IS 4989 (Part 4) (2003, Reaffirmed 2008): Multipurpose Aqueous Film Forming Foam Liquid Concentrate for Extinguishing Hydrocarbon and Polar Solvent Fires--Specification. ICS 13.220.10 : 71.080

IS 4989 (Part 4) : 2003

REAFFIRMED
2008

भारतीय मानक

हाइड्रोकार्बन और घुवी विलायक की आग बुझाने के लिए बहुप्रयोगी जलीय फिल्म बनाने वाले झाग एवं सांद्र — विशिष्टि

Indian Standard

MULTIPURPOSE AQUEOUS FILM FORMING FOAM LIQUID CONCENTRATE FOR EXTINGUISHING HYDROCARBON AND POLAR SOLVENT FIRES — SPECIFICATION

ICS 13.220.10; 71.080

BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

May 2003

Price Group 7

Fire Fighting Sectional Committee, CED 22

FOREWORD

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

Foam is a homogeneous mass of tiny air or gas filled in bubbles of low specific gravity which, when applied in correct manner and in sufficient quantity, form a compact fluid and stable blanket which is capable of floating on the surface of flammable liquids and preventing atmospheric air from reaching the liquid. It is produced, by mechanically mixing a gas or air to a solution of a foam compound (concentrate) in water. This standard covers the foam compound in the form of a homogeneous opaque liquid, free from suspended matter and visible impurities used for the production of fire fighting foam which is produced by mechanical aeration of water foam compound solution.

The foam produced from concentrates are of low expansion (up to 20 times), medium expansion (20 to 200 times) and high expansion (above 200 times). The low expansion foam concentrates are of following types:

a) Protein foam,
b) Aqueous film forming foam (AFFF),
c) Fluoro — Protein foam,
d) Synthetic foam (This can also be medium and high expansion foam), and
e) Multipurpose aqueous film forming foam.

Conventional foams such as Protein Fluoro Protein, AFFF and chemical foams are suitable only for fighting fires of hydrocarbon fuels that are insoluble in water. The water soluble flammable liquids such as alcohols, ketones, amines, easters, ethers, aldehydes, etc, in pure form or mixture with hydrocarbons (Gasohol) rapidly destroy these foams and are ineffective on such fires. Increased complexities and varieties of flammable liquids and their mixtures have necessitated the development of new foam formulations suitable for water miscible flammable liquids. Though, there are more than a thousand of flammable liquids and 4/5 types of foam compounds, it is not possible for the user to keep different types of foams for different hazards in the same premises. It is however known that basically there are two types of flammable liquids, namely, hydrocarbon and polar solvents. The multipurpose foam concentrate covered under this standard is developed to combat the fires of both the types effectively using 3 percent for hydrocarbons and 6 percent concentration for alcohol and other water miscible liquids.

The principle of extinction of fire for hydrocarbon is same as that by other foams but for polar solvents the mechanism is that where foam produced by mixing foam concentrate with water as laid down in this standard is applied through foam nozzles on alcohol fires, a tough polymeric membrane is formed on the surface of the fuel, which in turn supports the foam blanket. The polymeric membrane produced is lighter than alcohols and spreads uniformly and floats over its surface. This foam blanket over the polymeric membrane foam formed under heat excludes the external air, thereby extinguishing the fire.

The shelf-life of the foam covered in this standard and stored in proper storage condition is generally not less than 5 years in tropical conditions.

The composition of Committee responsible for the formulation of this standard is given at Annex L.

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

AMENDMENT NO. 1 MARCH 2005
TO
IS 4989 (PART 4) : 2003 MULTIPURPOSE AQUEOUS FILM FORMING FOAM LIQUID CONCENTRATE FOR EXTINGUISHING HYDROCARBON AND POLAR SOLVENT FIRES — SPECIFICATION

(*Page* 1, *clause* **4.1**) — Delete second sentence 'It should be -------performance'.

(*Page* 1, *clause* **4.2**) — Delete.

[*Page* 1, *Table* 1, *Sl No.* (vi)] — Substitute '*n*-heptane' *for* '*n*-hexane' and shift Sl No. (vi) to Table 2 on page 2.

[*Page* 1, *Table* 1, *Sl No.* (vii)] — Shift Sl No. (vii) to Table 2 on page 2.

(*Page* 1, *clause* **6**, *line* 3) — Insert '50' between '30' and '100'.

(*Page* 2, *Table* 2) — Substitute the following for the existing:

(1)	(2)	(3)		(4)
With iso propyl alchohol i)	Expansion at 27 ± 5°C	6 *Min*		F
ii)	25 percent drainage time at 27 ± 5°C	5 Minutes		G
		Polar solvent	*n-heptane*	
iii)	Fire control time	120 s	60 s	H and J
iv)	Fire extinction time	300 s	90 s	H and J
v)	Burn back	10 Minutes	10 Minutes	K

(*Page* 2, *clause* **7.2**) — Substitute '49°C' *for* '50°C'.

(*Page* 2, *clause* **8.2**) — Substitute the following for the existing:

'The product may also be marked with Standard Mark.'

(*Page* 2, *clause* **A-1**) — Substitute '27 ± 5°C' *for* '27 ± 1°C'.

(*Page* 2, *clause* **B-1.2**) — Substitute '27 ± 5°C' *for* '27°C'.

[*Page* 3, *clause* **C-2.1**(d)] — Substitute the following for the existing first sentence:

'Maintain the temperature of the cooling bath at about 0°C' and in line 7, substitute '1.6°C' *for* '- 5°C'

(*Page* 5, *clause* **D-5.1.1**) — Substitute the following for the existing:

'$S_{a/b} = \gamma_a - \gamma_b - \gamma_i$'

(*Page* 7, *Annex* E) — Insert the following at the end:

E-3 CALIBRATION

E-3.1 The pressure gauges, nozzle, shall be calibrated before use when new and thereafter once every six months according to the standard procedure.

E-4 FOAM GENERATION

E-4.1 The equipment shall be arranged as shown in Fig. 3. The reservoir should be filled with 90 l of premixed solution of foam concentrate and potable water depending upon the type. The cap shall be tightened. A pressure of 8 kgf/cm^2 shall be built up with the help of air compressor. The discharge valve is then opened and the pressure is adjusted so as to give a pressure of 7 kgf/cm^2 at the inlet of the nozzle.

E-5 FILM FORMATION TEST

E-5.1 Equipment

a) Mild steel sheet fire tray having dimension of 60 cm × 60 cm and height 15 cm.

b) Cylindrical shaped drum made of stainless steel wire mesh having height of 45 cm, and internal diameter 20 cm. The drum is closed at lower end with M.S. sheet and opened at upper end.

c) A suitable tong to lower and raise the drum in the tray during test.

d) The nozzle and the arrangements as per details given in **E-4.1**.

E-5.2 Procedure

5.2.1 Pour water in the tray, up to height of 5 cm. Pour 2 l of *n*-heptane over the water surface. Generate the foam and operate the nozzle at 7 kgf/cm^2 and fill the tray by operation of the nozzle for 40 s. Immediately after stoppage of foam application place the cylindrical strainer drum with open end up on the tray. Wait for 2 min. Now lower a lighted torch (lighted with alcohol through the open end of the strainer and bring it near but not touching the liquid surface; care shall be exercised to ensure that burning alcohol does not drip down from the torch over the film surface. The surface shall not ignite. Now the burning torch shall be very lightly touched to the liquid surface. The surface should not ignite. Keep repeating the test at intervals of 1 min from stopping the foam application. In cases of samples having slow drainage, the film formation may be delayed and hence the sample can be considered acceptable even if it passes in the above test when tested at 5 min. The film shall hold for minimum 15 min.

NOTE — In all the above tests intermittent self-extinguishing 'walk over'/'Flash' of flame is ignored. However, if sustained burning occurs, then the film is considered weak/absent.

(*Page* 8, *clause* **F-2.2**) — Substitute '27 ± 5°C' *for* '27 ± 1°C'.

(*Page* 10, *clause* **H-8**) — In line 3, substitute 'jet' *for* 'yet' and '0.50 ± 1 m' *for* '0.5 ± 1 m'.

(*Page* 10, *clause* **H-8**) — In line 6, substitute '60 s' *for* '160 s'.

(*Page* 11, *clause* **J-2**) — Substitute '*n*-heptane' *for* 'iso propyl alcohol'.

(*Page* 11, *clause* **J-3**) — Substitute '*n*-heptane' *for* 'IPA' and '3 percent' *for* '6 percent'.

(CED 22)

Indian Standard

MULTIPURPOSE AQUEOUS FILM FORMING FOAM LIQUID CONCENTRATE FOR EXTINGUISHING HYDROCARBON AND POLAR SOLVENT FIRES — SPECIFICATION

1 SCOPE

This standard lays down the requirements in respect of physical properties and performance requirements, packing and marking of multipurpose foam concentrate intended for use with mechanical foam generating equipments for extinguishing fire of polar solvents like alcohols, ethers, ketones, etc, as well as hydrocarbon liquid fuel.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
2631 : 1976	Specification for iso propyl alcohol (*first revision*)
4308 : 1982	Specification for dry powder for fire fighting (*first revision*)
4309 : 1979	Method of measurement on direct reading *p*H meters (*first revision*)
4989 (Part 1) : 1985	Specification for foam concentrate (compound) for producing mechanical foam for fire fighting: Part 1 Protein foam (*second revision*)
7959 : 1987	Specification for polyethylene containers for foam compounds (*first revision*)
14609 : 1999	Specification for ABC dry powder for fire fighting

3 APPLICATION

The concentrate shall be mixed with water in fixed/ mobile equipment in the following proportion:

a) For polar solvents at the rate of 6 percent concentration, and

b) For hydrocarbons at the rate of 3 percent concentration.

4 REQUIREMENTS

4.1 The foam concentrate shall generally be of amber colour and free from repulsive odour. It should be free from any floating foreign matter which may affect its performance.

4.2 Multipurpose foam concentrate shall not show any stratification when determined by visual examination of a 200-ml sample contained in a 250-ml graduated glass cylinder.

4.3 Concentration

4.3.1 The multipurpose AFFF foam concentrate shall conform to chemical, physical and performance requirements as indicated in Tables 1 and 2 respectively, when tested in accordance with the method specified against each requirement.

Table 1 Chemical and Physical Requirements

Sl No.	Property	Requirements	Ref to Test in Annex
(1)	(2)	(3)	(4)
i)	*p*H value	6.0 to 8.5	A
ii)	Specific gravity	1.00 to 1.15	B
iii)	Pour point	Shall be pourable at 1.6°C	C
iv)	Surface tension 3 percent with water	19 dynes/cm, *Max*	D
v)	Spreading coefficient	3, *Min*	D
vi)	Film formation	Forms film on *n*-hexane	E
vii)	Polymeric film formation	Visual examination over iso propyl alcohol	—

5 COMPATIBILITY

5.1 Compatibility with Dry Power

The foam produced shall be compatible with dry chemical powder when tested as per IS 4308 and IS 14609.

6 PACKING

Multipurpose foam concentrate shall be packed in polyethylene containers conforming to IS 7959. The capacity shall be 20, 30, 100 and 200 litres.

Table 2 Performance Requirements

(*Clause* 4.3)

Sl No.	Performance	Requirements		Ref to Test in Annex
(1)	(2)	(3)		(4)
With iso propyl alcohol				
i)	Expansion at 27°C	6 *Min*		F
ii)	25 percent drainage time at 27 ± 1°C	5 m, *Min*		G
		Polar solvent	*Gasoline*	
iii)	Fire control time	5 m, *Max*	1 m	H and J
iv)	Fire extinction time	3 m	1 m	J
v)	Burn back	2 m	3 m	K

7 STORAGE

7.1 The storage place shall be free from dampness and shall be well ventilated and the container shall not be directly exposed to sun rays.

7.2 The foam concentrate shall not have any adverse effect on its quality when stored at temperature range of 0 to 50°C.

7.3 The polyethylene jerry cans shall preferably be stacked in single layer and shall not exceed more than 2 layers.

8 MARKING

8.1 Each container shall be legibly and indelibly marked with the following information:

a) Manufacturer's name or trade-mark, if any;

b) To be written as 'multipurpose foam for fire fighting';

c) Quantity, in litres;

d) Month and year of manufacture and production, batch number;

e) Net and gross weight, in kg; and

f) To be written 'contents should not be stored under direct sun light'.

8.2 BIS Certification Marking

Each extinguisher may also be marked with Standard Mark.

8.2.1 The use of Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the rules and regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

[*Table* 1, *Sl No.* (i)]

METHOD OF DETERMINATION OF *p*H VALUE

A-1 Take 100 ml of a thoroughly mixed alcohol resistant foam sample in a beaker and measure the *p*H value on a standard *p*H electrometer (*see* IS 4309) using glass electrode at a temperature of 27 ± 1°C. Record the *p*H value to nearest 0.1.

ANNEX B

[*Table* 1, *Sl No.* (ii)]

METHOD OF DETERMINATION OF SPECIFIC GRAVITY

B-1 PROCEDURE

B-1.1 To determine the specific gravity, take a thoroughly mixed 2 l sample of alcohol foam and in a 2 l capacity measuring cylinder having suitable height.

B-1.2 Now determine the specific gravity of the sample at 27°C using standard hydrometer.

B-1.3 Record the results to nearest 0.01.

ANNEX C

[*Table* 1, *Sl No.* (iii)]

METHOD OF DETERMINATION OF POUR POINT

C-1 APPARATUS

C-1.1 The apparatus shall be as shown in Fig. 1 and shall consist of the following:

a) *Test Jar* — A test jar of clear glass, cylindrical form, flat bottom, approximately 30 to 35 mm inside diameter and 112 to 125 mm in height. An ordinary 100 ml sample bottle may be used if it meets these requirements.

b) *Thermometer* — A cloud and pour test thermometer which can read up to –10°C.

c) *Cork* — To fit the test jar, bored centrally to take test thermometer.

d) *Jacket* — A jacket of glass metal, water tight, of cylindrical form flat bottom about 112 mm in depth with inside diameter 10 to 12 mm greater than the outside diameter of the test jar.

e) *Disc* — A disc of cork or felt, 6 mm thick and of the same diameter as the inside of the jacket.

f) *Gasket* — A gasket about 5 mm thick, to fit snugly around the outside of the test jar and loosely inside the jacket. This gasket may be made of cork, felt or other suitable material, elastic enough to cling to the test jar and hard enough to hold its shape. The purpose of the ring gasket is to prevent the test jar from touching the jacket.

g) *Bath* — A cooling bath of suitable size and shape for obtaining the required temperatures. The bath shall be provided with a support, suitable for holding the jacket firmly in a vertical position. The required bath temperature may be maintained by refrigeration, if available, otherwise by suitable freezing mixture (that is crushed ice + sodium chloride or calcium chloride).

C-2 PROCEDURE

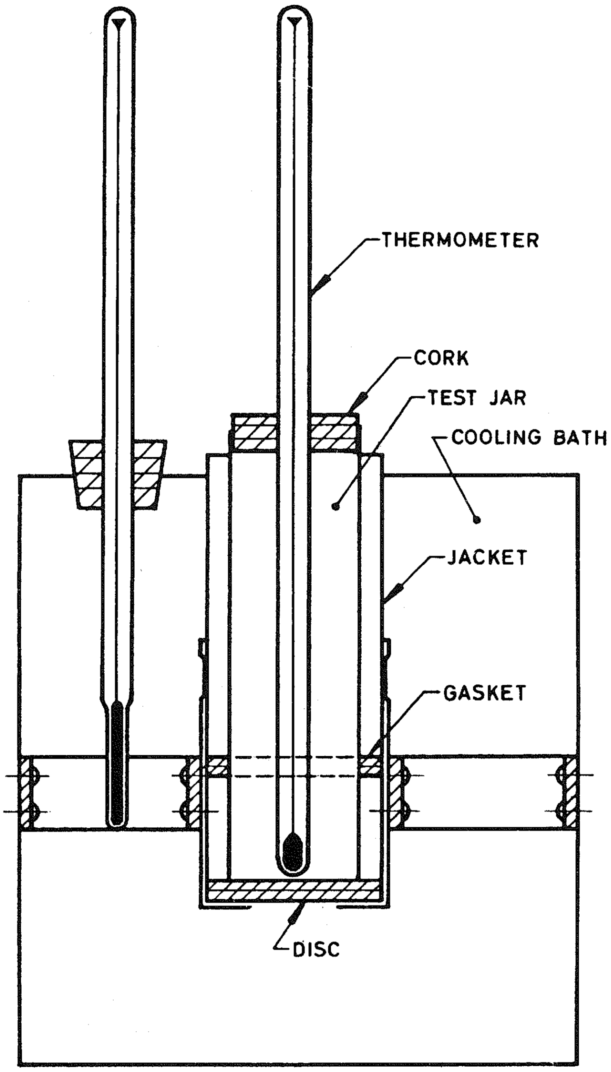
C-2.1 The following procedure shall be followed:

a) Pour thoroughly mixed sample of multipurpose AFFF foam into the test jar to a height of not less than 50 mm and not more than 56 mm. Mark the jar to indicate the proper level.

b) Close test jar tightly by the cork carrying the test thermometer in a vertical position in the centre of the jar with the thermometer bulb immersed so that the beginning of the capilliary shall be 3 mm below the surface of the sample.

c) Place the disc in the jacket and insert the test jar with the ring gasket 25 mm above the bottom into the gasket.

d) Maintain the temperature of the cooling bath between about 0°C to –5°C. Support the jacket containing the test jar, firmly in the vertical position in the cooling bath so that not more than 25 mm of the jacket projects out of the cooling medium. As soon as temperature of the sample goes to –5°C, the jar shall be tilted and flow observed by holding the test jar in a horizontal position for about 5 to 10 s. Foam sample shall flow freely.



Notation

A	Test Jar	*E*	Disc
B	Thermometer	*F*	Gasket
C	Cork	*G*	Bath
D	Jacket		

FIG. 1 APPARATUS FOR POUR POINT

ANNEX D

[*Table* 1, *Sl No.* (iv) and (v)]

METHOD OF DETERMINATION OF SURFACE TENSION

D-1 APPARATUS

The following apparatus is required:

a) Du Nouy precision tensiometer or equivalent,

b) Platinum ring of 4 or 6 cm circumference, and

c) Sample container (glass) 6 cm in diameter.

D-2 SAMPLE

A solution of 10 ml of 3 percent foam and 97 percent of distilled water by volume shall be prepared.

D-3 PROCEDURE

Calibrate the tensiometer and clean the glassware with chromic acid, wash and rinse in distilled water. The platinum ring shall be rinsed thoroughly in a solvent and distilled water and then dry it in the oxidizing portion of the gas flame. Check the level of the tensiometer and insert the platinum ring in the sample alcohol foam solution contained in the glass container. Take the measurement, set the dial and the vernier at zero point. Raise the sample platform until the ring is first submerged. Lower the platform slowly, at the same time applying torsion to the wire by means of dial adjusting screw so that the ring system remains constantly at zero position. As the breaking point is approaching nearer and nearer, adjustments are made slowly. Record the dial reading when the ring detaches from the surface and express it in dynes/cm.

D-4 METHOD FOR THE DETERMINATION OF INTER-FACIAL TENSION

D-4.1 Apparatus

Same as in **D-1**.

D-4.2 Sample

Same as in **D-2**.

D-4.3 Procedure

The inter-facial tension is determined in the same manner as the surface tension with the following modifications:

a) Use fresh solutions and freshly cleaned platinum ring for each determination.

b) Always move the ring from the aqueous side of the interface through the non-aqueous side liquid.

c) First place the aqueous solution in the sample vessel and immerse the ring therein. Carefully pour the cyclohexane on top of the aqueous solution to form the two layer systems. Contact between the cyclohexane and the platinum ring should be avoided during this operation. After allowing sufficient time, make the measurement in the same manner as that used for measuring surface tension.

D-5 METHOD OF DETERMINATION OF SPREADING COEFFICIENT

D-5.1 Spreading Coefficient

D-5.1.1 The spreading coefficient shall be determined with reference to cyclohexane in accordance with the following relationship:

$$S_{a/b} = \gamma_b - \gamma_a - \gamma_I$$

where

$S_{a/b}$ = spreading coefficient,

γ_a = standard value of surface tension of cyclohexane,

γ_b = surface tension of premixed AFFF solution as determined, and

γ_I = inter-facial tension between premixed AFFF and cyclohexane as determined.

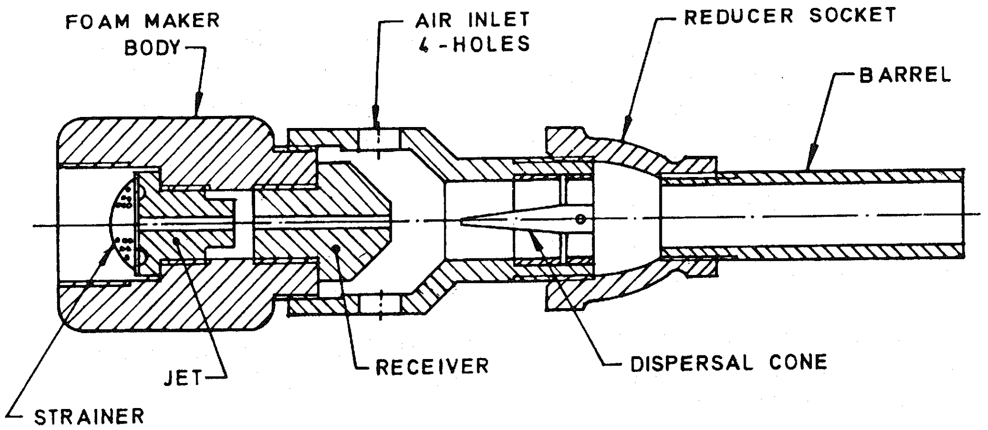
ANNEX E

[*Table* 1, *Sl No.* (vi)]

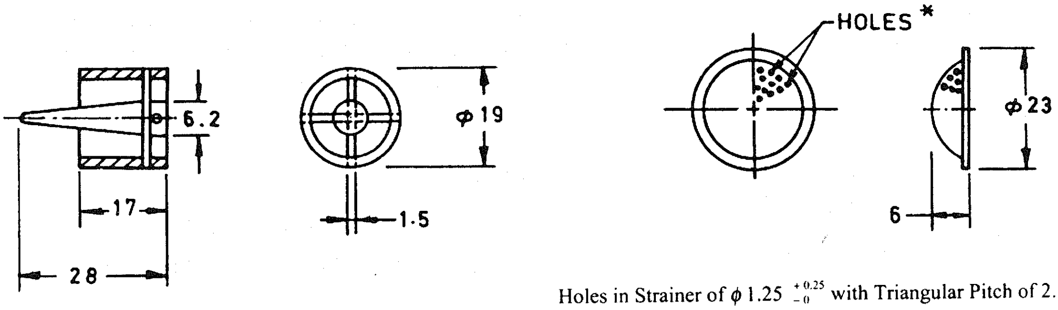
METHOD OF GENERATING FOAM

E-1 FOAM MAKING NOZZLE

A foam making nozzle having a water foam solution discharge capacity 7.5 l per minute at 7 kgf/cm^2 shall be used for producing foam and checking the performance requirements laid down in Table 2. The details and dimensions of nozzle are given in Fig. 2.



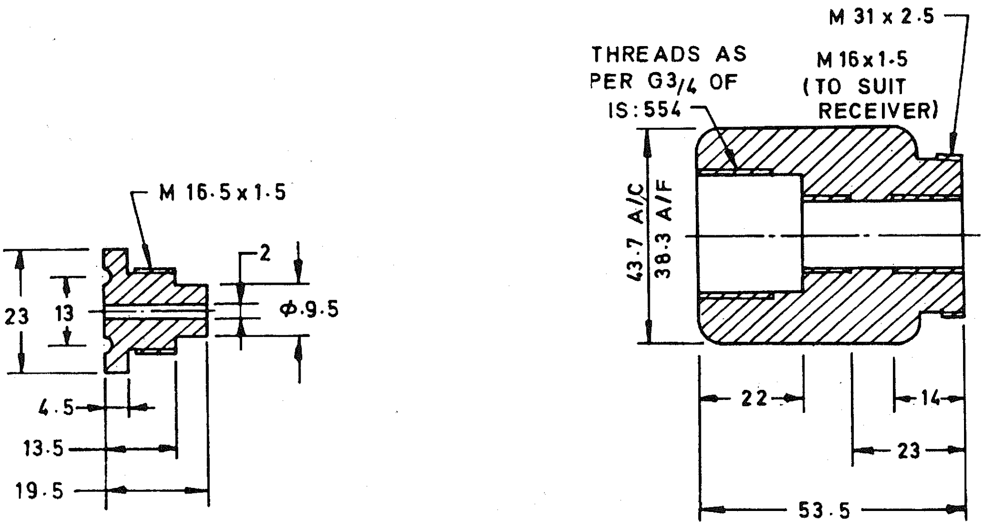
2A ASSEMBLY



Holes in Strainer of ϕ 1.25 $^{+0.25}_{-0}$ with Triangular Pitch of 2.5 ± 0.25mm

2B DISPERSAL CONE

2C STRAINER

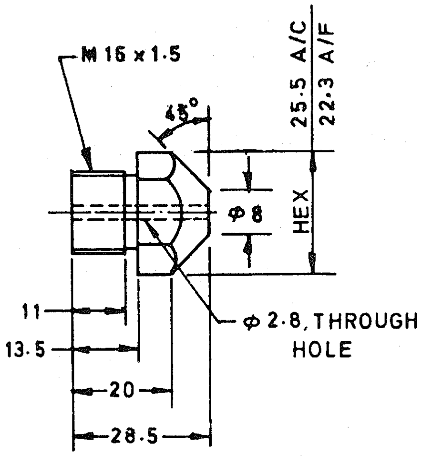


2D JET

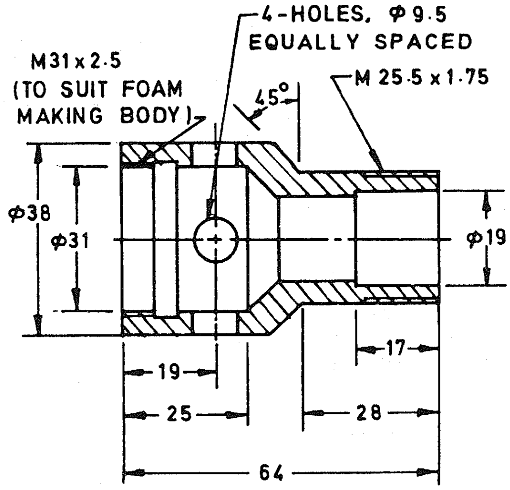
2E FOAM MAKING BODY

All dimensions in millimetres.

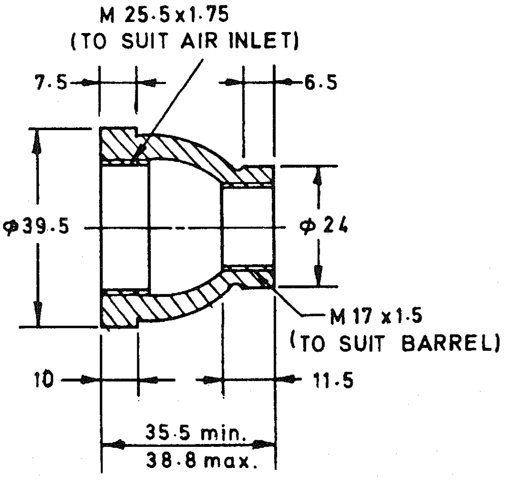
FIG. 2 FOAM MAKING NOZZLE OF CAPACITY 7.0 l/min (*Contd.*)



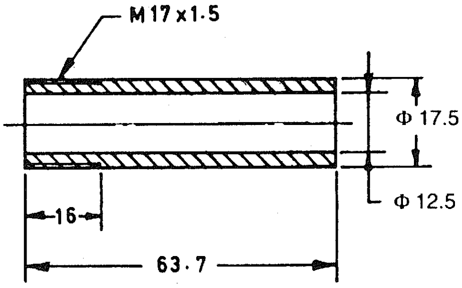
2F RECEIVER



2G AIR INLET



2H REDUCER SOCKET



2J BARREL

All dimensions in millimetres.

FIG. 2 FOAM MAKING NOZZLE OF CAPACITY 7.0 l/min

E-2 ARRANGEMENT FOR GENERATING FOAM

The following apparatus shall be used and assembled as shown in Fig. 3:

a) 100-litre capacity pressure reservoir made of stainless steel sheet and tested to withstand an internal pressure of 25 kgf/cm^2. It shall have a filling orifice of not less than 150 mm diameter with an air-tight cap with detail arrangements as shown in Fig. 3.
b) Adjustable stand,
c) Nozzle, and
d) Air compressor.

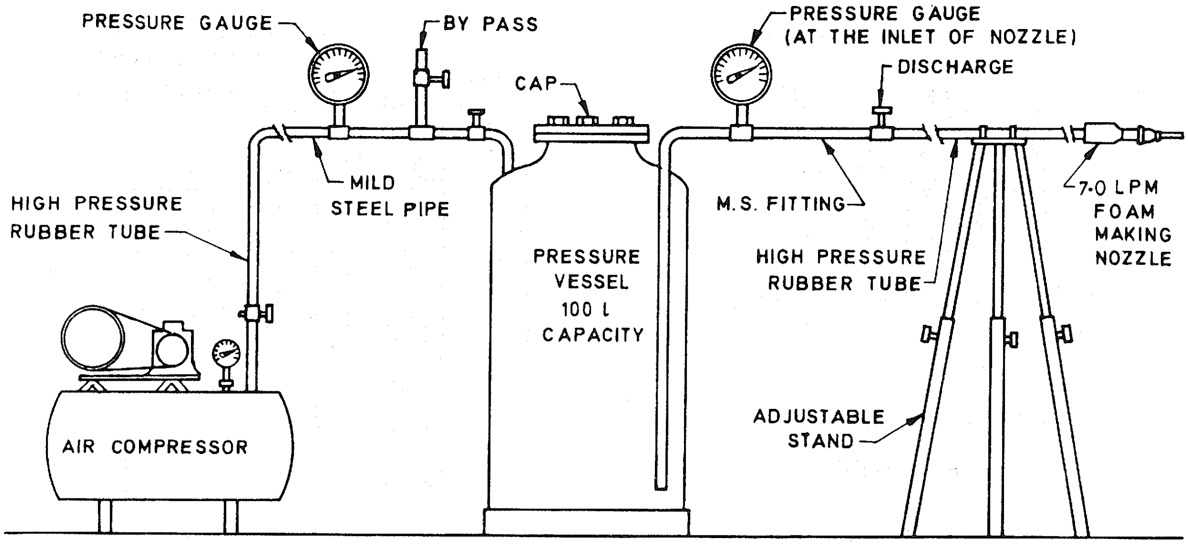


FIG. 3 ARRANGEMENT OF FOAM GENERATING EQUIPMENT

ANNEX F

[*Table* 2, *Sl No.* (i)]

METHODS OF DETERMINATION OF EXPANSION OF FOAM

F-1 APPARATUS

The following apparatus is required for this test:

a) *Weighing scales* — sensitivity 1 g or less,

b) *Foam collector board* (*see* Fig. 4), and

c) *Foam collecting pans* — Size 19.0 cm dia × 5.0 cm deep (capacity 1 400 ml), made of aluminium sheet of thickness 3 mm — Two numbers marked *A* and *B* and also with tare weight.

F-2 METHOD OF DETERMINATING THE EXPANSION

F-2.1 Weigh each empty foam collection pan and check with the tare weight stamped on it. Also check each pan for damage, deformation and correctness of capacity before use.

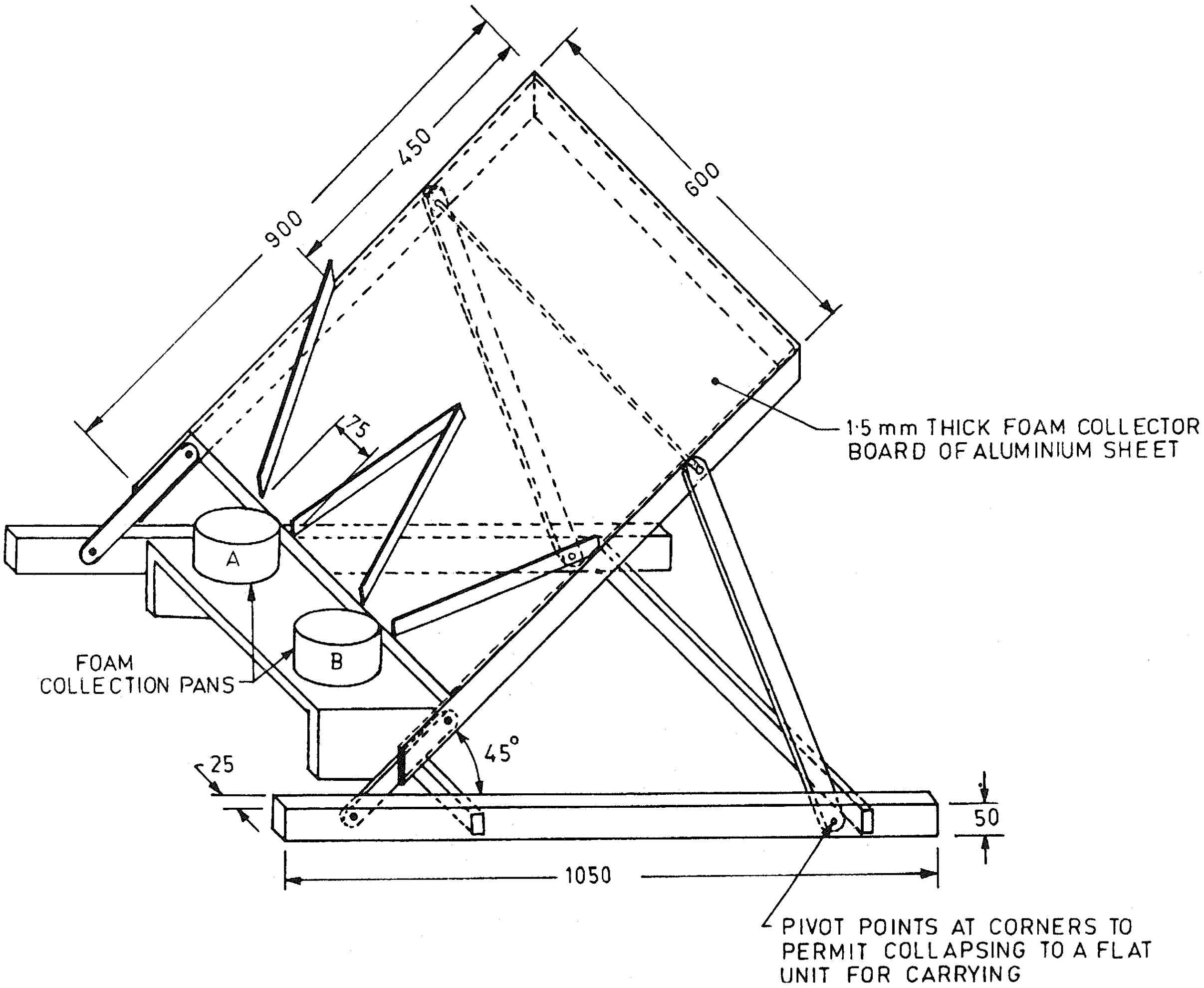
F-2.2 Generate foam at 7 kgf/cm^2 with the arrangement given in Fig. 3 at water temperature of 27 ± 1°C. Direct the jet of the foam on to the foam collector board.

F-2.3 Collect the foam flowing down at the bottom of the foam collector board in two foam collection pans. Level off the foam in the pans with a straight edge to its brim. Wipe the outside of each pan dry and weigh. Calculate the expansion factor in both cases as follows:

$$\text{Expansion factor} = \frac{\text{Volume of foam}}{\text{Volume of liquid in foam}}$$

$$= \frac{1\,400}{\text{Mass of pan} - \text{Mass of empty pan}}$$

F-2.4 Take the average of the two readings.



All dimensions in millimetres.

FIG. 4 FOAM COLLECTOR BOARD

ANNEX G

[*Table* 2, *Sl No.* (ii)]

METHOD FOR DETERMINATION OF TIME FOR DRAINAGE OF 25 PERCENT OF LIQUID IN THE FOAM

G-1 APPARATUS

G.1.1 Foam Collection Pan

A metallic foam collection pan of size 19.0 cm dia × 5 cm deep, capacity 1 400 ml with a small opening at the bottom towards the perimeter to which is attached a small rubber tube and pinch cock.

G-2 METHOD

The following method shall be adopted:

a) Generate foam with the arrangement described in Annex E.
b) Measure the expansion value of the foam according to the method given in Annex F.
c) Collect the same foam from the collection board in collection pan keeping the pinch cock attached to the rubber tube closed.
d) Level off the foam so collected immediately.
e) Open the pinch cock and collect the water drained from the foam in 100-ml graduated glass cylinder.

f) Calculate 25 percent volume of liquid from expansion as follows:

$$\text{Volume of 25 percent liquid} = \frac{1\ 400\ \text{m}}{4 \times \text{Expansion}}$$

g) After finding out volume [*see* (*f*) above], observe the time taken by this in draining out into the cylinder.

h) Repeat the test thrice and take the mean.

ANNEX H

[*Table* 2, *Sl No.* (iii)]

DETERMINATION OF FIRE TEST PERFORMANCE ON POLAR SOLVENTS

H-0 CONDITIONS OF TEST

NOTES

1 Fire test be conducted only when all the requirements of Tables 1 and 2 are fully met by the foam concentrate.

2 Manufacturer has to clearly mention whether the concentrate is sea water compatible. If it is in that case a separate test utilizing sea water composition as per IS 4989 (Part 1) is to be prepared. The test result of potable and sea water on the fire performance should not differ.

H-1 FOAM-GENERATING EQUIPMENT

The cylinder nozzle, hoses, stands, etc, are same as required in Annex F.

H-1.1 Temperature and Wind Conditions

Foam solution temperature 27 ± 1°C. Wind not more than 5 kmph.

H-2 FOAM SOLUTION

Prepare a foam solution mixing 94 l of potable or sea water as per requirement and 6 l of foam concentrate. Mix this solution thoroughly in a container outside the fire test cylinder and pour it in the cylinder when ready for fire test. Maximum transit time between mixing and fire test should be 15 min only.

H-3 SEA WATER COMPATIBILITY

Follow same procedure with sea water composition as in **G-2**.

H-4 FUEL

Use 125 l of 98 percent iso propyl alcohol, acetone or methyl ethyl ketone, whatever is agreed to between the manufacturer and the purchaser.

H-5 FIRE TRAY

Circular fire tray made of mild steel with following dimensions:

Diameter at rim : 1 480 ± 5 mm
Depth : 150 ± 10 mm
Thickness : 2.5 mm

With a vertical steel backboard 1 m ± 50 mm wide and 1 m ± 50 mm long, curved on the tray, the tray should have an area 1.73 m^2.

H-6 FOAM MAKING NOZZLE

As per IS 4989 (Part 1) with 7.5 lpm discharge to make about 4.1 lpm/m^2 application rate.

H-7 BURN BACK

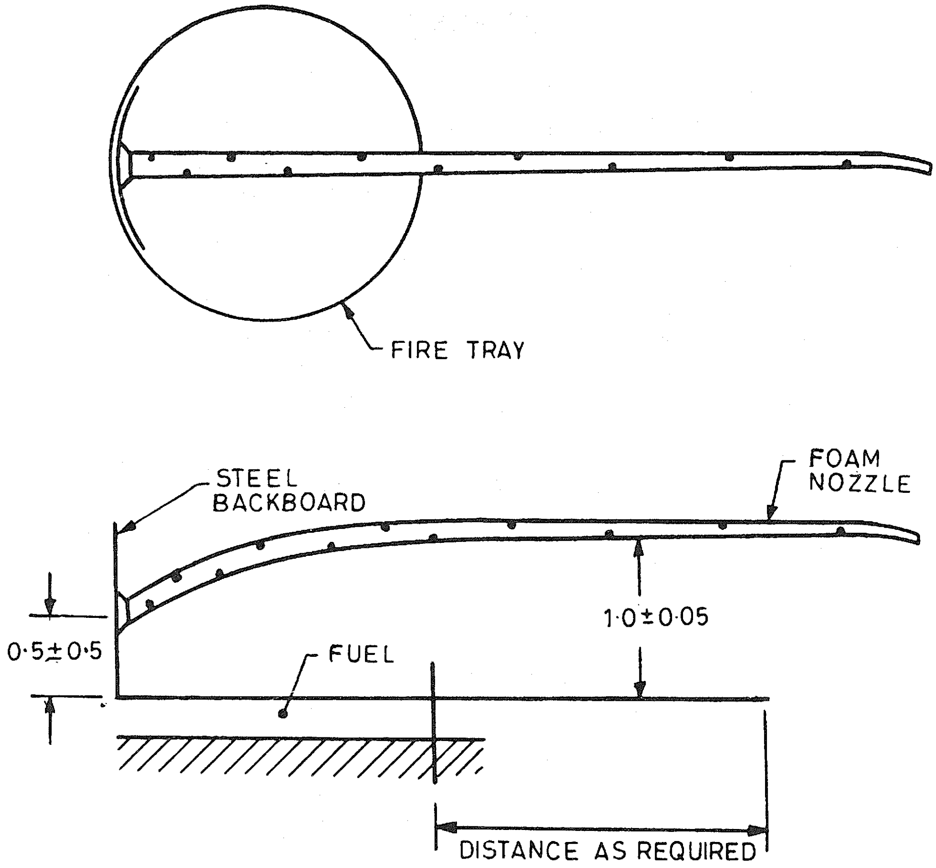
Same as in IS 4989 (Part 1).

H-8 FIRE TEST PROCEDURE

Place the fire tray on the level ground. Set up foam nozzle horizontally in such a way as to strike the foam yet at the centre of axis of the backboard (0.5 ± 1 m) above the fuel (*see* Fig. 5). Add 125 ± 5 litre of fuel.

Ignite the tray within 5 min of dumping of fuel. Allow it to burn for 160 s.

Start foam application and apply for 300 s during which visually note the time of fire control, that is, 90 percent control of fire and then note time for complete extinction.



All dimensions in millimetres.

FIG. 5 TEST FIRE FOR ALCOHOL-RESISTANT FOAMS

ANNEX J

[*Table* 2, *Sl No.* (iii) *and* (iv)]

METHOD FOR DETERMINATION OF FIRE CONTROL TIME AND FIRE EXTINCTION TIME

J-1 EQUIPMENT

J-1.1 Take a circular mild steel tank having base area of 2.6 m^2 with height 0.6 m and suitable steel backboard for striking foam jet. At the opposite end of the backboard is a suitable hole for holding the test nozzle (*see* Fig. 2), having bracket on the outer side to hold the nozzle securely.

NOTE — Before test, it shall be ensured that inside surface of the steel tank is clear, free from rust and even without any projections and dents.

J-1.2 Torch to Ignite the Fuel (Iso Propyl Alcohol Conforming to IS 2631)

J-2 PROCEDURE

Pour 100 l of iso propyl alcohol in the tank. Position the test nozzle at 7 kg/cm^2 pressure at such a level that the foam stream, when discharged inside across the tank, strikes it approximately 30 cm above the surface of the fuel level.

J-3 TEST

Ignite the fuel (IPA) and allow it to burn for 60 s. Generate foam with 6 percent solution and direct the stream at the opposite side of the tank. Record the time after starting foam application as follows for:

a) control time (time required to extinguish the fire except for licks of flame at the edges of foam blanket, that is, when 90 percent of fire is extinguished).

b) extinction time (time required for complete extinguishment of the fire).

ANNEX K

[*Table* 2, *Sl No.* (v)]

TEST METHOD FOR DETERMINATION OF BURN BACK

K-1 PRINCIPLE

This method is to assess the burn back resistance of foam concentrate in terms of time taken by a specified volume produced from spread over a specified area to burn completely when subjected to ignition under standard laid down conditions. This test has to be carried out under still air conditions in an enclosed room.

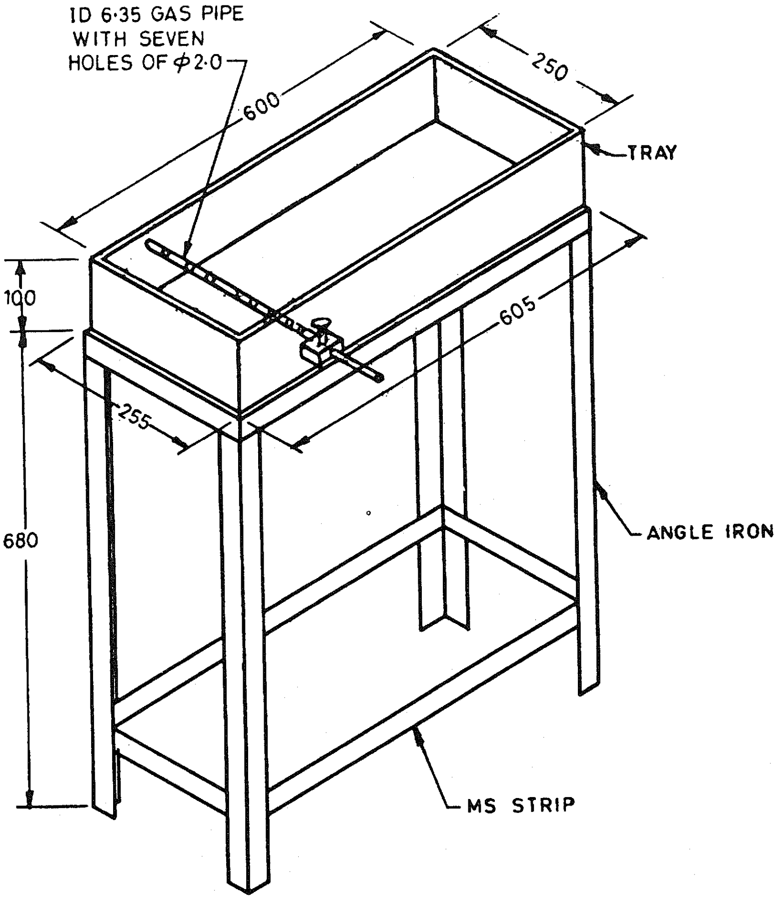
K-2 EQUIPMENT USED

a) Test nozzle as described in Annex E, and

b) Tray sparge and gas connection as per Fig. 6.

K-3 PROCEDURE

Pour 8 l of potable water in tray. Pour 3 l of 73 NL petrol over it. Ignite the fuel and allow it to burn freely for 30 s. Generate foam with solution at 7 kgf/cm^2 and apply it gently with the help of a goose neck over the burning fuel surface for 10 s. Connect the domestic gas line to the sparge pipe of the tray. 30 s after the foam application open the gas line fully and ignite the gas bubbling out from the foam blanket. Simultaneously start the stop watch. Record the time when hundred percent area of the tray is involved into flames.



All dimensions in millimetres.

FIG. 6 TRAY WITH STAND

ANNEX L

(*Foreword*)

COMMITTEE COMPOSITION

Fire Fighting Sectional Committee, CED 22

Organization	*Representative(s)*
Ministry of Home Affairs, New Delhi	SHRI OM PRAKASH (***Chairman***) SHRI D. K. SHAMI (*Alternate*)
Airport Authority of India, New Delhi	SHRI L. C. GUPTA SHRI H. S. RAWAT (*Alternate*)
Andhra Pradesh Fire Services, Hyderabad	SHRI SWARANJIT SEN
Bhabha Atomic Research Centre, Mumbai	CHIEF FIRE OFFICER
Bombay Fire Brigade, Mumbai	CHIEF FIRE OFFICER SHRI G. S. SAWANT (*Alternate*)
Central Building Research Institute, Roorkee	DR T. P. SHARMA DR A. K. GUPTA (*Alternate*)
Central Industrial Security Force, New Delhi	DEPUTY INSPECTOR GENERAL (FIRE) SHRI S. L. NAGARKAR (*Alternate*)
Central Public Works Department, New Delhi	CHIEF ENGINEER (E)
Centre for Environment and Explosive Safety, Delhi	SHRI A. K. KAPOOR SHRI H. S. KAPARWAN (*Alternate*)
Concord Arai Pvt Limited, Chennai	SHRI R. RAMAKRISHNAN
Controllerate of Quality Assurance (Fire), Pune	COL G. P. KRISHNAMURTHY
Defence Research and Development Organization, Delhi	DIRECTOR (FIRE SAFETY) DEPUTY DIRECTOR (FIRE SAFETY) (*Alternate*)
Delhi Fire Service, New Delhi	SHRI R. C. SHARMA SHRI SURINDER KUMAR (*Alternate*)
Directorate General of Supplies and Disposals, Hyderabad	SHRI M. GANGARAJU SHRI V. K. VERMA (*Alternate*)
Engineer-in-Chief's Branch, New Delhi	SHRI R. A. DUBEY SHRI AJAY SHANKAR (*Alternate*)
Fire and Safety Appliances Company, Kolkata	SHRI S. N. KUNDU
Home Department (Fire Service), Chennai	DIRECTOR DEPUTY DIRECTOR (*Alternate*)
Institution of Fire Engineers (India), New Delhi	PRESIDENT GENERAL SECRETARY (*Alternate*)
Kooverji Devshi and Company (P) Limited, Mumbai	SHRI P. H. SETHNA SHRI N. T. PANJWANI (*Alternate*)
K. V. Fire Chemicals, Navi Mumbai	SHRI H. M. SABADRA
Loss Prevention Association of India, Mumbai	MANAGING DIRECTOR SHRI D. K. SARKAR (*Alternate*)
Mather and Platt (India) Limited, New Delhi	SHRI DEEPAK AGARWAL
MECON Limited, Ranchi	SHRI R. N. CHACHRA SHRI SUNIL DAS (*Alternate*)
Newage Industries, Mumbai	SHRI B. J. SHAH SHRI A. M. SHAH (*Alternate*)
Northern Railway, New Delhi	SHRI I. M. MANSOORI
Oil and Natural Gas Commission, Dehra Dun	SHRI R. P. SAXENA SHRI NEERAJ SHARMA (*Alternate*)
Oil Industry Safety Directorate, New Delhi	JOINT DIRECTOR (PROCESS)
Real Value Appliances Limited, New Delhi	SHRI ASHUTOSH MANGAL
Safex Fire Services Limited, Mumbai	SHRI JITENDRA SHAH SHRI SANDIP SHAH (*Alternate*)

(*Continued on page* 14)

(*Continued from page* 13)

Organization	*Representative(s)*
State Bank of India, Mumbai	SHRI J. S. GAHLAUT
State Fire Training Centre, Mumbai	DR NAVINCHANDRA JAIN
Steel Authority of India, Bokaro	SHRI A. RAUTELA SHRI C. P. SINGH (*Alternate*)
Steel Authority of India, Rourkela	SHRI B. N. DAS SHRI B. P. DAS (*Alternate*)
Steelage Industries Limited, New Delhi	CHIEF EXECUTIVE SHRI V. KAMALANATHA (*Alternate*)
Surex Production and Sales (P) Limited, Kolkata	SHRI TARIT SUR SHRI D. NEOGI (*Alternate*)
Tariff Advisory Committee, Chennai	SHRI T. R. A. KRISHNAN
Tariff Advisory Committee, Mumbai	SHRI A. MUKHERJEE SHRI H. C. MAHESH KUMAR (*Alternate*)
Vijay Fire Protection Systems Pvt Limited, Mumbai	SHRI HARISH SALOT
West Bengal Fire Service, Kolkata	SHRI B. PATHAK
In personal capacity (*33/2965-A, Vennala High School Road, Vennala, Cochin*)	SHRI G. B. MENON
In personal capacity (*29/25, Rajendra Nagar, New Delhi*)	SHRI S. K. DHERI
BIS Directorate General	SHRI S. K. JAIN, Director & Head (CED) [Representing Director General (*Ex-officio*)]

Member Secretary
SHRI S. CHATURVEDI
Joint Director (CED), BIS