

**STANDARD**  
**FOR**  
**DELIVERY, INSPECTION, QUALITY CONTROL**  
**AND**  
**COMMISSIONING OF FIRE FIGHTING PUMPS**

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## **0. INTRODUCTION**

Fire pumps of adequate capacity, water pressure with reliable power and water supplies are recognized as a prime fire protection equipment in Petroleum Industries.

Fire pumps shall be of proper design, correctly installed and subjected to periodic tests and if not conscientiously maintained will be found out of order in the event of fire and resulting serious consequences.

## 1. SCOPE

This Standard covers the minimum requirements for acceptance test made at the time of commissioning, tests and inspections made at regular intervals and preventive maintenance of the pumping apparatus built for fire protection and used in Iranian Oil, Gas and Petroleum Industries.

## 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 standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor/Consultant/Contractor.

### IPS (IRANIAN PETROLEUM STANDARDS)

IPS-G-SF-100	"Fire Fighting Trucks"
Appendix A	

## 3. DEFINITIONS AND TERMINOLOGY

### 3.1 Acceptance Tests

Tests made at the time of apparatus commissioning to assure the Purchaser that the pump meets the performance requirement of the purchase contract.

### 3.2 Certification Tests

Test made at the manufacturers plant of pumps and witnessed by the representative of a testing organization and approved by the Iranian Oil, Gas and Petrochemical Industries.

### 3.3 Commissioning Test

Tests made at the time that apparatus is installed at its location and fixed with fire water piping and hydrant system.

Portable pumping unit is tested immediately after receiving at the site, before putting it into service.

### 3.4 Compound Gage

A gage reading pressure per kilo Paskal (kPa) and vacuum per mm Hg.

### 3.5 Discharge Pressure

The pressure at the point of gage attachment on the fire pump, as determined by the gage and corrected for any gage error.

### 3.6 Dynamic Suction Lift

The sum of the vertical lift and the friction and entrance loss due to the flow through the suction strainer and hose.

### **3.7 Service Tests**

Tests made occasionally (usually at least annually) after the pump has been put into service to determine if performance is still acceptable.

### **3.8 Suction Pressure**

The pressure at the point of gage of the suction passageway of the fire pump, as determined by the gage.

### **3.9 Vertical Lift**

The vertical distance from the surface of the water to the center of the pumping suction inlet.

## **4. UNITS**

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

## SECTION 1

### 5. ACCEPTANCE, OPERATION AND MAINTENANCE OF FIRE PUMPS (FIXED INSTALLATIONS)

#### 5.1 Field Acceptance Tests

**5.1.1** Project engineer shall notify the following responsible authorities of the time and program of acceptance fire pump tests:

- 1) Plant head of operation.
- 2) Responsible maintenance engineer (mechanical and electrical).
- 3) Chief fire officer or Hd of safety and fire.
- 4) Manufacturer/supplier representative.

**5.1.2** A copy of the manufacturer's certified pump test characteristic curve shall be available for comparison of result of field acceptance test. The fire pump as installed shall equal the performance as indicated on the manufacturer's certified shop test characteristic curve within the accuracy limits of the test equipment.

**5.1.3** The fire pump shall perform at minimum rated, and peakloads without objectionable overheating of any components.

**5.1.4** Vibration of the fire pump assembly shall not be of a magnitude to warrant potential damage to any fire pump component.

#### 5.1.5 Test procedures

##### 5.1.5.1 Test equipment

Test equipment shall be provided to determine net pump pressure, rate of flow through the pump, volts and ampers for electric motor driven pump and speed.

##### 5.1.5.2 Flow test

The minimum rated and peak load of the fire pump shall be determined by controlling the quantity of water discharged through the approved test devices.

##### 5.1.5.3 Measurement procedure

The quantity of water discharging from the fire pump assembly and pressure shall be determined and stabilized. Immediately thereafter, the operating conditions of fire pump and driver shall be checked as under.

- a) For electric motors operating at rated voltage and frequency, the ampere demand shall not exceed the product of a full load ampere rating times the allowable service factor as stamped on the motor nameplate.
- b) For electric motors operating under varying voltage, the product of the actual voltage and current demand shall not exceed the product of the rated voltage and rated full load current times the allowable service factor. The voltage at the motor shall not vary more than 5 percent below or 10 percent above rated (nameplate) voltage during the test.
- c) Engine driven units shall not show signs of overload or stress. The governor of such units shall be set to properly regulate the minimum engine speed at rated pump speed at the maximum pump brake horsepower.

- d) Steam turbine shall maintain its speed within the limits as specified.
- e) The gear drive assembly shall operate without excessive objectionable noise, vibration, or heating.

#### **5.1.5.4 Load start test**

The fire pump unit shall be started and brought up to rated speed without interruption under the conditions of a discharge equal to peak load.

#### **5.1.6 Controller acceptance test**

**5.1.6.1** Fire pump controller(s) shall be tested in accordance with the manufacturer's recommended test procedure. As a minimum, no less than 10 automatic and 10 manual operations shall be performed during the acceptance test.

**5.1.6.2** A fire pump driver shall be operated for a period of at least 5 minutes at full speed during each of the above operations.

**5.1.6.3** The automatic operation sequence of controller shall start the pumps from all provided starting features. This shall include pressure switches or remote starting signals.

**5.1.6.4** Tests of engine drive controllers shall be divided between both sets of batteries.

#### **5.1.7 Alternative power supply**

On installations with an emergency source(s) of power and an automatic transfer switch, loss of primary source shall be simulated and transfer shall occur while the pump is operating at peak load. Transfer from normal to emergency source and retransfer from emergency to normal source shall not cause opening of overcurrent protection devices in either line. At least half of the manual and automatic operations shall be performed with the fire pump connected to the alternative source.

#### **5.1.8 Emergency governor**

Emergency governor valve for steam shall be operated to demonstrate satisfactory performance of the assembly (hand tripping is acceptable).

**5.1.9** Alarm conditions both local and remote shall be simulated to demonstrate satisfactory operation.

#### **5.1.10 Test duration**

The fire pump shall be in operation for not less than one hour total time during all of the foregoing tests.

### **5.2 Maintenance**

#### **5.2.1 General**

Maintenance includes running the pump a few minutes each week. During such runs water is discharged through the relief valve or other opening. The run is carried up to nearly full speed and pressure. The condition of the pump and its associated equipment is least determined by an operating test. If a pump which is an important unit of fire protection shows more than 15 percent slip, a recommendation for repair is in order and the cause shall be found and remedied at once. There are three main type of maintenance; improvement, preventive and corrective actions.

### **5.2.2 Annual fire pump tests**

**5.2.2.1** The annual flow test (see 5.1.5.2) shall be conducted to determine its ability to continue to attain satisfactory performance at shutoff, rated and peak loads. All alarms shall operate satisfactorily. All valves in the suction line shall be checked to assure that they are fully open. The pressure relief valve, shall be verified by actual test to be correctly adjusted and set to relieve at the appropriate pressure.

**5.2.2.2** The annual test shall be performed by personnel trained in operation of fire pumps. Test results shall be recorded. The speed of the pump driver shall be determined and recorded.

**5.2.2.3** Any significant reduction in the operating characteristics of the fire pump assembly shall be reported and repair made immediately.

## **5.3 Fire Pump Operation**

**5.3.1** The fire pump shall be maintained in readiness for operation. After any test, the fire pump shall be returned to automatic operation. All valves shall be returned to normal operating positions.

**5.3.2** The fire pump room shall be kept clean, dry, orderly and free of miscellaneous storage. Access to this room shall be restricted.

**5.3.3** In the event of fire, qualified personnel shall be despatched to the fire pump room to determine that the fire pump is operating in a satisfactory manner.

**5.3.4** The fire pump unit shall be operated weekly and at least one start shall be accomplished by reducing the water pressure. This may be done with a test drain on a sensing line and with flow from the fire protection system.

**5.3.5** Qualified operating personnel shall be in attendance during the weekly pump operation. The satisfactory performance of the pump driver, controller and alarms shall be observed and noted.

## **5.4 Preventive Maintenance and Inspection**

**5.4.1** A preventive maintenance program shall be established in accordance with the pump manufacturer's recommendations. Records shall be maintained on all work performed on the pump, driver and controller.

### **5.4.2 Diesel engine operation and maintenance weekly run**

Engines shall be started no less than once a week and run for no less than 30 minutes to attain normal running temperature. They shall run smoothly at rated speed.

### **5.4.3 Engine maintenance**

Engines shall be kept clean, dry, and well lubricated. The proper oil level shall be maintained in the crankcase. Oil shall be changed in accordance with manufacturers recommendations, but no less frequently than annually.

### **5.4.4 Battery maintenance**

**5.4.4.1** Storage batteries shall be kept charged at all times. They shall be tested frequently to determine the condition of battery cells, and the amount of charge in the battery.

**5.4.4.2** The automatic feature of a battery charger is not substitute for proper maintenance of battery and charger. Periodic inspection shall determine that the charger is operating correctly. The water level in the battery shall be correct, and the battery is holding its proper charge.



**5.4.4.3** Only distilled water shall be used in battery cell. The plates shall be kept submerged at all times.

**5.4.5 Fuel supply maintenance**

The fuel storage tanks shall be kept as full as possible at all times, but never less than 50 percent of tank capacity, they shall always be filled by means that will ensure removal of all water and foreign material.

**5.4.6 Temperature maintenance**

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 heater and oil heater shall be followed.

**5.4.7 Emergency starting and stopping**

The sequence for emergency manual operation, arranged in a step-by-step manner shall be posted on the fire pump engine. It shall be the engine manufacturer's responsibility to list any specific instructions pertaining to the operation of equipment during the above-mentioned sequences.

## SECTION 2

### 6. ACCEPTANCE, SERVICE TEST, OPERATION AND MAINTENANCE OF FIRE SERVICE PUMPING UNITS

#### 6.1 General

Fire service pumping units are classified as:

- 1) Pumping Unit Mounted on Fire Trucks.
- 2) Trailer Mounted.
- 3) Portable.

In this Section operation, service test and maintenance of trailer mounted and portable light weight pumping units are discussed. For pumping unit mounted on fire trucks see IPS-G-SF-100.

#### 6.2 Tests Site Requirements

##### 6.2.1 Site

###### 6.2.1.1 Tests at draft

When tests are to be performed with the pump drafting, the test site shall be adjacent to a supply of clear water at least 1.25 m deep with the water level of 3 m below the center of suction inlet.

The suction strainer to be submerged at least 0.60 m below the surface of the water when connected to the pump by 6 m of suction hose.

###### 6.2.1.2 Other tests

When suitable site for drafting is not available, the site shall provide a level area for stationing the pump, a source of water such as fire hydrant connected to a water distribution system, and an area suitable for discharging the water.

##### 6.2.2 Environmental conditions

6.2.2.1 Pump test shall be performed when conditions are as follows:

<b>Air temperature</b>	<b>0 to 38°C</b>
<b>Water Temperature</b>	<b>2 to 32°C</b>
<b>Barometric pressure corrected</b>	<b>(737 mm Hg) minimum at sea level</b>

##### 6.2.3 Equipment

###### 6.2.3.1 Suction hose and strainer

When testing the pump at draft 6 m of suction hose of appropriate size for the rated capacity of the pump and suction strainer that will allow flow with total friction shall be furnished.

**6.2.3.2** When testing a pump from a hydrant or other source of water at positive pressure, the suction hose may be of any convenient size and length that will permit the necessary amount of water to reach the pump with the minimum suction pressure of 69 kPa (0.7 bar) and only the strainer at the pump inlet shall be required.

#### **6.2.3.3 Discharge system**

Sufficient fire hose shall be provided to allow discharge of rated capacity to the nozzles or other flow-measuring equipment without exceeding the flow velocity of 10.7 m/s(35 Ft/s).

**6.2.3.4** Approved flow gage or pitot tube shall be used and all gages shall have been calibrated within a week preceding tests.

**6.2.3.5** Speed measuring equipment shall consist of either a tachometer measuring revolutions per minute or a revolution counter and stop watch.

### **6.3 Acceptance Test**

**6.3.1** Test to be conducted by assigned fire protection engineer, mechanical engineer and manufacturer/supplier representative.

**6.3.2** A copy of manufacturers certified pump test characteristic curve shall be available for comparison of results of acceptance test.

**6.3.3** The fire pump shall perform at minimum rated and peak loads without objectionable overheating of any component.

**6.3.4** Elements of certification test to be duplicated in-so-far as practical. The pumping test, overload test, pressure control test and pump vacuum test shall be performed as a minimum.

**6.3.5** Result of all tests shall be recorded and the testing authorities shall decide if the specified criteria have been met.

**6.3.6** Where test results are not acceptable, the manufacturer shall be notified in writing, of the discrepancies and other matters to be remedied.

### **6.4 Service Tests**

#### **6.4.1 Quarterly output test**

Pump shall be subject to a pumping test from open water using one length of hose per delivery. The length of test shall be at least 15 minutes and any pump found incapable of sustaining the pressure indicated below with the lift as near as possible to, but not exceeding 3 m from the surface of water to the pump inlet should be reported. The test shall be recorded.

TABLE OF PUMP OUTPUT

Normal Output of Pump at 7 bar L/min.	Pump Test Pressure Minimum bar	Number of Hose Lines	Size of Nozzles mm
4500	5.5	2 2	28 25
4050	5.5	4	25
3600	5.5	3	28
3150	5.5	1 2	28 25
2700	5.5	2 1	25 20
2250	5.5	4	20
1800	5.5	3	20
1350	5.5	2	20
900	5.5	2	15
450	5.5	1	15

#### Notes:

- 1) Where the nominal output of a pump falls between any figures in the table, the number and/or size of the nozzle(s) should be adjusted accordingly.
- 2) Pumps having capacity below that shown above should be tested to about 75 percent of the performance specified by the maker.

#### 6.4.2 Quarterly vacuum test

This test shall be carried out immediately after the output test given above.

All length of suction shall be coupled up to the suction inlet of the pump with the blank cap in position at the end of the last length but with the blank caps left off all delivers. The primer should be run at priming speed for not more than 45 seconds. Priming should cease after obtaining 0.8 bar or more vacuum and the compound gage needle should then be watched. If the needle falls back to 0.3 bar in less than 1 minute an excessive air leak is present. This may be due to a defective pump gland, to leakage at compound or pressure gage connections, delivery valves, cooling water connections or faults in the suction hose or couplings. Any leak should then be rectified. A leak in the suction hose may be found by the water pressure test.

**6.4.3** The ambient air temperature, water temperature, vertical lift, elevation of test site and atmospheric pressure (corrected at sea level) shall be determined and recorded.

**6.4.4** The engine pump and all parts shall exhibit no undue heating, loss of power, overspeed, or other defects during the entire test. The capacity, discharge pressure, suction pressure and engine speed shall be recorded at the beginning and the end of each phase of pumping test.

#### 6.5 Maintenance of Portable and Trailer Fire Pumps

**6.5.1** On all occasions when a pump has been used other than from a hydrant on open water, the pump shall be washed out from such a hydrant as soon as possible.

**6.5.2** The pump shall not be allowed to run dry unless the pump bearings are of a type that can withstand such treatment.

**6.5.3** Mobile pumps shall be housed in a room in which temperature is not allowed to fall below 4°C but as an additional precaution during the winter antifreeze should be added to the engine cooling system if permitted by the manufacturer, who will of course advise against this if the engine has direct cooling system. It is also advisable to drain the water from the pump casing in the cold weather.

**6.5.4** The engine shall be regularly oiled in accordance with manufacturers instruction and an occasional spot of oil given to the controls such as the throttle control. It is sound practice to grease the threads on the suction inlet and the suction couplings at the same time.

**6.5.5** A suitable record book shall be prepared showing the history of the pump and all maintenance and repair work done on it. The record should also contain the number of hours that the pump has been running.

**6.5.6** The practice of starting and running the engine of a pump for only a few minutes every shift during the day and night is very damaging to the engine because it will be continually running on the chock and this procedure will cause sooted plugs, dilution of engine oil with petrol resulting in dry cylinder walls and moisture condensation throughout the exhaust system leading to general corrosion and rapid deterioration of the engine. The pump therefore shall be tested by pumping from clean water.