IS 3058 : 1990
(Reaffirmed 1996)

Indian Standard

CODE OF PRACTICE FOR FIRE SAFETY OF INDUSTRIAL BUILDINGS: VISCOSE RAYON YARN AND/OR STAPLE FIBRE PLANTS

(First Revision)

भारतीय मानक

औद्योगिक इमारतों की अग्नि सुरक्षा की रीति-संहिता: विस्कोस रेयन धागा और/अथवा स्टेपल रेशा संयत्र

(पहला पुनरीक्षण)

UDC 699'81 : 725: 42 : 677'463'051'1

© BIS 1990

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

September 1990 Price Group 3

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards on 20 February 1990, after the draft finalized by the Fire Safety Sectional Committee had been approved by the Civil Engineering Division Council.

In the entire process of rayon yarn or staple fibre manufacturing the greatest hazard lies in the handling of carbon disulphide which is one of the most dangerous of the common flammable liquids because of its low auto-ignition temperature and flash point, wide explosive range and high volatility. The chances of outbreak of fire in a staple fibre plant are also very high in the processes connected with treatment of the staple fibre, that is, processes subsequent to the extrusion of the fibre.

The other locations where fires are likely to occur are the polymerization sections, drier rooms, yarn packaging rooms, godowns and open storage areas. Chances of fires in these locations can be considerably reduced or even eliminated if precautions and safety measures mentioned in this Indian Standard are followed. This Indian Standard was first published in 1965. The revision has been prepared to align to the extent possible with the TAC rules and also update its requirements.

Provisions of this code are supplimentary to the relevant statutory requirements as laid down in Indian Factory Act, Petroleum Rules, Gas Cylinder Rules, etc.

Indian Standard

CODE OF PRACTICE FOR FIRE SAFETY OF INDUSTRIAL BUILDINGS: VISCOSE RAYON YARN AND/OR STAPLE FIBRE PLANTS

(First Revision)

1 SCOPE

1.1 This standard lays down the essential requirements for fire safety of plants manufacturing viscose rayon yarn or staple fibre or both.

2 REFERENCES

2.1 The Indian Standards listed in Annex A are the necessary adjuncts to this standard.

3 TERMINOLOGY

3.0 For the purpose of this standard, the definitions given in **3.1** to **3.12** shall apply.

3.1 After Treatment Section

The section where washing, desulphurizing, bleaching and soaping of yarn or staple fibre is carried on.

3.2 Alkali Cellulose

The cellulose which has been treated with caustic soda solution, after disintergrating (shredding) in the manufacture of viscose rayon yarn and staple fibre.

3.3 Auxiliary Plants

The plants which comprise carbon disulphide manufacturing plant, boiler house, water works and effluent treatment plant.

3.4 Churn Room (Xanthation Area)

The place where the orange coloured soft sticky mass known as exanthate is obtained by mixing carbon disulphide with alkali cellulose crumbs in rotating drums known as churns.

3.5 Drier

The equipment to dry wet viscose rayon yarn and staple fibre under controlled temperature and humidity.

3.6 Finished Carbon Disulphide Plant

A process room in the carbon disulphide plant where crude carbon disulphide is purified by washing and distillation.

3.7 Main Plant

The plant for manufacturing viscose rayon yarn and staple fibre from rayon grade wood pulp or cotton linters pulp.

It covers sections for viscose making, spinning of viscose filament yarn or staple fibre, after-treatment, drying, winding and packaging.

3.8 Regeneration

Conversion of the soluble chemical compound of purified cellulose into almost pure cellulose in the form of filaments.

3.9 Services Building

Engineering workshops attached to the chemical processing plants for maintenance purposes (mechanical workshop, electrical workshop, automobile workshop, power truck maintenance shop, air conditioning plant, carpentry workshop, etc).

3.10 Spinning Recovery

A unit in the viscose rayon and staple fibre manufacturing process, attached to spinning section used for concentrating the spent spinning acid and recovering sodium sulphate as a bye-product. This also covers purification and processing of sodium sulphate to make a marketable anhydrous product.

3.11 Staple Fibre

Rayon fibres of spinnable length manufactured directly or by cutting continuous filaments. It does not include rayon waste.

3.12 Viscose Rayon

Filaments of regenerated cellulose coagulated from a solution of cellulose xanthate.

4 LOCATION

4.1 The viscose rayon factories should be located in their own compound which should be very spacious (*see* **5.1**).

4.2 The exact location of the plant should be governed by various aspects but it shall be preferably in mofussil districts outside the limit of municipal areas and in close proximity of an abundant source of pernnial water supply, such as a river, etc.

4.3 The problems of effluent disposal also govern to a large extent the location of a rayon plant.

5 COMPOUNDS

5.1 The compound should be of sufficient areas to house main plant, service buildings and auxiliary plants at distances not less than those stipulated hereinafter, leaving sufficient open space for storage of charcoal, coal and sulphur and also for future expansion of the plant.

5.2 In no case should be built-up plinth area, allowing for all future expansions, exceed half of the area of the compound.

5.3 PUCCA roadways not less than 6 m in width should be constructed within the compound to facilitate the passage of fire engines.

5.4 The main gate for entry to or exit from the factory compound should be such that clear width and head room of at least 4·5 m are available. At least one additional gate of similar dimensions should also be provided for use in the event of the main gate getting blocked during an emergency.

6 STORAGE ARRANGEMENTS

6.1 General

6.1.1 Storage of material in general should comply with the provision of the relevant Indian Standard. (*see* IS 3594 : 1989).

6.1.2 Mixed storage, particularly of hazardous chemicals should be in a separate shed located away from surrounding structures at distance specified in 9.4.

6.2 Coal Storage

Coal should be stored in the open in an area cleaned of all vegetable growth and foreign matters such as leaves, weeds, rags, wastes, etc. The storage area should preferably have a hard base of brick or concrete.

6.3 Sulphur Storage in the Open

6.3.1 The storage of sulphur should be in accordance with the provisions of the relevant Indian Standard.

6.4 Carbon Disulphide Storage

6.4.1 The storage of carbon disulphide should be in accordance with the relevant Indian Standard. (*see* IS 5685 : 1970)

6.5 Fuel Oil Storage

6.5.1 Fuel oil storage should be in accordance with the provisions of IS 12056 : 1987 and IS 3594 : 1989.

7 CONSTRUCTION

7.1 The constructional features of all buildings within the compound should comply with the requirements of IS 1642 : 1989.

7.2 The buildings housing the xanthation areas or churn room should be of Type 1 as specified in IS 1642 : 1989.

7.3 Building housing the main plant where the process of rayon yarn and/or staple fibre manufacture is carried on should be of not less than Type 2 as specified in IS 1642 : 1989.

7.4 Buildings used as godowns should be of Type 1 as specified in IS 1642 : 1989.

7.5 The spinning recovery area auxiliary and service buildings should be of not less than Type 3 as specified in IS 1642 : 1989.

7.6 Adequate venting arrangements should be provided for the working and storage blocks in order to minimize smoke logging during a fire. For mechanical venting IS 941 : 1985 may be referred.

7.7 The entire building shall preferably be protected by automatic sprinkler system. The plinth area of any single building (without compartmentation) shall not exceed 10 000 m^2. In case of non-sprinkled buildings/compartments, the plinth area shall not exceed 5 000 m^2. However, in no case shall any point in the building or compartment be at a distance of more than 30 m from a fire hydrant. Where this distance exceeds, an internal hydrant system should be provided.

8 SEPARATING WALLS

8.1 The building or portion of building housing the xanthation areas (churn room) should be segregated from all adjoining blocks by separating walls complying with IS 1642 : 1989.

8.2 Separating walls should be provided between viscose section, spinning section, after-treatment section, packaging section and godowns.

8.3 Boiler houses and transformer houses should have similar separating walls if they adjoin the rayon yarn or staple fibre manufacturing plant.

9 DISTANCES

9.1 A minimum distance of 75 m should be maintained between the main plant and carbon disulphide and sulphuric acid plants.

9.2 A minimum distance of 30 m shall be maintained between the carbon disulphide plant and sulphuric acid plant.

9.3 Coal storage areas should be located at a distance of not less than 30 m from all other storage areas or from surrounding structures except boiler house from which it shall be at a distance of not less than 15 m.

9.4 Sulphur storage areas should be similarly located at distance of not less than 30 m from all other storage areas or from surrounding structures except carbon disulphide and sulphuric acid plants from which it shall be at a distance of not less than 15 m.

9.5 Godowns for storage of extra hazardous chemicals should be located not less than 15 m away from all surrounding structures.

9.6 Boiler houses, fire pump rooms and transformer houses should be located at a distance of 15 m from all surrounding blocks.

10 MACHINERY

10.1 Main Plant

10.1.1 *Xanthation Area*

10.1.1.1 Explosion venting shall be provided as per the provisions of Part 4 Fire Protection of National Building Code.

10.1.1.2 Vacuum exhausting systems should be provided in the churns from removing excess and unreacted carbon disulphide and care should be taken to see before unloading xanthate from the churn that the same is at a pressure lower than the room pressure.

10.1.1.3 The pipe conveying carbon disulphide should be adequately lagged, care being taken to see that flange joints are not left unlagged.

10.1.1.4 Carbon disulphide should be conveyed by means of pipes as described in **10.1.1.3** and should be fed into the churn from a metering equipment by water displacement method, the metering equipment being preferably located inside the churn room.

Carbon disulphide in excess of the quantity held in metering tanks and conveying pipes should be strictly prohibited in the main plant. For this purpose pumps of canned type shall be used.

10.1.1.5 Suitable arrangements for leakage detections should be provided in the pipe carrying carbon disulphide to the metering tanks. All joints in such pipes should be protected by steam lances.

10.1.1.6 The drains in the metering equipment should be of the closed type and adequate traps should be provided in the drains for trapping carbon disulphide carried over in the water.

10.1.2 Transformers if installed in working blocks should be of the non-flammable liquid filled or dry type.

10.1.3 The spacing of spinning frames should be such as to provide a clear distance of at least 3 m between rows of frames (that is, between the ends of any two frames) and also between the frames and the walls. The working space between two frames shall be not less than 1·5 m.

10.1.4 *Yarn or Staple Fibre Driers*

10.1.4.1 A clear space of 3 m should be provided between any two driers or between a drier and any other equipment or a wall.

10.1.4.2 All driers should be provided with automatic control to cut off the steam or electric supply at a pre-determined temperature.

10.2 Boiler Plants

10.2.1 *The Coal Fired Installations*

Coal fired installations should comply with the provisions of IS 3034 : 1981.

10.2.2 *The Oil Fired Installations*

Oil fired installations should also comply with the provisions of IS 3034 : 1981.

10.3 Carbon Disulphide Plant

10.3.1 The machinery of the carbon disulphide plant should comply with the provisions of the relevant Indian Standard (*see* IS 5685 : 1970)

10.4 Sulphuric Acid Plant

10.4.1 The machinery of the Sulphuric acid plant should comply with the provisions of the relevant Indian Standard (*see* IS 4262 : 1967).

11 ELECTRICAL INSTALLATION

11.1 The electrical installation should be in accordance with IS 1646 : 1982.

11.2 All electrical equipment in the xanthation area and carbon disulphide plant should be of the flame-proof type.

11.3 Vapour-proof lighting fittings should be installed in all areas where corrosive gases are evolved during the process.

11.4 All electrical current-carrying parts, contacts and hardware liable to corrosion should be preferably cadmium plated or suitably protected against corrosion and cables should be layed according to IS 12459 : 1988.

11.5 Maintenance of Equipment

11.5.1 All motors should be maintained and checked at regular intervals.

11.5.2 The bearings should be checked and overhauled every year.

11.5.3 All switchgear contacts should be thoroughly checked at regular intervals as recommended by manufacturers.

11.5.4 The overhauling and checking all flameproof electrical equipment should be carried out in consultation with the manufacturers or their representatives and put into use only after suitable test.

11.5.5 Electric wiring should be periodically inspected.

12 ILLUMINATION

12.1 For effective fire fighting purposes the minimum illumination required for the various blocks of the factory is as under:

	Lux
Godowns	100
Rayon plant	100
Carbon disulphide and sulphuric acid plants	100
Open compound under use	50

12.2 There should be provision of emergency lightings of adequate capacity.

13 FIRE FIGHTING ARRANGEMENTS

13.1 The first aid fire fighting arrangements and their maintenance should be in accordance with IS 2190 : 1979.

13.2 A hydrant service should be designed and laid in accordance with IS 3844 : 1989 and IS 3594 : 1989.

13.3 Sprinkler installations should preferably be installed to protect the rayon plant and the godowns.

13.4 In the absence of a sprinkler installation, driers should be provided with automatic water spray nozzles capable of opening at a predetermined temperature.

13.5 The procedure to be followed in the event of a fire by the operators working in the plant and those comprising the fire fighting squad should be strictly laid down and observed.

13.6 Spray or fog type nozzles should be provided near the hydrants protecting carbon disulphide plants, sulphur and oil storage areas and extra-hazardous chemicals godowns.

13.7 Additional large capacity fire extinguishers of dry powder type (*see* IS 10658 : 1983) should be provided in the areas where chances of outbreak of fire are high.

14 GENERAL SAFETY PROVISIONS AND HOUSE KEEPING

14.1 The areas where carbon disulphide is handled are as given in **14.1.1** to **14.1.3**.

14.1.1 The soles of shoes of all those entering these areas should be checked to see that they are fastened with sewing and not nail. Similarly steel toe or heal plates shall not be permitted.

14.1.2 Use of ferrous metal implements should be strictly forbidden. Only berylium-copper alloy or similar tools shall be used.

14.1.3 The wearing apparal of those working or new entrants should be of type which will not accumulate sufficient static electricity so as to be a source of sparks. Use of garments made from nylon, terylene or similar materials shall be prohibited.

14.2 Compound

14.2.1 All roads within the compound shall be kept clear and in good motorable condition. Further a clear headroom of 4·5 m should be available on the roads for passage of fire engines.

14.2.2 Stacking of materials in the open should be done in an orderly manner 15 m away from all working blocks and godowns.

14.2.3 Car and truck parking should be confined to parking lots only.

14.2.4 Movement of all locomotives and motor vehicles without spark arrestors of an approved type and cooling system (for motor vehicles only) for exhaust pipe should not be permitted within the danger area.

14.3 General

14.3.1 Open fires and naked lights in any working or storage building or within 15 m of sulphur, charcoal and coal storage areas should be prohibited.

14.3.2 The use of welding sets and blow lamps inside working or storage blocks should be carried out in the presence of the fire or safety officer and after all precautions are taken.

14.3.3 Carbon disulphide and hydrogen sulphide evolved in the regeneration process should be exhausted through exhaust system designed according to machinery manufacturer's specification.

14.3.4 Self-closing waste bins should be provided near machinery and all oily waste shall be kept in them until removed from the premises.

14.3.5 Smoking should preferably be prohibited throughout the compound of the factory. However, where so desired, smoking may be permitted in specified areas provided such areas are separated enclosed and made dust proof. Smoking should be prohibited in locker rooms.

14.3.6 Fire safety requirements and orders should be prominently displayed at conspicuous places.

ANNEX A

(*Clause* 2.1)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
941 : 1985	Blower and exhauster for fire fighting (*second revision*)
1642 : 1989	Code of practice for fire safety of buildings (general): Materials and details of construction (*second revision*)
2190 : 1979	Code of practice for selection, installation and maintenance of portable first-aid fire extinguisher (*second revision*)
3034 : 1981	Code of practice for fire safety of industrial buildings: Electrical generating and distributing stations (*first revision*)
3594 : 1989	Code of practice for fire safety of industrial buildings: General storage and warehousing including cold storages (*first revision*)
3844 : 1989	Code of practice for installation of internal fire hydrants in multistorey buildings (*first revision*)
4262 : 1967	Code of safety for sulphuric acid
5685 : 1970	Code of safety for carbon disulphide (carbon bisulphide)
10658 : 1983	Higher capacity dry powder fire extinguisher (trolley mounted)
12056 : 1987	Recommendations for safety requirements for fuel tank assembly of automotive vehicles
12459 : 1988	Code of practice for fire-protection of cable runs
Code of practice for installation and maintenance of external hydrant system (*under print*)	

Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Revision of Indian Standards

Indian Standards are reviewed periodically and revised, when necessary and amendments, if any, are issued from time to time. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition. Comments on this Indian Standard may be sent to BIS giving the following reference:

Doc : No. CED 36 (4505)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all Offices)

Regional Offices:	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002	331 01 31 331 13 75
Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola, CALCUTTA 700054	37 86 62
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	2 18 43
Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113	41 29 16
Western : Manakalaya, E9 MIDC, Marol, Andheri (East), BOMBAY 400093	6 32 92 95

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. PATNA. THIRUVANANTHAPURAM.

Printed at Printrade, New Delhi, India