

ENGINEERING AND MATERIAL STANDARD
FOR
FIRE-FIGHTING PUMP SYSTEMS
AND
TRAILERS

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0. INTRODUCTION

This Specification Standard has been prepared to provide a range of standard principal for specified fire pumps.

The pumps covered in this standard are intended to include material, fabrication, design and engineering features concerned with installation and use in water supply systems and mobile equipment in accordance with section 20 of NFC Standards for centrifugal electrical and diesel engines fire pumps.

All electrical equipment for pumps shall comply with the provisions of Material Standard listed in IPS-M-EL-132 to 290.

Included in this Standard is trailers used for mounting "Foam" and other fire extinguishing Agents and equipment such as premix FLC, Dry chemical, welding, cutting and miscellaneous tools for special tasks.

1. SCOPE

This Engineering and Material Standard specification covers the minimum requirements for fixed fire pumps and trailers carrying various fire extinguishing agents.

The adequacy and dependability of the water source are of primary importance and shall be fully determined prior to the purchase of pumping equipment, with due allowance for its reliability in the future.

In this Standard the water supply system, selection of pumps and their component parts as well as trailers used to take fire extinguishers and emergency tools to the scene of fire such as, foam equipment, premix FLC, dry chemical unit and foam/water monitor is discussed and divided into two parts:

Part I: Fire Pump Systems

Part II: Trailers Carrying fire Extinguishing Agents

2. REFERENCES

In preparation of this Standard, the following Codes and Standards have been referred to or considered. The latest edition of these Standards and Codes to the extent specified herein shall form a part of this Standard.

IPS (IRANIAN PETROLEUM STANDARD)

E-SF-220	"Fire Water Distribution & Storage Facilities"
E-SF-260	"Automatic Detectors & Fire Alarm Systems"
E-TP-100	"Paints"
M-EL-132 to 290:	"Covers all Titles in Electric Material Standards"
M-PM-125	"Fire Water Pumps"

NFC (NATIONAL FIRE CODES) NFPA

Section 20	"Centrifugal Fire Pumps"
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3. DEFINITIONS AND TERMINOLOGY

3.1 Centrifugal Pumps

A pump in which the pressure is developed principally by the action of centrifugal force.

3.2 Drivers

A piece for imparting motion to another piece either directly or indirectly.

3.3 Head

The unit for measuring head shall be the (m). The relation between a pressure expressed in (bars) and a pressure expressed in (m) of head is:

$$\text{Head in Meters} = \frac{\text{Pressure in bars}}{0.098}$$

3.4 Velocity Head (Symbol h)

The velocity head shall be figured from the average velocity (v) obtained by dividing the flow in (m³/s) by the actual area of pipe cross section in (m²) and determined at the point of the gage connection.

Velocity head is expressed by the formula:

$$h_v = \frac{V^2}{2g}$$

Where:

- g** = The acceleration due to gravity and is (9.807 m/s²) at sea level and 45 degrees latitude.
V = Velocity in the pipe in (m/s).

3.5 Prime Movers

An initial source of motive power.

3.6 Submerge Pump

Pump put under water.

3.7 F.L.C.

Foam liquid concentrate.

4. UNITS

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

PART I FIRE PUMP SYSTEMS

5. GENERAL - METHOD OF TAKING WATER

5.1 Pump Units Taking Suction from Open Water (See Appendices A & B)

5.1.1 At least two identical submerged pumps taking suction from open water shall be installed; one electric motor-driven, one diesel engine-driven, and if specified Steam Turbine.

5.1.2 The capacity of the pumps shall be in accordance with the requirements laid down in IPS-E-SF-220.

5.1.3 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 can be pressurized to 3 bar ga.

5.1.4 The electric motor shall be provided with an automatic starting device which should act after putting the fire-alarm system into operation.

5.1.5 The spare unit shall be provided with automatic starting facilities which should act as preset time if the electric motor or the pump does not function.

5.1.6 Manual starting and stopping of each unit shall be possible from a control center or from the fire station, and also shall be possible at the pump site. Manual starting shall be possible without the fire alarm coming into operation.

Note:

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

5.2 Pump Units Taking Suction from Stored Water

5.2.1 If water for fire fighting cannot be supplied direct from available open water under all conditions and at the required rate, or if owing to the excessively great distance it is not economically justified to install the fire-fighting pumps at that source, water storage facilities are required, e.g. an open tank or pond having an adequate replenishment rate. This replenishment rate is of vital importance and the aim shall be to obtain a rate equal to the installed capacity of one fire-fighting pump P-1 or P-2. See Appendix C.

5.2.2 Apart from using plant cooling water for this purpose, other sources, if available below ground level close to the premises can be utilized using electric motor-driven deep-well pumps.

5.2.3 If available from open water at an acceptable (not too great distance) replenishment can be handled by a centrifugal pump driven by a diesel engine.

5.2.4 The water storage shall be adequate to cover a period required to start the replenishment facilities. The reserve for fire fighting is to be as specified in IPS-E-SF-220.

5.2.5 If the ambient temperature can fall below 0°C, provisions shall be made to prevent the stored water from freezing, e.g. by circulating.

5.2.6 Adequate care shall be taken to keep the water in good condition e.g. to prevent algae growth.

5.2.7 If a tank has been selected for storing fire-fighting water, horizontal centrifugal pumps shall be applied. In this case a pressurizing pump is not required as the static head in the tank will keep the system filled with water.

6. DRIVERS

6.1 Type of Drivers

6.1.1 The drivers shall be diesel engine, electric motor or as specified steam turbine as indicated on the individual standard of pump specification.

6.2 Baseplate

6.2.1 Each pump with driver shall be mounted on the manufacturer's standard support plate. Horizontal drivers shall be mounted on a separate drain-rim type baseplate. The baseplate shall be of sturdy cast iron or fabricated steel construction. The baseplate shall be provided with adequate accurately drilled holes for anchor bolts.

7. CONTROL SYSTEM

7.1 Suitability

The control system shall be suitable for:

7.1.1 Automatic and manual starting of the alarm siren.

7.1.2 Local and remote manual operation of the electric motor-driven pump and the diesel engine-driven pump.

7.1.3 Starting the electric motor-driven pump automatically upon an alarm received from the fire alarm system.

7.1.4 Starting the diesel engine-driven pump automatically if the electric motor-driven pump does not function properly within a preset time.

7.2 Siren Control

The siren shall be started automatically in the case of a fire alarm, or manually by means of a "Fire" push button on the control panel.

7.3 Pump Control

7.3.1 The electric motor-driven fire-fighting pump shall be started automatically in the case of a fire alarm, or manually either local or remote from the control panel and shall have facilities for local and remote manual stopping.

7.3.2 Auxiliary contacts in the motor control circuit shall be connected to a lamp to indicate the electric motor is running on the control panel.

7.3.3 If the electric pump fails to build up pressure within a time period of 0-30 seconds (adjustable), the diesel engine-driven pump shall be started automatically. This latter pump shall also have facilities for local and remote manual starting and stopping.

7.4 Diesel Engine Control

7.4.1 All controls necessary for safe starting and operation of the diesel engine shall be located on a local panel adjacent to the engine with duplication of the most important functions on the control panel.

7.4.2 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 10 hours (see IPS-E-SF-220).

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 directly from drums.

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

7.5 Control Panel

7.5.1 The control panel shall be mounted adjacent to the alarm panel (see IPS-E-SF-260).

8. ELECTRICAL SYSTEM

8.1 A 220-V AC/24-V DC rectifier to supply 24-V DC to the control system, and to keep the batteries fully charged (the batteries to be located near the engine starter motor).

8.2 Stationary batteries shall be heavy duty and furnished in dual sets complete with necessary cables and connectors of proper size and length. AC-powered battery charger shall be furnished as specified by NFPA No. 20.

8.3 Battery trays (or boxes) shall be provided with a plywood-lined metal bottom and legs to facilitate cleaning of surface beneath trays (or boxes).

8.4 Boxes shall be constructed of 2 mm (14 ga.) sheet steel of ventilated design and with steel lid. The interior of the boxes shall be painted with acid resistant paint.

8.5 The exterior and finish shall be painted in accordance with IPS-E-TP-100.

8.6 Battery Location

8.6.1 Storage batteries shall be rack supported above the floor, secured against displacement, and located where they will not be subject to excessive temperature, vibration, mechanical damage, or flooding with water. They shall be readily accessible for servicing.

8.6.2 For the control system (and for the alarm system when mounted in the control center) an electricity supply shall be provided with rectifier and batteries, minimum voltage 24-V DC, capacity 24 h minimum, and suitable for variations in electricity supply voltage of ± 10 percent. This electricity supply shall also operate lamps, claxons, etc., and shall be completely separate from other systems (including those for process safeguarding, telecommunication, etc.) but shall be used for analogue signal transmission for fire-fighting water pressure control, if the distance would be too long for pneumatic signal transmission.

8.6.3 The siren shall be connected to the AC power supply of the emergency generator.

8.6.4 The diesel engine-driven pump shall have its own battery set for starting and control.

9. CENTRIFUGAL FIRE PUMPS

9.1 General

9.1.1 Water supplies

9.1.1.1 The adequacy and dependability of the water source are of primary importance and shall be fully determined prior to the purchase of pumping equipment, with due allowance for its reliability in the future.

9.1.2 Sources

Any source of water that is adequate in quality and quantity shall provide the supply for fire pumps. Where the water supply is from a public service main, pump operation shall not reduce the suction head below the pressure allowed by the local regulatory authority.

9.1.3 The minimum water level of a well or wet pit shall be determined by pumping at not less than 150 percent of the fire pump rated capacity.

9.1.4 A stored supply shall be sufficient to meet the demand, placed upon it for the expected duration, and a reliable method of replenishing the supply shall be provided.

9.1.5 The head available from a water supply shall be figured on the basis of a flow of 150 percent of rated capacity of the fire pump. This head shall be as indicated by a low test.

9.2 Special Requirements

9.2.1 Suitable means shall be provided for maintaining the temperature of a pump room or pump house, where required, above 5°C (40°F).

Temperature of the pump room, pump house or area where engines are installed shall never be less than the minimum recommended by the engine manufacturer.

The engine manufacturer's recommendations for water heaters and oil heaters shall be followed.

9.2.2 Artificial light shall be provided in a pump room or pump house.

9.2.3 Individual emergency lighting shall be provided by fixed or portable battery operated lights, including flashlights.

9.2.4 Provision shall be made for ventilation of a pump room or pump house.

9.2.5 Floors shall be pitched for adequate drainage of escaping water or fuel away from critical equipment such as the pump, driver, controller, fuel tank, etc. The pump room or pump house shall be provided with a floor drain which will discharge to a frost-free location.

9.3 Listed Pumps

9.3.1 Centrifugal fire pumps shall be listed for fire protection service.

9.4 Rated Pump Capacities

Fire pumps shall have the following rated capacities in LPM and rated at net pressures of 2.7 bars or more.

A horizontal split case or vertical turbine pump shall have a rated capacity equal to or greater than a value specified in Table (1).

An end suction or in-line pump shall have a rated capacity of less than 1892 L/min (500 GPM). See also IPS-M-PM-125.

TABLE 1 - PUMP CAPACITIES

L/min	L/min	L/min
95	1514	7570
189	1703	9462
379	1892	11355
568	2839	13247
757	3785	15140
946	4731	17032
1136	5677	18925

9.5 Outdoor Installation

9.5.1 If specified the pumps should also be suitable for outdoor installation under local ambient conditions.

9.5.2 Extraordinary local ambient conditions, such as high or low temperatures, corrosive environment, sand storms etc., for which the pump must be suitable and shall be specified by the Purchaser.

9.6 Prime Movers

The following have to be considered when determining the rated performance of the drive.

9.6.1 Application and method of operation of the pump

For instance in the case of parallel operation, the possible performance range with only one pump in operation taking into account the system characteristic shall be considered.

9.6.2 Position of the operating point on the pump characteristic curve.

9.6.3 Shaft seal friction loss.

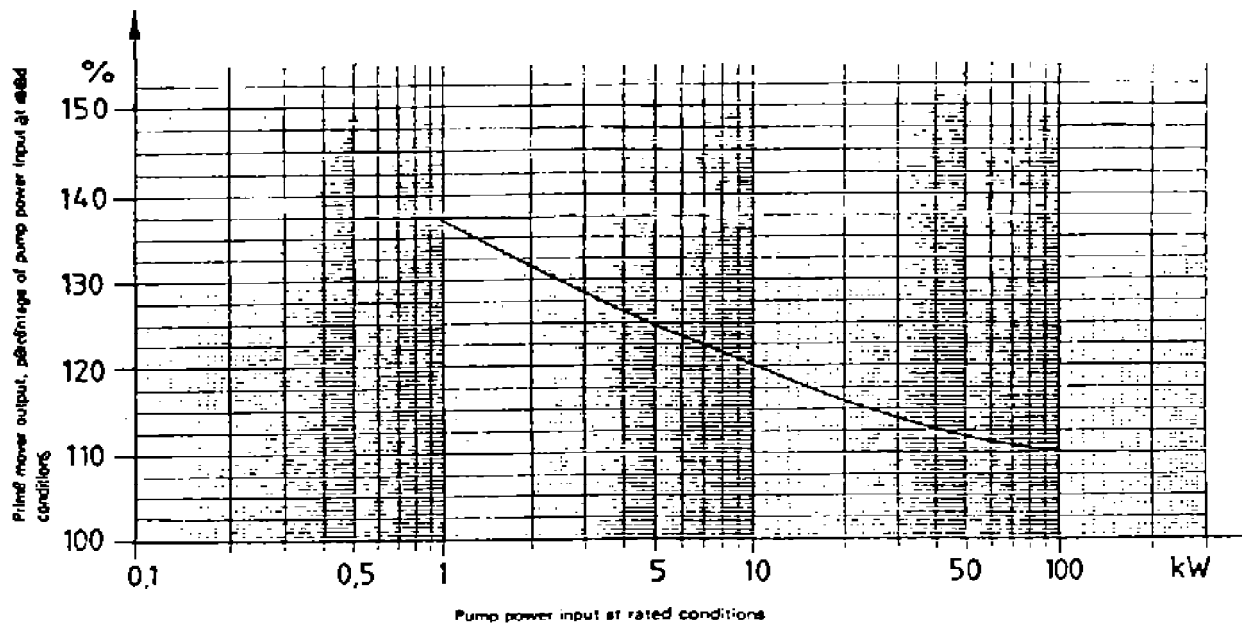
9.6.4 Circulation flow for the mechanical seal (Especially for pumps with low rate of flow).

9.6.5 Properties of pumped liquid (Viscosity, Solids content, Density).

9.6.6 Power and slip loss through transmission.

9.6.7 Atmospheric conditions at pump site.

Prime movers required as drivers for any pumps covered by this Standard shall have power output ratings at least equal to the percentage of rated pump power input given in Fig. 1, this value being never less than 1 kW. Where it appears that this will lead to unnecessary oversizing of the driver, an alternative proposal shall be submitted for the purchaser's approval.



PRIME MOVER OUTPUT, PERCENTAGE OF PUMP POWER INPUT AT RATED CONDITIONS
Fig. 1

9.7 Alarms

Various sections of standard which are in NFPA Section 20 specify alarms to call attention to improper conditions that should exist in the complete fire pump equipment.

9.8 Pressure Maintenance (Jockey or Make-Up) Pumps

9.8.1 Pressure maintenance pumps shall have rated capacities not less than any normal leakage rate. They shall have discharge pressure sufficient to maintain the desired fire protection system pressure.

9.8.2 A fire pump shall not be used as a pressure maintenance pump.

9.9 Horizontal Pumps

9.9.1 Types

Horizontal pumps shall be of the split-case, end-suction, or in line design. Single stage end suction and in-line pumps shall be limited to capacities of 1703 L/min. or less.

9.9.2 Foundation and setting

9.9.2.1 The pump and driver shall be mounted on a common baseplate and connected by a flexible coupling.

9.9.2.2 The baseplate shall be securely attached to a solid foundation in such a way that proper pump and driver shaft alignment will be assured.

9.9.2.3 The foundation shall be sufficiently substantial to form a permanent and rigid support for the baseplate.

9.9.2.4 The baseplate, with pump and driver mounted on it, shall be set level on the foundation.

9.10 Vertical Shaft Turbine-Type Pumps

9.10.1 Suitability

The deep-well, turbine-type pump is a vertical shaft centrifugal pump with rotating impellers suspended from the pump head by a column pipe that also serves as a support for the shaft and bearings.

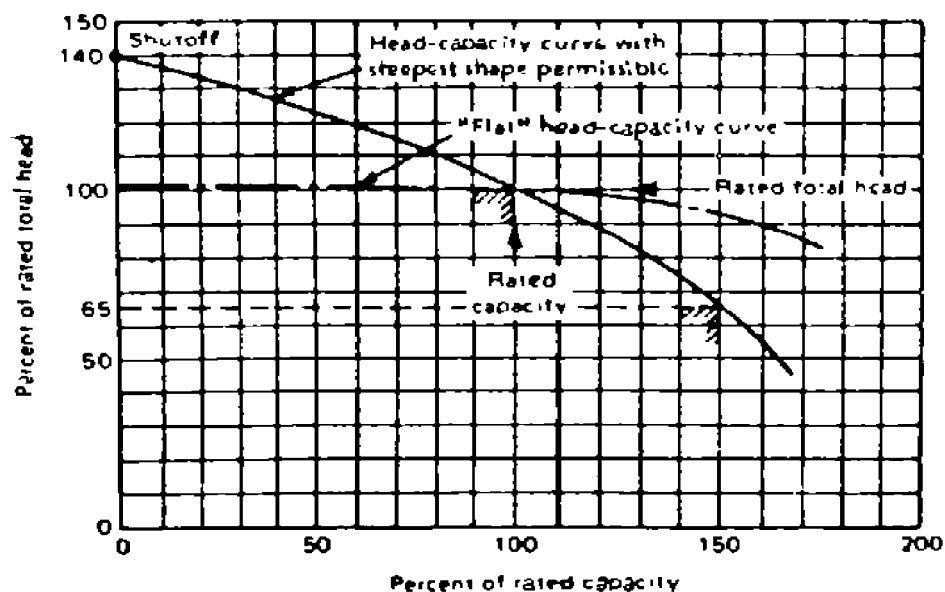
It is particularly suitable for the fire pump service when the water source is located below ground and where it would be difficult to install any other type of pump below the minimum water level. It was originally designed for installation in drilled wells, but should also be used to lift water from lakes, streams, open swamps and other subsurface sources. Both oil-lubricated enclosed-line-shaft and water-lubricated open-line shaft pumps shall be used. Some health departments object to the use of oil-lubricated pumps; such authorities shall be consulted before proceeding with oil-lubricated design.

9.10.2 Maximum depth

Fire pumps shall not be installed in a well where the pumping water level exceeds 61 m from the surface of the ground when pumping at 150 percent of rated capacity. In all applications the user shall be supplied with data on the draw-down characteristics of the well and the pump performance. The available discharge pressure at the discharge flange of the vertical pump can be determined from this data.

9.10.3 Characteristics

Pumps shall furnish not less than 150 percent of rated capacity at a total head of not less than 65 percent of the total rated head. The total shut off head shall not exceed 140 percent of total rated head on vertical turbine pumps. (see Fig. 2)



PUMP CHARACTERISTIC CURVES

Fig. 2

9.10.4 Water supply

9.10.4.1 The water supply shall be adequate, dependable, and acceptable to the responsible authorities.

9.10.4.2 The acceptance of a well as water supply source shall be dependent upon satisfactory development of the well and establishment of satisfactory water sources.

9.11 Pumps Submergence

9.11.1 Well installation

Proper submergence of the pump bowls shall be provided for reliable operation of the fire pump unit. Submergence of the second impeller from the bottom of the pump bowl assembly shall not be less than 3 m below the pumping water level at 150 percent of rated capacity.

The submergence shall be increased by 0.3 m for each 305 m of elevation above sea level.

9.11.2 Well construction

9.11.2.1 The vertical turbine-type pump is designed to operate in a vertical position with all parts in correct alignment. The well therefore shall be of ample diameter and sufficiently plumb to receive the pump.

9.11.3 Wells

Wells for fire pumps not exceeding 1703 L/min developed in unconsolidated formations without an artificial gravel pack (tubular wells) will be acceptable sources of water supply for fire pumps not exceeding 1703 L/min.

9.12 Pump

9.12.1 Head

The pump head shall be either the aboveground or belowground discharge type. It shall be designed to support the driver, pump column, and the oil tube tension nut or packing container.

9.13 Pump House

The pump house shall be of such design as should offer the least obstruction to the convenient handling and hoisting of vertical pump parts.

9.14 Outdoor Setting

If in special cases it is considered that the pump does not require a pump room and the unit is installed outdoors, the driver shall be screened or enclosed and adequately protected against tampering. The screen or enclosure shall be easily removable and have provision for ample ventilation.

9.15 Power Supply Dependability

9.15.1 Electric supply

Careful consideration shall be given in each case to the dependability of the electric supply system and the wiring system. This shall include the possible effect of fire on transmission lines either in the property or in adjoining buildings that might threaten the property.

9.15.2 Steam supply

Careful consideration shall be given in each case to the dependability of the steam supply and the steam supply system. This shall include the possible effect of fire on transmission piping either in the property or in adjoining buildings that might threaten the property.

9.16 Electrical Drive for Pumps

9.16.1 This section outlines the minimum requirements for the source(s) and transmission of electric power to motors driving fire pumps and the minimum performance requirements of all intermediate equipment between the source(s) and the pump, including the motor(s), excepting the fire pump controller and its accessories. All electrical equipment shall, as a minimum, comply with the provisions of Material Standards Listed in IPS-M-EL-132 to 290.

9.16.2 Power source(s)

Power shall be supplied to the fire pump by main and emergency power.

9.16.2.1 Utility service

Where power is supplied by a public utility service connection, the service shall be located and arranged to minimize the probability of damage by fire from within the premises and exposing hazards.

9.16.2.2 Single power station

Where power is supplied from a single private power station, the station shall be of noncombustible construction, located and protected to minimize the probability of damage by fire.

9.16.2.3 Other sources

a) Where reliable power cannot be obtained from a private power station or utility service, it shall be from two or more of either of the above or in combination, or one or more of the above in combination with an emergency generator, all as approved by the relevant authorities. The power sources shall be arranged so that a fire at one source will not cause an interruption at the other source(s).

b) Emergency Generator

Where power is supplied by an emergency generator, the generator shall be located and protected in accordance with 9.16.2 and 9.16.5.

9.16.3 Power supply lines

9.16.3.1 Circuit conductors

- a)** The fire pump feeder circuit conductors shall be physically routed outside of the building(s), excluding the electrical switch gear room and the pump room. When the fire pump feeder conductors must be routed through building(s), they shall be buried or enclosed by 51 mm of concrete (or equivalent 1-hour fire resistance) in order to be judged "outside of the building".
- b)** All pump room wiring shall be in rigid, intermediate, or liquid-tight flexible metal conduit.
- c)** The voltage at the motor shall not drop more than 5 percent below the voltage rating of the motor(s) when the pumps are being driven at rated output, pressure and speed, and the lines between the power source and motors are carrying their peak load.

9.16.4 Capacity of lines

Each line between the power source and the fire pump motor shall be sized at 125 percent of the sum of the full load currents of the fire pump(s), jockey pump, and fire pump auxiliary loads.

9.16.5 Transformers

9.16.5.1 Installation

Transformers shall be installed in accordance with the requirements of IPS-E-EL-150.

9.16.6 On-Site power generator systems

9.16.6.1 Where on-site generator systems are used to supply power to fire pump motors to meet the requirements of 9.16.2.3, they shall be of sufficient capacity to allow normal starting and running of the motor(s) driving the fire pump(s) while supplying all other loads connected to the generator.

9.16.6.2 Automatic shedding of loads not required for fire protection is permitted prior to starting of the fire pump(s).

9.16.6.3 Automatic sequencing of the fire pumps is permitted in accordance with 7-5-2-4 of NFPA Section 20.

9.16.6.4 Transfer of power shall take place within the pump room.

9.16.6.5 Conductors between the transfer switch and the generator source shall comply with clauses (a) and (b) of 9.16.3.

9.16.6.6 Protective devices in the on-site power source circuits at the generator shall allow instantaneous pick-up of the full pump room load.

9.16.7 Electric drive controllers and accessories

9.16.7.1 Location

- a)** Controllers shall be located as close as is practical to the motors they control and shall be within sight of the motors.
- b)** Controllers shall be so located or so protected that they will not be damaged by water escaping from pumps or pump connections. Current-Carrying parts of controllers shall not be less than 305 mm above the floor level.

- c) For controllers which require rear access for servicing, a clearance of not less than 1.1 m shall be provided at the rear of the controller and not less than 0.61 m on at least one side of the controller.

9.16.8 Alarm and signal devices remote from controller

When the pump room is not constantly attended, audible or visual alarms powered by a source, not exceeding 125 volts, shall be provided at a point of constant attendance. These alarms shall indicate the followings:

- a) Controller has operated into a motor running condition.

This alarm circuit shall be energized by a separate reliable supervised power source, or from the pump motor power, reduced to not more than 125 Volts.

- b) Loss of line power on line side of motor starter, in any phase.

This alarm circuit shall be energized by a separate reliable supervised power source. The phase voltage providing starting coil excitation shall be monitored to indicate loss of availability of such excitation.

- c) Phase reversal on line side of motor starter.

This alarm circuit shall be energized by a separate reliable supervised power source, or from the pump motor power, reduced to not more than 125 Volts.

PART II
TRAILERS CARRING FIRE EXTINGUISHING AGENTS

10. GENERAL

10.1 The capacity of trailer units shall not be more than 4 tons. Towing chassis shall be of four wheels with towing hook. The trailer shall be suitable for use in area as specified. The width shall not exceed 2.40 m and steering shall be possible by turning front axle with an extended towing connection. The suspension of each axle should be designed for a reserve of at least 10% when the trailer is fully loaded.

10.2 The trailer of 4 tons shall be provided with gravity brakes or air brakes for connection to the air braking system of the towing vehicle.

10.3 Mudguards shall be provided with mud flaps.

10.4 The lighting shall be in accordance with traffic regulations. The lighting shall be of 12 volts or as specified.

10.5 The equipment compartment and the total superstructure shall be fastened to the chassis beam by method which will prevent harmful influences and ensure flexibility of the body work and superstructure. All fire fighting and emergency equipment housed shall be stored properly, in such a way that they will not shift during driving, braking, and acceleration of the towing vehicle. The equipment shall be so arranged that they can be quickly removed.

SECTION 1

11. FOAM EQUIPMENT MOUNTED ON TRAILER UNIT

11.1 General

The purpose of the above trailer is to carry foam liquid to the scene of fire in order to replenish the major or general purpose fire trucks. It can also assist in direct fire fighting with foam by means of hoses connected between the water main and inductors installed on the trailer.

11.2 Equipment

The following equipment shall be installed on the trailer:

- 4000L tank for FLC,
- two inductors, each with a rating of approximately 400 LPM,
- inlet and outlet manifolds for foam liquid,
- lockers for materials.

The specific requirements given by the purchaser and details proposed by the supplier shall be given on a purchase order.

11.3 Trailer Chassis

The chassis of the trailer shall be suitable for carrying the equipment listed in 6.2.

The towing pole eye shall be suitable to fit the hook of towing vehicle.

The width of the trailer shall not exceed 2.40 m.

The brake system shall be of the positive air-brake type (air pressure to release brakes), actuated by the foot brake of the truck. A mechanical hand brake shall also be provided.

Electrical accessories shall comply with the traffic regulations.

11.4 Foam System

11.4.1 The FLC system mounted on the trailer is shown schematically in Appendix D.

11.4.2 Two inlet valves A, one at each side of the trailer, fitted with hose coupling valves and chained caps of the same type and size as mounted on the fire-fighting truck, shall be provided. Via each inlet the FLC can be pumped from the main FLC storage tank via hoses and check valve B into the tank mounted on the trailer. The trailer can also be filled by gravity from storage via the manhole.

Two outlet valves C, one at each side of the trailer, fitted with 65 mm hand suction round thread hose coupling of the same type and size as mounted on the truck shall be provided. Via each outlet and strainer D the foam liquid can flow from the trailer tank to the foam liquid pump of the truck.

The purpose of the inductors H is to make solution for direct fire fighting by mixing FLC from the tank via D and check valve E, with water via a water hose connected to coupling F. Regulation of the water/FLC ratio shall be done manually. For this purpose each inductor shall be fitted with a simple regulator.

Where instantaneous couplings are required, intlets shall be of the male type and outlets of the female type.

11.5 The Foam Liquid Tank (See Appendix D)

11.5.1 The FLC tank on the trailer shall be provided with internal transverse baffles and a 750 mm (29.5 inch) diameter expansion dome with a capacity of 3% of the tank volume. The manhole opening in the dome shall be 750 mm in diameter and be provided with a quick-release lock.

The tank shall be provided with:

- an inlet with an internal filling tube,
- an outlet which prevents sludge from flowing to the inductors,
- a sump with a bolted cover plate incorporating a sludge drain,
- a gage tube K to measure the tank contents,
- a breather valve L to prevent excessive underpressure or overpressure.

11.5.2 The tank shall be made of stainless steel to be protected against corrosion.

11.6 Additional Requirements

11.6.1 The trailer shall be provided with lockers and rolling shutters for storing small equipment.

11.6.2 The trailer shall be capable of carrying the following materials:

- two 65-mm suction hoses, each 4 m long complete with coupling of the same type as mounted on the fire truck,
- 12 hoses 70 mm (2¾") × 25 m long; synthetic fabric and lined, complete with instantaneous couplings,
- two air foam-making branch pipes, approximate capacity 500 LPM at 10 Bar each.

11.6.3 The trailer locker and tank shall be painted externally with fire brigade red enamel the mud wings with black enamel. Steelwork shall be treated against corrosion.

Grab handles shall be chromium-plated or stainless steel.

The interior of the lockers shall be covered with aluminum plate.

If the top of the tank is curved, a platform shall be provided on the tank for access to the manhole. For this purpose a fixed ladder is also necessary.

A spare wheel, not mounted on the trailer, shall be provided.

11.7 Testing and Quality Assurance

11.7.1 Manufacturers shall certify that tests have been carried out and give documentation for quality assurance before shipment from the factory.

11.7.2 Manufacturers shall also supply minimum of 2 operating manual and spare parts list.

SECTION 2

12. PREMIX FLC AND DRY CHEMICAL TRAILER UNIT

12.1 General

12.1.1 The purpose of this trailer is to have a mobile unit to be in hand at the site of construction work, maintenance or any emergency job in satellite areas where there is less possibility of quick reaching of fire service equipment in those areas.

12.1.2 The trailer width shall not be more than 2 meters and the total weight shall not exceed 2 tons.

12.2 Fire Fighting Systems

12.2.1 The trailer shall be mounted with a premix foam solution of the type AFFF or FFFP with the capacity of 500L, and two 200 kg dry chemical extinguishers.

Both systems should be actuated by dry air or nitrogen cylinder, each tank with separate actuating system.

12.2.2 Two hose reels with the combined outlet discharge nozzles and each hose reel fitted with 40 mm × 25 to 40 meters hose and shall be mounted on rear side of the trailer.

12.2.3 Dry chemical system shall be of twin tanks, each tank provided with one pressurized air/N₂ cylinder.

12.2.4 Dry chemical shall be of potassium bicarbonate (monex) compatible with the type of premix foam.

12.2.5 The following portable fire extinguishers shall also be provided:

2 × 10 kg dry chemical

2 × 5 kg CO₂.

12.2.6 Premix and dry chemical tanks shall be provided with pressure gages on discharge part of the tanks.

12.3 Trailer Chassis

12.3.1 The chassis of the trailer shall be suitable for carrying fire fighting system.

12.3.2 The trailer and premix / powder tanks and accessories shall be painted externally with fire service red enamel and wings with black enamel.

12.4 Tests and Quality Assurance

Pressurized air/N₂ cylinders shall be tested with specified test methods in accordance with BS or UL Standards. Premixed and dry chemical tanks shall be hydrostatically tested at 2 times of precalculated pressure at ambient temperature of 50°C when discharge valve is closed.

Manufacturer shall certify the quality assurance with documents before shipment.

12.5 Marking

Trailer unit shall bear the following marking engraved on a brass plate attached to the chassis:

- a) name of manufacturer or identifying symbol,
- b) catalog designation,
- c) date of manufacture,
- d) discharge rate.

SECTION 3**13. FOAM / WATER MONITOR TRAILER UNIT****13.1 General**

13.1.1 The purpose of this trailer is to carry large capacity of foam / water monitor to an outbreak of major fire, such as liquid hydrocarbon tank or major oil spill fire. By utilization of high capacity of water fog, a water shield can be set to cool the area, preventing heat radiation.

13.1.2 The trailer is to be of 3 wheels light weight that can be pulled by two men.

13.2 Foam / Water Monitor

13.2.1 The monitor shall have three hose inlet manifolds with instantaneous male couplings and ball valves. The piping shall be laid under the monitor base plate and the monitor should be of duplex branch type, foam and water.

13.2.2 Water branch to be of straight pattern but the nozzle tip can be changed to fog pattern type. The water discharge shall be of 2000 LPM at 10 Bar.

13.2.3 The foam monitor is to be provided with pick- up tube to take suction from foam drums. The pick-up tube to be of 40 mm Dia.

13.2.4 The water and foam solution capacity shall be of 2000 to 3000 LPM.

13.2.5 Vertical movement of the monitor to be of gear type, from 20° to 70° and horizontal movement 180° by hand.

13.3 Construction and Material

The monitor shall be made of corrosion resistant materials preferably of brass or brass alloy. The foam making barrel to be made of anodized aluminum alloy. The water discharge nozzle shall also be made of brass. The inlet manifold shall be made of material resistant to corrosion.

Monitors main valve to be of quick opening ball or gate valve and a pressure gage shall be provided and fixed to the water inlet adjacent to the inlet valve.

The monitor and piping shall be securely fixed on trailer chassis in such a way that during driving, braking and acceleration the monitor remain effectively secured.

13.4 Finishing

The trailer and parts made of brass to be painted fire service red. Trailer base plate and monitor barrel to be of aluminum.

13.5 Tests and Quality Assurance

Manufacturer shall certify by documents that trailer has been road tested and the monitor has been hydrostatically tested and assure that the quality of materials used have met BS. AU. 24 to 30b and UL. 711.

13.6 Marking

13.6.1 The unit shall have the following marking cast or engraved on a brass plate fixed on chassis.

- a)** Name of manufacturer or identifying symbol,
- b)** Catalog designation,
- c)** Manufacturing date,
- d)** Water and foam discharge rate.

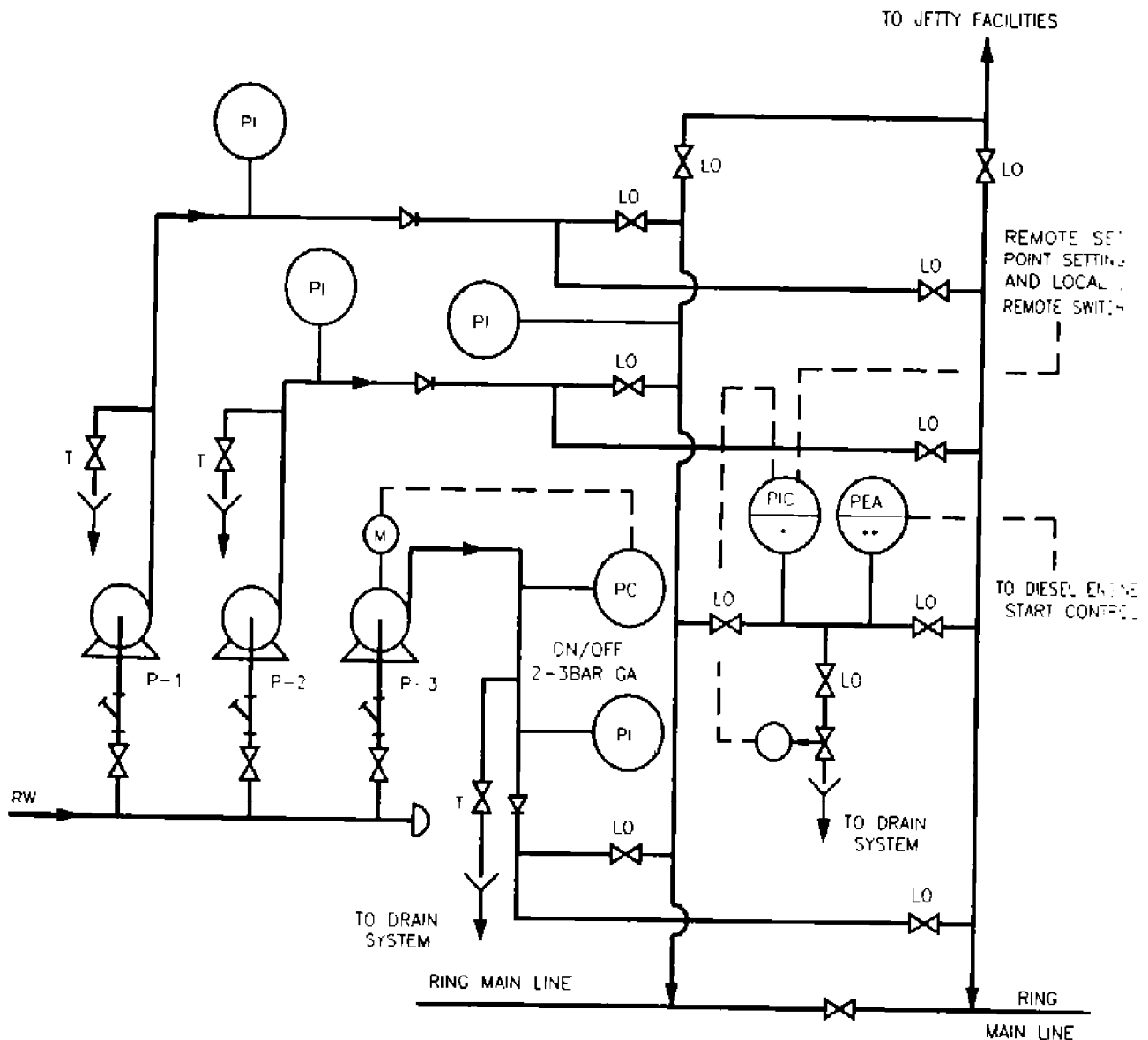
13.7 Equipments Carried by Trailer

- a)** 40 mm Dia. 2.5 mm length pick up tube,
- b)** minimum 4 length of standard fire hoses.

APPENDICES

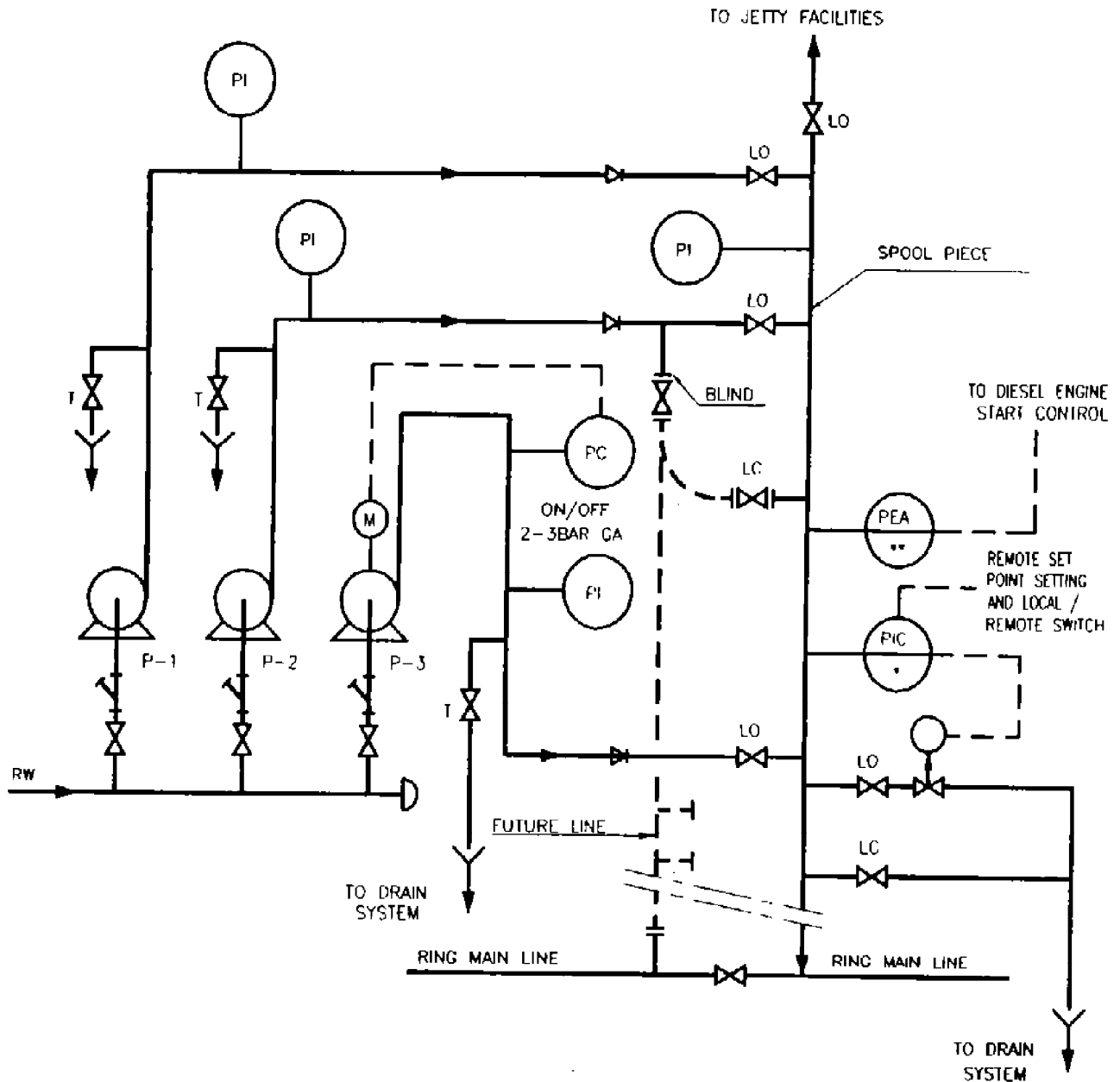
APPENDIX A

LINE - UP OF FIRE - FIGHTING PUMPS (CLOSE TO RING MAIN LINE)



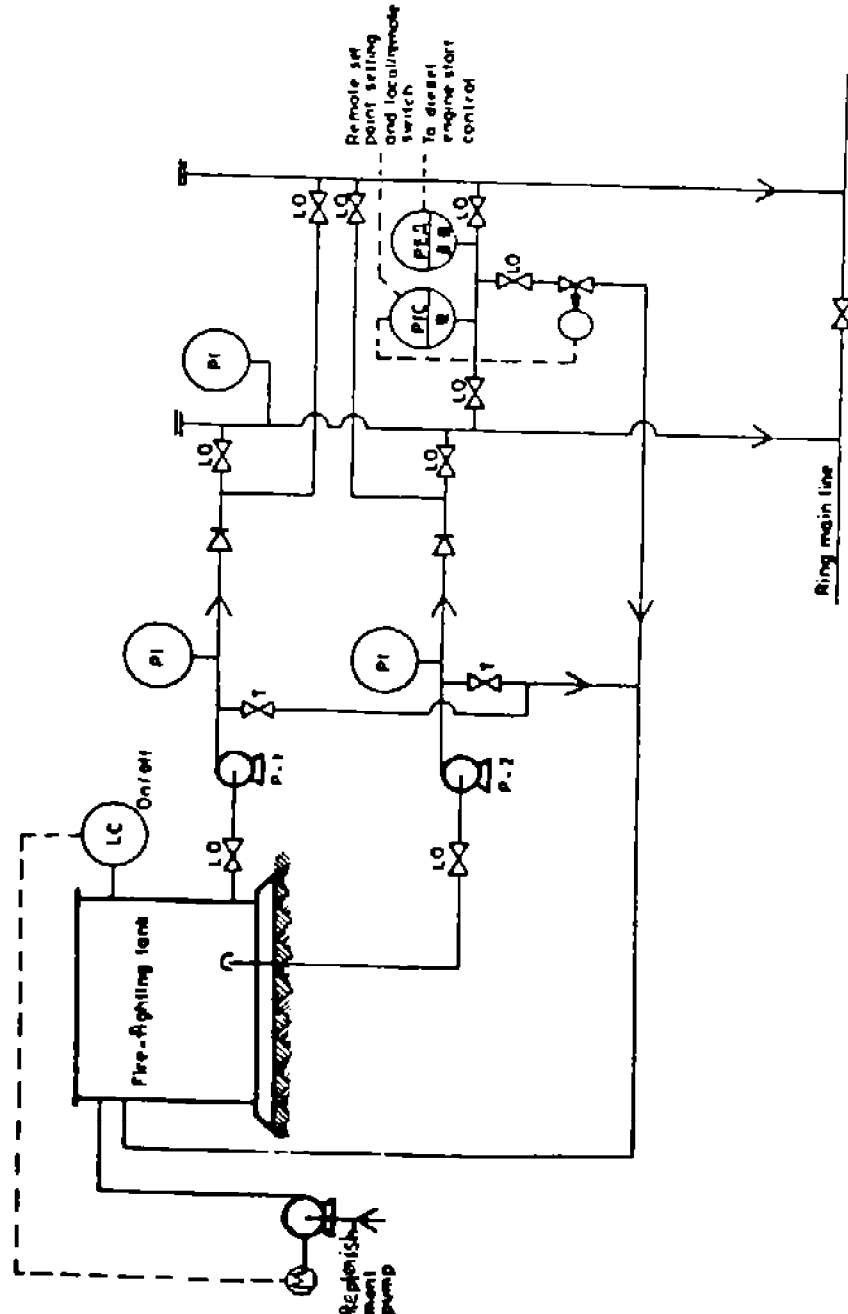
- RW = Raw water
- P - 1 = Electric motor driven submerged fire-fighting pump (or steam turbine)
- P - 2 = Diesel engine-driven submerged fire-fighting pump
- P - 3 = Electric motor-driven pressurizing pump
- LO = Locked open gate valve
- T = Test valve
- * = Operating range 6-20 bar GA
- ** = Set point range 2-6 bar GA

APPENDIX B
LINE - UP OF FIRE - FIGHTING PUMPS (REMOTE FROM RING MAIN LINE)



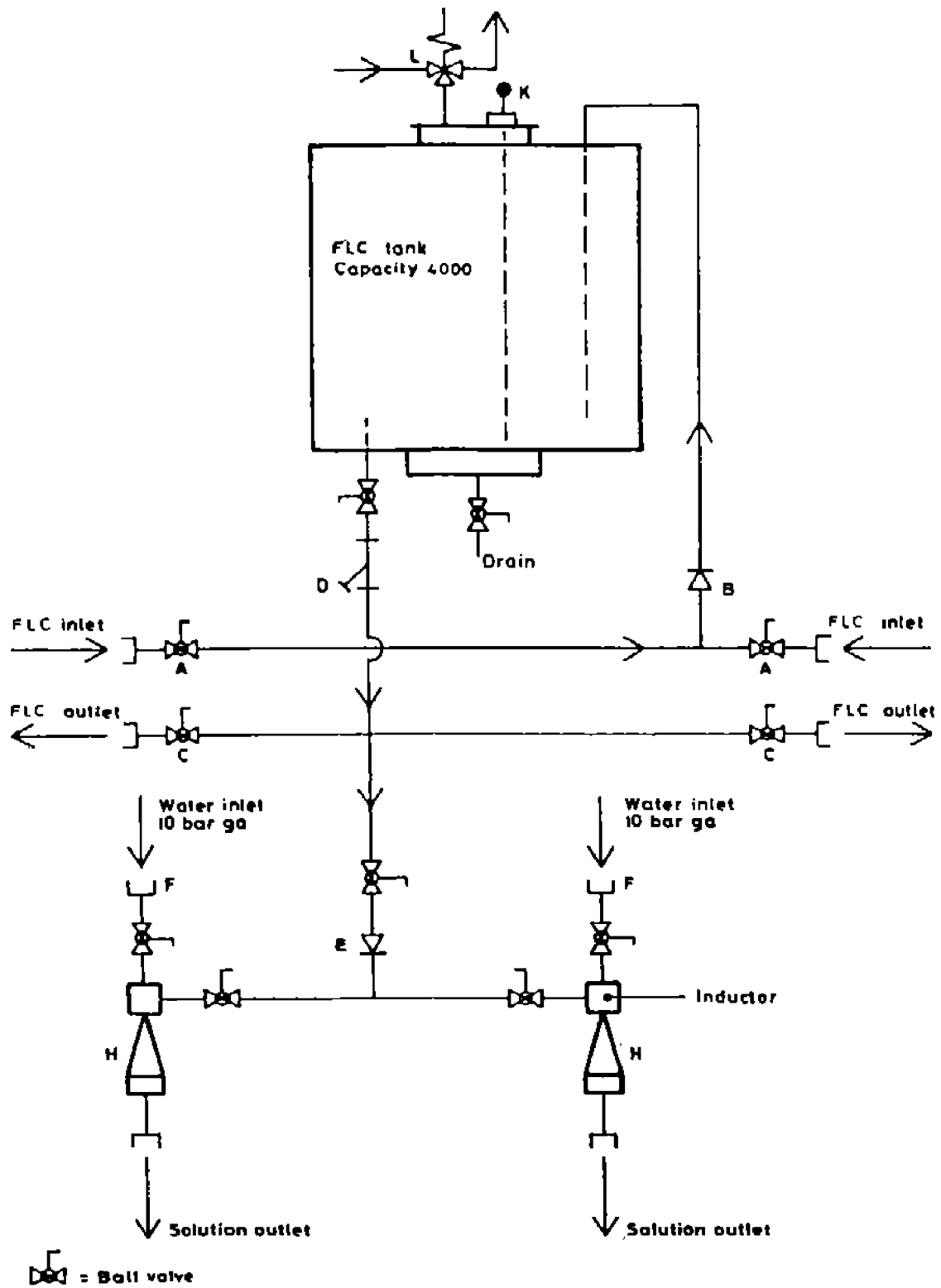
- RW = Raw water
 P - 1 = Electric motor (or steam driven pump)
 P - 2 = Diesel engine-driven submerged fire-fighting pump
 P - 3 = Electric motor-driven pressurizing pump
 LO = Locked open gate valve
 T = Test valve
 * = Operating range 6-20 bar GA
 ** = Set point range 2-6 bar GA

APPENDIX C LINE - UP OF FIRE - FIGHTING PUMPS (WITH WATER STORAGE)



- P-1 = Electric motor-driven fire-fighting pump
- P-2 = Diesel engine-driven fire-fighting pump
- LO = Locked open gate valve
- T = Test valve
- * = Operating range 6-20 bar GA
- ** = Set point range 2-6 bar GA

APPENDIX D
WATER FLC PIPING SYSTEM ON TRAILER



APPENDIX E TRAILER

