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NATIONAL IRANIAN OIL REFINING & DISTRIBUTION COMPANY
NATIONAL IRANIAN OIL ENGINEERING
& CONSTRUCTION COMPANY

NIOEC SP

NIOEC SPECIFICATION FOR FIRE FIGHTING SPRINKLER SYSTEMS

FIRST EDITION

JULY, 2009

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IN THE NAME OF GOD**FOREWORD**

By their very nature, technical Specifications are continuously subject to modifications and revisions. To strengthen their merit and usefulness, continuous improvements, addendum, deletion of disparate information and consequently provision of updated revisions are to be made in order to ascertain that such Specifications meet the current requirements, inclusive of Iranian Petroleum Standards (IPS) and the recognized and acceptable national and international Standards, as well as the optimal codes and practices based on the accumulated in-house know-how and plant knowledge and experiences.

However, in reality, due to several reasons, not to mention the complexity of the matter, the ultimate goal of continuous direct embedment of the required changes on the relevant Specifications may be far reaching. Therefore, in the interim periods between the officially issued revisions, the required changes will appear in other documents related to the engineering and design work of the ongoing projects.

In response to the initiative of the Design and Engineering Directorate, and considering that the task of the execution of several important and mega projects for the realization of the new oil refineries, pipelines and oil terminals as well as improvements of the existing facilities, has been assigned to NIOEC, it was decided to update the NIOEC Specifications and to issue new official revisions.

The Design and Engineering Directorate was itself entrusted to carry out this important task, and as such by forming several special technical committees, working in close co-operation and cohesion and sharing their expertise and knowledge, the updated and revised NIOEC Specifications were successfully prepared and complied.

These Specifications are intended to be used for Oil Refineries, Distribution Depots, Oil Terminals, Pipelines and Pump Stations within NIOEC's projects, and have been proven to be of high value for such purposes. It must however be appreciated that these Specifications represent the minimum requirements and should in no way be interpreted as a restriction on the use of better procedures, engineering and design practices or materials.

We encourage and highly appreciate the users and other clear sighted and experts to send their comments on the Specifications to the Design and Engineering Director of NIOEC for evaluation and approval.

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NOTES:

- 1) THIS SHEET IS A RECORD OF ALL REVISIONS TO THIS SPECIFICATION.
- 2) WHEN APPROVED, EACH REVISION SHALL BE CONSIDERED AS A PART OF THE ORIGINAL DOCUMENT.
- 3) NUMBER OF PAGES EXCLUDES THIS SHEET AND THE COVER SHEET.

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INTRODUCTION

To satisfy the requirements of this NIOEC Specification, Iranian petroleum standard IPS-E-SF-200 revised on October 2011 with the consideration, as Specified herein after shall be strictly followed.

Articles 1 through 3 of this document replace entirely the related articles in the referenced IPS Standards.

1. SCOPE

This NIOEC Specification covers the minimum requirements for the design of fire sprinkler systems, and open head deluge-type, foam-water sprinklers and foam-water spray systems in buildings and industrial plant. This Specification also covers the classification of hazards, provision of water supplies, and components to be used.

Deviations from this specification will only be permitted on obtaining written approval from NIOEC.

Resolution on cases not explicitly stipulated in this Specification, or on cases where conflicts may arise among the requirements of the referenced/relevant IPS and the international standards, shall be made through written consent and approval of NIOEC.

2. REFERENCES

The following standards, codes, and specifications, to the extent specified hereinafter, shall constitute a part of this NIOEC Specification. Latest edition of the undated referenced documents and the cited edition of the dated references shall apply. The applicability of changes made to the dated references ,after the cited date shall be mutually agreed upon between NIOEC and the Vendor/Contractor.

BSI (BRITISH STANDARDS INSTITUTION)

BS 5306-2	“Fire extinguishing installations and equipment on premises - Part 2: Specification for sprinkler systems”
BS EN 12845	“Fixed firefighting systems - Automatic sprinkler systems - Design, installation and maintenance”

IPS (IRANIAN PETROLEUM STANDARD)

IPS-E-SF-200	“Engineering Standard for Fire-fighting Sprinkler Systems”
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NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)

NFPA 13	“Standard for the Installation of Sprinkler Systems”
NFPA 15	“Standard for Water Spray Fixed Systems for Fire Protection”
NFPA 16	“Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems”

NIOEC-SP (NIOEC SPECIFICATIONS)

NIOEC-SP-00-10	“NIOEC Specification for Units”
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2.1. Equivalent to IPS Standards

Substitute the following IPS Standards as referred to throughout IPS-E-SF-200 for the relevant NIOEC’s Specifications as follows:

<u>IPS Standard</u>	<u>Relevant NIOEC Specification</u>
IPS-E-GN-100	NIOEC-SP-00-10
IPS-E-SF-140	NIOEC-SP-47-30

3. UNITS

International system of units (SI) shall be used in accordance with NIOEC-SP-00-10, unless otherwise specified.

ENGINEERING STANDARD

FOR

FIRE-FIGHTING SPRINKLER SYSTEMS

ORIGINAL EDITION

Nov. 1993

This standard specification is reviewed and updated by the relevant technical committee on Jan. 2000(1) and Oct. 2011(2). The approved modifications are included in the present issue of IPS.

FOREWORD

The Iranian Petroleum Standards (IPS) reflect the views of the Iranian Ministry of Petroleum and are intended for use in the oil and gas production facilities, oil refineries, chemical and petrochemical plants, gas handling and processing installations and other such facilities.

IPS are based on internationally acceptable standards and include selections from the items stipulated in the referenced standards. They are also supplemented by additional requirements and/or modifications based on the experience acquired by the Iranian Petroleum Industry and the local market availability. The options which are not specified in the text of the standards are itemized in data sheet/s, so that, the user can select his appropriate preferences therein.

The IPS standards are therefore expected to be sufficiently flexible so that the users can adapt these standards to their requirements. However, they may not cover every requirement of each project. For such cases, an addendum to IPS Standard shall be prepared by the user which elaborates the particular requirements of the user. This addendum together with the relevant IPS shall form the job specification for the specific project or work.

The IPS is reviewed and up-dated approximately every five years. Each standards are subject to amendment or withdrawal, if required, thus the latest edition of IPS shall be applicable

The users of IPS are therefore requested to send their views and comments, including any addendum prepared for particular cases to the following address. These comments and recommendations will be reviewed by the relevant technical committee and in case of approval will be incorporated in the next revision of the standard.

Standards and Research department

No.17, Street14, North kheradmand

Karimkhan Avenue, Tehran, Iran .

Postal Code- 1585886851

Tel: 88810459-60 & 66153055

Fax: 88810462

Email: Standards@ nioc.ir

GENERAL DEFINITIONS

Throughout this Standard the following definitions shall apply.

COMPANY :

Refers to one of the related and/or affiliated companies of the Iranian Ministry of Petroleum such as National Iranian Oil Company, National Iranian Gas Company, National Petrochemical Company and National Iranian Oil Refinery And Distribution Company.

PURCHASER :

Means the "Company" where this standard is a part of direct purchaser order by the "Company", and the "Contractor" where this Standard is a part of contract document.

VENDOR AND SUPPLIER:

Refers to firm or person who will supply and/or fabricate the equipment or material.

CONTRACTOR:

Refers to the persons, firm or company whose tender has been accepted by the company.

EXECUTOR :

Executor is the party which carries out all or part of construction and/or commissioning for the project.

INSPECTOR :

The Inspector referred to in this Standard is a person/persons or a body appointed in writing by the company for the inspection of fabrication and installation work.

SHALL:

Is used where a provision is mandatory.

SHOULD:

Is used where a provision is advisory only.

WILL:

Is normally used in connection with the action by the "Company" rather than by a contractor, supplier or vendor.

MAY:

Is used where a provision is completely discretionary.

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0. INTRODUCTION

"Fire Fighting and Fire Protection Systems" are broad and contain variable subjects of paramount importance therefore, a group of engineering standards are prepared to cover the subject. This group includes the following standards:

<u>STANDARD CODE</u>	<u>STANDARD TITLE</u>
<u>IPS-E-SF-120</u>	"Engineering Standard for Off-Shore Installations Fire Fighting & Fire Protection"
<u>IPS-E-SF-140</u>	"Engineering Standard for Foam Generating and Proportioning Systems"
<u>IPS-E-SF-160</u>	"Engineering Standard for CO ₂ Gas Fire Extinguishing Systems"
<u>IPS-E-SF-180</u>	"Engineering Standard for Dry Chemical Fire Extinguishing Systems"
<u>IPS-E-SF-200</u>	"Engineering Standard for Fire Fighting Sprinkler Systems"
<u>IPS-E-SF-220</u>	"Engineering Standard for Fire Water Distribution and Storage Facilities"
<u>IPS-E-SF-240</u>	"Engineering Standard for Fire Water Pump Systems"
<u>IPS-E-SF-260</u>	"Engineering Standard for Automatic Detectors and Fire Alarm Systems"
<u>IPS-E-SF-300</u>	"Engineering Standard for Application of Breathing Apparatus in Safety and Fire Fighting"
<u>IPS-E-SF-320</u>	"Engineering Standard for Tugs, Fire-Fighters and other Off-Shore Harbor Vessels"
<u>IPS-E-SF-340</u>	"Engineering Standard for Fire Fighting Hose Box and/or Shelter"

This Standard covers:

"FIRE FIGHTING SPRINKLER SYSTEMS"

1. SCOPE

This Standard provides the minimum requirements for the design of fire sprinkler systems in buildings and industrial plant, and open head deluge-type, foam-water sprinklers and foam-water spray systems.

It covers the classification of hazards, provision of water supplies, and components to be used.

Note:

All pressures are gage pressures and are expressed in bars.

$$1 \text{ bar} = 10^5 \text{ N/m}^2 = 10^2 \text{ kPa.}$$

Note 1:

This standard specification is reviewed and updated by the relevant technical committee on Jan. 2000. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No 87 on Jan. 2000. These modifications are included in the present issue of IPS.

Note 2:

This standard specification is reviewed and updated by the relevant technical committee on Oct. 2011. The approved modifications by T.C. were sent to IPS users as amendment No. 2 by circular No 324 on Oct. 2011. These modifications are included in the present issue of IPS.

2. REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

BSI (BRITISH STANDARDS INSTITUTION)

BS 5306 Part 2 "Specification for Sprinkler System"

BS EN 12845 "Fixed Fire Fighting Systems-Automatic Sprinkler Systems-Design, Installation and Maintenance"

NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)

NFPA 13 "Standard for the Installation of Sprinkler Systems"

NFPA 16 "Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems"

NFPA 15 "Standard for Water Spray Fixed Systems for Fire Protection"

IPS (IRANIAN PETROLEUM STANDARDS)

[IPS-E-GN-100](#) "Engineering Standard for Units"

3. DEFINITIONS AND TERMINOLOGY

For the purposes of this standard the following definitions apply.

3.1 Accelerator

A device that reduces the delay in operation of a dry alarm valve, or composite alarm valve in dry mode, by early detection of the drop in air pressure when a sprinkler operates.

3.2 Alarm Test Valve

A valve through which water will be drawn to test the operation of the water motor fire alarm and/or of any associated electric fire alarm.

3.3 Alarm Valve

A check valve, of the wet, dry or composite type, that also initiates the water motor fire alarm when the sprinkler installation operates.

3.4 Alarm Valve, Composite

An alarm valve suitable for a wet, dry or alternate installation.

3.5 Alarm Valve Dry

An alarm valve suitable for a dry installation; and/or in association with a wet alarm valve for an alternate installation.

3.6 Alarm Valve, Pre-Action

An alarm valve suitable for a pre-action installation.

3.7 Alarm Valve, Recycling

An alarm valve suitable for a recycling installation.

3.8 Alarm Valve, Wet

An alarm valve suitable for a wet installation.

3.9 Arm Pipe

A pipe, other than the last section of a range pipe, feeding a single sprinkler.

3.10 Assumed Maximum Area of Operation (AMAO)

The maximum area over which it is assumed, for design purposes, that sprinklers will operate in a fire.

3.11 Assumed Maximum Area of Operation, Hydraulically most Favorable Location

The location in a sprinkler array of an AMAO of specified shape at which the water flow is the maximum for a specific pressure.

3.12 Assumed Maximum Area of Operation, Hydraulically most Unfavorable Location

The location in a sprinkler array of an AMAO of specified shape at which the water supply pressure is the maximum needed to give the specified design density.

3.13 Booster Pump

An automatic pump supplying water to a sprinkler system from an elevated private reservoir or a town main.

3.14 Cut-Off Sprinkler

A sprinkler protecting a door or window between two areas only one of which is protected by sprinklers.

3.15 Deluge Installation

An installation or tail-end extension fitted with open sprayers and either a deluge valve or a multiple control arrangement so that an entire area is sprayed with water on operation of the installation.

3.16 Deluge Valve

A valve suitable for use in a deluge installation.

Note:

The valve is operated manually and usually also automatically by a fire detection system.

3.17 Design Density

The minimum density of discharge, in mm/min of water, for which a sprinkler installation is designed, determined from the discharge of specified group of sprinklers, in L/min, divided by the area covered, in m².

3.18 Design Point

A point on a distribution pipe of a precalculated installation downstream of which pipework is sized from table and upstream of which pipework is sized by hydraulic calculation.

3.19 Detector Sprinkler

A sealed sprinkler mounted on a pressurized pipeline used to control a deluge valve. Operation of the detector sprinkler causes loss of air pressure to open the valve.

3.20 Distribution Pipe

A pipe feeding either a range pipe directly or a single sprinkler on a non-terminal range pipe more than 300 mm long.

3.21 Distribution Pipe Spur

A distribution pipe from a main distribution pipe, to a terminal branched pipe array.

3.22 Drencher

A sprayer used to distribute water over a surface to provide protection against fire exposure.

3.23 Drop

A vertical pipe feeding a distribution or range pipe.

3.24 Dry Type Sprinkler

A sprinkler intended for installation in the upright or pendant position, designed to distribute water so that approximately 40 percent of the discharge is directed upward and 60 percent is directed downward. When installed in the upright position, this discharge will cover 3.05 m diameter circle, 3 m below the sprinkler, when the sprinkler is discharging water at the rate of 0.95 L/s.

3.25 End-Center Array

A pipe array with range pipes on both sides of distribution pipe.

3.26 End-Side Array

A pipe array with range pipes on one side only of a distribution pipe.

3.27 Exhauster

A device to exhaust the air from a dry or alternate installation to atmosphere on sprinkler operation to give more rapid operation of the alarm valve.

3.28 Fastener

A device for attaching pipe hanger components to a building structure or racking.

3.29 Foam-Water Sprinkler System

A foam-water sprinkler system is a special system pipe-connected to a source of foam concentrates and to a water supply, and equipped with appropriate discharge devices for extinguishing agent discharge and for distribution over the area to be protected. The piping system is connected to the water supply through a control valve which is usually actuated by operation of automatic detection equipment installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system, foam concentrate is injected into the water, and the resulting foam solution discharging through the discharge devices generates and distributes foam.

Upon exhaustion of the foam concentrate supply, water discharge will follow the foam and continue until shut off manually. Systems may be used for discharge of water first, followed by discharge of foam for a definite period and this followed by water until manually shut off. Existing deluge sprinkler systems that have been converted to the use of aqueous film forming foam are classed as Foam-Water Sprinkler Systems.

3.30 Foam-Water Spray System

A foam-water spray system is a special system pipe-connected to a source of foam concentrate and to a water supply, and equipped with foam-water spray nozzles for extinguishing-agent discharge (foam or water sequentially in that order or in reverse order) and distribution over the area to be protected. System-operation arrangements parallel those for foam-water sprinkler systems as described in the foregoing paragraph.

3.31 (Fully) Hydraulically Calculated

A term applied to pipework sized as specified, or an installation in which all the pipework downstream of the main installation control valve set is sized as specified in BS 5306: Part 2.

3.32 Gridded Configuration Pipe Array

A pipe array in which water flows to each sprinkler by more than one route.

3.33 Hanger

An assembly for suspending pipework from elements of building structure.

3.34 High-Rise System

A sprinkler system in which the highest sprinkler is more than 45 m above the lowest sprinkler or the sprinkler pumps whichever is the lower.

3.35 Hydraulic Alarm, Intermittent

Sounding of an hydraulic water motor alarm gong for intervals totaling less than the alarm period.

3.36 Installation (Sprinkler Installation)

Part of a sprinkler system comprising a set of installation main control valves, the associated downstream pipes and sprinklers.

3.37 Installation Alternate

An installation in which the pipework is selectively charged with either water or air according to

ambient temperature conditions.

3.38 Installation, Dry (Pipe)

An installation in which the pipework is charged with air under pressure.

3.39 Installation, Pre-Action

One of two types of dry, or alternate in dry mode, installation in which the alarm valve can be opened by an independent fire detection system in the protected area.

3.40 Installation, Recycling

A pre-action installation in which the alarm valve can be opened and closed repeatedly by a heat detection system.

3.41 Installation, Wet (Pipe)

An installation in which the pipework is always charged with water.

3.42 Jockey Pump

A small pump used to replenish minor water loss, to avoid starting an automatic suction or booster pump unnecessarily.

3.43 Life Safety

A term applied to sprinkler systems forming an integral part of measures required for the protection of life.

3.44 Looped Configuration

A pipe array in which there is more than one distribution pipe route along which water may flow to a range pipe.

3.45 Low-Rise System

A sprinkler system in which the highest sprinkler is not more than 45 m above ground level or the sprinkler pumps.

3.46 Main Distribution Pipe

A pipe feeding a distribution pipe (see Fig. 1).

3.47 Mechanical Pipe Joint

A component part of pipework other than threaded tubulars, screwed fittings, lead or compound sealed spigots and socket and flanged joint, used to connect pipes and to produce a seal both against pressure and vacuum.

3.48 Multiple Control

A valve, normally held closed by a temperature-sensitive element, suitable for use in a deluge system or for the operation of a pressure switch.

3.49 Node

A point in pipework at which pressure and flow(s) are calculated; each node is a datum point for the purpose of hydraulic calculations in the installation.

3.50 Pipe Array

The pipes feeding a group of sprinklers.

Note:

Pipe arrays may be looped, gridded or branched (see definitions above).

3.51 Precalculated

A term applied to pipework sized as specified in 18.1(b) of BS 5306: Part 2 or an installation in which pipes downstream of the design point are sized as specified in 18.1 (b) of BS 5306: Part 2.

3.52 Range Pipe

A pipe feeding sprinklers directly or via arm pipes of restricted length.

3.53 Riser

A vertical pipe feeding a distribution or range pipe above.

3.54 Rosette (Sprinkler Rosette)

A plate covering the gap between the shank or body of a sprinkler projecting through a suspended ceiling, and the ceiling.

3.55 Section

That part (which may be one or more zones) of an installation on a particular floor fed by a particular riser.

3.56 Sling Rod

A rod with a sling eye or screwed ends for supporting pipe clips, rings, band hanger etc.

3.57 Sprayer

A sprinkler that gives a downward conical pattern discharge.

3.58 Sprayer, High Velocity

An open nozzle used to extinguish fires of high flashpoint liquids.

3.59 Sprayer, Medium Velocity

A sprayer of sealed or open type used to control fires of lower flashpoint liquids and gases or to cool surfaces.

3.60 Sprinkler, (Automatic)

A temperature-sensitive sealing device which opens to discharge water for fire extinguishing.

Note:

The term “automatic sprinkler” is now rarely used. The term “sprinkler” does not include “open sprinkler”.

3.61 Sprinkler, Ceiling of Flush Pattern

A pendent sprinkler for fitting partly above but with the temperature-sensitive element below, the lower plane of the ceiling.

3.62 Sprinkler, Concealed

A recessed sprinkler with a cover plate that disengages when heat is applied.

3.63 Sprinkler, Conventional Pattern

A sprinkler that gives a spherical pattern of water discharge. See also:

cut-off sprinkler

detector sprinkler

3.64 Sprinkler, Dry Pendent Pattern

A unit comprising a sprinkler and a dry drop pipe unit with a valve, at the head of the pipe, held closed by device maintained in position by the sprinkler head valve.

3.65 Sprinkler, Dry Upright Pattern

A unit comprising a sprinkler and dry rise pipe unit with a valve, at the base of the pipe, held closed by a device maintained in position by the sprinkler head valve.

3.66 Sprinkler, Fusible Link

A sprinkler which opens when a component provided for the purpose melts.

3.67 Sprinkler, Glass Bulb

A sprinkler which opens when a liquid-filled glass bulb bursts.

3.68 Sprinkler, Horizontal

A sprinkler in which the nozzle directs water horizontally.

3.69 Sprinkler, Intermediate

A sprinkler installed below, and additional to the roof or ceiling sprinklers.

3.70 Sprinkler, Open

A device, otherwise like a sprinkler (automatic sprinkler), not sealed by a temperature-sensitive element.

3.71 Sprinkler, Pendent

A sprinkler in which the nozzle directs water downwards.

3.72 Sprinkler, Recessed

A sprinkler in which all or part of the heat-sensing element is above the plane of the ceiling.

3.73 Sprinkler Roof or Ceiling

A sprinkler protecting the roof or ceiling.

3.74 Sprinkler, Sidewall Pattern

A sprinkler that gives an outward half-paraboloid discharge.

3.75 Sprinkler, Spray Pattern

A sprinkler that gives a downward paraboloid pattern discharge.

3.76 Sprinkler, Upright

A sprinkler in which the nozzle directs water upwards.

3.77 Sprinkler System

The entire means of providing sprinkler protection in the premises comprising one or more sprinkler installations, the pipework to the installations and the water supply/supplies except town mains and bodies of water such as lakes or canals.

3.78 Sprinkler Yoke (Arms)

The part of a sprinkler that retains the heat-sensitive element in load-bearing contact with the sprinkler head valve.

3.79 Staggered (Sprinkler) Layout

An off-set layout with the sprinklers displaced one-half pitch along the range pipe relative to the next range or ranges.

3.80 Standard (Sprinkler) Layout

A rectilinear layout with the sprinklers aligned perpendicular to the run of the ranges.

3.81 Suction Pump

An automatic pump supplying water to a sprinkler system from a suction tank, river, lake, or canal.

3.82 Suitable for Sprinkler Use

A term applied to equipment or components accepted by the authorities as for a particular application in a sprinkler system, either by particular test or by compliance with specified general criteria.

3.83 Supply Pipe

A pipe connecting a water supply to a trunk main or the installation main control valve set(s); or a pipe supplying water to a private reservoir, suction tank or gravity tank.

3.84 Suspended Open Cell Ceiling

A ceiling of regular open cell construction through which water from sprinklers can be discharged freely.

3.85 Tail-End Alternate (Wet and Dry Pipe) Extension

A part of a wet installation that is selectively charged with water or air according to ambient temperature conditions and which is controlled by a subsidiary dry or alternate alarm valve.

3.86 Tail-End Dry Extension

A part of a wet or alternate installation that is charged permanently with air under pressure.

3.87 Terminal Main Configuration

A pipe array with only one water supply route to each range pipe.

3.88 Terminal Range Configuration

A pipe array with only one water supply route from a distribution pipe.

3.89 Toggle Support

A swivel device for securing hangers to hollow section ceilings or roofs.

3.90 Trunk Main

A pipe connecting two or more water supply pipes to the installation main control valve set(s).

3.91 User

The person responsible for or having effective control over the fire safety provision adopted in or appropriate to the premises or the building.

3.92 Zone

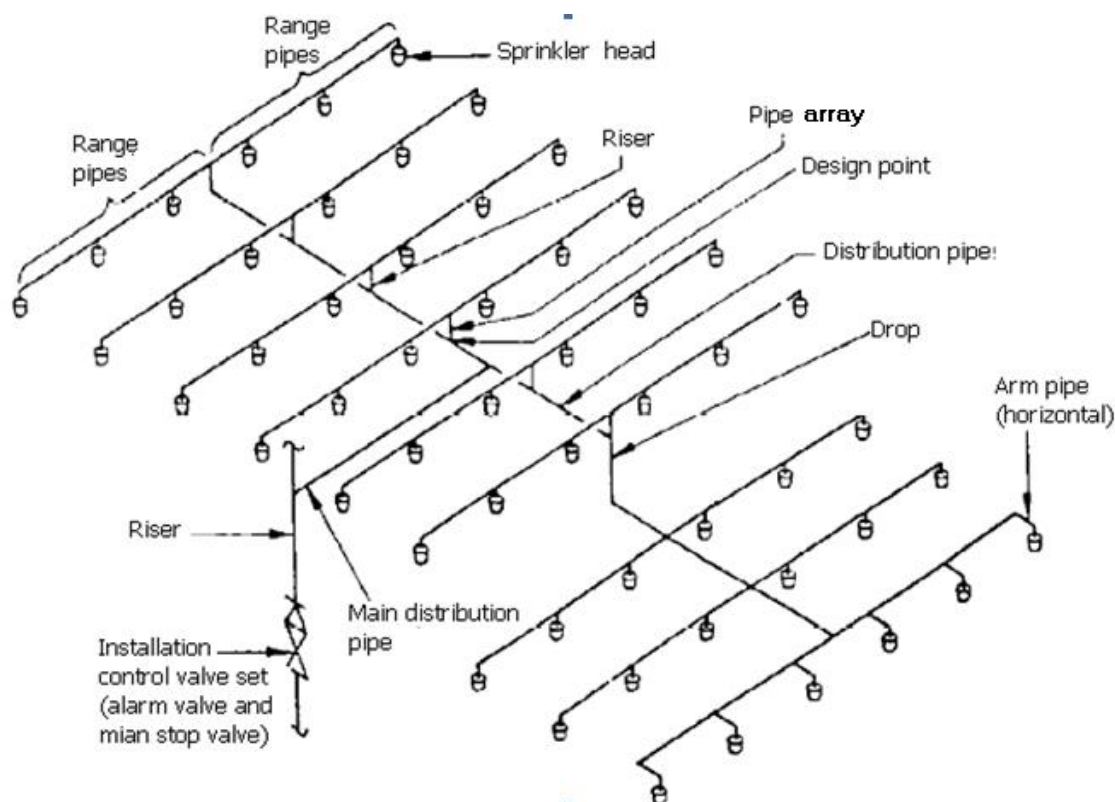
A subdivision of an installation fitted with a subsidiary stop valve or multiple control.

4. UNITS

This Standard is based on International System of Units (SI), as per [IPS-E-GN-100](#) except where otherwise is specified.

5. GENERAL

5.1 A sprinkler system is specialized fire protection system and requires knowledgeable and experienced design and installation. A sprinkler system consists of a water supply (or supplies) and one or more sprinkler installations, each installation consists of a set of installation main control valves and a pipe array fitted with sprinkler heads. The sprinkler heads are fitted at specified locations at the roof or ceiling, and where necessary between racks, below shelves, and in ovens or stoves. The main elements of a typical installation are shown in the Fig. 1.



MAIN ELEMENTS OF A SPRINKLER INSTALLATION

Fig. 1

The sprinklers operate at predetermined temperatures to discharge water over the affected part of the area below, the flow of water through the alarm valve initiating a fire alarm. The operating temperature is generally selected to suit ambient temperature conditions.

Only sprinklers in the vicinity of the fire, i.e., those which become sufficiently heated, operate.

In some life safety applications an authority shall require sprinkler protection only in certain designated areas and solely to maintain safe conditions for the evacuation of persons from the sprinklers protected areas. Such a system will not provide protection against a fire which starts in a

non-sprinklered part of the premises and develops to some size before spreading to the sprinkled parts, and for more complete protection the sprinkler system is extended throughout the premises with only limited exceptions.

It should not be assumed that the provision of a sprinkler system entirely obviates the need for other means of fighting fires and it is important to consider the fire precautions in the premises as a whole.

Structural fire resistance, escape routes, fire alarm systems, particular hazards needing other fire protection methods, provision of hose reels and fire hydrants and portable fire extinguishers, etc., safe working and goods handling methods, management supervision and good housekeeping all need consideration.

5.2 Outline Design

5.2.1 Consideration should be given to any benefits that will be gained by changes in building design, work procedures etc., when preparing the outline design. In planning site layout and building design, particular consideration should be given to the following:

5.2.2 The occupancy hazard class and goods category which determine the water discharge density and water supply pressure and flow.

5.2.3 The siting of any town main water supply connection(s).

5.2.4 The siting of any water supply tank(s) or reservoir.

5.2.5 The siting of any pump house.

5.2.6 The maximum quantity of water available and maximum rate of supply (based on site tests at periods of maximum demand) from the supply source compared with the system requirements.

5.2.7 The location of sprinkler installation control valves, together with the access thereto, indication of their position and the disposal of drainage and water supply test water.

5.2.8 The source and means of supply of electric power, etc.

5.2.9 The protection of valve sets, pipework and sprinklers against accidental damage. It is important to consider building design in the context of fire protection, e.g., choice of materials, support of sprinkler pipework having regard to the load imposed on structure by the weight of sprinkler pipework and the contained water, building heating, need for inbuilt drainage (which is strongly advised for computer areas) or raising of base of stacked goods above the floor where water damage may be severe, etc. When storage of goods is involved it shall be appropriate to consider the height of the building and of material stacks, and the height and type of any storage racks, which will have a considerable bearing on fire protection costs.

The design of double entry storage racks should be influenced by the need to mount sprinklers therein. Where sprinklers are fitted in racks additional rack structural members may be needed to prevent impact damage to the sprinkler head and pipework.

5.3 Contract Planning and Documentation

For more information, it could be typically refer to item 4 on page 20 of standard BS EN 12845.

6. INTERACTION WITH OTHER FIRE PROTECTION MEASURES

Account shall be taken of possible interaction between sprinkler systems and other fire protection measures. Examples of possible adverse interaction between sprinkler protection and other fire protection measures are:

6.1 Water damage to an inadequately shielded fire alarm control panel in a sprinkler-protected area with consequent possible failure of the fire alarm system.

6.2 Operation or failure of smoke detectors in zones adjacent to one in which water discharge is

taking place because of the water spray mist traveling into adjacent zones.

Such possible interactions need particularly careful consideration in the case of systems which are part of life safety measures.

7. BUILDINGS TO BE SPRINKLER-PROTECTED

The sprinkler system shall provide protection to all parts not specified as exceptions in 7-3 of the following:

7.1 The building under consideration.

7.2 Any building communicating directly or indirectly with the building under consideration.

7.3 Exceptions (Buildings and Parts of Buildings not Sprinkler-Protected)

7.3.1 Obligatory exceptions

Sprinkler protection shall not be provided in the following parts of a building or plant:

- a) Areas, rooms, or places where the water discharged from a sprinkler may present a hazard.

7.3.2 Optional exceptions

Sprinkler-protection shall be considered for, but need not be provided in the following parts of a building or plant:

- a) Stairs, spaces below stair headings (but not rooms above a stair) and lift wells. Any part not provided with sprinkler protection shall be enclosed by walls, ceilings and floors with a fire resistance of not less than 2 h, in which all doors are of not less than 1 h fire resistance, and in which all glazed areas either are of not less than 1 h fire resistance or in the case of stairs are protected by cut-off sprinklers. The area of glazing in any part not provided with sprinkler-protection shall not exceed 1.5 m² in each storey;
- b) Washrooms, toilets and WCs (but not cloakrooms);
- c) Rooms or compartments containing electric power distribution apparatus, such as switchgear and transformers, and used for no other purpose(s). Any part not provided with sprinkler protection shall be enclosed by walls, ceilings and floors of not less than 2 h fire resistance in which all doors are of not less than 1 h fire resistances;
- d) Areas containing oil or similar flammable liquids.

7.4 Communicating buildings. Sprinkler protection shall be considered for, but need not be provided in the following communicating buildings or structures:

7.4.1 A building or storey separated from the sprinklered building by walls of not less than 6 h fire resistance in which each opening is protected by two (arranged in series) fire doors or fire shutters each of not less than 2 h fire resistance.

7.4.2 Canopies of non-combustible construction, not extending beyond 2.3 m from the building wall.

Any such canopy not provided with sprinkler protection shall be fitted with cut-off sprinklers under the canopy over each opening between it and the sprinklered building. Any opening 2.5 m or less in width shall be provided with a cutoff sprinkler, positioned centrally over the opening. Openings exceeding 2.5 m in width shall be provided with cut-off sprinklers over the opening, and not more than 2.5 m apart and with a sprinkler not more than 1.25 m from each side.

7.4.3 Exterior loading docks and platforms either of non-combustible construction or with the space beneath closed off against accumulation of debris.

7.4.4 Buildings used solely as offices and/or private dwelling(s). Any part not provided with sprinkler protection shall be separated from the sprinkler protected building by a wall of not less than 6 h fire resistance in which any glazed areas are of not less than 1 h fire resistance and are provided with cut-off sprinklers, and in which all door openings are protected by either:

- a) Single fire doors or single fire shutters of not less than 2 h fire resistance; or
- b) Fire doors of not less than 1 h fire resistance and cut-off sprinklers.

7.4.5 Buildings, storeys or rooms of non-combustible construction used mainly for wet processes.

7.4.6 Stairs, washrooms and WCs external to the sprinkler-protected building in which all openings to the sprinklerprotected building are protected by doors of not less than 1 h fire resistance.

7.4.7 Staircases, washrooms, toilets and WCs external or internal to the sprinkler-protected building which form a means of communication between the sprinklered building and a non-sprinklered building. In any such part not provided with sprinkler protection all openings into the communicating area from the sprinklered and from the nonsprinklered building shall be protected by fire doors of not less than 1 h fire resistance.

8. CLASSIFICATION AND OCCUPANCIES AND FIRE HAZARDS

8.1 General

Occupancies or parts thereof shall be classified as:

- Light hazard; or
- Ordinary hazard; or
- High hazard.

Ordinary and high hazard occupancies shall in addition be assessed for any special variation to normal requirements specified in 8.5.

In storage areas the goods including any packaging shall be categorized as category I, II, III, IV (see Tables 1a and 2a).

COMMENTARY AND RECOMMENDATIONS ON 8.1. Hazard classification provides the basis for the design of sprinkler systems and is a skilled operation which is best carried out by the authorities. The range of occupancies and hazards encountered is extremely large, and it may be necessary to classify a particular case by analogy. The classification effects the choice of installation, operational method, water supply arrangements, components, pipework design etc.

Although this specification deals mainly with sprinkler systems which are installed primarily to reduce loss of property in fire some sprinkler systems are installed which additionally may serve for the protection of life. In particular circumstances these may form an integral part of measures approved by the fire authority for the protection of life, for example in covered and enclosed shopping complexes where automatic sprinkler systems serve to prevent the spread of fire and its products to adjacent exit routes (see BS 5588: Part 10).

Where a system is a high-rise system or a life safety system, additional safeguards are considered necessary to ensure reliability although the hazard is classified in the normal manner. These are detailed under the heading 'Life safety' in the appropriate section.

Figure 1a shows the relationship between classes and may be used in the process classification.

8.2 Light Hazard

In non-industrial occupancies where the quantity and combustibility of the contents are low, rooms and corridors not more than 126 m² in area and bounded by elements of construction with a fire resistance of not less than 30 min shall be classified as light hazard.

COMMENTARY AND RECOMMENDATIONS ON 8.2. Typical light-hazard occupancies are given in figure 1a No room may have more than six sprinklers (see 19.2).

Rooms larger than 126 m² or with walls of lower fire resistance are classified as ordinary hazard, group I.

8.3 Ordinary Hazard

8.3.1 In non-industrial occupancies, rooms which exceed the limits specified in 8.2 for light-hazard classification shall be classified as ordinary hazard, group I.

8.3.2 Commercial and industrial occupancies involving the handling, processing and storage of mainly ordinary combustible materials, which are unlikely to develop intensely burning fires in the initial stages, shall be classified as:

Ordinary hazard, group I; or

Ordinary hazard, group II; or

Ordinary hazard, group III; or

Ordinary hazard, group IIIS (group III special).

COMMENTARY AND RECOMMENDATIONS ON 8.3. Table 2a gives examples of goods categories.

Examples of the four ordinary-hazard occupancy groups are given in table 3a.

TABLE 1A- CLASSIFICATION OF STACKED GOODS AND LIMITATIONS ON STORAGE METHODS

Type (and storage method)	Goods category reference (see 8.1 and Table 2a)	Maximum storage height for protection by roof or ceiling sprinklers only		Limitations (ordinary and high hazard)	Design density and stack height given in
		Ordinary hazard group III	High hazard		
S1 Free standing or Block stacking	I II III IV	m 4.0 3.0 2.1 1.2	m 7.6 7.5 7.2 4.4	None	Table 8 for high- hazard, or table 7 for ordinary hazard
S2 Post or box pallets In single rows	I II III (expected rubber tyres) IV	3.5 2.6 1.7 1.2	6.8 6.0 6.0 4.4	Aisles shall be not less than 2.5 m wide	Table 9 for high- hazard, or table 7 for ordinary hazard
S3 Post or box pallets In multiple rows	I II III (expected rubber tyres) IV	3.5 2.6 1.7 1.2	5.7 5.0 3.2 3.0	No storage block shall exceed 150 m ² in plan area. Each storage block shall have aisles all round not less than 2.5 m wide.	Table 10 for high- hazard, or table 7 for ordinary hazard
S4 Open-bottom post pallets	III (rubber tyres only)	1.7	7.2	None	Table 8 for high- hazard, or table 7 for ordinary hazard
S5 Palletized rack (beam pallet racking)	I II III IV	3.5 2.6 1.7 1.2 } see note 1	6.8 6.0 6.0 4.4 } see note 1	Intermediate sprinklers shall be fitted where the aisles are less than 1.2 m wide (see 22.1.4)	Table 9 for high- hazard, or table 7 for ordinary hazard
S6 Solid or slatted shelves 1 m or less wide	I II III IV	3.5 2.6 1.7 1.2 } see note 1	5.7 5.0 3.2 3.0 } see note 1	Gangways shall be not less than 1.2 m wide, or storage blocks shall be not more than 150 m ² with aisles all round not less than 2.5 m wide	Table 10 for high- hazard, or table 7 for ordinary hazard
S7 Solid or slatted shelves over 1 m and not more than 6 m wide.	I II III IV	Not applicable	Not applicable	As S6 above. Intermediate sprinklers should be fitted under each shelf and shall be installed where storage blocks exceed 150 m ² in plan area or do not have aisles all round not less than 2.5 m wide	Table 10
S8 Solid or slatted shelves over 1 m wide where intermediate sprinklers cannot be installed	I II III IV	Not applicable	5.7 5.0 3.2 3.0 } see note 1	Continuous non-combustible full height vertical bulkheads shall be fitted longitudinally and transversely within each shelf (see 22.1.4) Not storage block shall exceed 150 m ² in plan area. Each storage block shall have aisles all round not less than 2.5 m wide	Table 10

Note 1:

Intermediate sprinklers shall be fitted under shelves where the maximum heights specified are exceeded.

Note 2:

See clause 19 for design density and AMAO according to storage heights and goods category.