 spot lights with adjustable beam selection;
- radio mounted on dashboard.

#### **8.5.3.2 Fire fighting system**

The following first aid fire fighting system shall be mounted on the vehicle:

- Fire pump 150-400 LPM at 7 bar;
- water (premix) tank 400 L;
- one 35 m hose reel terminated to foam-water fog nozzle.

#### **8.5.3.3 Miscellaneous fire, safety and emergency equipment**

The following equipment shall be carried:

- 45 mm standard fire hose	4 length
- 12 kg dry powder fire extinguisher	2
- breathing apparatus	1
- oxygen resuscitator	1
- suction hose	4
- tool kit	1
- foam liquid 20 L container	2
- cutting axe	1
- crow bar	1
- road stop reflector	1
- reflective flag	2
- shovel	1
- rope 1½ cm	20 m
- portable gas detector	1
- rubber boot	1 pair

### **8.6 Foam/Water Hydraulic Boom**

The truck shall meet the specifications in section I.



### **8.6.1 Chassis**

The hydraulic boom shall be mounted on an auxiliary chassis at the front or rear of the vehicle chassis and consist of an arm(s), a turntable and a remote-operated foam water monitor mounted on the upper arm.

### **8.6.2 Arms**

The arms shall be of profiled tubular steel in order to give the construction a minimum of mass with a maximum of strength and rigidity.

All rotation points shall, when necessary, be provided with grease-lubricated bronze bushes, the grease nipples being easily accessible.

The lower arm shall be mounted on the turntable.

The movements of the boom shall be controlled by hydraulic cylinders.

### **8.6.3 Turntable**

The turntable shall be of a robust steel plate construction. It shall run on ball bearing to ensure smooth and continuous rotation of the whole structure. The turntable shall operate electrically / hydraulically , but manual operation shall also be possible. All electrical equipment installed on the turntable shall be suitable and certified intrinsically safe.

### **8.6.4 Auxiliary chassis**

The boom and turntable shall be mounted on an auxiliary steel chassis. The auxiliary chassis shall be firmly fixed to the vehicle chassis.

To ensure stability of the boom, the auxiliary chassis shall be fitted with 4 hydraulic jacks, which will relieve the vehicle chassis sufficiently when the boom is in use.

These jacks shall consist of telescopic supports and have double-acting hydraulic cylinders for operation of the jacks.

The jacks shall extend in pairs, within 20 seconds by means of manually operated hydraulic valves. These valves shall be mounted in such a location that extension of the jacks shall be clearly visible at all times.

The pressure pipes of the jacks shall incorporate overload releases which are set so that it is impossible to lift the vehicle chassis off its springs.

The jack cylinders shall be provided with non-return valves which will hydraulically lock the jacks when the boom is in use to ensure stability at all times.

### **8.6.5 Hydraulic and electrical system**

The hydraulic pressure shall be obtained through a hydraulic pump drive by a separate air-cooled diesel engine. The diesel engine shall be equipped with an electric starting device, an exhaust fitted with a spark arrester of approved type and automatic overspeed protection, the fuel supply shall be obtained from the vehicle's fuel tank.

The hydraulic of tank shall be large enough to ensure that the oil temperature does not exceed the recommended manufacturer's temperature. During normal operation of the monitor, the hydraulic oil tank shall be fitted with a temperature gage. The telescopic movement of booms and turntable shall be controlled by means of hydraulic/electric valves installed at the turntable. These valves shall regulate smooth speed of movement from zero to maximum. The required electrical energy to actuate the magnetic valves in the valve blocks shall be obtained from the vehicle battery.

The hydraulically operated upper arm shall be provided with an electronic control device, which allows simultaneous movement of all functions at the same time. The speed of the required movements shall be obtained by actuating operating levers. The operating and control panel shall be mounted on a dustproof junction box at the left-hand side of the vehicle and shall be combined with the water/foam operating panel. This panel shall incorporate the following elements.

#### **8.6.6 Operating and control panel of the boom**

- Main operating handles (speed control of all boom movements);
- levers for boom and turntable movements;
- levers for jacking movements;
- switch for the searchlight on the monitor.

#### **8.6.7 Operating and control panel of the hydraulic pump unit**

- Pressure gage, oil system;
- start button;
- stop button;
- control lamp oil pressure engine;
- control lamp generator engine;
- temperature gage engine;
- hand throttle control.

#### **8.6.8 Safety devices**

- To ensure safe operation of the complete hydraulic circuit, a safety valve shall be fitted in the pressure piping near to the pump.

- The hydraulic cylinders for the movements of the booms shall be provided with 'fracture' valves mounted on the cylinders.

These valves shall shut off the oil discharge from the hydraulic cylinders in the event of a pipe failure.

- Driving off with the jacks extended shall not be possible. A red light on the dashboard shall warn the driver when the jacks are extended. A greenlight shall indicate when the jacks are fully retracted.

- Retracting the jacks shall only be possible, when the boom is in its transport position.

- The hydraulic system shall be designed so that violent or sudden operation of the levers will be balanced automatically and not affect the smooth movement of the boom.

- The boom shall have electric switches or hydraulic valves which shall automatically block movement when the boom has reached its extreme position.

- The hydraulic system shall incorporate a hand-operated pump, which will be able to bring the boom back to its transport position in the case of engine failure.

- The electric circuits shall each be safeguarded by individual fuses.

- An emergency stop button shall be fitted on the operating panel.

- The boom movements shall be controlled by operation levers which shall also act as "dead man's switches".

- Warning lights shall be mounted on top of the rear jacks.

### **8.6.9 Performance of boom and turntable**

- |                                    |                                    |
|------------------------------------|------------------------------------|
| - max. reachable height of monitor | : at least 14 m                    |
| - time to reach max. height        | : max. 40 s                        |
| - movement lower boom              | : 70° approximately                |
| - movement upper boom              | : 90° approximately                |
| - rotation                         | : 180° on each side of the vehicle |

### **8.6.10 Water/foam monitor**

The water/foam monitor shall be mounted at the end of the upper boom. The water or foam solution supply to the monitor shall be fed via stainless steel piping and rubber hoses and/or stainless steel rotation joints.

The monitor feed line shall be connected to the water/foam system of the vehicle.

A hand-operated ball valve shall be situated in the monitor feed line.

It shall be possible to feed the monitor directly from the hydrant by use of 3 extra inlets, complete with 6.30 cm ball valves, couplings and blind caps.

The water/foam monitor shall be suitable for a straight stream of foam or water, oscillating type monitor upto 2000 LPM solution may be specified.

## **SECTION V**

## **9. BRIEF DESCRIPTION AND LIST OF PROPOSED TYPES OF FIRE FIGHTING TRUCKS**

### **9.1 General**

The following fire truck specifications can also be used in high risk areas such as oil refineries, but the suitability generally depends on availability of fixed fire fighting system provided. However careful study shall be made for selection of the trucks.

Detail specifications for chassis, engine, cabins, electrical system drive, superstructure, brake, cabin, and booster pumps, are as given in Section 1. And foam-water-drychemical extinguishers, premix and twin agents in Section 2.

### **9.2 Types of Fire Fighting Trucks**

#### **Truck No. 1      Foam-water system+dry powder extinguisher**

- Booster pump 4000 to 6000 LPM at 7 bar;
- Foam liquid tank 1000 L;
- Fixed monitor 2000 LPM at 10 bar;
- Dry powder fire extinguisher 2 × 500 kg.



- Booster pump multi pressure 3000 LPM at 7 bar
  - Foam liquid tank 1000 L
  - Water tank 3000 L
  - Twin agent water/premix 500 L
  - dry powder 500 kg
  - Water hose reel 2
- } hose reel applicator gas expelled

**Truck No. 8 Foam-water system**

- Booster pump 4000 to 6000 LPM at 7 bar
- Foam liquid tank 4000 L
- Fixed monitors 2000 LPM-10 bar hydraulic or manual

**Truck No. 9 Dry chemical system 4000 kg**

- 1000 kg dry powder tanks 4 Nos (in four stages)
- Dry powder monitor
- Two hose reels

**Truck No. 10 Dry powder premix twin agents**

- Dry powder 2000 kg in 4 stages
- Premix (AFFF) 2000 L in 4 stages
- Twin agent monitor 1
- Hose reel (dry powder) 1
- Hose reel (premix) 1

**Truck No. 11 Foam dispensing water/foam system**

- Foam liquid tank 8000 L
- Foam pump 400 LPM (as specified in Section 1 Clause 7.6.4)
- Foam monitor manual (fixed) 2000 LPM at 10 bar

**Truck No. 12 Dry powder 3000 kg in 4 stages**

- Dry powder monitor 1
- Dry powder hose reel 2

**Truck No. 13 Dry powder 3000 kg in 3 stages**

- Dry powder monitor 1
- Hose reel 2

**Truck No. 14 Water, foam or premixed system**

- Water pump 3000 LPM at 7 bar
- water or premix tank 2000 L
- Foam tank 2000 L
- Hose reels 2

**Truck No. 15      Water-foam-twin agent system**

- Water pump 3000 LPM at 7 bar
- Foam liquid tank 2000 L
- Twin agent 2 × 250 kg dry powder and 2 × 250 L premix

**SECTION VI****10. FIRE FIGHTING PORTABLE, TRAILER, SKID AND FIXED MOUNTED PUMPS****10.1 General**

**10.1.1** This standard shall apply to portable light weight and trailer skid mounted and fixed pumping units used for fire suppression and other emergency activities. Light weight, trailer and skid mounted can be carried or towed to the site where they are to be used. This standard establishes requirements for operational characteristics, reliability and service performance of all different types of pumping units, so that a high degree of usefulness to the fire and emergency services can be achieved.

Before purchasing, the client shall evaluate the needs and uses of these specifications to assure that the units to be purchased will be equipped in the best way to meet this Standard.

**10.2 Classification of Pumping Units****10.2.1 Portable light weight pumping units****a) small volume relatively high pressure**

This pumping unit shall be capable of pumping 80 L/min at 13 bar through hose reel of 25 mm and of 4 cm suction inlet;

**b) medium volume-medium pressure**

This pumping unit shall be capable of discharging 250 L/min at 6 bar and 500 L/min at 4 bar of 4 cm discharge outlet while taking suction through 6 cm suction inlet;

**c) large volume-relatively low pressure**

This pumping unit shall be capable of supplying 500 L/min at 4 bar and 1100 L/min at 1½ bar through 6.50 cm discharge outlet while taking suction in 7.60 cm suction inlet.

**10.2.2 Performance**

**10.2.2.1** Portable pumping units shall be capable of delivering and maintaining capacity and pressure as specified in this standard by pumping water at any altitude specified above sea level from 3 m lift through 6 cm suction hose with strainers.

**10.2.2.2** The weight of a complete pumping unit including carrying handles and all other components, excluding fuel oil and accessories shall not exceed 80 kg for large volume and 70 kg for medium and small.

When starter motor, generator/alternator and battery are furnished, the weight of such equipment should be added to the weight as specified in the above paragraph.

**10.2.2.3** Centrifugal type pumps with self priming shall be used. The body of the pump shall be of bronze and stainless steel shafts with reliable seal of carbon or similar should be used. The engine shall be of four cycle, easy to start and air cooled and the stop switch should be of non locking type. It may be desirable to have the pumping unit mounted on one or, two wheeled dolly so that it can be transported over a considerable distance by one person.

### **10.2.3 Pump, pump connections, and fittings**

**10.2.3.1** Pump shall be of the centrifugal type

#### **Exception:**

Pump may be of a type other than centrifugal when specified by the purchaser in Special Provisions.

**10.2.3.2** Discharge connections of all portable pumping units shall be equipped with instantaneous fire hose couplings and suction connections storz or threaded as specified.

**10.2.3.3** Caps with chains or cables and suitable gaskets shall be provided for each suction and discharge connection.

**10.2.3.4** An adapter shall be provided that will permit attachment of 3.8 cm hose couplings when the discharge connection is 2.5 cm in size.

**10.2.3.5** An adapter shall be provided that will permit attachment of (6.3 cm) hose couplings when the discharge connection is 3.8 cm in size.

**10.2.3.6** Suitable means shall be provided for completely draining the pump and its attachment in cold weather.

**10.2.3.7** Pump body shall be capable of withstanding a hydrostatic pressure 7 bar (689.5 kPa) above the rated operating pressure.

**10.2.3.8** The pump casing shall be capable of being easily disassembled for inspection and replacement of parts.

**10.2.3.9** Pump impeller shall be constructed of cast iron, bronze, stainless steel, or copper-nickel alloy.

**10.2.3.10** Pump shaft shall be constructed of stainless steel or copper-nickel alloy.

### **10.2.4 Priming device**

**10.2.4.1** A priming device shall be provided. The device shall be capable of priming the pump at 3.05 m lift through 6.1 m of suction hose and through the suction inlet within 30 sec.

**10.2.4.2** The priming device shall be capable of making a vacuum of 43.18 cm of mercury at altitude up to 610 m above sea level.

### **10.2.5 Engine**

**10.2.5.1** The engine shall be air cooled.

**10.2.5.2** If the engine is subject to pump thrust, roller thrust bearing shall be provided.

**10.2.5.3** Engine electrical components and ignition exposed to the weather shall be protected from water.

**10.2.5.4** A rope, crank, or other manual starter should be provided.

**Exception:**

An electric starter, starter/generator starter/alternator shall be furnished in addition to manual starter, when specified.

**10.2.5.5** A manually adjustable automatic speed control shall be furnished that will automatically adjust engine throttle as necessary to maintain the engine speed, and shall limit the engine speed load, to the engine manufacturer's recommended minimum speed. The speed controller shall hold its position when the engine is operating unattended.

**10.2.5.6** A suitable muffler shall be furnished.

**10.2.5.7** A nonlocking stop switch, to stop the engine shall be furnished in a readily accessible location.

**10.2.6 Fuel tank**

**10.2.6.1** One or more fuel tanks shall be furnished.

**10.2.6.2** The fuel tank(s) shall be of sufficient size to meet operation of the pumping unit at rated capacity and pressure for at least two hours without refilling.

**10.3 Trailer Pumping Unit****10.3.1 General**

**10.3.1.1** The pumping unit shall be capable of delivering and maintaining capacity and pressure as specified below:

- a) Pumping capacity 2000 L/min minimum pressure 7 bar;
- b) pumping capacity 3000 L/min minimum pressure 7 bar;
- c) pumping capacity 4000 L/min minimum pressure 7 bar.

The operating pumping capacity should be  $\frac{3}{4}$  of the above at 10 bar and  $\frac{2}{3}$  at 15 bar respectively

**10.3.1.2** Unless otherwise specified gasoline driven or diesel engine should be specified in the purchasing order, but diesel engine as prime mover for 4 to 6 cylinders is preferred.

**10.3.1.3** Centrifugal pumps with automatic priming suitable for tropical sandy weather and salty/dirty water should be considered.

**10.3.1.4** Bronze pump body and impeller, and high grade stainless steel or copper alloy shaft with carbon seal should be provided.

**10.3.2 Suction & discharge manifold**

**10.3.2.1** Suction for type (a) (10.3.1.1) to be of 10 cm dia with round thread or Storz couplings whichever specified. There shall be two delivery connections with instantaneous 6.5 cm female coupling with quick opening valve.

**10.3.2.2** For type (b) and (c) (10.3.1.1), suction inlet shall be of 12.5 cm, round thread or storz couplings whichever specified and there shall be 4 delivery connections with instantaneous female valve of quick opening type .

Suction inlets shall have removable or accessible strainer provided inside each external inlet.

All suction inlets shall be provided with suitable closures, inlet having male threads shall be equipped with caps.

**10.3.2.3** All 6.5 cm outlets shall be equipped with valves which can be opened and closed smoothly and readily at any rated pressure. The flow regulating element of each valve shall not change its position under any condition of operation involving discharge pressures to 15 bar, the means to prevent a change in position shall be incorporated bar in the operating mechanism and may be manually controlled or automatic. Each discharge valve shall be equipped with a drain or



bleed-off valve with a minimum 2 cm pipe thread connection for draining or bleeding off pressure from a hose connected to the valve.

### **10.3.3 Engine controls**

**10.3.3.1** A hand throttle, controlling the fuel supply to the engine and of a type that will hold its set position, shall be so located that it can be manipulated from the operator's position with all gages in full view.

**10.3.3.2** When a supplementary heat exchange cooling system is provided, proper valving shall be so installed as to permit use of water from the discharge side of the fire pump for the cooling of coolant circulating through the engine cooling system without intermixing.

### **10.3.4 Gages and instruments**

**10.3.4.1** A pump suction gage shall be provided on the left hand side of the gage panel. It shall be not less than 10 cm in diameter, and it shall read from 75 cm. Hg vacuum and from 0 to 20 bar but not more than 40 bar pressure.

**10.3.4.2** A pump discharge pressure gage shall be provided located to the right of the suction gage as specified. It shall be not less than 10 cm in diameter of a type not subject to damage by vacuum, and shall read from zero to not less than 20 bar but not more than 40 bar pressure.

**10.3.4.3** All gages shall have 10 mm pipe thread connections and shall be mounted so that they are readily visible at the pump operator's position, and so that they are not subject to excessive vibration. They shall be suitably enclosed or otherwise protected.

### **10.3.5 Priming system**

**10.3.5.1** Priming system shall be capable of developing vacuum of 70 cm Hg at sea level.

An engine pressure and temperature gage shall be provided at the pump operating position.

### **10.3.6 Starting**

**10.3.6.1** Battery starting and alternator charger shall be provided. A suitable battery charger shall also be provided to keep the engine battery ready for starting.

### **10.3.7 Frame**

**10.3.7.1** Trailer pump frame shall be of stainless steel with 4 adjustable handles and independent suspension complete with jockey wheel and twin rear mounted probe stand and standard 32.5 cm wheels with mud guards should be supplied.

**10.3.7.2** One detachable flood light with 2 × 100 W bulbs and a tripod should be provided.

**10.3.7.3** Sufficient stowage capacity for 4 × 2 m length suction hoses together with two delivery hoses, nozzles, spanners and suction strainer etc shall also be provided.

### **10.3.8 Instrument**

**10.3.8.1** Pump operating panel shall be fitted on the pump at operators position with the following instruments.

- Pump compound suction pressure gage;
- pump delivery pressure gage;
- engine water temperature gage;
- engine oil pressure gage;

- battery condition meter;
- hours run meter;
- revolution per minute (rpm).

### 10.3.9 Fuel tank

Fuel tank shall be of stainless steel demountable type with capacity for 2 hours full load fuel consumption.

## 10.4 Fixed Pumps

### 10.4.1 General

Where fire water main is provided with hydrant for fire fighting operations, fire pumps of sufficient capacity and pressure shall be installed to pressurise the water main. The capacity of the pumps depends on the area and risk of major fire. However, 6000 L/min at 10 bar for each pump is the minimum requirement.

Refineries or a larger plant with different multi units are usually sub-divided into smaller sections, and each section has a water ring mains with block valves. These valves can be opened to serve water to unit(s) involved in fire.

At least two identical pumps taking suction from open water or storage shall be installed; in each zone one electric motor-driven and one diesel engine-driven, the latter serving as a spare.

The power of the drives, both the electric motor and the spare unit shall be rated such that it is possible to start these units against an open discharge system which may be pressurized to 3 bar.

The electric motor shall be provided with an automatic starting device which will act immediately after putting the fire-alarm system into operation or set water pressure.

The spare unit shall be provided with automatic starting facilities which will act immediately if the electric motor of the original pump is out of order or volume and pressure of water are not sufficient when electric pump is in operation during fire fighting.

Manual starting and stopping of each unit shall be possible from a control centre or from the fire station if the latter is permanently manned; it shall always be possible at the pump site. Manual starting shall be possible without the fire alarm coming into operation.

For detailed standard specification of stationary fire pumps reference is to be made to IPS-E-SF-240.

#### Note:

**In this publication a diesel engine has been taken as a typical example of an independent power source for driving the spare pump.**

For a diesel engine, the following additional requirements shall be adhered to:

- The capacity of the fuel tank shall be such that the engine can operate at full power for at least 24 hours;(see IPS-E-SF-220). Heat tracing provision shall be considered for fuel tank.

This tank shall be installed at such a level that the bottom is at least 0.2 m above the suction valve of the diesel injection pump. The tank shall be provided with a level gage and facilities for refilling direct from drums;

- No clutch shall be installed between diesel engine and pump.

### 10.4.2 Pump connections and facilities

At the suction side of the pumps common strainer facilities shall be provided which shall be easy to clean.

The discharge line of each pump shall be fitted with a check valve, a test valve, a pressure gage and a block valve with locking device. Each pump shall be connected separately to the ring main line.

The test valve shall be used for pump testing and be so sized that it will allow a minimum flow of 10% of the maximum pump capacity.

In cases where the pumps are located at a considerable distance from the water distribution system, e.g. at a jetty approach, consideration should be given to installing one discharge line only and making provisions for installing, if necessary, a new line in the future or replacing the discharge spool piece after installing a 90° elbow.

#### **10.4.3 Pressure regulation**

In order to maintain a system pressure of 10 bar at the most remote location under full flow conditions, the actual discharge pressure of the fire-fighting pumps shall normally be well above this figure. If fire-fighting water is required close to the pump area, the high discharge pressure in this area may cause an unsafe situation for personnel handling the hoses or may overstress the fire hoses proper. To keep this pressure within acceptable limits a pressure indicator controller shall be installed at the common discharge of the pumps in order to enable adjustment to the pressure required. Local control as well as central panel control is required.

In order to keep the system full of water and permanently under pressure when not in operation two alternatives are possible:

- a) A permanent connection to the plant cooling water system, should be considered;
- b) An electric motor-driven jockey pump. A permanent pressure of approximately 3 bar shall be maintained by this pump, which shall have a capacity of about 150 to 180 L/min.

In both cases the pressurizing facilities shall be protected against the discharge pressure of the fire-fighting pumps by means of a check valve.

### **10.5 Skid Mounted Pumps**

#### **10.5.1 General**

For oil well fire fighting operations the most reliable equipment are needed. One of the prime need to combat the fire is availability of adequate spray water fog to be used for cooling the equipment left at close proximity of radiant heat.

In most cases the source of water is far away from the oil well location and therefore, pipe lines should be laid down from a high pressure water pumping station to the near side of the fire where a large (20000 m<sup>3</sup>) water pond is erected for water storage. Close to the water storage, fire water pumping station shall be set to feed the fire water mains laid at strategic points. The fire pump requirements are:

#### **10.5.2 Pumping units**

**10.5.2.1** Two diesel operated pumps, each with minimum capacity of 12000 L/min at 10 bar is required with the following specifications.

- The pumps to be of centrifugal double stage the most reliable preferably built of cast steel or bronze impeller and stainless steel high tensile shaft with the capacity of 12000 L/min at 10 bar and 30 cm DIA suction and 20-25 cm discharge delivery.

The suction shall be of steel pipe terminated to a non return foot valve with strainer.

The engine shall be of super charger diesel engine, electric battery starter of 24 v or air pressure start with alternator with sufficient output for charging batteries and minimum of 500 watt lighting including flood lights.

The following instrument shall be fixed on operating panel of each pumping unit:

- 1) Pressure gage;
- 2) engine oil pressure;
- 3) engine oil temperature;
- 4) engine cooling system temperature;
- 5) start and stopping switches;
- 6) engine tachometer;
- 7) engine speed lever with overspeed protection.

#### **10.5.2.2 Fuel and water storage**

Two overhead tanks in separate locations shall be fixed as:

- 1) Fuel tank with sufficient capacity for 24 hours continuous operation of 2 pumping units.
- 2) Water storage of 2000 L for pump priming system.
- 3) A flood light of 24 V-60 W Halogen shall be provided over each pumping unit.
- 4) A walky talky radio shall be available to communicate with operational site.

### **SECTION VII**

## **11. MATERIAL PROCUREMENT STANDARD**

### **11.1 General Requirement**

The purchase of new fire trucks involves a major investment and should be treated as such, thus a large measure of uniformity throughout the procurement should be achieved with due consideration to its economic. The appropriate officials should consult transport authorities and experienced engineers to make thorough study of the needs before a purchase order is processed.

This specification is designed to render access for procurement of various types of fire trucks & pumps as referred in Section 1 to 5.

The tests of equipment are an important features which are required to assure that the materials will meet the specified standard. An appropriate list of equipment is prepared and included in the standard specifications which specifies the relevant fire equipment requirements for each types of fire trucks. Such portable equipment shall not be included in purchasing order except for fire fighting trucks purchases for new refineries or new fire stations in high risk areas.

### **11.2 Check List for Specification Purposes**

The check list shall be used by the purchaser to ensure that a complete specification of the type of vehicle required will be given to the manufacturer.

#### **11.2.1 Type and number of the vehicle**

- country and area of destination

#### **11.2.2 Climatic conditions**

- minimum local temperature : °C
- maximum local temperature : °C

- dust area : yes/no
- humidity & corrosive nature
- altitude from sea level.
- tropical sub-tropical

### **11.2.3 Chassis**

- make and type of towing hook
- type of socket for trailer brake
- type and voltage of connection for lighting of trailer
- spare wheel and tools: yes/no
- maximum permissible weights: total weight-axle load

### **11.2.4 Engine**

- gasoline b diesel b
- on-off buzzer when vehicle is reversing yes/no
- PTO operating from cabin/at the operating panel manually b hydraulic b
- electric heating element in the cooling system: yes/no

### **11.2.5 Drivers cabin**

- tilted b yes/no
- additional seats
- air conditioning: yes/no
- max. head room of vehicle: ..... meters

### **11.2.6 Superstructure**

- cabinets closed by: rollers/doors
- water hose reels on both sides: yes/no - front/rear

### **11.2.7 Electrical systems**

- battery charger: yes/no
- electric supply: 220-240 V, 50 Hz
- color of revolving beacons: red/blue/yellow
- type of cable connection for mobilphone at rear
- tires description

### **11.2.8 Extended cabin**

- crew compartment: yes/no
- number of seats in the crew compartment
- make and type of air breathing apparatus
- location and number of suspension

### **11.2.9 Line-up of water/foam**

- suction hose couplings: Storz/others
- Size of suction couplings: 65/80/125/150 mm

#### **11.2.10 Foam/water monitor**

- manual-hydraulic
- mounted at rear b over the drivers cab b or....
- max. allowable vehicle passage height: m
- water capacity at 10 bar, LPM
- discharge and throw trajectories to comply with standard IPS-E-SF-140

#### **11.2.11 Extinguishing powder installation**

- powder monitor: yes/no
- capacity of powder monitor : kg/s
- powder delivery manifold: yes/no
- number of delivery connections
- hose couplings on powder manifold: Storz/others
- size of hose couplings
- pressurizing of powder tanks: manually/electrically/pneumatically
- capacity of powder pistol: kg/s
- users language on operating panel: English or...
- type of powder: monnex/(purple.k)- or others
- discharge and trajectories to IPS-E-SF-180

#### **11.2.12 Operating panels**

- language for identification instruction: English....

#### **11.2.13 Painting and coating**

- signwriting details to be supplied

#### **11.2.14 Additional equipment**

- requirements should be selected from the list or otherwise specified

#### **11.2.15 Initial fills of chemicals**

- make and type FLC
- quantity/capacity: L
- make and type dry powder
- quantity dry powder: kg

#### **11.2.16 Operating manual**

- language for instruction books: English/...

#### **11.2.17 Requisition for trailer:**

- type of trailer
- voltage of lightings
- height of tow bar from ground level: m
- make and type of tow eye:

- make and type of socket for trailer brake
- make and type for lighting socket

#### **11.2.18 Performance testing**

- road test: 300 km /1500 km
- rough track test : yes/no
- tilt test: yes/no
- other test requirements

### **11.3 Quotation Requirements**

**11.3.1** The supplier shall include the following information with the quotation:

- technical specification
- vehicle lay-out and arrangement drawing, including a top view.
- water foam and dry powder flow schemes
- list of all makes and types of equipment which is purchased from other manufacturers. For each item the manufacturer's documentation on the purchasing specification shall be included.
- copies of the certified performance curves of the booster pump
- copies of the performance curves of the foam pump
- certified performance data for the monitors and hand nozzles
- test certificate of the dry powder hose
- list of all proposed deviations from the IPS specification and, where applicable, supported with reasons for the deviations.
- detailed loading calculations for front and rear axle
- proposed performance testing on the basis of IPS specifications
- list of the proposed color coding for electric wiring
- spare wheel location, if applicable
- list of recommended spare parts for two years operation
- advice on chassis requirements
- programme of in-house quality control during assembly/ construction.

### **11.4 Miscellaneous**

#### **11.4.1 Material inspection**

Inspection shall include but not be limited to the following:

- welding requirements, in accordance with Standard Specification,
- material certificates, DIN 50049, etc.
- pump and monitor castings

- all material to be in accordance with the specifications and approved design drawings
- pipe schedule and flange rating
- pressure testing of equipment
- relief valve settings, to be as specified

Pressure vessels constructed to a design code will be accepted on the evidence of certificates signed by the approved pressure vessel inspecting Authority.

#### **11.4.2 Surveillance during assembly of the vehicle**

##### **11.4.2.1** Surveillance shall include but not be limited to the following:

- the manufacturer shall check and accept the chassis in accordance with the purchasing specification. Any deviations should be reported to the client's inspector within 6 days after arrival of the chassis, in such cases work shall not be allowed to commence without the agreement of the inspector.

review:

- the manufacture's in-house quality control programme
- dimensional check
- pump alignment
- piping arrangement/hook-up/couplings
- coating and painting application
- lighting
- electrical installation and cabling
- marking, identification and nameplates
- weatherproofing
- drainage, overflow
- completeness of the vehicle and systems
- additional equipment
- spare parts and special tools
- checking documents and manuals
- visual inspection
- ergonomics and accessibility

#### **11.5 Performance Testing**

##### **11.5.1** The following performance test and checks shall be carried out.

- Road test

A road test with the fully loaded vehicle over a distance of 300 km on an average type of road. A representative of the chassis supplier shall attend this test.

- A brake test in accordance with company's requirements
- A two-hour rough track test
- A road test of 1500 km followed by a full service-adjustment by the chassis supplier



When specified in the purchase order.

After the road test a second hydrostatic test shall be carried out followed by the equipment performance tests as follows:



- Pump balance

During the shop test of pumps with anti-friction bearings, operating at rated speed or at any other speed within the specified operating range, the maximum allowable unfiltered root mean square vibration velocity measured on the bearing bracket in any plane with an instrument in accordance with ISO 2954-1975 (E) shall not exceed the following value:

<b>Flow range in % of flow at Best Efficiency Point(BEP)</b>	<b>rms vibration velocity in mm/s</b>
<b>25-49</b>	<b>4.5</b>
<b>50-110</b>	<b>3</b>

- Hydrostatic test of the total system
- calibration of each proportioner
- flexibility test

With a block of 200 mm under one front wheel and the opposite rear wheel, there shall be no movement of the cab on the chassis, the lockers should function without restriction and the complete pumping system should be fully operational without additional vibration. The clearance height in the wheel guards during the torsion test above shall be at least 50 mm unless otherwise stated by the chassis supplier

- Tilt test only when specified in the purchase order.
- Measure the wheel loading and deviation from horizontal when fully loaded including the weight of a full crew
- Pump performance test

at 1.5 m suction lift

at 3.0 m suction lift or at 6.0 m suction height from hydrants with 6 to 8 bar inlet pressure via the booster pump

- Full load pump test for 1 hour uninterrupted
- Foam proportioning test
- Monitor movement
- Water/foam monitor: capacity and throw
- Priming time: of the dry powder system
- Dry powder gun: capacity and throw
- Dry powder monitor: capacity and throw
- Dry powder charging time
- Quality of produced foam
- Hose reels (including rewind mechanism and overrun brakes)
- Fog guns
- Any other test that may be specified in the requisition

Certain tests can possibly be waived when equipment has already a "Type approval".

## **11.6 Documentation**

**11.6.1** The following certification and documents shall be prepared and dispatched before acceptance for shipment:

- water/foam and dry powder flow schemes
- list of all makes and types of equipment which is purchased from other manufacturers. For each item the manufacturer's documentation or the purchasing specification shall be included
- copies of the certified performance curves of the booster pump
- copies of the performance curves of the foam pump

- certified performance data for the monitors and hand nozzles
- test certificate of the dry powder hose
- list of all proposed deviations from the IPS specification and, where applicable supported with reasons for the deviations
- detailed loading calculations for front and rear axle
- proposed performance testing on the basis of IPS specifications
- list of the proposed color coding for electric wiring
- spare wheel location, if applicable
- list of recommended spare parts for two years operation
- advice on chassis requirements
- programme of in-house quality control during assembly/ construction.

### **11.7 Operational Instruction and Maintenance Manuals**

Manufacturer shall supply five copies of instruction and maintenance manual including trouble shooting instructions with each fire truck and pumping units together with recommended spare part list for two years operation.

### **11.8 Acceptance tests**

Acceptance tests on behalf of purchaser shall be as prescribed in purchasing order conducted within 10 days before delivery of each unit in the presence of such person or persons as the purchaser designates in the requirement for delivery. The tests requirement shall be conducted in accordance with chapter 11 1901 N.F.P.A (automotive fire apparatus)

Any inspection and testing in no way relieve the manufacturer of any responsibility for any fire fighting truck or fire pumps meeting all requirements of this specification and applicable codes.

### **11.9 Guarantees**

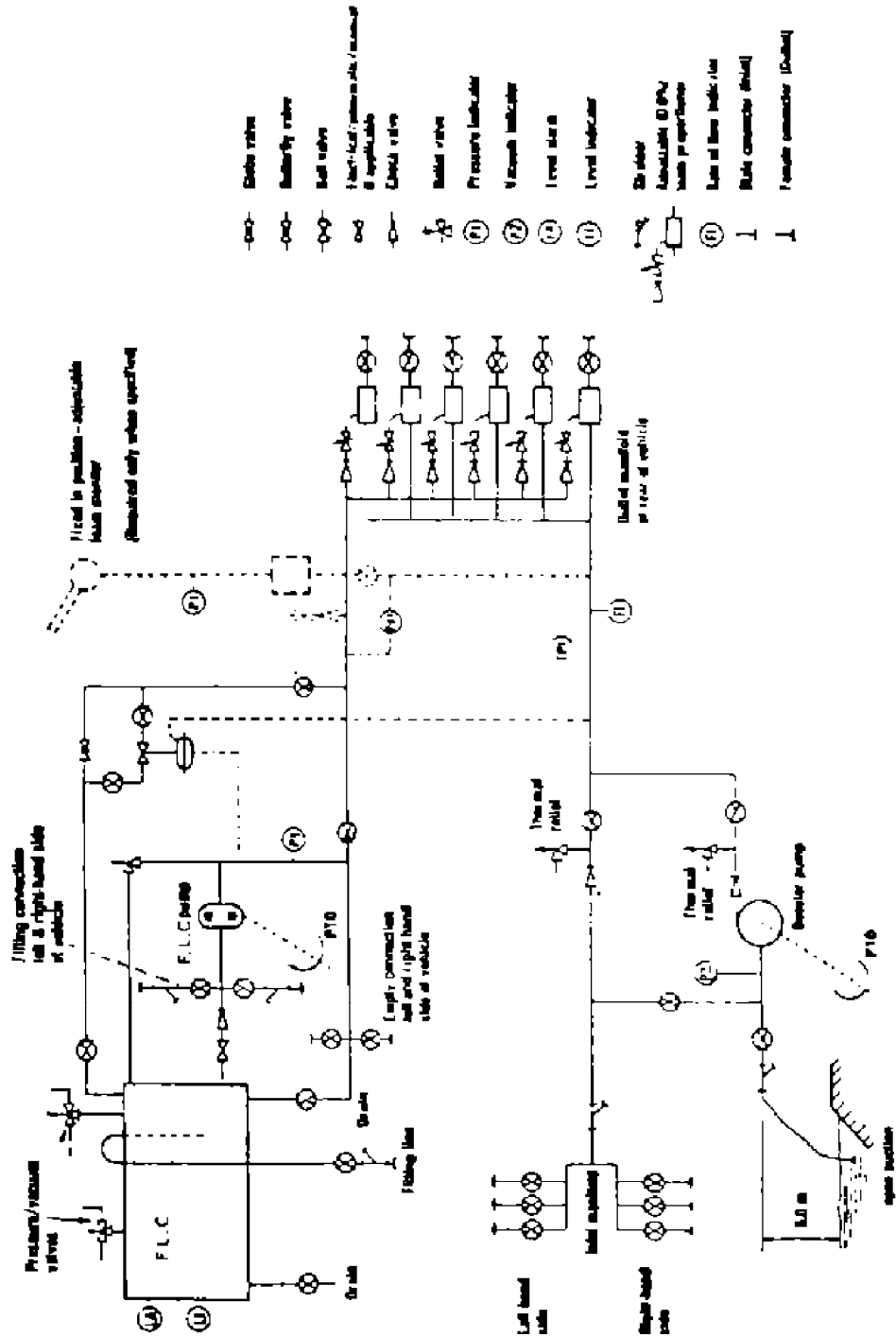
Manufacturer shall guarantee by letter of acceptance the satisfactory performance of the fire truck and pumping units in accordance with this specification. The manufacturer shall also guarantee to replace without charge any or all parts defective due to faulty material, design or poor workmanship for the period of 18 months after shipment.

### **11.10 Shipping**

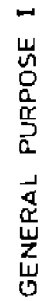
Adequate shipping support shall be provided in order to prevent damages during transit. Provision shall be taken to protect the truck and equipment from possible marine exposure.

APPENDICES

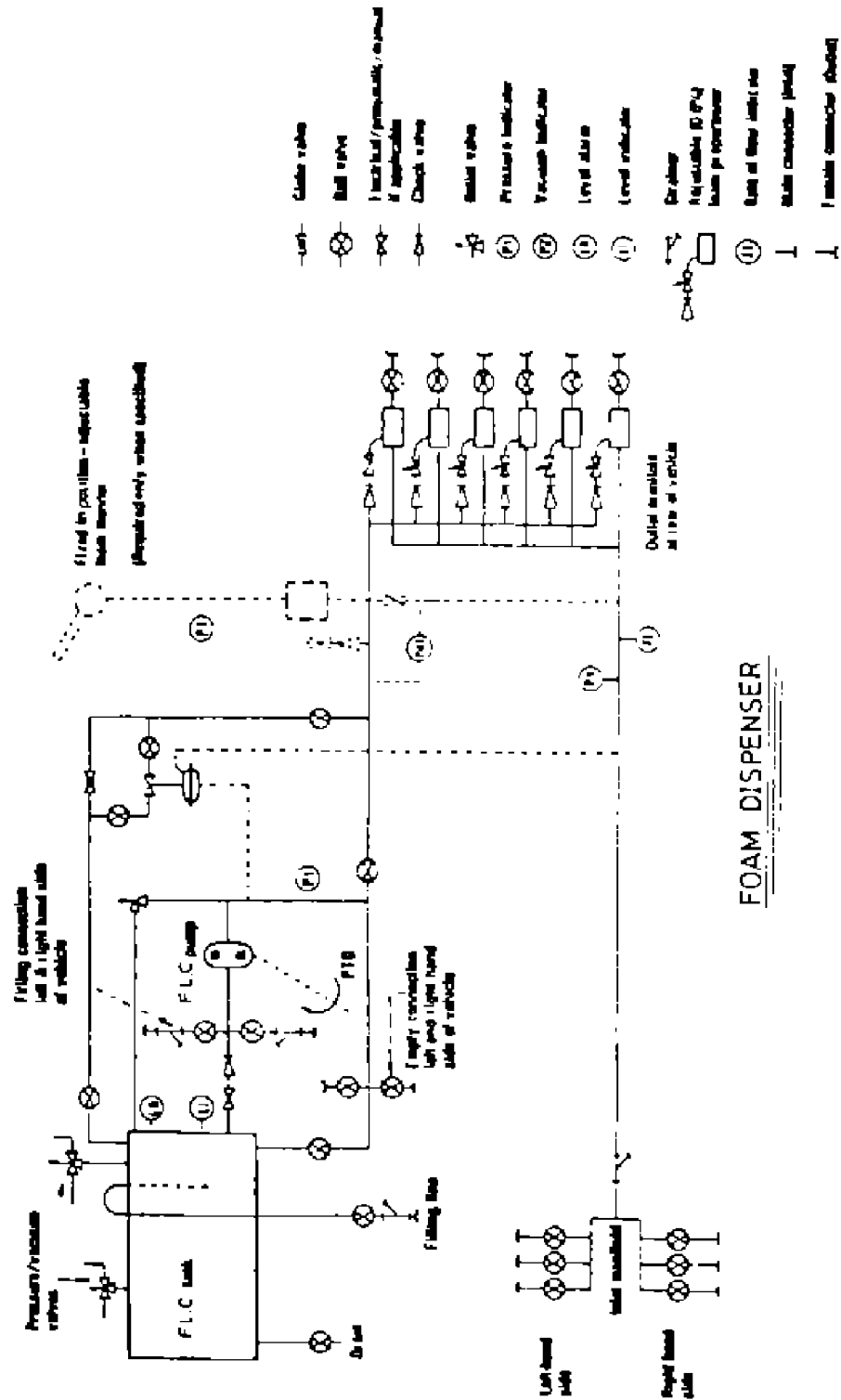
APPENDIX A  
WATER/FOAM FLOW SCHEME



(to be continued)

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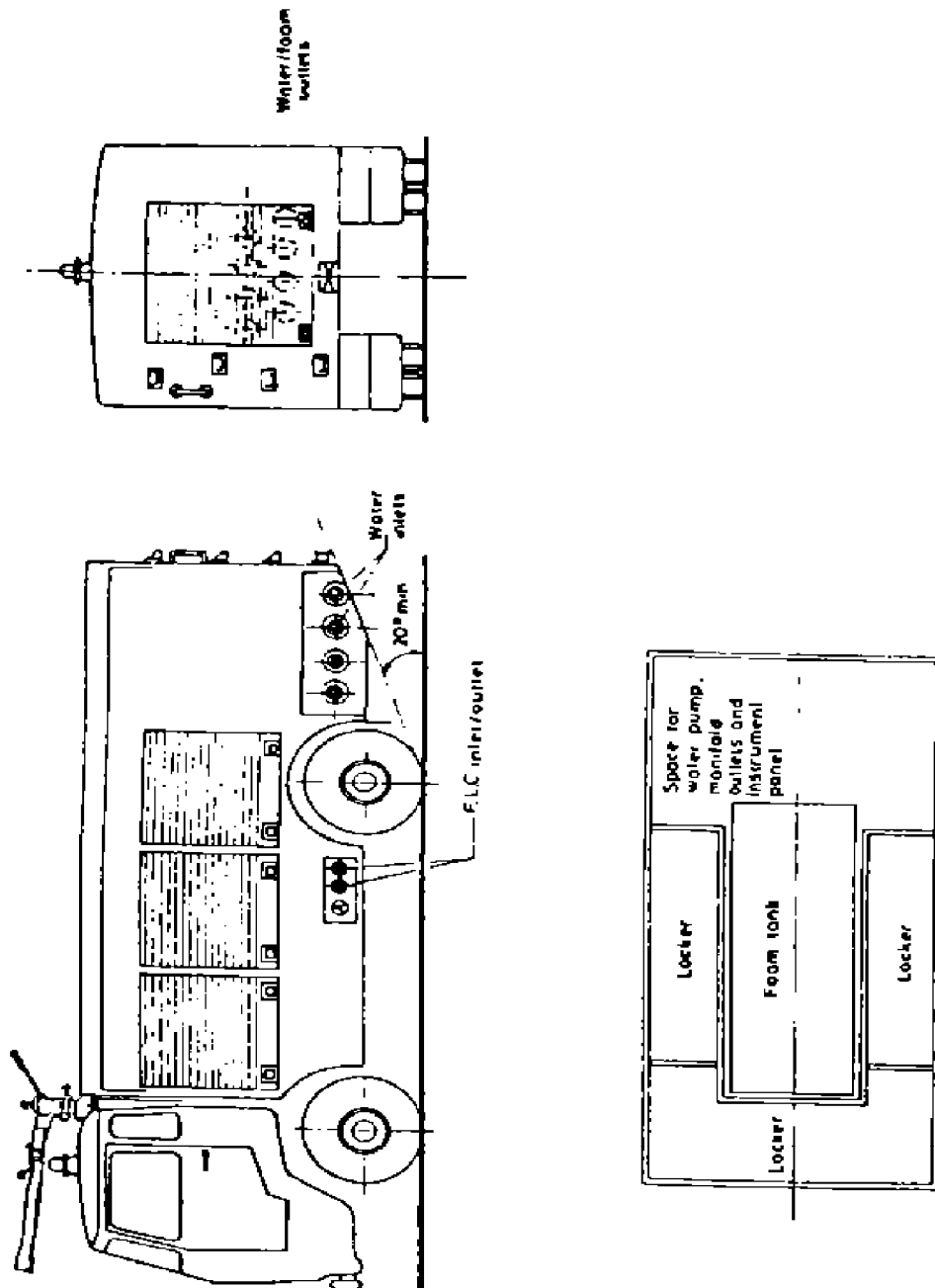
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**APPENDIX A (continued)**



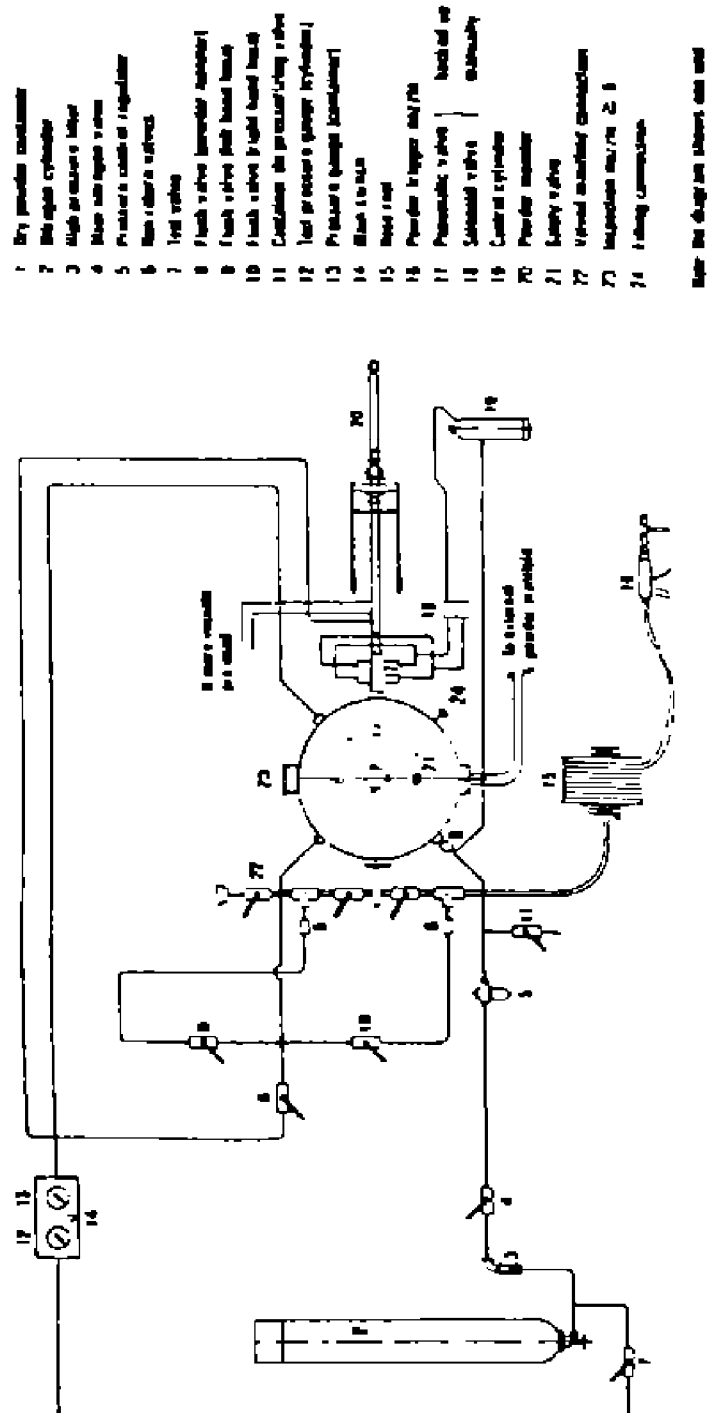


# APPENDIX D FIRE-FIGHTING TRUCK FOAM TENDER





# APPENDIX E POWDER FLOW SCHEME



(to be continued)

APPENDIX E (continued)

