

2024 RULES FOR AUTOMATIC SPRINKLER INSTALLATIONS

FORWARD

This document is not a design manual but is deemed to be a set of internationally accepted rules based on good minimum engineering practices. They do not represent individual thoughts or ideas but follow tried and proven methodologies which, in turn, creates a failsafe system that can be relied upon under a fire condition. The rules have been edited, where necessary, to accommodate the South African environment and conditions. They represent a scientific approach to the problem of automatic control and suppression of fires to meet the wide variety of conditions existing today.

Attention is drawn to the necessity for sprinkler installations to be installed in strict accordance with accepted rules, codes, standards, or proven criteria without ignoring any accepted engineering practice which may be in force at the date of the installation.

Specific attention is drawn to SANS10400-T which requires every owner or occupier of a building to, amongst other things:

Provide a building to be so designed, constructed, and equipped that in the case of fire:

- a) The occupants are protected and can affect evacuation.
- b) Sufficient stability is afforded the structure under a fire condition.
- c) Fire and spread of smoke will be minimised to the greatest extent as is practical.
- d) Adequate means for detecting, fighting, controlling, and extinguishing a fire are provided.

A correctly installed sprinkler protection is accepted as providing this.

The practice of splitting new installations into separate contracts whereby, for example, roof protection, rack protection and/or water supplies are awarded to differing contractors is to be deplored. In the event of failure, it will be difficult if not impossible to apportion responsibility accordingly other than to the person who advocated this in the first instance.

All owners of sprinkler systems are advised to check their insurance policies carefully and to obtain advice in respect of their obligations for testing, inspections, maintaining and remedial work of noted defects. It must be borne in mind that insurance acceptance of a risk is a commercial matter and the prerogative of the insurer and as such this does not mean that what the insurer accepts or denotes compliance with the National Building Regulations.

It has been stated that, in terms of legal requirement, if a standard such as SANS 10400 refers to another standard such as an accepted automatic sprinkler code, standard or set of rules, it is that document referred to that takes precedence and must be followed.

In the event of differences between differing rules, codes, or standards, it is the very latest knowledge that must be used based on the principle of "ignorantia juris non escusat", ignorance of the law excuses no one. A person who claims ignorance of the law or is unaware of a law may not escape liability merely because they were unaware of its content. Wilful blindness cannot become the basis of exoneration. It is not possible, and neither is it the intent of differing standards, codes, or rules to be intermixed whereby favourable aspects of one document are transposed into another. This is classed as "cherry picking" and will result in an unproven level of protection.

A local authority may obtain assistance from other sources, (for example, it may purchase services from the private sector, or the private sector may volunteer these services on a pro bono basis), if it does not have within its organization persons who are competent to carry out the tasks envisaged in this set of rules.

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Automatic Sprinkler Inspection Bureau (Pty) Limited

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Formula 726:

SECTION 8:

DEFINITIONS

"A" gauge

The pressure gauge connected to a town main connection, between the supply stop valve and the non-return valve.

Accelerator

Is 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 or inert gas pressure on sprinkler operation.

Acceptable; adequate; satisfactory; suitable

Acceptable, adequate, satisfactory, or suitable in the opinion of the authority having jurisdiction or in relation to any document issued by such authority.

Aerosol

An aerosol is a non-reusable container or dispenser made of metal, glass or plastic containing a compressed gas, liquefied, or dissolved under pressure, with a liquid, paste or powder, and fitted with a release device allowing the contents to be expelled as solid or liquid particles in suspension in a gas, as a foam, paste or powder, or in a liquefied state. The term aerosol shall refer to an aerosol dispenser, aerosol cap and its contents.

Aerosol cap

An aerosol cap is a device fitted to an aerosol dispenser to release its contents.

Δisle

An aisle is the space between rows of racking that enables access to the racks. Aisles are used by forklifts and personnel for loading items onto racks, unloading and picking items.

Alarm test valve

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

Alarm valve

An alarm valve is an approved check or non-return valve of either the wet, dry, or composite type that also initiates the water motor fire alarm when the sprinkler system operates.

Alarm valve - alternate

Is an approved alarm valve suitable for a wet, dry, or alternate installation.

Alarm valve, dry

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

Alarm valve preaction

An approved alarm valve suitable for a preaction installation.

Alarm valve, wet

An approved alarm valve suitable for a wet installation.

AMNOSO

Assumed maximum number of sprinklers operating

Anode and cathode

In electro-chemistry, the electrode where oxidation takes place is called the anode, and that where reduction takes place the cathode. When charging a cell, the current direction and all processes in the cell are reversed. However, in batteries and accumulators, anode and cathode always correspond to the situation of discharge, regardless of the actual direction of current flow. The anode is thus the negative electrode, and the cathode the positive electrode.

Application

Application as contemplated by the authority having jurisdiction.

Approval - approved

Endorsement by the authority having jurisdiction.

Approved and listed equipment

Approved in respect of equipment means approved and listed by an internationally recognised testing authority such as the Loss Prevention Certification Board, (LPCB) or Factory Mutual, (FM), for use on sprinkler systems.

Approved installer

Any person whom a registered person as a Fire Protection Systems Practitioner, as defined in section 1 of the Engineering Profession of South Africa Act, 1990 (Act 114 of 1990), deems to be competent through experience and examination-based selection process.

Area of operation, hydraulically most favourable

The location in a sprinkler array of an area of operation of specified shape at which the water flow is the maximum for a specific pressure measured at the control valve set.

Area of operation, hydraulically most unfavourable

The location in a sprinkler array of an area of operation of specified shape at which the water supply pressure measured at the control valve set is the maximum needed to give the specified design density of discharge.

Arm pipe

Pipe not less than 0,3 metres long connected directly to a distribution pipe.

Arrav

Group of sprinklers fed from one side of a distribution pipe connected by range pipes.

Assumed maximum area of operation - (AMAO)

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

Assumed Maximum Number of Sprinklers Operating - (AMNOSO)

For design purposes, the number of sprinklers that will operate simultaneously within the assumed maximum area of operation at roof or ceiling level and/or in-rack sprinklers.

Authorities

Are organisations, statutory or otherwise, shown to have, through experience, the expertise and competency related to the application under consideration.

Authority having jurisdiction

An organization, office or individual responsible for the approval and certification of an automatic sprinkler installation registered as a Fire Protection Systems Practitioner, as defined in section 1 of the Engineering Profession of South Africa Act, 1990 (Act 114 of 1990).

Automatic (in relation to an installation)

Descriptive of a sprinkler installation or part of a sprinkler installation that, when activated, performs a predetermined function without manual intervention.

Automatic (sprinkler) installation

An approved sprinkler installation that comprises installation control valves, sprinklers, and pipework to a water supply, and that, when actuated by the effect of fire, automatically releases water.

"B" gauge

The pressure gauge connected to and on the same level as an alarm valve, indicating the pressure on the upstream side of the valve.

Backflow

The flow of water in any pipe in a direction opposite to the normal direction of flow.

Back-siphonage

The backflow of water that results from a negative pressure in the sprinkler installation or from the water supply.

Base product

The base product is product concentrate and all contents of the aerosol container other than the propellant.

Beam pallet racking

There are two methods of employing basic beam pallet racking:

- a) Selective racking permits only one-unit-deep pallet loads to be stored side-by-side.
- b) Back-to-back racking systems which are built by putting two selective modules back-to-back and interconnecting them together.

Bin storage

Storage of items of supplies and equipment in an individual compartment or subdivision of a storage unit in less than bulk quantities. They are usually open top, self-supporting and have limited space surrounding each unit.

Blank spade

Also known as a paddle blind/blank, blinder and blank flange is a round piece of metal thick enough to withstand the pressure to which it will be subjected. It is inserted between two flanges with a gasket on either side and tightened to gain complete shutoff of the downstream side of the insertion point.

- a) For easy identification, blank spades must be fitted with a protruding handle at least 1,000 mm long and painted white.
- b) A visible numbered indicator tag shall be fitted to the blank spade and shall be numbered to aid timely removal.

Branch line

A pipe that is used on a grid system to connect the supply side main, (also known as the near side main), with either a centre main or tie-in side main, (also known as the far side main).

Bund

An embankment or wall of brick, stone, concrete or other impervious material, which forms the perimeter and floor of a compound and provides a barrier to retain liquid.

"C" gauge

The pressure gauge connected to and on the same level as an alarm valve, indicating the pressure on the downstream side of the valve.

Cavity barrier

A cavity barrier is defined as a separating element that will resist the passage of flame, heat, and fire gases for a period of 30-minutes when evaluated to BS 476-22.

Ceiling height

The ceiling height shall be taken as the maximum vertical distance measured from the floor to the highest point of the underside of the roof or ceiling. In the case of corrugated metal roofs or ceilings with a depth less than 75mm, the measurement can be made to the lowest point on the corrugation.

Central alarm station

A central alarm station for transmission of fire signals to the fire authority responsible for the area within which the sprinkler protected property is situated.

Centre main

A main distribution pipe that connects branch lines either from adjacent centre mains or the supply side feed main or to the tie-in side main.

Classes of sprinkler systems

Two classes of sprinkler systems have been developed to suit the above hazard classes of occupancy and have been designated accordingly:

- a) Ordinary Hazard system, and
- b) High Hazard system

Competent person

A person who is deemed a registered person in terms of section 1 of the Engineering Profession of South Africa Act, 1990 (Act 114 of 1990) as a Fire Protection Systems Practitioner.

Control valve set

Also referred to as installation control valve and sprinkler control valve assembly, comprising an alarm valve, a stop valve and all the associated valves and accessories for the control of one sprinkler installation.

CPVC - (chlorinated polyvinyl chloride)

The term "CPVC pipe" refers to both CPVC plastic pipe and approved CPVC plastic pipe fittings.

Cut-off sprinkler

A purpose made pendent or upright spray pattern sprinkler/s in the non-sprinkler protected building or in the non-sprinkler protected portion of a sprinkler protected building fitted immediately over the lintel of a door or window opening in either case to provide full protection to the opening.

Deadhead

When a centrifugal pump operates with no flow through the pump due to a closed or blocked discharge valve. The pump will recirculate the same water, causing the water temperature to rise and damage the unit.

Deluge installation

A sprinkler installation or a tail end extension fitted with open sprinklers or sprayers and either a quick-opening valve or a multiple control arrangement so that an entire area is sprayed with water on operation of the entire installation, or part of the installation.

Deluge valve

A valve that is suitable for use in a deluge installation and that controls the flow of water to an array of open sprinklers or sprayers.

Design (of an installation)

The planning of an installation using proven codes, standards, rules, and calculation in accordance with acceptable engineering and scientific principles, and in accordance with the provisions of these rules.

Design density of discharge - (DDoD)

The minimum quantity of water expressed in mm per minute per square metre of floor area, (mm/min/m²), delivered over the assumed maximum area of operation, (AMAO).

Design point

The entry point on a distribution pipe to an area of operation.

Detector sprinkler

A sealed device that is mounted on a pressurized pipeline, and that causes the deluge valve to open by releasing pressure.

Distribution pipes

Pipes of a uniform diameter between fittings directly feeding range pipes or single sprinklers on a non-terminal range pipe more than 300 mm long.

Division

A part of a building that is separated from the remainder of the building by an approved separating element.

Division wall (in a building)

An internal wall that separates one division from another division and that has a fire resistance equal to at least that required in terms of these rules.

Drenchable packaging

Water absorbent packaging that can be thoroughly wetted.

Drencher

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

Duplicate water supply

A secondary water supply of at least the same capacity as the primary water supply from which water can be provided at the same pressure and rate of flow as from the primary water supply.

Duty points

See Qmax, Pmax and runout.

Early Suppression Fast Response (ESFR)

A type of fast response sprinkler that has the capability to provide fire suppression.

Effective capacity (of a suction tank)

The volume between the normal operating level of the water contained in the tank or pit and low-water level.

Elevated private reservoirs

An elevated private reservoir is defined as a ground reservoir situated at a higher level than the sprinkler installation, which is under the sole control of the owner of the premises.

Electrolyte

Chemical compound which occurs as a solid or a liquid in batteries and contains free ions.

Encapsulation

Plastic packaging that completely encloses the product being stored inclusive of the sides and tops and excludes banding which is where plastic film is wrapped around the sides of the product being stored and is deemed to be for pallet stability.

End centre arrangement

Where there are range pipes on both sides of distribution pipes.

End side arrangement

Where there are range pipes on one side only of the distribution pipes.

Energy storage system

An energy storage system, often abbreviated as ESS, is a device or group of devices assembled, capable of storing energy to supply electrical energy later. Battery ESS are the most common type of new ESS installations.

Escutcheon plates

Escutcheon plates or rosettes are plates that cover the annular space around a sprinkler projecting through a suspended ceiling. Escutcheon plates shall be approved and listed.

Exhauster

A device that can rapidly expel the air or inert gas to atmosphere on sprinkler operation from a dry or alternate installation.

Fastener

A device used to permanently attach pipe hanger components to the building structure or the racking.

Favourable area of operation

The location, in a pipe array, of an assumed maximum area of operation of a specified shape at which the water flow is the maximum for a specific water supply pressure regarded as the point of lowest pressure and highest flow.

FFFC

First Expired First Out.

FIFO

First In First Out.

Fire damper

A device that, when actuated by an appropriate detector, will automatically so close an air duct or opening that it restricts the passage of fire, hot gases, and smoke.

Fire doo

An automatic or self-closing door assembly constructed specifically to prevent the passage of fire for a specified period.

Fire-hazard class

The fire-risk rating of a building, or part of a building, in terms of these rules. The fire-risk rating or fire-hazard class of a building depends on the particular use, or the type of use to which the entire building or a part of the building is normally put or intended to be put.

Fire load

The sum of the heat energy values of all combustible materials, including combustible partitions and other exposed combustible elements, contained in a component or a division. The fire load is expressed either as a timber equivalent (in kilograms per square metre), or as a heat energy value (in megajoules per square metre).

Fireproof

Construction or materials that resist the passage of flame for a period of not less than 120-minutes.

Fire resistance

The ability of a building element or component to satisfy, for a stated period, the appropriate criteria specified for stability, integrity, and insulation in the presence of fire

Fire-resistance rating

The fire resistance of a building element or component as determined in accordance with internationally accepted testing practices.

Fire safety official

The employee or agent of the owner or user of the sprinkler system(s) designated to undertake specified tasks relating to the upkeep of the sprinkler protection.

Fire shutter

An automatic or self-closing shutter assembly constructed specifically to prevent the passage of fire for a specified period.

Fire stop

A draught-tight barrier or seal placed within or between elements of a building in shafts, voids and other concealed spaces, to retard the spread of flame, heat or smoke.

Flow pressure

The pressure during flow in a pipe, measured immediately upstream of a pipe fitting.

Flow racking

See push back racking and live racking.

A flow rack is a type of racking system that has angled shelves that uses gravity to pull boxes, totes, bins, and containers from one side to the other. One side of the flow rack is where the goods are fed into and the other side is where the goods are received.

Fully hydraulically calculated installation

Descriptive of a system of pipework in which all the pipework downstream of the installation control valve(s) is sized in accordance with acceptable engineering and scientific principles and in accordance with these rules.

Gravity tanks

A purpose-built water container erected on the site of the protected premises at such an elevation as to provide the required pressure to flow conditions at the installation valves.

Grid system

A system where the water flows by more than one route to an operating sprinkler. Usually where a supply side main distribution pipe and a tie-in side main distribution pipe, (front and back main), are interconnected with branch lines. This does not preclude the use of either one or several central mains. A grid system is defined as follows:

- a) The sprinklers are uniform in respect of operating temperature, response time index, K-Factors and distribution patterns.
- b) The branch lines are uniform in diameter and length and do not change in any instance throughout the grid under consideration.
- c) The distance between the sprinklers on the branch lines is uniform throughout the grid.
- d) The supply side main pipe diameter must not differ from the tie in feed main diameter by more than two pipe diameter sizes.
- e) The total number of outriggers fitted to either the supply side or tie-in side mains may not exceed the integer of 40% of the total number of sprinklers deemed to be in simultaneous operation on a single branch line.

Hanger

An approved assembly for suspending pipework from elements of building structure.

Heat collection plate

A metal plate not less than 1,5 mm thick and 500 mm square, secured with a minimum of two securing points to prevent any movement and located directly above a detector to entrap radiated or convected heat. The use of heat collection plates has been found to delay the operation of standard sprinklers and their use is to be deprecated.

High Hazard

These occupancies are normally commercial and industrial occupancies having abnormal or high fire loads, for example:

- a) Where the materials handled or processed are of a combustible nature likely to develop rapid and intensely burning fires.
 (High Hazard Process risks).
- Where they involve high piling of combustible goods. (High Hazard - High piled storage risks).

High rise building

A building, measured from the lowest natural ground level, which is more than 2 storeys or 30,0 metres in height or a lesser height whereby the local authority cannot affect evacuation.

High-risk occupancy

Descriptive of commercial and industrial occupancies where a high-risk substance is handled, or where the process carried out is liable, in the event of fire, to cause combustion with extreme rapidity or to give rise to poisonous fumes, or to cause explosions (or any combination of these).

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High-risk storage

The storage of:

- High-risk substances, or a)
- b) Substances that are liable, in the event of fire, to cause combustion with extreme rapidity, or to give rise to poisonous fumes, or to explode (or any combination

High-risk substance

Any substance listed in the schedule to the Administrative Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).

High-velocity sprayer

A device with an open nozzle used to control fires of liquids that have a viscosity higher than that of paraffin.

Hydraulically designed

A term applied to an installation in which the pipework is sized by hydraulic calculation.

Inspection

A visual inspection of a sprinkler system or portion thereof, to verify that it appears to be in operating condition and is free from physical damage or non-compliance with the rules. These inspections are to be undertaken by competent persons.

Interlocking key type valve

Valve interlocks work through a trapped key system. This mechanical key interlocking system ensures that coded keys are released and locked in a predetermined sequence. The valve interlock thus guarantees that the valves are only opened or closed when the required conditions are met.

Intermediate level/rack sprinklers

Supplementary sprinkler protection required within racks or shelves, also referred to as in-rack sprinkler protection. Only approved and listed intermediate level/rack sprinklers shall be used for intermediate level protection.

A water fitting, including gate valves, sluice valves and stopcocks, that is used to shut off part of a sprinkler installation from the remainder of the installation.

K-Factor

A sprinklers coefficient of discharge where K is equal to the flow from the sprinkler in L/min divided by the square root of the pressure in kPa.

Level-control valve

A water fitting, such as a float valve, that is used to regulate the inflow of water in a storage tank and to maintain the level of the water at a predetermined level.

LIFO

Last In First Out.

Life safety installation

A sprinkler installation that complies with the provisions of these rules and with those of relevant statutory regulations related to the protection of life.

Life safety system/building

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

Lithium batteries

Batteries with substances containing lithium. There is a basic distinction between lithium metal and lithium-ion batteries. Lithium metal batteries contain pure lithium in small quantities. Lithium-ion batteries usually contain lithium dissolved in other substances.

Lithium metal battery

A non-rechargeable battery with lithium as an anode.

Lithium-ion battery

A rechargeable battery in which lithium ions move from the negative electrode to the positive electrode during discharge and back when charging.

- LFP
 - Lithium iron phosphate.
- LMO
 - Lithium manganese oxide
- LNP c)
 - Lithium nickel oxide

Racking where the incorporation of rollers or trolleys with bearings that facilitate the controlled movement of goods from one end of the channel to the other. The inclination of the roller platforms can be personalized depending on the unit loads: it's usually set at a 3% to 4% angle for pallets.

Longitudinal flue space

The space between not exceeding 500 mm between pallet ends that run perpendicular to the direction of loading, are vertically aligned, and clear of any storage maintained in single-row, double-row, and multiple-row racks. When racks are loaded, random variations in the vertical alignment and width of the flue space will occur which is acceptable.

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Looped mains or compound loop

An array where there is more than one distribution pipe which form several interconnected loops or rings along which water may flow to a range pipe.

Mains

A pipe other than a communication pipe and that is the responsibility of the local authority and used by it for conveying water to consumers.

Main distribution feed pipes

Main pipes feeding distribution pipework also known as feed mains.

Maximum flow demand

The peak flow that the installation might require.

Mean diameter

See Nominal diameter.

Mechanical pipe joint

A component or fitting other than a threaded tubular fitting, a screwed fitting, a lead-sealed spigot or a compound-sealed spigot or a socket and flanged joint, used to connect pipes and to produce a seal against pressure.

Medium-velocity sprayer

A sprayer of the sealed type or the open type used to control fires of liquids that have a viscosity lower than that of paraffin.

Mezzanine floor

A partial or full intermediate floor or series of floors between two main floors or the floor and a roof of a building.

Mole racking

Automated racking which allows shuttles to travel in three dimensions instead of just one or two dimensions:

- a) A 1D Mole is a form of shuttle based automated storage and retrieval system that can move in one dimension. Typically, this means that it travels back and forth down a single lane, where it deposits or retrieves inventory, usually in the form of pallets. The 1D Mole runs in tracks built into the racking that allow the mole to move underneath/below the pallets as the pallets are supported on the opposite edges of the storage lane. The mole raises up from underneath to pick up the desired pallet off the edge supports of the rack. Then the mole can move the pallet to the next specified position in the storage lane.
- b) A 2D Mole can travel in two dimensions. In addition to traveling back and forth down a lane, 2D Moles can travel between lanes autonomously. This means that a single piece of machinery (mole) is now capable of interacting with an even greater amount of inventory on a 2D plane in an autonomous manner.
- c) A 3D Mole can travel in three dimensions. In addition to being able to travel back and forth down a lane like a 1D Mole, and between lanes like a 2D Mole, a 3D Mole can travel vertically between storage levels.

Multi-storey building

Building comprising two or more storeys, above or below ground.

Node

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

Net Positive Suction Head (NPSH)

The Net Positive Suction Head - NPSH - can be expressed as the difference between the suction head and the liquids vapour head.

Nominal capacity

The stored electrical charge of a fully charged cell or battery which can be drawn when discharging under defined conditions, (example: a battery with a nominal capacity of 1000 mAh can be discharged for 1-hour at a current of 1 A).

Nominal Diameter

Also known as the mean or average outside diameter is neither equal to the inner diameter, (ID), nor the outer diameter, (OD), of the pipe. Nominal is a word that denotes non-specificity and identifies the approximate inner diameter with a non-dimensional number.

Nominal energy

The energy that a fully charged battery or accumulator can deliver under defined conditions, (calculated as the product of the nominal capacity and the nominal voltage, e.g., $1 \text{ Ah} \times 3.6 \text{ V} = 3.6 \text{ Wh}$).

Non-combustible

When used with reference to a material it means that the material has a fire-rating of at least 120 min when tested to a recognised international standard.

When used with reference to a construction or part of a building it means that the building or the construction is constructed wholly or in part of materials that have a fire-rating of at least 120 min.

Non-return valve

A water fitting that prevents the backflow or back-siphonage of water.

Normal water level

The water level at the water supply and in a storage facility needed to give the required effective capacity in relation to the low water level, including any necessary margins.

Occupancy class

The particular use or the type of use to which a building or portion thereof is normally put or intended to be put.

Occupant of a building

The person who occupies any premises, or part thereof, without regard to the title under which he occupies it.

Open sprinkler

A sprinkler head that is not sealed by a heat-sensitive element.

Operating temperature

The temperature at which a component, a fitting or an installation functions when in normal use.

Operating water level

The level reached by the water in a storage tank when the valve that controls the inlet of water to the tank closes under normal operating conditions.

Outriggers

A range pipe or series of range pipes feeding outboard sprinklers connected directly to either the supply side feed main or the tie-in side feed main.

Ordinary Hazard

Light non-commercial, commercial, and industrial occupancies involving the handling, processing, and limited storage of mainly ordinary combustible materials unlikely to develop intensely burning fires in the initial stages.

Orifice plate control device

A device that incorporates an orifice plate and that is installed in a pipeline to produce a pressure drop in the pipeline and thus a reduction in the flow rate.

Owner of an installation

The owner of the premises, or the building, or a particular part of the building, who is responsible for, or has effective control over, the fire safety provisions adopted for the premises, or the building, or that part of the building.

Pmax

A pump duty point representing the intersect of the calculated flow and pressure of the remote area of operation against the pump flow and pressure curve which shall pass to the left of the pump's Qmax duty point. Deemed to be the area of operation representing the lowest flow and highest pressure against the intersect point of the pump and system curve.

Pallet racking

Pallet rack is single or multiple level storage system designed in horizontal rows for palatalised storage where the inventory is on pallets that are loaded and unloaded with a forklift

Pallet types

In terms of length by width:

- a) EUR 1 pallet
 - This pallet measures 1,2 by 0,8 metres, with the maximum loading height usually being 220 cm and maximum loaded weight of 1,500 kg.
- b) EUR 2 pallet- FIN pallet (Finnish Pallet)
 - This pallet measures 1,2 by 1,0 metre, with the maximum loading height usually being 220 cm and maximum loaded weight of 1,250 kg.
- c) EUR 3 pallet
 - This pallet measures 1,0 by 1,2 metres, with the maximum loading height usually being 220 cm and maximum loaded weight of 1,500 kg.
- d) EUR 6 pallet HPL High Pressure Laminate
 - $This pallet \ measures\ 0.8\ by\ 0.6\ metres, with\ the\ maximum\ loading\ height\ usually\ being\ 220\ cm\ and\ maximum\ loaded\ weight\ of\ 500\ kg.$

The maximum pallet height is dictated by the product packaging, storage racking facilities, and height of transport vehicles. It is generally accepted that the maximum workable pallet height is 2200 mm.

Paper categories, based on weight

- a) Heavy weight is equal to or greater than 101 grams per m^2 .
- b) Medium weight is between 51 grams per m^2 and 100 grams per m^2 .
- c) Light weight is equal to or less than 50 grams per m².

Party wall

A wall devoid of common steelwork that complies in every respect with the definition of a perfect party wall except that the wall extends to, but not through, the roof.

Perfect party wall

A wall devoid of common steelwork that is constructed of a solid material and has a fire-resistance rating at least equal to 120-minutes.

a) Extends at least 220 mm through the roof.

Has no opening that:

- a) Is not protected by a double fireproof door with a fire-resistance rating equal to at least the standard rating, and
- b) Is of area exceeding 0,4 m² for the passage of spouts, chutes or trunks made entirely from iron or steel of thickness at least 6,5 mm, and that is provided with fire shutters of the same material and thickness fitted to both sides of every opening, and
- c) Has no hole of area exceeding 0,4 m², or any hole that is of area larger than that which adequately admits ropes, belts, shafts, straps, metal, or earthenware service pipes (that contain steam, gas, or water) or electric conductors where all services are placed in non-combustible and close-fitting sleeves or collars that are cemented round and through the full thickness of the wall.

Picking shelf

A picking shelf is a component of a manual picking system where goods are hand-stacked by someone hand-loading onto shelves. The picker usually picks one order at a time or a batch before taking it to the packing station.

Pipe array

The pipes feeding a group of sprinklers. Pipe arrays can be looped, gridded, or branched.

Pipe clip

An approved metal strap that supports pipework that is secured directly to the building structure by one or more fasteners, or by means of a support mechanism.

Pipe support

A permanent device for retaining a pipeline in a particular way or position.

Plenum

An unoccupied space, typically a ceiling void, throughout which air is circulated or moved at above or below atmospheric pressure, for heating, ventilation, or air conditioning purposes.

Pouch cell

In contrast to the cylindrical or prismatic cell, the pouch cell has no solid housing but instead has a surrounding metal-plastic foil.

Power density

Gives the electrical power, (energy per given time), that can be drawn from a battery in relation to its mass. Power density is especially important in electromobility, as this requires light batteries that can deliver enough energy to accelerate the vehicle very quickly. Power density is given in W/kg.

Pump duty points

See Pmax, Qmax and Pump runout.

Pump runout

The flow and pressure at 110% of the pump's duty point Qmax.

Prescribed

Dictated or imposed by the authority having jurisdiction.

Pressure control valve

A device that automatically controls the pressure on its outlet side to a maximum specific value.

Pressure maintenance pump (jockey pump)

Small automatic electric motor driven pump set used to replenish natural leakage and maintain system pressure.

Pressure rating

The nominal working pressure for which a water fitting was designed before any allowance is made for operation tolerances.

Pressure-reducing valve

A device that reduces the water pressure on its downstream side.

Primary battery

Non-rechargeable battery.

Primary support

A purpose-made bracket used to secure hanger components to the building structure by means of one or more fasteners.

Primary water supply

A single or unique water source of suitable capacity.

Prismatic cell

Prismatic cells are often used in mobile phones, notebooks or cameras and are usually protected by a solid plastic casing.

Pushback racking

Pallets are loaded and unloaded from the same end in such a way that only a front aisle is necessary. As a result, these racks are used with loads handled in line with LIFO flows. The structure of this type of live racking system is made up of carts and rails. The handling equipment pushes the incoming pallets into the channel, while gravity itself then draws them forward towards the channel's front position.

Qmax

A pump duty point representing the intersect of the calculated flow and pressure of the favourable area of operation against the pump flow and pressure curve and used to calculate the runout point with the suction source at its normal level. Deemed to be the area of operation representing highest flow and lowest pressure against the intersect point of the pump and system curve.

Range pipe

A pipe of restricted length and uniform diameter connecting sprinklers to each other and fed from a distribution pipe or main distribution pipe of uniform diameter. Where an arm, drop, rise pipe or combination of these exceeds 300 mm in length, (excluding fittings), the pipe feeding this array is classed as a distribution pipe. The range pipe may not change diameters between sprinklers but may change in diameter only where the pipe is offset around obstructions.

Reflux valve

Non-return valve.

Registered person

Competent person.

Remote area of operation

The location, in a pipe array, of an assumed maximum area of operation of a specified shape at which the water supply pressure is the maximum needed to give the specified design density of discharge regarded as the point of highest pressure and lowest flow.

Response time index (RTI)

The speed by which the operating element of a sprinkler reacts to the velocity of fire gasses measured in metres per second.

Ring main

Where the main feed pipe is interconnected forming a closed loop.

Risers or drops and main distribution pipe risers and drops

Main vertical pipes rising, (or dropping), from the installation valves and for linking the pipe network between floors and for linking distribution pipes with ranges, (or single sprinklers if the rise or drop exceeds 300 mm in length).

Should a riser, dropper or arm pipe, or combination thereof exceed an effective length of 300 mm, then the pipe feeding this shall be classed as a distribution pipe.

Rising spindle gate valve

A valve that has a stem that lifts out of the valve's body, which provides a visual, gross indication of the valve's position in lieu of an indicator.

Rosette or rosette plate

Escutcheon plate

Runout

The maximum flow usable flow and pressure a fire pump can produce representing 110% of Qmax.

Secondary battery

Rechargeable battery, (accumulator).

Section

A part (which may include one or more zones) of a sprinkler installation on a particular floor, and that is fed by a particular riser.

Separate array

A group of sprinklers that provides protection for a relatively small area that is not part of the main protected area, and that is fed by a separate distribution pipe.

Sling rod

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

Sprayer

A device with a directional pattern discharge.

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 or supplies in accordance with the requirements of this set of rules.

Spirituous liquor

A liquid that contains equal to or more than 20% alcohol.

Sprinkler arms

Sprinkler yoke.

Sprinkler yoke

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

Sprinkler protection user

Those persons responsible for or having effective control over the sprinkler system provision and its upkeep.

Staggered (sprinkler) layout

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

Standard (sprinkler) layout

A rectilinear layout that has the sprinklers at equal pitch along the range pipe relative to the next range or ranges.

State of Charge

Charging status of the battery or accumulator in %.

Static pressure

The water pressure at zero flow.

Stopcock

A small isolating or gate valve that can prevent flow in either direction by means of an orifice that can be sealed with a washer and plate as in a tap, or by means of a ball with a hole through it, and that can be sealed by rotating the ball through 90°.

Storage tank

A vessel that forms part of a sprinkler installation and in which water is stored.

Sub-circuit

The term "sub-circuit" means a circuit connected to a switch supplied directly from the low or medium voltage busbars on the fire pump room distribution board.

Subsidiary valve

A valve that controls the flow of water to sprinklers fitted downstream of the main installation control valves or that controls the flow of water to sprinklers fitted in remote pump houses.

Suitable for sprinkler use

Descriptive of equipment or components that the authority having jurisdiction has deemed acceptable, within the predetermined tested parameters of the equipment or components, for a particular application in a sprinkler installation or in relation to any document issued by such authority.

Supply feed main or near side main distribution pipe

The main distribution pipe or feed main immediately downstream of the installation control valve assembly on a grid system into which branch lines are connected.

Suppression mode

Defined as follows:

- a) The condition whereby equilibrium has been achieved between burning commodity and sprinkler discharge such that ceiling level temperature does not increase: and
- b) Horizontal fire spread has been eliminated; and
- c) Fire on vertical surfaces of burning commodity has been suppressed.

Suspended open cell ceiling

A ceiling of regular open-cell construction through which water from sprinklers can discharge freely.

Storage

The term "storage" wherever used in these rules includes the warehousing or the temporary depositing of goods or materials whilst undergoing process or relocation.

Terminal main feed

Where the main feed pipe terminates at the end of the system.

Thermal runaway

Thermal runaway begins when the heat generated within a battery exceeds the amount of heat that is dissipated to its surroundings which an incident where one exothermal process triggers other processes, finally resulting in an uncontrollable increase in temperature.

Tie side or far side main distribution pipe

The main distribution pipe or feed main on a grid system into which branch lines are connected on the opposing side of the supply side feed main.

Transverse flue

The space between pallet loads running parallel to the direction of loading which are vertically aligned and free of any storage. Nominal 150 mm transverse flue spaces between loads and at rack uprights shall be maintained in single-row, double-row, and multiple-row racks. When racks are loaded, random variations in the vertical alignment and width of the flue space will occur which is acceptable.

Trunk main

The connecting pipe either from the delivery of a pump or town main connecting to the underside of the control valve assembly.

U bolt

A shaped rod with screwed ends used to support pipework by means of a primary support.

Vertical

In relation to any pipe or device, inclined at 45° or more to the horizontal.

Water supply datum point

Point on the installation pipework at which the water supply pressure and flow characteristics are specified and measured.

Weekly test card

Record card(s), giving both specific advice and space for recording of weekly testing of sprinkler system alarms and water supplies.

Zone

Sub-division of an installation with a specific flow alarm and fitted with a monitored subsidiary stop valve.

PREAMBLE

Automatic sprinkler installations shall not be regarded as conforming to this set of rules unless the erection is carried out by sprinkler installers who are skilled and experienced in this work.

Notwithstanding the rules and requirements in these rules, the protection shall comply with a high standard, and it is quite clear that the rules shall be regarded as the minimum requirement. Where the word "approved" is used, it means approved, listed, and accepted in all instances and the equipment used shall be suitable for sprinkler service and listed by a recognised authority accordingly.

This set of rules does not preclude the use of any proven and acceptable technology that may exist in any other internationally recognised code, standard or set of rules.

The building shall be sprinkler protected throughout except where the omission of sprinklers or permitted exceptions are specifically allowed as indicated in these rules. A building which is not so protected will not be classified as a sprinkler protected building.

Pipework for two or more different classes of hazard systems installed to the same standard, code, or set of rules may be connected to a common set of control valves provided the total number of sprinklers does not exceed the maximum allowed.

Differing equipment, codes, standards, or rules cannot be intermixed, and it is the installation of origin that generally dictates the document to which any extension or alteration is carried out.

Any deviation from these rules may be allowed on the basis that accredited full scale fire tests have been carried out and documented accordingly which clearly show that the level of protection is equivalent to the intent.

To assist in the interpretation of this set of rules, the Automatic Sprinkler Inspection Bureau (Pty.) Limited, (ASIB), can be consulted. These are conducted on a case-by-case basis whereby no decision arrived at between parties can be regarded as setting a precedent.

CLASSISFICATION OF FIRE HAZARD

Classification of occupancy, storage and fire hazard shall be in accordance with these rules.

For the purposes of this standard, the fire hazard of any storage, building, or any part of building not of single occupancy shall be:

- a) Classified in terms of the appropriate fire-hazard classes.
- b) Shown on all plans and drawings.

The occupancy class and the fire-hazard class designated to any building, or any part of a building not of single occupancy shall be indicated in accordance with the appropriate hazard classification.

Fire hazard classification provides the basis for the design of sprinkler installations and is a skilled operation and shall be carried out by a competent person. The range of occupancies and fire hazards is extremely large, and it might be necessary to classify a particular case by analogy. The fire-hazard classification affects the choice of installation, operational methods, water supply arrangements, components, pipework design, etc.

These rules deal with sprinkler installations that are installed to prevent loss of life and property in the event of fire. In some circumstances the sprinkler installation might form an integral part of the measures approved by the fire authority for the protection of life, for example in covered and enclosed shopping complexes, where automatic sprinkler installations serve to prevent the spread of fire and its products to adjacent routes.

In the case of high-rise installations and life safety installations, additional safeguards to ensure reliability are considered necessary in terms of these rules although the hazard is classified in the normal way.

No person shall use any building or cause or permit any building to be used for any purpose that will result in a change in the fire-hazard classification of the building as shown on the approved plans unless:

- a) The sprinkler installation is re-evaluated and found suitable for the change regarding the fire hazard class.
- b) Written confirmation is obtained from the authority having jurisdiction for the change in the fire hazard class rating of the building.

SECTION 1: GENERAL INFORMATION

1000 Scope

These rules cover the minimum criteria required for the installation of automatic sprinkler systems in buildings housing one or more of an Ordinary Hazard or High Hazard class of occupancy.

1001 Ordinary Hazard

Light non-commercial, commercial, and industrial occupancies involving the handling, processing, and limited storage of materials unlikely to develop intensely burning fires in the initial stages.

1002 High Hazard

Commercial and industrial occupancies having abnormal or high fire loads.

a) High Hazard - Process risks

Where the materials handled or processed are of a combustible nature likely to develop rapid and intensely burning fires.

b) High Hazard - High piled storage risks

Involving high piling of combustible goods.

Pipework for two or more different classes of hazard systems may be connected to a common set of control valves provided the total number of sprinklers does not exceed the maximum allowed.

Dry and alternate systems should be avoided especially for High Hazard systems but where there is no alternative available and it is necessary to utilise a dry pipe system the assumed maximum area of operation shall be increased by 25%.

1003 Design density of discharge

The design densities of discharge and the assumed maximum area of operation for the two classes of sprinkler systems, are as follows:

a) Ordinary Hazard Systems

Design Density of discharge: 5,0 mm/min/m²
Assumed maximum area of operation: 130 m² to 360 m²

b) High Hazard Systems

c) Process Risks

Design Density of Discharge: 7,5 to 12,5 mm/min/m²
Assumed maximum area of operation: 260 m² to 450 m²

d) Deluge operation: Zoned area of operation

e) High Piled Storage Risks

Design Density of Discharge: 7,5 to 30.0 mm/min/m²
Assumed maximum area of operation: 260 m² to 450 m²

Special consideration is given to the area density method of protection as in Early Suppression Fast Response systems where the area of operation is determined by the number of sprinklers deemed to be in simultaneous operation at a predetermined pressure and not an area of operation expressed in square metres.

1004 Storage limitations

The storage heights of the relevant tables for the differing storage configurations are deemed to be the maximum for efficient sprinkler protection where sprinklers are provided at the roof or ceiling level only. The design densities of discharge cannot be interpolated.

The protection of high piled storage risks depends on the method of storage, the combustible nature of the stock, and the height of storage.

Provision is made for protection where sprinklers are only provided at the roof or ceiling and where additional sprinklers are provided at intermediate levels within storage racks.

Risks have been subdivided into four categories according to the severity of hazards of the stock.

1005 Stack height signs

Stack height signs not less than 500 mm by 500 mm in size must be prominently displayed at the maximum level of the allowable storage height in all storage and process risk areas.

It must be clearly stated on each stack height sign in lettering of not less than 35 mm in height for what type of storage risk the limitation relates to as well as the design density of discharge specific to that area.

1006 Clear space beneath roof or ceiling level sprinkler protection

In limited head space areas, a clear space shall always be maintained below the level of the sprinkler deflectors throughout the installation as follows:

- a) 0,5 metre for Ordinary Hazard.
- b) 1,0 metre for High Hazard.

Roof trusses shall always be accessible to water discharged from the sprinklers.

Where sloping ceilings or roofs are concerned, the storage of goods may follow the slope, subject to compliance with the requirements in these rules.

1007 Roof or ceiling slope

Roof or ceiling slopes shall not exceed 10° and where this occurs the effect on the assumed maximum area of operation and the design density of discharge needs to be evaluated on a case-by-case basis.

Where sprinklers are installed beneath a roof or ceiling slopes less than 10° the sprinkler deflector shall be orientated parallel to the roof or ceiling slope.

Where sprinklers are installed for roof or ceiling slopes exceeding 10° the sprinkler deflector shall be orientated parallel to the floor.

For rack and shelf storage where the roof or ceiling slope exceeds 10°, intermediate level protection is mandatory, and the uppermost level of protection shall be above the top of storage.

Where the slope of the ceiling is greater than 18,5° the assumed maximum area of operation shall be increased by 25% except where intermediate level protection has been installed and the uppermost level of protection is above the top of storage.

1008 Smoke and draft curtains

A draught curtain or smoke and draft curtain generally assists in restricting the spread of the products of combustion at roof level and can accelerate the operation of the desired sprinklers above the fire area. Factory Mutual Data Sheet 1-10 (3.3) may be used to calculate the depth and criteria of draft curtains.

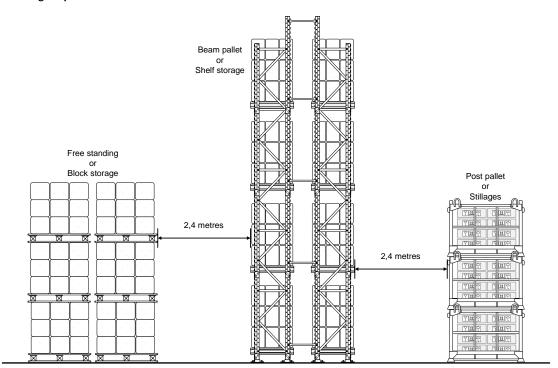
Non-combustible draft curtains shall extend down a minimum of 0,6 metre from the ceiling. The bottom edge of the curtain shall be kept level and at a uniform height above the floor.

Draft curtains shall be installed at the interface between differing temperature ratings of sprinklers or adjoining areas, mezzanine floors, differing hazards categories or design densities of discharge.

1009 Separation of types of storage with or without intermediate level protection

A clear separation of a minimum of 2,4 metres is required between each differing type of storage within the same compartment to limit the spread of fire.

Figure 101: Storage separation



1010 Excessive Clearance (free standing and block storage)

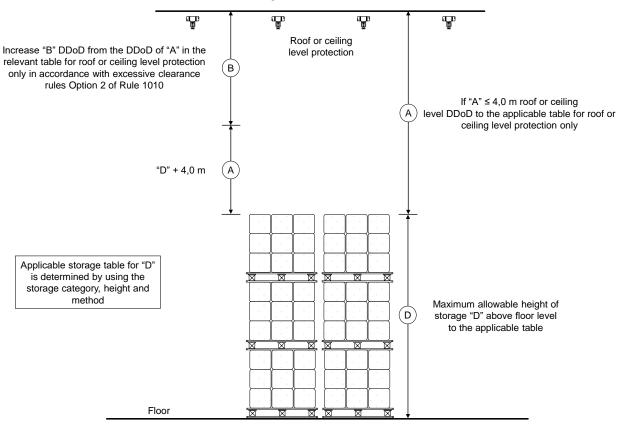
In all cases where the distance between the top of storage and the roof or ceiling level sprinklers exceeds 4,0 metres, one of the following options shall be applied.

Option 1: Install a non-combustible false ceiling or mezzanine meeting the Euroclass A1 or A2 rating of BS EN 13501 Part 1 that can withstand an updraft of 50 N/m² shall be installed above the storage with sprinkler protection above and below to reduce the clearance.

Option 2: See Figure 102. Where, in any instance, the clearance distance between the storage height and the ceiling or roof, exceeds 4,0 metres more than that allowable when applying the relevant storage table, the following can be applied for control mode sprinkler protection:

- a) Increase the roof level design density of discharge for the first excessive metre above the 4,0 metres allowance or part thereof by 2,5 mm/min/m².
- b) For each additional metre or part thereof, increase the design density of discharge by 1,0 mm/min/m².
- c) The roof level sprinklers operating temperature shall not exceed 93° C and a K-Factor of not less than 11,5 shall be used.

Figure 102: Section through excessive clearance for roof or ceiling protection only for free standing and block storage configurations - Excludes the installation of an underdrawn ceiling or mezzanine floor



1011 Excessive clearance for beam pallet racking and shelf storage

In all cases where the distance between the top of storage and the roof or ceiling level sprinklers exceeds 4,0 metres, one of the following options shall be applied.

Option 1: Reduce the clearance to 4,0 metres or less with a non-combustible false ceiling or mezzanine meeting the Euroclass A1 or A2 rating of BS EN 13501 Part 1 that can withstand an updraft of 50 N/m² shall be installed above the storage with sprinkler protection above and below.

Option 2: See Figure 103. If the intermediate level protection above the top of storage is excluded the design density of discharge at roof or ceiling level shall be determined as follows:

- a) The initial design density of discharge shall be determined by the relevant table.
- b) Increase the roof level design density of discharge for the first excessive metre above the 4,0 metres allowance or part thereof by 2,5 mm/min/m².
- c) For each additional metre or part thereof, increase the design density of discharge by 1,0 mm/min/m².
- d) The roof level sprinklers operating temperature shall not exceed 93° C and a K-Factor of not less than 11,5 shall be used.

Option 3: See Figure 104. Provide intermediate levels of in-rack sprinklers installed in accordance with these rules where the highest level of intermediate rack protection is positioned above the top of storage.

Figure 103: Section through excessive clearance for roof or ceiling level protection only for rack or shelf protection configurations – does not depict the installation of an underdrawn ceiling or mezzanine floor

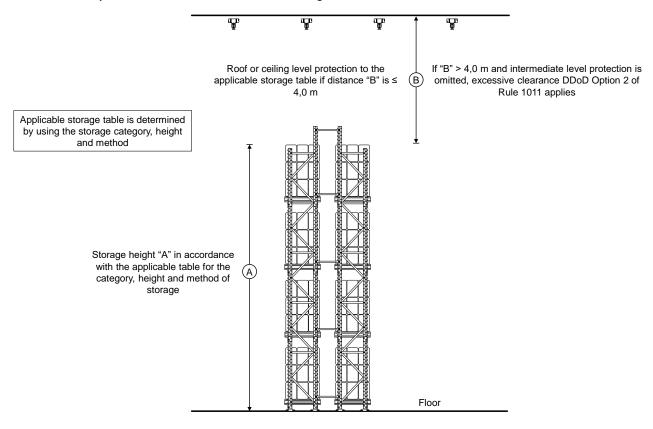
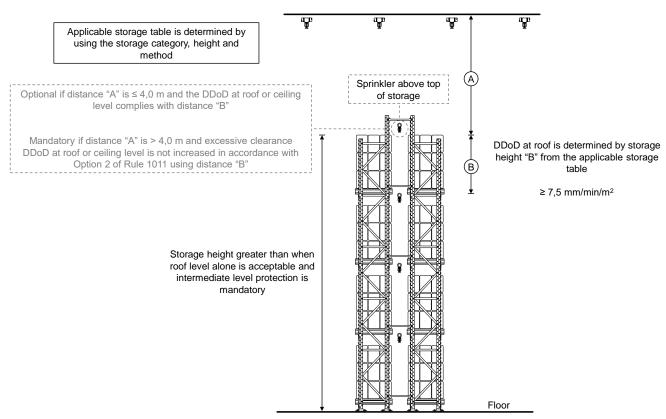


Figure 104: Section through excessive clearance for rack and shelf storage configurations where intermediate level protection is installed/mandatory – does not depict the installation of an underdrawn ceiling or mezzanine floor



1012 Classification of storage

Storage of goods usually do not consist of a single commodity. When determining the category of storage, it is the most challenging combination of goods, packaging or storage method that shall be used to determine the category of storage even if these form a small proportion of the overall fire load.

1013 Ordinary Hazard storage considerations

It is considered that overall storage heights not exceeding those stated in Table 101 in the various categories are suitable for Ordinary Hazard systems and need not be regarded as high piled storage.

For shelf or rack widths more than 1,0 metre within Ordinary Hazard occupancies and where the roof or ceiling protection is within 4,0 metres of the top of storage, intermediate level sprinkler protection in accordance with these rules shall be installed without necessarily increasing the design density of discharge at roof level providing that the maximum allowable storage heights of Table 101 are not exceeded.

The excessive storage height as defined in Rule 1010 and 1011 shall be applied as required for all types of storage configurations.

Table 101 Ordinary Hazard storage limitations

1	2	2 3		5	6	7
Category	Block stacking or free-standing storage Category Category Single row post pallets 2,4 m aisles Solid or slatted shelf storage ≤ 1,0 m wide Stack height (metres)		Design density of discharge required (mm/min/m²)	Assumed maximum area of operation (m²)	Maximum storage block area (m²)	Minimum width of aisles separating storage (m)
Category I	4,0	3,5				
Category II	3,0	2,6	5,0	216	50	2,4
Category III	2,1	1,7	3,0	216	50	2,4
Category IV	1,2	1,2				

Where these storage limitations cannot be complied with and for solid or slatted shelves with widths greater than 1,0 m and less than 6,0 metres the sprinkler protection shall be installed in accordance with the requirements of High Hazard.

1014 High Hazard storage

Dry and alternate systems should be avoided for High Hazard. Where no alterative exists, the assumed maximum area of operation shall be increased by 25% in accordance with Rule 1002.

1015 Types of storage - roof or ceiling protection only

1016 Stockpile or loose storage

Stockpile storage includes but is not limited to products such as coal, raw chemicals, sugar, wood chips, grain and bagasse and is usually delivered into the storage area by conveyor and deposited on the floor forming a pyramid, (polyhedron), shape.

To determine the height of storage and providing the storage forms a reasonable equilateral triangle, half the height of the pyramid formed may be taken to determine the required density of discharge using Table 101 or Table 102 over an extended maximum assumed area of operation of not less than 360 m² for Ordinary Hazard applications and 450 m² where the storage falls into High Hazard.

Excessive storage height is measured from the apex of the pyramid.

1017 Free standing and block storage

Table 102 indicates the appropriate density of discharge and assumed maximum area of operation according to the category and stack height where free standing or block storage is to be protected by roof or ceiling protection only. The storage heights are deemed to be the maximum for efficient sprinkler protection where sprinklers are provided at the roof or ceiling level only. The design densities of discharge cannot be extrapolated.

For control mode sprinkler protection, the maximum area shall not exceed 150 m² in plan for any single block of storage surrounded by aisles of not less than 2,4 metres.

It is good practice for the actual or assumed height of storage to provide for any future requirements which normally shall not be less than eaves height or to a height 1,0 metre below any flat ceiling or roof.

Table 102 Free standing and block storage

1	2	3	4	5	6
Category I	Category II	Category III	Category IV	Design density of discharge required	Assumed maximum area of operation
	Stack height (metres)		(mm/min/m²)	(m²)	
5,3	4,1	2,9	1,6	7,5	260
6,5	5,0	3,5	2,0	10,0	260
7,6	5,9	4,1	2,3	12,5	260
	6,7	4,7	2,7	15,0	260
	7,5	5,2	3,0	17,5	260
		5,7	3,3	20,0	300
		6,3	3,6	22,5	300
		6,7	3,8	25,0	300
		7,2	4,1	27,5	300
			4,4	30,0	300

1018 Palletised rack storage (beam pallet racking)

Where wire mesh is used without pallets, the storage shall be classed as shelving and be protected in accordance with these rules.

The distance between goods stored in racks or shelves positioned back-to-back with or without intermediate level protection shall not be less than 150 mm in the longitudinal and transverse flue between adjacent pallets. If required, stops shall be fitted to maintain the minimum distances.

1019 Single beam pallet racks

Roof or ceiling level protection only is acceptable when:

- a) The storage height, design density of discharge and the assumed maximum area of operation given in Table 103 shall apply.
- b) A maximum pallet load width of 1,6 metre aisle to aisle is not exceeded and pallet loads are butted only in one direction.
- c) The aisle widths are greater than 1,2 metres.
- d) Clear transverse flues of not less than 150 mm are maintained between the sides of the butted pallets.
- e) There are no solid or slatted shelves in the rack.
- f) Wire decking is acceptable where pallets are utilised for storage and the total open area of wire mesh is not less than 70% of the plan area between the horizontal beams.
- g) The racks are fixed in place.

Table 103 Beam pallet racking

1	2	3	4	5	6	
Category I	Category II	Category III	Category IV	Design density of discharge required	Assumed maximum area of operation	
Stack height (metres)		(mm/min/m²)	(m²)			
4,7	3,4	2,2	1,6	7,5	260	
5,7	4,2	2,6	2,0	10,0	260	
6,8	5,0	3,2	2,3	12,5	260	
	5,6	3,7	2,7	15,0	260	
	6,0	4,1	3,0	17,5	260	
		4,4	3,3	20,0	300	
		4,8	3,6	22,5	300	
		5,3	3,8	25,0	300	
		5,6	4,1	27,5	300	
		6,0	4,4	30,0	300	

1020 Back-to-back beam pallet racks

Roof or ceiling level protection only is acceptable when:

- a) The storage height, design density of discharge and the assumed maximum area of operation given in Table 103 shall apply.
- b) The maximum width of back-to-back racking aisle to aisle shall not exceed 3,2 metres.
- c) The aisle widths are greater than 1,2 metres.
- d) Clear transverse flues of not less than 150 mm are maintained between the sides of the butted pallets.
- e) For racks positioned back-to-back a clear longitudinal flue space of not less than 150 mm must be maintained.
- f) There are no solid or slatted shelves in the rack.
- g) Wire decking is acceptable where pallets are utilised for storage and the total open area of wire mesh is not less than 70% of the plan area between the horizontal beams.
- h) The racks are fixed in place.

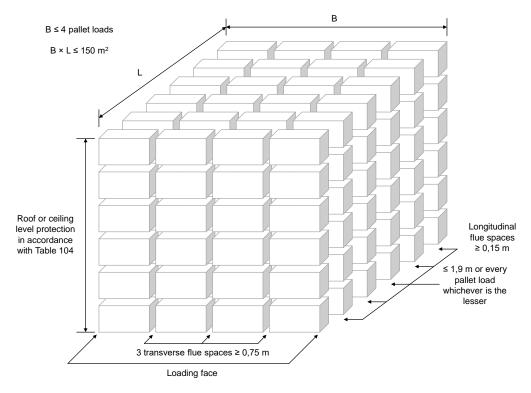
1021 Double deep pallet racking

Double deep pallet racking is where the racking is arranged for a 4-pallet single entry front load. See Figure 105.

Roof or ceiling level protection is acceptable based on the following being complied with:

- a) The storage height, design density of discharge and the assumed maximum area of operation given in Table 104 shall apply.
- b) Each block of storage shall be limited to 150 m² of floor area.
- c) Each storage block shall be surrounded by a clear space of not less than 2,4 metres.
- d) 150 mm transverse flue spaces are to be maintained between pallet loads or every 1,9 metres whichever is the lesser.
- e) 150 mm clear longitudinal flue spaces shall be maintained between each row of storage, i.e., 3 front loading flue spaces per block.

Figure 105: Example of double deep pallet racking with roof or ceiling protection only



1022 Multiple row rack storage, drive in, flow through, push back, mole racking

Multiple row racking is where the pallets usually abut onto each other. See Figure 106.

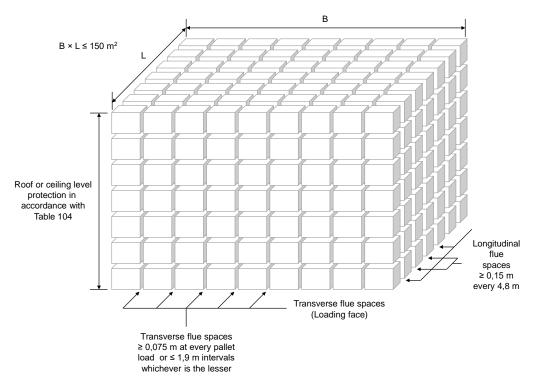
See Figure 106. Roof or ceiling level protection is acceptable based on the following being complied with:

- a) The storage height, design density of discharge and the assumed maximum area of operation given in Table 104 shall apply.
- b) Each block of storage shall be limited to 150 m² of floor area.
- c) Each storage block shall be surrounded by a clear space of not less than 2,4 metres.
- d) 150 mm transverse flue spaces are to be maintained between pallet loads or every 1,9 metres whichever is the lesser.
- e) 150 mm clear longitudinal flue spaces shall be maintained at a maximum distance of 4,8 metres.

Table 104 Roof or ceiling sprinkler design criteria for double deep pallet racking, drive through, push back, live or mole racking and multiple row post or box pallets with roof or ceiling level protection only

1	2	3	4	5	6	7	
Storage configuration	Category Category Category I II III IV				Design density of discharge	Assumed maximum area of operation (m²)	
Storage configuration	Stack height (metres)				(mm/min/m²)		
	5,7	4,2	2,6	2,0	10,0	260	
Double deep pallet racking, drive through, push back, live or mole racking and multiple row post or box		5,0	3,2	2,3	12,5	260	
pallets				2,7	15,0	260	
				3,0	17,5	260	

Figure 106: Example of drive through, push back, live or mole racking with roof or ceiling level protection only



1023 Storage in single or multiple row post or box pallets

Where single row post pallet storage stack heights exceed that stated in Table 101, the roof or ceiling protection shall be in accordance with Table 105 subject to the top of storage being within 4,0 metres of the roof or ceiling protection. See Rule 1011.

There is no restriction on the maximum storage block area of post pallets under High Hazard.

The aisle width between single or multiple row post pallet block of storage shall not be less than 2,4 metres.

1024 Open top bin-box storage

Open top bin-box storage is not covered in these rules and in such cases the proposed design for acceptance by all parties shall be on a case-by-case basis.

1025 Storage on single row solid or slatted shelves

Roof or ceiling level protection only is acceptable when:

- a) The storage height, design density of discharge and the assumed maximum area of operation given in Table 105 shall apply.
- b) The maximum width of the shelf aisle to aisle shall does exceed 1,0 metre.
- c) The shelf area does not exceed 2,0 m^2 and is bounded by full width 150 mm transverse flue spaces.
- d) Storage is open fronted metal construction bin-box storage regardless of shelf depth.
- e) Storage without flue spaces is not deeper than 1,2 metres, limited to 150 m² blocks and each block of storage is surrounded by 2,4 metre aisles.

Table 105 Roof or ceiling protection for shelf storage

1	2	3	4	5	6
Category I	Category II	Category III	Category IV	Design density of discharge required	Assumed maximum area of operation
		height tres)		(Minimum mm/min/m²)	(m²)
4,7	3,4	2,2	1,6	7,5	260
5,7	4,2	2,6	2,0	10,0	260
	5,0	3,2	2,3	12,5	260
			2,7	15,0	260
			3,0	17,5	260

1026 Storage on back-to-back solid or slatted shelves with roof or ceiling protection only

Where storage heights exceed that stated in Table 101:

- a) The storage height, design density of discharge and the assumed maximum area of operation given in Table 105 shall apply.
- b) Shelves are positioned back-to-back, and the total width of each shelf shall not exceed 0,8 metres.
- c) A clear longitudinal flue space of 150 mm between shelves shall be maintained.
- d) Clear transverse flues of not less than 150 mm coincident with the shelf uprights shall be maintained.
- e) Aisle widths shall be greater than 1,2 metres.

1027 Continuous non-combustible bulkheads – all configurations

Where such bulkheads are installed and the stored goods extend into the aisles beyond the face of the rack, the bulkheads shall extend beyond the rack at least as far as the storage.

- a) To limit the horizontal spread of fire within a shelf it is recommended that continuous non-combustible vertical bulkheads be installed.
- b) To limit the vertical spread of fire within a shelf it is recommended that continuous non-combustible horizontal bulkheads be installed.

Where it is not possible to install intermediate level protection within shelves the following shall apply:

- a) The storage height, design density of discharge and the assumed maximum area of operation given in Table 105 shall apply.
- b) The plan area of any block of shelved storage shall not exceed 150 m².
- c) Each block of storage shall be surrounded by aisles of not less than 2,4 metres wide.
- d) Continuous non-combustible vertical bulkheads shall be installed to restrict the horizontal spread of fire to not more than every second upright or 6,4 metres whichever is the lesser.
- e) Continuous non-combustible horizontal bulkheads shall be installed at every third-tier level.

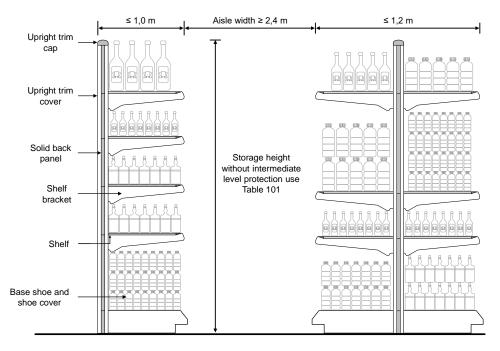
1028 Gondola shelving

Gondola storage shall be limited to a total width of 1,2 metres with a solid end or central barrier extending from the base to the top of storage when positioned back-to-back.

The storage height, design density of discharge and the assumed maximum area of operation given in Table 101 shall apply. For heights exceeding Table 101, protection is to be determined on a case-by-case basis. See figure 107.

Figure 107: Section through gondola shelving

Excessive clearance for the roof or ceiling level design density of discharge applies if the ceiling level sprinkler protection is > 4,0 m above the top of storage



1029 Intermediate level sprinklers

Intermediate level protection is strongly recommended for heights below those indicated in the tables, but where this cannot be achieved, storage configurations shall be provided in accordance with these rules.

If the allowable storage heights or widths are exceeded for roof or ceiling level protection only, intermediate level sprinklers are required.

Rack or shelf storage with aisles less than 1,2 metres in width or where storage takes place within the aisles are treated as multiple row storage due to the ease in which a fire can be transferred from rack to rack and shall have intermediate level sprinkler protection installed.

Except where allowed otherwise in these rules, where the storage has more than two pallets in more than one direction in the horizontal plane, the provision of intermediate level sprinklers is mandatory.

Row end and frame protection for racks and shelves is required where intermediate level protection is installed to limit any potential damage.

For multiple row storage configurations, sprinkler protection is required in every longitudinal flue space and rack, or shelf ends regardless of configuration.

Intermediate level sprinklers shall be fed from separate sets of installation control valves.

Where not more than 50 intermediate level sprinklers are installed, they may be fed directly from the ceiling sprinkler distribution pipework, subject to the control valve not being less than 150 mm nominal diameter.

1030 General requirements for intermediate level protection for racks and shelves

The requirements for roof or ceiling level protection and intermediate level protection for racks and shelves shall always be hydraulically calculated.

Standard response sprinklers having a nominal temperature rating of 93° C shall be used at the roof or ceiling for High Hazard protection and 68° or 79° C operating temperature sprinklers for products that produce an initial low heat output as, for example, baled cotton or protect structures such as cold rooms and freezers.

Dry pipe systems shall not be intermixed with wet pipe systems. For example, a dry pipe system within racks and wet pipe at roof or ceiling level. An exception to this for control mode sprinkler operation will be where dry barrel droppers are used at roof level where the assumed maximum area of operation and design density of discharge are increased by 25%.

Unless otherwise noted, the minimum design density of discharge for roof or ceiling protection shall not be less than 7,5 mm/min/m² over an assumed maximum area of operation of 260 m².

Where the building is classed as a rack clad where the racks or shelves support or are affixed to a mezzanine, roof, or ceiling structure the design density of discharge for the roof or ceiling sprinklers shall not be less than 10,0 mm/min/m² over an assumed maximum area of operation of 260 m².

1031 Flexible couplings for fixed rack storage

Movement can occur between the sprinkler pipework within storage racking, (floor or roof), and the distribution pipework that is attached to the building structure. Where excessive movement can be reasonably expected, a flexible coupling or swivel/swing joint shall be fitted to the distribution mains at the point of connection leading to each rack or shelf.

Flexible couplings shall:

- a) Be capable of withstanding a test pressure one-and-a-half-times the maximum working pressure, or 1,800 kPa, whichever is the greater, and shall not include parts that might impair either the integrity or the performance of sprinkler installations when subjected to fire.
- b) Not used to compensate for misalignment between the distribution main and the feed pipe to intermediate level sprinklers.
- c) Flexible couplings shall contain a continuous pressure retaining inner tube of stainless steel or nonferrous metal.
- d) Not be fitted in the fully extended condition.

Pipe couplings configured as a swivel/swing arrangement can be used in lieu of flexible couplings to take up any mild misalignment that may occur due to normal movement.

1032 Protection of structural members and columns and obstructions

Wherever any rack or structural steelwork is likely to interfere with the sprinkler water distribution pattern, additional sprinkler protection shall be provided and included in the hydraulic calculations.

Where building columns located within the racks, if not protected by non-combustible materials having a minimum fire resistance of 2-hours, must be wetted for cooling purposes by additional sprinklers at the rate of 10,0 mm/min/m² per square metre over each side of the surface area of the structural member. See Figure 108.

The use of narrow angle sealed sprinklers is contemplated and the discharge from these within the assumed maximum area of operation shall be included in the water supply and hydraulic calculation considerations.

Sprinklers shall be positioned at 4,5 metre vertical intervals to provide uninterrupted rundown below the level of the roof or ceiling level sprinklers.

Where columns are placed between racks or shelves positioned back-to-back and these disrupt the regular spacing of the intermediate level sprinklers in relation to the transverse flues or will significantly interfere with the water distribution pattern, a sprinkler shall be placed within 75 mm of either side of the column. The sprinkler range is to be positioned centrally in relation to the column and the rear face of each side of the storage. See Figure 108.

1033 Clearance between sprinkler deflector and top of storage

 $A\ clear\ space\ of\ not\ less\ than\ 150\ mm\ shall\ be\ maintained\ between\ intermediate\ level\ protection\ sprinkler\ deflector\ and\ the\ top\ of\ stored\ goods\ within\ racks\ or\ shelves.$

This space may be reduced to 100 mm with the use of approved and listed flat spray sprinklers. See Figure 110 and 111.

Figure 108: Plan view of vertical structural I-Beam protection

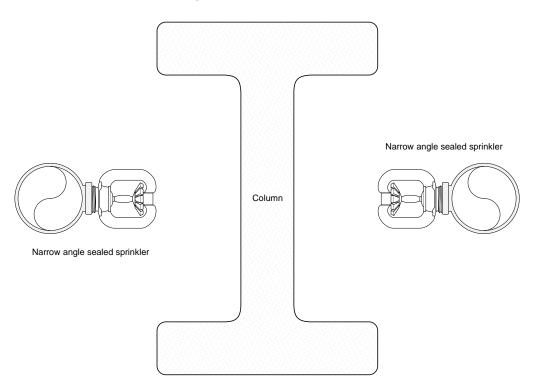
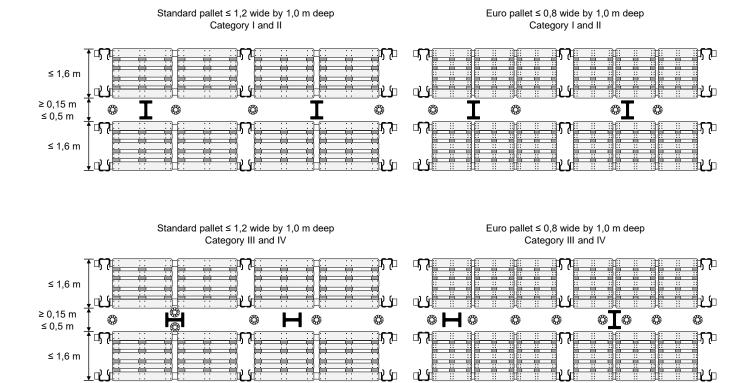


Figure 109: Plan view of examples of the location of intermediate level sprinklers in relation to columns and rear face of storage



1034 Type of sprinkler required for intermediate level protection

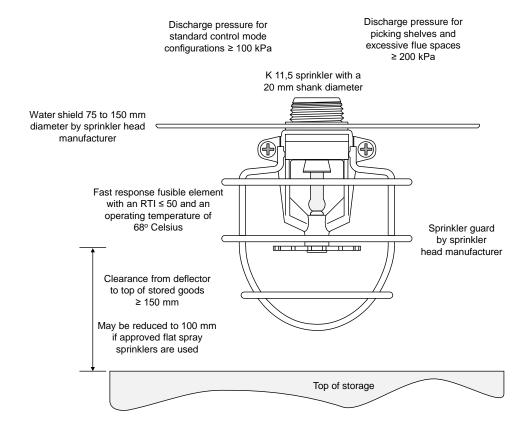
Sprinklers used for the protection of intermediate level protection shall conform to the following criteria:

- a) Listed and approved as an intermediate level sprinkler.
 - i. Pendent spray pattern sprinklers are usually suited for beam pallet racking.
 - ii. Pendent spray pattern sprinklers are usually suited for longitudinal flue spaces.
 - iii. Centrally positioned upright spray pattern sprinklers are usually suited for single solid or slatted shelving.

Note: The depiction of upright or pendent spray sprinklers in these rules does not suggest that these are the only options available. The choice of the type of sprinkler and orientation remains with the designer or determined on a case-by-case basis.

- b) A K-Factor of not less than 11,5 with a starting pressure at the most remote sprinkler of 100 kPa unless otherwise noted in these rules.
- c) A response time index, (RTI), of less than 50.
- d) 68° C operating temperature.
 - i. Listed and approved sprinkler metal water shields of between 75 mm and 150 mm diameter shall be fitted to intermediate level sprinklers. The presence of solid shelves or mezzanine floors does not negate the use of a water shield.
 - ii. Listed and approved sprinkler guards shall be fitted to intermediate level sprinkler protection for palletised rack protection, solid or slatted shelves.
 The use of upright spray pattern sprinklers does not negate the use of sprinkler guards.
- e) The minimum vertical clearance between the spray pattern sprinkler deflector and the stored goods shall be maintained at not less than 150 mm.
- f) Consideration shall be given to the protection of pipework and sprinklers against mechanical damage.
- g) Sprinkler tiers are to be calculated from the top of the storage.
- h) For intermediate level sprinkler protection in ESFR occupancies refer to Rule 3064.

Figure 110: Example of an intermediate level pendent spray sprinkler



1035 Positioning of the intermediate level sprinklers and deflector

Where possible the pipework and sprinkler shall be installed in a position that will obviate damage when pallets or goods are being loaded or unloaded into shelves or beam pallet racks.

Intermediate level sprinklers shall be positioned at least 25 mm clear from any upright support. See Figure 111.

Unless the manufacturer's requirements differ, the minimum distance a sprinkler deflector shall be beneath the unloaded horizontal framework of a beam pallet rack or within the longitudinal flue where shelves are positioned back-to-back is 25 mm. This measurement is to be taken before beam deflection is taken into account for storage loading. See Figure 111.

Note: Beam deflection shall not exceed 0,55% of the length of the beam between uprights which equates to the length of the beam divided by 180. A minimum distance of not less than 10 mm shall be maintained between the underside of a fully loaded horizontal bean and the sprinkler deflector.

Where picking shelves are positioned between shelf tier levels, a tier level of protection shall be directly above the top of the storage on the picking shelf level.

1036 Water requirements where intermediate level protection is installed

Except if otherwise noted, the pressure and flow requirements of intermediate level sprinklers for control mode application shall be calculated on the assumption that the hydraulically most unfavourable sprinkler operates at a pressure of not less than 100 kPa when using K-11,5 sprinklers and 200 kPa for K-8,0 sprinklers where consideration is given for their use on a case-by-case basis.

The number of sprinklers in Table 106 are deemed to be in simultaneous operation in conjunction with the roof or ceiling level protection in the hydraulically most unfavourable or favourable locations.

Figure 111: Front elevation of the location of sprinklers relative to storage and upright and horizontal supports

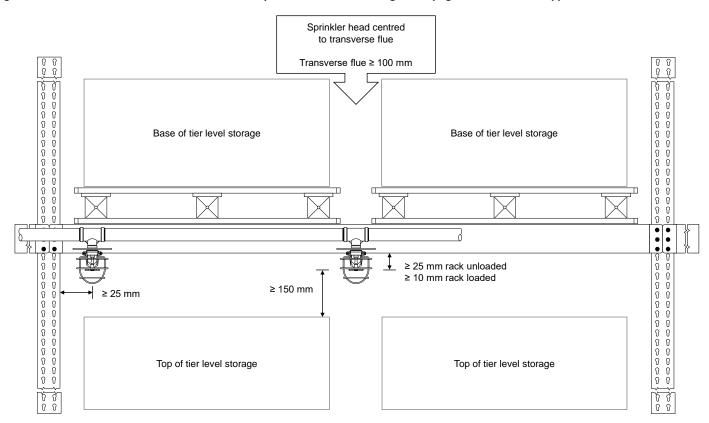


Table 106 Number of intermediate level sprinklers deemed to be in simultaneous operation

1	2	3	4	5					
Aisle Width		Number of Sprinklers in Simultaneous Operation							
(metres)	Number of sprinklers per level	Number of tier levels	Number of racks	Total					
< 1,2	3	3	3	27					
≥1,2 ≤ 2,4	3	3	2	18					
> 2,4	3	3	1	9					

The water supply characteristic must be adequate to supply the simultaneous flow to the ceiling sprinklers and intermediate level sprinklers in the most unfavourable and most favourable areas of operation.

The amount of water available must be capable of supplying the simultaneous flow to the ceiling sprinklers and intermediate level sprinklers, derived from the intercept of the pump curve and the demand curve for the hydraulically most unfavourable and favourable area for 90-minutes.

1037 Location of intermediate level sprinklers in palletised rack storage

Longitudinal and transverse flues are critical in respect of channelling the passage of heat and water penetration by the sprinklers and shall be continuous for the full height of each block of storage, vertically aligned, free of stored goods, and regularly spaced. See Figure 112.

Sprinkler protection of racks positioned back-to-back shall be installed within the longitudinal flue spaces at the intersections of the transverse flue.

For single racks, the sprinklers shall be positioned at the rack horizontal support levels in the aisles if these cannot be centrally located within the rack.

Where the intermediate level sprinkler exceeds 250 mm from the face of storage in back-to-back storage configurations, (500 mm clear space), each rack shall be treated as single row and two rows of sprinklers shall be installed within the longitudinal flue space at every opposing tier level vertically and staggered horizontally.

Where rack pallets touch in back-to-back storage configurations or the longitudinal flue space cannot be maintained, the storage shall be classed as solid shelving and the protection adjusted in accordance with these rules.

1038 Maximum vertical distance between sprinkler tier levels

For Category I, II, III and IV goods the vertical distance from the floor and between tier levels of intermediate level protection shall not exceed 3,5 metres or every second-tier level whichever is the lesser. See Figures 113, 114, 115 and 116.

Where palletised rack storage stack heights distance is greater than the values of Table 107 or the top of storage is more than 4,0 metres below the roof or ceiling protection excessive clearance must be applied. See Rule 1011.

In no case shall the highest level of intermediate level sprinkler protection be installed lower than one tier below the top of the storage.

1039 Maximum horizontal distance between sprinklers on a range

In the case of Category I and II goods the sprinklers shall be positioned within the longitudinal flue at the intersection of every second pallet transverse flue or a maximum of 3,75 metres, whichever is the lesser. See Figure 113.

The sprinklers shall be staggered in relation to the next highest row and the product of the horizontal and vertical distances between the sprinklers for Category I and II goods shall not exceed 9,8 m².

In the case of Category III and Category IV goods, the sprinklers shall be positioned within the longitudinal flue and at the intersection of every pallet transverse flue or a maximum of 1,9 metres, whichever is the lesser. The product of the horizontal and vertical distances between the sprinklers shall not exceed 4,9 m². See Figure 114.

1040 Beam pallet rack widths

The number of rows of sprinklers is determined by the rack width. Where racks are positioned back-to-back, the total width is calculated by adding together the width of each pallet and the distance between them.

The width of back-to-back beam pallet racking shall not exceed 3,2 metres which allows a maximum ingress of 1,6 metres from centre of the longitudinal flue to the outside face of the pallet.

The front, side, and rear faces of single, double, or multiple row racks shall be protected in a manner so that the sprinklers per tier level or alternate tier level shall be positioned in the front of the racks first pallet or behind the last pallet load and side faces. See Figures 113, 114, 115 and 116.

The maximum allowable storage height above the top line of sprinklers within beam pallet racking shall not exceed the values as determined in Table 107 if the top of storage is within 4,0 metres of the roof or ceiling level protection. See Rule 1011.

Table 107 Roof or ceiling sprinkler design criteria with intermediate level sprinklers for beam pallet racks

1	2	3	4	5	6	7
Storage	Maximum permitt	•	ve the top tier level of ection tres)	intermediate level	Assumed maximum area of operation	
configuration	Category I	Category II	Category III	Category IV	(mm/min/m²)	(m²)
Palletised Racks	3,5	3,4	2,2	1,6	7,5	
			2,6	2,0	10,0	260
			3,2	2,3	12,5	200
			3,5	2,7	15,0	

Figure 112: Typical rack terminology

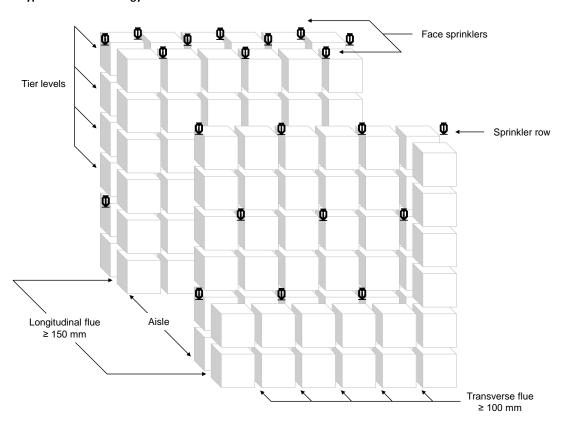


Figure 113: Location of intermediate level protection sprinklers for Category I or II

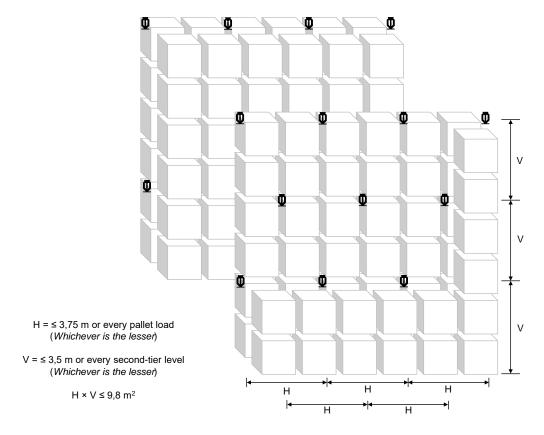


Figure 114: Location of intermediate level protection sprinklers for Category III and IV

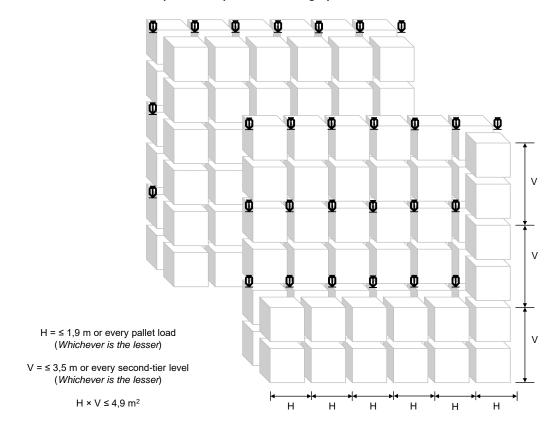


Figure 115: Location of intermediate level protection for Category I and II multiple row racks

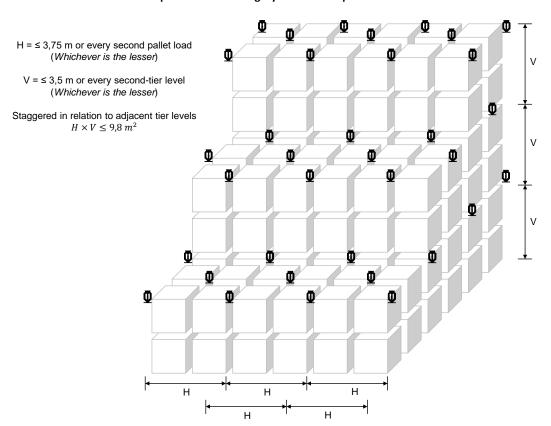
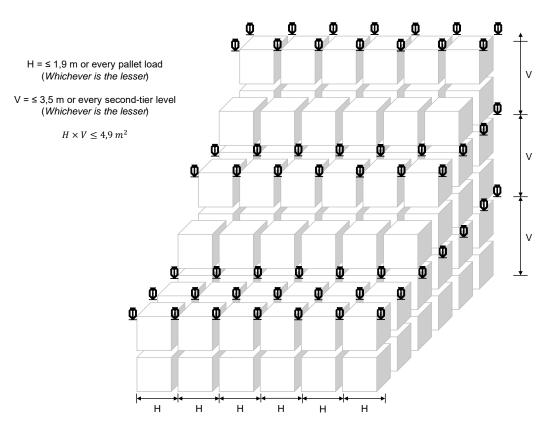


Figure 116: Location of intermediate level protection for Category III and IV multiple row racks



1041 Mobile or moveable racks

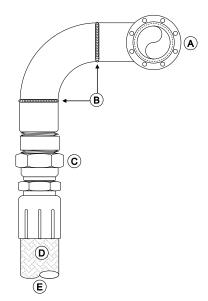
Movable racks are to be treated as multiple-row rack storage.

The connection to the intermediate level protection shall be via flexible in-rack sprinkler system connections, or other arrangements that provide adequate movement and water to the intermediate level protection.

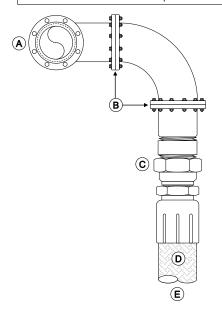
- a) SAE 100R5 hydraulic hose shall be used as a minimum standard and shall be wrapped in woven stainless steel or encased in a high temperature fire sleeve that can withstand a constant radiated heat of not less than 250° C and a splash temperature of not less than 1,000° C.
- b) The fire sleeve shall be fitted to the hose prior to the hydraulic hose connectors ensuring that it is integral with the entire finished hose.
- c) All fittings and fixtures for the system shall be welded or screwed fittings.
- d) The following shall apply for welding and screwed fittings:
 - I. A full penetration weld is a type of weld that has completely consumed the root of the joint. A full penetration weld is a requirement for joints that will be subjected to high stresses because it typically has higher strengths than a partial penetration weld.
 - II. Where slip-on flanges are welded to pipe with a single fillet weld, the weld shall be on the hub side of the flange and the minimum throat weld thickness shall not be less than 1,25 times the pipe wall thickness or the hub thickness, whichever is less. Face welds on the internal face of the flange shall be applied in addition to the hub weld required.
 - III. Where screwed fittings are used, they shall be joined using thread sealant or thread tape which shall be applied only to the male threads. The use of plumber's hemp is not acceptable.
- e) The feed main and the racks/shelf distribution pipe connections shall be aligned vertically to ensure that they are positioned in parallel with the racks/shelf feed horizontally displaced closest to the rack.
- f) The hose should preferably traverse in one direction only from the fully closed position to the fully open position.
- g) The minimum distance between any two connections to the racks/shelf protection from the feed main shall be determined by the travel distance from the closed to the open position.
- h) Irrespective of hose diameter, an additional allowance of not less than 3,5 metres for racks/shelves positioned back-to-back, and 2,0 metres for single racks/shelves shall be made for the bend at the bottom of the hose where it rises to the distribution pipe leading into the rack.
- i) The fittings from the feed main and those connecting the distribution main for the racks/shelves shall be aligned in the pendent position.
- j) When bent to the minimum radius, the internal diameter of the un-pressurised hose shall not reduce by more than 10%.

Figure 117: Typical moveable rack or shelf connections

- A. Feed main from wet or dry valve.
- B. Full penetration welds.C. Screwed connections to hydraulic hose using jointing compound or tape.
- SAE 100R5 Flexible hydraulic hose with woven stainless-steel or fireproof outer.
- E. To mobile intermediate level sprinklers.



- A. Feed main from wet or dry valve.
- B. Flanged fillet welds.
- C. Screwed connections to hydraulic hose using jointing compound or tape.
- SAE 100R5 Flexible hydraulic hose with woven stainless-steel or fireproof outer.
- To mobile intermediate level sprinklers.



1042 Location of intermediate level sprinklers in single row solid or slatted shelves

Within High Hazard occupancies, intermediate level sprinklers shall be fitted under all solid or slatted shelves which exceed 1,0 metre in width. The uppermost level of protection shall be positioned above the top of storage unless this is within 4,0 metres of roof or ceiling level protection. See Rule 1011.

- a) Table 108 shall be used to determine the design density of discharge at roof or ceiling level.
- b) The sprinklers shall be staggered at each tier level to ensure the ends of the shelves are protected at every alternate tier level. The distance from the end of the shelf perpendicular to the range pipes to the nearest sprinkler on all other tier levels shall not exceed half the sprinkler spacing or 1,4 metres whichever is the lesser.
- c) Sprinklers in storage racks shall be located centrally where the shelf does not exceed 3,0 metres in width. See Figure 118.
- d) Where the shelves exceed 3,0 metres but are less than 6,0 metres, two rows of sprinklers will be required. The sprinklers at each tier level shall be staggered vertically and horizontally. See Figure 118 and 119.
- e) Where shelf widths exceed 6,0 metres, special consideration is required, and protection is to be based on a case-by-case assessment.
- f) The horizontal spacing of sprinklers within the tier levels shall not exceed 2,8 metres irrespective of the category of goods.
- g) The distance from the side of the shelf longitudinally to the nearest sprinkler shall not exceed 1,5 metres.
- h) The vertical rows between tier levels shall not exceed 3,5 metres.

Figure 118: Plan view of intermediate level protection for shelf widths ≤ 3,0 metres and > 3,0 metres and ≤ 6 metres

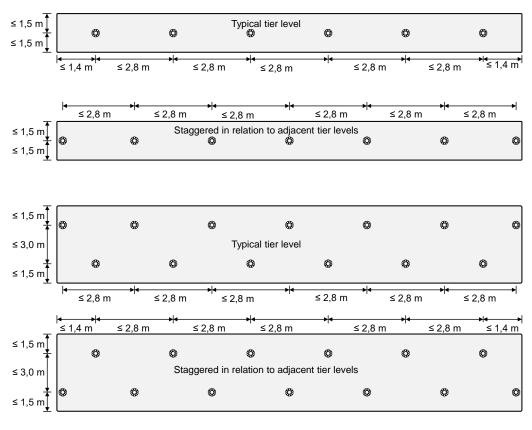


Figure 119: Section through intermediate level protection for shelf widths ≤ 3,0 metres and > 3,0 metres and ≤ 6 metres

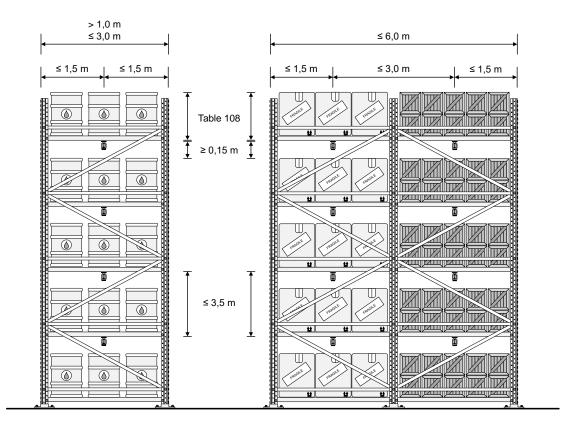


Table 108 Roof or ceiling sprinkler design criteria with intermediate level sprinklers for single shelf widths greater than 1,0 metre and less than 6,0 metres

1	2	3	4	5	6	7
Storage	Maximum permitt		bove the top tier levotection tres)	Design density of discharge	Assumed maximum area of operation	
configuration	Category I	Category II	Category III	Category IV	(mm/min/m²)	(m²)
	3,5	3,4	2,6	2,0	10,0	
Single shelf			3,2	2,3	12,5	260
				2,7	15,0	

1043 Location of intermediate level sprinklers in shelves positioned back-to-back and picking shelves

This section shall apply for back-to-back shelves for Category I to Category IV with one or more of the following characteristics:

- a) Individual shelf widths positioned back-to-back greater than 0,8 metres but less than 1,6 metres.
- b) Storage height greater than Table 105.
- c) A ceiling level clearance greater than 4,0 metres above the top of storage when Rule 1011 shall be applied.

The following design criteria shall be met: (See Figure 120.)

- a) Clear transverse flue spaces of at least 150 mm shall be maintained coincident with the shelf upright supports.
- b) Horizontal spacing between sprinklers shall not exceed 1,6 metres and shall be coincident with the flue spaces.
- c) Storage heights above the top line of intermediate level protection if this is not located at the top of storage shall not exceed 2,0 metres for Category I to Category IV.
- d) Intermediate level protection shall be installed at every tier level at no more than 2,0 metre intervals.
- e) The design density of discharge at roof level shall not be less than 10,0 mm/min/m² over an assumed maximum area of operation of 260 m².
- f) Should the distance between the top of storage and roof or ceiling level protection exceed 4,0 metres, Rule 1011 shall be applied.

Note: An exception to this may be present when handpicking shelves start at floor level, exceed 2,0 metres in height, and are too close together to be sprinkler protected at every level. The level of protection will need to be addressed on a case-by-case basis.

Where the intermediate level sprinkler exceeds 250 mm from the face of storage in back-to-back storage configurations, (500 mm clear space), each shelf shall be treated as single row and two rows of sprinklers shall be installed within the longitudinal flue space at every opposing tier level vertically and staggered horizontally.

1044 Location of intermediate level sprinklers in carpet shelves or racks

Intermediate level sprinklers are mandatory within carpet racks. The racks shall be configured to suit the layout of the carpet rack as shown in Figure 121 and Figure 122.

- a) The roof or ceiling slope shall not exceed 10°.
- b) Intermediate level sprinklers will be required at every tier level.
- c) Aisles between racks are assumed to be equal to or greater than 2,4 metres based on the loading length of the carpet.
- d) Full height 150 mm clear transverse flue spaces at not more than 3,2 metre intervals shall be provided spaced in-between full height non-combustible transverse bulkheads.
- e) Longitudinal flue spaces of not less than 150 mm shall be provided for racks or shelves positioned back-to-back, alternatively full height non-combustible longitudinal bulkheads will be required.
- f) Carpets stored above the highest row of intermediate level protection shall not exceed the height given in Table 110.
- g) The number of intermediate level sprinklers deemed to be in simultaneous operation within the carpet rack will normally not be less than 27 or, where unique circumstances occur, on a case-by-case basis.

Figure 120: Front elevation and plan view of sprinkler protection within solid or slatted shelves with or without pallets and picking shelves positioned back-to-back

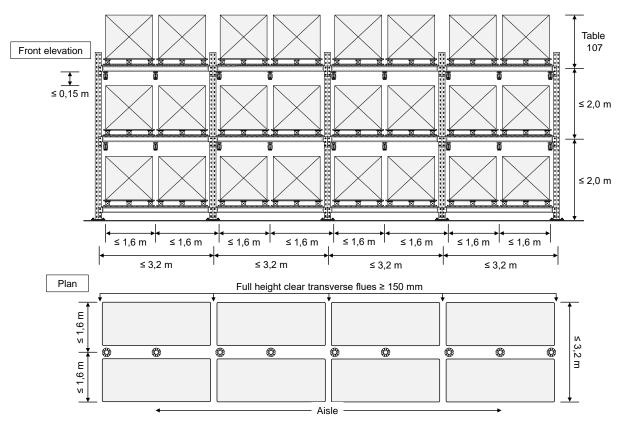


Table 109 Roof or ceiling sprinkler design criteria with intermediate level sprinklers for single shelf widths and picking shelves positioned back-to-back

1	2	3	4	5	6	7
Storage	Maximum permitt	level pr	bove the top tier lev otection tres)	Design density of discharge	Assumed maximum area of operation	
configuration	Category I	Category Category Category I II III IV				(m²)
Back-to-back shelves	2,0	2,0	2,0	2,0	10,0	260

Table 110 Roof or ceiling sprinkler design criteria with intermediate level sprinklers for carpet shelves or racks

1	2	3	4	5	6	7	
Storage	Maximum permitt	level pr	bove the top tier levotection tres)	Design density of discharge	Assumed maximum area of operation		
configuration	Category I	Category II	Category III	Category IV	(mm/min/m²)	(m²)	
Carpet shelves or racks	Not applicable		2,0	Not applicable	10,0	260	
Carpet sherves of racks	мос ар	Jilcabie	2,7	Not applicable	12,5	200	

Figure 121: Front elevation of sprinkler protection within carpet racks

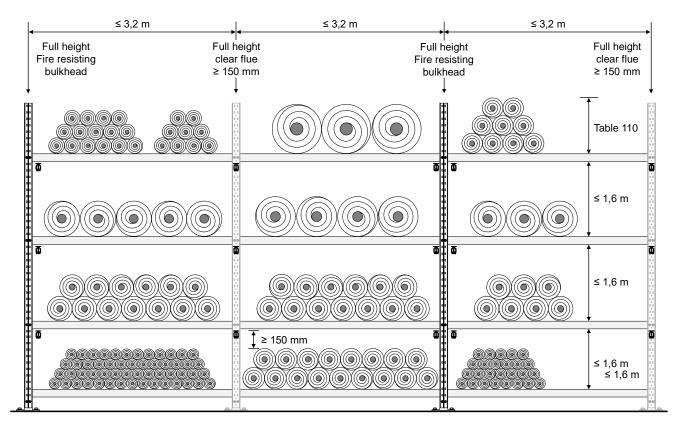
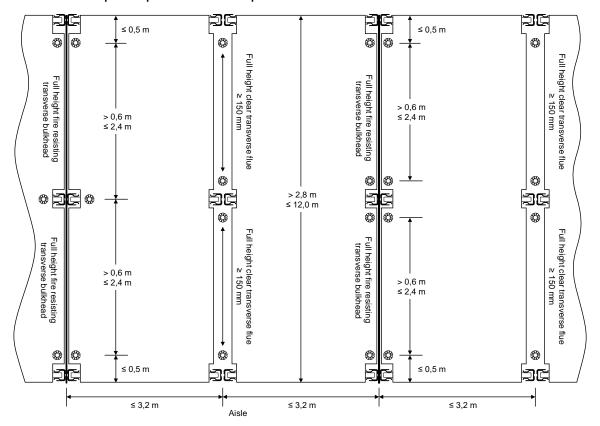


Figure 122: Plan view of sprinkler protection within carpet racks



1045 General requirements for mezzanine floors

Table 111 shall be used to determine the water requirements for the protection beneath the decking of a picking shelf mezzanine floor and the design density of discharge at roof or ceiling level.

Smoke and draft curtain boards of not less than 600 mm in depth shall be fitted to the periphery of a mezzanine floor.

Conventional sprinklers are not suitable for mezzanine level protection regardless of construction. Sprinklers with the following characteristics shall be used for mezzanine floors:

- a) Spray pattern sprinklers only are acceptable regardless of construction.
- b) A K-Factor of not less than 11,5 within the aisles unless otherwise noted in these rules.
- c) A K-Factor of not less than 11,5 within the longitudinal flue spaces of shelves positioned back-to-back unless otherwise noted in these rules.
- d) A response time index, (RTI), of less than 50.
- e) 68° C operating temperature.
 - Listed and approved sprinkler metal water shields of between 75 mm and 150 mm diameter shall be fitted to intermediate level sprinklers. The presence of solid shelves does not necessarily negate the use of a water shield whereas a solid decking mezzanine floor would not necessarily require water shields to be fitted.
 - II. Listed and approved sprinkler guards shall be fitted to intermediate level sprinkler protection for palletised rack protection, solid or slatted shelves. The use of upright spray pattern sprinklers does not negate the use of sprinkler guards.
- f) The minimum vertical clearance between the spray pattern sprinkler deflector and the stored goods shall be maintained at not less than 150 mm.

1046 Location of sprinklers beneath single picking shelf storage mezzanine floors

Where storage in single row picking shelves not exceeding 1,0 metre in width takes place beneath a mezzanine floor, the following shall apply:

- a) Where the picking shelves do not exceed 1,0 metre in width and are not positioned back-to-back and half the aisle and half the picking shelf width does not exceed 1,1 metres, one row of sprinklers centrally located in the aisle will be required. The sprinklers are to be staggered in relation to the sprinklers in the adjacent aisle. See Figure 123 and Figure 124.
- b) Aisles shall not be greater than 1,2 metres in width and the sprinkler not more than 600 mm from either face of storage.
- c) The maximum permissible distance between any 2 adjacent sprinklers in an aisle shall not exceed 2,8 metres.
- d) Preference shall be given to the positioning of the sprinklers centrally within the aisles over other services. Where this cannot be achieved, additional rows of protection may be required and the inclusion of baffles to prevent wetting of adjacent sprinklers.
- e) In all cases, non-combustible horizontal bulkheads must be provided at the underside of the mezzanine decking above the top of storage to inhibit the vertical spread of fire.
- f) Where the aisle widths are greater than 1,2 metres and less than or equal to 3,5 metres, two rows of sprinklers will be required within the aisle for shelf widths that do not exceed 1,0 metre. The sprinklers within shall be staggered in relation to the opposing row of sprinklers in the aisle and those in the adjacent aisles. Aisle sprinklers shall be positioned not less than 250 mm from the picking shelf face. Suitable baffles may be required to prevent cold soldering. See Figure 125 and Figure 126.

Note: Should the aisle sprinklers be offset whereby the positioning of the sprinkler is not centrally located but favours one side, two rows of sprinklers may be required when assessed on a case-by-case basis with baffles suitably positioned between them to prevent cold soldering.

Table 111 Storage heights and design criteria for picking shelf mezzanine floors

1	2	3	4	5	6	7	
Storage	Maximum p		tht beneath the mezza etres)	nine decking			
configuration	Category I	Category II	Category III	Category IV			
	3,5	3,5	3,5	3,5	28 - K 11,5 sprinklers in operation with a minimum discharge pressure of 200 kPa		
	Roo	f and ceiling protection (me	Design density of	Assumed maximum			
Mezzanine picking shelves	Category I	Category II	Category III	Category IV	discharge (mm/min/m²)	area of operation (m²)	
	3,5	3,5	2,6	2,0	10,0	260	
			3,2	2,3	12,5	260	
	_		_	2,7	15,0	260	
				3,0	17,5	260	

Figure 123: Plan view of mezzanine sprinkler protection for single picking shelf widths ≤ 1,0 metre with aisles ≤ 1,2 metres wide

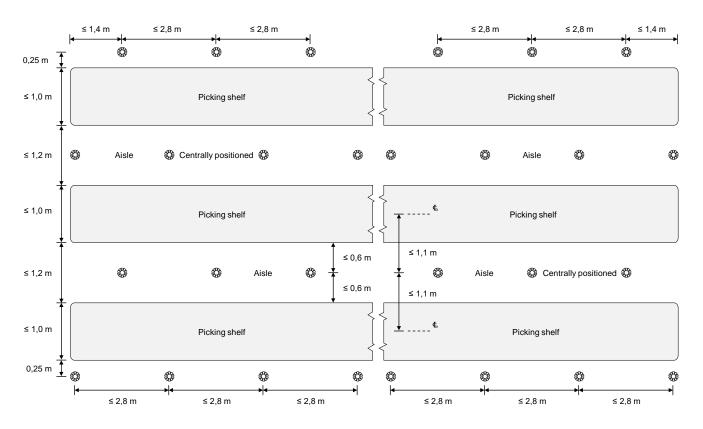


Figure 124: Section through mezzanine sprinkler protection for single row picking shelves ≤ 1,0 metre wide and aisles of ≤ 1,2 metres wide

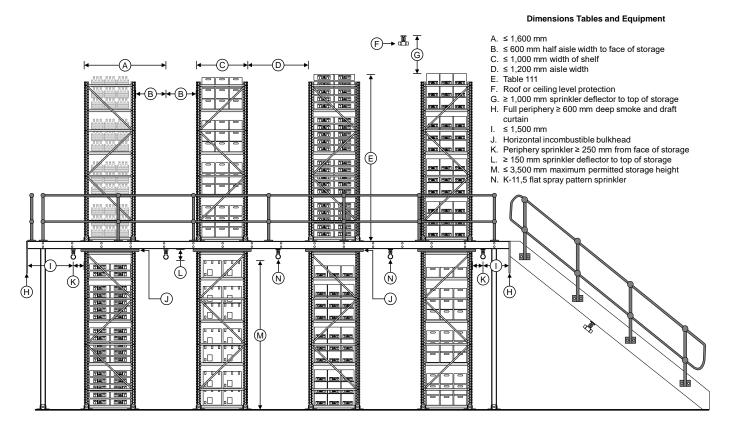


Figure 125: Plan view of mezzanine sprinkler protection for single picking shelf ≤ 1,0 metre wide and aisles > 1,2 and ≤ 3,5 metres wide

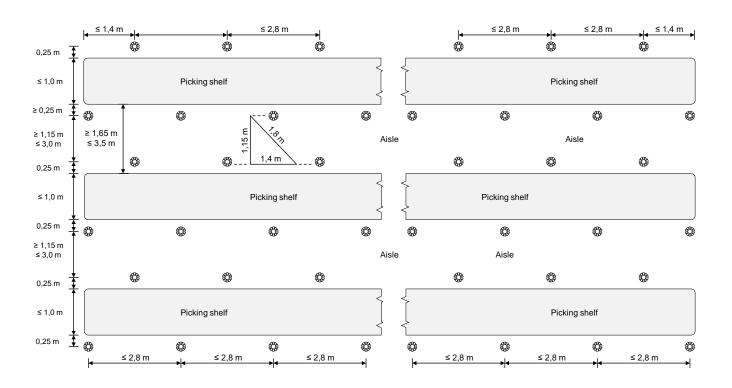
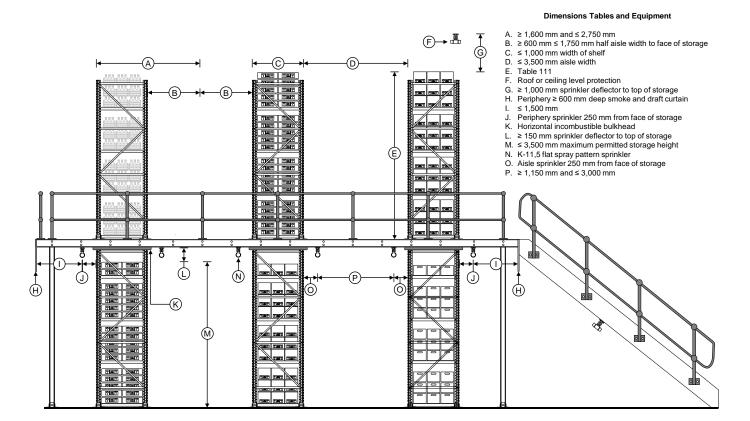


Figure 126: Section through mezzanine sprinkler protection for single picking shelf of ≤ 1,0 metre wide and aisles > 1,2 and ≤ 3,5 metres wide



1047 Location of sprinklers beneath back-to-back picking shelf storage mezzanine floors

Where storage in back-to-back picking shelves each not exceeding 1,0 metre in width in accordance with the maximum permissible storage heights stated in Table 105 takes place beneath a mezzanine floor, the following shall apply:

- a) Aisle protection alone is not acceptable for back-to-back shelf widths greater than 1,0 metre.
- b) The maximum permissible distance between any 2 adjacent sprinklers in an aisle shall not exceed 2,8 metres.
- c) Intermediate level protection is required within the longitudinal flue at the top of storage where the maximum permissible horizontal distance between any two sprinklers shall not exceed 1,4 metres.
- d) Preference shall be given to the positioning of the sprinklers centrally within the aisles over other services. Where this cannot be achieved, additional rows of protection may be required and the inclusion of baffles to prevent wetting of adjacent sprinklers.
- e) In all cases, non-combustible horizontal bulkheads must be provided to prevent the vertical spread of fire to above the mezzanine floor.
- f) Where the picking shelves do not exceed 1,0 metre in width and are positioned back-to-back and half the aisle width does not exceed 0,75 metres, one row of sprinklers centrally located in the aisle will be required. The sprinklers are to be aligned in relation to the sprinklers in the adjacent aisle. See Figure 127.
- g) Where the aisle width is greater than 1,5 metres and less than or equal to 3,5 metres, two rows of sprinklers will be required within the aisle. The sprinklers within the aisles shall be staggered in relation to the opposing row of sprinklers and positioned not less than 250 mm from the picking shelf face. Suitable baffles may be required to prevent cold soldering. See Figure 128 and Figure 129.

Note: Should the aisle sprinklers be offset whereby the positioning of the sprinkler is not centrally located but favours one side, two rows of sprinklers will be required with baffles suitably positioned between them to prevent cold soldering.

Figure 127: Plan view of mezzanine sprinkler protection for back-to-back picking shelves each ≤ 1,0 metre wide and aisle widths ≤ 1,5 metres wide

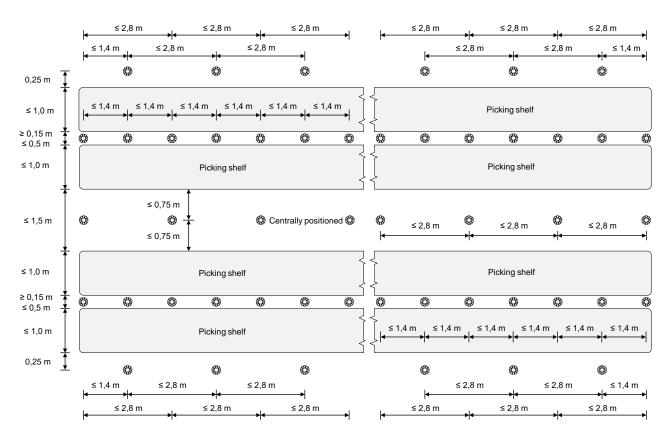


Figure 128: Section view of mezzanine sprinkler protection for back-to-back picking shelves each ≤ 1,0 metre wide and aisle widths ≤ 1,5 metres wide

Dimensions Tables and Equipment A. ≤ 1,000 mm width of shelf B. ≤ 150 mm longitudinal flue C.≤ 1,500 mm - ≤ 750 mm to face of storage D.≤ 1,825 mm - 1/2 aisle width, shelf and flue space E. Table 111 F. Roof or ceiling level protection G.≥ 1,000 mm sprinkler deflector to top of storage H.Full periphery ≥ 600 mm deep smoke and draft curtain I. Periphery sprinkler ≤ 1,500 mm from curtain board J. 250 mm from face of storage K. Horizontal incombustible bulkhead L. ≥ 150 mm sprinkler deflector to top of storage M.≤ 3,500 mm maximum permitted storage height N. K-11,5 flat spray pattern sprinkler 8 \$ ð 8 N \oplus M

Figure 129: Plan view of mezzanine sprinkler protection for back-to-back picking shelves each ≤ 1,0 metre wide and aisle widths ≥1,5 metres wide and ≤ 3,5 metres wide

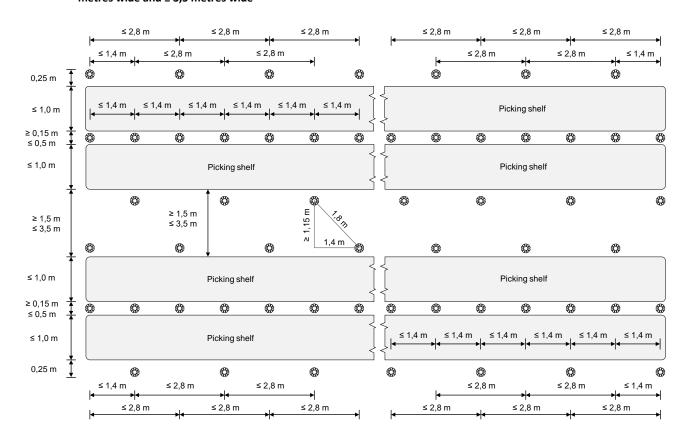


Figure 130: Section through mezzanine sprinkler protection for back-to-back picking shelves each ≤ 1,0 metre wide and aisles widths > 1,2 and ≤ 3,5 metres wide

Dimensions Tables and Equipment A.≤ 1,000 mm width of shelf B. ≤ 150 mm longitudinal flue C.≤ 1,500 mm - ≤ 750 mm to face of storage D.≤ 1.825 mm - 1/2 aisle width, shelf and flue space E. Table 111 F. Roof or ceiling level protection G.≥ 1,000 mm sprinkler deflector to top of storage H. Full periphery ≥ 600 mm deep smoke and draft curtain I. Periphery sprinkler ≤ 1,500 mm from curtain board J. 250 mm from face of storage K. Horizontal incombustible bulkhead L. K-11,5 flat spray pattern sprinkler M.≤ 3,500 mm maximum permitted storage height N.≥ 150 mm sprinkler deflector to top of storage 8 8 ₹ **₹** 8 (Ĺ) \bigcirc \mathbb{H} (K) (M)

1048 Water requirements for picking shelf storage mezzanines

Unless otherwise noted, the pressure and flow requirements of sprinklers positioned beneath a storage mezzanine shall be calculated on the assumption that the hydraulically most unfavourable sprinkler operates at a pressure of not less than 100 kPa using K-11,5 sprinklers when 28 sprinklers in are in simultaneous operation in the hydraulically most unfavourable or favourable location.

The shape of the remote and favourable assumed maximum areas of operation shall be taken as 7 adjacent sprinklers on a range operating on each of 4 adjacent rows Where back-to-back picking shelves with aisle widths greater than 1,5 metres are installed, two picking shelves are deemed to be in simultaneous operation, i.e., two rows of sprinklers within an aisle and two rows of sprinklers within the longitudinal flues.

1049 Multiple level mezzanine storage

The purpose of multiple level mezzanine floors determines the type and level of protection required.

When, for example, a mezzanine level is classed as picking shelves, the protection and water supply shall be installed in accordance with the relevant rules for that method of storage.

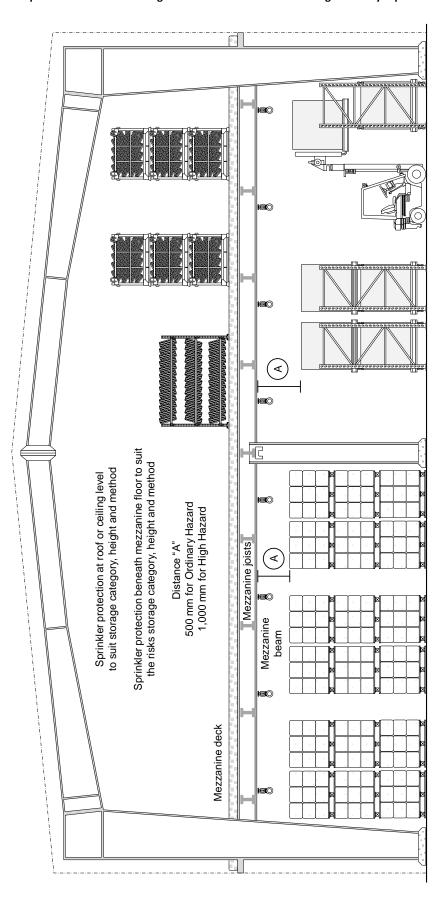
1050 Bulk storage mezzanines

Aisle protection is not suited for bulk storage mezzanine floors. See Figure 131. Standard response, spray pattern sprinklers with an operating temperature of 93° C shall be used for the protection of a bulk storage mezzanine using Tables 101, 102, 103 or 105. The required clearances as stated in Rule 1006 must be adhered to for roof, ceiling or mezzanine decking.

For a mezzanine floor which is used for bulk storage, the protection and water supply is determined by the category of storage, storage method and heights.

Where aisle widths are less than 1,2 metres wide and storage takes place in post pallets, shelves or beam pallet racking, intermediate level protection is mandatory subject to a case-by-case review if applicable.

Figure 131: Protection requirement for a bulk storage mezzanine where roof or ceiling level only is provided



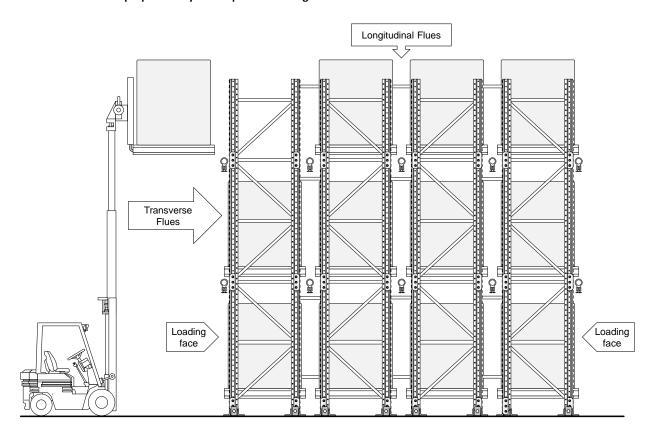
1051 Document storage facilities are treated as picking shelves.

Sprinkler protection shall be located centrally over the shelf storage at each tier or walkway level within the longitudinal flue.

The maximum allowable single shelf width aisle to aisle shall not exceed 3,0 metres and shall have a clear longitudinal flue space of not less than 150 mm centrally located into which no goods may protrude.

The sprinkler protection shall be staggered relative to each tier or walkway level.

Figure 132: Information purposes only – multiple row racking



1052 Flammable and dangerous liquid storage bunding

Bunds are used as an adjunct for fire protection. Bunds shall be designed to contain spillages and leaks of liquids used, stored, or processed above ground and to facilitate clean-up operations. As well as being used to prevent pollution of the receiving environment such as stormwater and natural waters, product recovery and process isolation.

The pollutants include products such as:

- a) Agricultural chemicals.
- b) Cleaning agents.
- c) Detergents and their byproducts.
- d) Engine coolant.
- e) Fuel dispensing area wash water.
- f) Oil, grease, lubricants, and petroleum products.
- g) Photographic chemicals.
- h) Pesticides.
- i) Flammable liquids.
- j) Solvents.

The requirement for bunding shall be determined on a case- by-case basis. Facilities that require bunded areas include:

- a) Storage facilities for chemicals, pesticides, or petroleum.
- b) Electrical transformers containing oil and/or PCB's.
- c) Facilities used to transfer stored liquids (such as transport facilities).
- d) Drum storage areas, either temporary or permanent.
- e) Processing areas.
- f) Wineries, breweries, and milk processing plants.
- g) Any other facilities that store substances other than water or uncontaminated stormwater.
- h) Any other locations where spills are common, including transfer points, workshops, factories, service stations, wash bays, and other areas in which a material is transferred from its container.

1053 Drainage

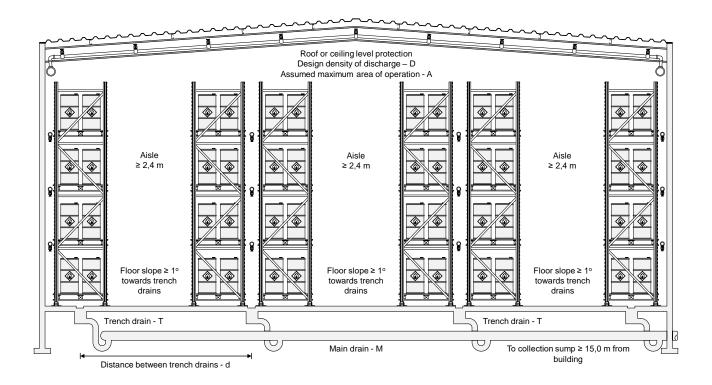
A collection sump shall be provided in the bund floor to make it easy to remove accumulated liquids, and the floor shall be graded in such a way that liquids collect in the sump. The sump shall not be connected to stormwater or sewer drainage systems, and it is only a collection point from which to pump out the liquid. See Figure 133

There shall not be any access to the stormwater system within the bund.

Pump controls shall be located outside the bunded area. Accumulated liquids resulting from spills or vessel ruptures may be able to be collected and reused on site, where this is not possible or appropriate, the liquid shall be collected and disposed of by an authorised liquid waste contractor.

For storage facilities such as tank farms rainwater will often evaporate from within the open bund area. If there is no rainwater in the bund after heavy rainfall it may indicate that the bund may not be properly sealed and must be inspected and repaired as appropriate. Accumulated rainwater may be contaminated and should not be disposed of to the stormwater drainage system.

Figure 133: General layout of drainage for flammable liquid warehouse



Formula 101: Calculation of the trench drain diameters

Provide drainpipe connections to the trenches at trapped sumps. Size the drainpipes to carry 150% of the anticipated sprinkler water discharged in the area served by the drain. Use the following equation to calculate the flow to individual drains:

 $F = 1.5 \times D \times A$

Where: F is the flow in drainpipe in L/min.

D is the sprinkler design density of discharge in L/min/m².

A is the sprinkler design area in m^2 .

Formula 102: Calculation of the main drain diameters

Size the main drain lines connected to the individual trench drains to carry 150% of the estimated sprinkler water to be discharged. Use the following equation to calculate the flow through the main drains:

 $F = 1.5 \times d \times D \times A^{.5}$

Where: F is the flow in drainpipe in litres per minute.

d is the distance between trenches in metres.

D is the sprinkler design density of discharge in L/min/m².

A is the sprinkler design area in m^2 .

1054 Capacity of a bund

The net capacity of a bund in a storage facility shall be at least 120% of the net capacity of the largest tank. Consideration shall be taken of the capacity displaced by other tanks within the same bunded area and any foundations. Interconnected tanks shall be treated as a single tank of equivalent total volume for the purposes of the bund design criteria.

For flammable liquids, the bund capacity shall be at least 133% of the net capacity of the largest tank. Where sprinkler systems are installed in or over any bunded tank or drum storage area, the capacity of the bund shall be increased either by a volume equal to the output from the sprinkler system for a period of at least 20-minutes, or to 133% of the capacity of the largest tank, whichever is greater.

1055 Packaged storage

If the material to be bunded is contained in drums, (or other small containers), the bunded area shall be able to contain at least 25% of the total volume of the stored products. In addition, provision shall be made for the containment of firewater onsite by designing and constructing adequate drainage controls and formulating emergency response plans.

1056 Materials used for bunding

The bund floor and walls shall be built of materials impervious to the contents of any tank or container within the bund. They shall be of sufficient strength and structural integrity to ensure that it is unlikely to burst or leak in ordinary use and should not have a damp course. The use of un-reinforced materials is not recommended for bund wall construction.

The bunded area shall be capable of preventing the migration of any spillage or leakage to the surrounding environment. Earthen bunds are not recommended, except where there is no other viable alternative.

1057 Special hazards

The following special hazards are dealt with in these rules:

- a) Aerosols with flammable content.
- b) Bonded spirituous liquor stored in wooden barrels.
- c) Clothes in multiple garment stores.
- d) Flammable liquid storage.
- e) Idle pallets.
- f) Lithium-ion battery storage
- g) Non-woven synthetic fabric.
- h) Polypropylene or polyethylene storage bins, and
- i) Plastic packaging recycling plants
- j) Rubber tyres

1058 Aerosols

1059 General

Notwithstanding the requirements relating to occupational health and safety, in terms of these rules, it is recommended that the latest edition of NFPA 30B, Code for the Manufacture and Storage of Aerosol Products be used. Alternatively, the requirements in accordance with these rules shall be applied.

The protection of storage of aerosols is a particular challenge to sprinkler systems. Under fire conditions, failure of an aerosol may occur due to increasing internal pressures caused by the container being subjected to heat. Any failure of a stored aerosol is likely to cause subsequent failure or ejection from the fire site to adjacent aerosols. Tests have shown that under fire conditions unrestrained aerosol containers can travel distances of up to 30,0 metres and aerosol caps can travel up to 20 metres whilst ignited creating a possible secondary ignition source.

Aerosol storage is a Category IV risk.

The base product is product concentrate and all contents of the aerosol container other than the propellant.

The term aerosol shall refer to an aerosol dispenser, aerosol cap and its contents.

An aerosol will be deemed to have flammable contents if it contains either:

- a) More than 45% by weight of flammable substances.
- b) More than 250 grams of flammable substances.

Flammable substances mean highly flammable gases or flammable liquids having closed cup flash points equal to or less than 100° C.

1060 Segregation of aerosols

Aerosols shall be segregated and isolated from other stock, preferably in a separate building or fireproof enclosure, (see definitions), of not less than 120-minutes.

Ideally, the area of the compartments shall be no greater than the appropriate assumed maximum area of operation as provided by the installation design protecting the aerosol storage.

Where this is impracticable, the aerosols shall be totally enclosed within a stout steel mesh or chain link fencing cage of appropriate size and strength, including self-closing doors, to prevent rocket ejection of exploding aerosols and parts of aerosols.

The plan area of any storage cage shall ideally not exceed 20% of the total area of the warehouse or up to a maximum of 2,750 m².

Expanded metal or wire mesh may be used providing the metal is:

a) Not lighter than 2.9 mm, (9 gauge), steel wire woven into a maximum 50 mm diamond mesh or approved by the independent third-party inspectorate.

A minimum of two personnel exits shall be provided and all openings in the fencing shall be provided with self-closing or automatic-closing gates or shall be protected with a labyrinth arrangement.

Where automatic-closing gates are used, manual closure actuating devices shall be provided adjacent to the opening to allow for manual closure of the gates.

Small quantities of aerosols may be stored in mesh bins of similar construction.

Other than the aerosol packaging, containers, and pallets on which they stand, no combustible material shall be stored inside or within 2,5 metres of any protective cage.

Aerosols shall be stored in a cool, dry, well-ventilated area, free from the risk of freezing, and where the ambient temperature cannot exceed 40°C.

To prevent the possible accumulation of flammable vapours, aerosols shall not be stored in basements or similar sunken areas.

Low- and high-level ventilation direct to the open shall be provided in the storage building or compartment to prevent the accumulation of flammable vapour. This may be achieved using ventilation grills or equivalent. The vent area shall comprise at least 2,5% of the combined area of the roof (ceiling) and walls.

Alternatively, mechanical ventilation may be used, providing at least 6 air changes per hour. Extract must be at low-level, inlet at high-level, positioned to provide crossflow. Duct openings shall not allow fire spread. Fan motors shall not be positioned within the duct work and shall be suitable for the hazard zone.

Care shall be taken to prevent obstruction of the openings.

1061 Protection of aerosol storage areas

Systems shall be of the wet-pipe type only.

Conventional or spray pattern sprinklers with a K-Factor of not less than 16,0 shall be used for roof or ceiling protection.

Where spray pattern sprinklers are used, the ceiling insulation shall be non-combustible and fire ventilation systems shall be manually operated.

Intermediate level rack sprinkler protection is mandatory. Fast response spray pattern sprinklers with a response time index of less than 50 rated at an operating temperature of 68° C with a K-Factor of not less than 11,5 shall be used for intermediate level protection. The discharge pressure of any operating intermediate level sprinkler shall not be less than be 200 kPa.

Aerosols stored in free standing or block stacking shall be in accordance with Table 112 which shall not be exceeded.

Aerosols having a container made of metal shall have a capacity of 1,000 ml or less and if made of glass or plastic 220 ml or less.

Aerosol contents shall be classified as either alcohol or hydrocarbon based, with the base product and not the propellant as the basis for the classification.

Examples of both types of aerosols are:

a) Alcohol based: Hair spray, antiseptics, and anaesthetics.b) Hydrocarbon based: Paints, lubricants and oil based anti-perspirant.

Fire tests have shown that the base product of an aerosol makes the major fire load contribution, and it is therefore the base product that forms the basis for any hazard assessment.

1062 Smoke and draft curtains for aerosol storage

Non-combustible draft curtains shall extend down to a minimum of 0,6 metre from the ceiling and shall be installed at the interface between ordinary and high temperature sprinklers or segregated areas within aerosol storage areas.

The roof slope shall not exceed 5° for ESFR protection.

The area of the design for the required ceiling sprinkler system shall extend 6,0 metres beyond any area where the aerosols be stored within a caged off area.

The roof or ceiling level design requirements for aerosols stored in racks shall not be less than that stated in Table 113.

Any intermediate level sprinklers shall be installed at every tier level of storage at a maximum horizontal spacing of 1,4 metres or every pallet load.

There shall be a minimum vertical clearance of 150 mm between any sprinkler deflector and the storage immediately below.

Face sprinklers shall be provided at every alternate tier level or 3,6 metres intervals, whichever is the lesser and at the top of storage. These sprinklers shall be spaced at no more than 2,8 metres horizontally or every second pallet, whichever is the lesser and shall be staggered in relation to the adjacent tier levels.

Minimum aisle widths of not less than 2,4 metres shall be maintained. Where aisle widths are less than 2,4 metres wide special considerations will be required on a case-by-case basis.

Table 112 Sprinklers for aerosol intermediate level protection deemed to be in simultaneous operation

1	2	3	4	5
Aisle width	simultaneous operation			
(metres)	Number of sprinklers per level	Number of tier levels	Number of racks	Total
	9	1	1	9
≥ 2,4 metres	9	2	1	18
	9	3	1	27

Table 113 Roof or ceiling level protection for aerosol storage

1	2	3	4	5	6
	Storage height (metres)				Assumed maximum area of
Storage type	Alcohol based	Hydrocarbon based ¹	Sprinkler temperature rating (° C)	Ceiling sprinkler density (mm/min/m²)	operation (m²)
Dallational David	Tiers ≤1,8	-	93	12,5 ²	260
Palletised Rack	-	Tiers ≤1,8	93	15 ²	260
: Other than alcohol : Plus intermediate level sprinklers					

Table 114 Free standing and block storage of cartoned or uncartoned aerosols

1	2	3	4	5	6
	Maximum storage height (metres)	Ce			
Maximum ceiling height (metres)		Sprinkler type K-Factor	Response	Design density of discharge and assumed maximum area of operation or number of ESFR sprinklers in operation and minimum discharge pressure (kPa)	Water supply duration (Minutes)
6,1	1,5	Spray Pattern K≥11,5	Standard	12,5 mm/min/m² 260 m²	120
0,1	3,0	Large Drop K = 16,0	Standard	15 @ 520	120
	4,6	ESFR K = 20,0	Fast	12 @ 340	60
7,6		ESFR K = 24,0	Fast	12 @ 240	60
7,0		ESFR K = 32,0	Fast	12 @ 170	60
		ESFR K = 36,0	Fast	12 @ 170	60
	1,5	Spray Pattern K≥16,0	Standard	25,0 mm/min/m ² 260 m ²	120
		ESFR K = 20,0	Fast	12 @ 520	60
9,1	4.6	ESFR K = 24,0	Fast	12 @ 360	60
	4,6	ESFR K = 32,0	Fast	12 @ 310	60
		ESFR K = 36,0	Fast	12 @ 170	60

1063 Bonded stores (spirit-based liquors in wooden barrels)

Barrels of sprit-based liquor with an alcohol content greater than 20% may be stored to a height not exceeding 4,6 metres with ceiling sprinklers only. For storage heights more than this, NFPA 30, Flammable and Combustible Liquids Code, can be referenced for guidance.

For greater storage heights intermediate level sprinklers shall be installed in accordance with the requirements for racks or shelves in accordance with Category III and IV.

In both cases the ceiling sprinklers shall be installed to provide a design density of discharge of not less than 15,0 mm/min/m² over an assumed maximum area of operation of 360 m².

Drainage or a bund shall be provided to limit the spread of liquid spills. If it proves to be impracticable to provide drainage or a bund, the automatic sprinkler system shall be equipped for the injection of suitable foam. Such systems shall be designed in accordance with the following:

- a. NFPA 11, Standard for Low-, Medium-, and High-Expansion Foam, or
- b. NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems

1064 Clothes in multiple garment hanging storage

This section contains special requirements for the protection of intensive hanging garment stores having multiple rows or garment racks at two or more levels. They may have automatic or semi-automatic garment delivery, picking or transportation systems.

Access to elevated garment storage levels within the warehouse is usually by walkways and ramps. A common feature of hanging garment storage is that there is no fire separation between the decks. Walkways, aisles, ramps, and garment racks create a significant obstruction to ceiling level sprinkler protection.

Protection of hanging garments stored in carousels or vertical blocks without aisles is beyond the scope of these rules.

The requirements of these rules shall be applied to all types of garments, irrespective of their storage category.

1065 Sprinkler protection other than at ceiling

Sprinkler protection shall be in accordance with the requirements for intermediate level sprinklers on the wet pipe system.

Each garment rack shall be limited to two rows of hanging garments, (side by side), and a storage height of 3,5 metres between intermediate levels of sprinklers.

- a) Each rack shall be separated by an aisle of at least 0,8 metre width.
- b) The garment racks shall be protected by a single row of sprinklers.
- c) The spacing between the sprinkler rows shall not exceed 3,0 metres.

The sprinklers installed directly above the garment racks shall be stagger spaced in the vertical plane, at horizontal intervals of not more than 2,8 metres along the length of the rack.

There shall be a sprinkler not more than 1,4 metres from the rack end. The clearance between the top of the garments and the sprinkler deflector shall be at least 150 mm

Except as modified below, each sprinkler row protecting garment storage racks shall be capped by a continuous solid horizontal baffle of at least the length and width of the garment row. The baffle shall be of non-combustible construction.

The upper level of sprinkler rack protection and baffle may be omitted providing the clearance between the top of the garments and the deflectors of the ceiling sprinklers does not exceed 3,0 metres height.

Sprinklers shall be installed below all access ramps, main aisles, walkways, and transportation routes, except for aisles, not exceeding 1,2 metres wide, between sprinkler protected garment storage rows.

1066 Sprinklers in operation

The number of rack sprinklers assumed to be in operation shall be as noted in Table 115:

Table 115 Sprinklers in operation in multiple garment hanging storage

1	2	3	
Rows	Levels	Sprinklers per row	
3	≤3	3	

Where there are more than three levels of sprinkler protection, three rows of three sprinklers on three protected levels shall be assumed to operate. Where there are less than three levels, three rows of three sprinklers shall be assumed to operate on all protected levels.

1067 Roof or ceiling level sprinklers

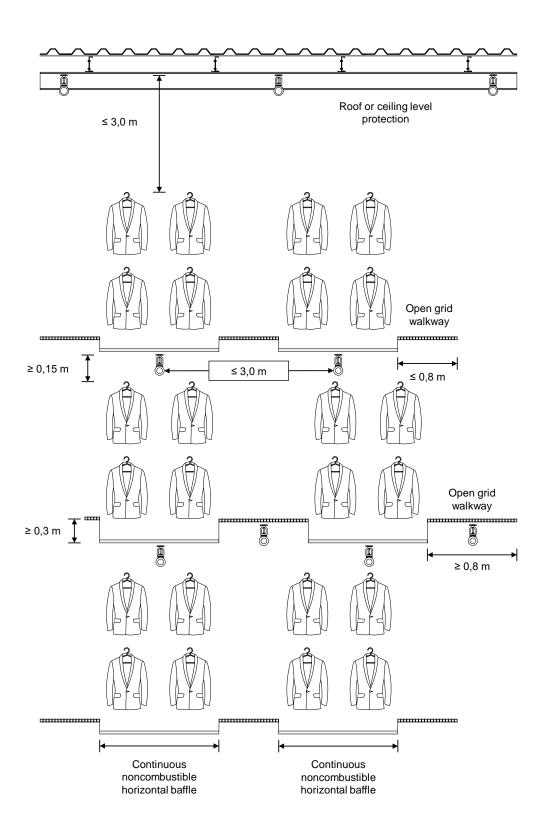
Ceiling sprinklers shall be designed on the wet pipe system to provide a density of 7,5 mm/min/m² over an assumed maximum area of operation of 260 m², providing the uppermost level of racks is capped and protected by rack sprinklers.

If the uppermost level or the capping is omitted, the ceiling sprinklers shall be designed based on at least Category III goods. The stack height shall be measured from above the uppermost intermediate level sprinklers to the top of the hanging garments.

1068 Automatic shutdown

 $Operation\ of\ the\ sprinkler\ system\ shall\ automatically\ stop\ all\ automated\ distribution\ systems\ within\ the\ warehouse.$

Figure 134: Typical sprinkler protection of garment racks



1069 Flammable liquid and oil stores and solvent based paint storage

This covers solvent-based paint storage whether they are intermixed with water-based paints and non-pressurised flammable liquids in metal drums. Full cognisance must be taken of the requirements relating to occupational health and safety, related standards, and any local authority bylaws.

For the purposes of these rules for sprinkler protection, oil is defined as a liquid with a closed-cup flash point below 300° C and flammable liquids shall be divided into four classes according to their flash point, (FP), and boiling point, (BP), as shown in the Tables 116 to 118.

Roof or ceiling level sprinklers shall be standard response with a nominal operating temperature rating of 93° C.

Intermediate level sprinklers shall be fast response with a response time index of less than 50 and a nominal operating temperature rating of 68° C with a K-Factor of not less than 11,5.

All installations shall be installed on the wet pipe system. If a preaction system be used, this shall be limited to a compartment size not exceeding 450 m².

Table 116 Free standing or block storage of flammable liquids in metal drums >20 L and ≤208 L

1	2	3	4	5	6	
				Roof or ceiling sprinklers		
Class	Properties (° C)	Drum orientation	Permitted storage	Design density of discharge (mm/min/m²)	Assumed maximum area of operation (m²)	
1	FP ≥ 100	On side On end	≤12 drums high ≤6 drums high	10,0	450	
2	FP < 100	On side On end	≤6 drums high ≤2 drums high	25,0	450	
3	FP < 35	On side On end	≤3 drums high 1 drum high	25,0	450	
4	FP < 21 and BP < 35	On side or On end	1 drum high	Deluge 25,0	Zoned	

Table 117 Beam pallet racking storage of flammable liquids in metal drums >20 L and ≤208 L

1	2	3	4	5	6	
			Permitted storage configuration in rack requirements	Roof or ceiling sprinklers		
Class	Properties (° C)	Drum orientation		Design density of discharge (mm/min/m²)	Assumed maximum area of operation (m²)	
1	FP ≥ 100	On side On end	every 12th tier every 6th tier	10,0 10,0	450 450	
2	FP < 100	On side On end	every 6th tier each tier	25,0 10,0	450 450	
3	FP < 35	On side On end	every 3rd tier each tier	25,0 10,0	450 450	
4	FP < 21 and BP < 35	On side On end	each tier	Deluge 25,0	Zoned	
Note: Drums s	Note: Drums shall be stored at a height of one drum per tier					

1070 Intermediate level sprinkler protection

Sprinklers for intermediate level protection and the maximum number deemed to be in simultaneous operation shall be designed in accordance with Category IV requirements in accordance with these rules.

1071 Foam additive

An aqueous film forming foam shall be added to the sprinkler water in accordance with the manufacturers' recommendations. The duration of the supply shall not be less than 1,15 times Qmax multiplied by 15-minutes flow.

Table 118 Free standing, block storage, solid or slatted shelf storage less than or equal to 1,0 metre in width or solid and slatted shelves not over 1,0 metre in width for flammable liquids in metal drums with a capacity of 20 L

11/10/2024

1	2	3	4	5	6	
		Drum orientation	Permitted storage height (metres)	Roof or Ceiling Sprinklers		
Class	Properties (° C)			Design density of discharge (mm/min/m²)	Assumed maximum area of operation (m²)	
1	FP ≥ 100	Free standing Block storage Shelving	5,5 5,5 4,6	10,0 10,0 7,5	450 450 450	
2	FP < 100	Free standing Block storage Shelving	4,0 4,0 4,6	12,5 12,5 12,5	450 450 450	
3	FP < 35	Free standing Block storage Shelving	1,5 1,5 2,1	12,5 12,5 12,5	450 450 450	
4	FP < 21 and BP < 35	Free standing Block storage Shelving	1,5 - Deluge 1,5 - Deluge 2,1 - Deluge	12,5 12,5 12,5	Zoned Zoned Zoned	

1072 Control of fire water run-off

Consideration shall be given to the control of fire water run-off where the release of such water may result in the damage to the environment.

In all cases an assessment of the possible environmental impact of a fire shall be carried out.

1073 Zoned deluge protection

The following latest editions shall be used for zoned deluge systems as appropriate and on a case-by-case basis:

- NFPA 11, Standard for Low, Medium and High-Expansion Foam.
- NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection. b)
- NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems.

1074 Idle pallets

Pallets shall be classified as:

Group I Wood and cellulose material pallets. a)

Plastic pallets. b) Group II

Sprinkler systems protecting idle pallet storage shall be of the wet pipe system only.

Free standing or block storage of idle pallets shall be protected in accordance with Table 119.

Idle pallets stored in racks shall be protected at roof or ceiling level in accordance with Table 120 with tier heights not exceeding 1,8 metres.

Table 119 Free standing or block storage of idle pallets

1	2	3	4	5	6
Pallet group	Maximum height of storage (metres)				
		Design density of discharge (mm/min/m²)	Assumed maximum area of operation (m²)	Temperature rating (° C)	Special requirements
	3,8	25,0	300	93	
I	4,4	30,0	300	93	60-minute fire resistant compartment
II	3,3	25,0	300	93	60-minute fire resistant compartment

Table 120 Idle pallets stored in racks

1	2	3	4	5	6
Pallet group	Intermediate level sprinklers	Design density of discharge (mm/min/m²)	Assumed maximum area of operation (m²)	Temperature rating (° C)	Special requirements
ı	Category IV Storage	Table 103	Table 103	93	60-minute fire resistant compartment when storage >3,8 metres
II	As for Category IV storage with one row of K-11,5 sprinklers above the top level of storage and a minimum operating pressure of 300 kPa	25,0	300	93	60-minute fire resistant compartment

When reinforced polypropylene or high-density polyethylene plastic pallets are used for storage of goods other than plastic commodities, the category of storage shall be increased by one category. For example, a Category II product will be classed as Category III. Category IV products will require special consideration on a case-bycase basis.

Where ESFR protection is installed for both classes of idle pallet it shall comply with the requirements of these rules and the following criteria:

- a) 7,5 metre maximum storage height.
- b) 9,0 metre maximum ceiling height.
- c) A sprinkler operating pressure of 350 kPa.

1075 Lithium-ion battery storage

Lithium batteries are constantly undergoing changes and as a result the levels of protection can alter accordingly. Currently, there is not an exacting solution available in respect of any facet of fire protection regardless of what any entity claims as there is insufficient data and experience with the product.

What is acceptable at this time may not be in the future potentially due to new knowledge, fire tests or experience. The protection requirements may need to be altered to cater for this.

Lithium-ion battery cells are energy dense and combine a flammable electrolyte with significant stored energy, and if a lithium-ion battery cell creates more heat than it can effectively disperse, it could lead to a rapid uncontrolled release of heat energy, known as thermal runaway, that can result in a fire or explosion.

1076 Considerations for storage

In general storing batteries in an inside environment, that is away from direct sunlight, excess heat, ignition sources and flammable substances is required.

The risk of a battery is based on its Ah rating as per Table 121:

Table 121 Level of risk

1	2	
Level of risk	Ah	
Low	1,0	
Medium	≥ 1,0 and ≤ 50	
High	≥ 50	

Sporadic storage, (excluding bulk storage), of batteries are classed as Category IV risk.

- a) Class B fire extinguishers are effective against lithium-ion battery fires.
- b) Class D fire extinguishers are effective against lithium-metal battery fires.

1077 Exclusions

The following are excluded from these rules.

- a) Car batteries.
- b) Recycling of batteries.
- c) Production or assembly of batteries.
- d) The requirements in these rules may change.

The following precautions are to be taken when storing lithium-ion batteries:

- a) It shall be ensured that the batteries stored are not damaged or defective.
- b) All batteries or goods shall be stored in drenchable packaging whereby encapsulation or full shrink-wrapping is not permitted. Minimal side wrapping for pallet stability can be considered on a case-by-case basis.
- c) The batteries must not be overcharged.
- d) Compliant charging equipment may be used.
- e) Overheating or exposure to heat or extreme temperatures such as direct sunlight shall be avoided.
- f) Lithium-ion batteries shall be stored within the optimum temperature range of 5° to 25° C.
- g) The environment shall be dry to maintain the performance of the battery as well as its safety.

1078 Storage of goods using lithium batteries

Appliances and tools that use lithium batteries as their power source require special consideration. Usually, the product and packaging contain a high content of plastic. Any deviation from the requirements shall be on a case-by-case basis. Where such goods are stored, the following shall apply:

- a) The stored energy per storage unit such as a pallet shall be less than 50 kWh.
- b) Block and free-standing storage separate or mixed storage.

1079 Block and free-standing storage of goods using lithium-ion batteries

Sprinkler protection of block and free-standing storage shall conform to the following storage heights:

- a) The vertical distance from the sprinkler deflectors shall not be less than 1,0 metre above the top of storage in limited headspace areas.
- b) Dry and alternate installations are not acceptable.
- c) Excessive clearance up to a maximum roof or ceiling height of 12,0 metres can be applied.

Table 122 provides the maximum allowable storage height and required density of discharge for roof or ceiling protection which is less than 4,0 metres above the top of storage.

Table 122 Free standing and block storage permissible stack heights

1	2	3	4
Storage method	Maximum storage height (metres)	Minimum design density (mm/min/m²)	Assumed maximum area of operation
	1,6	10,0	260
	2,0	12,5	260
Free standing Block Storage	2,3	15,0	260
2.22000.080	2,7	17,5	260
	3,0	20,0	300

Table 123 provides the required density of discharge for varying roof heights up to the maximum of 12,0 metres.

Table 123 Roof level design density of discharge

1	2	3	4	5	6	7	8	9
Stack height	Ceiling or roof height (metres)							
(metres)	5	6	7	8	9	10	11	12
1,6	10,0	12,5	13,5	14,5	15,5	16,5	17,5	18,5
2,0	12,5	12,5	15,0	16,0	17,0	18,0	19,0	20,0
2,3	15,0	15,0	17,5	18,5	19,5	20,5	21,5	22,5
2,7	17,5	17,5	20,0	21,0	22,0	23,0	24,0	25,0
3,0	20,0	20,0	20,0	22,5	23,5	24,5	25,5	26,5

- a) Fast response sprinklers shall be used for roof or ceiling level protection.
- b) K-11,5 shall be used for roof level protection as a minimum.
- c) The maximum allowable sprinkler spacing shall not exceed 3,0 metres between adjacent sprinklers on a range and 3,0 metres between adjacent ranges.

1080 Beam pallet racking and shelving of goods using lithium-ion batteries

Where racking or shelving is installed sprinkler protection is mandatory.

Sprinkler protection of beam pallet racking shall conform to the following:

Roof or ceiling level protection for racks and shelving:

- a) The minimum ceiling or roof level design density of discharge shall not be less than 12,5 mm/min/m² over an assumed maximum area of operation of 260 m²
- b) Fast response sprinklers shall be used for roof or ceiling level protection.
- c) K-11,5 shall be used for roof level protection as a minimum.
- d) The maximum allowable sprinkler spacing shall not exceed 3,0 metres between adjacent sprinklers on a range and 3,0 metres between adjacent ranges.

1081 Racks

- a) Sprinkler protection shall be installed at every tier level.
- b) The maximum horizontal distance between adjacent sprinklers shall not exceed 1,4 metres.
- c) The distance between tier levels shall not exceed 2,0 metres.
- d) K 11,5 sprinklers shall be used for the protection of the racks.
- e) The discharge pressure of any rack sprinkler deemed to be in operation shall not be less than 100 kPa.

1082 Shelves

- a) Solid shelving is acceptable, slatted shelving shall be treated as racks as in Rule 1081.
- b) Solid shelving shall be fire stopped at every level.
- c) Shelving shall be protected at every tier level.
- d) The maximum horizontal distance between adjacent sprinklers shall not exceed 2,4 metres.
- e) The distance between tier levels shall not exceed 2,0 metres.
- f) K 11,5 sprinklers shall be used for the protection of the shelves.
- g) The discharge pressure of any shelf sprinkler deemed to be in operation shall not be less than 100 kPa.

1083 Storage of lithium-ion batteries

Where batteries are stored, the following shall apply:

a) Battery storage shall not be intermixed with other storage products.

1084 Block and free-standing storage of lithium-ion batteries

Sprinkler protection at roof or ceiling level for block and free-standing storage shall conform to the following storage heights and design criteria:

- a) The maximum allowable roof height shall not exceed 12,0 metres.
- b) Dry and alternate installations are not acceptable.
- c) The maximum permissible block of storage shall not exceed 20 m².
- d) A storage height of 1,5 m shall not be exceeded.
- e) Fast response K-16 sprinklers shall be used for roof or ceiling protection.
- f) The roof level design density of discharge shall not be less than 17.5 mm/min/ m^2 .
- g) The assumed maximum area of operation shall not be less than 260 m^2 .
- h) Sprinkler spacing of 3,0 metres between adjacent sprinklers on a range and 3,0 metres between adjacent ranges shall be applied.
- i) The vertical distance from the sprinkler deflectors shall not be less than 1,0 metre above the top of storage in limited headspace areas.

1085 Racks

- a) Face sprinklers spaced at 1,4 metres horizontally shall be installed at every second-tier level in each transverse flue in addition to the sprinklers in the central flue.
- b) Horizontal non-combustible barriers shall be installed above every third-tier level.

1086 Shelves

- a) Solid shelving is acceptable, slatted shelving shall be treated as racks as in Rule 1085.
- b) Solid shelving shall be fire stopped at every tier level.
- c) Face sprinklers shall be installed at every second-tier level at each upright and centrally between uprights in addition to the sprinklers in the central flue.

1087 Intermediate level protection for racks and shelves storing lithium-ion batteries

Intermediate level sprinkler protection for racking and shelving configurations shall be protected at every tier level.

K 11,5 sprinklers shall be used for the protection of the racks.

The discharge pressure of any rack sprinkler deemed to be in operation shall not be less than 100 kPa.

The maximum horizontal distance between adjacent sprinklers within the central flue for racks or where centrally positioned beneath the shelf tier levels shall not exceed 1,4 metres or as allowed on a case-by-case basis.

The vertical distance between tier levels shall not exceed 2,0 metres.

Where rack or shelf aisle widths are greater than 1,2 metres but less than or equal to 2,4 metres, 36 intermediate level sprinklers are deemed to be in simultaneous operation.

Where rack or shelf aisle widths are greater than or equal to 2,4 metres, 27 intermediate level sprinklers are deemed to be in simultaneous operation.

1088 Early Suppression Fast Response protection of lithium-ion batteries

Where ESFR protection is proposed the following shall apply.

- a) 12 sprinklers are deemed to be in simultaneous operation.
- b) A maximum ceiling or roof height of 12,0 metres shall not be exceeded.
- c) Operating pressures and temperature:
 - i. K-32 sprinklers at 300 kPa.
 - ii. K-36 sprinklers at 240 kPa.
 - iii. 74°C operating temperature sprinklers shall be used.
- d) A maximum storage limit of 3 tiers in rack or palletised storage is allowable subject to a maximum storage height of 4,5 metres.
- e) State of charge shall not exceed 60%.
- f) Electrolyte weight shall not exceed 20%
- g) The maximum capacity shall not exceed 41 Ah.
- h) Packaging shall be drenchable cardboard and/or unexpanded plastic for internal packaging.
- i) For pumped water supplies a suction tank capacity of 90 times that of the intercept of the system curves of the unfavourable and favourable areas of operation, whichever is the greater, when overlaid against the pump curve for High Hazard systems shall be provided.

1089 Car sales showrooms, car parks, and parking garages

Electric vehicles as well as car charging station increases the fire risk in car parks and garages substantially. The design criteria for these risks where charging stations are provided shall conform to the following:

- a) The design density of discharge shall not be less than 12,5 mm/min/m².
- b) The assumed maximum area of operation shall not be less than 260 m^2 .
- c) A maximum allowable spacing of 9 m² per sprinkler shall be applied.
- d) K-11,5 sprinklers shall be used.

1090 Water supply for lithium battery storage

Duplicate water supplies are required.

A minimum duration of 90-minutes supply is required but 120-minutes is recommended.

1091 Non-woven synthetic fabric

Non-woven synthetic fabric is a manufactured sheet of directionally or randomly orientated fibres bonded by friction, and/or cohesion and/or adhesion.

Roof or ceiling protection shall be in accordance with Table 124.

For storage heights more than those stated in Table 124 consideration shall be given to the use of ESFR or large drop sprinkler protection.

1092 Rack storage

Intermediate level sprinkler protection in accordance with Category IV shall be used.

Roof or ceiling sprinkler protection shall have a minimum design density of discharge of 12,5mm/min/m² over an assumed maximum area of operation of 260 m².

Table 124 Non-woven synthetic fabric storage heights

1	2	3	4	
Storage Configuration	Maximum permitted storage height (See Note 1) (metres)	Design density of discharge (mm/min/m²)	Assumed maximum area of operation (See Note 2) (m²)	
	1,6	10,0	260	
	2,0	12,5	260	
	2,3	15,0	260	
Free standing	2,7	17,5	260	
or	3,0	20,0	300	
Block storage	3,3	22,5	300	
	3,6	25,0	300	
	3,8	27,5	300	
	4,1	30,0	300	

Note 1: The vertical distance from the floor to the ceiling or roof, minus 1 metre, or the highest value shown in the table, whichever is the lesser.

Note 2: Dry and alternate installations are not permitted

1093 Plastic packaging recycling plants

The different areas of plastic packaging recycling plants shall be protected by sprinkler or deluge systems according to the amount of combustible loading available. Pneumatic conveyor equipment may require additional protection by spark extinguishing systems. As the fire extinguishing of bulk and bale storage requires additional clearing and follow-up extinguishing measures, it is necessary to have direct alarm transmission to a permanently manned station.

The protection concept shall be agreed during the planning stage.

1094 Design data of sprinkler systems for recycling plants

A sprinkler system shall be used for:

- a) Free standing or block storage.
- b) Bale storage (compressed plastic), and
- c) Sorting area.

The following equipment should be protected by an additional water extinguishing system (sprinkler or deluge system):

- a) Material storage bunker.
- b) Comminuting systems (e.g. shredders, mills).
- c) Drying systems, and
- d) Silo systems.

The maximum storage heights for bulk storage and bale storage are given in Table 125 and the design data in Table 126.

Table 125 Maximum bulk and bale storage heights

1	2	3
Storage configuration	Maximum storage height (Metres)	Maximum room height (Metres)
Bulk storage	5,0	9,0
Baled storage	4,0	9,0

For local protection of the equipment present in the sorting area a density of discharge of 7,5 mm/min/m² is required. Special or quick response sprinklers shall be used.

If dry pipe systems are required for the protection of bulk and bale storage, it shall be ensured that an opening of the test fitting at the end of the pipework induces the discharge of water after 20-seconds at the latest.

Table 126 Design data for sprinkler systems for bulk and bale storage

1	2
Design density of discharge (mm/min/m²)	17,5
Assumed maximum area of operation (m ²)	260 (wet system) 325 (dry system)
Sprinkler sensitivity	Fast response
Sprinkler temperature rating (° C)	93
Extinguishing agent	Water with film forming foam
Water supply (minutes)	90
Foam supply (minutes)	60

1095 Design data of deluge systems in recycling plants

A deluge system shall be used for enclosed mechanical conveyor equipment such as long belt, chain and spiral or vibratory conveyors with a density of discharge of 7,5 mm/min/m².

An alternative to sprinkler protection for bulk and bale storage is that these areas may be protected by a deluge system with a density of discharge of 17,5 mm/min/m² and a proportioning of film-forming foam, provided that the storage heights are in accordance with Table 125.

1096 Area of operation for deluge systems

The area protected by one deluge installation shall be not less than 100 m^2 except in rooms with an area of less than 200 m^2 . The water supply shall be capable of supplying the total area of operation. The total area of operation shall be found by assuming a fire at the borderline between adjacent areas protected by different deluge installations. All areas are to be supplied at the same time which are touched by a radius of 7,0 metres from the most unfavourable possible location of a fire.

Upon triggering of the deluge system, the conveyor and screening equipment of the appropriate area shall be disabled automatically.

The water demand for the local protection equipment in the operating areas shall be included hydraulically.

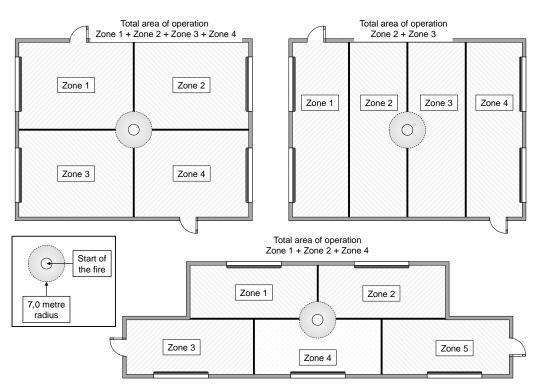
1097 Monitoring of sprinkler or deluge system

The sprinkler deluge systems shall be monitored for operational availability.

1098 Spark extinguishing systems in recycling plants

A spark extinguishing system (CEA 4033) shall be used for pneumatic conveyor equipment for waste material and dust (e.g. baling presses, filter systems, air separators and press waste container station).

Figure 135: Area of operation of deluge systems



1099 Polypropylene or polyethylene storage bins

Unless alternative approved and appropriate sprinkler testing is shown to be valid, the following requirements shall be met.

Polypropylene and polyethylene storage containers empty or used as storage receptacles shall be classed as Category IV.

Beam pallet racking for polypropylene or polyethylene storage bins

Intermediate level sprinkler protection shall have a maximum horizontal spacing not exceeding 1,5 metres.

The vertical spacing shall not exceed 2,0 metres.

The roof or ceiling level sprinklers shall be of the fast response type with a response time index of less than 50 and shall have a nominal operating temperature rating of 93° C.

The intermediate level sprinklers shall have a K-Factor of not less than 11,5 and shall be of the spray pattern type, fast response with a response time index of less than 50 and a nominal operating temperature rating of 68° C.

1100 All other storage of polypropylene or polyethylene storage bins

The maximum storage height shall not exceed 3,0 metres.

Only non-flammable pallets, for example steel pallets shall be used.

The stack height per pallet shall not exceed 1,0 metre and the uppermost storage container on each pallet shall be closed with a lid.

The roof or ceiling level sprinklers shall be of the fast response type with a response time index of less than 50 and shall have a nominal operating temperature rating of 93° C.

1101 Rubber tyres

1102 Storage methods

This section covers tyres stored horizontally; storage of tyres vertically is not covered. There are several different methods for tyre storage. (See Figure 136.)

a) Banded Tyre Storage

Several tyres are strapped together.

b) Beam Pallet Racking

Storage of tyres on pallets that are stored within a typical rack framework.

c) Block Storage

The tyres are stored in a self-supporting pile either with vertical sides or in a pyramid fashion for stability.

d) Laced Tyre Storage

The sides of the tyres are stored in an overlapping pattern creating a laced appearance.

e) On Side Storage

The tyres are stored flat or horizontally.

f) On Tread Storage

The tyres are stored on their treads or vertically.

g) Post Pallet or Stillage Storage

Pallets are stored within post pallets or stillages with either open or solid bottoms. Tyres can be stored in the laced pattern, on side or on end within the post pallet.

1103 Types of sprinklers for tyre storage

For design densities of discharge from 7,5 mm up to 12,5 mm/min/m² over an assumed maximum area of operation of 260 m², standard response sprinklers with a K-Factor of 11,5 shall be used for the roof or ceiling level protection.

For design densities of discharge from 12,5 mm to 17,5 mm/min/m² over an assumed maximum area of operation of 260 m², standard response sprinklers with a K-Factor 16,0 shall be used for the roof or ceiling level protection.

For design densities of discharge from 20,0 up to 30,0 mm/min/m² over an assumed maximum area of operation of 300 m², standard response sprinklers with a K-Factor of not less than 20,0 shall be used for the roof or ceiling level protection.

1104 Columns within tyre storage areas

All building columns, if not protected by non-combustible materials having a minimum fire resistance of 2-hours, must be wetted for cooling purposes by additional sprinklers at the rate of 10.0 mm/min/m^2 per square metre over each side of the surface area of the structural member. See Rule 1032 and Figure 108.

Column protection may be omitted where ESFR protection is installed.

1105 Intermediate level sprinkler water demand

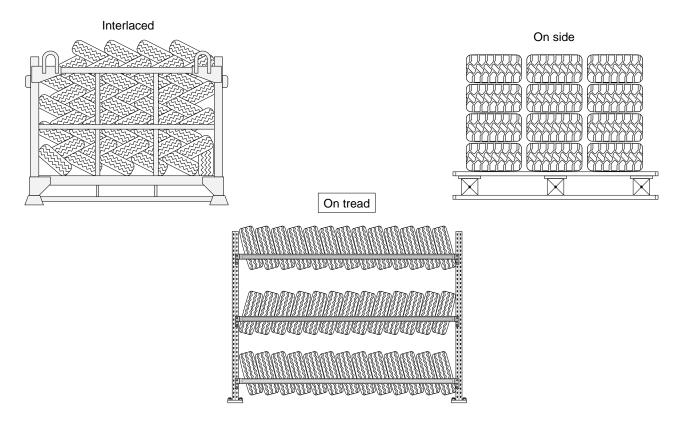
The pressure and flow requirements of intermediate level sprinklers shall be calculated on the assumption that the hydraulically most unfavourable sprinkler with a K-Factor of not less than 11,5 operates at a pressure of not less than 200 kPa for racks and shelves when the following number of sprinklers are in simultaneous operation in the hydraulically most unfavourable location. See Table 127.

Table 127 Number of intermediate level sprinklers in operation for rubber tyre storage

1	2	3	4		
Aisle Width	Number of sprinklers in simultaneous operation				
(metres)	Number of sprinklers per tier level	Number of tier levels	Number of racks or shelves		
< 1,2	4	3	3		
≥1,2 ≤ 2,4	4	3	2		
> 2,4	4	3	1		

Where only one rack is deemed to be in operation the minimum number of sprinklers deemed to be in operation shall be 12 regardless of the number of tier levels.

Figure 136: Typical tyre storage methods



1106 Categorisation of goods in storage

The fire hazard of stored goods is influenced by many factors such as the rate of heat release, the rate of burning, accessibility to water discharge.

The packaging materials and storage configuration play a major role in determining the level of sprinkler protection required.

To establish the level of protection required the procedure shown in the flow chart for determining the category of goods stored shall be followed. See Figure 137.

1107 Methodology for categorising goods

To categorise goods containing plastic or rubber this method requires an analysis of the materials used, including any packaging. The result of this analysis will yield a material factor.

The storage configuration of the goods is then considered. The material factor combined with the storage configuration will determine the category of the stored goods.

In some instances, the material factor number and category will be the same, but where plastics are involved, the category may be higher than the material factor.

1108 Material factor

A material factor of 1 to 4 shall be determined for all goods. The material factor shall take into account the product and packaging and pallet materials.

Typical materials are listed below and modifying influences are shown pictorially in the Figure 138 for material factors with plastics content.

Material factor 1

Non-combustible materials either without packaging or packaging with a low energy content and having:

- a) An unexpanded plastic or rubber content less than 5% by weight, and
- b) An expanded plastic or rubber content less than 5% by volume

EXAMPLES: Metal parts or tools with or without cardboard packaging on wooden pallets.

Powdered foods in sacks. Tinned or bottled foods.

Cloth or fabric made wholly of natural fibres.

Leather goods.
Wood products.

Ceramics in cardboard or wooden packing cases.

Non-flammable liquids in plastic, glass, or waxed paper containers.

Large electrical appliances with little packaging.

Material factor 2

Goods which are potentially more difficult to sprinkler protect, having a higher energy content than in Material Factor 1.

EXAMPLES: Wood or metal furniture with plastic furnishings within the allowable limits.

Electrical equipment with plastic parts and packaging within the allowable limits.

Electrical cable on reels or in cartons, excluding PVC.

Cloth or fabric with synthetic fibre content.

Material factor 3

Goods that are made predominantly of unexpanded plastic or less than 40% expanded plastic or have similar energy content.

EXAMPLES: Empty car batteries.

Plastic briefcases.
Personal computers.
Unexpanded plastic utensils.

Material factor 4

Goods with an expanded plastic or rubber content greater than 40% by volume or materials with similar burning characteristics.

EXAMPLES: Foam rubber mattresses.

Expanded polystyrene packaging.

Foam upholstery.

1109 Determining the category of stored goods using the material factor

The category of the stored goods is determined by assessing the influence of storage configuration once the material factor is known. Consult Table 128, identify the most appropriate goods storage configuration description listed in Columns 1 and 2.

The category is given at the intersection with the appropriate material factor given in Columns 3 to 6.

If the goods are also listed in Table 1365 and Table 137 and the category is different to that determined using the methodology, the higher of the two categories shall be used.

Figure 137: Flow chart for determining the category of goods stored

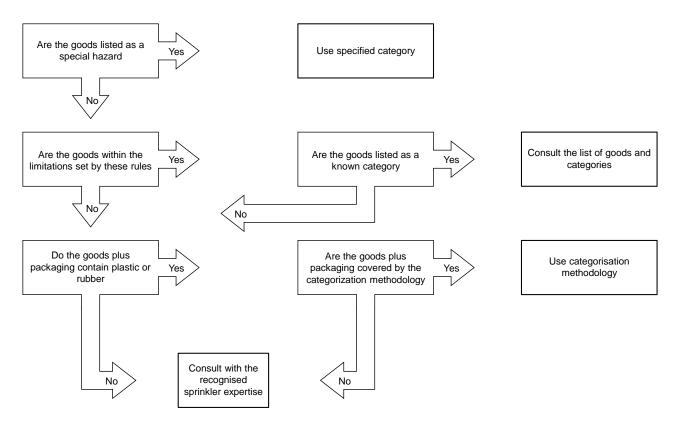
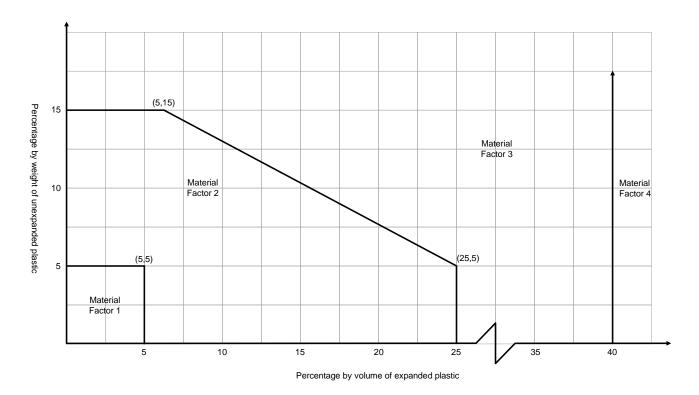


Table 128 Category determination table

1	2	3	4	5	6
Sto	rage configuration details – Note1		Materi	al factor	
Exposed surface	Stored goods	1	2	3	4
Unexpanded plastic container	Non-combustible solids and liquids which are in intimate contact with container		II	II	2
Unexpanded plastic container	Non-combustible solids forming air gaps		II	III	2
Unexpanded plastic container	Combustible solid content	Apply	II	III	IV
Unexpanded plastic film	Non-combustible solids	Table 136	Note 2	Note 2	Note 2
Unexpanded plastic film	Combustible solid content	or Table 137	II	III	IV
Expanded plastic	Combustible or non-combustible		IV	IV	IV
Unexpanded plastic or rubber	Solid blocks		II	III	IV
Paper or cardboard	Plastic content		II	III	IV

Figure 138: Material factor plastic content



1110 Exposed unexpanded plastic container with non-combustible solids and liquids which are in intimate contact with the container

This description applies to containers which hold non-flammable liquids or solids which are in direct contact with a high proportion of the internal container surfaces. It does not include metal components in storage bins or boxes.

a) Containers with non-combustible liquids: Category I
 b) Small containers (≤50 L) with non-combustible solids: Category II
 c) Large containers (> 50 L) with non-combustible solids: Category III

EXAMPLES: Plastic bottles of soft drinks or liquids with less than 20% alcohol.

Plastic drums containing inert powder such as talcum.

Non-combustible materials in plastic containers provide a heat sink and modify the rate of burning of the containers. Liquids usually have a greater effect than solids due to their greater thermal conductivity.

1111 Exposed unexpanded plastic container with non-combustible solids with air gaps

This applies to plastic containers in which the contents have little or no heat sink effect. If the contact area between the container and the contents is small, (≤25 % of the potential storage envelope), Category III ratings shall be increased to Category IV.

EXAMPLE: Metal parts in plastic storage bins.

1112 Unexpanded plastic film covering non-combustible solids

These commodities only have a small proportion of plastic by weight (in the plastic wrapping, usually < 5%) and hence no categories are given for material factors 2, 3 and 4.

EXAMPLE: Shrink wrapped tinned foods.

In a fire the plastic film is likely to burn rapidly and accelerates the fire spread. Where the packaging and the stored goods are combustible and fully shrink wrap encapsulated or fully wrapped in plastic film, the category of storage shall be increased by 1.

Where shrink wrap is used for the sides of pallet loads leaving the top of the goods stored exposed to provide stability the category of product need not be adjusted.

1113 Unexpanded plastic film covering combustible solids

Combustible solids may contain plastic and are hence given categories for Material Factors 1 to 4.

In a fire the plastic film is likely to burn rapidly and accelerates the fire spread.

1114 Exposed expanded plastic

Exposed expanded plastics are more challenging than expanded plastic in non-plastic containers and are classified as Category IV.

1115 Exposed unexpanded rubber, vinyl or plastic in solid blocks

Unexpanded materials in solid blocks burn at a slower rate than the same materials with higher surface area to volume/mass ratios.

EXAMPLE: Vinyl floor tiles.

1116 Exposed paper or cardboard in solid blocks

EXAMPLE: Cardboard flats.

1117 Paper or cardboard packaging with an open structure

Materials with an open internal structure which present a high surface area to mass to flames and allow access to air and will therefore promote rapid spread of flame and a high rate of heat release.

EXAMPLES: Empty cardboard boxes having a low structural strength: Category II

Empty cardboard boxes having a high structural strength: Category III
Paper rolls stored vertically (see also special risks): Category III

1118 Exposed paper or cardboard containing unexpanded granular or powdered materials

EXAMPLE: Plastic granules for plastics moulding stored in cardboard boxes or paper sacks.

1119 Limitations of packaging

The listed categories in Table 136 are applicable where the goods packaging is no more hazardous than a cardboard box or single layer of corrugated cardboard wrapping. This limitation applies to the packaging only and is applied whether the goods are stored on pallets.

1120 Classification of special hazards

The following tables contain the minimum classifications for specific hazard process risks. They can also be used as a guide for occupancies not specifically mentioned.

1121 Ordinary Hazard reduced area of operation occupancies

Storage shall not take place in the occupancies listed in Table 129.

Table 129 Reduced area of operation occupancies

1		2	3		
Ordinary Hazard Category III		Design density of discharge (mm/min/m²)	Assumed maximum area of operation (m²)		
	Car parks and parking garages Ceiling and floor voids	5,0	144		
Note 1: Note 2: Note 3:	ote 2: Excludes vehicle storage or warehousing.				

Table 130 Ordinary Hazard process risks and occupancies

1	2	3
Process Risk Ordinary Hazard Category III	Design density of discharge (mm/min/m²)	Assumed maximum area of operation (m²)
Alcohol distilleries Amusement arcades (life safety) Casinos (life safety) Cinemas (life safety) Convention centres (life safety) Cotton mills Exhibition halls and (life safety) Film and Television Production Studios Flax preparation plants Hemp preparation plants Paint application shops (not solvent based) Plywood factories Sawmills Theatres (life safety) Tobacco factories Wastepaper processing	5,0	360

Table 131 High Hazard Category I process risks

Process Risk High Hazard Category I 7,5 mm/min/m² design density of discharge 260 m² assumed maximum area of operation

Boots black and polish manufacturers

Carpet manufacture (Including unexpanded plastic)

Electrical cable manufacture

Floor cloth manufacture

Footwear manufacture (Including plastic and rubber)

Glue works and adhesives

Lamp black manufacture

Linoleum manufacture

Match manufacture

Oil skin manufacturers

Paint application shops (Solvent based)

Piers - all buildings - bridges and landing stages

Printing works

Refrigerator manufacture

Resin manufacture

Rope manufacture

Rubber substitute manufacture

Synthetic fibre manufacture (Excluding acrylic)

Turpentine manufacture

Wood wool manufacture

Table 132 High Hazard Category II process risks

Process Risk High Hazard Category II

10 mm/min/m² design density of discharge 260 m² assumed maximum area of operation

Brake and clutch lining manufacturers

Carpet manufacture (Including foam rubber and expanded plastics)

Chipboard manufacture (Additional protection may be required for machinery)

Cocoa nut fibre and goods stores

Paint, colour, pigment and varnish manufacture

Paper manufacture (Paper mills and machine halls)

Tar distilling

Timber milling and manufacture

Table 133 High Hazard category III process risks

Process Risk High Hazard Category III

12,5 mm/min/m² design density of discharge 260 m² assumed maximum area of operation

Candle manufacture (Wax and paraffin wax)

Cellulose nitrate manufacture

Celluloid goods manufacture

Depots and storage warehousing for buses, unloaded trucks/lorries and railway carriages

Esparto, halfa or needle grass processing and manufacturers

Firelighter manufacturers

Manufacture of foamed plastics and foam rubber and goods

Steel wool manufacture

Vehicle manufacturer paint shop – excluding areas using solvents and solvent based paints

Vehicle tyre manufacture

Table 134 High Hazard Category IV process risks

Process Risk
High Hazard
Category IV
Zoned Deluge Protection
Minimum design density of discharge 30 mm/min/m²

Aircraft hangers

Bitumen - solid - semisolid - liquid

Calcium hypochlorite manufacture and/or storage - 2-hour separation required

Firework manufacturers

Foam making machines - polyester - polyethylene - polyurethane

Gunpowder

Oil mills - crushing and solvent extraction

Table 135 High Hazard process risks special considerations

Process Risk High Hazard

Expanded polyethylene using butane - 30 mm/min/m^2 over 300 m^2

Table 136 Product categorisations

1	2	3
Duadust ou occurance	Category	Comments
Product or occupancy	Α	Comments
Abrasive wheel and powder manufacturers	- 1	
Accumulator manufacturers (battery)	II	
Adhesives with flammable solvents warehouses	III	Special hazard protection required
Adhesives without flammable solvents warehouses	I	
Aeroplane instrument manufacturers	I	
Aerosols contents and expellant flammable		See special hazards section
Aerosols contents flammable		See special hazards section
Aerosols contents and expellant non-flammable	I	
Aircraft engine works	ı	
Aircraft factories	ı	
Alcoholic beverages ≤ 20% proof by volume	II	In metal or glass containers
Alcoholic beverages > 20% proof by volume	II	Cartoned glass bottles
Ammunition - small arms	IV	Packaged or cartoned
Amusement grounds	ı	Excludes amusement arcades
Appliances - example - stoves, refrigerators	i	Not packaged - no appreciable plastic trim
Appliances - example - stoves, refrigerators	II	Cartoned corrugated - no appreciable plastic trim
Appliances - example - stoves, refrigerators	III	No exposed expanded plastic - packaging in cardboard
Appliances - example - stoves, refrigerators	III	Appreciable plastic trim - no packaging
Appliances - example - stoves, refrigerators	IV	Exposed expanded plastic packaging or plastic trim
Artificial manure manufacturers	1	Exposed expanded plastic packaging or plastic tilli
Artificial silk manufacturers	ı II	
Artificial stone manufacturers	1	
Asbestos and asbestos millboard manufacturers	i	
Asphalt paper stored horizontally	ı II	
Asphalt paper stored vertically	III	
	1	Gold and silver
Assayers Astronomical instruments manufacturers	1	Gold and Silver
Athletic clubs and racecourses, etc.	<u>'</u>	
,	'	First index stabling and consults are supported.
Athletic goods manufacturers	-	Excludes clothing and wearing apparel
Automobile spare part warehouses	III - IV	
	B .	
Bacon curers		
Bakers and biscuit manufacturers	l 	
Baked goods	II	Frozen, packaged in cartons
Baked goods	III	Packaged in cartons
Bakelite goods manufacturers	I	
Baking powder manufacturers	II	
Balata belting manufacturers	II	
Ballast and sand warehouses	ı	
Barometer manufacturers	ı	
Barrel stores	II	
Basket warehouses	II	
Bass stores	II	
Bass and fibre dressers	II	
Batteries	Ш	Automobile, empty
Batteries	I	Automobile, filled
Batteries	IV	Lithium-ion – special consideration
Batteries	II	Dry Cell non-lithium blister pack
Beans - dried	III	Packaged, cartoned

Product or occupancy Badd makers 1	1	2	3
Read makers 1 Golds, etc.		_	
Sedding manufacturers	Product or occupancy		Comments
Sedding manufacturers	Bead makers		Gold etc.
Seer			•
Beer		1	-
Seer III Plastic crate covers less than one-third of the bottle height Seer IV Plastic crate covers more than one-third of the bottle height Stauch and dye works 1 Empty - glast- cartoned Sottles - plastic - pre-form III Per - polyethylene teraphthalate Sottles - plastic - pre-form IV Arry thermoplastic Sottles - plastic - pla		ı II	• •
Situmen bonded products II			
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Bottles - plastic - pre-form Bottles - plastic - fully formed (expanded) Bot houses 1 Boiler composition manufacturers Booler makers, planting mills, tube makers, Bone warehouses Booler makers, planting mills, tube makers, Bone warehouses Boot and shoe factories and warehouses Breweries bottling section (wet process) Br		ı	Empty - glass - cartoned
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1	2	3
Product or occupancy	Category	
	С	Comments
Carriers and transit warehouses	II - III - IV	Dependent on goods stored
Cartons - waxed made up	III	
Cartons - waxed flat	II	
Cattle food manufacturers	1	
Carvers (stone)	ı	
Cellulose - not cellulose nitrate or cellulose acetate	II	Baled
Cellulose pulp	II	
Cement works	I	Includes bagged cement
Ceramics	ı	30
Cereals boxed	II	
Charcoal manufacturers	П	
Cheese	П	Packaged and cartoned
Chemical warehouses	II - III - IV	May require special consideration
Chemists (analytical)	1	
Chemists (manufacturers and wholesale)	II	Assumes no appreciable plastic content
Chemical works	II	Excluding flammable liquids
Chewing gum	II	Packaged and cartoned
China merchants	1	Wholesale and warehouses
Chipboard	ı II	Not pegged
Christmas cracker manufacturers	II	Not pegged
Chrome platers	ï	
Chutney	i	
Cigar and cigarette importers warehouses	ı II	
Cloth wool or cotton	II	
Cloth synthetic	III	
Clothes without linings	11	Stored flat - assumes no synthetic fibres
Clothes foamed plastic or rubberized linings	III	Stored Flat
Cocoa products	II	Packaged and cartoned
Coconut matting	II	i ackaged and cartoned
Cod liver oil manufacturers	II	
Coffee hullers and roasters	"	
Coffee - canned - beans bagged	II	Packaged and cartoned
Coir	"	Curled hair used in mattresses
Cold storage warehouses	II - IV	Curied Hall dised in mattresses
<u> </u>	II	Excludes solvent based product
Colour and paint warehouses Compact disks	"	Excludes solvent based product
Condensed milk manufacturers	1	
Confectionery	ll ll	
		Combustible containers and content treat as Category N
Containers - contents unknown	III - IV	Combustible containers and content treat as Category IV
Copper plate engravers Copra kilns (coconut dried meat or kernel)	l l	
		In glass bottles
Cordials & minerals	1	In glass bottles
Cordials & minerals	II III	In PET bottles
Cordials & minerals	III	In plastic crates
Cork factories cutters and dealers	II II	For Ordinary Hazard - increase the area of operation
Cork baled	II .	For Ordinary Hazard - increase the area of operation
Corn merchant's warehouses	I .	
Corn, flour, and provender mills	1	
Corset manufacturers	- 1	
Cotton baled	II	Increase the area of operation – 7,5 mm/min/m² minimum
Cotton waste dealer's warehouses	III	
Creamery and wholesale dairies	I	

1	2	3
	Category	
Product or occupancy	C	Comments
Crockery without packaging	ī	
Curled hair manufacturers	ı II	
Custard powder manufacturers	<u>"</u>	
Custara powder manaractarers	D	
Dental material and manufacturers	1	
Dental material warehouses	i	
Departmental stores	H - III	Assessment of goods stored is required
Departmental stores	III	Wooden furniture and foam upholstery
Diapers	II	Cotton or linen
Diapers - disposable	III	Social di lineri
Draper's warehouses	II	Wholesale
Dried foods	II	Packaged and cartoned
Drysalters warehouses	<u>"</u>	i delidació del concord
brysuiters waremouses	E	
Earthenware warehouses	1	
Elastomers	IV	
Electric cable warehouses	III	Excludes plastic insulation material
Electric cable or wire on reels	III	Stored in racks requires intermediate level sprinklers
Electric lamp and neon light manufacturers	1 1	Stored in racks requires intermediate level sprinklers
Electric wire coverers	111	
	"	Plastic content less than or equal to 5% by volume
Electrical dealers/wholesale/warehouses Electrical dealers/wholesale/warehouses	111	Plastic content ness than of equal to 5% by volume Plastic content more than 5% by mass or volume
	"	Plastic content more than 5% by mass or volume
Electro platers	lli	Disetis content, includes computers and spaces
Electronic equipment with or without packaging	111	Plastic content - includes computers and spares
Emery grinders	<u>'</u>	
Emery paper cloth manufacturers	II	
Empty bottles in cardboard boxes (glass)	IV	Thermonlectics or similar metarial
Empty bottles in cardboard boxes (plastic) Enamellers	I	Thermoplastics or similar material
	<u> </u>	
Engineering works	'	
Engravers (metal)		
Esparto, halfa or needle grass loose or baled	III F	
Farance and a company of the company		Assume a constant plantic content
Fancy goods warehouses		Assumes no appreciable plastic content
Feather merchant's warehouses	II	
Felt manufacturers Fent dealer's warehouses		
		Man and the second
Fertiliser - solid	II	May require special measures
Fertiliser - solid	II II	Bagged nitrates and phosphates
Fibreboard		Day on health durally harmed an improved
Fibreglass insulation	III	Paper backed rolls, bagged, or unbagged
Fibre goods manufacturers and stores	II .	
Fibrous plaster, etc. modellers	<u> </u>	
Film (photographic) manufacturers	l 	
Firelighters warehouse	III	
Firewood cutter and dealers	II .	
Fish curers	!	
Fishing gear store	l 	
Fishing net manufacturers	II	
Fish meal manufacturers	II	
Fish oil manufacturers	II .	
Flag manufacturers		

1	2	3
	Category	·
Product or occupancy	F	Comments
Flax, jute, and hemp mills	II	Excluding preparatory processes
Flax and linen warehouses	II	or of the second
Flock merchant's warehouses	II	
Flour in sacks or paper bags	II	
Floor tiles vinyl	IV	
Foodstuffs in sacks	II	
Food - tinned in cardboard boxes or trays	ı	With or without plastic film wrapping
Fountain pen manufacturers	ıı	The state of the s
French polishers	ı.	
Frozen foods - fish - meat - chicken	i	Non-waxed, non-plastic packaging
Frozen foods - fish -meat - chicken	ı II	Waxed paper containers - cartoned
Frozen foods - fish - meat - chicken	III	Plastic trays or boxes - cartoned
Fruit and vegetable	1	Wholesale
Fruit - dried	i	Wholesale
Furniture unexpanded or expanded micro cellular plastic	ı II	
Furniture upholstered excluding plastics	II	
Furniture upholstered with foam rubber or foam plastics	III	
Furniture wooden	II	
Furriers and furs	II	Stored flat in boxes
rumers and ruis	G "	Stored flat in boxes
Galvanisers	ı	
	'	
Glass bevellers, cutters	-	
Glass factories and warehouses Glass fibre unfabricated	I	
	1	F
Glass manufacturers warehouses	l	Empty
Glass merchants	1	Empty
Glass paper and sandpaper manufacturers	1	
Glucose manufacturers	1	
Gold and silver smelters	1	Turant as Disable respectively.
Gramophone record manufacturers	III	Treat as Plastic manufacturers
Grain	II	In sacks
Granaries	II	
Granaries merchant's warehouses	II	
Grease works	II	
Greasy cloth, etc. Washers	II .	
Grindstone manufacturers	I	
Grocery and provisions	II- III - IV	Wholesale
Ushavdashan,	H	
Haberdashery	II	
Handloom weavers	1	
Hat manufacturers	1 "	
Hay and straw dealers	II .	
Heald and reed heddle makers	l "	Fra Outline Heart Course on the
Hemp warehouses	II .	For Ordinary Hazard - increase area of operation
Hide warehouses	1	
Hops warehouses	II .	
Horn and ivory merchants	1	
Hose and motor belts on rhino racks	II	
Hosiery factories and warehouses	II	
	I	
Ice factories	I	
Ironmonger's warehouses (wholesale)	I	

1	2	3
	Category	
Product or occupancy	1	Comments
Ivory turners		
The first of the second of the	j	
Jeweller's warehouses	1	
Jewellery factories	i	
Jute warehouses	II	
Value Waller and asset	K	
Keg stores	1	
Knitwear - see clothes	<u> </u>	
Kintwedi See cioties	L	
Lace bleachers and dyers	<u> </u>	
Lace factories	<u> </u>	
Lace warehouses	<u> </u>	
Laminated board	ı II	
Lamp shade manufacturers	"	
Lard and fat refineries	ı II	
Laundries Lead light manufacturers		
Leather goods factories Leather substitute manufacturers	II	
Leather warehouses	II II	
	II .	
Lens manufacturers and optician's manufacturers	I IV	District and a subset in the subset of the s
Lighters - butane	†	Blister packs – otherwise treat as aerosol storage
Lime, etc. Warehouses	<u> </u>	
Linen	II	
Linoleum	III	4000/
Liquor	IV	100% proof in glass or plastic bottle
Logistics warehouses	III - IV	
Looking glass manufacturers		
Luggage	IV	
	M	
Magnetic tapes	III	
Manchester (linen) warehouses	II	
Manganese powder in drums	II .	
Manure merchant's warehouses	<u> </u>	
Marble and slate works	l 	
Margarine works and warehouses - excludes extraction	III	Up to 50% oil - any packaging
Margarine works and warehouses - excludes extraction	IV .	Between 50 and 80% oil any packaging
Marine store dealer's warehouses	l l	
Market gardeners	l	
Matches	III	For Ordinary Hazard - increase area of operation
Mattresses	II	With no foam rubber or expanded plastic
Mattresses	IV	Limited or full foam rubber or expanded plastics
Meat	II	Chilled or frozen
Metal cans	II	Plastic shrouded or corrugated cardboard
Metal goods	I	
Metal goods	I	
Metal workers	I	
Milk powder	II	Bags or sacks
Mirror manufacturers	ı	
Mohair	I	
Monument masons	I	
Motor garages and storage warehouses	III	Excludes flammable and combustible liquid stores

Product or occupancy Motor vehicle manufacturers and assembly plants Mustard, pepper, and chicory mills III Nali polish IV Natural rubber Nickel plating works III Nutsard (an expended of the plating works III Nutsard (an expended of the plating works III Nutsard (an expended of the plating works III Nuts III Canned, cartoned or bagged O Office material and stationary suppliers III Oil seeds III Oil warehouses III Oil warehouses III Falsh point ≥300° € excludes plastic packaging Ore grinders III Paints water based I Falsh point ≥300° € includes plastic packaging III Paints oil based - flash point < 32° € Paints oil based - flash point < 32° € IV Foam induction required - Flammable liquids Paper III Wrapped sheets stored horizontally Paper III Wrapped sheets stored horizontally Paper weight ≤5 kg / 100 m² Paper weight ≤5 kg / 100 m² III Paper weight ≤5 kg / 100 m²	
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Paints solvent based Paper IV Foam induction required - Flammable liquids Paper II Wrapped sheets stored horizontally Paper weight ≤5 kg / 100 m² Paper weight ≤5 kg / 100 m² Paper weight >5 kg / 100 m² Paper bitumen coated Paper pulp Rolled or baled Paper waste Paper waste Paper was coated Paper was coated Parking basements Parking basements Patent flour manufacturers II Packaged and cartoned Packaged and cartoned	
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Paper weight ≤5 kg / 100 m² Paper weight ≤5 kg / 100 m² Paper weight ≤5 kg / 100 m² Paper weight >5 kg / 100 m² Paper bitumen coated Paper bitumen coated Paper pulp Rolled or baled Paper waste Paper wax coated Paper wax coated Parking basements Parking basements Patent flour manufacturers Pae warehouses III Packaged and cartoned	
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Paper wax coated III Special considerations in the area of operation Particle board II Patent flour manufacturers II Packaged and cartoned	
Parking basements III Special considerations in the area of operation Particle board Patent flour manufacturers II Packaged and cartoned	
Particle board II Patent flour manufacturers II Pea warehouses II Packaged and cartoned	
Pea warehouses II Packaged and cartoned	
Pharmaceuticals IV Plastic bottles cartoned	
Photographic supplies manufacturers II 35 mm in metal film cartridges and bulk film rolls	
Photographic supplies manufacturers IV In thermoplastic containers	
Pillows feathers and down II	
Pillows with foam rubber or plastics IV	
Plastic non-expanded III Thermoset plastics	
Plastic expanded or foamed blocks and sheets IV	
Plastic expanded or foamed IV Off cuts and small packaging pieces	
Plastic glass reinforced (grp)	
Plastic crates IV Empty	
Plastic crates IV Excluding storage of idle pallets	
Plastic pallets for storage purposes III - IV Special consideration may need to be applied	
Paper weight ≤5 kg / 100 m ² III e.g.: Tissue paper stored horizontally	
Plastic for recycling or recycled plastic pieces IV Scrap, waste, or ground plastic	
Plumbers, painters, and decorators III Workshops and Stores	
Plywood stored flat II	
Polyethylene empty bottles or containers IV	
Polyethylene rolls vertical or horizontal IV	
Potteries I	
Poultry grit and food manufacturers	

1	2	3
	Category	· ·
Product or occupancy	P	Comments
Precious stone cutters	1	
Printers and allied trades (see nitrate storage)	II	
Printer cartridges	III	Polystyrene or cardboard packaging
PVA	IV	Polyvinyl alcohol resins
PVC	III	Polyvinyl chloride
PVC resins	III	Bagged
	Q	
Quarry buildings	ı	
	R	
Radio, television, etc. manufacturing and assembly	II	Excludes plastic rigid or foamed
Rag carbonisers	I	
Rag warehouses loose or baled	III	Natural and synthetic fibres
Restaurants and cafes	I	·
Resins excluding flammable liquids	II	Metal containers
Resins in conjunction with fibre glass	III	
Retail shops and departmental stores	II - III - IV	Limited storage
Rice husking mills	1	-
Roofing felt	III	
Rope natural fibres	II	
Rope synthetic fibres	III	
Rubber	III	Natural expanded
Rubber	IV	Natural not expanded
Rubber and rubber goods manufacturers	III	Excluding foam rubber and tyres
Rubber goods warehouses	III	Excluding foam rubber and tyres
Rubber foamed in blocks and sheets stored flat	III	
Rubber foamed other than in blocks and sheets	IV	
	S	
Sack and bag manufacturers	II	
Salt manufacturers	1	
Salt warehouses	II	Packaged and cartoned
Sauce, pickle, and preserved food manufacturers	1	
Sawmills and timber yards	11 - 111	For Ordinary Hazard - increase area of operation
Scenery (theatrical) stores	II- III	
Scientific instrument and thermometer manufacturers	1	
Seed and shale oil refineries	1	
Seedsmen warehouses	I	
Ship breakers	1	
Shipbuilders	1	
Shirt factories	- 1	
Shock absorbers	II	Plastic dust covers
Shoes leather	II	Less than 5% plastic by mass
Shoes synthetic	III	Includes rubber or plastic components
Shopping centres/malls	I - IV	High Hazard installations are generally suited
Silk spinners	1	Not artificial silk
Silversmith's manufacturing	1	
Sisal	1	
Skin rug manufacturers	1	
Skin warehouses	1	
Small wares manufacturers	1	Kitchen and bar appliances, flatware
Soap manufacturers or warehouses	II	
Soft drinks, concentrates and mineral water	II- III	Assess on plastic content and encapsulation
Soft goods warehouses	III	Stuffed toys

Solar panels storage Solar panels storage	Category S	Comments
Solar panels storage Solar panels storage	S	Comments
Solar panels storage		
	II	Aluminium frames with no plastic packaging
Spice grinders and warehousing		Plastic frames and/or plastic packaging
Spice grinders and warehousing		Process and storage
Spirituous liquors cased bottles or on pallets		Alcohol content ≥ 20%
Spirituous liquors bulk	III	Stored in barrels or with an alcohol content ≤ 20%
Sports goods warehousing	III	Including sports clothing
Stables	I	
Stained glass manufacturers	1	
Starch works	1	
Stationery and office supplies	III	
Steel wool	III	
Stone masons	1	
Straw plait and straw-hat manufacturers	П	
String natural materials	I	
String synthetic materials	П	
Stucco manufacturers	1	
Suet manufacturers	1	
Sugar warehouses factories and refineries	П	
	Т	
Tailors' wadding manufacturers	1	
Tallow warehouses	П	Beef or mutton fat
Tanneries	1	
Tanners' warehouses and dried skins	II	
Tarpaulin and tent manufacturers and warehousing	III	
Tar products roofing and bitumen products	III	
Tea factories	1	
Telegraph and telephone wire coverers	III	
Timber un-sawn	II	
Timber sawn not in ventilated stacks	П	
Timber sawn in ventilated stacks	III	
Tobacco bonds	П	
Tobacco manufacturers	П	
Tobacco warehouses	II	
Tortoiseshell works	II	
Toys metal	I	
Toys unexpanded plastics	III	
Toys expanded plastic	IV	
Toy warehouses	III	
Toys wooden	П	
Tripe boilers	I	
Twine warehouses	П	
Typewriter ribbon manufacturers	П	
Tyre warehouse	IV	Stored horizontally - vertically is not covered
	U	
Umbrella manufacturers	I	
Uralite manufacturers	I	
Upholstery	П	Excluding foam rubber and plastics
	V	
Vegetable fibres	П	Hay, straw, hemp, cotton, flax, etc.
Vinyl coated fabric	IV	
Vinyl floor coverings	IV	Tiles in cartons
Vinyl - rolled	IV	

1	2	3
Duadust or essurance	Category	Comments
Product or occupancy	W	comments
Wallpaper manufacturers	_	
Wastepaper dealer's warehouses	Ш	For Ordinary Hazard - increase area of operation
Waterproof cloth manufacturers	_	
Wax figure manufacturers	III	
Waxed paper and carton manufacturers	Ш	
Wax (paraffin)	IV	
Wet areas (production)	_	Assumes no storage or combustible walling
Whiting manufacturers	- 1	
Wicker works	Ш	
Wine packaged in cardboard boxes	_	Alcohol content < 20%
Wood chipboard excluding ventilated stacks	II	
Wood plywood stored flat	II	
Wood pulp	II	Baled
Wood veneer sheets	Ш	
Woodworkers	II	
Wood wool warehouses	IV	Baled
Wooden crates and wooden pallets in process	IV	Excludes idle pallet storage
Woollen warehouses	II	
Woollen and worsted mills	I	

Supplementary List

1	2	3
Product or occupancy	Category	Comments

Table 137 Plastic process risks

1	2	3
Plastic Process Risk Ordinary Hazard Category IV	Design density of discharge (mm/min/m²)	Assumed maximum area of operation (m²)
Blown Film Extrusion Calendaring Extrusion Extrusion Coating Pressing and press laminating of thermoplastics Rotational Moulding Slush moulding Spreading Compounding Vacuum metallization	5,0	360
Plastic Process Risk High Hazard Category II	Design density of discharge (mm/min/m²)	Assumed maximum area of operation (m²)
Blow moulding Coating Metal Articles dip/spray/compression/transfer moulding Film conversion Hot press moulding of reinforced plastics Injection moulding Laminated material fabrication Press lamination of thermosets Thermoforming, including vacuum forming	7,5	260
Plastic Process Risk High Hazard Category III	Design density of discharge (mm/min/m²)	Assumed maximum area of operation (m²)
Contact moulding of reinforced plastics Filament winding Pultrusion of reinforced plastics Resin casting (including manometer Casting)	10,0	260
Plastic Process Risk High Hazard Category IV Zoned Deluge Protection	Design density of discharge (mm/min/m²)	Assumed maximum area of operation (m²)
Fabrication of cellulose nitrate - celluloid or xylonite	12,5	260
lote: If solvents are used in any Category I or II process, these shall be reclas	sified to Category III	

Table 138 Plastics Categorisation

1	2	3		
	Category			
Product or trade name	Α	Type of plastic		
ABS	III	Acrylonitrile-butadiene-styrene copolymer		
Acribel	П	Acrylic		
Acrilan	III	Acrylic		
Acronal	III	Polyacrylic		
Acrylonitrile Butadiene Styrene Resins	III	Acrylonitrile Butadiene Rubber		
Acetal and Acetal Resins	III	Polyformaldehyde		
Acrylic Fibre Yarn	III - IV	Polymethyl methacrylate		
Acrylic Resins	III			
Aerolite	ı	Amino		
Aerodux	П	Formaldehyde		
Aero Jablex	III	PVC		
Akulon	III	Nylon		
Alkathene	III	Polythene		
Alprokyd	I	Alkyd Resin		
Alathon	III	Polythene		
Alloprene	III	Chlorinated Rubber		
Alvar	III	Polyvinyl Acetal		
Aldehydes	1	Formaldehydes, etc.		
Alkyd Resins	1			
Amberlite	II	Phenol Formaldehyde Resin		
Amino Plastics	II			
Aniline Formaldehyde	1			
Armourbex	- II	Cellulose Acetate		
Araldite	II	Epoxide		
Armoride	IV	Vinyl		
Arlingcalf	III	PVC Coated Leather cloth		
Arlinghide	III	PVC Coated Leather cloth		
Armacord	III	PVC Coated Leather cloth		
Arnioride	III	PVC Coated Leather cloth		
Ardil Fibre	1	Protein		
Artilana	III	No information		
Ashlam	1	Amino		
Ashlam Laminate	III	Amino		
ASP	II	Phenolic		
Astralon	IV	Vinyl		
7.53(4)(6)	В	Vinji		
Bakelite	III	Phenolic & Cresylic or Polyester		
Beautide	IV	Vinyl		
Beckacite	1	Phenol Formaldehyde		
Beckamino	i	Amino		
Beckophen	ı II	Phenolic & Cresylic		
Beckosol		Aklyd Resin		
Bedacryl	III	Acrylic Resin		
Bedafin	1	Alkyd		
Bedesol	- 11	Phenolic & Cresylic		
Beetle U.F.	"	Amino		
Beetle O.F.	ı II	Alkyd or Polyester Resin		
Bexan	IV	Vinyl		
Bexfilm	II	Cellulose Acetate		
Bexform	IV	Expanded Polystyrene		
If solvents are used with Category I classify as Category III or with Categories II or III classify as Category IV				

1	2	3		
Description of the second	Category	T.m. of alastic		
Product or trade name	В	Type of plastic		
Bexoid	II	Cellulose Acetate		
Bexol	IV	Cellulose Nitrate		
Bexone	III	Polyvinyl Acetate		
Bexphane	III	Polypropylene		
Bextrene	III	Unexpanded Polystyrene		
Breon	IV	Vinyl		
Brulon	III	Nylon		
Butacite	III	Polyvinyl Butyl		
Butyl Rubber	=	Rubber		
	C			
Calaroc	ı	Alkyd		
Calatac	III	Acrylic		
Calature	I	Amino		
Carinex	III	Unexpanded Polystyrene		
Carlona	III	Polythene		
Carp	Ш	Phenolic & Cresylic		
Cascamite	I	Amino		
Casco-resin	I	Amino		
Cascophan	II	Phenolic & Cresylic		
Casein	I	Protein		
Catabond	III	Polyester		
Catacol	Ш	Phenolic & Cresylic		
Catacore	I	Amino -Phenolic & Cresylic		
Catacost	II	Phenolic & Cresylic		
Cataform		Phenolic & Cresylic		
Catalin	I	Phenol Formaldehyde		
Catanam	II	Phenolic & Cresylic		
Catavar	II	Phenolic & Cresylic		
Celastoid	II	Cellulose Acetate		
Cellobond	I	Amino Epoxide & Vars		
Cellastine	II	Cellulose Acetate		
Cellit	II	Cellulose Acetate		
Cellomold	II	Cellulose Acetate		
Cellophane	IV	Regenerated Cellulose		
Celluloid	IV	Cellulose Nitrate		
Cellulose Acetate	III			
Cellulose Acetate Butyrate	III			
Cellulose Nitrate	IV			
Celoron	III	Phenolic Fibreglass Laminate		
Cerex	III	Unexpanded Polystyrene		
Cinabex	II	Cellulose Acetate		
Cinemoid	II	Cellulose Acetate		
Chloreuene	III	PVC		
Chloroprene Rubber	III			
Clarifoil	П	Cellulose Acetate		
Cobex	IV	Vinyl		
CorviC	III	PVC		
Courtelle	III	Acrylic		
Craylene	IV	Vinyl		
Craymac	IV	Vinyl		
Craytherm	III	PVC		
Craytube	IV	Vinyl		
If solvents are used with Category I classify as Category III or with Categories II or III classify as Category IV				

1	2	3
	Category	
Product or trade name	С	Type of plastic
Creyslic Plastics	I	
Crestakyd	ı	Alkyd
Crestapon	II	Epoxide
Crinothene	III	Polythene
Crystic	III	Polyester
Crystolex	III	Acrylic
Cycolac	III	Acrylonitrile Butadiene Styrene
	D	
Dacron	III	Polyester
Daltolac	I	Alkyd
Darvic	III	PVC
Decorplast	ı	Amino
Delaron	II	Cellulose Acetate
Delrim	II	Phenolic & Cresylic
Dentacryl	II	Acrylic
Dexel	III	PVC
Dialam	III	Polyester
Diakon	III	Polythene
Dichlorid	III	PVC
Diolen	III	Unexpanded Polystyrene
Diothene	ı	Protein
Diorid	II	Acrylic
Distrene	III	PVC Coated Fabric
Dorcasine	III	PVC Coated Fabric
Dralon	IV	Vinyl
Dupraplex	III	Phenolic
Duranide	- 1	Polyamide
Duraplex	III	PVC
Durex	IV	Vinyl
Durethan	III	Polythene
Durotube	III	Unexpanded Polystyrene
Durrna	II	Cellulose Acetate
Dylan	II	Phenolic & Cresylic
Dylene	II	Acrylic
	E	
ECTFE	IV	Ethylene-chlorotrifluoro-ethylene copolymer
EPDM	III	Ethylene-propylene rubber
ETFE	IV	Ethylene-tetrafluoroethylene copolymer
Eanplast	11	Cellulose Acetate
Ecarit	II	Cellulose Acetate
Elo	II	Phenolic & Cresylic
Elvax	IV	Vinyl
Emitape	11	Cellulose Acetate
Empire	III	Laminated Glass Fibre-Silicone Resin
Enkalon	I	Polyamide
Epikote	II	Thermosetting Resin - no other information
Epok	1	Alkyd Amino
Epopher	II	Epoxide
Epoxy or Epoxide Resins	II	
Erinite	1	Phenol Formaldehyde
Erinofort	II	Cellulose Acetate
Erinoid	II	Cellulose Acetate
If solvents are used with Category I classi	fy as Catego	ory III or with Categories II or III classify as Category IV

1	2	3		
Post at a start and a second	Category	The state of the s		
Product or trade name	E	Type of plastic		
Erinoid	III	Unexpanded Polystyrene		
Ethocel	=	Ethyl Cellulose		
Ethyl Cellulose	III			
Everex	III	Polythene		
Everflex	III	PVC Coated Fabric		
Expanded Plastics	IV			
Exton	III	Nylon		
	F			
FEP	IV	Fluorinated ethylene-propylene copolymer		
FRP	III	Fibreglass reinforced polyester		
Fablon	III	PVC coated fabric		
Fablothene	III	Polythene		
Featalak	I	Amino		
Featasol	I	Alkyd		
Fibestos	II	Cellulose Acetate		
Fibravil	IV	Vinyl		
Fibreglass	III			
Filabond	III	Polyester		
Finapic	II	Phenolic & Cresylic		
Florafoam	IV	PVC FOAM Fabric		
Florestin	III	PVC Coated Fabric		
Fluon	I	Polytetrafluoroethylene		
Flurocarbons	I			
Fluoroplastics	IV			
Foampac	IV	Urea Formaldehyde Foam		
Foam Plastics	III - IV	Varies on type		
Formaldehyde Plastics	I			
Formapex	II	Phenolic & Cresylic		
Formica	III	Phenol Formaldehyde		
Formica Laminates	III	Phenol Formaldehyde		
Formite	Ш	Phenolic & Cresylic		
Formvar	IV	Vinyl		
Forticel	II	Cellulose Acetate		
Fromocene	IV	Vinyl		
Fromoplas	IV	Vinyl		
Fromosan	IV	Vinyl		
Fromotan	IV	Vinyl		
	G			
Gelva	III	Polyvinyl Acetate		
Geon	III	PVC		
Geon 101	III	PVC		
Geon 200	III	Vinyl Chloride		
Grilon	1	Polyamide		
Guttasya	III	PVC		
	Н			
Harcose C	II	Cellulose Acetate		
High density polyethylene	IV	HDPE		
Holoplast	II	Phenolic & Cresylic		
Holoplast Laminate	II .	Phenolic & Cresylic		
Hornblend	<u>l</u>	Amino		
Hostaflon C	l	Polytrifluorochloroethylene		
Hostaflon T.F.		Polytetrafluoroethylene		
If solvents are used with Category I classify as Category III or with Categories II or III classify as Category IV				

1	2	3		
Product or trade name	Category	Type of plastic		
	Н			
Hostalen C	III	Polythene		
Hostalen P.P.	III	Polypropylene		
Hostalit	III	PVC		
	1			
lgelit	PVC			
Insmat	III	Phenolic & Cresylic		
Isoflex	П	Cellulose Acetate		
Isolene	II	Butylene Polymer		
	J			
Jectothane	П	Polyurethane		
	К			
Kabroloid	II	Cellulose Acetate		
Kallodent	II	Polymethyl Methacrylate		
Kallodoc	П	Acrylic		
Keebush	1	Phenol Formaldehyde		
Kel - F	1	Polytrifluorochloroethylene		
Kematal	II	Acetal Copolymer		
Kite	II	Phenolic & Cresylic		
Kodaloid	IV	Cellulose Nitrate		
Kodapak	II	Cellulose Acetate		
Kollecast	II	Phenolic & Cresylic		
Kralastic	III	Acrylonitrile Butadiene Styrene		
	L			
Lacisana	1	Protein - Casein		
Lectofil	1	Protein - Casein		
Lactoid	1	Protein - Casein		
Lamalac	III	Laminated		
Laminac	III	Polyester		
Laminated Plastics	III			
Lanital	1	Protein - Casein		
Lansil	II	Cellulose Acetate		
Lanusa	III	Viscose - Rayon		
Lauxite	II	Phenolic & Cresylic		
Layflat	III	Polythene		
Leguval	III	Polyester		
Lexan	I	Polycarbonate		
Loanlin	III	Unexpanded Polystyrene		
Lorival	II	Phenolic & Cresylic		
Lorival	III	Polythene		
Lorival	IV	Vinyl		
Lucentine	III	Styrene/Devinyl Benzene Copolymer		
Lucite	II	Polymethyl Methacrylate		
Lumarith	II	Cellulose Acetate		
Luran	III	Unexpanded Polystyrene		
Luron	I	Polyamide		
Lustrette	III	PVC coated Fabric		
Lustrex	III	Unexpanded Polystyrene		
Lustron	III	Unexpanded Polystyrene		
Lyafol	I	Polyamide		
Lypolene	III	Polythene		
	М			
Macite	II	Cellulose Acetate		
If solvents are used with Category I classify as Category III or with Categories II or III classify as Category IV				

1	2	3	
	Category	_ ,,,,	
Product or trade name		Type of plastic	
Makalot	ı	Phenolic	
Marco	III	Polyester	
Marcon	III	Polyester	
Marlex	III	Olefin Polymer No information - treat as	
Malamine	IV	Melamine formaldehyde	
Melloroid	III	PVC Coated Fabric	
Melinex	III	Polyester	
Melmex	I	Melamine Formaldehyde	
Melplas	II	Cellulose Acetate	
Methocel	III	Methyl Cellulose	
Micanite	III	Laminated Glass Fabric - Silicone Resin	
Micor	II	Phenolic & Cresylic	
Movil	IV	Vinyl	
Moltopren	IV	Polyester & Polyether Foam	
Mouldrite	II	Phenolic & Cresylic	
Montopore	III	Unexpanded Polystyrene	
Mylar	III	Polyester	
	N	•	
Nestor	ı	Amino	
Nestorite	ı	Amino	
Netlon	III	Thermoplastic No information - treat as	
Nitron	II	Cellulose Acetate	
Nixonite	II	Cellulose Acetate	
Northproof	III	PVC Coated Fabric	
Nouellon	II	Cellulose Acetate	
Novilon	II	Asbestos tile with PVC Face	
Nuron	III	Polyester	
Nylaf	II	Polyamide	
Nylon	IV	Polyamide - Nylon 6 - Nylon 6/6	
Nyion	0	Totyumae Nyion o Nyion oyo	
Onazote	IV	Expanded Ebonite	
Oppanol	III	Polyisobutylene No information - treat as	
Orlon	II	Acrylic	
CHOIL	Р	Actylic	
DET		Polyathylana taranhthalata	
PET ECTFE	IV	Polyethylene terephthalate Polychlorotrifluoroethylene	
PTFE	IV	Polytetrafluoroethylene	
Panilax	1	Aniline Formaldehyde	
Panilax Laminate	III	Aniline Formaldehyde	
Paralac	"	Alkyd & Amino	
Paxolen Paxolin	II I	Phenolic & Cresylic	
		Amino	
Paxolin Laminate Pe - Ce	III IV	Vinul	
		Vinyl	
Penton	III	Chlorinated Polyether	
Perlon		Polyamide	
Permali	II	Phenolic & Cresylic	
Permawood	II	Phenolic & Cresylic	
Perspex		Acrylic	
Phenco	III	PVC	
Phenolic	IV		
Phenrib	IV	Vinyl	
If solvents are used with Category I classify as Category III or with Categories II or III classify as Category IV			

1	2	3
	Category	
Product or trade name		Type of plastic
Phoenmark	II	Vinyl
Plaskon	I	Urea Formaldehyde
Plastacele	III	Cellulose Acetate
Plastokyd	I	Alkyd & Amino
Plasoco	III	PVC Coated Fabric
Plasvic	IV	Vinyl
Plaxide	III	PVC Coated Fabric
Plexiglass	П	Polymethyl Methacrylate
Polana	I	Protein - Casein
Polyamides	I	
Polycarbonate	- 1	
Polyester Resins	III	
Polyethylene	III	
Polygram	I	Phenol Formaldehyde
Polypropylene	III	
Polystyrene	III	Not foam
Polystyrene	IV	Foamed
Polythene	III	
Polyvinyl	IV	Vinyl - excluding PVC
Polyvinyl - Chloride	III	PVC - plasticiser content up to 20%
Polyvinyl - Chloride	IV	PVC - plasticiser content greater than 20%
Polyzote	III	Unexpanded Polystyrene
Polyurethane	II	Not foamed
Polyurethane	III	foamed
Polyester Yarn	III	Includes polyester elastomer
Portex	II	Acrylic
Portex	Ш	Polyamide or Polythene
Porvic	Ш	PVC
Propathene	III	Polypropylene
Protein Resins	- 1	
Prystal	1	Phenol Formaldehyde
Pyalin	IV	Cellulose Nitrate
	Q	
	R	
Reinforced Plastics	III	Polyester
Rooplex	III	Phonolic
Resinox	- 1	Amino
Resolite	- 1	Cellulose Acetate
Rhodoid	П	Vinyl
Rhovil	IV	Polythene
Rigidox	Ш	Vinyl
Rilboard	IV	PVC
Rilcom	Ш	Vinyl
Rilene	IV	Vinyl
Rilford	IV	Amino
Rilica	I	Vinyl
Rilmould	IV	PVC
Rilon	Ш	PVC
Rilotex	Ш	Vinyl
Rilplate	IV	Vinyl
Rilpol	IV	Polyester
If solvents are used with Category I classi	fy as Catego	ory III or with Categories II or III classify as Category IV

Ricar	1	2	3
Name		Category	
Saran			Type of plastic
Saran	Rilsan	1	Polyamide
Saran	Rockite	ı	
Scraph		S	
J. Amino Schwarza Jil Viscose Rayon Schwarza Jil Viscose Rayon Silicone Rubber Jil Eduding Rubbers Silicone Rubber Jil Laminated Glass Fabric - Silicone Resin Spauldite Jil Laminated Phenolic Screylic Storatin Vising Storatin Vising Vising	Saran	III	PVC
J. Amino Schwarza Jil Viscose Rayon Schwarza Jil Viscose Rayon Silicone Rubber Jil Eduding Rubbers Silicone Rubber Jil Laminated Glass Fabric - Silicone Resin Spauldite Jil Laminated Phenolic Screylic Storatin Vising Storatin Vising Vising	Saroy	III	Unexpanded Polystyrene
		ı	
		III	
IV	Silicones	ı	
Spauditie	Silicone Rubber	IV	
III	Silon	ı	Polyamide
Spauldite III Laminated Phenolic Stellon III Methyl Methacrylate Polymer Sternite III Phenolic & Creylic Storaya IV Virnyl Storaya IV Virnyl Storeen IV Virnyl Storde III PVC Coated Fabric Storolan IV Virnyl Styron III Unexpanded Polystyrene Styrafoll III Unexpanded Polystyrene Styron III Unexpanded Polystyrene Styron III Unexpanded Polystyrene Superion IV Virnyl Superion IV	Silopex	III	
Steinite		III	Laminated Phenolic
Sternite		III	Methyl Methacrylate Polymer
Storaya IV Vinyl	Sternite	II	
Storaya IV Vinyl	Storain	IV	·
Storeen IV Vinyl	Storaya	IV	
V Vinyl	-	IV	Vinyl
Strovic IV Vinyl	Storide	III	PVC Coated Fabric
Strovic IV Vinyl	Storolan	IV	Vinyl
Stryaloy 22	Storvic	IV	
Stymer III Unexpanded Polystyrene Styraficil III Unexpanded Polystyrene Styrafic III Unexpanded Polystyrene Styroffex III Unexpanded Polystyrene Styropor III Unexpanded Polystyrene Styron III Unexpanded Polystyrene Styron III Unexpanded Polystyrene Superlom III DVC Coated Fabric Superlon IV Vinyl Superlon IV Vinyl Superlon I Amino Sutron I Polyamide Survon I Polyamide Survon I Polyamide Swan III Phenolic & Cresylic Syrton III Phenolic & Cresylic Syrton III Unexpanded Polystyrene Teca III Viscose Rayon Tedlar III Polyatyrity Fluoride Tedlar III Polytetraffuoroethylene Tego I Phenolif	Stryaloy 22	III	·
Stryafoil III			
Styramic		III	
Styrofiex III Unexpanded Polystyrene Styropor III Unexpanded Polystyrene Styron III Unexpanded Polystyrene Superlom III PVC Coated Fabric Superlon IV Vinyl Supertone I Amino Survon I Polyamide Survon I Polyamide Swan III Phenolic & Cresylic Synphorm III Phenolic & Cresylic Sytron III Unexpanded Polystyrene Teca III Unexpanded Polystyrene Teca III Viscose Rayon Tedlar III Viscose Rayon Tedlar III Polyatirafluoroethylene Tego I Phenol Formaldehyde Teklan III Acrylic Teklan III Acrylic Tenaplas III PVC Tenasco III PVC Tenatube III PVC Tenite I		III	
Styropor III Unexpanded Polystyrene Styron III Unexpanded Polystyrene Superlom III PVC Coated Fabric Supertone I V Vinyl Supertone I Amino Sutron I Polyamide Survon I Polyamide Swan III Phenolic & Cresylic Symphorm III Phenolic & Cresylic Sytron IIII Unexpanded Polystyrene Teca III Viscose Rayon Tedlar III Polyvinyl Fluoride Tedlor III Polystrafluoroethylene Tego I Phenol Formaldehyde Teklan III Acrylic Tenaplas III PVC Tenaplas III PVC Tenatube III PVC Tenite I III Cellulose Acetate Tenite I III Cellulose Acetate Terionka III Polyester		III	
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Superion IV Vinyl Supertone I Amino Sutron I Polyamide Survon I Polyamide Swan II Phenolic & Cresylic Syphorm II Phenolic & Cresylic Sytron III Unexpanded Polystyrene Teca III Viscose Rayon Tedlar III Polyvinyl Fluoride Teflon II Polytetrafluoroethylene Tego I Phenol Formaldehyde Teklan II Acrylic Telothene III Polythene Tenaplas III PVC Tenasco III Viscose Rayon Tenatube III PVC Tenite III Cellulose Acetate Tenite III Cellulose Acetate Tenite III Cellulose Acetate Tergal III Polyester		III	
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Teflon II Polytetrafluoroethylene Tego I Phenol Formaldehyde Teklan II Acrylic Telcothene III Polythene Tenaplas III PVC Tenasco III Viscose Rayon Tenatube III PVC Tenite III Cellulose Acetate Tenite I III Cellulose Acetate Tenite III Cellulose Acetate Terigal III Polyester Terlonka III Polyester	Tedlar	III	
Tego I Phenol Formaldehyde Teklan II Acrylic Telcothene III Polythene Tenaplas III PVC Tenasco III Viscose Rayon Tenatube III PVC Tenite III Cellulose Acetate Tenite I III Cellulose Acetate Tenite III Cellulose Acetate Tenite III PVC Tenite III PVC Tenite III PVC Tenite III PVC Tenite III Cellulose Acetate Tenite III Polyester Terlonka III Polyester	Teflon	II	
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Tenite I III Cellulose Acetate Tenite II III Cellulose Acetate Tergal III Polyester Terlonka III Polyester	Tenite	III	Cellulose Acetate
Tenite II III Cellulose Acetate Tergal III Polyester Terlonka III Polyester		III	
Tergal III Polyester Terlonka III Polyester			
Terlonka III Polyester			
Terylene III Polyester	Terylene		Polyester
Texolex II Phenolic & Cresylic		II	
If solvents are used with Category I classify as Category III or with Categories II or III classify as Category IV	If solvents are used with Category I cla		

1	2	3	
	Category		
Product or trade name	Т	Type of plastic	
Termovyl	IV	Vinyl	
Thor	I	Amino	
Tiolan	I	Protein-Casein	
T.P.X.	III	No information	
Traffolite	III	Laminated Plastic	
Traffolyte	I	Amino	
Transpex I	II	Polymethyl Methacrylate	
Transpex II	III	Unexpanded Polystyrene	
Trevira	III	Polyester	
Trolit B	II	Cellulose Acetate	
Trolit W	II	Cellulose Acetate	
Trolit F	IV	Cellulose Nitrate	
Trolitul	III	Unexpanded Polystyrene	
Tufnol	III	Laminated Plastic - no details	
Tulox T.T.	II	Cellulose Acetate Butyrate	
Tygan	III	Polyvinylidene Chloride	
	U		
Umaplex	II	Acrylic	
Ultramide	I	Polyamide	
Undulite	III	Polyester	
Utilex	II	Cellulose Acetate	
Urea	I	Amino	
Urea	IV	Urea Formaldehyde	
	V		
Velbex	IV	Vinyl	
Videne	III	Polyethylene	
Vinagel	III	PVC	
Vinalak	II	Acrylic	
Vinamold	IV	Vinyl	
Vinamul	II	Acrylic	
Vinatex	III	PVC	
Vinco	III	PVC Coated Fabric	
Vinidur	III	PVC	
Vinifoil	III	PVC	
Vinnol	III	PVC	
Vinylite	IV	Vinyl chloride Vinyl acetate Copolymer	
Vinyon	IV	Vinyl chloride Vinyl acetate Copolymer	
Vistanex	III	Polyisobutylene	
Vistralan	III	Cellulose Rayon	
Visqueen	Ш	Polythene	
Vitel	Ш	Polyethylene	
Vistrathene	III	Polythene	
Vitrite	I	Amino	
Vitrone	IV	Vinyl	
Vole	II	Phenolic & Cresylic	
Vuepak	II	Cellulose Acetate	
Vulcoplas	III	Polysulphide	
Vybak	Ш	PVC	
Vybax	IV	Vinyl	
Vykem	IV	Vinyl	
Vynide	Ш	PVC Coated Fabric	
If solvents are used with Category I classify as Category III or with Categories II or III classify as Category IV			

1 2 3				
Build at a start and a second	Category	Turn of alastic		
Product or trade name	W	Type of plastic		
Wareite	- 1	Amino		
Welvic	III	PVC		
Whale	II	Phenolic & Cresylic		
Wireweld	II	Cellulose Acetate		
	Х			
Xylonite	IV	Cellulose Nitrate		
Y				
	Z			
Zopide	III	PVC Coated Fabric		
Zytel	III	Polyamide - Nylon		
If solvents are used with Category I classify as Category III or with Categories II or III classify as Category IV				

Supplementary List

1	2	3
Product or occupancy	Category	Comments
Product or occupancy		Comments
	1	
	1	
	1	
	1	

1122 Storage - general categorisation

The lists of items for categorisation are not exhaustive and it must be assumed that items of storage not specifically mentioned are regarded automatically as in doubt whereby external consultation will be required.

1123 Fire retardants

The use of fire retardants does not change the category of storage.

1124 Retail and wholesale outlets

Care must be taken when categorising retail and wholesale outlets whether these are standalone structures or incorporated into shopping centres. The highest hazard dictates the overall protection that will be required which is generally found to be Category III.

Where a retail outlet on the floor or selling area utilises picking shelves only, the classification of the occupancy is based on the height of storage against the highest category or hazard of goods stored. Where storage takes place above the hand-picking level, the premises are classed as a warehousing risk and the level of protection shall be in accordance with these rules.

Sporadic storage of aerosols for all occupancies and where beam pallet racking is employed is exempt from the requirements for aerosol storage as detailed in these rules based on the following requirements being adhered to:

- a) Intermediate level sprinkler protection need not be provided if the roof level design density of discharge is in accordance with the requisite Category of storage which need not necessarily be based on aerosol Category IV if the aerosol storage volume is less than 5% of the total product stored but shall not be less than Category III.
- b) If the volume of aerosols exceeds 5% but be equal to or less than 10%, intermediate level protection is mandatory and shall be in accordance with Category IV.
- c) If the volume of aerosols exceeds 10% but be equal to or less than 15% of the stored goods, mandatory intermediate level protection in accordance with these rules to Category IV requirements shall be installed but not necessarily in accordance with the design density of discharge for aerosol requirements for roof level protection.
- d) Where the volume of aerosols is greater than 15% a separate storage facility or compartmentalised facility in accordance with the aerosol requirements must be provided.

In all cases where aerosol storage is less than or equal to 15% of the storage capacity:

- a) Aerosol pallets shall not be stored adjacent to each other in the horizontal plane.
- b) A minimum horizontal distance of not less than 5,2 metres or three pallet loads, whichever is the greater, shall separate pallet loads.
- c) Aerosol pallets may not be stored directly above each other, and
- d) A minimum vertical distance of not less than three tier levels shall separate individual aerosol pallet storage and shall be offset by at least one pallet load.

1125 Transformer and electrical rooms

In situations where there are transformers, switch rooms or other electrical gear housed separately which cannot be protected with water systems, they shall be housed in a 2-hour rated non-combustible compartment and provided with an approved detection system in accordance with the requirements of SANS 10139.

Where sprinkler or spray protection is provided the enclosure or compartment shall be enclosed in a bund to contain at least that required in Rule 1054.

1126 Goods stored in the open - drenchers

Compartmentation and separation between combustible materials stored in the open air and in sprinklered buildings shall be in accordance with National Building Regulations.

Drenchers are purpose made sprinklers and are designed to spray water over a surface to provide protection against fire exposure. The use of standard sprinklers with the fusible elements either in place or removed is not acceptable.

For a single owner or occupier, the separation between combustible materials stored in open air and the sprinklered building shall not be less than 10,0 metres where Table 101 is applicable and 15,0 metres where High Hazard tables are applied or not less than 1,5 times the height of the stored material, whichever is the greater. Where these distances cannot be achieved a drencher system shall be installed.

Goods must be stored in such a way that, in the event of fire, they will not collapse onto the side of the building.

The drencher system must extend along the walls of the protected building to 10,0 metres beyond each end of the stored goods.

The feed for the drenchers must be taken from the upstream side of the installation control valves and shall be manually operated with an automatic over-ride.

The stop valve controlling the drencher installation shall be located near to the sprinkler control valves but must be at least 10,0 metres from the goods stored or from the area where they are expected to operate.

Zones shall not exceed the design capacity of the sprinkler installation.

Drenchers shall be spaced not more than 1,8 metres apart and shall deliver not less than 40 litres per linear metre.

If a fire can be expected to simultaneously operate the drenchers and the sprinkler protection within the building, allowance shall be made for this when calculating the water supplies.

Where goods are stored externally, an external hydrant system shall be installed.

1127 Buildings to be protected

1128 Sprinkler protection general requirement

The protected building must be sprinkler protected throughout and no part of the unsprinklered building or section shall be located below a sprinklered building or section except where the omission of sprinklers is specifically allowed as an exception under these rules. A building which is not so protected will not be classified as a sprinkler protected building.

Sprinklers shall be located so as not to exceed the minimum parameters as given in these rules and shall be installed and located to provide optimum performance in respect of timely activation and distribution.

1129 Buildings communicating directly or indirectly with or adjoining the sprinkler protected building

Every building communicating directly or indirectly with or adjoining the sprinkler protected building must be sprinkler protected throughout or unless allowed as an exception in terms of these rules.

The separation between a sprinkler protected area and a non-protected area shall have a fire resistance specified by the authority but in no case less than 60-minutes, doors shall be self-closing or be closed automatically in the event of a fire.

1130 Exposure hazard from nearby buildings

Any detached building within 10,0 or 15,0 metres, (dependent upon risk), of the protected building which is considered to present an exposure hazard to the protected building, shall be sprinkler protected. Where there are practical difficulties in providing such protection as, for example, the detached building under separate ownership, or is lofty and open on all sides, (e.g. timber storage sheds), and the value of standard sprinkler protection is doubtful, the sprinkler system shall be extended in the protected building to provide external protection. This protection will cover window and door openings and any combustible sections of the wall opposing the exposure hazard.

Sprinkler protection shall be provided in any detached or adjacent building which is within 10,0 metres of the protected building and constitutes an exposure hazard. As a general guide this would include any building that:

Has a capacity exceeding 150 m³.

Is within 10,0 metres of the protected building.

Might present an exposure hazard to the protected building, provided that, where there are practical difficulties in providing protection for a detached building, the sprinkler system of the sprinkler-protected building shall be extended to provide external protection.

Any building or part of a building that houses diesel engine-driven fire pumps.

1131 The sprinkler protected building - Obligatory exceptions

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

- a) Grain silos or grain bins inside buildings that form part of a corn mill, distillery, malting mill or oil mill.
- b) Salt baths, ovens, metal melt pans and hovels and kilns in pottery works, earthenware works, brick works, tile works, and glass works.
- c) Areas, rooms, or places where the water discharged from the sprinkler installation might present a hazard or could endanger personnel.
- d) Over potable water storage where there is danger of contamination of the stored water in the event of sprinkler operation but, sprinkler protection may be located over such places if they are protected by a suitable canopy.

1132 The sprinkler protected building – Permitted exceptions

1133 Staircases and stairways

These include non-combustible stairways, spaces below stair headings, (but not rooms above the stairway), and lift lobbies, provided that:

- a) They are enclosed by structural elements, (such as walls, floors, and ceilings), that have a fire resistance rating not less than 2-hour fire-resistance rating.
- b) all openings to the sprinkler-protected building, (such as doors but other than glazed windows), have a fire resistance rating not less than 2-hour fire-resistance rating.
- c) All glazed areas that issue from these stairways, etc. have a 2-hour fire resistance rating and are protected by cut-off sprinklers on the unprotected side.
- d) Non-combustible stairways where the total area of glazing does not exceed 1,5 metres per storey, provided that such glazed areas have a fire-stability rating and a 2-hour fire resistance rating.
- e) Any stairway that complies in all respects with these provisions except for the ceiling over the top landing if sprinkler protection is provided for such ceiling, and to any rooms above the stairway.
- f) A cut-off sprinkler protects the unprotected side of two areas of which only one is sprinkler protected.

1134 Lifts

Lift shafts and lifts with self-closing metal doors shall have a fire-resistance rating not less than 2-hour.

1135 Toilets – (lavatories, WC's)

These include rooms that present no fire hazard in terms of processes and storage and that are of a minor proportion with respect to the protected floor area at that level, provided that:

- a) All structural elements or components of the room, (such as walls, floors, and ceilings), have a fire- resistance rating not less than 1-hour.
- b) All openings to the sprinkler-protected building, (such as doors but other than glazed windows), have a fire-resistance rating not less than the 1-hour fire-resistance rating and are protected by cut-off sprinklers on the unprotected side.
- c) All glazed areas that issue from such rooms have a fire-resistance rating not less than 2-hour and are protected by cut-off sprinklers on the unprotected side.
- d) Any such room or compartment of which the floor area exceeds 9 m² is equipped with suitable manual fire-fighting equipment.
- e) There is no common ceiling or floor void space to the rest of the premises.

1136 Additional considerations

The protection of the openings between the two non-sprinkler protected buildings is not required if the indirectly communicating building is not at any point within 10,0 metres of the sprinkler protected building, and the directly communicating building is of non-combustible construction without combustible linings to walls and roof and is occupied as offices or for purposes not involving the use or storage of combustible materials.

Window openings shall be fixed and fitted with suitably rated glass such as heat strengthened or tempered. Sprinklers used shall be specifically listed and approved as window drenchers. Cognisance shall be taken of any horizontal or vertical obstructions and, if necessary, sprinklers shall be fitted to both sides of the glazing. These following areas shall be separated from the sprinkler protected portions of the building in accordance with the authority having jurisdiction or be provided with an appropriate automatic fire extinguishing system as detailed:

In the case of rooms or compartments containing electronic apparatus, having walls of combustible materials and ceilings of non-combustible materials, or underdrawn with non-combustible materials provided that a line of open window drenchers is fitted outside the room or compartment along the combustible walls and operated by multiple-jet-controls within the room or compartment.

Silos or bins constructed to provide a fire rating in accordance with the authority for the storage of grain inside buildings forming part of corn mill, distillery, malting or oil mill premises where the substances expand on contact with water.

Near industrial furnaces, ovens, kilns, salt baths, smelting ladles or similar equipment, the undersides of screens or shields erected over the wet ends of paper-making machines and if the hazard would be increased using water to extinguish a fire.

A shed, building or storey separated from the sprinkler protected building by a wall constructed to provide a fire rating in accordance with the authority in which all openings are protected by approved fireproof doors or fireproof shutters or approved wood fire doors with cut-off sprinklers.

A building occupied solely as offices or private dwelling, separated from the sprinkler protected buildings by a wall constructed to provide a fire rating in accordance with the authority or cavity wall in which all door openings are protected by single approved fireproof doors or single approved fireproof shutters, or approved wood doors with cut-off sprinklers.

A building communicating with a sprinkler protected building through a fireproof staircase, provided that all openings to the staircase from the non-sprinkler protected building are protected by single approved fireproof doors or single approved fireproof shutters, or approved hardwood doors and cut-off sprinkler inside the non-sprinkler protected building.

1137 Life safety installations

In general, sprinkler protection shall be provided in all areas where a life safety installation is required to maintain safe conditions for the evacuation of persons from sprinkler-protected areas.

A life safety building cannot be classified as High Hazard.

1138 Partial protection

Partial protection is the single largest cause of sprinkler failure. Partial protection is loosely defined as a portion of premises being sprinkler protected with communicating sections that are not.

Partial protection can lead to a fire originating in the protected area radiating heat into the unprotected portion of the premises and starting secondary fires. The heat from these fires radiates or spreads back into the protected area causing excessive sprinkler operation. This results in a lowering of the available water flow and pressure, excessive fire, water and smoke damage and probable loss of the premises.

Conversely, a fire originating in the unprotected portion will radiate heat or spread into the protected portion rapidly causing unnecessary sprinkler operation overwhelming the sprinkler system installed.

1139 Fire resisting doors

An approved fire resisting door shall comply with the requirements of SANS 1253:2003 and Table 139:

- a) Must be complete with doorframe and associated hardware assembly.
- b) Must be identical to the original SANS 1253 -tested door.
- c) Must bear a metal label indicating SANS 1253 approval.
- d) Must comply with the time and size requirements of SANS 1253.

All fire resisting doors must be fitted with automatic devices capable of closing them from any set position and of holding doors open. Manual movements of the doors must not be prevented by the automatic device. Where double doors are installed a leaf co-ordinator mechanism shall be fitted.

Table 139 Fire door minimum resistance period

1	2	3	4
S laves	Minimum resistance periods, minutes		
Class	Stability	Integrity	Insulation
А	60	30	30
В	120	60	60
С	120	120	No Requirement
D	120	120	120
E	30	30	30
F	30	30	No Requirement

For perfect separation between fire resisting floors:

- a) One suitably classed fire door is required to be fitted to every opening on each floor.
- b) An individual floor may be deemed a separate risk if each opening from that floor is protected by one Class B, (or C or D), door and cut-off sprinklers.
- c) For perfect separation between buildings having perfect walls constructed to provide a 120-minute fire rating:
- d) Class A or B doors are not adequate to protect openings.
- e) Class C doors may be used to protect openings if two doors at least 1,0 metre apart if fitted to each opening, the opening must be protected by 230 mm brickwork having a concrete slab for a roof so that a fire-resisting cubicle is formed.

1140 Provision of hand extinguishing appliances – General requirements

Hand extinguishing appliances are necessary adjuncts of sprinkler protection. Their main use is in the extinguishment of fires in the incipient stages before the sprinklers are brought into operation and for final extinguishment of the small remnants of combustion which may not have been completely extinguished following the operation of the sprinklers. It is therefore necessary in the case of sprinkler protected premises for hand extinguishing appliances to be provided as required in SANS 10400 TT 37.

A hose reel complying with the requirements of SANS 543:2004 and bearing this mark of approval shall count as six units providing that coverage of the entire premises is achieved considering partitions, walls, and obstructions.

Fire hose reel feeds are permitted to be taken from a 50 mm connection from the upstream side of the installation control valve assembly only. The water flow and pressure requirement of the hose reels shall be considered when calculating the water demand for the sprinkler system.

SECTION 2: WATER SUPPLIES

2000 General requirements

Water supplies shall be under the control of the occupier of the building containing the installation. Where this is not practicable, the right of use of the supply must be suitably guaranteed.

The water for a sprinkler installation must be potable and free from fibrous or other matter in suspension which may be liable to cause accumulation in the system pipework is obligatory.

Where the water supply is likely to be predisposed to microbiologically influenced corrosion, steps such as introducing a suitable biocide into the water must be taken.

Additives or chemicals shall not be used in sprinkler systems unless these have been proven to have no detrimental effect.

The use of salt or brackish water is not allowed. In special circumstances where there is no fresh water source available, consideration may be given to the use of salt or brackish water, provided that the installation is normally charged with fresh water and the system operation is not compromised.

The sprinkler water supply must have a pressure/flow characteristic that will adequately supply the simultaneous operation of the hose reels and sprinkler system to the requisite design criteria. It must be automatic and thoroughly reliable and not subject to either freezing or drought conditions that could deplete the supply.

The maximum allowable static pressure, (non-flowing), under any circumstances, shall not exceed 1,200 kPa in any part of a sprinkler installation with the water supply at the normal level.

Should the static or non-flowing pressure exceed 1,200 kPa, suitable measures shall be taken to limit this accordingly.

2001 Connections to other services

The supply pipe or the pipe that connects the water supply to the trunk main of a sprinkler system or to the sprinkler installation valves must not have any connections except as indicated in Table 201 and all connections must be provided with a stop valve near the supply pipe.

The pumps and the water source of a sprinkler system shall be separate from any pumps and water source of the hydrant installation except as allowed for in these rules.

Table 201 Allowable water supply connections

1	2
Water supply type	Acceptable connections
A town main supply where the supply pipe is not a dead end and nominal diameter is not less than 100 mm where fed from both ends. In the case of a dead-end feed, the supply pipe shall be 150 mm nominal diameter	40 mm for non-industrial or domestic use 50 mm fire hose reel connection taken upstream of the alarm valve
Elevated private reservoir	50 mm fire hose reel connection taken upstream of the alarm valve
Gravity tank	50 mm fire hose reel connection taken upstream of the alarm valve
Automatic pump	50 mm fire hose reel connection taken upstream of the alarm valve

2002 Internal ring mains

Where there is a ring main within the premises, it is permissible to provide isolating stop valves of the indicating type normally chained and padlocked in the open position and situated to maintain the maximum possible service in the event of fracture or if necessary, to close part of the ring main.

2003 Required number of supplies

Sprinkler systems are graded according to the number and type of water supplies available. There are two classes, and each supply shall comply with the requirements of these rules:

Single water supply:

- a. Town main.
- b. Elevated private reservoir.
- c. Gravity tank.
- d. Diesel engine driven pump drawing from an approved subdivided or two 50% capacity suction tank(s).
- e. A single supply for a High Hazard system may be accepted on the basis that the supply is thoroughly reliable and the water supply as well as the sprinkler system is tested in accordance with the minimum requirements as detailed in these rules. Hard copies of these tests are kept on and off site as proof of compliance.
- f. All maintenance checks and schedules must be carried out as required. Where installed, the pump house remote alarm notification and data logging unit must always be operational and shall be connected to the person/s responsible for the system testing and maintenance.

A failure to produce the required documentation means that the system does not comply with these rules.

Duplicate water supplies:

- a) Duplicate water supplies are strongly recommended for High Hazard systems due to the nature of these risks. This ensures that should one supply be out of service for any reason, the alternative supply is operational.
- b) Duplicate water supplies are strongly recommended for Early Suppression Fast Response systems.

Duplicate water supplies are required for the following types of sprinkler installations:

- a) Life Safety.
- b) Water supplies that are designed for the simultaneous operation of sprinklers, hydrants, and hose reels.
- c) Installations that feed multi-tenancy industrial sites under multiple ownership.

Note:

Hydrants shall be installed on a separate reticulation. The connection to the hydrant reticulation shall be taken upstream of the installation control valve assembly.

Multi-tenancy industrial sites under single ownership require duplicate water supplies. Should single ownership change to multiple ownership, duplicate water supplies may be required for each occupancy.

The following combinations of water supplies are regarded as affording a duplicate water supply service:

- a) Two town mains that are not interconnected.
- b) Town main and elevated private reservoir or gravity tank.
- c) Town main and diesel engine driven pump.
- d) Diesel engine driven pump and elevated private reservoir or gravity tank provided the latter does not form the source of supply to the diesel engine driven pump.
- e) Two elevated private reservoirs or gravity tanks.
- f) Two automatic pumps where the primary pump may be electric motor driven and the secondary pump shall be diesel engine driven drawing from approved subdivided or two 50% capacity suction tank(s). This arrangement assumes that the pumps are not operating in parallel but independent of one another and, where possible, have similar characteristics at all flow and pressure rates. Where flows and pressures differ, each unit shall be treated as a separate supply for design and calculation purposes.
- g) Three automatic 50% capacity pumps, all of which are diesel engine driven. They shall have identical characteristic curves and be capable of operating in parallel at all possible flow and pressures rates of the sprinkler installations drawing from approved subdivided or two 50% capacity suction tank(s).

2004 Acceptable sources of supply

2005 General

The use of potable water is obligatory.

In-line boosting of a water supply is not permitted.

Where fire pumps form the supply for a sprinkler system, pumping in series is not permitted.

The use of a water supply in two or more buildings under separate ownership is not allowed.

2006 Town main

The main must be capable of furnishing at all times of the day and night the minimum pressure to flow requirements for the simultaneous operation of the hydrants, hose reels and sprinkler system to the requisite design criteria.

The main shall preferably be fed at both ends and each end shall be capable of satisfying the flow and pressure demands.

Terminal mains or branch dead end mains shall not be less than 150 mm diameter.

Each town main connection shall be fitted with a pressure gauge between the supply pipe stop valve and the non-return valve which shall be designated the installation control valve "A" gauge.

The town main network must be fed from a source of at least 1000 m³ capacity plus 90 times the maximum envisaged flow requirements for the simultaneous operation of the hydrants, hose reels and sprinkler system to the requisite design criteria.

Any stop valves, apart from those under the control of the Water Authority, on the branch connection from the town main must be secured open with a chain and padlock, (keyed alike), and under the control of the occupier of the building containing the installation.

Where a town main supply forms part of a duplicate water supply with a pumped water supply, the town main shall be classed as the secondary supply. The pump starting pressure shall be set to above the highest known town main static pressure.

The pressure and flow capacity of town mains are normally not guaranteed by the local authority and flow from such mains to the sprinkler installation might be reduced by fire brigade operations.

If an installation has a town main supply, a reduction in pressure can have adverse consequences. A supply of stored water increases security in this respect.

The water pressure in the town mains shall be measured during a flow test at a period of maximum demand and shall be adjusted to take account of static head and friction losses between the test point and the position of the installation control valve "C" or installation pressure gauge.

At the proposed point or points of the connection to the town main feeding the sprinkler installation, a pressure recording chart shall be installed for not less than seven continuous days, to prove the integrity of the supply.

Where a town's main forms one or both supplies the usable characteristic of that main shall be assumed to be 85% of the available pressure at the "C" gauge over the flow range achieved at test during a period of maximum demand. In no case shall the assumed pressure reduction be less than 50 kPa.

Where it is proposed to utilise two mains as a duplicate service, in addition to the requirements mentioned above:

- a) Both incoming mains must be independent, may not form part of an interconnected system and shall have stop valves so arranged that in the event of a breakdown anywhere in the system from the boundary, at least one of the mains to the installation can remain operative.
- b) The system must be fed from more than one reservoir.

2007 Water meters

Sprinkler connections should not be metered. Should a Water Authority insist on metering, a guarantee will be required that any device fitted will not reduce the flow or pressure or be subject to non-operation due to foreign matter.

2008 Automatic pumps

2009 General

Where a single pump is required and this constitutes the primary supply, the prime mover shall be a diesel engine.

Electric motor driven pumps may not be used as a primary supply unless it constitutes a duplicate water supply whereby the second pump is diesel engine driven.

It is permissible to combine the flows for sprinklers and hydrants for a site under single or common ownership provided that:

- The quantity of stored water for the hydrants is not less than that stated in Column 3 of Table 202.
- b) The flow of the pump shall be increased in accordance with Column 4 of Table 202.
- c) Any hydrant shall be fed upstream of the installation control valve assemblies.
- d) A duplicate water supply is provided.

The reticulation feeding the combined system shall, where possible, be fed from a ring or looped main reticulation and sized in a manner whereby should one leg or portion of the reticulation be isolated, the combined flow and pressure of the simultaneous operation of hydrants, hose reels and sprinkler system will not be compromised upstream or downstream of the isolated portion.

2010 General requirements for suction, elevated and gravity tanks

Before erection of the tank, the installing company shall ensure that any supporting structures and ground conditions comply with the manufacturer's recommendations.

Tank capacities shall not be sized dependent upon infill.

The quantity of water required for the sprinkler installation must be automatically maintained.

The tank fill pipe must be fitted with a strainer, stop cock and pressure gauge.

The water supply temperature should not be less than 4° C or exceed 25° C.

The location of the tanks shall be such that the tank and structure are not subject to fire exposure. If a lack of available space makes this impractical any exposed steelwork shall be suitably fireproofed or shall be protected by open sprinklers. Fireproofing is deemed to be necessary for steelwork within 10,0 metres of exposures, combustible buildings or windows, and doors from which a fire may issue.

All steelwork, including any roof steel of a suction tank shall be protected against corrosion.

Any tank, together with the inlet and outlet pipes must be adequately protected against freezing where exposed to severe climatic conditions.

The fill line outlet and test return line shall be orientated so that it discharges water a minimum of 4,6 metres horizontally, from any part of the vortex inhibitor or suction inlet pipe.

Dependent upon the sprinkler classification and type of tank, the tank must have an effective holding capacity of either 60-minutes for Ordinary Hazard and 60 or 90-minutes for High Hazard of the maximum envisaged flow demand of the installations hydraulically calculated requirements or as required by these rules. Should the capacity of the tank exceed these requirements, it is permissible to draw upon the surplus for other purposes by means of an outlet pipe which must be taken out of the side of the tank above the level of the quantity to be reserved for the sprinkler installation.

All valves associated with the water supply shall be at or near ground level and readily accessible for exercising, testing and maintenance without the use of ladders or scaffold.

The tank shall be fitted with content gauges or an indicator of the flag and ball type or other approved indicator style which shall show the depth of water therein. The use of glass or plastic tube which indicates the level of the water is not acceptable due to clouding.

Flow control valves shall be used to refill the tank automatically and shall be set to operate when the water level is a maximum of 150 mm below the overflow level.

The tank shall be completely enclosed and fitted with a substantial rigid roof that will carry the weight of a person/s without distortion and serving to protect against rain, snow, sunlight, wind, extremes of temperature, and does not become contaminated with extraneous matter such as dirt insects and vermin.

The roof structure shall be sloped or domed to prevent the accumulation of water and the roof sheets shall overhang the tank walls by 100 mm nominally.

Adequately sized overflow pipes and drainage facilities of not less than 100 mm diameter taken out of the side of the tank shall be provided and taken to a suitable drainage point.

The tank must be fitted with an approved indicator showing the depth of water therein. The water must be kept clean and free from sediment and the tank must be cleaned at least once in every 3-years or as required by these rules, when it must be treated inside if this is found to be necessary. The opportunity shall be taken at this time to examine and overhaul all back pressure and stop valves.

A substantial permanent ladder or stairway extending a sufficient distance above the top of the tank shall be provided to permit easy access.

Galvanised tanks shall conform to SANS 121/ISO 1461 specifications.

2011 Elevated private reservoirs

An elevated private reservoir is defined as a ground reservoir situated at a higher level than the premises to be protected, which is under the sole control of the owner of the installation.

Where such reservoirs serve other than the sprinkler installation, for example, water for trade and domestic purposes, there must be a constant capacity of at least 1000 m³ plus 90 times the maximum envisaged flow requirement for the simultaneous operation of the hose reels and sprinkler system to the requisite design criteria.

The tank, if the materials used are subject to corrosion, shall be painted or given other suitable protection which reduces the need for emptying the tank for maintenance to periods of not less than 10-years.

2012 Gravity tanks

A gravity tank is defined as a purpose-built water container, erected on the site of the protected premises at such an elevation as to provide the requisite pressure to flow conditions at the installation valves. The tank is to be subdivided equally.

If the tank forms the sole supply to the sprinkler system, the supply to the tank must be capable of refilling to the capacity required within 6-hours.

If the rate of input of the supply to the tank is less than that required to refill it within 6-hours, the capacity of the tank shall be increased by the amount of the shortfall.

When a gravity tank forms one of the supplies, the non-return valve on the supply pipe therefrom must be fixed not less than 5,0 metres below the base of the reservoir or tank.

2013 Minimum capacity of water supplies

Dams, lakes, rivers, canals, water features and swimming pools are not acceptable for use as suction tanks.

The minimum capacities of stored water entirely reserved for wet pipe sprinkler systems, shall be derived from:

- a) 60 times the intercept of the system curves as shown in Figure 711 for Qmax with the suction source at its normal level when overlaid against the pump curve for Ordinary Hazard systems and Early Suppression Fast Response systems, (0,060 × Qmax = m³).
- b) 90 times that of the intercept of the system curves as shown in Figure 711 for Qmax with the suction source at its normal level when overlaid against the pump curve for High Hazard systems, $(0.090 \times \text{Qmax} = \text{m}^3)$.

2014 Elevated, gravity and suction tanks

In all cases each tank provide a stored water supply each tank shall be provided with a plate issued by the approving company stating the following:

- a) Name of the company that supplied the tank/s.
- b) Date of installation.
- c) The tank approval number.
- d) The type of tank, i.e., welded steel, sectional steel, bladder tank or other.
- e) Whether or not a vortex inhibitor has been installed.
- f) Required service/refurbishment or inspection interval. (Usually a 3-yearly inspection interval.)

Unless the effective stored capacity is proven or required otherwise by hydraulic calculation in accordance with these rules, the effective stored tank capacity shall not be less than that stated in Table 202 to Table 207 and increased by 25% for dry pipe systems or as required.

2015 Hydrant suction tank allowance

Should a coupling that enables the fire department to draw water from the sprinkler suction tank be installed or the suction tank be used to feed the hydrant reticulation, the effective tank capacity shall be increased in accordance with Column 3 of Table 202.

Table 202 Hydrant suction tank allowance

1	2	3	4
Hydrant consideration	Hazard classification	Minimum additional effective tank capacity (m³)	Flow (litres per minute)
1 hydrant	Ordinary Hazard	72	1,200
2 hydrants	High Hazard	220	2,400
3 hydrants	High Hazard	325	3,600

Table 203 Ordinary Hazard minimum tank capacity

1	2	3
Assumed maximum area of operation (m²)	Height of highest sprinkler above control valve assembly (m)	Minimum tank capacity (m³)
	15	150
216	30	175
	45	200
	15	260
360	30	325
	45	375

Table 204 Ordinary Hazard minimum tank capacity

1	2	3
Assumed maximum area of operation (% Reduction of 216 m²)	Height of highest sprinkler above control valve assembly (m)	Minimum tank capacity (m³)
40		90
30	45	105
20	15	120
10		135
40		105
30	30	125
20		140
10		160
40		120
30	45	140
20	45	160
10		180

Table 205 ESFR sprinkler installations minimum tank capacity

1	2
Nominal K-Factor	Minimum tank capacity (m³)
20,0	450
24,2	475
32,0	550
36,0	675

Table 206 High Hazard roof level protection minimum tank capacity

1	2
Design density of discharge (mm/minute/m²)	Minimum tank capacity (m³)
7,5	280
10,0	370
12,5	460
15,0	550
17,5	590
20,0	650
22,5	740
25,0	830
27,5	920
30,0	1010

Where rack or shelf protection is installed in conjunction with roof level protection, the following additional allowance per sprinkler shall be added to the suction tank storage capacity for roof or ceiling level protection:

Table 207 Rack or shelf sprinkler minimum tank capacity

1	2	3
K-Factor (metric)	Discharge pressure (kPa)	Additional capacity per operating sprinkler (m³)
8,0	200	12
8,0	350	17
11,5	100	12
11,5	200	18
11,5	350	24

2016 Pump suction tanks

These rules provide for full holding pump suction tanks only. The suction tanks shall be subdivided into two equal divisions so that 50% of the required supply shall be available during maintenance. Alternatively, two separate tanks of 50% capacity may be used providing that the layout and positioning of the tanks in relation to the pump house are symmetrical.

Provision must be made for the pumps to draw from either tank so that when one tank is rendered inoperative for cleaning or maintenance, the other tank is available for all pumps.

Provision must be made for each section of the suction tank to be isolated for cleaning and maintenance purposes.

Where necessary, provision shall be made at the point where the supply water enters the tanks for suitable baffles to ensure the minimum entrainment of air when the pump is operational.

The inflow to a tank shall not be less than that required to fill the tanks within 36-hours. The automatic fill line shall not be less than 100 mm nominal diameter and fitted with a permanently attached direct reading flow test assembly calibrated to match the required inflow. The fill line outlet and test return line shall be orientated so that it discharges water a minimum of 4,6 metres horizontally, from any part of the vortex inhibitor or suction inlet pipe.

Where the pressure characteristic of the town main is not capable of operating a flow control valve or is beneath the minimum infill rate, equilibrium float valves or a suitable inline booster pump, automatic in operation, shall be fitted to the tank infill pipe sized in accordance with the required rate of infill and of the same construction for a jockey or make-up pump as detailed in these rules.

An easily accessible hinged, roof hatch that can be locked with a minimum dimension of 750 mm by 750 mm shall be provided for the roof to access to the infill valves and entry into the tank. The opening shall have a curb of not less than 100 mm high and the cover shall have a minimum downward overlap of 50 mm.

Suitable platforms shall be provided for the access hatches with a minimum platform area of not less than 800 mm by 600 mm. All platforms shall be supplied with handrails to facilitate access to and from the internal and external ladders.

Where inspection hatches are installed at the base of the tank for maintenance purposes, they shall not be less than 600 mm diameter. If inspection hatches are not installed, internal ladders shall be constructed of a suitable material not subject to corrosion.

Outside steel ladders that are arranged for convenient passage from one tank to the other and through the roof hatch shall be provided. Ladders shall not interfere with the opening of the roof hatch cover and shall not incline outward from the vertical at any point.

Ladders shall comply with the relevant safety provisions and shall be fitted with a suitable cage.

At least one anchor point shall be provided on the handrail for the attachment of safety equipment used by personnel entering the tank.

Platforms shall have provision for fastening the internal and external ladders.

Platforms shall be fitted with an approved safety rail. This safety rail shall restrict access to areas of the roof other than the access hatch.

Allowance is made for three types of suction tanks:

The tank must be constructed and suitably protected against corrosion in such a way and from such materials as to obviate the need for emptying, cleaning, maintenance, or repair to the fabric of the tank for a period of not less than 15-years. Concrete and galvanised sectional steel tanks generally comply with this requirement although the fabric of the tank shall be examined every 3-years.

The tank must be constructed and suitably protected against corrosion in such a way and from such materials as to obviate the need for emptying, cleaning, maintenance, or repair to the fabric of the tank for a period of not less than 3-years. Welded circular steel tanks generally comply with this requirement.

Where bladder tanks or tanks that use an internal lining are used, the manufacturers' recommendations must be taken.

Should it be necessary to empty one of the tanks for maintenance, the tank must be cleaned in a short as time as possible reducing any delay to a minimum.

Where alternative protection is used, the lining shall be applied and maintained in accordance with the recommendations of the product manufacturer.

A record of the refurbishment or maintenance shall be permanently attached to the tank and updated as required.

2017 Pump suction balance tanks – (Slave or make-up tanks)

A balance tank shall be gravity fed without the use of any mechanical or motorised devices to achieve the required full holding capacity of the sprinkler system as defined as Qmax.

Where a balance tank is retrofitted to make up the minimum amount of stored water, the feed from the tank shall not connect into the primary tanks suction line but into the fabric of the tank or subdivisions.

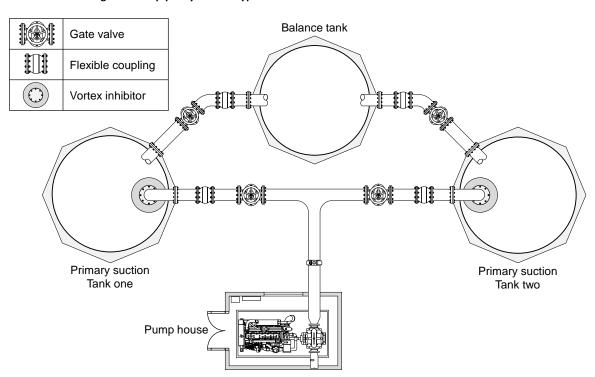
The feed pipe from the balance tank leading into the primary suction tanks shall be sized one diameter larger than the suction line feeding the fire pumps.

The balance pipework shall not be fitted with a vortex inhibitor or any other device or fitting that may restrict gravitational flow.

The balance tanks feeds to the primary suction tanks is not required to be symmetrical in layout.

The valves and flexible couplings shall be arranged to allow maintenance to be carried out without isolating the entire water supply.

Figure 201: Positioning and feed pipe layout of a typical balance or slave tank



2018 Pump suction tank sumps

An approved vortex inhibitor shall be fitted to all suction pipes unless circumstances do not allow for the installation.

In calculating the effective capacity of a pump suction tank, the depth shall be taken as the measurement between the normal water level in the tank or reservoir "N" and the low water level "X" shown in Figures 204, 205 and 206 which is the level above the inlet to the suction pipe determined by Dimension "A" in Column 2 of Table 208

Low water level "X" is calculated to be the lowest level before a vortex is created and the pump would draw air. Where an approved Vortex inhibitor is installed, dimension "A" in Table 208, the low water level "X" can be taken as 100 mm above the top flange attachment for the suction pipe.

When a suction pipe is not fitted with an approved vortex inhibitor and is taken from the side of the tank as in Figures 211 and 212, there must be a clearance of not less than that shown as Dimension "B" in Column 2 of Table 208, between the base of the tank and the lowest level of the pump suction pipe.

Where, under special circumstances, a vortex inhibitor could not be installed within a pump suction tank, the effective stored capacity of the tank shall be taken as starting as dimension "A" in Table 208 above the top of the suction pipe.

Where an approved vortex inhibitor is installed in accordance with Figures 204, 205, and 206 and is seated on the base of the tank or sump, dimension "B" of Table 208 may be taken from the base of the sump or suction tank to the vortex inhibitor top flange attachment. In the case of Figure 206, this is not an appropriate arrangement for the employment of a vortex inhibitor.

Where the suction pipe draws water from a sump at the base of a suction tank, the dimensions of the sump shall not be less than that in Figures 204, 205, and 206 as applicable and specified.

Table 208 Suction pipe inlet clearances

1	2	3	4	5
Nominal diameter of suction pipe "D" (mm)	¹ Dimension "B" minimum dimension from the suction pipe to the bottom of the sump (mm)	Dimension "A" without an approved vortex inhibitor (mm)	Dimension "A" with an approved vortex inhibitor (mm)	Minimum diameter of vortex inhibitor "V" (mm)
65	85	250	100	200
80	90	310	100	250
100	100	370	100	400
150	100	500	100	600
200	150	620	100	800
250	200	750	100	1000
300	200	900	100	1200
350	300	1050	100	1200
400	300	1050	100	1200
450	350	1200	100	1200
500	350	1200	100	1200

¹ Dimension "B" is the minimum distance without a vortex inhibitor installed or is the width of the approved vortex inhibitor to the upper flange when this equipment is installed.

Figure 202: Typical vortex inhibitor

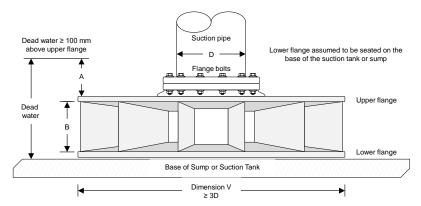


Figure 203: Typical minimum dimensions of clearances from tank sides and division walls and sumps

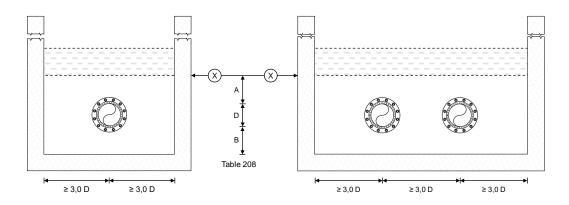


Figure 204: Effective capacity of a suction tank (A)

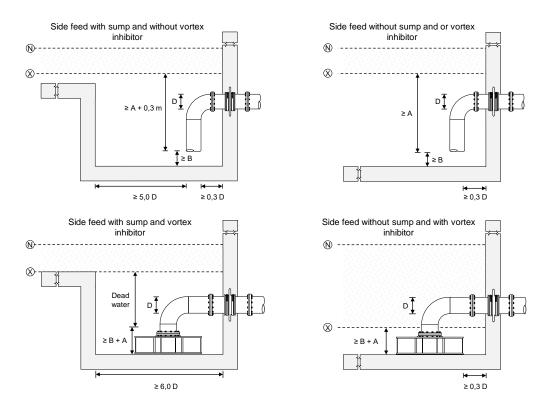


Figure 205: Effective capacity of a suction tank (B)

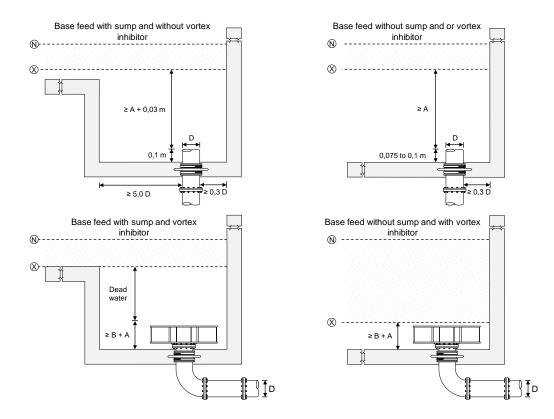
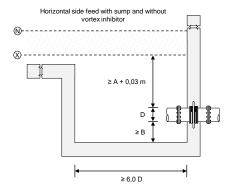
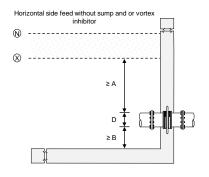


Figure 206: Effective capacity of suction tank (C)





2019 Automatic pump

2020 General

The approved sprinkler installer shall be responsible for the supply and installation of automatic pumping sets which must conform to these rules.

A pump shall have a stable head overflow curve, i.e., one in which the maximum head and shut off head are coincidental, and the total head declines continuously with an increasing rate of flow.

Pump sets shall be capable of satisfying the flow rate and pressure requirements of any assumed maximum areas of operation in the system under consideration when the pump suction tank level is at the low water line.

The pump shall provide a pressure of at least 50 kPa higher than that required for the most unfavourable assumed maximum area of operation, (Pmax).

The maximum predicted flow shall be assumed to occur at the intercept of the system demand flow/pressure relationship for the hydraulically most favourable assumed maximum area of operation with the pump performance flow/pressure characteristic when the pump suction tank water level is at the high water line, (Qmax).

An automatic pump shall start automatically and shall be stopped manually.

The fire pump, driver, controller, water, and power supply shall be protected against possible interruption of service through damage caused by weathering of any description, explosion, fire, rodents, insects, vandalism, or any other adverse condition.

Where more than one pump is installed, they shall have compatible characteristic curves and be capable of operating in parallel at all possible flow rates.

All main isolating and test valves within and outside the pump house shall be secured in their correct operative positions with 25 mm link chain and padlocks and subsidiary valves with light chain and padlocks which are keyed alike.

Pumping in series is not an acceptable configuration for sprinkler systems.

2021 Air Release Valves

Fire pumps shall be provided with an approved float-operated air release valve having a nominal minimum diameter of not less than 12,5 mm discharging to atmosphere.

2022 Pump room

A pump house is the most critical part of a sprinkler system. The fire pumps shall to be housed within a structure classed as fireproof that will resist the passage of flames for the required time frame as stipulated in order to retain structural stability, insulation, and integrity for the expected period.

Steel shipping container are not suitable as pump houses for the South African environment and have proven to be problematic in most cases.

The pump room must always be locked and a notice stating where the keys are obtainable must be mounted on the door.

Fire pumps shall be housed as follows:

- a) The pump house is to be located between 6,0 and 15,0 metres away from the protected building dependent on the code, standard or rules applied.
- b) The construction is to be 120-minute fire rated but can be reduced to 60-minutes if the premises are fully sprinkler protected.
- c) The separation between a pump house and the protected premises where space is restricted must be via a fire wall of 120-minute rating.

Internal Pump House

a) The pump house situated within a building shall be separated from the rest of the building by a 120-minute rated compartment where access is from the outside and not through the protected building. The doors to the pump house are to be D-Class and rated for 120-minutes. If the pump house is located at or below the ground level, the entrance, or other means of access to it shall be from a street, public place, or an open area on the site.

External Pump House

- a) The pump house will be separated from a protected building by 15,0 metres if that building is not fully sprinkler protected.
- b) The pump house will be separated from a protected building by 6,0 metres if that building is fully sprinkler protected.
- c) The pump house will be separated from a protected building by a 120-minute rated fire wall where it is positioned against the premises being protected or within the 6,0-metre radius.
- d) The pump house will be constructed of 220 mm brick.
- e) The roof will be concrete of at least 100 mm thickness.
- f) A crawl beam will be centrally located to enable a chain block and tackle to be attached capable of lifting the heaviest weight of any piece of equipment.
- g) The doors will be D-Class and rated for 120-minutes.
- h) Louvres will be exempt from the 60- or 120-minute requirement.
- Windows shall be fitted with Georgian wired glass and are exempt from the 60- or 120-minute requirement.

Equipment, such as pumps, elevated private reservoirs and gravity tanks shall not be housed in buildings or sections of premises where hazardous processes are undertaken or where there are explosion hazards.

The temperature of the pump room shall be maintained above 10° C where compression ignition type engines are used. Adequate natural and mechanical ventilation must be provided and increased, if necessary, to limit the temperature rise in the pump room to not more than 10° C above the ambient temperature under stationary to engine full load conditions for a period of not less than 6-hours.

Mechanical extraction shall be positioned at high level close to the roof or ceiling of the pump house whereas louvers shall, where possible, be positioned at a lower level to draw air across the diesel engine.

Table 209 Mechanical ventilation air extraction for pump houses

1	2
Size of engine	Minimum air extraction (m³ per minute)
2 and 3-cylinder naturally aspirated	6
4-cylinder naturally aspirated	6
4-cylinder turbo charged	6
6-cylinder naturally aspirated	6
6-cylinder turbo charged	12
8-cylinder engines	15
Above 7 litre capacity	20

Where it is impractical to heat the pump house to the required temperature, all equipment within the pump house shall be heated to 10° C.

All gauges, isolation devices, test valves, control valves shall be located no more than 1,7 metres above floor, walkway or platform level and shall be easily accessible, visible, and free of clutter.

Where appropriate, platforms, steps or elevated walkways shall be provided to negate trip hazards and obstacles. Positioning of equipment close to exhaust pipes or manifolds shall be avoided.

Artificial and emergency lighting shall be provided within the pump house and lighting levels shall not be less than 500 lux. Where possible lighting switches shall be positioned adjacent to the entry to the pump house or room.

Sufficient natural lighting is recommended, (where the pump house is located above ground). Access doors are not acceptable for providing natural lighting.

All equipment within the pump room must be clearly labelled and tagged. This in turn shall relate to comprehensive operating instructions detailing the required testing and maintenance routine.

2023 Pump house protection

Where a pump room is situated remote from the sprinkler protected premises, such that it is impracticable to provide sprinkler protection from one or other of the installation control valve sets in the premises, the sprinkler protection in such a pump house may be supplied from the nearest accessible point on the downstream side of the non-return valve on the supply pipe from the pump.

In such cases there shall be a controlling stop valve, (secured in the open position), fitted on the supply pipe to the sprinklers together with an approved alarm device with visible and audible indications of the operation of the sprinklers provided at the pump house.

The alarm shall be in an approved position at a responsibly manned location in the plant or on the premises.

A 15 mm drain valve must be provided downstream of the flow alarm to permit a practical test of the alarm system.

Sprinklers for the protection of a pump room shall have a minimum operating temperature of 93° C.

No sprinkler shall be located within 800 mm of the diesel engine exhaust pipe.

2024 Pump house drainage

Provisions shall be made for the pump house floor to be sloped to provide natural drainage of the pump room where the pump room is above finished ground level.

An adequately sized sump pump must be provided, and a high-water level warning device fitted to this for pump rooms which are partially below the finished ground level.

The cooling water from the engine jacket and the leak off water from the pumps shall be taken back to the suction tank or to a suitable drainage point.

All test and drainage lines within the pump house shall be taken separately to a suitable drainage point or facility external to the pump house whereby the discharging water will not wet the person testing the system.

2025 Pump house pipework

The pump house must be arranged and sized to allow easy unobstructed access to pipework, pump units and controlling equipment.

All pressure gauges within the pump house must conform to the requirements of these rules.

A clearance of not less than 5,0 mm shall be allowed around all pipes that pass-through walls or floors of the pump room to provide relief against any movement. The space around the pipe shall be watertight and packed with mineral fibre, asphalt mastic or other suitable material held in place with collars on each side.

There shall be a suitable number of joints on the pipework to allow any of the equipment to be removed for overhauling or replacement to minimise the amount of time the fire pump is inoperative for maintenance or other reasons.

The weight of pump suction pipework, delivery pipework and valves, and any dynamic forces acting on them shall be carried by purpose made pipe supports and not by the pump branches.

All pipework must be suitably supported with at least one support on both suction and delivery as close to the pump casing as possible and no strain shall be imposed on the pump casing by the pipework.

It shall be possible to unbolt suction and delivery flange bolts on the pump and no visible movement shall be observed in the pipework at this time.

Pump test lines shall be adequately anchored and restrained.

2026 Pump foundations

The pump and driver shall be mounted on a common base plate and connected by the means of a flexible coupling. A suitable coupling guard shall be fitted over the flexile coupling.

Provision shall be made for lifting lugs permanently attached to the base plate for safe rigging of the pump unit.

The base plate shall be securely attached to a concrete foundation in accordance with the manufacturers' specifications.

The pump and driver mounted on the common base plate shall be fixed by way of foundation bolts to a reinforced concrete foundation plinth which shall either be a:

a) **Foundation Plinth:** Cast as an integral part of the pump room floor, or

b) **Floating Plinth:** Cast as a separate foundation, set into the pump room floor.

The foundation shall be installed independent and free of expansion joints and shall be at least 300 mm wider than the pump set on all sides.

The minimum height that the foundation shall project above the floor shall not be less than 150 mm but shall have sufficient height to achieve the necessary weight, to accommodate the pockets for fixing bolts and to ensure that the foundation bolts do not come into contact with water. Where a floating plinth is used it shall be between three and five times the weight of the unit to ensure alignment is maintained and vibration is taken up.

The foundation should preferably be made of reinforced concrete that has been poured without interruption to within 25 mm of the finished height.

The top surface shall be well scoured and grooved before the concrete sets to provide a bonding surface for the grout.

Machinery foundations, frames or platforms are acceptable providing these mountings are of sufficient strength and mass to withstand the static and dynamic forces imposed by the pump set.

The base plate with pump and driver mounted on it shall be set level on the foundation.

After the pump and driver unit have been placed on the foundations, the coupling halves shall be disconnected and the pump and driver checked for alignment, they shall be checked for alignment again after all pipework has been connected, the base plate levelled, and the base plate and foundation bolts grouted in concrete.

Only after alignment are the coupling halves to be reconnected.

After commissioning the pump base plate must be filled with grout of high strength and poured in accordance with the manufacturers' instructions. This will compensate for uneven foundations as well as evenly distribute the weight of the pump set, prevent movement, and reduce vibration.

When the grout has thoroughly dried an approved oil-based paint shall be applied to the exposed faces of the grout to prevent air and moisture coming into contact with it.

Formula 201: Calculation for a pump's foundation height

The foundation height may be calculated as follows:

$$H = \left(\frac{W}{2400 \times B \times L}\right)$$

Where: H is the height of the base, (metres).

W is the total weight of the pump set, (kg).

2400 is the density of normal concrete, (kg/m³).

B is the foundation width, (metres).

L is the foundation length, (metres).

2027 Pump set installation and fixing

Vibration isolators or anti vibration mounts or dampers are not acceptable for use on fire pumps.

The pump set must be installed before installing the suction and delivery lines. This will ensure that the pipes are positioned to match the pump location and prevent a transmission of load which will induce strain onto the pump casing.

The following procedures shall be carried out before and during the pump installation:

- a) The foundation shall be checked for position and correct dimensions before the pump set is put in place.
- b) The pump set shall be positioned level on the foundation using shims or packing pieces at the point specified by the pump set manufacturer.
- c) Shims or packing pieces shall support the pump set frame on at least two sides of any anchor bolt.
- d) Foundation bolts shall pass through purpose made holes in the pump set base frame and not through lugs welded to the side of the base plate frame.
- e) After levelling the pumps at the nuts, the anchor bolts may be partially tightened, systematically and evenly, but not to the final torque setting.
- f) Pump sets shall be grouted to the foundation by filling the pump base with grout as required by these rules.
- g) The shims or packing pieces shall also be grouted in place with grout extending along the full length of the frame.
- h) After the grout is fully cured the nuts on the anchor bolts shall be tightened to the torque setting recommended by the pump set manufacturer.

The pump set alignment shall be finally checked after the pipework has been connected to the pump.

The pump set shall not be re-shimmed or moved to accommodate misalignments of the system pipework.

2028 Anchor Bolts and Projection

Achor bolts shall pass through the pump baseplate to secure the unit to the plinth or foundation. Brackets welded onto the pump baseplate are not an acceptable means of securing a pump to a plinth or foundation.

Anchor bolts projection above the top of concrete shall be as follows:

a) For single nuts: P = G + B + 1.5d

b) For double nuts: P = G + B + 2.5d

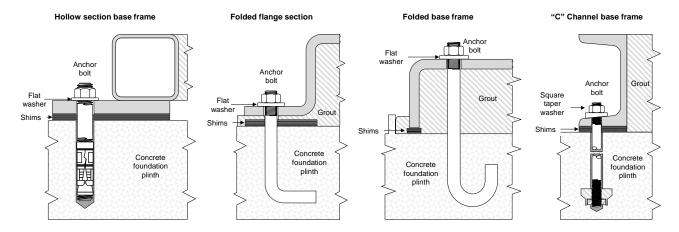
Where: P is the anchor bolt projection above concrete, (mm).

G is the thickness of the grout, (mm).
B is the thickness of base plate, (mm).
D is the diameter of anchor bolt, (mm).

During construction to provide tolerance for errors in the elevation of the anchor bolt placement, a thread length of not less than three bolt diameters shall protrude above the pump foundation.

The thread length required at the top of the anchor bolt must be sufficient to accommodate two nuts and one-half of the anchor bolt diameter projecting above the top nut. See Figure 207 for examples of suitable anchor bolts.

Figure 207: Typical examples of pump base plates and differing acceptable anchor bolts



2029 Suction pipework and fittings

Valves or flexible couplings shall not be fitted directly to the pump suction inlet and there shall be between 5 and 10 diameters allowed between any fitting and the pump inlet on the suction line.

Gear driven butterfly valves increase turbulence and the possibility of blockages and are acceptable for use on suction lines only when installed between 10 diameters upstream of the pump suction inlet. Where an isolating suction valve is within 5 to 10 diameters of the pump suction inlet, a post indicator outside spindle and yoke valve shall be used.

Where it is not possible to make provision for a sufficient settling distance in the pipework before the pump, inline flow conditioners or straighteners shall be fitted downstream of any valve or fitting in accordance with an acceptable standard such as ISO 5167 or ASME MFC-3M.

Centrifugal pumps shall be installed below the minimum effective storage level of the water supply which in the case of suction tanks is the low water level "X". See Figures 203, 204, 205 and 206.

The suction pipes under positive head conditions shall be symmetrical so that the suction tanks will drain proportionately and, in the case of more than one pump set being installed, each pump will receive its proportional supply.

When the suction pipe and the pump suction are not of the same size, they shall be connected with an eccentric tapered reducer, (transition piece), in such a way as to avoid air pockets in the pipework, i.e., belly down. The transition piece shall have a maximum included angle not exceeding 15° and shall be at least two diameters long.

Bends in the suction pipework shall be kept to a minimum. Bends and tees shall be of the long smooth swept type having a radius of curvature of not less than one-and-a-half-times the diameter of the suction pipe.

An isolating stop valve shall be installed on all pump suction pipes except where the pumps are operating under suction lift conditions and the known high-water level of the source is below the level of the pump suction pipe.

To provide stress relief when the pump and its suction supply are on separate foundations with rigid interconnecting pipework, there shall be at least one approved flexible coupling positioned external to the pump house and upstream of the suction isolating stop valve on all suction pipes of 65 mm diameter and larger. Where two suction tanks are provided and these are on separate foundations, additional flexible couplings will be required to take up any settling that may occur between them.

A compound vacuum pressure gauge shall be connected to the suction pipe either in the position provided by the pump manufacturer on the pump casing or as close to each of the pump suction inlets as possible. The face of the dial shall read in kilopascals and have a maximum pressure range of minus 100 kPa to plus 150 kPa.

2030 Pumps installed under positive head conditions

Where pumps are installed under positive head conditions a common suction pipe is permitted and the following additional conditions must be observed:

- a) The diameter of the pipe must be such that a velocity of 1,8 metres per second is not exceeded when the pump is operating at maximum flow demand, i.e.,

 Omax.
- b) The suction line must be laid truly horizontal. A rise towards the pump without dips may be allowed provided so that no air can be trapped in the suction pipe for flooded suction or positive head conditions.

2031 Pumps installed under suction lift conditions

Suction lift is to be avoided where possible as experience has shown that this is problematic.

Where pumps are installed with their centre line above the minimum effective storage level of the water supply or installed with less than two-thirds of the effective storage capacity in the tank above the top of the pump casing, they are under suction lift conditions.

The diameter of the pipe must be such that a velocity of 1,5 metres per second is not exceeded when the pump is operating at maximum flow demand, i.e., Qmax. The height from the low water level to the centre line of the pump shall not exceed 3,2 metres.

For every 100 metres increase above sea level the vertical height must be reduced by 100 mm.

At the lowest point on the pump suction pipe a foot valve shall be provided and the position of the point of entry to the foot valve must comply with the dimensions given in Columns 2 and 3 of Table 208.

A strainer with openings that shall prevent the induction of a 5,0 mm solid sphere shall be fitted upstream of the foot valve on the pump suction line and shall have an aggregate open area of at least 1,5 times the cross-sectional area of the suction pipe. It shall be fitted to ensure it can be cleaned without the tank having to be emptied.

There must be adequate provision made, (lifting lugs), to ensure that the foot valve and strainer can easily be removed for an overhaul. There must be at least one flanged joint above the level of the water and before the pump. Consideration shall be given to the provision of guides or runners to enable the assembly to be removed and repositioned without causing damage or stressing other components.

Automatic priming equipment must be provided to ensure that the pump will be always primed with water and shall take the form of an elevated cistern maintained automatically filled from an alternative supply, with a priming pipe therefrom taken direct to the pump delivery branch upstream of the non-return valve on the connection close to the pump.

Where pumps are under suction lift or negative head conditions, there must be independent suction pipes and elevated priming arrangements for each unit which shall not be interconnected.

The suction pipework must be laid truly horizontal or with a continuous rise towards the pump and without dips to avoid the possibility of air locks for suction lift conditions and shall not exceed 30,0 metres in length inclusive of fittings unless calculation proves otherwise.

The water for priming the pump suction connection shall be provided by a connection from a branch from a town main forming a supply to the premises. Such connection must be made on the town main side of the non-return valve, upstream of any pressure tapping for the pump starting device.

The size of the priming tank shall not be less than 500 litres capacity.

The size of the priming pipe shall not be less than 50 mm nominal diameter.

Mechanical seals shall be used on pumps installed under suction lift conditions.

Means must be provided whereby the priming tank, the pump case and the suction pipework are maintained and filled with water notwithstanding serious leakage from the foot valve, the arrangements being such that the pump is started if the water in the cistern drains from it at a greater rate than can be supplied from the normal source and the water level drops to two thirds of the normal level.

11/10/2024

2032 Nett positive suction head

The NPSH required by the pump (NPSHr), under installed conditions will be the Net Positive Suction Head Available, (NPSHa), less 1,5 metres to a minimum of 10% more than the pump duty point Qmax.

Formula 202: Calculation of NPSH available

The available NPSHa shall be calculated at the pumps runout as follows:

$$NPSH_a = P_S + (P_a - 1.5) - P_v - P_f$$

Where: NPSHa is the Net Positive Suction Head Available, (metres)

Ps is the suction head measured from the lowest water level to the pump suction centre line or impeller eye, (metres).

Pa is the effective absolute atmospheric pressure at the installed altitude, (metres).

Pv is the Vapour Pressure, (metres), (assumed to be 0,32 metres).

Pf is the friction loss in suction pipework, (metres), using the pump runout.

If a pump is installed under suction lift conditions, Ps may be negative, however the minimum NPSH available shall not be less than 6.4 metres.

2033 Delivery pipework and fittings

A town main bypass connection shall be provided unless duplicate supplies are provided whereby the bypass is recommended but not required. The connection is to be taken to the delivery side of the pump downstream of the non-return and stop valve. The bypass shall be the same diameter as the water supply connection and fitted with a non-return valve. Stop valves, chained in the closed position, shall be fitted on the upstream and the downstream side of the non-return valve.

When the delivery pipework and the pump delivery are not of the same size, they shall be connected with a concentric reducer, i.e., a nozzle shaped transition piece. It shall be ensured that all downstream pipework is suitably rated in terms of the static and working pressure of the system.

A non-return valve shall be installed on all pump delivery assemblies.

A stop valve shall be installed on the downstream side of the non-return valve to make the non-return valve and pump accessible for repair.

A pressure gauge shall be connected to the delivery pipework between the non-return valve and the pump delivery flange or on the pump casing if an outlet has been provided by the pump manufacturer.

There must be a test valve and pipe connection coupled to the pump delivery branch downstream of the non-return valve, including an approved direct reading flow meter or an orifice plate test arrangement to facilitate a flow and running pressure test on the pump at any flow up to Qmax. A direct reading flow test arrangement shall be calibrated to not more than 1,35 the value of Qmax.

Where the pump draws its water from a sump, care shall be taken to avoid aeration of the water during testing.

The test water shall be returned to the suction tank.

Where it is impracticable to dispose of the water discharged under a full load test condition, details of the facilities available must be acceptable to all parties.

Where more than one pump forms the source of supply to the fire protection system with identical characteristics, the test pipe may be taken from the common delivery pipe, provided a stop valve is fitted in the delivery pipe downstream of the test connection. While not testing, the stop valves on the test pipe must be secured in the closed position by a chain and padlock.

All pump delivery stop valves must be of the gear driven butterfly type and secured in the open position by 25 mm link chains and padlocks.

A direct connection, without isolating facilities, for the starting mechanism must be taken from downstream of the delivery stop valve and shall be not less than 25 mm diameter.

Each pump shall have separate starting arrangements.

2034 Jockey or make-up pump

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

Where automatic pumps are installed and to cater for natural leakage a jockey or make-up pump must be fitted to maintain pressure in the system.

The jockey pump shall:

- a) Be of centrifugal pump design
- b) Sized to prevent this pump from maintaining one sprinkler in operation without the main fire pump starting.
- c) Shall be free of hunting and shall not cause water hammer.
- d) Have a steep head to capacity characteristics to avoid excessive flow when pumping within the pressure operating range.
- e) Have a pressure and operating range not exceeding 1,200 kPa at any sprinkler and shall not be less than the pressure switch setting to start the primary fire
- f) Have a discharge pressure sufficient to maintain the desired fire protection system pressure.
- g) Have a rated capacity of not less than any normal leakage rate and

The kilowatt rating of the jockey pump motor shall be sufficient to drive the jockey pump from no flow to maximum flow condition without overloading.

A jockey or make-up pump shall be of cast iron casing construction with bronze internal parts and high tensile steel shaft or better.

The suction pipe for the jockey or make up pump shall be taken from the side or top of the main fire pumps suction line and not from the bottom where sediment may be drawn into the unit.

A non-return valve shall be installed in the jockey or make-up pump discharge pipe upstream of an isolating stop valve.

Stop valves and unions shall be installed in such places as needed to make the jockey or make up pump and non-return valve along with other miscellaneous fittings accessible for repair or removal and replacement.

Means must be provided to reduce the applied water pressure to the jockey or make-up pump starting device to simulate the conditions of automatic starting and stopping at the requisite pressures.

Full details for the approval of the proposed jockey pump must be submitted to the approved testing authority simultaneously with the details required for pump approval testing.

A jockey pump shall not be used for commissioning, filling, or priming any part of a sprinkler system.

2035 General requirements for pumps

Two pumps of differing or identical flow and pressure characteristics used for making up the total calculated demand of a sprinkler system and used as a single water supply is not permitted.

The performance characteristics of pumps shall be such that the pressure falls progressively with the rate of demand, so that whilst being capable of providing the rate of flow and pressure required at the highest and most unfavourable parts of the protected premises, the output will be so controlled that there is not an excessive rate of discharge at the lowest level in areas close to the installation valves.

Applications for approval shall show that the pressure and flow characteristics of the pump will adequately satisfy the calculated requirements of the most unfavourable and most favourable areas of operation.

The closed outlet valve pressure, under installed conditions shall not exceed 1,200 kPa.

In selecting pump characteristic curves, allowance shall be made for the increase in pressure at zero flow due to an increase in shaft speed of the prime mover and for an increase or decrease in pressure due to a positive or negative pressure at the pump suction flange.

Means for venting all cavities of the pump casing and pipework shall be provided.

Pumps shall be of centrifugal horizontal split case or end suction horizontal shaft design.

For end suction pumps bronze case wear rings shall be fitted to the pump casing.

Cast iron shall not be used for any wetted rotating component or stationary part in close running contact with the rotating member. Pumps constructed other than as above shall have the design features approved for sprinkler use.

All pump parts shall be standard stock items with no special treatment, i.e., impeller under filing, polishing or other changes are not permissible.

For end suction pumps it must be ensured that the bearing housing is adequately supported.

The coupling between the engine or motor and the pump must allow each unit to be removed without disturbing the other.

Fire pumps shall have a direct drive and shall start automatically.

A fall in water pressure in the sprinkler system, which is intended to initiate the automatic starting of a pump or pumps, shall at the same time provide a visual and audible alarm preferably in an area with responsible manning where the pump house is situated remotely from the risk.

Where the following pump parts are used, the materials shown in Table 210 shall apply:

Table 210 Pump part materials

1	2
Part	Material
Bearings	Ball/Roller Type - Stainless Steel
Casing	Cast Iron
Case wear rings	Bronze
Gland	Bronze
Gland packing	High Grade Graphite Cotton
Impeller	Bronze
Lantern Rings	Bronze or Stainless Steel
Mechanical Seals	Carbon Ceramic (Suction lift conditions)
Shaft	E N 8 Steel
Shaft sleeves	Bronze
Stuffing box bushes	Bronze

The starting of the pump or pumps shall not cause the cancellation of the alarm.

The visual and audible alarm shall form part of an alarm system approved for sprinkler use and shall be initiated by electrically separate contacts. These contacts shall consist of one change-over moving contact and two fixed contacts, one normally open and one normally closed, or two separate contacts, one normally open and one normally closed.

The contacts shall be wired to clearly identified terminals on the terminal strip of the controller. The contacts shall be of the positive make or break type, but the alarm system shall be designed to operate on "fleeting" signals and shall latch on to either momentary make or break signals.

In all cases each pump must be provided with a plate issued by the company witnessing the endurance test stating the following:

- a) The endurance test approval number.
- b) Name of the company that supplied the unit.
- c) The pump model.
- d) The pump serial number.
- e) The impeller diameter.
- f) The rotational speed.
- g) The churn pressure of the pump.
- h) The duty point flow and pressure of Pmax.
- i) The duty point flow and pressure of Qmax.
- j) The duty point flow and pressure of the runout, i.e., 110% of Qmax.
- k) The maximum power absorbed at the flow rate given.
- I) The flow and pressure of Pmax.
- m) The flow and pressure of Qmax.
- n) The flow and pressure of the runout.

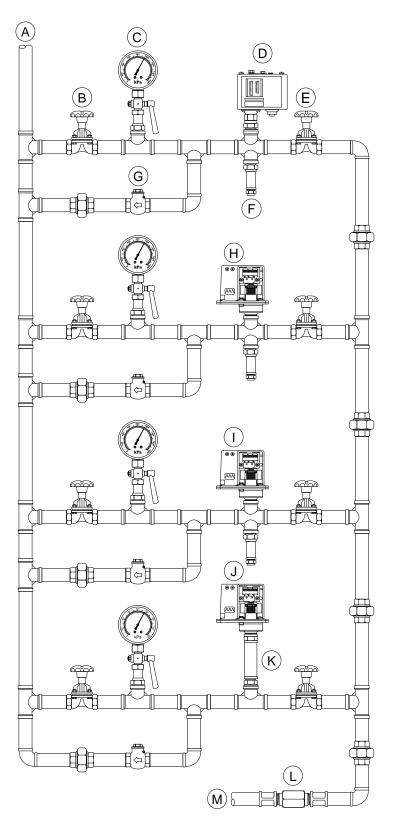
Where the performance characteristic is achieved with an orifice plate not integral with the pump delivery, the plate must carry a reference to the fact that the performance given is that of the pump and orifice plate combination, together with the flow of the pump, pressure loss across the orifice plate and K-Factor of the orifice plate.

When the pump set is shut down, no water must circulate.

Means must be provided to reduce the applied water pressure to the starting device to simulate the condition of automatic starting at the requisite pressure. This can take the form of a drain valve on the hydraulic connection to the pump starting pressure switch and suitable permanent drainage facilities must be provided. Where valves are used to control the drop in pressure, they shall be of the diaphragm type.

In order that the pressure may be dropped at a suitable rate to judge the pump cut in pressure, the drain valve referred to shall be fitted with an orifice plug. A pressure gauge to indicate the pressure at which the pump starts must be placed between the isolating and drain valves in such a position that it can be read during the starting test. Figure 208 is a typical example of a pump automatic starting arrangement.

Figure 208: Typical auto-start arrangement



- A. From trunk main
- B. Upstream diaphragm valve
- C. Pressure gauge
- D. Jockey pump pressure switch
- E. Downstream diaphragm valve
- F. Sludge trap
- G. Non-return valve
- H. Electric motor driven pump pressure switch
- Primary diesel engine driven pump pressure switch
- J. Secondary diesel engine driven pump pressure switch
- K. 150 mm sprig as an alternative to a sludge trap
- L. 3,0 mm orifice
- M. To waste

All pressure switches, if screwed directly into a tee shall be fitted with a 150 mm sludge and sediment trap of non-corroding material. If the pressure switch is fitted onto a rising sprig of 100 mm in length, a sludge trap is not required.

Power sufficient to drive the pump at the required pressure must always be available.

Power for the warning systems must be taken from a separately switched sub-circuit to that feeding the pump in the case of an electric pump. In the case of diesel engine driven pumps, the power for the warning system may not be taken from the battery which is used for automatic starting.

The warning system shall be equipped with its own batteries which shall have an ampere-hour capacity to provide 48-hours of monitoring the complete system and 1-hour of audible and visual alarm. The term "sub-circuit" means a circuit connected to a switch supplied directly from the low or medium voltage busbars on the fire pump room distribution board.

Pumps must be driven by an approved diesel engine if this is the primary supply or electric motor as a primary supply and diesel engine as the secondary supply.

Fire pumps shall not be used for commissioning, filling, or priming any part of a sprinkler system.

2036 Starting pressures of fire pumps

Once started, a fire pump must run continuously until stopped manually.

Means shall be provided for manual starting by reproducing the pressure reduction.

a) Jockey pump

The jockey or make-up pump shall be set to start automatically when the pressure in the system has fallen to a value of not less than 90% of the churn pressure of the primary pump and to shut off automatically 20-seconds after the system pressure has been reached of the churn pressure of the primary fire pump plus the minimum static supply pressure when the suction tanks are at their normal level.

b) Primary fire pump

The automatic starting device for primary pumps shall be of an approved pattern and set to operate the unit when the pressure in the trunk main has fallen to a value of 80% of the churn pressure of the primary pump. Where the churn pressure exceeds 1,000 kPa this shall not be less than 100 kPa beneath the starting pressure of the jockey pump or 50 kPa where the churn pressure is lower than 1,000 kPa.

Two pressure switches shall be provided to start the diesel engine driven pump. The second pressure switch shall be set to operate at not less than 20 kPa and not more than 50 kPa beneath the starting pressure of the primary switch. They shall be connected in such a way that either switch will start the pump automatically. See Figure 209.

The second pump of a three 50% capacity pump system shall be hardwired to start automatically within 30-seconds of the primary pump coming into operation.

c) Secondary fire pump

Where duplicate pumps are provided the second pump shall be set to start when the trunk main pressure falls to a value equal to or above 60% of the churn pressure of the primary unit but not less than 100 kPa beneath the starting pressure of the primary pump's main pressure switch.

Note: In all cases it must be ensured that the jockey and fire pump starting pressures are set above that of static pressure.

2037 Deadheading

Sufficient water must be permitted to circulate when the pump is running to prevent it from overheating when operating against a closed discharge valve. Recirculation into the suction line is not permitted.

The quantity of water discharged in litres per minute may not be less than the equivalent of 10% of the numerical kilowatt rating of the prime mover and must be included when sizing a pump. See Figure 209.

An isolating valve with a minimum hole diameter of 10 mm drilled into the gate to ensure water passes through this valve when the pump is operational when the valve is closed shall be fitted downstream of a flow indicator or sight glass. The valve shall be locked in the correct operative position with a light chain and padlock.

Formula 203: Calculation of flow of water to waste

The minimum quantity of water that flows to waste when a pump is churning shall be calculated as follows:

$$Q \ge \left(\frac{P}{C_P \times T}\right) \times 60$$

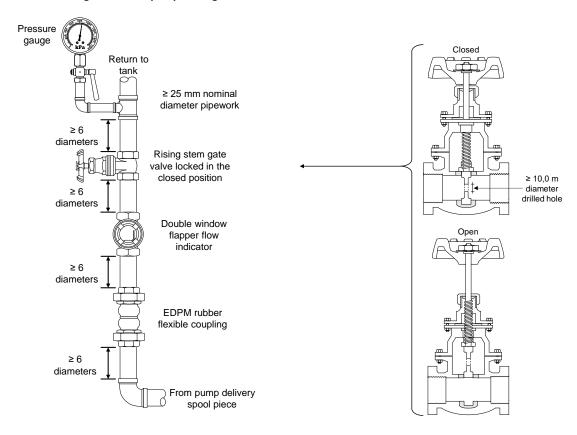
Where: Q is the flow of water to waste in litres per minute.

P is 1,25 pump absorbed power at churn pressure in kW.

T is the maximum allowable temperature rise assumed to be $\leq 15^{\circ}$ C.

 C_p of water assumed to be 4,2 kJ/kg $^{\circ}$ C.

Figure 209: General arrangement for a pump cooling water to waste under churn conditions



2038 Pump approval

Each complete engine and pump set must be tested on a suitable test bed and be independently witnessed by a recognised approving authority familiar with the requirements of fixed fire protection systems. Prior to testing, the information detailed by the independent witnessing and approving authority shall be provided.

Adequate warning and copies of the detailed information shall be circulated to the approving authority in order that they may witness the test. Copies of a certificate showing the records of the hydrostatic and endurance test which shall be conducted in the following manner must be supplied to the inspecting authority.

Before shipment from the factory, each pump shall be hydrostatically tested by the manufacturer for a period of not less than 10-minutes.

The test pressure shall not be less than 1,5 times the churn pressure of the pump plus its maximum allowable suction head.

The pump casings shall be tight at the test pressure and during the test no leakage shall occur at any joint.

2039 Detailed endurance testing information

The pump test acceptance grade shall be in accordance with ISO 9906:2012(E) Table 8 2U in that zero negative tolerances shall be permitted other than efficiency where a negative 5% can be accepted.

Pump

- a) The pump manufacturer.
- b) The pump model.
- c) The pump serial number.
- d) The pump impeller diameter.
- e) The pump duty points of Qmax and Pmax and runout.
- f) Sprinkler installers calculated flows and pressures of the design points.
- g) Net Positive Suction Head required at all stated flows and pressures.
- h) Power absorbed at calculated flow.
- i) The pump efficiency curve.

If a pump impeller or complete pump unit excluding the prime mover requires replacing once installed, the pump set shall be retested on site or at a suitable test bed for a period of not less than 2-hours at any flow up to runout. The test shall be independently witnessed by a recognised approving authority familiar with the requirements of fixed fire protection systems.

Diesel engine

- a) Make of engine.
- b) Speed of engine for site conditions.
- c) Rated power output, (24-hours in 24-hours) at the suggested site speed.

Electric motor

- a) Make of motor.
- b) Speed of motor.
- c) Rated power output.

2040 Endurance test - diesel engine driven pump

The pump set shall be run at the pump runout for 6-hours and shall be taken to runout where the pressure and flow at this point shall be recorded.

If a diesel engine requires rebuilding or replacing once installed, the pump set shall be retested on site or at a suitable test bed for a period of not less than 6-hours.

At the end of the test the engine speed, the suction and delivery pressure must be recorded at zero, 25%, 50%, 75%, Pmax, 100% which is deemed to be Qmax, and runout which is 110% of Qmax. Each point shall be clearly indicated on the test curve.

The following hourly records shall be made:

- a) Ambient temperature.
- b) The engine speed.
- c) The cooling water flow rate.
- d) The temperature of the water into and out of the engine.
- e) Engine jacket cooling water.
 - i. Temperature taken from a suitable welch plug, (also known as core or freeze plugs).
- f) The lubricating oil temperature.
 - i. Temperature taken from the diesel engine sump.
- q) $Flow \ge Qmax \times 1.1$.

Note:

- h) Pressure at flow in (f) above.
- i) The pump gland temperature.
- j) The bearing drive and free end bearing temperatures.

If the diesel engine speed is adjusted more than 5% of the documented test speed, the fire pump set is deemed to have failed and shall undergo diagnostic evaluation.

2041 Endurance test - electric motor driven pump

The pump set shall be run at the pump runout for 6-hours.

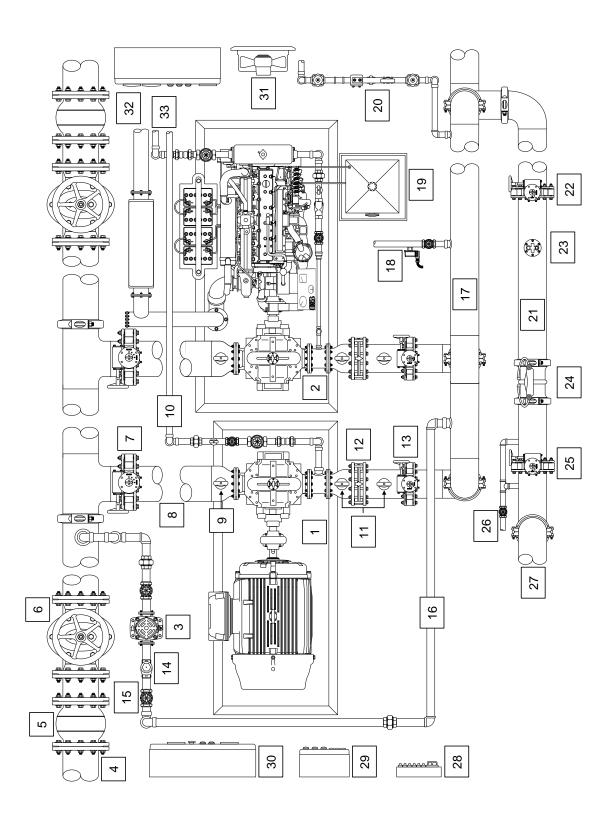
If an electric motor requires rewinding or replacing once installed, the pump set shall be retested on site or at a suitable test bed for a period of not less than 6-hours.

At the end of the test the engine speed, the suction and delivery pressure must be recorded at zero, 25%, 50%, 75%, Pmax, 100% which is deemed to be Qmax, and runout which is 110% of Qmax. Each point shall be clearly indicated on the test curve.

The following hourly records shall be made:

- a) Ambient temperature.
- b) Motor bearing temperatures.
- c) Stator temperature.
- d) Bearing temperatures.
- e) The motor speed.
- f) Flow \geq Qmax \times 1.1.
- g) Pressure at flow in (f) above.
- h) The pump gland temperature.
- i) The bearing drive and free end bearing temperatures.

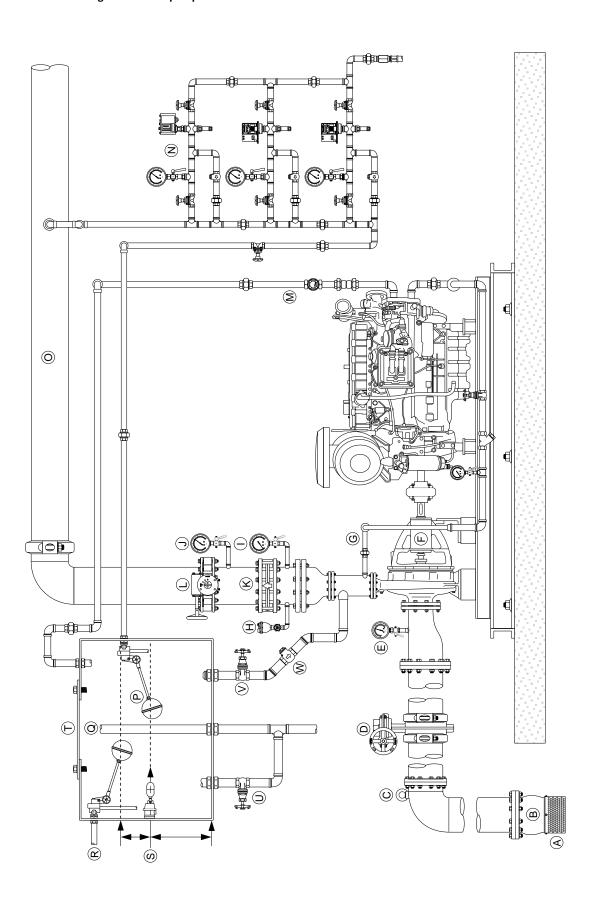
Figure 210: Typical layout of a duplicate supply flooded suction pump room



Index to Figure 210

- 1. Primary unit, electric motor driven pump with cooling water line to waste.
- 2. Secondary unit, diesel engine driven pump, cooling to heat exchanger.
- 3. Jockey pump.
- 4. From suction tank. (50% subdivided or two 50% units)
- 5. Flexible coupling. (Where pump and pump house are on separate foundations)
- 6. Isolating stop valve. (Gate valve preferred and recommended)
- 7. Suction line isolating stop valve.
- 8. At least 5 diameters, preferably 10, between the pump inlet and any fitting upstream of this unit.
- 9. Suction compound vacuum pressure gauge reading from -100 to +150 kPa.
- 10. Cooling water return to tank.
- 11. Delivery pressure gauges.
- 12. Delivery line non-return valve.
- 13. Delivery line isolating stop valve.
- 14. Jockey pump delivery line non-return valve.
- 15. Jockey pump delivery line isolating stop valve.
- 16. Jockey pump delivery line into trunk main.
- 17. Trunk main main delivery pipe.
- 18. Feed for pump house protection.
- 19. Bunded diesel engine fuel tank.
- 20. Auto-start test arrangement.
- 21. Pump proving test pipe.
- 22. Upstream test arrangement isolating valve.
- 23. Automatic air relief valve.
- 24. Flow meter.
- 25. Downstream isolating stop valve.
- 26. 25 mm drainage pipe led to waste for the test arrangement.
- 27. Test return to suction tank.
- 28. Pump house distribution board.
- 29. Pump house annunciator panel.
- 30. Electric motor driven pump controller panel.
- 31. Extraction fan,
- 32. Diesel engine driven pump controller panel.
- 33. Cooling water to waste return to suction tanks.

Figure 211: General arrangements for a pump under suction lift conditions



Index to Figure 211

- A. Foot valve strainer.
- B. Foot valve.
- C. Eye bolt.
- D. Suction isolating valve optional if the water line is beneath this valve.
- E. Suction compound vacuum pressure gauge reading from -100 to +150 kPa.

Note: At least 5 and preferably 10 diameters required between point "D" and point "E"

- F. Pump.
- G. Diesel engine cooling water line.
- H. Automatic air relief valve.
- Delivery pressure gauge.
- J. Installation or trunk main pressure gauge.
- K. Non-return valve.
- L. Isolating stop valve.
- M. Diesel engines cooling water return to tank.
- N. Auto-start arrangement.
- O. To installation.
- P. Low level valve for pump starting set to operate at at two-thirds the capacity of the priming tank.
- Q. Priming tank overflow pipe.
- R. Priming tank town main infill valve represents 100% in terms of the normal level of water.
- S. Automatic starting switch Mobrey switch set to operate at two-thirds the capacity of the priming tank.
- T. Priming tank.
- U. Priming tank test and drain valve.
- V. Priming tank delivery isolating stop valve.
- W. Priming tank delivery set at 45°.

2042 Diesel engine driven pumps

Power available shall be understood as the net power at the driver shaft after derating for speed, altitude, and temperature, and for engines and auxiliary drives such as fans and cooling water pumps.

The engine shall have 10% power more than that absorbed by the pump at any point up to 110% of the pump duty point Qmax after deductions for altitude, temperature as detailed in Tables 211 and 212 and ancillary components using the continuously rated curve in accordance with ISO 3046 at the engine selected speed which shall not exceed that as allowed in Table 213.

The diesel engine must be of the compression ignition type capable of being started without the use of wicks, cartridges, heater plugs or ether, at a pump room temperature of 4° C and must accept full load within 15-seconds from the receipt of the signal to start.

The diesel engine must be naturally aspirated, supercharged or turbo-charged and either air or water cooled. Charge air cooling must be water cooled.

Radiator cooling is not an acceptable or a suitable method of cooling for South Africa. If radiator cooling is the only option available, the radiator must be ducted externally to the pump house.

The diesel engine must be capable of operating continuously on full load at the site elevation for a minimum period of 6-hours.

The diesel engine shall be provided with a governor to control the engine speed within 5,0% of its rated speed under any condition of load up to the full load rating.

Should electronic injection be installed to achieve the required level of governing engine speed, the following shall be implemented:

a) All fail safe features shall be removed.

Where a communication bus is being used:

a) Annunciation of communication failure shall be monitored.

Where analogue controlled linear actuators are used.

a) Two controllers shall be run in parallel.

The diesel engine must not have any manual device fitted to the engine which could prevent the engine starting. Where any device is fitted, it shall automatically return to the reset position for automatic starting.

The diesel engine shall be provided with a tachometer or proximity switches and an hour meter which must be permanently attached to the engine or the controller panel.

The diesel engine must be provided with an excess fuel device for the automatic cold starting of the engine. The device is to return automatically to the reset position for automatic starting.

The diesel engine must be provided with dual auxiliary starting solenoids which shall be continuously rated.

2043 Cooling system

The following systems are acceptable:

- a) Cooling by water from the sprinkler pump direct into the engine cylinder jacket(s) via a regulating valve of not less than 10 mm diameter to limit the applied pressure to a safe value as specified by the engine manufacturer. The outlet connection from this system must terminate at least 150 mm above the engine water outlet pipe and be directed into an open tundish or sight glass so that the discharge water is visible.
- A heat exchanger, the raw cooling water being supplied from the sprinkler pump via a regulating valve, of not less than 10 mm diameter, if necessary, to limit the applied pressure to a safe value as specified by the engine manufacturer. The raw cooling water outlet connection from this system must terminate at least 150 mm above the water outlet pipe and be directed into an open tundish or sight glass so that the discharge water is visible. The water in the closed circuit must be circulated by means of an auxiliary pump driven from the engine and the capacity of the closed circuit must not be less than that recommended by the engine manufacturer. If the auxiliary pump is belt driven, there must be multiple belts such that should half the belts' break, the remaining belts must be capable of driving the pump.
- c) Direct air cooling of the engine by means of a multiple belt driven fan. When half the belts are broken, the remaining belts must be capable of driving the fan.

Where engines use cooling water from the pump discharge, means must be provided to prevent excessive pressure on the engine cooling system. The regulating valve(s) must be set during site commissioning and locked in the "set-open" position to limit the applied pressure to a safe value as specified by the engine manufacturer. Once pre-set, the regulating valve must be completely enclosed in a locked housing to prevent the valve working loose due to general vibration of water movement or tampering.

A 0-250 kPa, pressure gauge shall be fitted in the line between the regulating valve(s) and the inlet to the engine jackets or heat exchanger.

The cooling water line must have a suitable strainer fitted prior to entry into the engine jacket or heat exchanger.

All cooling water pipes including return pipes must be of galvanised steel or copper.

The additional total water consumption rate for cooling the engine either directly through the cylinder jackets or as raw cooling water supplied to a heat exchanger plus the cooling water consumed to prevent the pump overheating whilst churning shall be provided.

To prevent an excessive build-up of pressure in the engine jacket, no thermostat device is to be fitted and the cooling water lines between the "set-open" regulating valve on the inlet side and the ultimate open discharge shall be free of any other valves or restrictive fittings.

A flow indicator sight glass shall be fitted on the engine cooling water discharge pipe. The piping must be returned and shall discharge directly to the pump suction tank and may not be taken into the suction or test pipe. In all cases care shall be taken to ensure that no flow through the engine jacket takes place whilst the engine is stationary.

Spring loaded or electrically operated pressure limiting devices are not permitted.

2044 Air filtration

The air intake shall be fitted with a filter of adequate size to prevent foreign matter entering the engine and must be protected from water discharge where sprinklers are fitted in the engine room.

2045 Exhaust system

The exhaust pipe run must be as short as possible to minimise back pressure and fitted with a lined flex bellow section and suitable silencer and the total back pressure shall not exceed the engine manufacturers' recommendation.

The exhaust system must be supported to ensure that there is no weight on the flexible pipe.

The lined flex bellow is designed to accommodate expansion and not misalignment.

The lined flex bellow section may not be welded to the exhaust pipe but must be fixed using purpose made flanges or couplings.

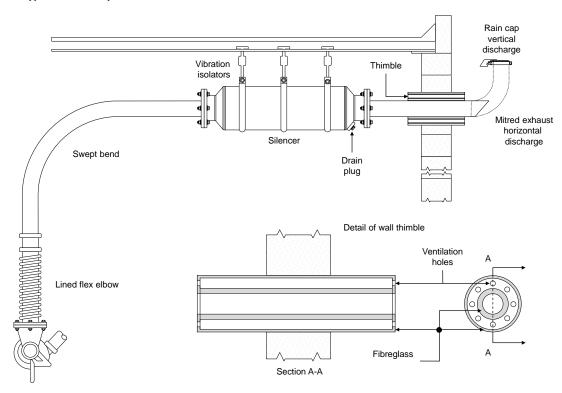
Where the exhaust system rises above the engine, means must be provided to prevent any condensate flowing into the engine.

The exhaust system shall run at least 300 mm above engine base plate level.

The engine exhaust system within the pump house shall be lagged or guarded, as necessary, for the safety of personnel.

Attention is drawn to the need to ensure that the point of exit of the exhaust pipe from the engine house does not pose any fire risk to the structure, and that exhaust fumes cannot be drawn into the engine house or into any occupied building.

Figure 212: Typical exhaust system



2046 Engine shut down mechanism

On the diesel engine an extended accessible fuel stop control or, for engines with electronic governor, a stop pushbutton clearly labelled must be manually operated and return automatically to the starting position after use.

2047 Fuel

The engine fuel must comply with the engine manufacturers' requirements.

The capacity of the tank must be sufficient to allow the engine to run on full load for 6-hours.

Sufficient fuel to run the engine on full load for 6-hours in addition to that in the engine fuel tank must be kept on hand.

Where there are two diesel engine driven fire pumps they shall have separate fuel tanks and fuel feed pipes.

Provision shall be made for the retention of any spilled fuel using a material impervious to the contents of the tank for a bund which shall contain not less than the contents of the fuel tank plus 33%.

Drainage facilities for the bund shall be provided.

2048 Fuel tank

The fuel tank shall be of welded steel and shall be located above ground in accordance with municipal requirements. The static head of the fuel tank when full shall not exceed the manufacturer's pressure limit.

The fuel tank shall be fitted with a drain valve of at least 20 mm diameter at the base of the tank.

The fuel tank may be fitted at the end of the pump set furthest away from the pump or outside the pump house but shall be positioned in a safe location to ensure there is convenient filling access and that the fuel line runs are as short as possible.

The tank shall be mounted higher than the engine fuel transfer pump and be provided with an indicator showing the level of the fuel in the tank.

The fuel level indicator shall not allow any leakage or spillage of fuel if broken.

Fuel tanks shall not be fitted to or above either the engine or the batteries, neither shall they be positioned such that any spillage or leakage from the fuel tank can come into contact with any hot surface on the engine.

2049 Fuel feed pipes

The fuel feed pipe shall be located at least 20 mm above the bottom of the fuel tank.

Any valve in the fuel feed pipe between the fuel tank and the engine shall not automatically close and shall be placed adjacent to the tank locked in the open position.

Pipes that carry lubricating oil or fuel shall be of flame-resistant reinforced flexible hose or suitable material listed for this service. Pipes shall not be made from plastic, rubber and pipe joints may not be soldered. Piping for any fuel line shall not be copper, cast iron, aluminium, or galvanised tubing.

2050 Fuel system auxiliary equipment

The following shall be provided:

- a) A sludge and sediment trap.
- b) A readily visible fuel level gauge which must not be of the glass or plastic tube type.
- c) Damage or fracture of the fuel level gauge must not result in fuel spillage.
- d) An inspection and cleaning hole.
- e) A filter between the fuel tank and fuel pump mounted in an accessible position for cleaning
- f) Means to enable the entire fuel system to be bled of air.
- g) An air vent to prevent air locks or a vacuum forming.
- h) Means to fill the fuel tank.

Air relief cocks are not allowed, screwed plugs are permitted.

2051 Starting mechanism

Provision must be made for two separate methods of engine starting as noted below.

Two separate batteries of adequate capacity must be provided for automatic and manual starting of the engine.

Where electric starting is used, the system must operate from a battery supply recommended by the engine supplier.

Automatic starting by means of a battery powered electric starter motor of the axial displacement type having no retaining catches or inertial features. The pinion must rotate at reduced speed during the process of engagement with the flywheel gear ring, but during the initial engagement the pinion and armature shaft assembly must mesh by moving axially towards the gear ring.

The starting sequence must be initiated by a fall in pressure in the water supply pipe to the sprinkler installation and repeat engagement facilities must be provided should the starter pinion fail to engage with the engine flywheel ring.

When the engine fires the starter motor pinion shall be withdrawn from the flywheel ring automatically by means initiated by a directly driven tacho generator or centrifugal speed or proximity switch.

Flexible drives are not permitted.

Battery charging, voltage generators, alternators and pressure switches on the engine lubricating system or water pump outlet, as a means of de-energising the starter motor, are not permitted.

The starter motor in combination with each battery power supply shall have a design capability to rotate the engine for at least 3-minutes or twelve cycles of not less than 15-seconds cranking and not more than 6-seconds' rest.

2052 Batteries

Sealed maintenance-free batteries only are acceptable.

Each battery used for starting must be of a type suitable to accommodate the method of charging with an expected life of approximately 4-years and not less than 3-years with a capacity to provide 3-minutes continuous cranking or twelve cycles of cranking a cold engine of 4° C according to the method of starting employed.

A built-in hydrometer shall be provided to enable the state of the batteries to be determined. An information chart pertaining to the built-in hydrometer must be mounted on the battery case.

All batteries within a pump house shall be engraved with the date of installation and shall be replaced at least every 3-years regardless of their condition.

Batteries shall be readily accessible for servicing, positioned side by side and not stacked, located on stillages above the floor, secured against displacement and in a position where they will not be exposed to excessive temperature, vibration, mechanical damage, or flooding water.

Current carrying parts, regardless of voltage, shall be at least 300 mm above finished floor level.

Battery cables shall be at least 50 mm² with a current carrying capacity of not less than 345 amperes and be fitted with suitable bolt through lug style terminals.

Cable insulation must be resistant to petrol, diesel, lubricating oils, and diluted acids.

Batteries used for starting the diesel engine shall be located close to the starter motor.

The length of the battery cables shall be as short as possible subject to a maximum allowance of 300 mm slack.

Batteries not used for the automatic starting of diesel engine driven pumps, when fully charged and disconnected from the charger, shall be of sufficient capacity to monitor all specified circuits for at least 48-hours, followed by 1-hour in fully operational alarm condition.

Any battery used for an automatic power failure alarm shall not be used for the automatic starting of a diesel engine driven pump or for any purpose other than protection against fire.

2053 Battery chargers

The means of charging the batteries must be by a fully automatic continuously connected constant voltage, variable current up to 5 amperes charge having automatic trickle and boost charge facilities.

The equipment must indicate that each battery and the relevant charger circuits are connected and carrying direct current.

The charging rate shall be set so that the battery does not gas excessively at any stage during the charging and shall be automatically adjusted to suit the state of the battery.

The circuits of the batteries must not be linked so that power may be transferred from one to the other.

The charger must have self-resetting overload protection and shall be capable of operating on a short circuit.

The charger shall operate on a short circuit and operate even when the battery is totally flat.

The charger shall float a fully charged battery continuously.

The charger shall be designed to be protected against damage when an attempt is made to charge a reverse connected battery and shall initiate an alarm when the charger output has failed.

2054 Tools and spare parts

A standard kit of tools and spare parts as recommended by the engine manufacturer should be provided with the engine and kept on hand where pumps are installed outside main urban centres.

2055 Deration factors

The kilowatt output of the diesel engine as determined at sea level is initially derated for altitude. The resultant power available is then derated for temperature.

The deration factors of Table 211 and Table 212 shall be allowed for when determining the kilowatt output of the diesel engine.

Table 211 Diesel engine altitude deration factors

1	2
Type of engine	Altitude deration
Naturally Aspirated	3,5% every 300 metres above 150 metres above sea level
Turbo Charged	1,5% every 300 metres above 150 metres above sea level
Inter-cooled Turbo Charged	1,0% every 300 metres above 150 metres above sea level

Table 212 Diesel engine temperature deration factors

1	2
Type of engine	Temperature deration
Naturally Aspirated	2,0% every 5,5° C above 30° C ambient
Turbo Charged	3,0% every 5,5° C above 30° C ambient
Intercooled Turbo Charged	1,0% every 5,5° C above 30° C ambient

Table 213 Maximum allowable diesel engine speeds

1	2
Diesel engine size	Maximum speed
2 or 3-cylinder	2600 rpm
4-cylinder naturally aspirated	2400 rpm
4-cylinder turbocharged	2200 rpm
6-cylinder naturally aspirated	2400 rpm
6-cylinder turbocharged	2200 rpm
8-cylinder	1800 rpm

2056 Electric motor driven pumps

Electric motors for pump sets must be capable of developing a power output of at least 10% more than the maximum power absorbed by the pump at any flow rate up to at least 110% of the maximum calculated flow of the pump duty point Qmax.

Motors shall be of squirrel cage rotor design. Slip-ring motors may be used where low starting current requirements are desired.

Motors shall be continuously rated in accordance with BS 5000-99, as in A1, wound with Class E insulation and having a temperature rise not exceeding 75° C above a maximum ambient temperature of 40° C when measured by the resistance method given in BS 5000-99.

Motors shall be constructed in accordance with the metric dimensions in conformity with SANS 1804-2 and shall have three-phase windings suitable for 50 Hz supply.

 $Methods \ used \ for \ the \ cooling \ of \ electric \ motors \ shall \ comply \ with \ the \ requirements \ of \ SANS \ 1804-2.$

Motor enclosures shall be totally enclosed fan cooled.

Motors shall have normal starting and breakdown torque.

Motors shall produce sufficient starting torque to accelerate the pump up to full operating speed within 10-seconds.

The starting torque of squirrel cage motors which are to be Star/Delta started must be such that the starting torque produced in the star will be sufficient to accelerate the motor up to 75% of full load speeds within 5-seconds. These accelerating times shall be achieved under open valve conditions against the specified motion and delivery pressure conditions.

Motors shall have the ends of each winding brought out to six terminals in the terminal box in accordance with SANS 1804-2 in the terminal box so that Star/Delta starting may be used if desired. Motors of 3 kW power less shall have the ends of the three windings brought out to three terminals.

For the electrical operation of reduced voltage starts, timed automatic acceleration of the motor shall be provided, and the period of acceleration shall not exceed 10-seconds.

Starting resistors shall be so designed as to permit 15-seconds starting operation during each period of 80-seconds, for a period of at least 1-hour.

Direct on-line starting is preferred, but star/delta, auto-transformer or stator and rotor type starters may be used if limitations in the electric power supply exist.

Variable Speed Drives (VSDs) are also known as Adjustable Speed Drives, Variable Frequency Drives (VFDs), Adjustable Frequency Drives, Inverter Drives, Microdrives or AC Drives. These drives are a method for controlling motor speed in response to varying process demands and are not acceptable for use on sprinkler installations.

The electric supply shall be obtained from a reliable source. A diesel engine driven generator is not regarded as a reliable source of electrical supply as these are not subject to requirements suitable to these rules.

The electrical connections shall be such that a power supply is always available for the motor when the switches for the distribution of other power throughout the premises are open.

Any switches on the power feed to the motor must be clearly labelled:

SPRINKLER PUMP MOTOR SUPPLY NOT TO BE SWITCHED OFF IN THE EVENT OF FIRE

A voltmeter and voltmeter selector switch and a fully integrated combined phase failure and phase reversal relay shall be provided in the controller to indicate there is a power supply available for the motor and the failure of any one phase of the AC supply. Such a phase failure/reversal relay shall not prevent the motor from attempting to start up nor shall it stop the motor while it is operating when any such phase failure/reversal occurs.

The controller shall be positioned in accordance with these rules so that it can be readily seen by maintenance personnel.

An automatic warning of power failure to the motor starting switches, (in the case of AC, supply, of any one phase of the supply), shall be given visually and audibly as detailed in these rules.

Power for this warning system must be taken from a separately switched sub-circuit to that feeding the motor alternatively, where the power is taken from a battery instead of the mains supply, the battery must be trickle-charged and shall have an ampere hour capacity sufficient to provide 48-hours of monitoring the complete system and 1-hour of audible and visual alarm.

The power may not be provided from any battery used for automatic starting of a compression-ignition engine driven pump.

2057 Electrical installations

Each pump room shall be equipped with a distribution board which shall be designed to interrupt the fault current.

The board shall be fitted with current limiting devices to ensure that the controller, monitoring panel or any other accessory which is connected to the switchboard is afforded suitable short circuit back-up protection.

The distribution board shall be fitted with a separate switched fuse unit or circuit breaker of suitable rating to supply each:

- a) MV Electric drive controller.
- b) Compression-ignition engine drive controller.
- c) Jockey pump controller.
- d) Pump room monitoring panels.
- e) Pump room heating circuits.
- f) Pump room lighting circuits.
- g) Pump room plug circuits.
- h) Accessories.

Taking of power for light and plug circuits or any other devices from drive controllers or monitoring panels is strictly prohibited.

Pump room electrical power connections from the distribution board to the pump drive controllers, annunciator panels, audible and visual signalling devices, pressure, flow and level monitors and interconnections between these items shall be designed for sprinkler use.

These power supplies shall be protected by means of suitably rated switch-fuse units or circuit breakers on the main HV or MV switchboards. These protective devices shall be clearly labelled:

SPRINKLERS PUMP POWER SUPPLY NOT TO BE SWITCHED OFF IN EVENT OF FIRE

The lettering shall be in 25 mm capitals.

The pump room MV switchboard, pump drive controllers, monitoring panels, etc., may be incorporated in one common panel within the pump room, provided that general arrangement is acceptable for sprinkler service.

Separately switched power sub-circuits shall be used to supply power:

- a) For alarm devices connected to pump(s) and for any mains failure alarm system, and
- b) For any pump that would be the first to come into operation because of a drop in the sprinkler installation pressure and any mains-powered low-water pressure alarm system.

The indicating equipment shall be mains-powered fed by an uninterruptible power system.

2058 Power supplies

Control and monitoring panels shall be designed for an electrical fault level of 31 MVA at 415 V, three-phase 50 Hz.

In the case of diesel engine drive controllers, the following shall apply:

- a) All DC electrical components shall be capable of functioning effectively at the reduced voltage levels that occur during engine cranking, and
- b) Relays shall not chatter on drop-out and solid-state circuits shall not "switch" under reduced voltage conditions.
- c) The battery power supply for indicator panels or alarm systems shall not be supplied from the batteries provided to start the diesel engine(s).

2059 Cables and wires

Electric cables shall be:

- a) Suitable for electrical use in conjunction with sprinkler systems.
- b) Selected, handled, and installed in accordance with SANS 10198-2, SANS 10198-4 and SANS 10198-8.
- c) Protected, as far as possible, from direct exposure to fire.
- d) uPVC-insulated or rubber-insulated and rubber-armoured, or enclosed in steel conduit, or mineral- insulated and copper-sheathed.
- e) Steel wire armoured.

2060 Wires

Electrical wires shall:

- a) Be single core, uPVC-insulated, annealed copper conductors of 600 V grade in accordance with SANS 1507-1.
- b) Be continuously rated.
- c) Not use conductors that have fewer than seven strands or that are of cross-sectional area less than 2,5 mm².

The following are normally deemed suitable for sprinkler use (depending on the application):

- a) Wiring and wire ways that comply with the requirements of SANS 529, SANS 950.
- b) Cross-linked polyethylene-insulated (XLPE-insulated) electric cables that comply with the requirements of SANS 1339.

In the case of cables to motors inside buildings, cable that are:

- a) Armoured and rubber-insulated in accordance with the requirements of SANS 1574, or
- Enclosed in screwed steel conduit and that are rubber-insulated in accordance with the requirements of SANS 1574 or that are mineral-insulated and coppersheathed, and
- c) Wire ways for electrical cables that comply with the requirements of SANS 1197-1.

Steel conduit shall be threaded in accordance with the requirements of SANS 1306-1.

External overhead cables are not permitted.

2061 Circuit breakers and switches

Circuit breakers, isolators and switches shall be suitable for sprinkler use.

Moulded-case circuit breakers shall comply with the requirements of SANS 156 and earth-leakage protection units shall comply with the requirements of SANS 767-1.

The following are deemed suitable for sprinkler use (depending on the application):

- a) Electrical switches that comply with the requirements of SANS 60669-1
- b) Moulded-case circuit breakers that comply with the requirements of SANS 156
- c) High-voltage AC circuit breakers.
- d) Manually operated air break switches.
- e) AC disconnectors and earthing switches
- f) Electrical high-voltage switches that comply with the requirements of SANS 60265-1 and SANS 60265-2.

2062 Fuses, fuse cartridges and fused switchgear

Fuses, fuse cartridges and fused switchgear shall be suitable for sprinkler use.

a) Fused switchgear that complies with the requirements of SANS 60298 is normally deemed suitable for sprinkler use (depending on the application).

2063 Busbars, contactors, fused switchgear and instruments

Busbars, contactors, fused switchgear, and instruments shall be suitable for sprinkler use.

The following are deemed suitable for sprinkler use:

- a) Busbars that comply with the requirements of SANS 1195.
- b) Electrical terminals and connectors that comply with the requirements of SANS 1433-1 or SANS 1433-2.

Power supplies

2065 General

2064

The equipment and materials shall be installed in accordance with SANS 10142-1 and shall comply with the requirements and be installed by a licensed electrician in accordance with any requirement relating to occupational health and safety.

11/10/2024

Power supply voltages, currents and insulation levels for sprinkler installations shall comply with the requirements of SANS 1019.

Power supply circuits that serve sprinkler equipment and services shall function independently of any other main or sub-main circuits that do not serve the sprinkler installation.

Power for light and plug circuits or any other device shall not be taken from drive controllers or monitoring panels.

2066 Main Power Supplies

The power supply shall be obtained from a public electricity supply or other suitable reliable source.

If the electricity supply is not taken from a public source, full particulars of the generating plant shall be agreed upon by all parties at the planning stage.

The fuel tanks of power-generating plant engines shall be kept fully filled when they are kept on stand-by.

Main power supplies for the installation shall be taken direct from:

- a) The main high voltage (HV) switchboard for HV electric motor-drive controllers.
- b) The main medium voltage (MV) switchboard for all MV equipment.

A typical diagram for the power supplies and the interconnecting of controllers and monitoring equipment for sprinkler installations is given in Figure 213.

The power supplies for the pump room shall be derived direct from:

- a) The main HV switchboard, in the case of the HV electric motor-driven controllers.
- b) The main MV switchboard, in the case of the pump room MV switchboard.

Pump room electrical power connections from the distribution board to the pump drive controllers, annunciator/repeater panels, audible and visual signalling devices, pressure, flow and level monitors and interconnections between these items shall be such as to be suitable for sprinkler use.

The power supply circuit for electric motor-driven pumps shall be separate from all other circuits in the premises.

Power to drive the pumps shall always be available.

All wiring associated with the electric motor-driven pump shall be in accordance with SANS 10142.

2067 Protection

The protection of the main and the control circuit power supplies shall be:

- a) Designed to suit a design fault level of 31 MVA at 415 V three-phase 50 Hz in situations of varying fault levels.
- b) Provided with either high-rupturing capacity fuses of suitable rating or circuit breakers of suitable rating and breaking capacity (or both).

Switches that control the power supplies shall be readily accessible to the fire brigade.

Power supply connections to any sprinkler equipment or services shall incorporate suitable isolating protective devices and these devices shall be secured against unauthorized operation.

Separately switched fuse units or circuit breakers of suitable rating shall, for example, be provided for all electric drive controllers, diesel engine drive controllers, jockey pump drive controllers, pump room monitoring panel(s), pump room heating and lighting circuits and plug circuits.

Power supply connections to the pump room shall be protected by means of suitably rated switch fuse units or circuit breakers to interrupt the fault current on the HV or MV switchboards.

The following shall apply in the case of electric motor-driven pumps:

- a) The electricity supply to motors shall incorporate fuses of high-rupturing capacity that can carry the stalled motor current for a period of not less than 75 % of the period needed for the motor windings to fail.
- b) Any no-volt release mechanism shall be of the automatic resetting type so that, on restoration of the supply, the motor can be restarted automatically if the trunk main pressure falls.

Magnetic and thermal overload trips shall not be used.

2068 Control panels

Control circuit power supplies shall not exceed a voltage of 110 VAC/DC and shall be derived from a separate, suitably rated double-wound air-cooled transformer within the enclosure of each controller, monitoring panel or power supply point.

Current-carrying parts of any control circuits and panels shall be at least 300 mm above floor level.

2069 Electrical earthing

All exposed metalwork in installations shall be efficiently earthed to prevent the metalwork from becoming electrically charged.

Sprinkler pipework shall be not used as a means of earthing electrical equipment.

Electrical equipment below sprinkler installations shall have normal earthing and overload protection.

Sprinkler installation metalwork and metal wire-ways for electric cables shall be efficiently connected to the main earthing terminal of the electrical installation.

2070 Cables and cable routes for electrically driven pumps

External overhead cables shall be not used for electrically driven pumps and all cables shall be protected against fire and mechanical damage.

If there are two or more electric motor driven pumps, failure, (owing to mechanical breakdown or fire damage), of equipment or cables that supply any one pump shall not affect the supply to other pump.

The supply to the pump controller shall be solely for use of the sprinkler pump set and separate from all other connections.

Where permitted by the electrical supplier, the electric supply to the pump controller shall be taken from the input side of the main switch on the incoming supply to the premises and where this is not permitted, by a connection from the main switch.

To protect cables from direct exposure to fire they shall be run outside the building, or through those parts of the building where the fire risk is negligible and that are separated from any significant fire risk by walls, partitions or floors with a fire-resistance rating of at least 60-minutes for Ordinary Hazard occupancies and 90-minutes for High Hazard risks, or they shall be given additional direct protection or be buried.

Cables shall be in single lengths with no joins.

2071 Pump drive controllers

2072 General

Each pump must have its own controller which shall be specifically designed for sprinkler fire pump service and approved for sprinkler service.

All pump manufacturers must use the panels which are approved in conjunction with their units.

An independent certificate of approval will be required for every panel and any modifications without prior approval will invalidate the certificate.

The controller shall be completely assembled, wired and tested by the manufacturer and an independent authority before shipment from the factory to site.

The controller shall be labelled in accordance with these rules and the nameplate shall show plainly the name of the manufacturer, the identifying designation, the complete electrical rating, and the certificate of approval number.

It is the responsibility of the approved sprinkler installer to make the necessary arrangements for the services of a manufacturer's representative, when needed, for installation and adjustment of the equipment.

2073 Labels

Labels shall consist of a composite red/white/red plastic sandwich type to show white letters on a red background.

Anodised aluminium type labels with red background are acceptable.

Label descriptions shall be in both English and any other required official language.

The letter and numeral sizes which shall be used for labels are shown in Table 214.

Table 214 Pump drive controller labels

1	2
Label type	Letter height (mm)
Main panel designation	12
Individual component designations	6
Small component designations	3
Control/signal device designations	2,5

Plastic embossed stick-on tape labels are not acceptable.

Labels for control fuses shall indicate function and fuse rating.

Each operating component of the controller shall be marked to plainly indicate the identifying letter or number referenced to the wiring diagram and the markings shall be located to be visible after installation.

2074 Starting and control

In the control circuit there shall be a pressure actuated switch having high and low calibrated adjustments or two pressure actuated switches, one having high and the other having low calibrated adjustments and responsive to water pressure in the fire protection system.

Suitable means shall be made for relieving pressure to the pressure actuated switch, to test the operation of the controller and the pump.

When the pump supplies special water control equipment, (deluge valves, dry pipe valves, etc.), and it is desired to start the pump before the pressure actuated switch(es) would do so, the controller shall be equipped to start the pump upon operation of the fire detection equipment.

The controller shall be wired for manual shut down.

Shut down shall be accomplished by operation of the stop/reset push button on the outside of the control enclosure and, in the case of automatic controllers, shall return the controller to full automatic position.

2075 Location of controller

The controller shall be located as close as it is practical to the motor/engine it controls and shall be within sight of the motor/engine.

Diesel engine controllers shall, where possible, be in a position whereby the fuel shut off lever and controller panel buttons can be accessed simultaneously.

The controller shall be so located or so protected that it will not be damaged by water escaping from the pump or pump connection.

2076 Construction of controller

All controller equipment shall be incorporated within a total enclosed, damp, dust, and flash proof enclosure.

All equipment excepting those items fixed in the door shall be mounted on a removable 2,0 mm thick rolled mild steel chassis plate which shall be folded and braced to ensure rigidity.

The controller enclosure shall be constructed from 2,0 mm thick cold rolled mild steel and shall be equipped with a hinged door supported on robust hinges and secured by enough substantial catches to ensure proper sealing of the gasket.

The door shall be fitted with a non-deteriorating gasket made from butyl sponge rubber or similar material.

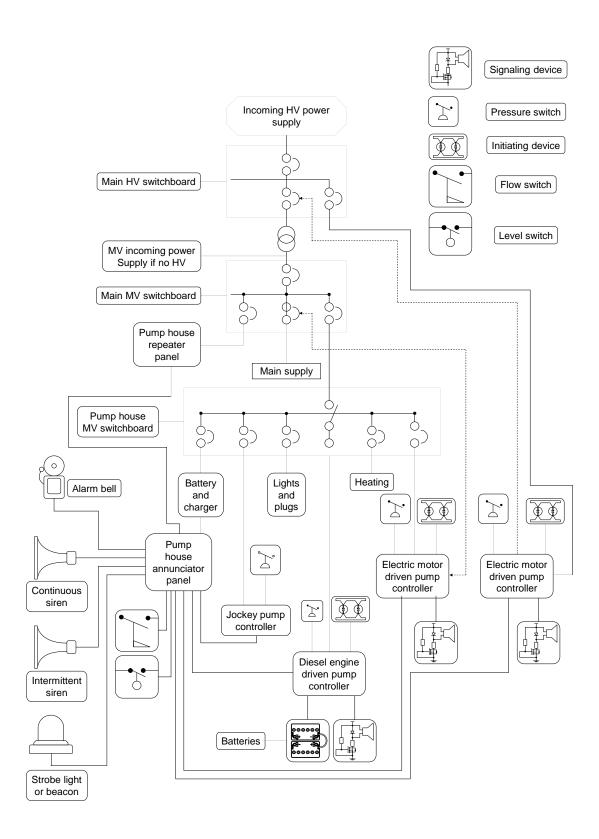
The following shall be provided in a suitable pocket permanently secured inside the enclosure door:

- a) Wiring diagrams with clearly identifiable letters and numbers for all components and wires.
- b) Complete component schedule giving wiring diagram reference, make, type, size and supplier.
- c) Operation and maintenance instructions.

Complete operating instructions, in English and any other official language that may be required, a wiring diagram and a component schedule shall be affixed in the pump room in a suitable weatherproof mounting.

Electrical terminals and both ends of all wires shall be plainly marked to correspond with the as-built wiring diagrams for the controller.

Figure 213: Typical diagram of the power supplies for a pump house



2077 Electric motor drive controllers

The controller shall be labelled:

ELECTRIC MOTOR DRIVEN PUMP CONTROLLER

All busbars and connections shall be readily accessible for maintenance work after installation of the controller without disconnecting the external circuit conductors.

Circuits which are depended upon for proper operation of the controller shall not have over current protective devices connected in them. Maximum short circuit protection with current limiting facilities shall, however, be provided for all circuits.

All switching equipment for manual use in connecting or disconnecting or starting or stopping the motor shall be externally operable.

A manually operated fused isolating switch shall be mounted within the controller enclosure.

The switch shall be equipped with one fuse in each phase and the switch rating shall be determined by the fuse size.

The fuses shall conform to these rules and the fuse rating shall be in accordance with Table 215, irrespective of method of starting.

High rupturing capacity, (HRC), cartridges of a suitable rating mounted in insulated withdrawable fuse holders, conforming to these rules shall be provided for the protection of each branch circuit conductor.

The removal or blowing of any HRC fuse will initiate an alarm or fault condition at the alarm annunciator panel.

If used, one complete set of spare main motor circuit and control circuit HRC fuse cartridges shall be secured on approved brackets inside the enclosure door.

The ampere rating of the switch shall be determined by the fuse size as mentioned above but shall be at least 115% of the name plate current rating of the motor.

No over current protective devices shall be installed in the motor circuit.

The motor starter shall be of the AC automatic type, incorporating magnetically operated air break contactors.

For electrical operation of reduced voltage starts, timed automatic acceleration of the motor shall be provided, and the period of acceleration shall not exceed 10-seconds.

Starting resistors shall be designed to permit 15-second starting operation in each 80-seconds for a period of not less than 1-hour.

Direct on-line starting is preferred but Star Delta, Auto transformer or Stator and Rotor type starters may be used if the supply authority and/or user insist on this because of electric power supply limitations. The installer shall establish what type of starting is permissible.

A fully integrated combined phase failure and phase reversal relay must be incorporated in the panel. Electrically separate contacts shall be provided on the phase failure relay, and these shall be wired out to clearly identified terminals on the controller.

Such a phase failure/reversal relay shall not prevent the motor from attempting to start nor must it stop the motor while it is operating when any such phase failure/reversal occurs.

A voltmeter complete with fuses and a voltmeter selector switch arranged to select phase to phase and phase to neutral readings shall be provided.

An ammeter, three current transformers and a selector switch shall be fitted on the controller connected in such a way as to test each phase to check the loading of the motor.

For motors more than the ratings in Table 215, the manufacturer shall submit details of a proposed back up protection for approval to the relevant authorities.

The controller shall be fitted with electrically separate potential free contacts to make provision for the following conditions to be maintained:

- a) Fire alarm.
- b) Power failure, (main electrical supply).
- c) Pump failure.
- d) Pump running.
- e) Control circuit failure, (wired from the end of the control circuit).

Indication on the controller shall be in the form of indicating lamps in duplicate to show the following:

- a) Fire alarm.
- b) Pump failure to start.
- c) Pump running.

A reset push button shall be fitted on the controller to reset the controller.

The controller shall latch on to a starting signal until the reset push button is pressed.

A push button shall be fitted on the controller for emergency starting which will bypass the automatic starting circuit.

A separate test push button shall be fitted on the controller to initiate the automatic starting sequence operation.

Should the power requirements of the fire pump be such that it cannot be started at the same time as the plant is operating, an electrically separate contact and timer shall be provided on the controller to initiate tripping of the plant circuit breaker before power is applied to the motor terminals.

Table 215 High rupturing capacity cartridge fuse rating selection chart

1	2	3	4
On 400 \	On 400 VAC		VAC
Maximum motor size (kW)	Fuse rating (Amps)	Maximum motor size (kW)	Fuse rating (Amps)
1,5	16	1,5	16
2,2	16	2,2	16
3,0	20	3,0	16
4,0	25	4,0	20
5,5	32	5,5	25
7,5	40	7,5	32
9,2	50	9,2	40
11	63	11	40
15	80	15	50
18,5	80	18,5	63
22	80	22	80
30	125	30	100
37	160	37	125
45	160	45	125
55	200	55	160
75	250	75	200
90	315	90	250
110	355	110	315
132	400	132	355
150	400	150	355
160	400	160	355
185	500	185	400
200	500	200	400
220	500	220	400
250	630	250	500
260	630	260	500
300	800	300	500
315	800	315	630
330	800	330	630

2078 Compression-ignition engine drive controllers

The controller shall be labelled:

DIESEL ENGINE DRIVEN PUMP CONTROLLER

All switching equipment for manual use in connecting or disconnecting or starting or stopping the engine shall be externally operable.

A manually operated isolating switch shall be mounted within the controller enclosure.

Fuses for protection of both the AC and DC circuits shall be provided and shall conform to these rules and the fuse rating shall be in accordance with Table 215.

High rupturing capacity cartridge fuses of suitable rating mounted in insulated withdrawable fuse holders shall be provided for the protection of each branch circuit conductor.

The removal or blowing of any HRC fuse will initiate an alarm or fault condition at the annunciator panel.

One complete set of spare HRC fuse cartridges shall be secured on approved brackets inside the enclosure door.

Automatic starting will be initiated by one of two external monitoring devices wired in parallel and the starting components will be arranged to crank for a maximum period of 15-seconds and dwell for a period of not more than 6-seconds. Both time periods shall be adjustable and set to suit engine and site conditions.

A pre-settable counter arranged to count each cranking period shall be provided and shall be capable of being pre-set for up to 9 counts but shall normally be pre-set for six counts. If the engine has not started after the pre-set number of counts, the cranking must be stopped, and the pump failure indication and alarm must be initiated. Only actual cyclic counters are acceptable. A timer set for the overall calculated time for the pre-set number of starts is not acceptable.

The components shall be arranged to connect each of the two batteries to the engine starter motor on alternate cranking cycles and so designed that the first cycle of a fresh attempted start shall alternate between one battery and the other.

A suitable voltage relay shall be connected across the load side of the main fuses and electrically separate contacts on this relay shall be wired out to clearly identified terminals for initiating the power failure alarm.

An AC voltmeter shall be provided to indicate the input voltage to the controller.

A DC voltmeter shall be provided to indicate the terminal voltage of each battery.

A DC ammeter shall be provided to indicate the charging rate of each battery.

Electrically separate potentially free contacts wired out to clearly identified terminals are to be provided for the following conditions to be monitored:

- a) Fire alarm.
- b) Power failure, (battery charger electrical supply).
- c) Pump failure.
- d) Pump running.
- e) Low oil pressure.
- f) Charger failure, (from both charger outputs in parallel).
- g) Control circuit failure, (from the end of the control circuit).
- h) Electronic governor communication failure.

Indication in the form of duplicate indicating lamps shall be provided to show the following:

- a) Fire alarm.
- b) Pump failure.
- c) Pump running.
- d) Low oil pressure.

A reset push button shall be provided to reset the controller.

The controller shall latch on to a starting signal until the reset push button is pressed.

One "emergency start" push button shall be provided for each battery and the circuitry shall be arranged so that each push button will bypass the automatic starting circuit and will energise its associated starter motor solenoid. It shall be possible to depress both push buttons and apply power from both batteries simultaneously to the starter motor.

An adjustable voltage sensitive device shall be provided to sense the potential generated by the tacho generator. One set of normally open contacts of one voltage sensitive relay shall be wired in parallel with that of the other relay to initiate the pump running relay.

- a) Each engine shall be fitted with two tacho generators taken off different drive points on the engine, or
- b) A combination of one tacho generator and one proximity sensor may be fitted to the engine to monitor engine motion. Where such a sensor is used, the controller panel must be fitted with a matching sensing relay with one set of normally open contacts to be wired in parallel to those of the voltage sensitive relay to initiate the pump running relay.

Manual isolating and/or selector switches in the battery to engine starter motor circuits are not permitted.

A separate test button shall be provided to initiate the automatic starting sequence.

Controllers mounted on the engine bedplate shall be supported by a substantial frame securely bolted to the engine bedplate and the controller shall be secured to this frame by means of approved resilient mountings.

Plug-in components such as fuses, relays, PC boards, etc., in controllers which are mounted on the engine bedplates shall be provided with suitable spring clips or securing facilities to prevent unplugging due to vibration.

The removal of any relay must initiate either a "Fault" condition or the "Control Circuit Failure" alarm at the annunciator panel.

Batteries shall be mounted and securely clamped on stands or stillages and located in a readily accessible position where the likelihood of contamination by oil, fuel, damp, pump set cooling water or being damaged by vibration, is unlikely.

The battery shall be installed as close to the starter motor as possible to minimise voltage drops between the battery and starter motor terminals. The batteries shall be mounted on a wooden base.

Continuously rated, heavy current solenoid operated contactors for connecting the battery to the engine starter motor shall be located on the engine or bedplate immediately adjacent to the engine starter motor or batteries.

All DC electrical components shall be capable of functioning effectively at the reduced voltage levels that exist during cranking. Relays shall not chatter or drop out and solid-state circuits shall not "switch" under these low voltage conditions.

The battery voltage shall be as specified by the engine manufacturers, 24 volts are preferred, but 12 volts are acceptable.

The control circuit shall be arranged to operate across the full battery voltage. Connections for any reduced voltage shall not be taken by tapping-off cells in the battery.

The controller shall be equipped with one battery charger in accordance with these rules for each battery.

2079 Electric motor driven jockey pump controllers

The controller shall comply with the paragraphs pertaining to the electrical installations and general section pertaining to pump drive controllers.

The controller shall be labelled:

JOCKEY PUMP CONTROLLER

Starting and stopping of the motor will be initiated by a pressure actuated switch having high and low calibrated adjustments and which is responsive to water pressure in the fire protection system.

Suitable means shall be made for relieving pressure to the pressure actuated switch to test the operation of the controller and the pump.

The controller shall be fitted with the following:

- a) Suitably rated triple pole isolators with auxiliary contacts as may be necessary.
- b) Suitably rated contactors.
- c) Adjustable, ambient temperature compensated thermal overload relay for motor protection.
- d) Hand/auto selector switch.
- e) A timer with a 0 to 30-second setting normally set to 20-seconds.

When the hand/auto selector switch is in the hand position, the pump shall run continuously, and when the switch is in the auto position, the pump will start and stop automatically under the control of the pressure switch.

Selector switches incorporating off positions are not acceptable.

2080 Annunciators for sprinkler pump room installations

The controller shall be labelled:

PUMP HOUSE ANNUNCIATOR PANEL

Each pump room must have its own annunciator panel, audible and visual signalling devices and, where required, a repeater panel, all of which shall be approved for sprinkler use.

The panel manufacturer's audible and visual signalling devices such as sirens, bells, hooters, beacons, and lamps will be accepted for use in conjunction with approved annunciator and repeater panels.

It shall be the responsibility of the approved sprinkler installer to make the necessary arrangements for the services of a manufacturer's representative, when needed, for installation and adjustments of annunciator and repeater panels and equipment.

Each component of the alarm or annunciator and/or repeater panel shall be marked to clearly indicate the identifying letter or number referenced to the wiring diagram and the markings shall be located to be permanently visible after installation.

All circuits, including the pressure switches and battery connections, shall be monitored as follows:

- a) Open circuits shall indicate a "fault" condition.
- b) High impedance closed circuits shall constitute a normal condition and no indication is required.
- c) Short circuits shall indicate an "alarm" or "warning" condition.

A "fault", "alarm" or "warning" as described above shall initiate the audible alarm which shall be silenced by means of an "accept" push button.

When a "fault", "alarm" or "warning" condition occurs, the circuit annunciator shall flash on and off until the signal has been accepted, when the annunciator will change from a flashing to a steady visual signal. When the circuit is restored to a normal condition as described above, the steady signal shall reset.

A first alarm condition must cause the audible alarm to sound, after acceptance a second alarm must again cause the audible alarm to sound. Systems in which the audible alarm is negated after acceptance are not acceptable.

Where a pump house repeater panel is required, it shall be mounted in an approved position at a responsibly manned location in the plant or on the premises.

The three audible and one visual signalling device shall be mounted immediately outside the pump room in an approved position.

The audible range of all audible signalling devices shall be adequate to suit the distance to be covered and the noise environment of the location with a signal strength of not less than 75 dB. Where this is not practical, a repeater panel must be installed at a permanently manned position.

A steady audible alarm and a flashing visual alarm shall be initiated when a "FIRE" condition exists.

An intermittent audible alarm shall be initiated when a "PUMP FAILURE" condition exists.

A steady audible alarm bell and a flashing visual alarm shall be initiated when a "POWER FAILURE" condition exists.

The "PUMP HOUSE PROTECTION" alarm shall initiate the steady audible and flashing visual alarms.

The signalling devices shall be suitable for operation from the battery powering the annunciator system.

Battery chargers and batteries shall not be housed in the same enclosure as the annunciator or repeater panels.

The charger and batteries may be housed in a common enclosure but in separate compartments suitably divided and sealed to ensure that charger components are not subjected to battery fumes.

2081 Controller panel approval

Each complete controller panel must be cyclically tested at a suitable test facility within South Africa and verified by a recognised approving authority familiar with the requirements of fixed fire protection systems.

The approving authority shall be independent and have no affiliation with the company manufacturing or supplying the panel, or the company designated to perform the testing of the panel.

Copies of a certificate showing the records of the test which shall be conducted in the following manner must be supplied to the inspecting authority.

2082 Testing of electric motor driven fire pump controllers

A minimum of 160 cycles of each test shall be conducted. Should the cycle be interrupted, or failure of a component take place, the testing shall be restarted.

2083 Tests performed per cycle

Test 1:

- a) Initiate a fire condition via the pressure switch.
- b) Monitor fire and pump run signals only.
- c) Initiate the Stop/Reset button.
- d) No signals shall be received at this stage.

Test complete.

Test 2:

- a) Initiate a fire condition via the Test push button.
- b) Monitor fire and pump run signals only.
- c) Initiate the Stop/Reset button.
- d) No signals shall be received at this stage.

Test complete.

Test 3:

- a) Initiate the Emergency Start push button.
- b) Monitor the pump run signal only.
- c) Initiate the Stop/Reset button.
- d) No signals shall be received at this stage.

Test complete.

Test 4:

- a) Initiate a fault on the Delta Contactor.
- b) Initiate a fire condition via the pressure switch.
- c) Monitor fire and pump fail signals only.
- d) Remove the fault condition on the Delta Contactor.
- e) Monitor Fire and Pump Fail signals only.
- f) Initiate the Stop/Reset button.
- g) No signals shall be received at this stage.

Test complete.

Test 5:

- a) Initiate a Mains Fail.
- b) Monitor Mains Fail and Control Circuit Fail signals only.
- c) Remove Mains Fail condition.
- d) No signals shall be received at this stage.

Test complete.

Test 6:

- a) Initiate a Control Circuit Fail.
- b) Monitor Control Circuit Fail signal only.
- c) Remove Control Circuit Fail condition.
- d) No signals shall be received at this stage.

Test complete.

2084 Testing of diesel engine driven fire pump controllers

A minimum of 80 cycles of each test shall be conducted. Should the cycle be interrupted, or failure of a component take place, the testing shall be restarted.

2085 Tests performed per cycle

Test 1:

Fire condition through pressure switch:

- a) Monitor for Fire, Pump Run signal.
- b) Monitor 220-volt output for pump house extraction fan.

Test 2:

Fire condition through push buttons:

- a) Monitor for Fire, Pump Run signal.
- b) Monitor 220-volt output for pump house extraction fan.

Test 3:

Fire condition through pressure switch with Mains Fail condition:

- a) Monitor for Fire, Pump Run, Mains Fail and Battery Charger Fail signals.
- b) Initiate a Low Oil condition.
- c) Monitor for Fire, Pump Run, Mains Fail, Battery Charger Fail and Low Oil signals.

Test 4:

Fire condition through pressure switch with Mains Fail condition:

- a) Monitor for Fire, Pump Run, Mains Fail and Battery Charger Fail signal.
- b) Initiate a High Engine Temperature condition.
- c) Monitor for Fire, Pump Run, Mains Fail, Battery Charger Fail and Low Oil signals.

Test 5:

Fire condition through pressure switch with 300 rpm crank condition:

- a) Monitor for 15-seconds crank and 6-seconds dwell time.
- b) Monitor alternating crank cycles.
- c) Monitor for Fire, Mains Fail and Battery Charger Fail signals.
- d) Monitor for Pump Fail signal after six start attempts.
- e) Monitor for Fire, Mains Fail and Battery Charger Fail signals.
- f) Initiate Emergency Start 1.
- g) Monitor for Fire, Pump Run, Mains Fail and Battery Charger Fail signals.

Test 6:

Fire condition through pressure switch with 300 rpm crank condition:

- a) Monitor for 15-seconds crank and 6-seconds dwell time.
- b) Monitor alternating crank cycles.
- c) Monitor for Fire, Mains Fail and Battery Charger Fail signals.
- d) Monitor for Pump Fail signal after six start attempts.
- e) Monitor for Fire, Mains Fail and Battery Charger Fail signals.
- f) Initiate Emergency Start 2.
- g) Monitor for Fire, Pump Run, Mains Fail and Battery Charger Fail signals.

Test 7:

Initiate a fire condition through pressure switch continuously:

- a) Monitor for Fire and Pump Run signals.
- b) Initiate Reset button.
- c) Monitor for Fire, and Pump Run Signals.

Test 8:

De-energise 220-volt AC and 12- or 24-volt DC control circuit supply:

- a) Monitor for Mains Fail, Battery Charger Fail and control Circuit Fail signals.
- b) Testing of annunciator panels

A minimum of 160 cycles of each test shall be conducted. Should the cycle be interrupted, or failure of a component take place, the testing shall be restarted.

Each signal for the diesel engine driven pump and the electric motor driven pump shall be mimicked.

The annunciator shall be checked for the following alarm signals:

- a) A Fire condition shall initiate a continuously sounding sired and strobe light or beacon.
- b) A Pump Failure condition shall initiate an intermittent sounding siren and strobe light or beacon.
- c) A Pump running or Emergency Start shall initiate a strobe light or beacon.
- d) Mains Failure shall initiate an electric motor driven alarm bell and strobe light or beacon.
- e) Controller Circuit Failure shall initiate an electric motor driven alarm bell and strobe light or beacon.
- f) Battery Charger Failure shall initiate an electric motor driven alarm bell and strobe light or beacon.
- g) Low Oil Pressure shall initiate an electric motor driven alarm bell and strobe light or beacon.
- h) Pump House Protection shall initiate a continuously sounding siren and strobe light or beacon.

2086 Pump house remote alarm notification and data logger module.

2087 General

Each pump house shall be equipped with a remote alarm notification and data logger module to enable remote monitoring of the pump house events and retrieval of data.

The data logger memory shall be fixed and permanent on the dater logger and may not be a removable device.

2088 Data logger module functionality

The data logging module shall have:

- a) The ability to locally log all events that occur within the pump house facility.
- b) The ability to remotely log all events that occur within the pump house facility.
- c) The ability to send pump house alarms to personnel via SMS or pager.
- d) The ability to send pump house alarms to a computer via SMS or pager.
- e) Be fitted with a real-time clock (RTC) to maintain the date and time regardless of whether or not a Subscriber Identity Module, (SIM), card has been installed.

The remote alarm module device shall be located inside the pump house within a metal IP55 enclosure.

All controller panels shall have the remote alarm module factory fitted during panel construction before any certification tests.

The hardware product must operate independently from all installed panel systems, i.e., Electric, Diesel, Annunciator or Jockey controllers.

The device shall send alarm notification messages via cell phone SMS or pager to both personnel, and or remote offsite computers.

The device must have the capability to log events internally if pager or cell phone services are unavailable.

The remote alarm module shall conform to the following technical specifications:

- a) Store up to 3,500 events internally on a FIFO (First In First Out) basis.
- b) Both a local and remote event log upload facility to obtain log files.
- c) A minimum of six personnel contact numbers. (Cell phone or pager).
- d) A minimum of twenty potential free (dry contact) alarm inputs.
- e) A minimum of two relay outputs. (2A).
- f) A minimum of four counters and timers so that required pump house rules can be defined.
- g) A 24/7 schedule for daily tests and weekly statistical reports.

The remote logger shall conform to the following pump house alarm rules:

- a) If the jockey pump runs continuously longer than 5-minutes, then send an alarm.
- b) If the jockey pump starts more than ten times within a 1-hour period, then send an alarm, and
- c) If the system is in maintenance mode, then disarm the cell phones or pagers.

To facilitate weekly tests the panel must have a maintenance button that disables remote alarms messages to cell phones or pagers while the pump house is being tested or repaired, however data is still logged on a remote computer for hard copy test reports.

The following data in Table 216 are deemed to be the minimum alarms that shall be monitored.

Table 216 Alarm monitoring

1	2	3
	Panel	Maintenance MODE SWITCH
1.	Jockey Controller Panel	ALARM - Pump RUN
2.	Jockey Controller Panel	ALARM - Pump FAIL
3.	Electric Motor Driven Pump Controller Panel	ALARM - Fire ALARM
4.	Electric Motor Driven Pump Controller Panel	ALARM - Pump RUN
5.	Electric Motor Driven Pump Controller Panel	ALARM - Mains FAIL
6.	Electric Motor Driven Pump Controller Panel	ALARM - Control circuit FAIL
7.	Electric Motor Driven Pump Controller Panel	ALARM - Pump FAIL
8.	Diesel Engine Driven Pump Controller Panel	ALARM - Fire ALARM
9.	Diesel Engine Driven Pump Controller Panel	ALARM - Pump RUN
10.	Diesel Engine Driven Pump Controller Panel	ALARM - Pump FAIL
11.	Diesel Engine Driven Pump Controller Panel	ALARM - Mains FAIL
12.	Diesel Engine Driven Pump Controller Panel	ALARM - Control circuit FAIL
13.	Diesel Engine Driven Pump Controller Panel	ALARM - Low oil pressure FAIL
14.	Diesel Engine Driven Pump Controller Panel	ALARM - Battery charger FAIL
15.	Diesel Engine Driven Pump Controller Panel	ALARM - Engine over temperature FAIL
16.	Electronic governor communication failure	ALARM – Governor communication failure

- a) Alarm inputs are to be connected directly to the electric, diesel, jockey, or annunciator panels.
- b) All alarms signal wires shall be potential free, (dry contact).
- c) No voltage shall be sent to or received from the pump house panels.
- d) If the unit is in a standalone cabinet, it must operate from its own power source.
- e) No AC power, 12 V shall be drawn from any pump house panel.
- f) The real-time clock shall be checked annually and adjusted if necessary.
- g) The battery for the real-time clock shall be replaced every 3-years.

SECTION 3: SPACING AND LOCATION OF SPRINKLERS

3000 Spacing

The maximum area coverage per sprinkler and maximum distance between sprinklers on range pipes and between adjacent rows of sprinklers, excluding specialised sprinklers, shall not exceed that stated in these rules or by the manufacturer, whichever is less.

Ordinary Hazard class

The maximum allowable area coverage per standard sprinkler shall not exceed:

a) Sidewall sprinklers $9 m^2$ b) Sprinklers other than sidewalls $12 m^2$

3001 Sidewall sprinklers

The maximum distance between sidewall sprinklers on range pipes and between adjacent rows of sprinklers shall not exceed:

Along the Walls: Ordinary Hazard systems: 3,4 metres

From End Walls: Ordinary Hazard systems: 1,8 metres

From the backwall:

a) Horizontal sidewall sprinkler standard coverage:
 b) Vertical sidewall sprinkler standard coverage:
 c) Extended coverage sidewall sprinklers:
 40 mm

3002 Distance between rows of sidewall sprinklers

For rooms not exceeding 3,4 metres in width, only one row of sprinklers lengthwise of the room need be provided.

For rooms more than 3,4 metres in width but not exceeding 6,8 metres, one row of sprinklers at each side lengthwise of the room must be provided. In the case of rooms exceeding 6,8 metres in width the sprinklers shall be regularly staggered so that sprinklers face midway between the sprinklers on the opposing wall. See Figure 301.

In rooms exceeding 6,8 metres in width, conventional, spray or ceiling type sprinklers centrally positioned under the ceiling will be required to supplement the sidewall sprinklers. See Figure 302.

Sidewall sprinklers are intended for use in rooms having flat, smooth ceilings and there must be no obstruction at the ceiling within a square extending along the wall 1,0 metre on each side of the sprinkler and 1,8 metres perpendicular to the wall.

Beams on the boundary of this square must not exceed a depth of 100 mm. Beams of a greater depth than 100 mm must not be closer to a sprinkler than is specified in Table 301, otherwise the bays thus formed must be separately protected.

Extended coverage sidewall sprinklers are specialised and where installed, the manufacturer's specifications shall be used.

Where bulkheads are used for the installation of sidewall sprinklers which are less than or equal to 200 mm in width or projection from the wall, additional sprinklers shall not be required below the bulkhead. Where the bulkhead exceeds 200 mm in width, spray pattern sprinkler protection shall be installed under the bulkhead.

Table 301 Minimum distance from sprinkler to beam

1	2	3				
	Minimum distance from sprinkler to beam					
Depth of beam not exceeding (mm)	In a direction perpendicular to wall (metres)	In a direction parallel to wall (metres)				
100	1,8	1,0				
125	2,1	1,2				
150	2,4	1,4				
175	2,7	1,6				
200	3,0	1,8				

Figure 301: Sidewall sprinkler protection for a room ≥ 3,4 and ≤ 6,8 metres wide

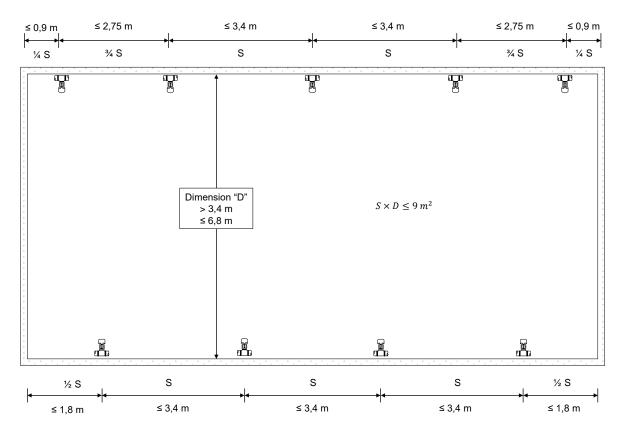
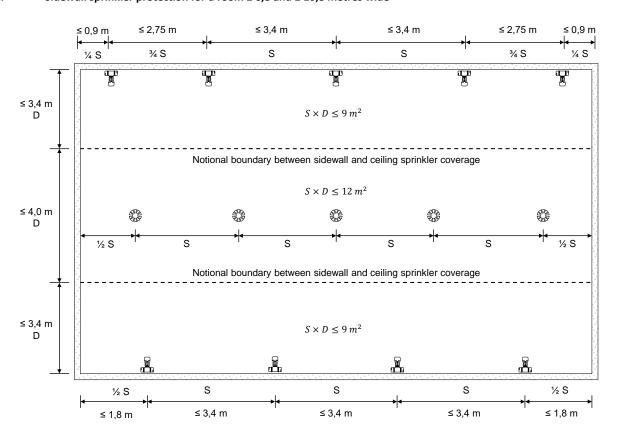


Figure 302: Sidewall sprinkler protection for a room ≥ 6,8 and ≤ 10,8 metres wide



3003 Ordinary Hazard class standard spray or conventional pattern sprinklers

Where standard spacing is employed the maximum allowable distance between adjacent sprinklers shall not exceed 4,0 metres in one direction.

Where staggered spacing is employed the maximum allowable distance between adjacent sprinklers on a range shall not exceed 4,6 metres.

In standard or staggered spacing and subject to the maximum area covered per sprinkler the maximum allowable distance between adjacent ranges shall not exceed 4,0 metres. See Figure 303.

In the case of cold storage fridges, freezers and warehouses using the air circulation method of refrigeration, corn, provender, and rice mills, (other than those using the pneumatic system of conveying), film and television production studios, theatres and music halls, (stage protection), where Ordinary Hazard can be proven to be an acceptable level of protection, the maximum area coverage is limited to 9 m² per sprinkler and the maximum distance between sprinklers on a range or between adjacent ranges to 3,0 metres.

3004 High Hazard class

The maximum area coverage per standard sprinkler shall not exceed 9,0 m².

Maximum distance between adjacent sprinklers on range pipes or between adjacent rows of sprinklers shall not exceed 3,7 metres subject to the maximum allowable area coverage per sprinkler.

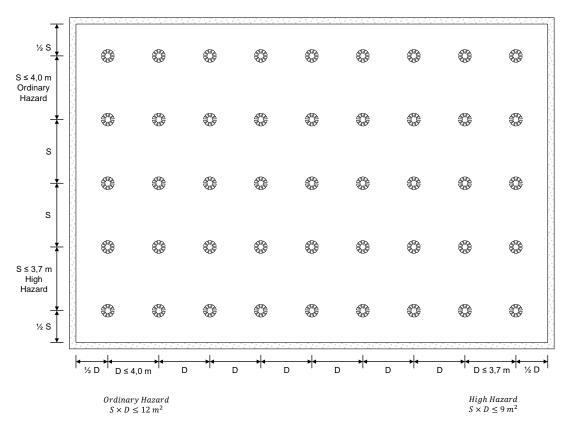
3005 Staggered spacing – Ordinary Hazard

Where sprinklers are required to be staggered, the arrangements shall be uniform.

The distance from the end sprinkler to the wall or partition in each alternate row is to be one-quarter of the design sprinkler spacing down the row and the spacing of the next sprinkler in the same row is to be three-quarters the design spacing.

The maximum area coverage for as stated in these rules may not be exceeded. See Figure 304.

Figure 303: Standard spacing arrangement



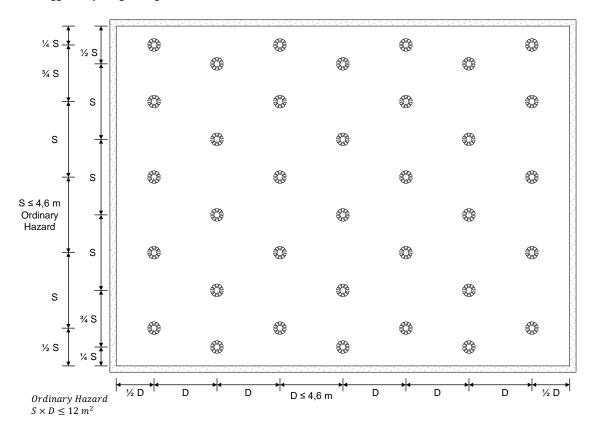
3006 Minimum distance between sprinklers

Other than intermediate level sprinkler protection, sprinklers shall not be spaced closer than 1,8 metres for spray pattern and 2,0 metres for conventional pattern sprinklers except where intervening construction features provide a satisfactory baffle or where special baffles as described in these rules are installed to prevent the first sprinkler operating from wetting adjacent sprinklers.

For extended throw sidewall sprinklers, the adjacent or opposing sprinklers must be positioned at least 1,0 metre past the extremity of the coverage or as taken from the manufacturer's literature.

Baffles shall be not less than 200 mm wide and 150 mm high and preferably of sheet metal or similar incombustible material. They shall be located midway between sprinklers and arranged to baffle the actuating elements. When placed on range pipes, the top of the baffles shall extend above the deflectors by 75 mm to 100 mm.

Figure 304: Staggered spacing arrangement



3007 Location of sprinklers

The use of any rule in respect of obviating structural obstructions at roof or ceiling level such as beams, columns, girders, and trusses to avoid bay protection and to space adjacent ranges the maximum distance apart is not an acceptable method of protecting a structure.

Sprinklers shall be located under beams or in bays or a combination of both, provided the locations meet the provisions outlined within these rules.

Where roofs or ceilings are constructed using beams and girders or profile panelling, sprinklers shall be in bays rather than under beams.

Where the ceiling is profiled the distance from the ceiling shall be measured from the top of the profile. The deflector position relative to the ceiling profiling shall comply with these rules.

In addition to meeting the limitations specified for the maximum area coverage per sprinkler and the maximum distance between sprinklers, sprinklers must be so located that there will be minimum interference to the discharge pattern by structural members such as beams, columns, girders and trusses, or any other obstructing features.

Sprinklers must be located at the appropriate distance below ceilings and beams as required in these rules.

3008 Walls and partitions

The use of combustible wall cladding or lining is not contemplated within sprinkler protected structures other than as allowed for such as composite panels.

Except as provided for in these rules, the distance of sprinklers from internal walls or partitions must not exceed 2,0 metres or half the design distance, whichever is the lesser in Ordinary or High Hazard systems.

The minimum distance a sprinkler may be from a wall, partition, or end or side of fixtures or fittings, (such as lighting that protrudes beneath the finished level of ceilings or roof structures), shall not be less than 150 mm.

Sprinklers shall not be spaced more than 1,5 metres or half the design distance, whichever is the lesser from:

- a) Ceilings that are open-joisted.
- b) A roof that has exposed rafters.
- c) Where the boundary is the open face of a building or canopy.
- d) Where the external walls are of inferior construction, for example, where they are constructed of either:
 - I. Combustible material,
 - II. Asbestos cement, metal, or fibre cement.
 - III. Metal (whether on a wood or a metal frame and whether with or without a combustible lining), protected with a coating of bitumen, tar, or pitch, or with material impregnated or treated with bitumen, tar, or pitch.

3009 Ceilings and roofs

Where sloping ceilings or roofs are installed, the spacing measurements are to be taken horizontally.

Where the roofs incline changes more than 45°, the angle changes must be treated as a wall or other obstruction, and the sprinkler position will be determined from this point.

Where a bulkhead, roof or ceiling rises or drops more than 450 mm the change in elevation shall be treated as a wall or other obstruction whereby the sprinkler position will be determined from this point.

Where the roof or ceiling slope is greater than 1 in 3, a line of sprinklers must be fixed at the apex or not more than 750 mm radially therefrom.

Roof insulation materials shall be classed as non-combustible.

The use of thermoplastics for roof or ceiling insulation is not permitted.

Where, whether being impregnated with retardants the protection is above a structure such as a cold room or freezer where combustible sandwich or composite panel construction is employed, the following is required:

- a) High Hazard with a minimum design density of 7,5 mm/min/m² over an assumed maximum area of operation of 260 m².
- b) A maximum allowable spacing of 3,0 metres between sprinklers on a range and 3,0 metres between adjacent ranges shall not be exceeded.
- c) 79° C or 93° C operating temperature, fast response sprinklers shall be used.

Deflectors of sprinklers must be parallel to the slope of the ceiling, roof, or incline of stairs and where possible the deflectors shall be located between 75 mm and 150 mm below ceilings and roofs.

Where this is not possible, the area involved must be as small as possible and the sprinklers installed at lower levels shall have their deflectors not more than:

- a) 300 mm below the underside of combustible ceilings and roofs.
- b) 450 mm below the underside of:
 - i. Ceilings of incombustible construction which are in no part less than 75 mm thick, or
 - ii. Ceilings of incombustible construction less than 75 mm thick but which are affixed to the underside of a fireproof floor, or
 - iii. Roofs entirely of incombustible construction, (excluding asbestos cement sheeting, wired glass and other similar frangible materials which are treated as combustible).

A hollow block or concrete roof may be covered externally with a weatherproofing material, with or without a layer of heat insulating material between it and the roof, provided there is no intervening air space.

The minimum allowable distance of 75 mm must be adhered to for sprinklers installed in the upright position to facilitate removal of these.

a) Open joist ceiling

With open joist ceilings the deflectors must be not more than 150 mm below the underside of the joists.

b) Exposed common rafters in roofs

With exposed common rafters in roofs the measurements are to be taken from the underside of the rafters.

c) Arched Ceilings

With arched ceilings the measurements are to be taken from the crown of the arch.

d) Skylights

Skylights with a volume greater than $1,0 \text{ m}^3$ measured above the normal ceiling or roof level shall be sprinkler protected unless the distance from the normal ceiling or roof level and the skylight does not exceed 300 mm or there is a tightly fitting frame and glass fitted level with the roof or ceiling.

3010 Beams, joists etc.

Where deflectors of sprinklers are above the level of the bottom of the beams or joists, the sprinklers must be at such distances therefrom that undue interference with the sprinkler discharge pattern is avoided.

The dimensions in Table 302 indicate the minimum distances to the values specified in Figure 305.

Should it not be possible to apply the dimensions in Table 302 sprinklers shall be installed on either side as though it were a wall.

3011 Coffer, waffle or shofco slab construction

Providing the sprinkler deflector is within the maximum allowable distance from the soffit of the coffer, the deflector must not be within the coffer itself and shall be positioned on the underside of the rib at the intersect point between the coffers or shofco construction.

The deflector must be below the level of the rib and range pipes shall be positioned beneath these. In all cases pendent or upright style spray pattern sprinklers shall be used.

Where narrow bays are formed by coffer construction and the beams are spaced at not more than 1,5 metre centres, the sprinkler ranges may be positioned beneath the beams and every alternate row of sprinklers shall be positioned within the coffer with the sprinkler deflector within 75 to 150 mm of the soffit.

The sprinkler shall be installed at no greater than 1,0 metre from any wall running parallel to the beams and 1,5 metres from the walls perpendicular to the beams.

The distance between sprinklers on a range and the distance between adjacent ranges shall not exceed that allowable under the hazard class.

Where the depth of the beam, (or joist), exceeds 300 mm, (combustible ceilings), or 450 mm, (incombustible ceilings), and it is impracticable to position sprinklers at the required distance from the side of the beam, the beam is to be treated as a wall so far as the sprinklers in the adjoining bay are concerned.

Where the depth of beams, (or joists), are such that the dimensions specified in Table 302 cannot be complied with and the beams, (or joists), are spaced closer than 1,8 metres, measured from centre to centre of beam, special consideration may be applied if the parameters do not exceed those of the manufacturer.

In such cases, as mentioned above, it will normally be a requirement that the sprinklers be stagger spaced. Where beams of these depths are spaced closer than 1,2 metres, it is strongly recommended that they be under-drawn with substantial incombustible material.

Table 302 Maximum height of sprinkler deflector above or below a beam or joist

1	2	3	4	5	6	
Minimum horizontal distance (a) vertical axis from sprinkler to side of beam or joist	Maximum h		or above (+) or below (-)		m or joist (b)	
(mm) (See Figure 305)					Sprinklers (mm)	
(See Figure 303)	Upright	Pendent	(mm)	Upright	Pendent	
200	0	-	- 50	0	0	
400	+ 10	-	- 45	+ 10	+ 20	
600	+ 30	-	- 40	+ 20	+ 50	
800	+ 60	-	- 30	+ 20	+ 110	
1000	+ 100	- 200	- 20	+ 30	+ 180	
1200	+ 150	- 160	0	+ 60	+ 250	
1400	+ 210	- 100	+ 20	+ 90	+ 350	
1600	+ 280	0	+ 45	+ 125	+ 480	
1800	+ 390	+ 140	+ 80	+ 190	+ 670	

3012 Columns

In general, sprinklers shall be spaced well clear of columns. Where it is unavoidable that individual sprinklers fall within 600 mm of any column, the obstruction to the distribution of water from the sprinkler shall be minimised by placing a sprinkler within 2,0 metres of the opposite face of the column.

3013 Girders

Sprinklers shall be at least 1,2 metres from girders except that where the top flange of girders does not exceed 200 mm nominal in width, sprinklers may be located directly over the girder, provided the sprinkler deflectors are not less than 150 mm above the top of the girder.

3014 Roof trusses

Sprinklers shall be installed in accordance with one of the following:

- a) 150 mm directly above the truss where the flange of the truss is no more than 200 mm wide.
- b) Not less than 300 mm laterally from truss members where the flange of the truss member is not more than 100 mm in width.
- c) Where the flange of the truss members exceeds 100 mm wide, the sprinklers shall be at least 600 mm laterally therefrom.

Where sprinkler ranges are located parallel to the truss members, the distance of the sprinkler deflectors therefrom shall be in accordance with Table 302.

Figure 305: Distance of a sprinkler deflector from beams

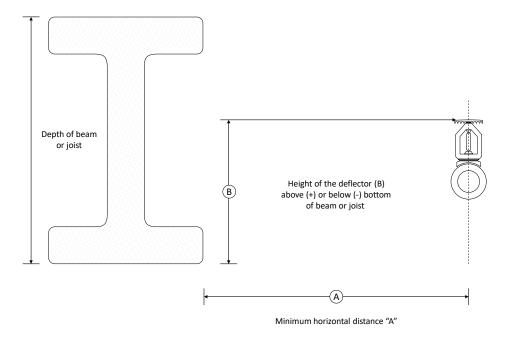
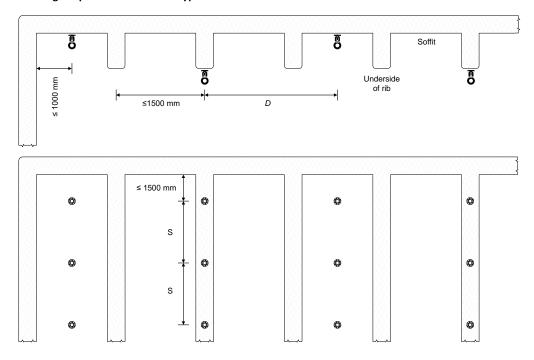


Figure 306: Positioning of sprinklers beneath a typical coffer or beam construction



3015 Locations or conditions involving special consideration (supplementary protection)

3016 Concealed spaces

Non-combustible concealed spaces having an exposed combustible insulation where the heat content does not exceed 11,500 kJ per m² shall not require sprinkler protection.

Concealed spaces of non-combustible and limited combustible construction with minimal combustible loading having no access shall not require sprinkler protection, i.e., less than 11,500 kJ per m² combustible loading.

Concealed spaces of non-combustible and limited combustible construction and access and not permitting occupancy or storage of combustibles shall not require sprinkler protection.

Concealed spaces over isolated small rooms not exceeding 5 m² in area shall not require sprinkler protection.

Concealed spaces where rigid materials are used and the exposed surfaces have a flame spread index of 25 or less, and the materials have been demonstrated not to propagate fire when tested in accordance with ASTM E84, extended for an additional 20-minutes in the form in which they are installed, shall not require sprinkler protection.

Sprinklers installed upright are usually more effective than pendent sprinklers especially where the height of the concealed space is limited.

Sprinklers protecting ceiling ventilation intake plenums shall be rated as standard response thermal sensitivity.

If there is any communication between the ceiling level sprinklers and the void protection or the void is being used as a return air plenum the sprinklers protecting a concealed space shall be fed from separate pipework or from the pipework serving an adjoining room.

Where combustible materials are used in construction of concealed spaces, or where there is open communication between the protected room or area and the concealed space, for example, sprinkler protected ventilation plenums, simultaneous operation of sprinklers in the concealed space and the naturally accompanying or associated room shall be assumed when determining pipe sizes and pressure and flow characteristics of the installation.

Where non-combustible materials are used in the construction of concealed spaces and there is no communication between the protected space and the room, simultaneous operation of the void and protection beneath the void ceiling need not be assumed.

3017 Roof spaces

The spaces between ceilings and roofs including those at the apex and sides of buildings exceeding 800 mm in depth in any portion measured between the underside of the roof and the top of the ceiling or soffit if of concrete construction must be sprinkler protected. In the case of spaces less than 800 mm in depth where combustible construction is involved, a suitable cavity barrier must be installed.

Such cavity barrier shall be provided for vertical division and at approximately 15 metre intervals for horizontal division.

3018 Floor spaces - ceiling voids

Where concealed spaces between floors and ceilings below exceed 800 mm in depth measured from the top of the ceiling board to the underside of the floor above or soffit if of concrete construction contain any combustible materials, including PVC conduits, they shall be fitted with sprinklers.

In the case of spaces less than 800 mm in depth where combustible construction is involved, cavity barriers that resist the passage of flames, heat, and smoke for not less than 30-minutes shall be installed.

Where extensive concealed spaces between floors and ceilings comply in respect of being formed of non-combustible material, the ceiling tiles and grid system shall have a minimum rating of 30-minutes and resist the passage of flames, heat, and smoke for this period.

Where it is impractical to install protection a suitable smoke detection system shall be installed. Smoke detection or ventilation are not substitutes for sprinkler protection.

Protection at roof or ceiling level may be omitted above cloud ceilings where the open area between does not exceed 20% of the total area under consideration. The maximum allowable width between ceiling sections shall not exceed 200 mm.

3019 Spaces under floors

Sprinklers must be installed in all spaces below combustible floors, except where:

- a) The space is not accessible for storage purposes or entrance of unauthorised persons and is protected against accumulation of debris.
- b) The space contains no equipment such as steam pipes, electric wiring, (except cables in metal conduit or mineral insulated copper-sheathed cables, suitably earthed), shafting or conveyors.
- c) The floor over the space is tight in respect of services and access, and
- d) No flammable liquids are stored on the floor above.

3020 Ceiling void ventilation systems or air conditioning plenums

Where ceiling voids are used as plenums for ventilation or air conditioning systems the following shall apply:

- a) The ceiling void plenum shall be protected by a suitable automatic fire detection system. Operation of the ceiling void fire detection shall automatically shut down the ventilation system.
- b) The ceiling void plenum shall be inspected at least every 6-months for the build-up of dust or debris and cleaned as necessary.

Where the plenum construction is not combustible, and the plenum contains no combustible material the plenum void need not be fitted with sprinklers.

Where the plenum construction is combustible or the plenum contains combustible materials such as PVC conduit or wiring, the plenum void shall be sprinkler protected and the assumed maximum area of operation required for the risk as stated in these rules beneath the plenum shall be increased by four sprinklers from within the plenum void area.

3021 Roof spaces that vary in depth

Where the roof space changes in depth and the deeper section requires sprinkler protection the roof space shall be either:

- a) Sprinkler protected throughout, or
- b) Sprinkler protected within the section greater than 800 mm in depth and compartmentalised with cavity barriers in those areas less than 800 mm in depth.

3022 Ceiling voids protected with CPVC pipe

CPVC pipe shall not be used for the protection of intermediate floor spaces or ceiling voids only.

CPVC pipe may be used within a ceiling void where the pipe supplies sprinklers protecting the area below the void.

CPVC pipe shall not be used where the floor space or void is used as a ventilation plenum.

Where CPVC pipe is concealed, it shall have a minimum protection of:

- a) One layer of 10 mm gypsum wallboard or equivalent.
- b) Suspended non-combustible ceiling weighing not less than 1,7 kg per m².
- c) Alternative protection having not less than 30-minutes fire rating.

3023 Suspended ceilings - underdrawn ceilings

The use of any material below the sprinklers, (as for example in connection with diffused lighting), is not allowed unless that material is shown through approved fire testing not to impair sprinkler protection.

Where sprinklers are fitted below suspended ceilings, the material must be of a type which has been shown through approved testing not to be subject to partial collapse under fire conditions.

Spray pattern sprinklers fitted with escutcheon plates shall be used for the protection of the underside of suspended ceilings.

3024 Suspended open ceilings

Suspended open ceilings are ceilings having a regular open cell construction recurring throughout their design. They are usually fitted for aesthetic purposes, but when positioned below a sprinkler system must not prevent its effective operation.

Suspended open ceilings may be permitted beneath Ordinary Hazard sprinkler systems not involving storage areas. The suspended open ceilings and sprinkler arrangement must comply with the following requirements:

- a) Suspended open ceilings shall preferably be of non-combustible construction and shall not be liable to collapse before operation of sprinklers.
- b) The ceiling shall be suspended on non-combustible supports, and the materials shall not cause dripping of molten particles in fire conditions.
- c) The structural integrity of the suspended open ceilings and any other equipment such as light fittings within the volume above the suspended open ceilings, shall not affect the operation of the sprinkler system.
- d) The total plan open area of the suspended open ceiling shall not be less than 70% of the ceiling plan area.
- e) Services installed in suspended open ceilings such as light fittings, shall not reduce the open plan area of the ceiling below 60% of the total ceiling plan area.
- f) Supplementary sprinklers shall be provided to discharge below light fittings or similar obstructions exceeding 800 mm in width.
- q) The minimum dimension of the openings shall not be less than 25 mm or the vertical thickness of the suspended ceilings, whichever is the greater.
- h) The sprinkler spacing above suspended open ceilings shall not exceed 3,0 metres maximum with an area of coverage not exceeding 9 m² maximum.
- i) The vertical separation between any sprinkler deflector and the top of the suspended ceiling shall not be less than 800 mm for sprinklers other than flat spray sprinklers and not less than 300 mm if flat spray sprinklers are used.
- j) Wherever obstructions within the ceiling void are likely to cause significant interference of the water discharge they must be treated as walls for the purpose of sprinkler spacing.

3025 Concealed wall cavities

Concealed spaces or cavities between walls without combustible linings that exceed 100 mm in width and those between roofs and linings which exceed 100 mm in depth must be fitted with sprinklers.

Electric cables are permitted provided the wiring is either in a screwed steel conduit or in mineral-insulated metal-sheathed cable.

3026 Composite panels and roof or ceiling insulation materials

It is the responsibility of the building designer to ensure that the insulation materials are non-combustible and will not contribute to a fire.

A fire involving combustible insulation will spread in an uncontrolled manner above the line of sprinklers.

Roof or ceiling insulation materials that are classed as non-combustible in accordance with internationally accepted testing standards shall be used within sprinkler protected premises.

Cold rooms, freezers, and fridges regardless of construction or if constructed of composite panels using expanded plastics, hydrocarbons, or similar products such as polystyrene or polyurethane whether impregnated with retardants and irrespective of size shall be fully sprinkler protected.

Where the use of combustible materials is contemplated such as for fridge, freezers and cold rooms or any structure using composite panels which have either a positive flame spread index or are hydrocarbon based, the following requirements shall be applied.

- a) The sprinkler protection within such structures shall have a minimum design density of discharge of 7,5 mm/min/m² over an assumed maximum area of operation of 260 m² or the applicable occupancy standard, whichever is the greater.
- b) For High Hazard risks and occupancies, conventional pattern, fast response sprinklers having an operating temperature of 93° C with a Response Time Index of less than 50 shall be used within structures or rooms maintained above freezing, i.e., 5° C or greater.
- c) Special consideration shall be given to the protection and operating temperature of sprinklers protecting cold rooms or freezers where the temperature is maintained below 5° C. The use of 68° C operating temperature is recommended.
- d) The maximum allowable spacing for sprinkler protection within a structure that has combustible walls or partitions as detailed in Rule 3027 shall not exceed 3,0 metres between adjacent sprinklers on a range or 3,0 metres between adjacent ranges, 0,6 metres from end walls or partitions within the structure.
- e) Sprinkler protection is required above such structures within the roof or void space where this is equal to or more than 800 mm in depth, the design density of discharge shall not be less than 7,5 mm/min/m² over an assumed maximum area of operation of 260 m².
- f) For roof or void protection Rule 3027 d) shall apply except for the distance from end walls and partitions where this may not exceed 1,5 metres or half the design distance whichever is the lesser.
- g) Sprinklers with an operating temperature of 93° C and a Response Time Index of less than 50 shall be used to protect void or roof spaces.

3027 Shopping malls and building atria

Sprinkler protection of shopping malls and building atria shall not be omitted unless the construction and occupancy conforms with the following and is reviewed on a case-by-case basis:

- a) The mall is of lofty construction, i.e., 18,0 metres above any combustible content or décor.
- b) Is of non-combustible construction.
- c) The amount of combustible material, (floor level and overall construction), is negligible.
- d) Those portions of the mall or atrium under consideration are not used for restaurant seating, display, or retail purposes.
- e) There is a rated full height fireproof barrier between each adjacent shop and within the void.
- f) The void areas are fully sprinkler protected in accordance with these rules.
- g) The shop frontage and any bulkhead is sprinkler protected on the mall side.

3028 Ventilation in sprinkler protected premises

Sprinklers operation is susceptible to side draughts which may be produced by roof ventilation as well as providing the ability to move hot gases, ventilate a fire and assist in the horizontal spread.

Installations shall be designed to ensure that the sprinklers are not positioned beneath the throat of a ventilator or an extract area and shall be installed in such a way that the ventilation does not negatively affect the timely operation of the installation. See Figures 307 and 308.

Manually operated ventilators shall be used within storage premises where the growth of a fire may be rapid and especially where fast response or specialised sprinklers are used.

Where there are no high stacks of goods or products that represent a high fire load, ventilators may open under a fire condition using fusible links, the operating temperature of the link shall be set to above the operating temperature of the roof or ceiling level sprinkler protection and subject to a minimum temperature of 180° C.

Where high volume low speed fans are installed, they shall be centred between four sprinklers.

In life safety structures where the opening of vents will facilitate in the evacuation of occupants, a fast-opening system such as that linked to a fire detection system should be considered.

Figure 307: Ridge ventilation ≥ 0,8 m and ≤ 3,0 m

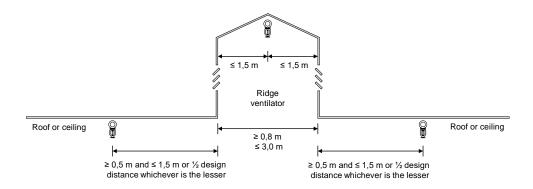
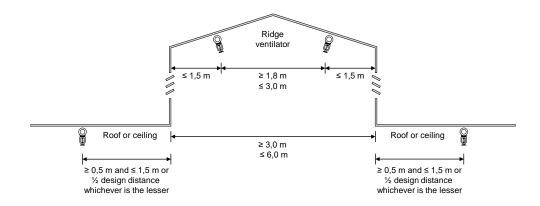


Figure 308: Ridge ventilation ≥ 3,0 m and ≤ 6,0 m



3029 Machinery pits where waste may collect and the underside of production lines

Machinery pits and production lines must be fully sprinkler protected.

3030 Hoists, lift shafts and enclosed chutes through floors

All hoists, lift shafts and chutes inside or in communication with the sprinkler protected buildings other than as permitted within these rules must be protected by sprinklers.

Where sprinklers are installed at the head of lift shafts, these must be protected by approved sprinkler guards.

3031 Elevators, rope or strap races, gearing boxes and dust receivers

A sprinkler must be fitted in the box at the top of every elevator, (other than those of the pneumatic type or which comprise a slow-moving endless chain fitted with rings, loops, or forks, capable of functioning only when the elevator is full). The sprinkler in each case must be so placed as to command the head and both legs or shafts of the elevator.

Sprinklers must be fitted internally in all rope or strap races, gearing boxes and in all enclosed belt or shaft machine drives.

Sprinklers must be fitted in dust cyclones, collection chambers and boxes where:

- a) Housed within the protected building.
- b) Erected outside and directly above the protected building unless the roof is of incombustible construction.
- c) External to but connected with and closely adjacent, (within 10,0 metres), to the protected buildings.

Where dust cyclones, collection chambers and boxes are erected above non-combustible roofs or where they are situated remote from the protected building, (more than 10,0 metres), at least one sprinkler must be fitted inside the trunking where it leaves the protected building.

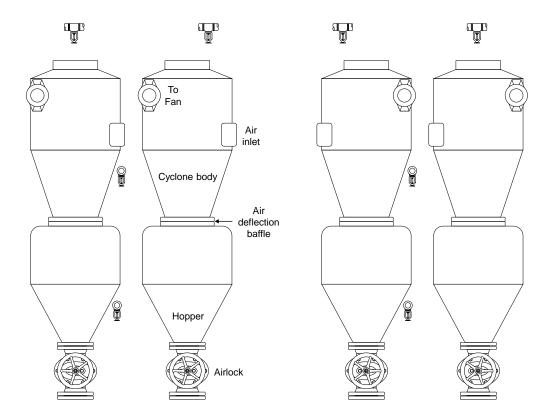
3032 Corn, rice, provender, and oil mills

Sprinklers must be fitted not more than 3,0 metres apart inside all dust trunks which are more than 300 from the vertical and constructed of combustible materials.

A sprinkler must be fitted at the head of every dust trunk.

When centrifugal or similar machines are placed one above another in tiers and are less than 1,0 metre from each other, sprinklers must be fitted in the spaces as shown in Figure 309.

Figure 309: Suitable location for sprinklers protecting centrifugals or cyclones spaced less than 1,0 metre apart



3033 Bins and silos

All bins and silos of combustible construction having a plan area in excess of 9 m² for the storage of flour, bran, or other similar material which has undergone any process of reduction, (in such premises as flour mills, granaries, oil mills or distilleries), or for the storage of sawdust, wood flour, pulverised coal and similar easily ignitable materials which can be extinguished by water, must be internally protected by sprinklers on the basis of one sprinkler per 9 m² of the bin or silo area.

If the bin or silo contains material which will swell if wet and thereby incur the risk of bursting, exemption from this rule may be specially allowed.

3034 Escalators and stairwells

Providing the area beneath an escalator or stairwell contains no combustible materials and is not used for concessions, protection will not be required beneath these structures but the number of sprinklers around the peripheral opening formed by the escalator or stairwell shall be increased.

Sprinklers shall not be more than 1,8 metres apart and shall not exceed 0,5 metres from the face of the opening.

For hydraulic calculation, only the sprinklers on the longer side of the opening need be considered.

3035 Canopies

Sprinklers must be installed under all canopies where goods are offloaded, stored, or handled and which communicate with the sprinkler protected building. The design density of discharge for the protection of a canopy shall not be less than that within the main facility.

Canopies which are of incombustible construction and do not extend more than 2,3 metres from the wall of the building need not be fully protected if cut-off sprinklers are fitted under the canopy over each of the openings into the sprinkler protected building.

Where such openings do not exceed 2,5 metres in width, one sprinkler positioned centrally over each opening will suffice. Where openings exceed 2,5 metres in width, the sprinklers over the openings must be spaced not more than 2,5 metres apart and not more than 1,25 metres from the sides of the opening.

Where canopies or loading ways for warehousing are less than 1,2 metres wide or are over a public street designated as such by a Municipality, protection may be waived.

The maximum distance from the edge of a canopy to the terminal sprinklers shall not exceed 1,5 metres.

3036 Exterior docks and platforms

Sprinklers shall be installed under exterior docks and loading platforms of combustible construction unless such space is closed off against the accumulation of debris.

3037 Enclosed paint lines, drying ovens, and drying enclosures

Sprinkler protection must be provided inside these structures. Open wide angle medium velocity sprayers are the most effective positioned along the corners of the oven and directional onto risk and structure.

Obstructions below the sprinklers which are likely to delay the operation thereof and impair effective water distribution will require additional sprinklers beneath them.

Drying ovens or enclosures where the temperature is close to or exceeds 70° C can be protected using a manually operated suitably activated deluge system.

Consideration shall be given to a manually operated system on a case-by-case basis, see Figure 310.

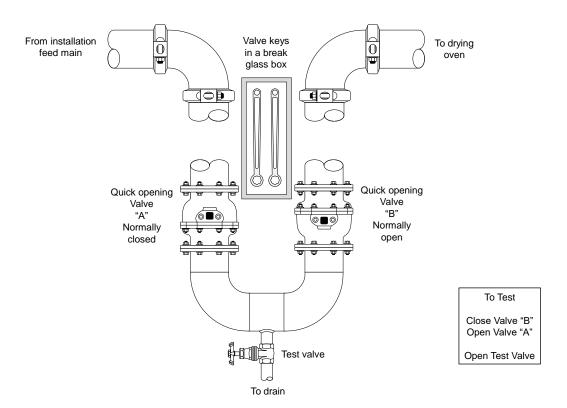
The design density of discharge to these structures shall not be less than 10,0 mm/min/m² with an assumed maximum area of operation of the length of a spray paint booth and drying tunnel.

Suitable high temperature sprinklers shall be installed 3,0 metres past the boundary of the oven at roof level.

Cellophane bags having a thickness of 0,076 mm or less or thin paper bags shall be used to protect sprinklers for spray areas and mixing rooms and in areas where over spray or residue may settle on the sprinklers.

Coverings shall be replaced periodically so that heavy deposits of residue do not accumulate and sprinklers that have been painted or coated shall be replaced in accordance with the requirements of these rules.

Figure 310: Manually operated deluge system for a drying oven



3038 Internal mezzanine floors, overhead platforms, heating panels, galleries, walkways, stagings, stairs, stairways, conveyors, and chutes

Sprinklers are required under these structures if they exceed 800 mm in width regardless of whether they are open grid or of solid construction unless there is at least 150 mm clearance from adjacent walls or partitions and 500 mm clearance below the sprinkler deflector to top of structure when the width without protection may be 1,0 metre.

3039 Ducts

Sprinklers are required under rectangular ducts exceeding 800 mm in width and under circular ducts exceeding 1,0 metre in diameter, unless there is at least 150 mm clearance from adjacent walls and 500 mm clearance below the sprinkler deflector to top of the duct, when the width without protection may be 1,0 metre and 1,2 metres, respectively.

3040 Cooking hoods and extract equipment

Cooking areas and surfaces including deep fat fryers shall be protected with an approved and listed fire extinguishing system.

Where these are protected with sprinklers or sprayers the following shall apply:

- a) Cooking areas and surfaces including deep fat fryers shall be sprinkler protected with nozzles specifically approved for this application. FM or similar listed and approved 6,4 mm orifice or smaller stainless steel wide-angle (120o or larger) full cone discharge water spray nozzles are deemed to be acceptable.
- b) Where the supply is taken from a sprinkler installation protecting the remainder of the building, a subsidiary stop valve can be provided to isolate the sprinklers in the event of operation.
- c) Where deep fat frying occurs, if nozzles specifically approved for this purpose are not used, an approved and listed automatic foam, dry powder or gas extinguishing system shall be installed.
- d) Water from a sprinkler will initially excite a fat fire before the suppression process commences, occupants of a sprinkler protected kitchen must leave immediately if a fire occurs.
- e) Sprinkler protection shall be installed within all cooking equipment ventilation systems.
- f) Where extraction canopies are designed to extract grease laden vapours or heat through a ventilation system, they shall be fully sprinkler protected, inclusive of exhaust ducts and exhaust plenum chambers, using 141° C operating temperature spray pattern type nozzles unless alternative protection is installed.
- g) The operation of the fire protection measures taken to protect extract canopies shall automatically shut off any source of fuel and heat.

3041 Worktables

Additional sprinkler protection shall be required beneath worktables over 800 mm in width where the undersides are used for housing of motive power or under which combustible process waste or storage may accumulate.

3042 Hoods over paper-making machines

The underside of hoods or shields over the dry ends of paper-making machines must be sprinkler protected. Sidewall sprinklers may be used for this purpose.

Subsidiary stop valves to control these sprinklers is allowable.

3043 Film and television production studios

Overhead platforms or walkways including those for lighting or other equipment, whether slatted or not, together with stairs thereto, shall be fitted with sprinklers on the underside if they exceed 800 mm in width. This does not apply to temporary platforms in connection with sets.

3044 Theatres and music halls

3045 Protection on the stage side of the proscenium wall

In addition to the normal sprinkler protection at the roof, sprinklers protection is required under the grid iron, under the flies, under the stage and in every portion of the stage side of the proscenium wall and in any buildings communicating therewith otherwise than by fireproof doors.

Where a fireproof curtain is installed, it shall be provided with a line of open drenchers spaced at no more than 2,0 metre intervals on the apron side of the curtain. The control valve must be of the quick-opening type fitted in an easily accessible position at least 10,0 metres away from the line of drenchers.

The water supply to these open sprinklers or drenchers may be taken from the upstream side of any automatic sprinkler installation valve and shall be capable of catering for the combined operation of the drenchers and the sprinkler system.

3046 Protection on the auditorium side of the proscenium wall

Sprinklers are to be placed in the dressing rooms, scenery, storerooms, refreshment bars, cellars, anteroom, in the boxes, under the dress circle, upper circle and under and in the gallery, also directly over the pit and under the ceiling and in the spaces between the ceiling of the auditorium and the roof, whether that space is used for the storage of stage props or not.

Where movable scenery is in use (for example under fly gallery floors) and there are projecting sprinklers, particular care shall be taken to ensure that the scenery can be moved safely and that the sprinklers are protected from damage.

Sprinklers shall be sited with particular care where personnel might work in proximity, for example, under the grid, to reduce the risk of impact and injury.

Stage floors are subject to frequent modification with some parts being removed and others replaced. This is to be considered when sprinkler pipework is fitted under the stage.

Where hydraulic lifts, etc. are used, special consideration is to be given to the protection as standard sprinkler protection may not be suitable.

3047 Computer areas and archive rooms

It is recommended that two forms of protection be installed, i.e., a sprinkler installation that complies with the contents of Rule 3046 and/or an approved and certified automatic gas flooding system.

Where sprinkler protection is omitted and an alternate approved and listed system is installed, the room or area shall be constructed with a fire resistance of not less than 60-minutes.

Sprinklers protecting computer areas shall, where practicable, comprise a separate installation fed directly from the trunk main through a set of main installation control valves. Fast response sprinklers with a response time index of less than 50 shall be used.

Where the supply must be taken from a sprinkler installation protecting the remainder of the building, a subsidiary stop valve shall be provided to control the sprinklers in the computer area. The valve shall be either:

- a) Electrically monitored at a continuously manned position at which any partial closing of the valve shall be signalled by a visible and audible alarm, or
- b) Of the interlocking key or rising spindle type.

A local indication of sprinkler operation in the computer area may be given by either a subsidiary alarm valve with hydraulic alarm or an approved water flow switch.

A special visual check of sprinklers and pipework shall be carried out prior to commissioning.

Facilities shall be provided for drainage of the protected area.

Notwithstanding that voids less than 800 mm deep may be left unprotected, there shall be sprinkler protection in such floor and ceiling voids forming cable ways wherever practicable, unless they are protected by an approved automatic gas extinguishing system.

3048 Early Suppression Fast Response Sprinklers (ESFR)

3049 Preliminary arrangements

The information provided at the preliminary or estimating stage shall include an assessment to establish ability to comply with critical requirements.

The assessment shall include a review of the intended actions to comply with all requirements as listed within these rules.

Any known non-compliance with any other requirements shall be declared.

3050 Management systems

ESFR sprinkler protection shall only be used in buildings where the property, storage systems and contents are controlled by appropriate management systems.

The management system documentation shall include procedures throughout consisting of at least the following:

- a) Risk assessment controls for incoming goods.
- b) Routine checking and inspection procedures.
- c) Sprinkler system maintenance contract with an approved sprinkler installer.
- d) Maintenance of an outline specification for the building and fire protection with a record of any changes which may influence the performance of the sprinkler systems.
- e) Bi-annual review of storage methods.
- f) Bi-annual review of the hazard.
- g) Bi-annual review of compliance with ESFR installation requirements.
- h) Dealing with non-compliance.

A bi-annual review of the hazard shall include checking that the aisles and flues in the storage comply with the respective requirements.

These procedures shall encompass actions to be taken where major non-compliance occurs and shall include informing the fire department authorities and the leading insurers.

3051 Occupancies and fire hazards

ESFR sprinklers may be used to protect storage in accordance with the Tables 114 and 304 to 313.

ESFR sprinklers may be used to protect Ordinary Hazard and High Hazard process areas adjacent to the ESFR protected storage areas.

ESFR sprinklers shall not be used to protect areas where one of the following may be present:

- a) Materials on which fires cannot readily be controlled by sprinklers, (example, acrylic fibre yarn).
- b) Commodities or storage configurations which may give rise to unusual fire characteristics, (example, lightweight paper, such as rolls of tissue or acrylic fibre yarn where control mode and not suppression mode is contemplated).
- c) Open top containers, (example, plastic storage boxes such as tote boxes with solid bottoms).
- d) Commodities which have not been assessed or tested for protection by ESFR sprinklers.
- e) Pushback racking, solid shelving, and bin box storage.
- f) Storage where the racking or shelving support system is angled and not in the vertical position.
- g) Automatic smoke venting.
- h) Where combustible roof, ceiling insulation or construction is present.

3052 Automatic smoke venting.

ESFR sprinkler protection may be used in conjunction with manually operated smoke ventilation systems, suitable only for smoke ventilation purposes, operated by the fire brigade or fusible links with an operating temperature of above 180° C with a manual override. Ventilation may also be operated using a flow switch within the rising feed main set to activate once the initial critical sprinklers have opened.

3053 Combustible roof insulation.

ESFR sprinklers may not be installed beneath combustible roof insulation.

3054 Racked, shelved and post pallet storage

All longitudinal and transverse flues shall be continuous for the full height of each block of storage, vertically aligned, free of stored goods and regularly spaced.

Some ESFR sprinklers are not suited for the protection of solid or slatted shelving and in all cases the manufacturer's literature must be adhered to. As a guide, where ESFR sprinklers are acceptable for the protection of shelving, the open plan area of any shelf may not be less than 70%.

Where acceptable to the manufacturer, single and double-row shelved racks shall comply with one of the following:

- a) Shelves having openings of less than 70% of the plan area shall not exceed 2,0 m² total plan area and shall be bounded on all four edges by flue spaces of not less than 150 mm width.
- b) Products stored on racks shall not create single areas of obstruction greater than 2,0 m² plan area.
- c) Slatted shelves shall have shelf-open areas, uniformly interspaced of at least 50% of the shelf plan area. The distance openings shall not exceed 150 mm, or
 - Grated or mesh-type shelves shall have uniform openings of at least 50% of the shelf plan area. The horizontal distance between openings shall not exceed 150 mm.
- d) In multiple row, post pallet, drive in and flow through racks where pallet loads abut one another, longitudinal flues are required at maximum intervals of 4,8 metres

3055 Flue spaces for back-to-back racks

150 mm wide longitudinal flue spaced maximum of 1.6 metres from the face of storage for back-to-back beam pallet racking.

 $150 \ \text{mm}$ wide transverse flue spaced a maximum of every $1.4 \ \text{metres}$ shall be maintained.

3056 Flue spaces for multiple row racks

Multiple row racks are limited to a maximum depth of 6.0 metres and block of storage shall be separated to the adjacent block of storage by a 2,4-metre-wide aisle.

- a) 150 mm wide longitudinal flue spaces at maximum of 1.5 metres apart.
- b) 150 mm wide transverse flue spaces at maximum of 1.5 metres apart.

Note: The suitability of storage systems such as pushback, live, mole and flow racking shall be assessed to ensure the required flue spaces can be maintained. It is not possible to maintain flue spaces where pallets abut, and intermediate level protection will be required in accordance with these rules.

3057 Movable Racks

Movable racks are to be treated as multiple-row rack storage.

3058 Intermediate level sprinklers in ESFR occupancies

Where indicated, ESFR protection specified within these rules allows for extended storage heights in racks provided intermediate level sprinkler protection is installed. Intermediate level sprinklers shall be in accordance with the following requirements:

- a) At least one level of intermediate level sprinklers shall be installed.
- b) Multiple tier level intermediate protection shall be applied for pushback racking.
- c) The vertical distance from floor to the intermediate level sprinklers shall be half the rack height to within one tier height level.
- d) Intermediate level sprinklers shall have the following properties.
- e) Spray pattern sprinklers.
- f) K-Factor of 11,5.
- g) Fast response sprinkler with an RTI of less than 50.
- h) Nominal operating temperature of 68° C.
- i) Be fitted with an approved and listed metal water shield.
- *j)* Be fitted with an approved sprinkler guard.
- k) Intermediate level sprinklers shall be located within the longitudinal flue at each transverse flue intersection at a maximum spacing of 1,5 metres in either direction.
- I) At least eight intermediate level sprinklers shall be assumed to be in simultaneous operation.
- m) The minimum pressure of any operating intermediate level sprinklers shall not be less than 350 kPa.
- n) The water supply shall have sufficient capacity of simultaneous operation of the roof level ESFR sprinkler protection plus the flow requirement for the intermediate level sprinklers.

3059 Storage tables

The heights in the tables refer to the ceiling height which shall be taken as the maximum vertical distance measured from the floor to the underside of the ceiling.

The pressures referred to in the tables are the minimum operating pressure of any ESFR sprinkler within the assumed maximum number of sprinklers operating.

Angled racking such as pushback racking are not suited for ESFR protection and are excluded.

The following tables provide a guide to ESFR sprinkler use.

Table 303 ESFR storage table guide

1	2		3	4
Commodity	Free standing and block storage (Table)	Solid or slatted shelving (Table)	Post pallets multiple rows (Table)	Beam pallet racking (Table)
Aerosols	107	-	-	304
Exposed unexpanded plastic	305	-	-	305
Lightweight paper rolls stored on end or on side	305	-	-	305
Expanded plastic in cardboard boxes	306	-	-	-
Expanded plastic in cardboard boxes	-	-	-	307
Exposed expanded plastics	308	-	-	-
Medium weight paper rolls on end or on side	309	-	-	-
Heavy weight paper rolls stored on side or end	310	-	-	-
Rubber tyres	-	-	311	311
Category I, II and III goods	312	-	-	-
Unexpanded plastic in cardboard boxes	312	-	-	-
Category I, II and III goods	-	-	313	313
Unexpanded plastic in cardboard boxes	-	-	313	313

Table 304 SFR palletised racking of aerosols

1	2	3	4	5	6
	Aerosol Ba	sed Product	Maximum cailing	Nominal	Minimum anninklau
Aerosol packaging materials	Alcohol Storage height (metres)	Hydrocarbon Storage height (metres)	Maximum ceiling height (metres)	K-Factor	Minimum sprinkler operating pressure (kPa)
	6,0	-	7,6	20,0	350
Cardboard Cartons	4,6	-	9,0	20,0	350
	-	4,6	7,6	20,0	350
	-	4,6	9,0	20,0	520
Disabile Films Francisculation	4,6	-	9,0	20,0	350
Plastic Film Encapsulation	-	4,6	9,0	20,0	520

The packaging materials referred to are those which enclose the aerosols.

Where either the packs of aerosols or the pallets are encapsulated in plastic film, the values for "plastic film encapsulation" shall be applied.

The aerosol content is the base material which shall be either:

Alcohol based: typically, hair spray, antiseptics, and anaesthetics.

Hydrocarbon based: typically paints, lubricants and oil based anti-antiperspirants.

Table 305 Exposed unexpanded plastic

1	2	3	4	5	6
Storage			Free standing Block storage Racking		
laximum storage			Maximum ceiling heights (metres)		
height (metres)	9,1	9,7	10,6	12,2	13,7
(metres)		Minimum unfavourable sprin	kler operating pressure (kPa)	
	ESF	R pendent sprinkler nominal	K-Factor 20,0		
7,6	350	410	520	620 *	620 *
9,1	-	-	520	620 *	620 *
10,6	-	-	-	620 *	620 *
12,2	-	-	-	-	620 *
	ESF	R pendent sprinkler nominal	K-Factor 24,2		
7,6	240	290	360	360	430 *
9,1	-	-	360	360	430 *
10,6	-	-	-	360	430 *
12,2	-	-	-		430 *
<u>.</u>	ESF	R pendent sprinkler nominal	K-Factor 32,0		
7,6	350	350	350	350	-
9,1	-	-	350	350	-
10,6	-	-	-	350	-
12,2	-	-	-	-	-
	ESF	R pendent sprinkler nominal	K-Factor 36,0		
7,6	350	350	350	350	-
9,1	-	-	350	350	-
10,6	-	-	-	350	-
12,2	-	-	-	-	-

Table 306 Expanded plastic in cardboard boxes.

1	2	3	4	5	6
Storage			Free standing Block storage		
laximum storage			Maximum ceiling heights (metres)		
height (metres)	9,1	9,7	10,6	12,2	13,7
(incues)		Minimum unfa	vourable sprinkler operating	pressure (kPa)	
		ESFR pendent spri	nkler nominal K-Factor 20,0		
7,6	350	410	-	-	-
		ESFR upright sprir	kler nominal K-Factor 20,0		
7,6	350	-	-	-	-
		ESFR pendent or uprigh	t sprinkler nominal K-Factor	24.2	
7,6	240	290	-	-	-
		ESFR pendent spri	nkler nominal K-Factor 32,0		
7,6	140	-	-	-	-
		ESFR pendent spri	nkler nominal K-Factor 36,0		
7,6	140	410 *	410 *	410 *	-

Table 307 Expanded plastic in cardboard boxes.

1	2	3	4	5	6
Storage			Beam pallet racking		
/laximum storage			Maximum ceiling heights (metres)		
height (metres)	9,1	9,7	10,7	12,2	13,7
(ineties)		Minimum unfavo	ourable sprinkler operating	pressure (kPa)	
·		ESFR pendent sprink	ler nominal K-Factor 20,0		
7,6	350	410	-	-	-
		ESFR upright sprink	ler nominal K-Factor 20,0		
7,6	350	-	-	-	-
·		ESFR pendent or upright s	prinkler nominal K-Factor	24,2	
7,6	240	290	-	-	-
·		ESFR pendent sprink	ler nominal K-Factor 32,0		
7,6	140	-	-	-	-
·		ESFR pendent sprink	der nominal K-Factor 36,0		
7,6	140	410 *	410 *	410 *	-
9,1	-	-	410 *	410 *	-
10,6	-	-	-	410 *	-

Table 308 Exposed expanded plastics.

1	2	3	4	5	
Storage		Free sta Block s	_		
Maximum storage		Maximum ce (met			
height (metres)	7,6	9,1	10,7	12,2	
(metres)		Minimum unfavourable sprin	kler operating pressure (kPa)		
		ESFR pendent sprinkler nominal K-F	actor 20,0		
6,1	-	690	-	-	
7,5	- 690				
		ESFR upright sprinkler nominal K-F	actor 20,0		
6,1	-	-	-	-	
		ESFR pendent sprinkler nominal K-F	actor 36,0		
6,1	410 *	410 *	410 *	410 *	
7,5	=	410 *	410 *	410 *	

Table 309 Medium weight paper rolls on end or on side.

1	2
Storage	Free standing Block storage
Storage	Medium weight paper rolls stored on end
Maximum storage	Maximum ceiling heights (metres)
height (metres)	9,1
(meacs)	Minimum unfavourable sprinkler operating pressure (kPa)
	ESFR pendent or upright sprinkler nominal K-Factor 20,0
7,6	350
	ESFR pendent or upright sprinkler nominal K-Factor 24,2
7,6	240
	ESFR pendent sprinkler nominal K-Factor 32,0
7,6	170
	ESFR pendent sprinkler nominal K-Factor 36,0
7,6	100

Medium weight paper - non-absorbent paper or board with a hard or smooth surface weighing more than 51 g/m² and less than 100 g/m².

Medium weight paper may be protected as heavy weight paper, where wrapped completely on the sides and both ends, or where wrapped on the sides only with steel bands. Wrapping paper shall be a heavy weight paper of total density equal to or greater than 196g/m².

Light weight paper or tissue paper may be protected as medium weight paper where wrapped completely on the sides and both ends, or where wrapped on the sides only with steel bands. Wrapping paper shall be a heavy weight paper of total density equal to or greater than 196g/m².

Table 310 Heavy weight paper rolls stored on side or end.

1	2	3	4	5				
Storage	Free standing Block storage Heavy weight paper rolls stored on side or end							
Maximum	Maximum ceiling heights (metres)							
storage height (metres)	9,1	10,7	12,2	13,7				
(metres)	Minimum unfavourable sprinkler operating pressure (kPa)							
		ESFR pendent sprinkler nominal	K-Factor 20,0					
7,6	350	520	-	-				
9,1	-	520	-	-				
		ESFR pendent sprinkler nominal	K-Factor 24,2					
7,6	240	360	360	-				
9,1	-	360	360	-				
		ESFR upright sprinkler nominal k	(-Factor 24,2					
7,6	240	360	-	-				
9,1	-	360	-	-				
		ESFR pendent sprinkler nominal	K-Factor 32,0					
9,1	170	280	280	340				
		ESFR pendent sprinkler nominal	K-Factor 36,0					
7,6	100	170	170	340				
9,1	-		170	170				

Table 311 Rubber tyres.

1	2	3	4			
Storage	Post pallets in single or multiple rows (1) Racking (1)					
Maximum storage	Maximum ceiling heights (metres)					
height (metres)	9,1	10,7	12,2			
(metres)	Minimum unfavourable sprinkler operating pressure (kPa)					
		FOFF and a solid and a solid Fort 200				
	(-)	ESFR pendent sprinkler nominal K-Factor 20,0				
7,6	350 (2)	520 ⁽⁶⁾	-			
		ESFR upright sprinkler nominal K-Factor 20,0				
7,6	350 (2)	520 ⁽⁶⁾	-			
	ESFR pendent sprinkler nominal K-Factor 24,2					
7,6	350 (2)	520 ⁽⁶⁾	-			
	ESFR upright sprinkler nominal K-Factor 24,2					
7,6	240 (2)	-	-			
	ESFR pendent sprinkler nominal K-Factor 32,0					
7,6	170 (2)	240 ⁽⁶⁾	-			
	ESFR pendent sprinkler nominal K-Factor 36,0					
7,6	140 (2)	280 ⁽⁶⁾	280 (4)			
7,6	280 (4)	520 ⁽³⁾	-			
7,6	520 (3)	-	-			
	ESFR pendent sprinkler nominal K-Factor 36,0					
9,1	-	520 ⁽³⁾	520 (3)			

⁽¹⁾ Open bottomed storage systems only

⁽²⁾ Tyres may be stored on side or on tread (3) Tyres stored laced, on side or on tread

⁽⁴⁾ Tyres stored laced or on tread – post pallets only

⁽⁵⁾ Tyres stored on side – post pallets only (6) Tyres stored on side

Table 312 Category I, II and III goods.

1	2	3	4	5	6			
Storage	Free standing Block storage Unexpanded plastics in cardboard boxes							
laximum storage	Maximum ceiling heights (metres)							
height (metres)	9,1	9,7	10,6	12,2	13,7			
(metres)	Minimum unfavourable sprinkler operating pressure (kPa)							
		ESFR pendent spr	inkler nominal K-Factor 20,0					
7,6	350	410	520	-	-			
9,1	-	-	520	-	-			
10,6	-	-	-	-	-			
		ESFR pendent spr	inkler nominal K-Factor 24,0					
7,6	240	290	360	360	-			
9,1	-	-	360	360	-			
10,6	-	-	-	360	-			
		ESFR upright spri	nkler nominal K-Factor 24,0					
7,6	240	290	360	-	-			
9,1	-	-	360	-	-			
		ESFR pendent spr	inkler nominal K-Factor 32,0					
7,6	140	210	240	280	280			
9,1	-	240	240	280	280			
10,6	-	-	-	280	280			
12,2	-	-	-	-	280			
		ESFR pendent spr	inkler nominal K-Factor 36,0					
7,6	140	140	140	170	280			
9,1	-	-	140	170	280			
10,6	-	-	-	170	280			
12,2	-	-	-	-	280			

Table 313 Category I, II and III goods.

1	2	3	4	5	6
Storage	Post pallets with open bases Beam pallet racking Unexpanded plastic in cardboard boxes Racked storage of medium or heavyweight reeled paper stored vertically or horizontally				
laximum storage			Maximum ceiling (metres)	heights	
height (metres)	9,1	9,7	10,6	12,2	13,7
, ,		Minimur	n unfavourable sprinkler o	perating pressure (kPa)	
		ESFR pender	nt sprinkler nominal K-Fac		
		T		Not si	uitable for post pallets
7,6	350	410	520	620 *	620+ 1 level of in-rack *
9,1	-	-	520	620 *	620+ 1 level of in-rack *
10,6	-	-	-	620 *	620+ 1 level of in-rack *
12,2	-	-	-	-	620+ 1 level of in-rack *
		ESFR uprigh	t sprinkler nominal K-Fact	or 20,0	
7,6	350	410	520	-	-
9,1	-	-	520	-	-
		ESFR pender	nt sprinkler nominal K-Fac	tor 24,0	
					Not suitable for post pallets
7,6	240	290	360	360	430+ 1 level of in-rack *
9,1	-	-	360	360	430+ 1 level of in-rack *
10,6	-	-	-	360	430+ 1 level of in-rack *
12,2	-	-	-	-	430+ 1 level of in-rack *
		ESFR uprigh	t sprinkler nominal K-Fact	or 24,0	
7,6	240	290	360	-	-
9,1	-	-	360	-	-
		ESFR pende	nt sprinkler nominal K-Fac	tor 32,0	
7,6	170	240	240	280	280
9,1	-	-	240	280	280
10,6	-	-	-	280	280
12,2	-	-	-	-	280
		ESFR pender	nt sprinkler nominal K-Fac	tor 36,0	
7,6	140	140	140	170	280
9,1	-	-	140	170	280
10,6	-	-	-	170	280
12,2	-	-	-	-	280

* Not suitable for post pallet storage

3060 Roof or ceilings

Only non-combustible roof insulation that complies with internationally acceptable testing criteria shall be installed at roof or ceiling level.

The ceiling slope influences the movement of hot gases across the ceiling and therefore influences the operation of the sprinklers during a fire. Excessive ceiling slope may result in the operation of sprinklers remote from the fire whilst delaying the operation of those sprinklers near the fire.

The roof or ceiling slope shall not exceed 9,5°, (2 units of vertical drop for every 12 units of horizontal distance).

Where the roof or ceiling slope exceeds 9,5°, the roof or ceiling shall be underdrawn with a false ceiling. The false ceiling shall be of non-combustible construction, having an acceptable slope. ESFR sprinklers shall be deployed below the false ceiling. Standard sprinkler protection shall be employed in the roof or ceiling space in accordance with these rules.

Ceilings and any sub-ceilings shall be firmly secured and shall be capable of withstanding a vertical upward thrust of 50 N/m².

Ceiling materials considered suitable are 10 mm gypsum board, corrugated and sheet steel and mineral tiles.

Roof lights shall be flush to the ceiling or underdrawn at ceiling level.

Roof lights shall be capable of withstanding a temperature of 300° C for a period of not less than 5-minutes.

3061 Ventilation

Automatic ventilation or open natural ventilation shall not be installed in conjunction with ESFR sprinkler protection.

If roof vents or other roof openings are unavoidable, they shall be operated manually.

3062 Powered ventilation

Where High Volume Low Speed (HVLS) fans are installed in buildings protected with ESFR sprinklers, the following shall be complied with:

- a) The maximum fan diameter shall be 7,3 metres.
- b) HVLS fans shall be centred between four sprinklers.
- c) The vertical distance between HVLS fan blades to sprinkler deflector shall be ≥0,9 metres.
- d) All HVLS shall be shut down immediately upon sprinkler or fire alarm detection (whichever occurs first).

Where ESFR sprinkler protection is to be employed, any ventilation openings at roof level must close automatically upon sprinkler or fire alarm detection (whichever occurs first).

Powered ventilation systems shall be shut down immediately upon sprinkler or fire alarm detection (whichever occurs first).

Powered ventilators and fire dampers should be stopped before the first sprinkler operates. Fire detection systems should be either:

- a) Aspirating smoke detectors installed in all ventilation ducts extracting from the ESFR protected risk.
- b) A fire detection system of detection performance equivalent to an aspirating smoke detection system.

3063 Installation types

Sprinkler protection shall only be installed on the wet pipe installations and shall not be used in dry pipe, alternate, preaction or recycling systems.

Sprinklers shall be listed and approved to the appropriate standard in accordance with Table 314.

Table 314 Sprinkler nominal K-Factor and shank thread relationship

1	2	3
Sprinkler nominal K-Factor	Sprinkler pattern	Sprinkler shank thread (mm)
11,5	Spray	20
20 and 24,2	ESFR	20
32 – 36 – 40	ESFR	25

ESFR sprinklers and any spray pattern sprinklers below walkways and mezzanine shall have a fast response thermal sensitivity rating.

All Sprinklers shall have one of the temperature ratings given in Table 315 and shall be correspondingly colour coded.

Table 315 ESFR sprinkler temperature ratings and colour coding

1	2	3	4
Glass bull	o sprinklers	Fusible link sprinklers	
Temperature rating (° C)	Colour of bulb liquid	Temperature rating (° C)	Colour of yoke arms
68	Red	68 to 74	Uncoloured
93	Green	93 to 104	White

Under normal circumstances the 74° C operating temperature sprinkler shall be used, and the higher temperature ratings shall only be used where needed due to high ambient temperature conditions.

3064 ESFR sprinkler location relative to obstructions at or near the ceiling or roof

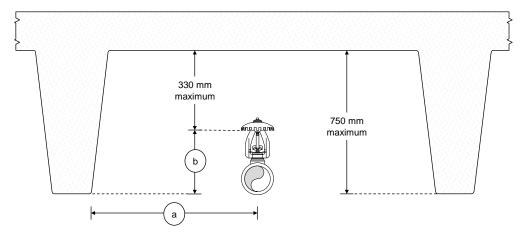
ESFR Sprinklers shall be located at the appropriate horizontal distance from obstructions at the ceiling and roof such as beams, ducts, joists, distribution pipes, range pipes or light fittings as given in Table 316.

ESFR sprinklers shall be located no closer than 100 mm horizontally from the bottom nearside edge of joists, trusses, or similar obstructions. In some instances, it may be advantageous to vary ESFR sprinkler spacing across the ceilings to avoid obstructions to the sprinkler water distribution.

Table 316 ESFR sprinkler location relative to ceiling obstructions

1	2	3
Distan	ce "a" ¹	Distance "b" 1
Minimum horizontal distance from	m sprinkler axis to side obstruction	Maximum height of ESFR sprinkler deflector above (+) bottom of obstruction
Greater than (mm)	Less than (mm)	(mm)
100	300	0
300	500	40
500	600	75
600	800	140
800	900	200
900	1100	250
1100	1200	300
1200	1400	380
1400	1500	460
1500	1700	560
1700	1800	660
1800	1850	790
¹ See Figure 308 ESFR sprinkler locations	relative to ceiling obstructions	

Figure 311: ESFR sprinkler locations relative to ceiling obstructions



3065 Calculation parameters

ESFR sprinkler systems flow, and pressure demand shall be hydraulically calculated in accordance with these rules.

ESFR sprinkler systems shall be fed from a pumped water supply operating under positive head conditions. A duplicate water supply is strongly recommended.

The minimum nominal bore of any range pipe shall not be less than 32 mm.

The maximum nominal bore of any range pipe shall not exceed 100 mm.

The calculated discharge pressure of any ESFR sprinkler, when all the sprinklers in the assumed maximum number of sprinklers operating plus any additional sprinklers under obstructions are operating shall not be less than that given within the applicable tables used relating to ESFR sprinklers in these rules.

The number of sprinklers in the assumed maximum number of sprinklers operating shall be 12, except for mezzanines less than 4,0 metres high where the assumed maximum number of sprinklers operating shall be 6, plus any additional sprinklers deemed to be operating such as sprinklers under obstructions, walkways or conveyors or intermediate level sprinklers.

Any additional ESFR sprinklers beneath obstructions within the assumed maximum area of operation shall be assumed to be in simultaneous operation at a pressure of not less than that specified for the ESFR sprinkler as specified in these rules if they are fed from the same installation control valves.

The shape of the roof or ceiling level remote assumed maximum area of operation shall be taken as 4 adjacent sprinklers on a range operating on each of 3 adjacent range pipes plus any additional intermediate level sprinklers or protection that is required by these rules.

The shape of the roof or ceiling level favourable assumed maximum area of operation shall be taken as 2 adjacent sprinklers on a range on opposing sides of the main distribution pipe operating on each of 3 adjacent range pipes plus any additional intermediate level sprinklers or protection that is required by these rules.

Where ESFR sprinklers are used to protect storage areas beneath mezzanines and where the assumed maximum number of sprinklers deemed to be in simultaneous operation is reduced to six ESFR sprinklers, then three adjacent sprinklers on a range shall be assumed to operate on each of two adjacent ranges.

Where range pipes have fewer than the designated number of ESFR sprinklers per range, for example, fed from an end side arrangement, all adjacent sprinklers on a range are assumed to be in simultaneous operation and the number of adjacent ranges shall be increased to compensate.

Changes in sprinkler spacing, array design, elevation, range spacing as well as possible location, whether on or between distribution pipes, shall be considered for the hydraulically most unfavourable location of the assumed maximum number of sprinklers operating.

Full calculation for each possible location is necessary except where it is obvious that an array is like another array under consideration and hydraulically nearer the water supply.

Continuous operation of the assumed maximum number of sprinklers operating at the hydraulically most unfavourable location creates the most adverse pressure. This is used to establish that the minimum ESFR sprinkler flow pressure is achieved.

Changes in sprinkler spacing, array design, elevation, range spacing as well as possible location, whether on or between distribution pipes shall be considered for the hydraulically most favourable location of the assumed maximum number of sprinklers operating.

Continuous operation of the assumed maximum number of sprinklers operating at the hydraulically most favourable location defines the flow rate which is used to determine that the pipework design is compatible with the water supply pressure flow characteristic.

Proof of correct position in grid systems is established by displacing the assumed maximum area of operation by one sprinkler pitch in each direction along ranges and by one range pipe in each direction along distribution pipes.

Any additional ESFR sprinklers beneath obstructions within the assumed maximum number of sprinklers operating shall be assumed to be operating, at not less than the specified ESFR sprinkler flow pressure as defined in the tables relating to this protection.

3066 Sprinklers beneath walkways and conveyors

Walkways and conveyors exceeding 3,0 metres in width shall be treated as a mezzanine.

Where sprinklers are installed below walkways as required within these rules, two sprinklers shall be assumed to be in simultaneous operation at a pressure as given within Table 317.

It shall be assumed that the ceiling sprinklers and two sprinklers beneath each walkway in the assumed maximum area of operation are in simultaneous operation.

Table 317 Minimum operating pressure for sprinklers beneath walkways and conveyors

1	2	3
Sprinkler nominal K-Factor	Sprinkler pattern	Minimum operating pressure (kPa)
11,5	Spray	350
20,0	ESFR	350
24,2	ESFR	240
32,0	ESFR	170
36,0	ESFR	140

3067 Sprinkler spacing and location

ESFR sprinklers shall be installed in a standard and uniform layout pattern.

The area coverage and spacing of ESFR sprinklers shall comply with Table 318.

Sprinklers shall be located beneath the ceiling in accordance with Table 319.

Table 318 ESFR sprinkler spacing

1	2	3	4	5	
Coiling hoight	Distance betw	Distance between sprinklers		Area of coverage per sprinkler	
Ceiling height (metres)	Minimum (metres)	Maximum (metres)	Minimum (m²)	Maximum (m²)	
≤ 9	2,4	3,7	6,0	9,0	
> 9 ≤ 13,7	2,4	3,0	6,0	9,0	

Table 319 Sprinkler distance from underside of roof or ceiling

1	2	3	4
Sprinkler nominal		Vertical distance from the underside of the ceiling to the sprinkler deflecto	
K-Factor	Sprinkler pattern	Not less than (mm)	Not more than (mm)
11,5	Spray	75	150
20 and 24,2 (pendant)	ESFR	150	360
20 and 24,2 (upright)	ESFR	75	150
32 and 36 (pendant)	ESFR	150	460

Where roofs or ceilings are constructed using beams and girders or profile panelling, sprinklers shall be in bays rather than under beams. Bays formed by these methods of ceiling construction shall not exceed 750 mm in depth.

Where the ceiling is profiled the distance from the ceiling shall be measured from the top of the profile. The deflector position relative to the ceiling profiling shall comply with these rules.

ESFR sprinklers shall be installed with the waterway axis perpendicular to the ceiling.

Throughout the protected area and regardless of hazard rating or occupancy, the clear space below an ESFR sprinkler shall not be less than 1,0 metre.

Where draught or smoke curtains are fitted at the ceiling level, the draught or smoke curtain shall be treated as a boundary.

Where ESFR sprinkler protection adjoins areas protected by standard sprinklers, the following measures shall be complied with:

- a) Where ESFR and the adjacent sprinklers are at the same ceiling height or where the ESFR sprinklers are installed at a greater ceiling height than standard sprinklers, smoke and draft curtains shall be installed at the ceiling separating the ESFR and standard sprinklers. The smoke and draft curtains shall be at least 600 mm deep and shall be located at the midpoint between the ESFR and standard sprinklers. The smoke curtain shall be made of non-combustible material.
- b) An aisle of not less than 1,2 metres wide, free of all stored goods, shall be maintained between ESFR protected areas and those protected by standards sprinklers. The centre of the aisles shall coincide with the midpoint between the ESFR and standard sprinklers.

11/10/2024

SECTION 4: SYSTEM COMPONENTS

4000 Sprinklers

Generally, Factory Mutual and Loss Prevention Certification Board are deemed to be acceptable sprinkler equipment approving authorities.

Sprinklers must be listed and approved, handled with care, and stored in a cool, dry place in the original shipping container.

The year of installation must, as far as possible, correspond to that of manufacture.

On new installations and as far as is practicable for existing systems that are being extended, sprinklers and equipment may not be intermixed.

All sprinklers within any compartment at roof or ceiling level shall have identical operating characteristics inclusive of K-Factor, manufacturer, distribution patterns, orientation, and thermal sensitivities. A compartment is defined as a room or area separated from any adjoining area with walls or partitions where a door lintel is at least 200 mm below the level of the sprinkler deflector.

Where sprinkler head protectors are used for shipping to prevent damage to the sprinklers, these shall remain in place and be removed when the sprinkler is in its intended installed position.

Only the manufacturers sprinkler wrench may be used to fit sprinklers to pipework.

Sprinklers shall be installed with the sprinkler frame running parallel to the pipe to avoid pipe or frame shadow.

Sprinklers shall not be screwed into range pipes before range pipe erection and may only be installed once the pipework is secured in place.

Where it is necessary to screw sprinklers into prefabricated ranges at ground level, pipe racks shall be used, and the practice only undertaken immediately prior to hoisting the range into position.

Sprinklers that have been dropped or damaged in any way shall be destroyed immediately.

Sprinklers must not be altered in any respect or have any type of ornamentation coating applied, be painted other than by the manufacturer after leaving the manufacturers facilities or except as provided in these rules.

Where a sprinkler is contaminated by paint or any other substance that adheres to any part of the sprinkler, it must not be cleaned but shall be removed, destroyed, and replaced with a new one.

Sprinklers that have been in service may not be reused or relocated regardless of the circumstances. Once a sprinkler or a sprinkler pipe with sprinkler fitted to it is unscrewed from the fitting it shall be discarded.

4001 Types of sprinklers

4002 General

In all cases the manufacturer's requirements and approval listing relating to the installation of a sprinkler must be adhered to.

The following types of sprinklers, but not necessarily limited to these, are accepted for use.

4003 Conventional pattern sprinklers

These sprinklers are designed to produce a spherical type of discharge with a proportion of water being thrown upwards to the ceiling. They are usually designed with a universal type deflector, enabling the sprinkler to be erected in either the upright or pendant position.

Some conventional pattern sprinklers are made in two types, one suitable for erection in the upright position and the other in the pendent position.

Conventional pattern sprinklers are to be used:

- a) To protect premises or portions thereof where there is exposed steelwork.
- b) These sprinklers are optional for the protection of flat smooth concrete roofs or ceilings.

4004 Spray pattern sprinklers

These sprinklers are designed to produce a hemispherical discharge below the plane of the deflector with little or no water being discharged upwards to wet the ceiling.

They are made in two types, one suitable for erection in the upright position and the other in the pendent position.

Spray pattern sprinklers are to be used, if suitable, for the protection of:

- a) Rack and shelf protection in accordance with these rules.
- b) Mezzanine floors.
- c) Beneath concrete, coffer or smooth flat ceilings or roofs with not less than 60-minutes fire resistance.
- d) Offices with under-drawn ceilings.

Fast response spray pattern sprinklers are used, for example, for the protection of life safety environments and intermediate level protection of racks and shelves.

Standard response spray pattern sprinklers may be used, for example, the protection of the underside of suspended ceilings and concrete construction where the premises do not comply with life safety.

Spray pattern sprinklers with a K-Factor greater than 11,5 may be used in High Hazard installations only where the roof or ceiling insulation is classed as incombustible in accordance with recognised international standards.

4005 Flat spray sprinklers

A flat spray sprinkler produces a flatter spray pattern than a standard sprinkler, enabling them to be used with lower clearances above suspended open ceilings, the underside of mezzanine floors, in racks and within concealed spaces.

4006 Sidewall pattern sprinklers

These sprinklers are designed for installation in Ordinary Hazard occupancies only along the walls of a room close to the ceiling.

The design of the sprinkler is usually like the standard sprinkler except for a special deflector which causes most of the water to be discharged to one side in a pattern somewhat resembling one quarter of a sphere with a small proportion discharging on the wall behind the sprinkler.

Sidewall pattern sprinklers are not considered a substitute for standard sprinklers and their use is, in the main, limited to offices, entrance halls, lobbies, corridors, etc.

Sidewall sprinklers can, however, be used with advantage in the case of drying tunnels and hoods over paper-making machines where condensate dripping from sprinklers and pipework at the ceiling might be troublesome. Also, in certain other locations such as sales shop windows and under platforms, etc., having low headroom, where standard sprinklers would be subject to damage.

These sprinklers may also be used for the protection of corridors in High Hazard occupancies where no storage takes place, cable ducts and for the protection of columns and structural members in High Hazard storage facilities.

Sidewall sprinklers shall not be used in High Hazard or Ordinary Hazard storage occupancies or above suspended ceilings for general protection purposes.

4007 Ceiling (flush) pattern sprinklers

The use of ceiling flush sprinklers for life safety applications such as hotels and offices are not acceptable as they are regarded as "double knock" operation and are only accepted on a case-by-case basis. The cover plate must fall away before the fusible element is exposed. The South African experience with this type of sprinkler is exceptionally poor in that they are either initially or eventually painted or plastered in rendering them useless in every case.

Concealed sprinklers cannot be examined for correct installation or condition without removing the concealing plate assembly. These sprinklers take longer to respond to a fire due to their design and positioning of the fusible element relative to the fire gas flow.

These sprinklers are designed for use with concealed pipework and are installed pendent with a plate or base flush with the ceiling. The heat-sensitive element is positioned above the ceiling line. They are made with spray pattern discharge deflectors.

They are in three types:

- a) Those having fixed deflectors.
- b) Those having retracted deflectors that drop to the normal position on actuation.
- c) Those having fusible cover plates.

Sprinklers of the type where the deflector drops to the normal operating position must not be fitted under stairs or sloping roofs where the angle of the stairs or roof exceeds 45° from the horizontal.

Ceiling flush pattern sprinklers are not considered suitable for use in atmospheres which are corrosive, subject to high dust content or rooms or areas subject to positive pressure.

4008 Semi concealed sprinklers

A sprinkler may be semi-concealed by using a recessed escutcheon plate. The escutcheon plate is fitted into the ceiling and rises slightly above it and the sprinkler is screwed into the fitting directly above the escutcheon plate.

These sprinklers are usually spray pattern type and are suitable for under-drawn or plastered ceilings where the pipework is concealed.

In all cases no part of the escutcheon plate shall project from the ceiling below the top of the visible portion of the heat sensitive element of the sprinkler or that of the manufacturer's requirement.

4009 Recessed, horizontal sidewall and concealed sprinklers

Recessed, horizontal sidewall and concealed sprinklers are not designated with a thermal sensitivity rating.

The standard thermal sensitivity test is not appropriate, and these are classified as un-rated due to at least one of the following reasons:

- a) The nature of the sprinkler assembly.
- b) Orientation of the sprinkler frame when installed.
- c) Location of the temperature-sensitive element in relation to the roof or ceiling line.
- d) Sprinklers with protective coatings over the heat sensitive element.

The temperature-sensitive elements and their supporting components used in the construction of these sprinklers shall operate in accordance with the special or quick response requirements when tested on a conventional spray or sidewall pattern sprinkler frame or suitable mounting assembly.

4010 Extended coverage horizontal sidewall sprinklers

These sprinklers are designed for use within Ordinary Hazard occupancies excluding storage risks and have coverage greater than a standard sidewall sprinkler.

Their use is limited to low fire loading life safety environments such as offices and hotel rooms where the room length cannot be adequately covered by normal sidewall sprinklers and the installation of standard sprinkler protection is not possible.

The distances from the ceiling or roof are critical and in all cases the manufacturer's requirements must be adhered to.

Care must be taken in the decision of where to use these sprinklers as the nominal thread diameter varies.

4011 Extended coverage sprinklers

Extended coverage sprinklers are normally of the spray pattern type and are suitable for Ordinary Hazard risks where extended spacing can be advantageous such as open office areas, retail areas or shopping malls.

In all cases the manufacturer's specifications with respect to the spacing of the sprinklers and the flows and pressures at the predetermined spacing must be adhered to.

4012 Enhanced protection extended coverage sprinklers

EPEC sprinkler protection is specialised and specifically for storage of commodities that have undergone fire tests and for Ordinary Hazard occupancies.

The protection is to be installed in accordance with the requirements of the manufacturer.

4013 Early suppression fast response sprinklers

Early Suppression Fast Response, (ESFR), sprinklers are thermo-sensitive devices designed to react at a predetermined temperature by automatically releasing a stream of water and distributing it in a specified pattern and density over a designated area to provide early suppression of a fire when installed on the appropriate sprinkler piping with a suitable water supply.

ESFR sprinklers are quick-acting high-performance sprinklers which have the capability of suppressing fires within storage risks.

There is no room for error in the design and installation of ESFR sprinkler systems. The design principles and the operating characteristics are significantly different from standard sprinkler protection.

ESFR sprinklers may be unable to cope with adverse design features and non-compliance, which may be common practice when installing standard sprinkler protection. It is therefore essential that all the requirements of the manufacturer and rules are observed without exception when applying ESFR protection.

4014 Intermediate level or in-rack sprinklers

A sprinkler that is primarily designed for use within in-rack storage and fitted with an approved and listed water shield and guard where the operating element or parts close to this must be shielded from the water discharged from sprinklers at a higher elevation.

They may also be used under mezzanine floors, gratings, outdoors as a weather shield or any other application where water shielding is required.

The sprinkler is approved and listed with a water shield as an intermediate level/rack sprinkler.

4015 15 mm shank threads and K-Factors of 11,5 sprinklers

Sprinklers with a 15 mm shank thread and a K-Factor of 11,5 shall only be used in refit applications.

Replacing 15 mm sprinklers, (K-Factor of 8,0), is allowable in installations where the suitability of the water supplies, pipework and enlarged sprinkler head orifice has been proven and remains within the maximum allowable parameters of the requirements for full hydraulic calculation.

4016 Dry (barrel) pendent pattern sprinklers

Dry pendent droppers may not be screwed directly into elbows, in all cases tees shall be used.

These sprinklers are approved for use in portions of premises protected by a dry pipe or an alternate wet and dry pipe system where it is not practicable to install standard sprinklers in the upright position or on a wet pipe system where the sprinklers may be subject to frost or freezing such as cold rooms or exposed portions of a building.

Apart from the valve arrangement, the sprinklers are of standard design having either conventional or pendent spray pattern type deflectors.

Dry pendent pattern droppers are manufactured integral with drop pipes of varying lengths, the valve being so placed that there is no pocket or depression within which water can be trapped.

4017 Dry (barrel) upright pattern sprinklers

Dry upright droppers may not be screwed directly into elbows, in all cases tees shall be used.

These sprinklers are essentially the same as the dry pendent types except that instead of the spray pattern, an upright type of deflector is incorporated.

Dry upright pattern sprinklers are used for the protection of unheated concealed roof spaces in connection with installations on the wet pipe system.

4018 Drencher heads

A drencher sprinkler head is a type of automatic fire sprinkler system that is designed and installed to provide protection to a building that is exposed to an external fire source feature such as storage, an shared boundary, or another building within the same boundary, or an egress path passing by an unprotected opening in a building.

There are two types of drencher systems:

- a) A wet (drencher) system is one where there is no risk of water freezing in the pipes and are permanently charged with water and incorporate a stop valve (main stop valve), a non-return valve, system drain valve and remote test valve.
- b) A dry (drencher) system is one where there is a risk of water in the pipes freezing and must be fitted with a deluge valve or dry pipe alarm valve, a main stop valve, system drain valve and either:
 - I. Sealed sprinklers and dry pipework, permanently charged with air or inert gas under pressure above the alarm valve.
 - II. Open sprinklers and dry pipework controlled by a deluge valve that is automatically actuated.

4019 Medium and high velocity sprayers

These are special purpose sprayers that produce a conical spray pattern directional onto the risk for use in water spray systems, (which may or may not form part of standard sprinkler systems), intended for the extinguishment or control of fires involving flammable liquids and for the cooling of storage tanks, process plant and exposed structural steelwork against heat from an exposure to fire.

Medium velocity spray systems are not recommended to be used for the protection of transformers and generator excluding engine. It is preferable to emulsify the oil used for cooling purposes and for this purpose high velocity spray systems will be required.

Where medium or high velocity spray systems are fed from a separate set of valves or tail end system, the requirements of NFPA 15 shall be used or be reviewed on a case-by-case basis.

These sprayers have directional discharge characteristics with cone angles ranging from 400 to 1800 and with orifice sizes varying from 5,0 to 13 mm.

The Medium Velocity Sprayers are produced as either:

- a) Sealed sprayers with glass bulbs or soldered links or levers as for standard sprinklers, or
- b) Open sprayers.

They are designed essentially for cooling purposes when dealing with fires involving low flash point fire hazards as, for example, liquefied petroleum gases.

In such risks the aim is not for automatic extinguishment, but to control the burning within safe limits until the source of gas supply has been shut off, thus avoiding the danger following a fire incident of these heavier-than-air gases continuing to escape and collecting in low lying areas producing an explosion hazard.

The High Velocity Sprayers are of the open type and are designed for the extinguishment of fires involving high flash point liquids.

4020 Multiple-jet-controls

These are heat-sensitive sealed valve-controlled outlets, (single or double), using either glass bulbs or soldered links or levers as the heat sensitive device. They are approved for use in systems using medium or high velocity sprayers of the open type in circumstances where it is required to operate small groups of sprayers simultaneously.

The controls are made in various sizes relevant to the diameter of the valve and the number of sprayers that are to be fed therefrom.

Typically, multiple-jet-controls are used for the protection of small flammable liquid stores, transformers, and standby generators.

Multiple-jet-controls have sliding valve components and are susceptible to build-up of corrosion, paint and environmental deposits which may render the device unserviceable or slow to operate.

Depending on the installed conditions and service life, these need to be examined on a regular basis and, if necessary, overhauled or replaced.

4021 Anti-corrosion treatment of sprinklers

Sprinklers used in bleach, dye and textile print works, alkali plants, organic fertiliser plants, foundries, pickle and vinegar works, electro plating and galvanising works, paper mills, tanneries, and in any other premises or portions of premises where corrosive vapours are prevalent, must have approved corrosion resistant coating, (applied by the manufacturer), or must be coated twice with a good quality petroleum jelly, the first coat to be applied before erection and the second after installation.

The petroleum jelly coatings are to be renewed at periodic intervals as may be necessary, but only after the existing coatings have been thoroughly wiped off.

In the case of glass bulb type sprinklers, the anti-corrosion treatment is to be applied to the body and yoke and not to the sprinkler fusible element.

4022 Sprinkler guards

In situations where sprinklers are liable to accidental or mechanical damage, for example, cold rooms, freezers, the underside of mezzanine floors, intermediate level rack or shelf protection or sprinklers protecting low structures, sprinklers must be protected by fitting approved metal guards as provided by the manufacturer of the sprinkler heads.

4023 Escutcheon plates

Escutcheon plates or rosettes are plates that cover the gap between the shank or body of a sprinkler projecting through a suspended ceiling and the ceiling.

Where installed, these must be manufactured from either metal or thermosetting plastic material.

The escutcheon plate must not be used to support ceilings or other structures. No part of the escutcheon plate may protrude beyond the top of the visible portion of the sprinkler heat sensitive element.

Escutcheon plates used with recessed, semi-recessed or flush type sprinklers shall be part of the approved sprinkler assembly.

4024 Sprinkler orifice sizes

To avoid the possibility of inadvertent interchange between sprinklers of different orifice sizes, Table 401 shows the general relationship that shall exist between sprinkler nominal thread size and nominal orifice size.

The same manufacturer's equipment to be used for new installations and extensions to existing systems, i.e., control valves, sprinkler heads, flow switches, detection, etc.as far as practical.

Sprinklers shall be marked on the body or the deflector with an indication of nominal orifice size, type of distribution pattern, approving authority, and Sprinkler Identification Number, (SIN).

4025 Suitability of sprinklers

The types and sizes of sprinklers which are applicable for the Hazard classes are indicated in Table 402.

Except for K-16 sprinklers which are used for High Hazard installations, spray pattern sprinklers for Ordinary Hazard and High Hazard risks are allowed where there is no exposed structural steelwork or combustible materials at the roof or ceiling.

Where spray pattern sprinklers are used for the protection of a risk under exposed steel construction, it must be ensured that the roof level insulation is non-combustible and that the necessary precautions in the form of supplementary protection are taken for the steel supports.

Note:

Care must be taken when choosing sprinklers such as extended throw sidewall sprinklers and adherence to the manufacturer's specifications. In general, these are listed for a 4,0 mm/min/m² coverage for Ordinary Hazard which will require adjustments to the flow and pressures.

Table 401 Water flow performance constant "K"

1	2	3
Sprinkler nominal thread size (mm)	Sprinkler nominal orifice size (mm)	All sprinklers excluding dry types (K-Factor)
15	15	8,0
15	20 2	11,5
20	20 1	11,5
20	20	16,0
20	20	20,2
20	20	24,2
25	25	32,0
25	25	36,0
25	25	40,4
32	32	48,0

¹ Includes Enhanced Protection Extended Coverage sprinklers.

² Retrofit application only.

Table 402 Sprinkler K-Factor against design density of discharge

1	2	3
Category of risk	Design density of discharge (mm/min/m²)	K-Factor (Metric)
Ordinary Hazard	5,0	K-8,0
High Hazard	≥7,5 ≤10,0	K-8 or K-11,5
High Hazard	≥12,5 ≤17,5	K-11,5 or K-16,0
High Hazard	> 17,5	K-16,0

Table 403 Types of sprinklers for the hazard classes

1	2	3	4
Hazard class	Type of sprinkler	Sprinkler nominal orifice size (mm)	Temperature rating (° C)
Ordinary Hazard Commercial	Conventional pattern Standard response	15	68
Ordinary Hazard ¹ Life safety	Spray pattern Fast response	15 or 20	68
Ordinary Hazard ² Life safety	Sidewall pattern Fast response	15 or 20	68
Unventilated voids	Conventional pattern	15 or 20	93 or 141
High Hazard Commercial	Conventional pattern Standard or fast response	15 or 20	93
High Hazard Roof Commercial with racks	Spray pattern Standard or fast response	15 or 20	93
High Hazard ESFR	Spray pattern Fast response	20, 25 or 32	74
High Hazard High piled storage intermediate level sprinklers	Spray pattern Fast Response	20	68
Includes Enhanced Protection Extended Coverage sprinklers Includes 20 mm extended coverage sidewall sprinklers		•	

4026 Operating temperature rating

Approved sprinkler nominal temperature ratings range from 57° C to 343° C.

The temperature rating chosen shall be as close as possible to, but not less than, 30° C above the highest anticipated temperature conditions.

For normal conditions in South Africa, a rating of 68° C or 79° C is suitable for Ordinary Hazard occupancies.

Under glazing and in unventilated concealed spaces which includes ceiling or roof voids and show windows, it will be necessary to install sprinklers with a temperature rating between 93° C and 141° C.

Unless otherwise stipulated, in High Hazard systems, 93° C operating temperature sprinklers shall be used whether they are process or roof protection over racks.

For ESFR installations 68° C or 74° C operating temperature are preferred.

For Ordinary Hazard systems and those installed within cold rooms and freezers of incombustible construction of not less than 60-minutes fire resistance where the temperature is maintained below 5° C, 68° C operating temperature standard response sprinklers can be used at roof or ceiling level.

Where high temperature sprinklers are installed within, for example, drying ovens or hoods over paper-making machines, sprinklers at the ceiling or roof immediately over and to 3,0 metres beyond the boundary of such structures shall be of the same temperature rating.

In all cases where sprinklers are installed in buildings having PVC, GRP, polycarbonate or similar translucent roof lights, sprinklers shall not be installed directly below such roof lights. The sprinkler spacing requirements of these rules must, however, be observed.

If sprinklers are positioned beneath roof lights, these shall be flush to the ceiling or underdrawn at ceiling level. Roof lights shall be capable of withstanding a temperature of 300° C for a period of not less than 5-minutes.

In all cases in High Hazard risks and where sprinklers having temperature ratings exceeding 68° C are installed in Ordinary Hazard risks, the use of PVC roof light or similar material above the sprinklers must be restricted as follows:

- a) The area of each roof light does not exceed 5 m^2 .
- b) The distance between individual roof lights is not less than 1,8 metres.
- c) The total area of such roof lights does not exceed 15% of the plan area of the buildings.

Table 404 colour codes distinguish sprinklers of different nominal temperature ratings.

Table 404 Sprinkler operating temperature colour codes

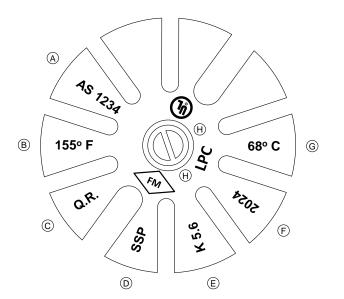
1	2	3	4
Nominal operating temperature (°C)	Liquid colour code	Nominal operating temperature within range (° C)	Yoke arms colour code
57	Orange	57 to 77	Uncoloured
68	Red	80 to 107	White
79	Yellow	121 to 149	Blue
93	Green	163 to 191	Red
100	Green	204 to 246	Green
121	Blue	260 to 302	Orange
141	Blue	320 to 343	Black
163	Mauve		
182	Mauve		
204	Black		
227	Black		
260	Black		
286	Black		
343	Black		

Sprinklers spaced to maximum coverage are less effective in controlling a fire than when spacing is reduced due to the higher pressures required to achieve the density of discharge.

The higher the pressure the smaller and less efficient the droplet will be and the greater the likelihood of a larger number of sprinklers operating for the control of a fire. Preference should be given to a low-pressure installation design.

Table 402 defines the minimum K-Factor of sprinkler to be used for specific design densities of discharge. See Figure 401.

Figure 401: Deflector or yoke identification markings



Deflector/Yoke Markings of a Sprinkler

- A. SIN Sprinkler Identification Number.
- B. Operating temperature in Fahrenheit.
- C. Response time of the sprinkler.
- D. Type and orientation of the sprinkler.
- E. K-Factor of the sprinkler.
- F. Year of manufacture.
- G. Operating temperature in Celsius.
- H. Approvals.

Pipework

4027

Pipes sizes are determined through design by hydraulic calculation.

4028 Feed pipes to high temperature sprinklers

The sprinklers in ambient temperatures less than 5° C or more than 70° C shall be on the dry pipe system.

4029 General care of materials and protection of pipework

Components shall be properly stored on site until they are required for installation.

The unloading stacking and storage of components shall be done with care to prevent damage to pipe and pipe threads, valves and sprinklers, gauges and any pump and power units used in the installation.

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Components shall be so stored that they are not damaged by building operations. Site locations shall be prepared in advance of delivery so that heavy items, such as fire pumps and strainers can be transported direct to their final locations.

Sprinkler pipework that has been in service may not be reused and shall be discarded when stripped out from its original location.

Sprinkler pipework shall be suitably rated in terms of the maximum working pressure of a sprinkler system but not less than 1600 kPa.

All sprinkler pipework concealed or exposed either above ground or in-ground shall be suitably cleaned, primed, and painted with a finished coat of paint in accordance with an internationally recognised painting specification.

Pipes shall be protected, for example, by caps against the entry of foreign matter, such as rubble and cordage, and shall be examined for such matter before erection and the open ends of pipes shall be capped as building construction proceeds.

Sprinkler pipework or components shall not be erected in locations where it is prone to damage by forklift trucks and other mobile equipment. It shall not cross gangways where such equipment is used unless the headroom is in excess of the height of the equipment concerned and fitted with approved guards as shall the sprinkler pipework.

Sprinkler pipework shall not be chased into the walls or embedded in the concrete floor or ceiling of the building.

Sprinkler pipes shall not be concealed in any situation where this would result in difficulty or undue expense when the installation is to be modified or expanded.

4030 Protection of feed mains in non-sprinkler protected buildings

Feed mains shall be run on the outside of an unprotected building. The area under consideration may not be classed as hazardous and the feed main shall run at low level and be protected using a masonry or concrete trench.

Underground mains, except lead-ins, shall be positioned 1,5 metres away from building foundation footings and the near side of the trench. Clearance shall be provided around the main where it passes under or through a foundation wall so that building settlement will not damage the main.

All the necessary precautions in accordance with the manufacturers' requirements and recommendations regarding the installation of underground pipework thrust and anchor blocks must be adhered to. The calculation of thrust and anchor blocks is complex whereby soil types and compaction criteria are critical to the overall mass requirements.

Where ring or looped mains are installed, isolating valves shall be provided so that sections of the main can be isolated for maintenance or repair of damage.

4031 Protection of pipework against mechanical damage

Pipework feeding sprinklers shall not be fastened to the outside of buildings regardless of whether such buildings are sprinkler protected.

Where it is impracticable to avoid areas subject to such traffic, the pipework shall be protected by adequate guards. Where installation valves or risers are situated in such areas, in addition to guard rails, floor safety guidelines shall be marked out.

For sprinkler protected structures, except for the lead in portion of a feed main and as high-level mains are subject to damage, feed mains shall be run on the outside of a building and not through the protected area. See Rule 4030.

The fire mains are to be installed to minimize, as far as possible, any loss of protection for any reason whatsoever, for example, damage or maintenance.

4032 Pipework that feed sprinklers and sprayers

Except where allowed in these rules such as in the case of ESFR sprinkler protection, the nominal diameter of range pipes shall not exceed 65 mm.

Individual sprinklers shall be not connected directly to distribution pipes. These are connected using an arm, drop or rise pipe which is a pipe other than the last section of a range pipe that feeds a single sprinkler of at least 300 mm in length.

Arm, rise or drop pipes of nominal diameter not exceeding 32 mm can be used to connect individual sprinklers where these are fed from pipes of a diameter exceeding 65 mm.

Any common feed main or main distribution pipe shall be of nominal diameter of at least 65 mm.

4033 Pipework that feeds upright or pendent conventional or spray pattern sprinklers

If upright or pendent conventional or spray sprinklers are installed within 400 mm of the pipe axis alongside a pipe of nominal diameter exceeding 65 mm, the deflector shall be not more than the appropriate distance given in Table 406 above the lower edge of the pipe.

If a sprinkler is fitted on a drop from a pipe of a diameter exceeding 65 mm, the horizontal centre line of the exposed portion of the sprinkler detector element shall be at least 75 mm below the lower edge of the pipe.

The vertical centre line of detection elements of sidewall sprinklers that are fed from the side of and that spray away from a pipe of nominal diameter exceeding 65 mm shall be situated at least 75 mm distance from the side of the pipe.

Where possible and practical the socket or connection for a distribution or feed pipe, sprinkler ranges or return bends, (swivel arrangements), shall be taken from the top or side of the pipe feeding these to avoid the accumulation or deposit of sediment within the pipe.

Table 405 Location of sprinklers alongside feed pipes exceeding 65 mm

1	2	3	
Minimum horizontal distance from pipe centre line to sprinkler centre line	Maximum height of sprinkler deflector above lower edge of pipe (mm) Dimensions can be interpolated		
(mm) Dimensions can be interpolated	Conventional sprinkler installed upright	Spray sprinkler, (upright and pendent), and pendent conventional sprinkler	
100	0	17	
200	17	40	
400	34	100	

4034 Pipework feeding grid systems

Gridded systems shall be of a uniform pipe diameter.

The diameter of outriggers shall be the same as the branch lines.

Branch lines, excluding rise pipes leading to the branch lines, shall be uniform in diameter and shall not increase or decrease between the supply side feed main and tie-in feed main.

The supply side and tie-in feed mains shall each be uniform in diameter. The ti-in feed main shall not be less than one diameter less than than the supply side feed main.

Grid systems must not be installed:

- a) On dry pipe, preaction, refrigeration, or vacuum systems.
- b) Where flammable liquids are stored or comprise as part of the risk being protected.
- c) Where racks or shelves run parallel with the branch lines and protection is provided at roof or ceiling level only.

A grid system, regardless of branch line orientation, is acceptable for roof or ceiling protection above racks or shelves where intermediate level protection is installed.

4035 Pipes and sprinkler fittings

Pipes and sprinkler fittings shall be suitable for sprinkler use.

The following pipes fittings are deemed suitable for sprinkler use (depending on the application):

- a) Steel pipes that comply with the requirements of SANS 62-1.
- b) Steel pipes, large bore, that comply with SANS 719:2011.
- c) Fabricated flanged steel pipes and fittings used upstream of the alarm valve above ground and that comply with the requirements of SANS 1476.
- d) Shouldered-end pipes, fittings and couplings that comply with the requirements of SANS 815-1:2005 and SANS 815-2:2004 and carry Factory Mutual or Loss Prevention Certification Board approval.
- e) Malleable cast iron pipe fittings that comply with the requirements of SANS 14.
- f) Cast iron fittings for fibre-cement pressure pipes that comply with the requirements of SANS 1223
- g) Cast iron fittings and couplings for shouldered-end pipes that comply with the requirements of SANS 815.
- h) Fibre-cement pressure pipes that comply with the requirements of SANS 1223.
- i) Pre-stressed concrete pressure pipes that comply with the requirements of SANS 975.
- Reinforced concrete pressure pipes that comply with the requirements of SANS 676.
- k) Class 16 pipe and components of uPVC pressure pipe systems that comply with the requirements of SANS 966 Part 1.
- Class 16 pipe and components of mPVC pressure pipe systems that comply with the requirements of SANS 966 Part 2.

Pipes that are not rigid and can be distorted or bent such as black polyethylene pipe, (HDPE), are not suitable for sprinkler use.

One piece reducing fittings shall be used where a change in the size of the pipe is made. Hexagonal or face bushings shall not be permitted in reducing the size of openings of fittings.

Galvanised pipe shall be used for dry pipe systems and for the downstream pipework of any test or drain valve installed on the system.

Shouldered or grooved couplings used on dry pipe systems shall be listed and approved for such service.

4036 Flanges and bolting

Flanges and bolting shall be suitable for sprinkler use.

The following flanges and bolting are normally deemed suitable for sprinkler use (depending on the application):

- a) Flanges that comply with the requirements of SANS 1123.
- b) Bolts and nuts that comply with the requirements of SANS 1700 SET.
- c) Hexagon locknuts that comply with the requirements of SANS 1700 SET.
- d) Mushroom-head and countersunk-head bolts and nuts that comply with the requirements of SANS 1143.
- e) Shouldered and grooved couplings that comply with the requirements of SANS 815.

4037 Welded pipes

The specification used for welding procedure qualification shall be:

a) SANS/ISO 15614 SET "Specification and Qualification of welding procedures for metallic materials – Welding procedure tests".

Welder qualification can be done to ISO 9606 Part 1.

Only pipes 50 mm and above may be joined by welding, provided the joints are fabricated and welded in the workshops of the installing engineers whose welding procedures are approved.

Where sockets are welded onto pipes, no part of the socket shall protrude into the pipe.

No welding or heat cutting is permitted on any site of erection unless:

- a) A hot work permit has been issued.
- b) Special permission has been obtained from the owner or developer of the building.

Welding offsite is preferred for safety and quality control purposes.

On-site welding, where unavoidable, shall be carried out under controlled conditions and appropriate safety precautions shall be observed.

Before galvanised pipes are welded, the zinc coating on both pipes, on the ends and on the outside it, over 25 mm from the joint, shall be removed by grinding.

After pressure testing of the welded joint, the exposed metal and weld shall be coated with two coats of a zinc rich metal paint.

4038 CPVC plastic pipe

The term "CPVC pipe" refers to both CPVC plastic pipe and CPVC plastic pipe fittings. CPVC requirements in these rules shall be read in conjunction with the suppliers' installation instructions.

If the occupancy under consideration is not suitable for protection as defined within these rules, CPVC pipe may not be used.

Where the system is designated as life safety careful consideration of the use of CPVC pipe is required.

Sprinklers installed with CPVC pipe shall have a temperature rating not exceeding 79° C.

CPVC pipe can be used only in occupancies classed as Ordinary Hazard which include or are similar to hotels, hospitals, (excluding kitchens and plant rooms), museums, libraries, (excluding stock rooms), court rooms, nursing homes, offices and data processing rooms, schools, colleges, prisons, churches, restaurant seating areas, theatres, and auditoriums, (excluding stages and prosceniums), and unused attics.

CPVC pipe may only be used in wet pipe systems. CPVC shall not be used in dry pipe, alternate, preaction or recycling systems. Consideration shall be given to the use of gridded or looped systems such that the operation of a single sprinkler exposes the pipework to flow which will assist in added cooling to the pipe.

CPVC pipework shall only be installed downstream of the installation alarm valve. The maximum nominal bore of pipework shall not exceed 80 mm for distribution pipes and 65 mm for range pipes.

CPVC pipe shall not be installed or used outdoors or in locations that are exposed to UV radiation. Paint and/or lagging that is approved by the pipe manufacturer can be used to protect CPVC pipe indoors from UV radiation.

CPVC pipe shall only be used where the expected ambient temperature is in the range from -2° C to 50° C.

Where CPVC pipe is used in corrosive conditions, the pipe and fittings shall be tested and approved for use in such areas or conditions by a recognised sprinkler approving authority.

The suppliers' guidelines and/or design manual and any requirement of a third-party certification body shall be followed when installing CPVC pipe.

Following installation, joints shall be left to cure for the appropriate minimum periods as given by the suppliers' installation instructions. Care shall be taken that the correct curing times for cementing of CPVC pipes are maintained. The pipe size, tightness of fit, temperature, and relative humidity, all influence the set and cure times. Drying time is faster for smaller pipes, tighter fits, higher temperatures, and drier environments.

Sprinklers shall not be installed until after the correct curing time has elapsed.

Only PTFE tape, paste or other substances which have been tested and approved by the supplier shall be used when making threaded joints.

Only water shall be used for pressure testing of pipework. CPVC piping systems are not designed for use of compressed gas, including air and these shall not be used. Any fault disclosed, such as permanent distortion, rupture or leakage shall be corrected, and the test repeated.

4039 CPVC exposed pipework

Where CPVC pipe is exposed, the following shall be met:

- a) Sprinklers shall be rated as fast response with an RTI of less than 50.
- b) Sprinkler pipework shall be installed beneath smooth, flat horizontal ceilings.
- c) Pendent sprinklers shall be installed with their deflectors not more than 150 mm below the ceiling at centres not exceeding 4,0 metres.
- d) Upright sprinklers shall be installed with their deflectors not more than 100 mm below the ceiling at centres not exceeding 4,0 metres.
- e) Sidewall sprinklers shall be installed with their deflectors not more than 150 mm below the ceiling and 100 mm from the wall.

Protection above an open cell, or open grid ceiling, shall comply with the above requirements for exposed pipework as well as the requirements for suspended open ceilings as detailed in these rules.

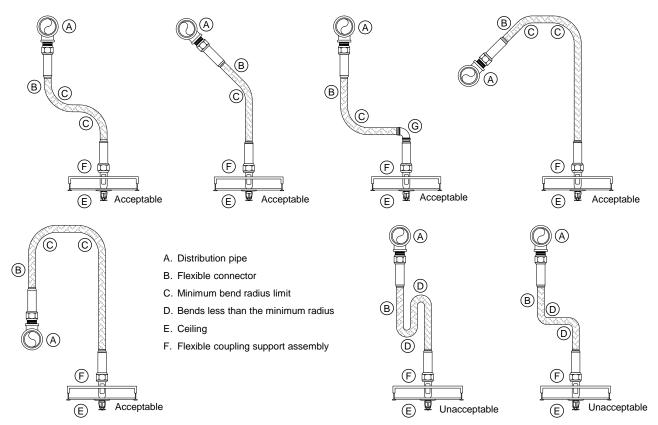
The maximum system working pressure under flowing conditions shall not exceed 690 kPa or in accordance with the manufacturers recommendations.

4040 Flexible connectors

Approved flexible connectors suitable for sprinkler service only are acceptable and shall comply with the following requirements and as shown in Figure 402:

- a) These shall comply with the suppliers' instructions and shall not exceed any limitations of use stated in their certification listing.
- b) These shall be used on wet pipe installations only.
- c) The total aggregate bend shall not exceed the value stated in the product certification listing.
- d) All flexible connector sprinkler terminations shall be supported by a product suppliers' certificated support bracket assembly.
- e) The flexible connection shall be of the appropriate length.
- f) Pipe bending to reduce the effective flexible connector length is not permissible.
- g) Flexible connectors can only be used to connect a single sprinkler to a distribution pipe.
- h) Where the distribution pipe outlet is on top of the distribution pipe the flexible pipe shall follow a 180° arc before falling vertically towards the sprinkler. For all other connection locations on a distribution pipe, the flexible connector may run either horizontally or be inclined towards the sprinkler termination location.
- i) The bend radii shall not be smaller than the specified minimum bend radius for the product identified in the product certification listing and all bends greater than 45° shall be fitted with the minimum radius indicator.
- j) Any flexible connector which is damaged or kinked shall be replaced.
- k) Flexible connectors shall only be used in accessible locations where third-party inspections can be conducted.
- I) Flexible connectors shall not be used above plasterboard ceilings.
- m) Flexible connectors are used to connect single sprinklers to distribution pipes with a minimum diameter of 32 mm.

Figure 401: Acceptable and unacceptable single sprinkler flexible connector configurations



4041 Protection of pipework

In all cases underground pipes shall be protected against corrosion.

Bituminous paint is not regarded as being adequate protection for underground pipework.

Degreasing is an important process step in the surface treatment of sprinkler pipework. Degreasing shall take place in a purpose made bath and it is to be ensured that the grease and ferric oxide contents are kept to within acceptable limits before changing the degreasing agent.

Where pipes are to be welded, degreasing with a suitable deoxidising agent is required to provide an improved weld.

Non-galvanised ferrous pipes above ground shall be supplied on site with one external coat of suitable self-etching primer already applied which is to be touched up after erection.

Ferrous pipes and fittings shall be painted with a suitable finished coat of paint in-situ as soon as practicable after installation.

If hemp is used as a pipe jointing method, the excess hemp shall be cut away from the exposed pipe threads after erection.

Above ground ferrous pipework in premises where corrosive conditions exist shall be thoroughly cleaned and then be protected by suitable coating.

In bleach, dye and textile print works, paper mills, tanneries and in other premises where corrosive conditions exist, pipework must be thoroughly cleaned and protected by suitable means, for example, by two coats of good quality bituminous paint, one coat to be applied before and one after erection. While this treatment will materially lengthen the effective life of the pipes, it will probably be found necessary to renew the coatings from time to time at intervals from 1- to 5-years according to the severity of the conditions.

4042 Flushing of trunk and feed main pipework

There must be a 50 mm flushing connection fitted on the trunk main below each installation control valve. Flushing points must be plugged downstream of an isolating valve to prevent misuse.

4043 Terminal drain valve

25 mm drain valves must be fitted at the extremity of the distribution pipe at each level of protection. This is to indicate that there is water at this point and that no blank spades are left in the installation.

The valve must be clearly labelled as the remote test valve or inspectors test valve, be positioned at hand operating level, routed to waste, and must be normally secured in the closed position.

4044 Sprinklers in concealed spaces - Ordinary Hazard

Sprinklers may be fed individually from the main distribution pipes feeding the sprinklers in the room below.

In determining the sizes of all pipework, the sprinklers above and below the ceiling need not be taken cumulatively if no communication exists between the two areas.

4045 Sprinklers in concealed spaces - High Hazard

The sprinklers must be fed by separate pipework from that feeding the sprinklers in the room below.

The water requirement of the concealed sprinklers need not be considered in assessing the distribution pipework.

4046 Slope of pipes for drainage

Sprinkler pipes of installations, whether on the wet, dry, or alternate system, must be so installed that the system can be thoroughly drained.

As far as practicable, all pipes shall be arranged to drain to the installation drain valve which must not be less than 50 mm diameter.

The downstream pipework of the installation drain valves shall be galvanised.

Drains shall not be interconnected and must be taken separately to waste.

Sprinkler pipes must be laid to the minimum slopes as stated in Table 406.

Table 406 Slope of pipes for drainage

1	2
Type of system	Slope of drainage
Wet pipe systems	2 mm in 1 metre
Dry pipe and alternate wet and dry pipe systems with pipe diameter ≥ 50 mm	4 mm in 1 metre
Dry pipe and alternate wet and dry pipe systems with pipe diameter < 50 mm	12 mm in 1 metre

The slope required must be a true slope of pipe and not the slope relative to building structure level unless the structure level is horizontal.

The true pipework slopes must be shown on the layout drawings.

All trapped sections of pipework, (except where single sprinklers are situated on drop pipes below suspended ceilings), must be drained through permanent pipework provided with drain valve(s) and plug(s) or cap(s) situated at a level of not more than 3,0 metres above floor level to facilitate the task of drainage.

Pipework and valves provided for drainage must conform to Table 407.

Trapped sections of range pipes may be drained by 25 mm pipework and valves.

Table 407 Pipe diameter for drainage purposes

1	2
Size of pipework to be drained (mm)	Size of drain, pipework, and valves (mm)
Up to 50 mm	25 mm
65 mm and 80 mm	40 mm
100 mm and above	80 mm

4047 Valves

4048 Identification of alarm valve and alarm gongs

In buildings containing more than one installation, each alarm valve must have a number indicated thereon and the relevant alarm gong must bear the same number in bold figures.

4049 Installation control valves

Where possible, the main control valves shall be installed externally from the protected premises, preferably as close to the main entrance to the premises as possible, in such a position it will always be readily visible and accessible to authorised persons.

The installation control valves shall be housed within a brick, concrete, or stone compartment with a substantial locked door. This compartment must be sprinkler protected.

Access to the installation control valve assembly shall not be through the sprinkler protected area or be located internally if there is any possibility of storage or the risk in general having an adverse effect upon the valve assembly or impeding access to these under a fire condition. Where located internally, the valve assembly shall be protected against mechanical damage with a barrier and shall be positioned as close as possible to an external door.

The rising feed main above the control valve assembly shall be located within the sprinkler protected cabinet or premises and shall not rise on an external face of the building being protected.

Each installation control valve shall have four stop valves fitted, one on the upstream and downstream side of a single alarm valve and one on the upstream and downstream side of the bypass connection non-return valve. The bypass connection stop valves will be normally closed. For life safety systems each of the four stop valves shall be fitted with tamper proof devices to monitor their status for all other systems monitoring of the valves is optional. See Figure 403.

The installation control valve assembly shall not reduce in diameter in relation to the connecting pipework downstream of the assembly. Each installation must be provided with a set of installation control valves which shall conform to the original approval standard and comprise of, but not necessarily limited to:

- a) A main isolating stop valve.
- b) A 50 mm flushing connection upstream of the main isolating stop valve.
- c) A "B" pressure gauge located upstream of the alarm valve.
- d) An alarm valve, (wet pipe), and/or an alarm valve, (dry pipe), or a complete alarm valve suitable for either wet or dry systems
- e) A "C" pressure gauge located downstream of the alarm valve.
- f) A water motor alarm and gong.
- g) A life safety or operational bypass for maintenance purposes.
- h) A pressure gauge positioned above the bypass arrangement.
- i) A 15 mm test pipe.
- j) A 50 mm drainpipe.
- k) A direct reading flow proving test arrangement that shall not be used for drainage purposes.
- I) A centrifugal false alarm prevention pump or approved retarding chamber except where a pumped water supply is provided.
- m) Fire brigade booster connections.
- n) Flow switch if required for life safety application or operational conditions.

The downstream pipework of the installation test and drain valves shall he galvanised and routed in such a way to prevent the water from the test and drainpipes from wetting the person conducting the tests.

All drainpipes of any description on a sprinkler installation shall not be interconnected and must be taken separately to waste. This prevents back-pressure from being created in pipework which can result in failure of a component or water backing up a pipe and discharging from the entry point.

4050 Pressure gauges

All pressure gauges fitted to a sprinkler system shall:

- a) Read in kPa.
- b) Have a scale value of 150% of the maximum working pressure of the system.
- c) Have divisions not exceeding 5 kPa for the suction compound vacuum pressure gauge.
- d) Have divisions not exceeding 20 kPa for pressures up to 1600 kPa.
- e) Have divisions not exceeding 50 kPa for pressures above 1600 kPa.
- f) Have a dial face of not less than 100 mm in diameter.
- g) Be of the glycerine filled type.
- h) Be fitted with an isolating gauge cock with bleed to be able to confirm gauge operation back to zero and enable each pressure gauge to be readily removed without interruption of the installation water supplies.

On all installations there must be the following pressure gauges:

- a) The town main, incoming supply main or "A" pressure gauge is fitted on the supply side from the town main or, where a pump is the sole source of supply, can be the delivery pressure gauge fitted immediately downstream of the pump delivery flange and upstream of the delivery pipe non-return valve.
- b) The trunk, feed main or "B" pressure gauge is fitted immediately down stream of the installation control valve main isolating stop valve and upstream of the alarm valve.
- c) The main control valve or "C" pressure gauge is fitted immediately downstream of the alarm valve and upstream of the main isolating stop valve of the bypass arrangement.
- d) The installation or "D" pressure gauge is fitted downstream of the bypass arrangement.

4051 Prevention of false alarms

Town main water supplies often have widely fluctuating pressure characteristics such as to exceed the normal installation pressure and thereby cause false alarms.

A retarding chamber or a false alarm centrifugal pump shall be installed for each installation or group of installations. These pumps will be subject to a maximum boosting pressure of 1,200 kPa.

The use of peripheral turbine pumps is not acceptable.

4052 Water supply proving test assembly

The assembly shall be of an approved direct reading flow meter type and accurate to within 5%, calibrated to not more than 1,35 times the value of the maximum calculated flow required at the control valve assemble at the requisite pressure.

The proving test pipe cannot be used in combination or multiples but shall be a single unit calibrated to the required flow.

The measuring device must be designed to be fitted directly on the downstream side of the installation control valves, to straight pipes or into elbow fittings, globe valves or their hydraulic equivalent.

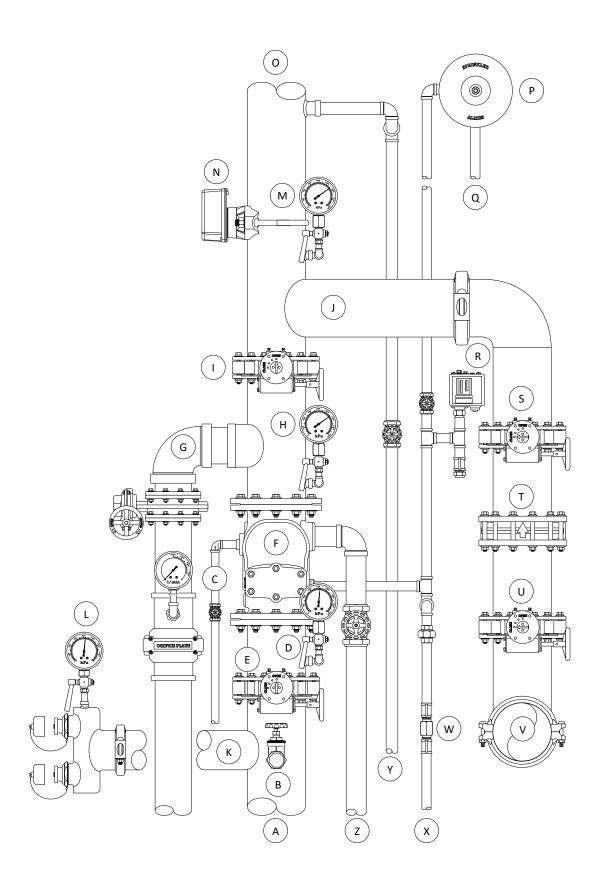
The drain pipework downstream of the proving pipe must be galvanised and be well secured to prevent movement.

The pipework must terminate with a horizontal pipe routed to discharge water without flooding into a drain.

The proving test assembly is to be fitted to the installation control valves, regardless of the type of water supply to the installations, in the following situations:

- a) Where there are several installation control valves sited together, provide only one proving test assembly to the highest demand.
- b) Where the installation control valves are distributed around the premises, each installation control valve shall have its own proving test assembly.

Figure 402: Typical installation control valve arrangement



Index to Figure 403

- A. Incoming feed main.
- B. 50 mm plugged flushing connection.
- C. 15 mm test valve to waste.
- D. "B" or feed main pressure gauge.
- E. Monitored alarm valve upstream isolating stop valve.
- F. Alarm valve assembly.
- G. Direct reading flow measuring device.
- H. "C" or installation pressure gauge.
- I. Monitored alarm valve downstream isolating stop valve.
- J. Bypass arrangement for maintenance purposes.
- K. Fire brigade booster connections.
- L. Booster connection pressure gauge.
- M. "D" pressure gauge downstream of the bypass arrangement.
- N. Flow switch required for life safety protection and optional for industrial installations.
- O. To installation.
- P. Mechanical alarm gong.
- Q. Alarm gong water to waste.
- R. Pressure switch with sludge trap positioned downstream of the alarm gong isolating valve.
- S. Monitored isolating bypass valve downstream of the non-return valve.
- T. Bypass arrangement non return valve.
- U. Monitored isolating bypass valve upstream of the non-return valve.
- V. Bypass arrangement incoming feed.
- W. Alarm gong drip union.
- X. Alarm gong waste pipe led separately to waste.
- Y. Flow switch test pipe positioned 2 diameters downstream of the flow switch.
- Z. 50 mm installation drain pipe to waste.

Note: For life safety purposes monitoring of the isolating stop valves is mandatory and optional where valves are used for industrial protection

4053 Fire brigade booster connection inlets

Installations must be fitted with fire brigade booster connection inlets connected upstream of the installation control valves, to enable the fire brigade to pump water into the installation using their own equipment. See Figure 404.

The fire brigade booster connection inlets shall be fitted directly into an expansion chamber that will not restrict the opening of the valve.

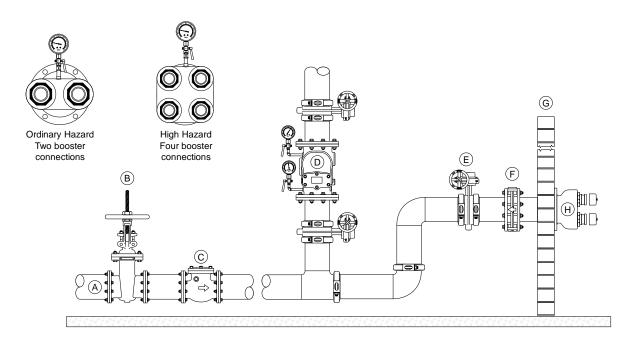
The minimum connection leading into the expansion chamber shall not be less than 100 mm diameter over its entire length for Ordinary Hazard installations and 150 mm for High Hazard.

The number of inlets shall not be less than 2 for Ordinary Hazard and 4 for High Hazard installations positioned between 400 and 600 mm above ground level.

If additional fire brigade booster inlet connections are required based on the flow requirements of the installation, these must be installed to the requirements of the local chief fire officer.

Fire department connections shall be equipped with approved inlet blank caps properly secured to the body of the unit and arranged for easy removal by fire departments.

Figure 403: Typical layout of a fire brigade booster connection inlet



- A. Incoming feed
- B. Isolating stop valve
- C. Non-return valve
- D. Installation control valves
- E. Isolating stop valve
- F. Non return valveG. External wall
- H. Booster inlets

4054 Alarm devices

4055 Water motor alarm gongs

Every installation must be fitted with an approved water motor alarm gong, externally located to the building as near the alarm valve as practicable so that in the event of it sounding, it may be recognised for what it is.

The water motor alarm must not be located higher than 6,0 metres above the valve and fitted with a shut off cock indicating whether it is open or closed.

The total length of pipework feeding the alarm gong from the installation control valve assembly shall comply with the following when considering all equivalent lengths for fittings:

- a) Where the length of the piping to the alarm does not exceed 6,0 metres it shall be not less than 15 mm nominal diameter.
- b) Where the length of the piping to the alarm exceeds 6,0 metres but does not exceed 25 metres, it shall be not less than 20 nominal diameter.
- c) Where the length of the piping exceeds 25 metres, it shall be not less than 25 mm nominal diameter.

The pipework shall be arranged to drain through a fitting, (drip union), having an orifice not larger than 3,0 mm diameter. The orifice plate, (which may be integral with the fitting), shall be of stainless steel or of suitable nonferrous material such that the hole will not become blocked by corrosion.

Water motor alarms must be tested at least once a week for at least a 30-second period. For this purpose, there must be a 15 mm test valve on the installation side of the alarm valve. Unless otherwise required in these rules, water motor alarms must be sufficiently sensitive to operate within 60-seconds when only one sprinkler is actuated.

In the case of installations on the alternate wet and dry pipe system using both wet pipe and dry pipe alarm valves, testing valves must be fixed both above the dry pipe alarm valve, (for use when the installation is under water pressure), and between the wet pipe and dry pipe alarm valves, (for use when the installation is under air pressure).

Water motor alarm drainpipes shall be galvanised, taken separately to waste, and may not be interconnected into common drains due to back-pressures created within the water motor during testing which causes intermittent ringing or eventual failure of the unit.

4056 Electrically operated alarms

4057 Water flow alarm switches

Approved water flow alarm switches may be incorporated in the system pipework above the alarm or dry pipe valves to indicate on a central control panel the section of the system which is operating.

Unless otherwise required in these rules, a water flow alarm switch shall detect any flow equal to or more than that from a single operating sprinkler and must be sufficiently sensitive to operate within 60-seconds when only one sprinkler is actuated.

A 25 mm galvanised steel test pipe fitted with a stop valve shall be fitted not less than two diameters downstream of each water flow alarm switch to periodically test the switches and shall simulate the operation of a single sprinkler.

The test valve shall be accessible at hand level and is to be normally locked closed.

The test pipe shall run into a common drain and shall be fitted above the drain to see the test water flow or fitted with a suitable sight glass.

4058 Electric alarm pressure switches

Approved electric alarm pressure switches are permitted on a system as an auxiliary warning device.

Electric alarm pressure switches are not accepted as a substitute for the standard water motor alarm device and shall be fitted upstream of the alarm bell isolating valve with a minimum of a 150 mm sludge and sediment trap of non-corroding material such as galvanised steel.

Unless otherwise required in these rules, electric alarm pressure switches must be sufficiently sensitive to operate within 60-seconds when only one sprinkler is actuated.

4059 Transmission of alarm signals to a fire brigade or central monitoring facility

When arrangements are incorporated in a sprinkler system for the automatic transmission of alarm signals to a fire brigade or central monitoring facility, such arrangement will only be regarded as approved if they comply with the following conditions whereby there must be either:

- a) A connection directly or through a central fire alarm facility or through a public/private fire brigades' control with a public/private fire station manned by full-time personnel, or part-time retained personnel alerted by sirens and call bells and so situated as to be capable of providing an attendance at the premises of at least one mobile pumping appliance within a maximum time limit of 10-minutes, or
- b) A private fire brigade consists of at least one officer and three men always available on the premises and equipped with a power pump or with hydrants.
- c) The direct line from the premises whether to the Public Fire Station, Approved Central Alarm Depot, or Public Fire Brigade Control, shall terminate in a watch room or control room permanently manned day and night.
- d) The use of automatic dialling systems is not approved.

The apparatus, including the alarm switch and control unit, must be approved for sprinkler use and the installation must be carried out by manufacturers of approved automatic fire alarm systems or sprinkler systems, or other contractors specially approved by such manufacturers for the purpose.

There shall be a maintenance contract which will ensure that the installing engineers will attend to the requirements noted in the half-yearly inspections of the systems and always maintain it in an efficient working order.

Following each inspection, the installing engineers shall certify that the system is in satisfactory working order.

Alarm signals may be initiated either:

- a) By a flow of water in the sprinkler system using an electric alarm pressure switch connected to the alarm valve in a similar manner to the sprinkler alarm motor or using water flow alarm switches in the system pipework above the alarm valve, or
- b) By a fall in pressure in the system pipework above the alarm valve.

Pressure switches for transmitting alarm signals to the Fire Brigade shall be of the diaphragm, bellows or a bourdon tube operated type and shall be mounted on a vertical branch pipe at least 300 mm long.

Unless otherwise required in these rules, pressure switches must be sufficiently sensitive to operate within 60-seconds when only one sprinkler is actuated.

When the alarm switch is situated on the pipe leading to the sprinkler alarm motor, the stop valve controlling the flow of water to the sprinkler alarm motor must be positioned upstream of the alarm switch.

When an installation is on the dry system, an approved means can be employed to ensure that pressure operation of the alarm switch cannot be prevented either in the event of a fire or during the weekly test of the alarm motor.

If at any time the connection to the fire brigade or monitoring facility is severed as, for example, during hydraulic testing, then attention must be automatically drawn to this fact by means of duplicate warning lights conspicuously placed and a buzzer.

A test must be made every weekday, (holidays excepted), of:

- a) The Brigade/monitoring connection.
- b) The circuit between the alarm switch and control unit, and
- c) The batteries.

It is permissible for the test to be carried out by the Fire Brigade if the latter are prepared to give a written undertaking to perform this duty.

Where the circuits are continuously monitored or due to special conditions or environments, tests need only be made once per week.

There shall be a notice near the sprinkler test valves on each installation to indicate that there is a direct alarm connection to the fire brigade or monitoring facility.

4060 Installation control valve cabinet signage

4061 Valve location plate

A valve location plate must be fixed on the outside of an external wall, as near to the main stop valve as possible, bearing the following words in raised letters or other approved type of letters:

SPRINKLER STOP VALVE INSIDE

The words shall be in letters of at least 35 mm in height. It is recommended that the words be painted white on a black background.

4062 Valve instruction chart

A weatherproof valve instruction chart that relates specifically to the manufacturer's control valve assembly installed, (not a generic instruction chart) shall be mounted on a wall within the control valve cabinet or if the valves are internally located, as close to these as possible.

4063 Block plan

An approved weatherproof block plan of the risk with the position of the main stop valve or valves clearly indicated thereon must be placed within the valve cabinet, main building and the pump house when provided.

The minimum size of the block plan shall be equal to or greater than A2 international paper size, (420 mm by 594 mm), to readily enable reading of the design criteria and identification of the areas of protection.

A copy of the block plan shall be mounted on a wall within the valve cabinet/room, main building/s and the pump house when provided where it can be readily seen by firemen or others responding to the alarm.

The block plan shall include details of and a general specification of the protection including particulars of the water supplies. The block plan of the premises shall include the following showing at least the following information:

- a) Extent of the protection.
- b) Where more than one valve is installed, the area controlled by the numbered valve. See Rule 4048.
- c) A cross-section of the full height of the building or buildings indicating the height of the highest portion of the roof or ceiling with respect to a stated datum level deemed to be the floor or ground level.
- d) The class or classes of system to be installed according to the hazard class in the various buildings.
- e) The occupancy of each building.

Note: It is the responsibility of the installer to confirm the respective hazard class or classes to which the protection is to be designed.

f) The storage height and method for the most onerous risk, see Rule 1012.

Note: It is not acceptable to list all storage heights for a specific design density of discharge. The block plan shall be purpose made and unique to the premises it relates to.

- g) Clear identification of the positioning of any subsidiary stop valve.
- h) The positioning and details of any orifice plate installed.
- i) The calculated flow and pressure requirement of each installation:
 - I. At the installation control valve under consideration, and
 - II. Pmax and Qmax where a pumped water supply is provided for each installation.

Note: All flows and pressures of a system design are to be taken up to the next logical integer divisible by 10, for example: 4581,547 litres per minute at 724,951 kPa would be shown on the block plan as 4590 litres per minute at 730 kPa.

4064 Fire brigade booster connection inlets

The positions of fire brigade booster connection inlets are externally located and indicated by a notice reading as follows:

SPRINKLER BOOSTER CONNECTION PRESSURE LIMIT 1,200 kPa

4065 Stop valves

4066 General

All stop valves shall be specifically listed and approved for sprinkler use and shall be pressure rated accordingly.

Any valve fitted to a sprinkler system shall not open or close in less than 5-seconds when operated at the maximum possible speed. Screwed butterfly or ball valves are not permitted for use on sprinkler installations.

Zinc base alloys whether protected by electro-plating or any other coating are not acceptable materials for valves when used in sprinkler installations.

All stop valves shall have an indicator fitted to them which will show whether the valve is open or shut.

All stop valves, (except those fixed by the Water Authorities on the branches from a town main), must be "right-handed", i.e., they must be so constructed that to shut the valve, the spindle must turn clockwise.

The controlling wheels of all stop valves must be clearly marked showing in which direction the wheel is to be turned to open or close the valve.

4067 Stop valves controlling water supplies

All stop valves controlling water supplies must be secured in their correct operative positions by a keyed alike padlocked chain.

In the case of elevated private reservoirs and gravity tanks, the stop valve must be fixed close to the non-return valve and on the reservoir or tank side thereof.

4068 Butterfly valves

These must be gear driven, lever operated valves are not acceptable for use in sprinkler systems.

4069 Main stop valves

Each installation must be provided with a main stop valve, which when closed, will shut off all supply of water to the installation.

They must be secured in the open position by a keyed alike chain and padlock

All main stop valves shall be adequately protected from the action of frost.

4070 Subsidiary stop valves

Stop valves subsidiary to the main stop valve, i.e., above the alarm valve, apart from the installation drain and test valves or as allowed within these rules, are not permitted except in the following circumstances:

Taps, cocks or other attachments for drawing water from an installation other than as permitted in these rules are strictly forbidden.

- a) To facilitate the testing of a dry pipe valve when a system is permanently on the dry system subject to the valve being of an approved glandless interlocking key or rising spindle type.
- b) To control small groups of sprinklers in areas not exceeding 100 m², which are exposed to frost conditions as for example in exposed cart ways, loading places, outside hoists, kitchen canopies or exhaust ducts, outside staircases, or gangways. Suitable auxiliary drainage facilities must be provided.
- c) To control sprinklers on a tail-end dry pipe system provided the stop valve is of the interlocking key or rising spindle type, and the valve is positioned in a conspicuous place where, when the valve is temporarily closed, the key is readily visible and there are suitable auxiliary drainage facilities.
- d) In connection with hoods over the drying ends of a paper making machine, to enable cylinders to be changed, etc., provided the stop valves are padlocked in the open position when the hoods are in position.
- e) In connection with flushing connections.
- f) In connection with outlets at the level of the highest sprinkler, where it is required that periodic running pressure tests be carried out at this level.
- g) In connection with the test facilities for water flow alarm switches.
- h) Life safety by-pass arrangement for multi storey buildings.

4071 Non-return valves

All non-return valves shall be approved for sprinkler use and shall be suitably pressure rated.

Where there is more than one water supply to an installation, a non-return valve shall be fitted in each water supply connection and a test cock for testing the valve is to be provided between the non-return valve and the supply control valve subject, in the case of town mains, to the water authority raising no objection.

Non-return valves must be readily accessible for testing and maintenance. Where the fitting of a non-return valve below ground is unavoidable, the position of the valve shall be indicated, and an inspection chamber shall be provided in such cases. The inspection chamber shall be suitably sized to allow full access to service the valve.

4072 Alarm valves

An alarm valve is an approved check or non-return valve of either the wet, dry, or composite type that also initiates a water motor fire alarm when the sprinkler system operates.

4073 Alarm (wet pipe) valves

Alarm, (wet pipe), valves, (often referred to as ordinary alarm valves), must be of an approved type. They must be fixed on the main supply pipe immediately above the block piece that is located above the main stop valve and before any connection is taken off to supply any part of the installation.

4074 Alarm (dry pipe) valves

Alarm, (dry pipe), valves, (often referred to as "air valves" or "dry pipe valves"), must be of an approved type. They must be fixed on the main supply pipe immediately above the main stop valve, and the alarm, (wet pipe), valve in the case of installations on the alternate wet and dry pipe system not employing a composite alarm valve and before any connection is taken off to supply any part of the installation.

In the case of systems maintained permanently under air pressure, the alarm gong water motor shall be connected to the atmospheric chamber of the alarm motor auxiliary valve of the alarm, (dry pipe), valve.

To facilitate the carrying out of flow tests when the installation is under air pressure, an additional 50 mm drain valve may be fitted below the alarm, (dry pipe), valve. Alternatively, a stop valve of approved type may be installed immediately above the alarm, (dry pipe), valve.

Alarm, (dry pipe), valves are to be exercised at least twice-yearly.

4075 Composite alarm valves

These valves which must be of approved type, are dual purpose valves suitable for either wet or dry systems.

4076 Accelerators or exhausters for alarm valves (dry system)

This is 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.

These devices which must be of an approved type are designed to accelerate the operation of an alarm, (dry pipe), valve. They must be located as close as possible to the alarm, (dry pipe), valve or composite alarm valve.

Care must be taken to ensure that the connection to the device from the system is so located that the restriction orifice and other operating parts are not likely to become flooded with priming water or back drainage under normal conditions.

4077 Pressure reducing valves

A pressure reducing valve on the branch from a town main to an installation is not normally allowed but where installed this must be specifically designed for sprinkler use.

The controlling mechanism for the valve is to be operated from the low-pressure side.

4078 Deluge and preaction valves

Deluge and preaction valves shall be overhauled annually.

To facilitate testing, an isolating stop valve shall be fitted downstream of a deluge, preaction, or similar valve.

Deluge valves which must be of an approved type are employed to control the water to an array of open sprinklers or sprayers which are required to discharge simultaneously.

The valve normally held closed is released automatically by a loss of air pressure from independent pipework carrying purpose made detector sprinklers or initiated by the operation of an approved heat or smoke detection system.

Alarm equipment is normally connected to the outlet pipework from the valve so that an alarm is given when water flows into the distribution pipework.

Preaction valves, which are to be of an approved type, are employed:

- a) To control the water supply to a dry sprinkler installation either to prevent water discharge from pipework of sprinklers which have suffered mechanical damage, or
- b) To admit water to the pipework of a dry installation prior to the operation of a sprinkler or sprinklers.

In the case of preventing water discharge after mechanical sprinkler damage, the normally closed valve will be released by the operation of a heat or smoke detector system and the valve will be of similar type to the deluge valve, but the sprinkler pipework will be charged with air under pressure.

In the case of admitting water prior to sprinkler operation, the valve may be a standard alarm, (dry pipe), valve, (which may be fitted with an accelerator).

The heat or smoke detector system is arranged to trip the valve in a similar manner to the operation of an accelerator.

4079 Hazardous process and explosion hazard - special precautions concerning pipework, valves, etc.

In buildings or sections of premises in which hazardous processes are carried out or conditions exist which are liable to result in explosions:

- a) A separate set or set of valves must be provided to control the sprinklers therein, and
- b) The valves must be installed in a separate building, accessible from the open and cut-off from the building in which the processes are carried on.

Alternatively:

- a) Where it is not practicable to house the valves in this manner, an isolating stop valve of the interlocking key or rising spindle type must be provided external to the buildings concerned, at least 6,0 metres therefrom, which will control the water to the sprinkler installations.
- b) Trunk and feed mains leading to and from such installations must be either carried external to the buildings concerned or be adequately protected from damage arising from building collapse following an explosion.
- c) No water supplies such as pumps or gravity tanks may be housed therein.

4080 Support of pipework for sprinkler installations

4081 General

Sprinkler pipes shall be adequately supported from the building structure which shall be capable of supporting the additional load of water filled pipes.

No object of any description can be attached to or suspended from sprinkler pipework. This includes but is not necessarily limited to all types of wiring regardless of whether they carry electrical current, decorations and signage.

During equipment selection, design and erection of sprinkler pipework, consideration shall be given to the following:

- a) The thermal movement of pipework, pipe supports and the structure.
- b) Relative movement between the elements of the structure to which pipes are attached, for example the movement of the roof of the building (possibly wind-generated) relative to a sprinkler-protected platform or duct below. It might be necessary to use flexible or swivelling couplings to allow for the relative movement of the two parts of the installation.
- c) The reaction caused by the sudden filling of pipework, pumping effects, and water discharge from sprinklers, (particularly when the water is aerated), or water hammer.
- d) The uniformity of support.
- e) Vibration.
- f) Possible mechanical damage resulting from movements of the plant and machinery.
- g) Maintaining the integrity of the installation under fire conditions.

Pipe supports, support fittings and associated components, and the material from which they are manufactured, shall be suitable for sprinkler use. Mechanical screws for fastening to steelwork are not suitable for the support of sprinkler systems.

Pipe supports, support fittings and associated components, the adequacy in respect of which an accredited laboratory familiar with the requirements of sprinkler systems has issued a favourable test report or a favourable evaluation certificate, are normally deemed suitable for sprinkler use.

All threads shall be standardised metric sizes.

All parts of the pipe support shall be of thickness not less than:

- a) 1,2 mm, in the case of stainless steel of Grade 3045-15.
- b) 1,2 mm, 1,6 mm, or 2,0 mm as applicable to the nominal pipe diameter, when protected against corrosion in accordance with SANS 10064 or galvanised.
- c) 3,0 mm, in the case of all other ferrous materials that are not protected against corrosion other than stainless steel.

Eye rods shall be formed from mild steel bar and the eye shall be either:

- Made separately from square bar and attached to the circular cross-section rod by screwing or welding.
- b) Forged integrally.
- c) A loop that has been hot or cold formed.

4082 Strength of pipe supports

The following provisions shall apply in respect of the strength of pipe supports:

- a) There shall be no failure of or damage to a support assembly when the proof load appropriate to each sprinkler pipe nominal diameter given in Table 408 is gradually applied through the appropriate size mandrel to the pipe clip.
- b) Except for any initial movement caused by the application of the appropriate pre-measurement load given in Table 408, the bedding-down extension shall not exceed 5,0 mm as the load increases from the pre-measurement load to the proof load.

Table 408 Test loads for support assemblies

1	2 3		4	
Nominal diameter of Sprinkler Pipe (mm)		Pre-measurement Load	Proof test load	
Exceeding (mm)	Not Exceeding (mm)	(kg)	(kg)	
-	50	40	500	
50	100	120	850	
100	150	220	1000	
150	200	340	1500	
200	250	450	2450	

The following pipe support assemblies shall be deemed to comply with the provisions of these rules:

- a) Pipe clips and band hangers that are made from rolled strip iron, cast iron or malleable iron and that comply with the requirements of Table 409.
- b) Sling rods, (a rod with a sling eye or screwed ends used for the support of pipe clips, rings, band hangers, etc.), and U bolts that comply with the requirements of Table 410.
- c) Fasteners that comply with the requirements of Table 411 or Table 412.

Table 409 Minimum dimensions of pipe clips and band hangers

1	2	3	4	5	
Nominal diameter of pipe (mm)		Type of	material		
		Minimum Cross-section (mm)		Maximum diameter of hole in the clip	
(····· ,	Ungalvanised, other than Galvanised, stainless steel or stainless steel non-ferrous		(mm)	
Exceeding	Not exceeding	Stanness Steel	non terrous		
-	50	25 x 3,0	25 x 1,5	11	
50	65	25 x 3,0	25 x 2,5	11	
65	100	32 x 3,0	32 x 2,5	13	
100	150	40 x 3,0	40 x 2,5	18	
150	200	50 x 3,0	50 x 2,5	22	
200	250	50 × 3,5	50 × 3.0	22	

Table 410 Sling rods, threaded rod, and U bolts

1	2	3
Nominal diameter of pipe (mm)		Minimum diameter of single sling rod or bolt (mm)
Exceeding	Not exceeding	(mm)
-	50	8
50	100	10
100	150	12
150	200	16
200	250	20

Table 411 Coach screws, coach bolts and bolt fasteners

1	2	3	4	5	6	7
	ameter of pipe mm)	Coach bolt		Coach screw		Minimum number
Exceeding	Not Exceeding	Diameter (mm)	Length (mm)	Diameter (mm)	Length (mm)	per support assembly
-	50	10	65	10	65	1
50	65	10	65	10	65	2
65	100	10	100	10	100	2
100	150	12	100	10	150	2
100	150	12	150	-	150	2
150	200	12	150	-	-	2
200	250	16	200	-	-	2

Table 412 Sleeve or lag shield anchors for fastening to concrete, brick, hollow/filled blockwork, or stone

1	2		3	4	
Nominal diameter of pipe (mm)		(mm) Minimum diameter		Minimum length of anchor bolt for concrete	
Exceeding	Not Exceeding		(mm)	(mm)	
-	50		8	30	
50	100		10	40	
100	150		12	50	
150	200		16	50	
200	250		20	65	

4083 Fasteners

Fasteners and plugs shall be made of steel, provide a stable fixing, and shall not be used in mortar.

The manufacturer's recommended maximum safe working load shall be not exceeded, and when fixed as recommended by the manufacturer, the fastening and the building element shall not fail or suffer damage when test-loaded in accordance with these rules.

When fixed as recommended by the manufacturer, the fastener shall not fail when the appropriate test load given in Table 413 is applied gradually.

There shall be no movement as the load is increased from the pre-measurement load to the test load.

 $Test \ certificates \ shall \ be \ submitted \ if \ required \ to \ the \ installing \ company, \ client, \ or \ client \ representative.$

When installing angle iron brackets for trapeze bars between purlins Table 414 shall be used.

Table 413 Test loads for on-site testing of fasteners

1	2	3	4	
Nominal diameter of pipe (mm)		Pre-measurement load	Proof test load	
Exceeding	Not exceeding	- (kg)	(kg)	
-	50	15	200	
50	100	20	350	
100	150	100	500	
150	200	100	850	
200	250	100	1250	

Table 414 Angle iron brackets - trapeze or between purlins

1	2	3	4	5	6	7	8
Nominal size of pipe		Trapeze or between purlin span Size in mm					
(mm)	≤ 1900	≤ 2400	≤ 2800	≤ 3300	≤ 3700	≤ 4200	≤ 4700
25	65×50×5	65×50×5	65×50×5	70×70×6	100×65×7	100×65×7	100×65×7
32	65×50×5	65×50×5	65×50×5	70×70×6	100×65×7	100×65×7	100×65×7
40	65×50×5	65×50×5	65×50×5	70×70×6	100×65×7	100×65×7	100×65×7
50	65×50×5	65×50×5	65×50×5	70×70×6	100×65×7	100×65×7	100×65×7
65	65×50×5	65×50×5	65×50×5	70×70×6	100×65×7	100×65×7	100×65×7
80	65×50×5	65×50×5	75×50 × 6	70×70×6	100×65×7	100×65×7	100×65×7
100	75×50×6	75×50×6	75×50×6	70×70×6	100×65×7	100×65×7	100×65×7
150	75×50×6	100×65×8	100×75×8	100×75×8	100×65×10	100×65×10	100×75×10
200	100×65×8	100×75×8	100×75×8	100×75×8	100×65×10	100×65×10	100×75×10
250	100×65×8	150×75×10	150×75×10	150×90×15	150×90×15	150×90×15	150×90×15

Table 415 Distance between pipe supports

1		2
Nominal diameter of pipe (mm)		Maximum spacing
Exceeding	Not Exceeding	(m)
-	65	4,0
65	100	6,0
100	250	6,5

4084 Spacing and location of hangers

Sprinkler pipes shall not rely on each other for support.

The distance between pipework supports, measured along the line of connected pipes whether the pipes run vertically, nominally horizontally, (which includes pipes with a slope to drain), at some intermediate angle, or change direction, (where pipes change direction, the support spacing dimension is measured along the axis of the connected pipes, and not direct across the angle from support to support), shall not exceed those given in Table 415.

There shall be at least one hanger supporting range pipe lengths between adjacent sprinklers.

There shall be at least one hanger supporting range pipe lengths between a sprinkler and a distribution pipe.

The first hanger on any range pipe shall not be more than 2,0 metres from the distribution pipe.

The first hanger on any horizontal distribution pipe shall not be more than 2,0 metres from the connection to the main distribution pipe.

Pipe supports shall be at least 150 mm from the axial centre line of a sprinkler.

The distance from the terminal hanger to the end of a range pipe shall not exceed 750 mm. Where drop or rise pipes up to 600 mm or horizontal arm pipes up to 450 mm are employed, this distance must be measured from the end of the drop, rise or arm pipe.

Horizontal arm pipes less than 450 mm or drop or rise pipes less than 600 mm long do not normally require to be supported unless they are at low level or vulnerable to mechanical impact. Pipework must be prevented from twisting. These measurements are not to be taken cumulatively.

Drop or rise pipes more than 2,0 metres in length shall have additional supports fitted to them.

Drop or rise pipes more than 1,0 metres in length feeding single sprinklers shall have additional supports fitted to them.

The distance from the last hanger to the end of any distribution pipe shall not exceed 450 mm.

Distribution rise/drop pipes shall be secured directly to the building structure or by hangers securing horizontal distribution pipes within 300 mm of the riser.

Distribution rise/drop pipes of less than 1,0 metre in length feeding range pipes but not individual sprinklers do not normally require securing.

Each section of pipe between two adjacent mechanical joints shall be supported by either:

- a) One support, which shall not be located within the central one-third of the section length, or
- b) Two supports, which shall be separated by not less than one-third of the section length.

Elbows and reducers shall have at least one pipe support that is not more than one-third of the length of the supported pipe away from the fitting on mechanically joined pipes.

On mechanically joined pipes, tees and crosses shall have pipe supports on at least two of the connected pipe lengths, and each support shall be not more than one-third of the length of the relevant supported pipe away from the fitting.

4085 Corrosion protection

Pipe supports in premises or parts of premises where corrosive conditions exist shall be of stainless steel or suitably corrosion protected.

4086 Brackets

The force on any fixing screw or bolt of a bracket shall not exceed the value of the load supported.

4087 Split-ring assemblies

Split-ring assemblies shall be secured by bolts and nuts.

4088 Toggle support

Where there is no other option, toggle supports shall be used only for the support of:

- a) Pipes of nominal diameter 65 mm or less, and then only where no alternative type of hanger can be used.
- b) Ranges under ceilings of hollow tile or metal lath and plaster.

4089 Design and construction

The installing company shall provide the client or his representative with a copy of a certificate stating that the hangers comply with the requirements of these rules.

Hangers and components shall be galvanised.

The manufacturers' recommended maximum safe working loads for fasteners must not be exceeded.

All components shall be true to shape and free from sharp corners. All bolt holes shall be accurately located and free from distortion.

In any abnormal or highly acidic atmosphere, the hangers and components must be suitably treated, and professional advice shall be obtained.

Components of a hanger must be securely attached to each other by bolts or threaded rod with nuts, lock nuts and washers.

Where threaded rod is used the end of the rod shall terminate not more than 5,0 mm above the top of the pipe the hanger assembly is fitted to prevent undue movement under operational conditions.

Split ring assemblies must be secured by nuts, lock nuts and bolts.

Hanger assemblies shall be capable of withstanding loads equivalent to the appropriate proof test loads listed in these rules. The proof test load shall not cause failure or damage to the hanger assembly. Test loads shall be applied to pipe clips using appropriately sized mandrels.

All hanging material must be approved for sprinkler use and tested by an approved authority familiar with sprinkler systems to comply with the stress loading in Table 408 and Table 413.

Cantilever supports and supplementary supporting steelwork are suitable for sprinkler use.

4090 Installation

It may be necessary to use flexible pipe or swivelling couplings to allow relative movement of the two parts of the installation.

Unless otherwise allowed within these rules, hangers must support the pipes directly from the building structure and must not be used to support any other objects, except for a primary support specially designed for the suspension of several pipes, in which case the supports and in particular the primary support must be tested for the full load.

The pipes must be supported independently of the roofing or ceiling cladding and any associated suspension system.

In cases where sprinkler protection is installed below duct work and the pipes cannot be supported from the building structure, pipes may be supported from a steel section supporting the duct work, providing that the steel section and its existing attachments to the building are of sufficient size and shape to support the combined weight of the duct work and water-filled sprinkler pipe.

Hangers shall not be screwed into tee pieces or crosses which are part of the sprinkler installation pipework.

Hangers, other than toggle hangers, which may be attached to the swivel rod by rivets, shall be held together by bolts, or threaded rods, with nuts and washers.

It is not permissible to use hangers whose sole means of fixing uses the elasticity of the materials of which they are made, i.e., spring clips.

It is not permissible to support main feed and main distribution pipes from the roof purlins alone. Purlins may be used as intermediate supports only in conjunction with trapeze bars.

Sprinkler pipes shall be supported from the building structure, which itself shall be capable of supporting the additional load of the water-filled pipework and shall not impair the performance of sprinklers under fire conditions.

Sprinkler supports shall not be used to support any other objects except where primary support is designed for the suspension of piped services.

Sprinkler pipes shall not be supported from ceiling sheathing or cladding or from any associated suspension system.

Only pipes of nominal diameter 50 mm or less shall be suspended from metal deck roofs, for example roofs of which the cross section is trapezoid.

Hangers shall not be welded or secured direct to sprinkler pipework, (for example, as a redundant tee or cross-fitting), or to structural steel work, or to any portion of the building.

Pipework that rests on a support shall be secured in position and branching pipes shall not rely on each other for support.

Pipework shall be restrained against twisting and misalignment.

Wherever possible, sprinkler pipes shall be supported from non-combustible building elements. Where combustible building elements are used for support, extra protection might be provided by suitable positioning of sprinklers or by using an appropriate type of sprinkler.

4091 Fastening to timber

Wood screws, nails and explosively powered fasteners shall not be used for fixing hangers on timber.

Coach screws, coach bolts and bolts shall be located at least 10 shank diameters apart, (centre-to-centre), and the thread of coach screws shall be completely engaged in the structural timber work.

Pilot holes of the diameter and depth recommended by the manufacturer shall be drilled before coach screws are fitted.

Where the shank of a coach screw or bolt enters structural timber work, clearance of the appropriate length shall be drilled to prevent the timber work from splitting.

Coach screws, coach bolts and bolts fixed in the side of a timber joist shall be at least:

- a) 65 mm above the lower edge of the joist when they support pipes of nominal diameter 65 mm or less, or
- b) 80 mm above the lower edge when they support pipes of nominal diameter exceeding 65 mm.

4092 Fastening to concrete, brickwork, or block work

Expansion shield fasteners shall be used in brickwork or block work.

When drilling into the building structure, care shall be taken to avoid crumbling of the structure around the hole.

Holes in the face of a concrete beam shall be sufficiently distant from the lower edge to avoid the reinforcing rods, and to prevent flaking of the concrete.

Explosive powered fasteners shall be not used in concrete, brickwork, or block work.

Expanding all-steel fasteners or set-in fasteners can be used in structural grade concrete.

4093 Fastening to steelwork

Where the design of steelwork permits and is structurally acceptable, hangers may be attached to steelwork members by drilling or bolting.

Explosively powered fasteners may be used for fastening in steelwork not less than 5,0 mm thick. Their use must be restricted to shear load application, and safety instructions should be observed.

Where there are no alternatives, correctly sized band, split band, clevis, or clip band hangers that comply with the required test loads and are suitable for sprinkler use would be acceptable as the primary fixing for support from structural tubular steel.

4094 Hanger assembly

Hex flange serrated nuts shall be used to assemble and secure hangers and shall apply to all metal-to-metal facings such as threaded rods, sling rod eyebolts, trapeze bars, filbows, purlin clips, angle cleats, and U bolts.

4095 CPVC pipe support

The distance between the pipes supports measured along the line of connected pipes, (whether the pipes run nominally horizontally or at some intermediate angle, or change direction), shall not be less than that given in Table 416.

Vertical pipes shall be supported at each floor or at 3,0 metre intervals, whichever is the smaller distance.

Pipework shall not rely on fittings or joints for support.

All pipe hangers shall have a load bearing surface of not less than 12,7 mm² and shall be free from any rough or sharp edges which could come into contact with the pipe. They shall be loose fitting and shall allow free axial movement of the pipe.

The amount of bending or snaking in the pipe shall not exceed that as given in the manufacturer's recommendations.

Where upright sprinklers are used, the maximum horizontal distance from the centre line of the sprinkler to the pipe support shall be 150 mm.

Where pendent sprinklers are used, the maximum horizontal distance from the centre line of the sprinkler to the pipe support shall not exceed that given in Table 417 for end of range sprinklers and that given in Table 418 for sprinklers other than at the end of range.

Table 416 Maximum distance between pipe supports

1	2
Pipe nominal bore (mm)	Maximum support spacing (mm)
25	1800
32	2000
40	2100
50	2400
65	2700
80	3000

Table 417 Maximum distance from end of range sprinkler to bracing

1	2	3
Pipe size (mm)	Pressure ≤ 700 kPa (Maximum distance mm)	Pressure > 700 kPa (Maximum distance mm)
25	300	225
32	400	300
40 - 65	600	300

Table 418 Maximum distance from sprinklers other than end of range to bracing

1	2	3	
Pipe size (mm)	Pressure ≤ 700 kPa (Maximum distance mm)	Pressure > 700 kPa (Maximum distance mm)	
25	1520	1220	
32	1830	1520	
40 - 65	2130	2130	

SECTION 5: TYPES OF SYSTEMS

5000 General

The types of systems covered by these rules are classed as standard sprinkler systems that may incorporate subsidiary special protection in the form of sealed medium velocity sprayers and/or open medium or high velocity sprayers fed through sealed multiple-jet-controls, in relatively small areas involving flammable liquid hazards, e.g. oil-fired boiler rooms, paint storage areas, etcetera.

These systems include, but are not necessarily limited to:

- a) Wet pipe system.
- b) Alternate wet and dry pipe system.
- c) Wet pipe or alternate wet and dry pipe system incorporating tail end dry pipe systems.
- d) Wet pipe system incorporating tail end alternate systems.
- e) Dry pipe systems.
- f) Preaction system.
- g) Recycling preaction system.
- h) Deluge systems using open sprinklers and/or medium or high velocity sprayers.
- i) Foam sprinkler systems.

Differing types of sprinkler installations are subject to incompatible design criteria and cannot be intermixed. Each type of system installed shall be adequately separated to ensure that there is no adverse effect exerted on an adjacent installation of a differing type.

5001 Number of sprinklers controlled by valve sets

Sprinkler systems shall be so designed to ensure that the number of sprinklers controlled by one set of valves is logically zoned in either square area or number of sprinklers in accordance with Table 501.

Table 501 Number of sprinklers per valve (excluding life safety premises)

1	2	3
Hazard or class	Square area (m²)	Number of sprinklers
Wet pipe Ordinary Hazard - Void is cumulative if communication exists	12,000	1,000
Wet pipe High Hazard - Void is cumulative if communication exists	9,000	1,000
Intermediate level protection - Racking and shelving	N/A	2,000
ESFR protection	N/A	1,000
Alternate wet and dry or dry pipe Ordinary/High Hazard with an accelerator or exhauster	N/A	Time based ≤ 500 ^{1,2,3}
Recycling preaction system	N/A	Time based ≤ $500^{1,2,3}$
Preaction system	N/A	Time based ≤ $500^{1,2,3}$
Tail end systems	N/A	100

¹ Alternate wet and dry or dry pipe, preaction, and where applicable deluge systems shall be fitted with an accelerator.

5002 Wet pipe systems

A wet pipe system is a standard sprinkler system permanently charged with water under pressure both above and below the installation alarm valve.

Wet pipe systems are to be installed in premises where there is no danger at any time of the water in the pipes freezing. Where these conditions cannot be ensured throughout the premises, the areas which are unheated may be on a tail end alternate wet and dry pipe system, provided the number of sprinklers thereon does not exceed the limits referred to in Table 501 otherwise, the installation must be erected on the alternate wet and dry pipe system.

Wet pipe systems shall be so designed that either the number of sprinklers or area controlled by one set of valves does not exceed that stated in Table 501.

In designing the area covered by a set of valves, cognisance shall be taken of logically zoning the roof level protection with intermediate level rack or shelf level protection.

Rack or shelf protection may not overlap multiple valve configurations for roof level protection.

In calculating the total number of sprinklers on one set of valves in wet pipe systems, the number of sprinklers in concealed spaces or in machines, etc., may be ignored.

² The volume of these systems shall not exceed 4 m³ for Ordinary Hazard and 3 m³ for High Hazard installations.

³ This does not preclude larger installations which are to be evaluated on a case-by-case basis.

5003 Alternate wet and dry pipe systems

A composite valve is suitable for wet, dry, or alternate operation whereas a dry alarm valve is suitable for a dry system or an alternate installation.

An approved subsidiary stop valve of the interlocking key or rising spindle type shall be fitted above the alarm valve to facilitate testing of the system.

An alternate wet and dry pipe system is a standard sprinkler system embodying either a composite alarm valve or a combination set comprising an alarm, (wet pipe), valve and an alarm, (dry pipe), valve where:

- a) During the winter months the system piping above the composite or alarm, (dry pipe), valve is charged with air under pressure, and the remainder of the system below the valve with water under pressure, and
- b) At other times of the year the system operates as a wet pipe system.

Sprinklers in alternate wet and dry pipe systems must be installed in the upright position above the line of pipes. An exception to this rule is allowed if approved dry pendent pattern sprinklers are installed.

Pipework must be arranged with adequate slope for drainage as described in these rules.

Alternate wet and dry pipe systems must be so designed that the number of sprinklers controlled by one set of valves, (inclusive of tail end extensions), does not exceed that stated in Table 501.

5004 Dry pipe system

An approved subsidiary stop valve of the interlocking key or rising spindle type shall be fitted above the alarm valve to facilitate testing of the system.

Fast response sprinklers used for dry pipe systems assist in getting water to the remote sprinklers sooner due to the speed of operation and the likelihood of more sprinklers opening at the incipient stage of fire.

A dry pipe system is a standard sprinkler system in which the system pipework is permanently charged with air under pressure above the alarm, (dry pipe), valve and with water under pressure below the valve.

Dry pipe systems are normally allowed in buildings where the temperature conditions are artificially maintained 5° C or less such as in cold or refrigeration stores, fur vaults, etc., or where the temperature is maintained above 70° C as in drying ovens, etc. Special approval is required for dry pipe systems in other circumstances on a case-by-case basis.

Alarm, (dry pipe), valves in dry pipe systems must be exercised at least once every 6-months. This may be accomplished by removing the inspection cover plate and manually operating the moving parts.

Dry pipe systems shall be so designed that the number of sprinklers controlled by one set of valves does not exceed the limits laid down in Table 501 for alternate wet and dry pipe systems.

Sprinklers shall be installed in the upright position above the line of pipes in dry pipe systems.

Pipework must be arranged with the required slope for drainage as described in these rules.

5005 Preaction system

Preaction systems are classed as wet pipe installations for Ordinary Hazard and no storage takes place.

Preaction systems are treated as dry pipe systems where storage of any description takes place, and the assumed maximum area of operation shall be increased to 125%

Preaction installations shall not be gridded.

An approved subsidiary stop valve of the interlocking key or rising spindle type shall be fitted above the alarm valve to facilitate testing of the system.

Suitability for High Hazard intermediate level protection shall be assessed, and precautions taken in avoiding the delay between the incipient stage of a fire and the detection system under consideration.

A preaction system is a combination of a standard sprinkler system and an independent approved system of heat and/or smoke detectors installed in the same areas as the sprinklers. In general, heat and/or smoke detectors operate prior to sprinklers, and so a preaction valve will open to allow water to flow into the sprinkler pipework before the first sprinkler operates. Deluge and preaction systems activated by pilot sprinklers shall not require an independent detection system alarm.

The detection system where installed shall automatically operate an alarm. The detection system shall operate an approved continuously energised valve, or trip mechanism, to release the preaction alarm valve when the valve or trip mechanism becomes de-energised. Each system shall be provided with a separate detection installation that shall be inspected and certified as required by an independent inspection authority specialised in this function.

Where the sprinkler system pipework is charged with air under pressure it shall be monitored so that an alarm is given on reduction of the air pressure.

The preaction alarm valve controlling the water supply is operated as follows:

- a) For a non-interlock system, the installation is flooded when there is operation of detection devices or automatic sprinklers.
- b) For a single interlock system, the installation is flooded when there is operation of detection devices.
- c) For a double interlock system, the installation is flooded when there is operation of detection devices and automatic sprinklers.

The maximum time between sprinkler operation and water discharge shall not be more than the value given in Table 503.

Table 502 Maximum time delay between sprinkler operation and water discharge for preaction installations.

1	2
Hazard class	Maximum time delay between sprinkler operation and water discharge
Ordinary Hazard preaction installation	50 seconds when 2 of the most remote sprinklers are in operation
High Hazard preaction installation	40 seconds when 4 of the most remote sprinklers are in operation
Installations less than 2,0 m ³ capacity	No specific time limitation is imposed

The maximum number of sprinklers controlled by a preaction valve, whether in heated or unheated buildings, is 500 and is regulated by the time the compressor takes to fill the system and/or the time delay between activation of the valve to water being delivered to the most remote operating sprinklers. Installations larger than 500 sprinklers shall be treated on a case-by-case basis.

The air compressor must be sized so that the system will fill within 30-minutes. Air compressors of the tank mounted, base mounted, or riser mounted type are acceptable. Each system shall be provided with an independent air compressor.

The tank mounted compressor provides a reservoir of air that is pressurized higher than the system requires. This type of arrangement with makeup air within a reservoir is ideal in that it avoids constant cycling on and off of the compressor by drawing from the available pressure in the reservoir.

Sprinklers must be installed in the upright position and the pipework must be arranged with an adequate slope for drainage as described in these rules.

5006 Recycling or multi-cycle systems

An approved subsidiary stop valve of the interlocking key or rising spindle type shall be fitted above the alarm valve to facilitate testing of the system.

A recycling system shall be approved and listed for use to the specific occupancy it is protecting strictly in accordance with the manufacturer's requirements.

A recycling system is a system of the type described in preaction systems with heat detectors and incorporating a special preaction flow control valve capable of repeated on/off cycles appropriate to the possible redevelopment of fire in the protected area.

The cycling occurs due to heat detector operation which, acting as an electrical interlock, causes the preaction flow control valve to open and close.

As a safety measure, the re-closing of the flow control valve is delayed for a predetermined period, (usually 5-minutes), by means of an automatic timer. If, however, the fire rekindles and re-actuates the heat detectors, the flow control valve is reopened without delay and water will again flow from the open sprinklers.

The objects of the recycling preaction system are:

- a) To restrict water damage after a fire has been controlled or extinguished.
- b) To obviate the need to close the main stop valve when affecting modifications to the system pipework or the replacement of sprinklers, and
- c) To avoid water damage caused by accidental mechanical damage to the system pipework or sprinklers.

The heat detectors must be spaced at half design spacing between detectors and from walls.

Sprinklers must be installed in the upright position and the pipework must be arranged with an adequate slope for drainage as described in these rules.

5007 Deluge systems

An approved subsidiary stop valve of the interlocking key or rising spindle type shall be fitted above the alarm valve to facilitate testing of the system.

Deluge systems are a system of open sprinklers or nozzles controlled by a quick opening valve, (deluge valve), which is operated by a system of approved heat detectors or sprinklers installed in the same areas as the open sprinklers.

Where sprinklers are used as the detector line, these shall be purpose made.

These systems are designed primarily for special hazards where intensive fires with a fast rate of fire propagation are expected, and it is desirable to apply water simultaneously over a complete zone in which a fire may originate by admitting water to open sprinklers or to medium or high velocity sprayers.

5008 Tail end alternate wet and dry pipe or tail end dry pipe systems

An approved subsidiary stop valve of the interlocking key or rising spindle type shall be fitted downstream of the tail end valve to facilitate testing of the system.

These systems are essentially like alternate and dry pipe systems as described in these rules except that they are of comparatively small extent and form extensions to standard sprinkler installations. They are permitted as an extension in:

- a) Comparatively small areas where there is possible frost danger in an otherwise adequately heated building.
- b) In high temperature ovens or stoves.
- c) The tail end systems would be on the alternate wet and dry pipe principle in case of frost danger and on the dry pipe principle in the case of freezers.
- d) As extensions to an alternate wet and dry pipe system in high temperature ovens or stoves when the tail end systems would be on the dry pipe principle.

Sprinklers in tail end systems must be installed in the upright position above the line of pipes.

The number of sprinklers in a group of tail end systems controlled by one set of wet pipe system or alternate wet and dry pipe system valves shall not exceed 250 in the aggregate with no more than 100 sprinklers on any one tail end system.

Each tail end system shall be provided with a 50 mm drain valve, drainpipe and a pressure gauge fitted at a point above the seating of the tail end valve.

Each tail end system must be controlled by a subsidiary stop valve of the interlocking key or rising spindle type and must include either a water flow alarm switch or an electric alarm pressure or flow switch to indicate the section operating. These sectional warning systems are additional to the water motor alarm on the main control valve.

5009 Cold room and freezer protection

5010 General

In cold storage warehouses refrigerated by air circulation, automatic means shall be provided to shut down the air circulation system immediately on detection of a fire or when the sprinkler system operates.

If there is a false ceiling within the cold chamber forming a plenum for the air circulation system, dry pendent sprinklers will also be required therein.

Sprinklers shall be installed in positions where there is no likelihood of mechanical damage through movement of goods.

Any sprinklers, other than flush sprinklers, installed in a position where there is a risk of accidental damage shall be fitted with an approved metal guard suitable for the purpose of protecting the sprinkler head.

5011 Design performance

The water discharge time of a dry or preaction sprinkler system, including any subsidiary dry pipe extension in cold stores or used in other applications, shall be determined by calculation at the design stage.

The discharge time performance shall be confirmed by tests at the commissioning stage using the remote test valve as specified in these rules and shall not exceed the value given in Table 503.

Table 503 Maximum time delay between sprinkler operation and water discharge for dry pipe systems

1	2
Hazard class	Maximum time between sprinkler operation and water discharge
Ordinary Hazard dry pipe installation	60 seconds
High Hazard dry pipe installation	30 seconds

5012 Pipework

The installation design shall allow for the inspection of pipework to establish that it is free from ice or other obstructions. Provision shall be made for the thorough purging of moisture after valve operation.

Installation pipework shall be above ground and accessible.

The pipework shall be easily dismantled.

At the point of entry of the pipework into the cold chamber and otherwise where practicable, a change by direction shall be made by a tee having one branch sealed off to allow for inspection.

Pipe fittings shall be fit for purpose and shall facilitate easy removal of the pipework.

Consideration shall be given to the use of compression fittings, mechanical pipe couplings or preferably flanged joints.

Pipe supports shall be such as to facilitate easy removal of the pipework.

5013 Pressurisation of dry installation pipework

The installation pipework downstream of the dry system installation control valve and any tail end control valve shall be pressurised with either:

- a) Dry nitrogen gas, or
- b) Air drawn across freezers of lowest temperature in the plant and through a chemical dehydrator.

Nitrogen is an asphyxiating gas, and the system owner and user shall be consulted about its use as a pressurising agent to enable a risk assessment to be carried out.

Nitrogen cylinders shall be fitted with a suitable pressure reducing valve to control the pressure.

A pressure relief valve shall be fitted, to operate at the upper limit of the required installation gas pressure.

The system must be provided with a low air/gas pressure alarm.

5014 Pressurisation half tail end installations on dry pipe systems

The air/gas pressure in a series of tail-end installations, on one set of main installation control valves operating on the dry pipe or alternate wet and dry pipe principle, shall not be less than the pressure in the feed pipe(s) between the main installation control valve and the tail-end dry pipe.

Differential dry pipe valves used in tail-end installations connected to an installation operating on the dry pipe or alternate wet and dry principle shall be suitable for sprinkler service and shall retain a pressure in the installation pipework between the main control valve and the underside of the tail end dry pipe or valves.

5015 Dry pendent or upright sprinkler pipe length

The length of the drop or rise pipe on a dry sprinkler within the heated area shall be of sufficient length to prevent condensate forming or freezing at the wet pipe end due to conduction of heat to the cold store.

Where the temperature of the freezer is above -30° C, the length of the dry pendent dropper above the top of the cold room or freezer insulation shall not be less than 305 mm or that required by the manufacturer whichever is the greater.

Formula 501: Calculation of the length of a dry pendent dropper

Where the temperature of the cold room or freezer is equal to or lower than -300 C, the minimum length for the dry pendent dropper shall be determined by using the following equation:

$$L = -0.0137 \times (T + 6.67) + I$$

Where: L is the minimum length of the drop pipe, (in metres), within the heated area.

(Drop pipe length exposed in the heated area not including the length covered by cold store ceiling insulation or exposed to cold store temperatures.)

T is the minimum temperature of the cold store in degrees Celsius, (negative value).

I is the thickness of the ceiling insulation or composite panel in metres.

5016 Dry pendent or upright calculation

For water flow and pressure calculations, the K-Factor shall include the friction loss in the drop pipe of the unit and if appropriate the effect of any internal mechanical device for obstruction.

The static head gain or loss in the drop or rise pipe respectively shall be allowed for in the hydraulic calculations.

5017 Dry pendent or upright sprinkler inspection

Dry sprinklers shall be inspected at regular intervals for ice build-up or signs of ice formation in the sprinkler rise or drop pipe. Visual inspections shall take place at least bi-annually.

Water and water vapour ingress into a dry drop sprinkler must be avoided. Water ingress may occur at:

- a) The valve due to a faulty seal.
- b) The connection between the drop pipe and dry sprinkler valve assembly due to poor seals allowing atmospheric pressure changes and pressure differentials to draw moist air into the dry sprinkler pipe.

Substantial pressure differentials may be more prevalent in small cold stores, where the effect of door openings is more significant and with units where they may be cyclical temperature changes.

Any water ingress into the sprinkler pipe will freeze, resulting in ice build-up. Ice build-up will seriously impair sprinkler performance and may prevent sprinkler operation or cause obstructions to the water flow.

Where ice build-up occurs or if ice extrudes through any drain aperture in the sprinkler heat sensitive element support, the dry sprinkler assembly shall be removed and replaced.

5018 Antifreeze systems

5019 General

Where at all possible, a dry pipe system would be the preferred method of protection as the use of anti-freeze systems is not recommended. The maintenance requirement for anti-freeze systems is onerous and, as a result, would be subject to failure.

Approved CPVC sprinkler pipe and fittings shall be protected from freezing with glycerine only. The use of diethylene, ethylene, or propylene glycols shall be specifically prohibited.

Prior to commissioning, an antifreeze system shall be hydrostatically tested with air to 250 kPa for 24-hours.

Where deepfreeze conditions or any condition where water in the pipes is liable to freeze with resultant damage, the following systems may be employed.

- a) Dry pendent droppers.
- b) Dry pipe systems.
- c) Where there is no other viable alternative, anti-freeze systems.

Normal air systems are not suitable where freezing conditions occur as compressed air invariably has a moisture content which is liable to collect at the lowest point in the pipework with resultant damage to the pipes. Where compressed air systems are used and to overcome the moisture content, the air is to be drawn from within the freezer compartment and through a dehumidifier before being introduced into the dry pipe sprinkler system.

The air circulation fans must be shut down automatically on operation of the sprinkler system.

5020 Antifreeze solutions

Only factory premixed, non-combustible anti-freeze solutions specifically formulated for sprinkler systems and provided by or endorsed by the manufacturer of the sprinkler system components can be used to ensure that the mixture is consistent and that the concentration levels are as required.

Signage at the control valve assembly and entry to the areas where antifreeze systems are used shall clearly identify:

- a) The manufacturer of the antifreeze.
- b) The type and brand of antifreeze used.
- c) The concentration of the antifreeze solution, and
- d) The volume of the antifreeze solution in the system.

The use of antifreeze solutions shall be in conformity with any government or local health regulations.

An antifreeze solution shall be supplied by or endorsed by the manufacturer with a freezing point of 10% or 5° C, whichever is the greater, below the expected minimum temperature for the locality.

The specific gravity of the prepared solution shall be checked by a hydrometer with suitable scale.

Where ESFR protection is installed, the entire system, premixed antifreeze solutions used as well as the ESFR sprinklers and all related equipment shall be specifically listed and approved for that purpose.

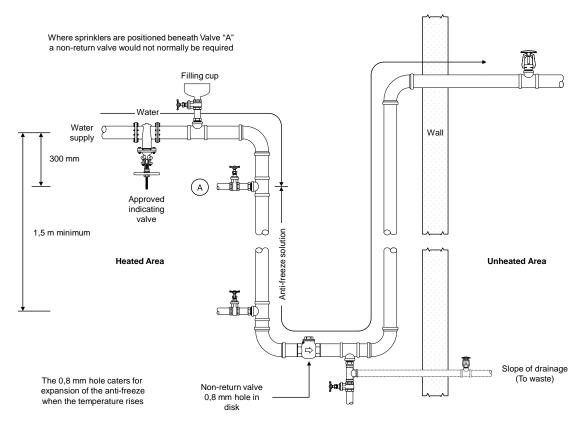
5021 Arrangement of supply piping and valves

The valve arrangement, equipment and supply pipe layout shall comply with the approved manufacturer's requirements. Figure 501 is representative of an approved valve arrangement.

Before freezing weather each year, the solution in the entire system shall be emptied into convenient containers and either replaced or, if allowable, brought to the proper specific gravity by adding concentrated liquid as needed and in accordance with the sprinkler manufacturers requirements. The resulting solution may be used to refill the system.

Where the system is continually under freezing conditions, the solution must be checked every 3-months.

Figure 501: Arrangement of supply piping and valves for an anti-freeze system



5022 Antifreeze systems solution maintenance

Using installation records, maintenance records, and information from the owner, chemical tests, or other reliable sources of information, the type of antifreeze in the system shall be determined.

- a) If the type of antifreeze is found to be a type that is no longer permitted, the system shall be drained completely and replaced with an acceptable solution.
- b) If the type of antifreeze cannot be reliably determined, then the system shall be drained completely and replaced with a premixed solution acceptable to the manufacturer of the equipment installed.
- c) If the antifreeze is not required to be replaced in accordance with the previous steps, test samples shall be taken at the top of each system and at the bottom of each system.
- d) The specific gravity of each solution shall be checked using a hydrometer with a suitable scale or a refractometer having a scale calibrated for the antifreeze solution
- e) If a concentration is greater than what is currently permitted to keep the fluid from freezing, alternate methods of preventing the pipe from freezing shall be employed.
- f) If any of the samples exhibits a concentration in excess or lower than what is permitted, the system shall be emptied and refilled with a new acceptable premixed solution.

Maintenance must be carried out annually before the onset of freezing weather, or every 3-months in the case where the system is continually under freezing the antifreeze solution shall be tested using the following procedure:

- a) The manufacturer's instructions shall be permitted to be used regarding the number of test points and refill procedure.
- b) If the most remote portion of the system is not near the top or the bottom of the system, an additional sample shall be taken at the most remote portion.
- c) If the connection to the water supply piping is not near the top or the bottom of the system, an additional sample shall be taken at the connection to the water supply.
- d) The antifreeze solution shall be tested at its most remote portion and where it interfaces with the wet pipe system.
- e) Where antifreeze systems have a capacity larger than 568 litres, tests at one additional point for every 379 litres shall be made.
- f) If the results indicate an incorrect freeze point at any point in the system, the system shall be drained and refilled with new premixed antifreeze.

Sampling from the top and bottom of the system helps to determine if the solution has settled. Antifreeze solutions are heavier than water.

If the antifreeze compound is separating from the water due to poor mixing, it will exhibit a higher concentration in the lower portion of the system than in the upper portion of the system.

If the concentration is acceptable near the top, but too low near the water connection, it may mean that the system is becoming diluted near the water supply.

If the concentration is either too high or too low in both the samples, it may mean that the wrong concentration was added to the system.

Test samples are to be drawn four times per annum, especially if any portion of the system has been drained for maintenance or repairs.

A hydrometer can be used so that a small sample is sufficient.

Where the sample indicates that the solution has become weakened, the entire system shall be emptied and refilled with acceptable solution.

Where systems are drained to be refilled, it is not typically necessary to drain drops as most systems with drops have insufficient volume to cause a problem, even if slightly higher concentration solutions collect in the drops.

For drops more than 1,0 metre, these shall be drained if there is evidence that unacceptably high concentrations of antifreeze have collected in these.

When emptying and refilling antifreeze solutions every attempt must be made to recycle the old solution with the antifreeze manufacturer rather than discarding it.

5023 Antifreeze systems calculation requirements

For antifreeze systems greater than 150 litres in size, the friction losses shall be calculated using the Darcy-Weisbach formula.

SECTION 6: HIGH RISE AND LIFE SAFETY BUILDINGS

6000 General

Notwithstanding the requirements within these rules the following special considerations apply to high rise buildings and other life safety occupancies.

A life safety environment is classed as a building which is open to the public, on entering the building they are generally not familiar with the layout. Life safety buildings may be buildings where the occupants are incapacitated or incarcerated. Such buildings include, but are not necessarily limited to:

- a) High rise office buildings and office blocks:
 - The protection shall be based on Ordinary Hazard design parameters with an assumed maximum area of operation not less than 216 m² should the building exceed 30,0 metres in height from the lowest point of access.
- b) Office blocks excluding those attached to or servicing a warehouse or industrial occupancy: The protection shall be based on Ordinary Hazard design parameters with an assumed maximum area of operation not less than 216 m².
- c) Hotels.

High rise sprinkler installations shall be subdivided into sprinkler installations such that the height difference between the highest and lowest sprinkler on any installation does not exceed 45 metres.

Pipework, fittings, valves, and other equipment shall be capable of withstanding the maximum pressures likely to be encountered for a high-rise building.

d) Shopping centres:

Shopping centres generally do not require fast response sprinklers to be installed. These structures fall largely into High Hazard due to the storage that takes place, and, in such instances, the maximum allowable operating temperature of the sprinklers must not exceed 93° C, where Ordinary Hazard is suited to the risk and installed, the use of 68° C sprinklers is required.

- e) Places of worship.
- f) Exhibition halls.
- g) Places of entertainment cinemas, concert halls and theatres for example.
- h) Hospitals, medical centres, clinics.
- i) Education centres schools, universities, and libraries for example.
- j) Retirement centres, old age homes, frail care facilities, prisons, mental institutions.

6001 Ordinary Hazard reduced assumed maximum area of operation

Life safety occupancy include, but are not necessarily limited to, hotels, office blocks and buildings over 30,0 metres in height or of a height that the fire brigade cannot affect evacuation from street level with their own equipment.

Where approved fast response sprinklers with a response time index of less than 50 are used for the protection of life safety occupancies and where applicable the assumed maximum area of operation may be reduced in accordance with Table 601.

The assumed maximum area of operation shall be based on the highest ceiling of the floor area where the reduction is to be applied.

Shopping centres, places of education, buildings higher than 30,0 metres from the lowest access point, buildings with a ceiling height more than 6,0 metres and storage or process risks, the assumed maximum area of operation shall not be reduced and a minimum design density of discharge of 5,0 m/min/m² over an assumed maximum area of operation of 216 m² shall be applied.

In life safety occupancies, the sprinkler installation shall provide progressive protection for the building whilst under construction.

Table 601 Ordinary Hazard life safety occupancies

	1	2
	ng height netres)	Allowable reduction in the assumed maximum area of operation
Greater than	Less than or equal to	(%)
-	3,0	40
3,0	3,75	35
3,75	4,5	30
4,5	5,25	25
5,25	6,0	20
6,0		0

6002 Ordinary Hazard room design method to determine the assumed maximum area of operation

Where the room design method is used for determining the assumed maximum area of operation for Ordinary Hazard life safety occupancies for hotels, guest houses or residences the water supply flow and pressure requirements shall be based on the room or rooms that create the greatest demand subject to a minimum of five sprinklers in operation within a room/s and a section of corridor of not less than 24 metres in length or six sprinklers whichever is the greater.

To utilise the room design method:

- a) The partitions or separating elements between the rooms shall be equal to or greater than the duration of the water supply for the sprinkler installation.
- b) No area, other than corridors shall exceed 130 m².

If the conditions are not met, the protection shall be based on Ordinary Hazard design parameters with an assumed maximum area of operation of not less than 216 m².

6003 Control valve assemblies

Each installation must be provided with a set of installation control valves as laid out in these rules and generally in accordance with Figure 403.

The installation control valves must be in the central core close to the main escape stairs, where the valves are positioned at various levels of the building. The number of installation control valves is determined by either zoning in accordance with Rule 6007 or Table 501.

The installation control valves shall be in a sprinkler protected area controlled by another set of valves.

An indication plate shall be installed adjacent to each set of installation valves giving the number of the installation and the number of floors which it controls.

An approved electric alarm pressure switch must be fitted to each installation control valve, which will indicate on the central control panel the installation which is operating.

Each installation control valve will be fitted with fire brigade inlet connections in accordance with Rule 6005.

Each installation shall have its own proving arrangement incorporating a sight glass. Adequate drainage must be provided.

The sprinkler risers feeding the installation control valves must run through the sprinkler protected areas or be housed in ducts with a minimum of 2-hours fire resistance. The duct must not have any openings or communicate in any way with an adjacent level.

6004 Water flow alarm switches

At least one approved water flow alarm switch must be incorporated in the sprinkler system pipework on each floor above the alarm valves, to indicate on a central panel the floor on which the sprinkler system is operating.

A bypass arrangement consisting of an isolating valve and a non-return valve shall be fitted immediately upstream of the water flow alarm switch and an isolating valve on the downstream side of the water flow alarm switch.

A bypass arrangement locked in the closed position of not less than the diameter of the distribution pipe feeding the area under consideration shall be fitted. See Figure 601.

A 25 mm stop valve must be fitted not less than two diameters immediately downstream of each water flow alarm switch to periodically test the switches. The test valve shall be accessible at hand level and will be normally locked closed. The test pipe shall incorporate a sight glass downstream of the test valve which must feed into an adequately sized common drain running through the height of the building.

Before more than one water flow alarm switch is installed into the sprinkler system on one floor, care must be taken in positioning the flow switches, such that the activation of one flow switch does not affect another, due to the turbulence caused by the flow of the water.

The central control panel shall ideally be situated on the ground floor in the foyer and where there is 24-hour surveillance.

A repeater panel is required to be situated in the caretaker's or security companies' office.

The central control panel shall comply with these rules pertaining to the construction of pump drive controller as shall the panel and battery details.

6005 Fire brigade booster inlets

For high rise buildings, in addition to the above, each sprinkler riser to the tower block will be fitted with a fire brigade inlet. The connection for these will be at ground level and be mounted on the face of the building in an accessible position.

Due to the pressure difference in the requirements for the various sprinkler risers, it will be necessary to indicate the floors which the riser connection serves and the maximum and minimum pressure that each riser requires should the fire brigade have to pump water into the installation.

The positions of fire brigade inlets must be indicated by a notice reading as follows:

SPRINKLERS

MINIMUM PRESSURE: _____kPa
MAXIMUM PRESSURE: _____kPa

SPRINKLER RISER SERVING

FLOOR:	TO FLOOR:	INCLUSIVE

6006 Non-return valves and control valve assemblies

For high rise sprinkler installations, the minimum standing pressure at the non-return valve inlet shall not be less than 1,25 times the static head difference between the valve and the highest sprinkler on the installation.

Non-return valves controlling installation flow shall operate correctly with a ratio of service pressure to installation pressure not exceeding 1,16:1, as measured by valve lift and pressure equalisation upstream of the non-return valve.

6007 Zoning of life safety installations

Zoning is mandatory for wet pipe Ordinary Hazard high rise installations and optional for all other life safety structures based on suitability and a case-by-case basis if necessary.

The number of sprinklers controlled by any one set of installation control valve set may not exceed 10,000 based on the following restrictions:

- a) The number of sprinklers to be controlled by any one set of wet installation control valves on any one floor shall not exceed 1,000.
- b) The installation shall be zoned in accordance with the requirements of these rules using the life safety bypass arrangement.
- c) Car parks and areas involving the unloading and storage of goods shall be on a separate un-zoned installation.
- d) The building shall be fully sprinkler protected throughout on all floors.
- e) The maximum allowable pressure for any component is not exceeded.

No zone shall:

- a) Include more than 500 sprinklers.
- b) Cover more than one floor level which may, however it may include a mezzanine floor no greater than 100 m².

Each zone shall be independently controlled by a single zone life safety bypass arrangement as shown in Figure 601 which shall be installed in a readily accessible position at the floor level of the zone it controls.

Each valve shall be secured open and be labelled to identify the area of protection it controls.

Each zone shall be fitted with a valve of not less than 25 mm nominal diameter, either on the end of the distribution pipe which is hydraulically most unfavourable from the water supply or on the end of each distribution pipe as appropriate. The valve outlet shall be taken to a suitable drainage point.

Zoned sprinkler installations shall be provided with tamper-proof devices to monitor the status of:

- a) Each stop valves position either fully open or not fully open including the subsidiary stop valves which may be capable of interrupting the flow of water to the sprinklers.
- b) Water flow into each zone immediately downstream of each zone subsidiary stop valve to indicate the operation of each zone by means of a water flow alarm switch capable of detecting a flow equal to or greater than that of a single sprinkler head, and
- c) Water flow through each main installation control valve assembly.

Permanent test and drainage facilities shall be provided immediately downstream of the water flow alarm switch on each zone.

The test facility shall simulate operation of any single sprinkler head. Adequate provision shall be made for the disposal of the wastewater.

The monitoring devices shall be electrically connected to a control and initiating panel installed at an accessible location on the premises where the following indications and warnings shall be given:

- Green visual indicators to indicate that each monitored stop valve is in its correct operational position.
- Audible devices and amber visual indicators to indicate that one or more control valve sets are not fully open.
- c) Audible devices and amber visual indicators to indicate that one or more subsidiary stop valves are not fully open.
- d) Audible devices and amber visual indicators to indicate that the static pressure in any trunk main supplying the system has fallen to a value of 50 kPa or more below the normal static pressure.
- Audible devices and red visual indicators to indicate that water is flowing into the installation.
- f) Audible devices and red visual indicators to indicate that water is flowing into one or more zones.

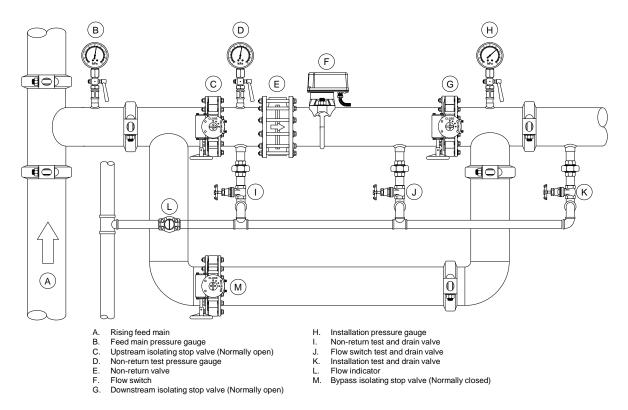
Facilities shall be provided at the indicator panel for silencing the audible alarms, but the visual indicators shall continue to operate until the installation is restored to its normal standby condition.

Fire and fault signals shall be indicated at a permanently manned location.

Any change in the panel alarm or fault indication after the audible alarm has been silenced shall cause it to resume sounding until it is again silenced, or the panel reset to the normal standby condition.

Where installations are arranged in zones, the site block plan shall additionally indicate the positions of the zone control valves.

Figure 601: Sprinkler high rise floor level life safety bypass arrangement



6008 Special considerations

Fast response sprinklers shall be used for all life safety applications as detailed in these rules.

Only one zone and the smallest part necessary of a multi zone installation shall be shut down at one time and for the minimum time necessary.

The partial or complete shutdown of a life safety sprinkler installation shall be avoided wherever possible.

When a zone is charged or recharged with water after draining, the flushing valves shall be used to check that water is available in all zones.

6009 Special considerations - hotels and high-rise buildings

6010 Garages parking levels

Sprinkler protection is required in all parking levels that are within the high-rise footprint or communicate with the sprinkler protected structure regardless of through flow ventilation.

Where sprinkler protection is provided, standard response sprinklers shall be used, and the assumed maximum area of operation may be reduced to 144 m².

6011 Utility spaces

Complete sprinkler protection in electrical, mechanical, telephone and computer rooms is required.

6012 Loading docks and truck bays

Provide full sprinkler protection within loading docks and truck bays.

6013 Freezer and cold rooms

Sprinkler protection for these areas is required. When the temperature is likely to drop or is maintained at or below 5° C, dry pendent droppers off a wet sprinkler system can be used.

6014 Guestroom bathrooms for hotels

Sprinklers are not required if the bathroom is less than 5 m².

Regardless of bathroom area, sprinklers are required when combustible tubs or shower or tub surrounds, (plastic/fiberglass), enclosures are used.

6015 Closets, wardrobes, cupboards, and pantries

Sprinklers are not required in clothes closets, linen closets, wardrobes, cupboards, and pantries within a hotel guestroom where the area of the space does not exceed 2,5 m².

Closets and pantries with washer, dryer, water heater, mechanical or electrical equipment within them require sprinkler protection.

6016 Multistage pumps for high-rise buildings

For installations where the static head and corresponding performance characteristic of 1,200 kPa is exceeded, approved multistage pumps shall be used.

Where the protection of a building exceeds 45,0 metres in height as would be the case for high rise structures, approved multi-stage, multi-take-off pumps shall be used.

The protection shall be subdivided into installations, each serving a set of floors where the height of the sprinklers on the upper floor of the set above the sprinklers on the lower floor does not exceed 45 metres.

The pump shall be of robust and compact design built up from several stages held together by body bolts between two end covers. The end covers shall incorporate the suction and final delivery branches respectively.

For each intermediate pressure take-off point, an intermediate flanged delivery branch shall be fitted.

Each effective live stage shall contain guide passages to carry the water being pumped from the delivery of one impeller to the eye of the next impeller.

A hydraulic balance valve or disc, or alternatively a suitable thrust bearing of the thrust pad design, shall be fitted to absorb the hydraulic thrusts.

Cast Iron shall not be used for any wetted rotating component or stationary part in close running contact with the rotating member. Pumps constructed other than as above shall have the design features suited for sprinkler use.

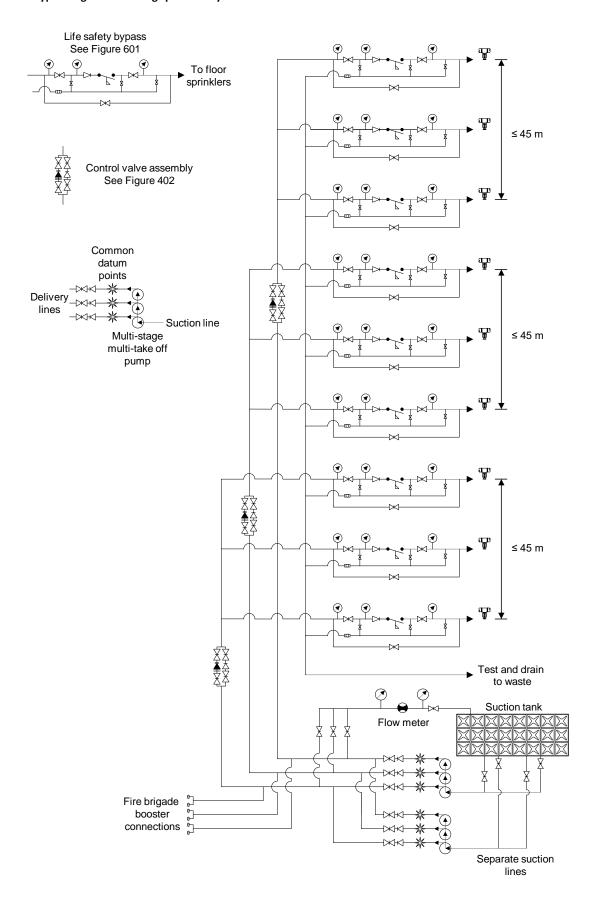
Where the following pump parts are used, the materials in Table 602 shall apply:

Table 602 Material composition of multi-stage pumps

1	2
Part	Material
Balance valve or disc	Bronze
Bearings	Ball/Roller or sleeve type
Casing neck rings	Bronze
Casing neck bushes	Bronze
End covers	Cast Iron
Glands	Bronze
Gland packing	High grade graphite cotton
Guide passages of diffusers	Bronze
Lantern rings	Bronze
Impellers	Bronze
Middle bodies	Cast Iron
Partition or division plates	Cast Iron
Shaft	EN 8 Steel
Sleeves	Bronze
Thrust bearing	Fitting pad double thrust assembly

Figure 602 provides indication in respect of the layout of water supplies for a high-rise installation.

Figure 602: Typical high-rise building sprinkler layout



6017 Centrifugal horizontal shaft design pumps

The performance characteristic of the pump or pumps shall be such that the pressure falls progressively with the rate of demand, so whilst being capable of providing the rate of flow and pressure required at the highest and most unfavourable parts of each floor, the output will be so controlled that the rate of discharge at the lowest level in areas close to the control valves on any floor will not overload the pump set.

Where the height of the building exceeds the capabilities of the sprinkler pumps situated in the lower level of the building, consideration shall be given to additional sprinkler pumps with suction tanks situated at intermediate levels of the building.

Pumps used for life safety applications shall be provided with a positive suction.

The closed outlet valve pressure at the pump, under installed conditions, may exceed 1,200 kPa, but must be within the design limits of the pump and associated pipework.

Each pump shall have its own controller, which shall be specifically designed for sprinkler fire pump service. The pump drive controller must comply with these rules.

The pump room shall have its own annunciator panel, audible and visual signalling devices, and a repeater panel, all of which shall be approved for sprinkler use.

The pump house annunciator and pump house repeater panel shall comply with these rules.

The pump house repeater panel shall also be capable of monitoring the circuits of all water flow alarm switches.

SECTION 7: INSTALLATION CALCULATION

7000 General

All sprinkler systems shall be hydraulically calculated in accordance with these rules.

Combined pre-calculated and fully hydraulically calculated systems are not permitted.

Systems of differing standards, codes or rules are not permitted.

Intermixing of requirements from differing standards is not permitted and once a standard, code or set of rules is decided upon it shall be used in its entirety and without deviation. Where deviation is unavoidable any decision made will be on a case-by-case basis.

7001 Calculation accuracy

Calculations shall be carried out in the following units and to the accuracy given in Table 701.

At every hydraulic junction where flows divide or conjoin:

- a) The total flow into the junction shall equal the total flow out of the junction to an accuracy of 0,1 litre per minute, and
- b) The pressure shall balance to within 0,1 kPa.

Table 701 Calculation accuracy

1	2	3
Quantity	Unit	Accuracy
Design density of discharge	mm/min/m²	0,1
Flow in calculations	litres per minute	0,001
Pressure in calculations	kPa	0,001
Velocity	metres per second	0,001
Pipe elevation	metres	0,001
Pipe length	metres	0,001
Equivalent pipe length	metres	0,001
Area	square metres	0,01
Length	metres	0,01

7002 Assumed maximum area of operation

The assumed maximum area of operation, is deemed to be the maximum area, expressed in square metres for design purposes, that the number sprinklers of sprinklers within this area will operate under a fire condition.

The assumed maximum area of operation is specified in these rules or reached by agreement between all parties where special circumstances may prevail on a case-by-case basis.

7003 Density of discharge

The design density of discharge is expressed in mm per minute per square metre of floor area, (mm/min/m²).

The density of discharge between any four adjacent sprinklers in a square or rectangle, (or parallelogram where the sprinklers are staggered), shall be assumed to be the sum of the total flow from the four sprinklers, (in litres per minute), divided by four times the square, rectangle or parallelogram of the floor area enclosed by the sprinklers.

The calculated density of discharge from any such four adjacent sprinklers within any assumed maximum area of operation with all sprinklers simultaneously discharging shall not be less than the design density of discharge required.

7004 Assumed Maximum Number of Sprinklers in Operation

Sprinkler systems that use an assumed maximum number of sprinklers in operation, (AMNOSA), such as the ESFR sprinkler have a predefined number of sprinklers in operation and unless otherwise noted, that number in accordance with these rules or the manufacturer's requirements shall be used.

7005 Nominal or average spacing

The area covered by a group of sprinklers or installation/s within the protected premises of the same design density of discharge and sprinkler characteristics shall be used to determine the average spacing.

Formula 701: Calculation of the average spacing of a sprinkler system

The average or nominal spacing of a sprinkler installation is determined by the following method:

$$S = \frac{A}{N}$$

Where: S is the average spacing of the sprinklers within the area (A) under consideration.

A is the area under consideration, (m²).

N is the number of sprinklers within the area (A) under consideration.

The area under consideration shall encompass:

a) A single hazard classification.

b) A single design density of discharge.

Unless the assumed maximum number of sprinklers in operation is given, the nominal spacing is used to determine the number of sprinklers in simultaneous operation.

7006 Actual spacing

The area covered by a sprinkler not on the operating area boundary shall be a square or rectangle centred on the sprinkler and extending along the range to the mid points between the sprinkler and adjacent sprinklers on the range and, normal to the range, to the mid points between the sprinkler and adjacent ranges.

The area covered by a sprinkler on the boundary shall be a square or rectangle extending, normal to the boundary, from the boundary to the midway point between the sprinkler and the adjacent sprinkler or range and, parallel to the boundary, from the sprinkler to the midway points between adjacent sprinklers or ranges.

Formula 702: Calculation of the actual spacing of a sprinkler system

$$A = S \times D$$

Where: A is the design area per sprinkler, (m²).

S Determine the greater distance between two adjacent sprinklers along a range pipe or twice the distance to the II running

parallel to the range pipe, (metres).

D Determine the greater distance between two adjacent sprinklers on adjacent range pipes or twice the distance between the last

sprinklers perpendicular to the wall, (metres).

7007 Number of sprinklers in operation for the assumed maximum area of operation

The following method shall be used to determine the number of sprinklers deemed to be in simultaneous operation within the remote and favourable areas of operation:

Formula 703: Calculation of the number of sprinklers in operation for the assumed maximum area of operation

$$N = \left(\frac{A}{S}\right)$$

Where: N is the number of sprinklers deemed to be in simultaneous operation.

A is the assumed maximum area of operation, (m^2) .

S is the nominal spacing as determined in these rules, (metres).

7008 Minimum flow

The minimum flow required at any sprinkler, unless otherwise specified in these rules, deemed to be in simultaneous operation within the assumed maximum area of operation shall be derived from the actual spacing of the sprinklers as defined in these rules.

7009 Starting flow

The minimum starting flow from the terminal sprinkler within the remote area of operation shall not be less than the design density of discharge multiplied by the actual spacing.

Formula 704: Calculation of starting flow

$$Q_m = D \times A$$

Where: Q_m is the minimum flow, (litres per minute).

D is the design density of discharge, $(mm/min/m^2)$.

A is the maximum actual spacing of any sprinkler as determined in these rules, (m^2) .

7010 Flow through a sprinkler

The flow through a sprinkler head is determined as follows:

The flow from an individual sprinkler within the area of operation shall be adjusted as determined by the pressure available at that sprinkler.

Formula 705: Calculation of the flow through a sprinkler

$$Q = K \times \sqrt{P}$$

Where: Q is the flow, (litres per minute).

K is the nominal K-Factor of the sprinkler, (metric).

P is the pressure, (kPa).

7011 Minimum pressure

The minimum operating pressure of a sprinkler shall not be less than 50 kPa unless the application for a specific listing has specified a pressure for the sprinkler, the higher pressure shall be used.

Formula 706: Calculation of the pressure to achieve the flow through a sprinkler

The minimum pressure required shall be determined as follows:

$$P = \left(\frac{Q}{K}\right)^2$$

Where: P is the pressure, (kPa).

Q is the flow, (litres per minute).

K is the nominal, K-Factor of the sprinkler (metric).

7012 Nominal K-Factor

The nominal K-Factor of a sprinkler is determined as follows:

Formula 707: Calculation of the K-Factor of a sprinkler head

$$K = \frac{Q}{\sqrt{P}}$$

Where: K is the nominal K-Factor of the sprinkler, (metric).

Q is the flow, (litres per minute).

P is the pressure, (kPa).

Figure 701: Main elements of a sprinkler system

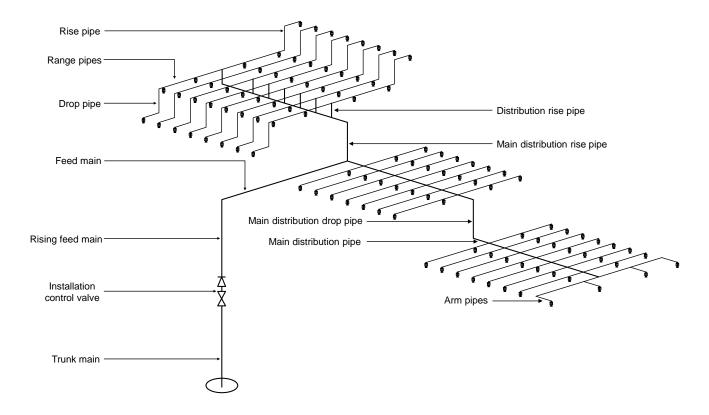


Figure 702: Examples of differing system pipework configurations.

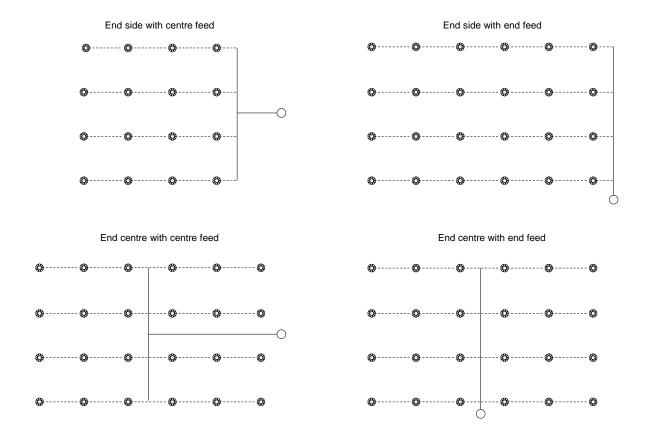


Figure 703: Typical sprinkler terminal main configuration

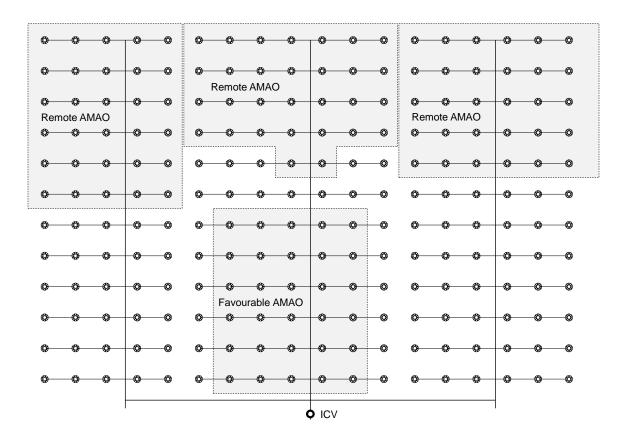


Figure 704: Typical sprinkler ring main configuration

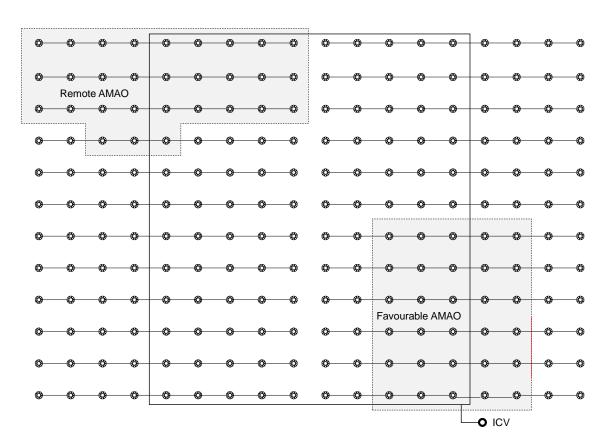


Figure 705: Typical sprinkler compound loop mains configuration

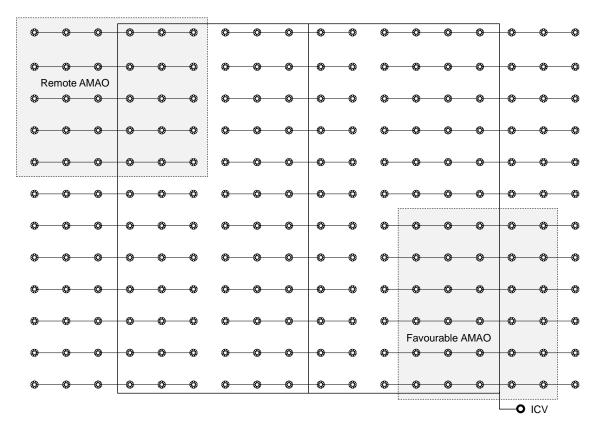
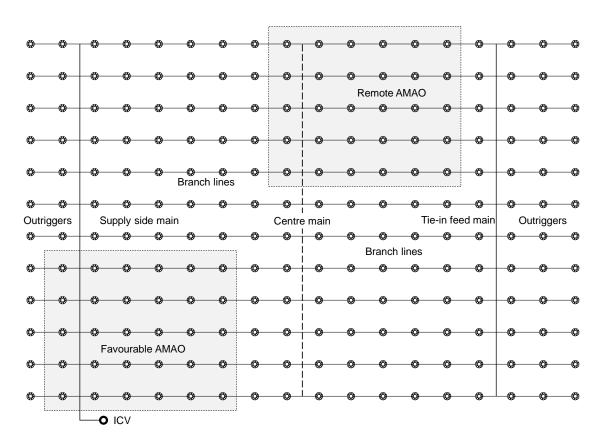


Figure 706: Typical sprinkler grid system configuration



7013 Hydraulically unfavourable assumed maximum area of operation

Continuous operation of the assumed maximum area of operation at the hydraulically most unfavourable position in the installation creates the most adverse pressure condition. This adverse pressure condition shall be used to establish the minimum sprinkler discharge pressures, (Pmax), and the required density averaged over any four adjacent sprinklers, as defined in Rule 7003.

To determine the hydraulically most remote or unfavourable position the assumed maximum area of operation shall be in turn in the hydraulically most unfavourable position on each distribution pipe, or between distribution pipes where they are connected by range pipes, in the installation, unless it is obvious that an array is like another array under consideration and is hydraulically nearer the water supply.

Consideration shall be given to any changes in sprinkler spacing, elevation, range centres, sprinkler orifice and pipe sizes.

7014 Hydraulically most favourable position

Continuous operation of the assumed maximum area of operation at the hydraulically most favourable position in the installation, when extrapolated onto the water supply pressure/flow characteristic will create the maximum flow load condition, (Qmax), at a specified pressure, which shall be used to determine the water supply requirements.

To determine the correct position, the assumed maximum area of operation must be located either at the hydraulically most favourable position on each distribution pipe, or between distribution pipes where they are connected by range pipes, that may represent the hydraulically most favourable position for the installation.

7015 Shape of the hydraulically most unfavourable position

7016 Remote terminal range, ring main and looped main systems

In the hydraulically most unfavourable position the shape of the assumed maximum area of operation for terminal range systems, including those with looped distribution pipework, shall be as near as possibly rectangular.

One side shall be defined by the array, or array pair where there is an end-centre arrangement.

Any remaining sprinklers not constituting a full array or range pair shall be grouped close to the distribution pipe on the next range row to the rectangular area.

The flows in a closed loop, (ring main), are termed to be positive, (clockwise), and negative, (anti-clockwise) in direction. In determining the split in flow one leg of the ring main leading to the area of operation will be longer than the other.

7017 Shape of the hydraulically most favourable position

7018 Favourable terminal range, ring main, looped and grid main systems

In the hydraulically most favourable position, the shape of the assumed maximum area of operation for terminal range systems including those with looped distribution pipework shall be as close as possible to a square, subject to the limitation that it shall, where possible, involve sprinklers on one distribution pipe only.

The number of sprinklers calculated to be operating on ranges, or range pairs in end centre systems, shall be located on each range or range pair at the hydraulically most favourable position. Any remaining sprinklers not constituting a full range or range pair shall be located on the next range row at the hydraulically closest positions.

Where the above is not feasible, agreement between all parties must be reached on a case-by-case basis.

Formula 708: Calculation of the flow in a ring main leg

The split in flow can be determined as follows:

$$Q_1 = \frac{Q}{\left(\frac{L_1}{L_2}\right)^{0.54} + 1}$$

Where: Q is the total calculated flow of the assumed maximum area of operation under consideration, (litres per minute).

Q1 is the flow associated with L1, (litres per minute).

L1 is one of the legs of the loop leading from entrance of the loop to the assumed maximum area of operation under consideration

inclusive of fittings, (metres).

L2 is the second leg of the loop leading from the entrance of the loop to the assumed maximum area of operation under

consideration inclusive of all fittings, (metres).

To determine the flow down L2 subtract Q1 from Q.

7019 Gridded systems branch lines remote area of operation

All measurements shall be made in the horizontal plane, including installations with sloping pipework. The length of the branch line excludes pipework for changes in elevation and fittings.

Where ranges run perpendicular to the ridge roof with a slope less than 6°, or along bays formed by beams less than 1,0 metre deep, the shape of the assumed maximum area of operation for the hydraulically most unfavourable position shall be rectangular with a length, (L), greater than or equal to 1,2 times the square root of the assumed maximum area of operation.

7020 Grid system branch line length – branch lines run parallel to the roof slope

Determine the length of a branch line for sprinklers in operation in a grid system for a standard roof structure where ranges run perpendicular to the ridge of the roof with a slope less than 6° or along bays formed by beams less than 1,0 metre deep.

Formula 709: Length of branch line where branch lines run perpendicular to the roof slope

$$L \ge 1.2 \times \sqrt{A}$$

Where: L is the dimensions of assumed maximum area of operation parallel to range pipes, (metres).

A is the assumed maximum area of operation, (m^2) .

Where ranges run parallel to the ridge roof with a slope greater than 6°, or along bays formed by beams greater than 1,0 metre deep, the shape of the assumed maximum area of operation for the hydraulically most unfavourable position shall be rectangular with a length, (L), greater than or equal to two times the square root of the assumed maximum area of operation.

Formula 710: Number of sprinklers on a branch line in operation where branch lines run perpendicular to the roof slope

$$N_s = \left(\frac{1,2 \times \sqrt{A}}{S}\right) + 1,5$$

Where: N_s is the minimum number of sprinklers deemed to be in simultaneous operation on a branch line.

A is the assumed maximum area of operation, (m^2) .

S is the average distance between all sprinklers on a branch line under consideration (metres).

All measurements shall be made in the horizontal plane, including installations with sloping pipework.

Formula 711: Length of branch line where branch lines run parallel to the roof slope

$$L \ge 2 \times \sqrt{A}$$

Where: L is the dimensions of assumed maximum area of operation parallel to range pipes, (metres).

A is the assumed maximum area of operation, (m^2) .

Formula 712: Number of sprinklers on a branch line in operation where branch lines run parallel to the roof slope

$$N_s = \left(\frac{2,0 \times \sqrt{A}}{S}\right) + 1,5$$

Where: N_s is the minimum number of sprinklers deemed to be in simultaneous operation on a branch line.

A is the assumed maximum area of operation, (m^2) .

S is the average distance between all sprinklers on a branch line under consideration (metres).

All measurements shall be made in the horizontal plane, including installations with sloping pipework.

7021 Gridded systems favourable area of operation

The shape of the assumed maximum area of operation for the hydraulically most favourable position shall be as close as possible to a square.

The number of sprinklers calculated to be operating shall be located on ranges at the hydraulically most favourable position. If there are a remaining number of sprinklers, they shall be located on the next range row at the hydraulically closest positions.

7022 Proof of correct position of assumed area of operation

Proof will be required that the position of the hydraulically most favourable and unfavourable assumed areas of operation have been established regardless of the type of supply.

Such proof may entail displacing the assumed maximum area of operation by one sprinkler in each direction along ranges pipes and/or by one range pipe in each direction along distribution pipes.

Figure 707: Example of range orientation

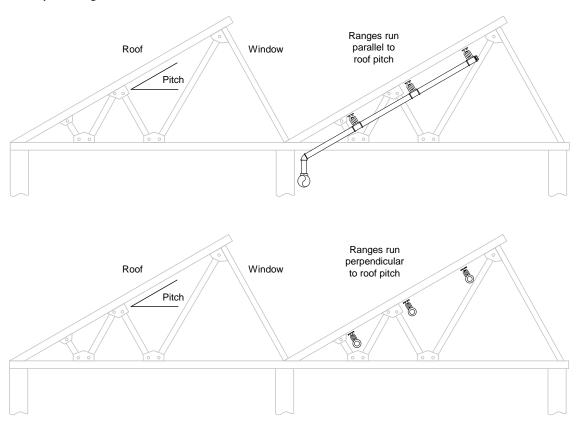
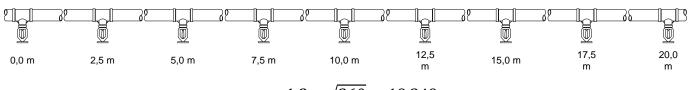


Figure 708: Example of determining the number of sprinklers in operation line with uniform elevation and sloping roof or ceiling

Standard roof structure Branches run perpendicular to roof slope Slope $< 6^{\circ}$

Assume 2,5 m between adjacent sprinklers Assume an AMAO of 260 m²



 $1,2 \times \sqrt{260} = 19,349 \ metres$

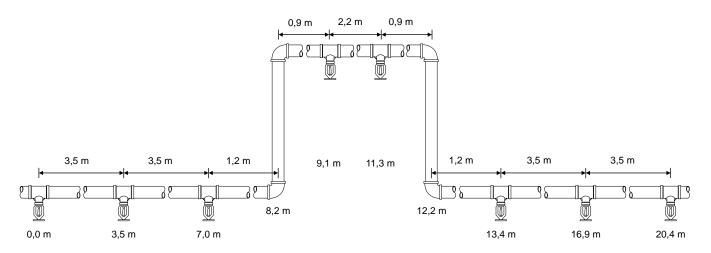
- >Measurements start at the centre line of the sprinkler
- >Measurements are taken in the horizontal plane
- >Measurements shall not take into account changes in elevation or fittings
- >Measurements shall include the next logical sprinkler where the measurement falls short of 19,349 metres
- >Therefore, in this example there are 9 sprinklers in operation per branch line

Figure 709: Example of determining the number of sprinklers in operation with differing roof or ceiling elevations

- > Example of roof a monitor structure
- > Branches run perpendicular to roof slope
- ➤ Slope < 6°
- > Variable spacing between adjacent sprinklers
- > Assume an AMAO of 260 m²

- > Measurements start at the centre line of the sprinkler
- > Measurements are taken in the horizontal plane
- > Measurements do not take into account changes in elevation or fittings
- > Measurements include the next logical sprinkler where this falls short of 19,349 metres
- > Therefore, in this example there are 8 sprinklers in operation per branch line

$$1.2 \times \sqrt{260} = 19.349 \text{ metres}$$



7023 Approximating the positioning of the remote area of operation in a grid system

To generally determine the positioning of the first operating sprinkler from the centre of the grid moving towards the tie in main on a branch line for the remote area of operation, the following formula can be used:

Formula 713: Calculating the approximate position for the remote area of operation on a grid system branch line

$$S = \left(\frac{\left(\frac{S_a}{S_b}\right)}{B_t}\right)^{1.85} \times \left(\frac{B_l}{2 \times B_s}\right)$$

Where: S is the number of sprinklers towards the tie-in main from the centre of the grid that the first operating sprinkler

is deemed to be positioned moving towards the tie-in main

 S_a is the total number of sprinklers deemed to be in simultaneous operation as determined within these rules.

S_b is the total number of sprinklers deemed to be in simultaneous operation on a branch line as determined by these rules.

B_t is the total number of branch lines excluding those within the area of operation.

B_I is the total length of the branch line inclusive of all fittings, (metres).

B_s is the distance between sprinklers on a branch line, (metres).

7024 Characteristic flow demand

The common datum point for the calculation of the characteristic flow demand shall, where possible, be located at the centre line of the pumped water supply.

The common datum point may not be located downstream of the installation control valves "C" or installation pressure gauge.

The characteristic flow, Qmax, and pressure, Pmax, demand of the installation shall be calculated with sufficient values to determine the intercept of the characteristic system curve of the installation against the water supply curve.

Formula 714: Calculation of characteristic system demand curve for a sprinkler system

The characteristic system demand curve of the installation shall be determined as follows:

$$P = 10h + (P_s - 10h) \times \left(\frac{Q}{Q_s}\right)^2$$

Where: P is the pressure, (kPa) to be determined at flow Q, (litres per minute).

h is the height of the highest sprinkler in the assumed maximum area of operation under consideration, (metres).

 P_s is the installations calculated pressure taken at a common datum point, (kPa).

Q is the flow (litres per minute) at pressure P, (kPa).

Qs is the installations calculated flow (litres per minute) at pressure Ps, (kPa).

Qmax and Pmax are representative of the total flow and pressure requirement of the sprinkler installation. This shall include, but is not necessarily limited to:

- a) The roof or ceiling level sprinkler operation in accordance with the required design density of discharge to the assumed maximum area of operation.
- b) Mezzanine, rack, or shelf protection when operating in isolation and/or in conjunction with the roof or ceiling level protection.
- c) Any significant exposed sprinklers that may be beneath the assumed maximum area of operation.

7025 Calculation of static differences

The static pressure equivalent of differences in height between sprinklers, junctions and datums shall be calculated by the formula:

Formula 715: Calculation of static head

$$P = h \times 10$$

Where: P is the pressure gain or loss due to an elevation change in the pipe, (kPa).

h is the difference in height between sprinklers, junctions, and datum, (metres).

7026 Calculation of friction and pressure losses

The Hazen-Williams formula is empirical and is generally acceptable for:

- a) Water at temperatures from about 4° C to about 25° C.
- b) Piping systems with Reynolds Numbers above 105.
- c) Fluids with a kinematic viscosity of approximately 1.1 Centistokes, (cSt).

For fluids where the specific gravity of the fluid is changed, for example, where foam and antifreeze solutions have been introduced, the Darcy Weisbach method of calculating friction losses should be used.

Formula 716: Hazen-Williams friction loss formula

Calculations of pipe friction losses shall not be less than those derived from the Hazen-Williams formula:

$$P = 6,05 \times 10^7 \times \left(\frac{Q^{1,85} \times L}{C^{1,85} \times D^{4,87}}\right)$$

Where: P is the pressure loss over the length of the pipe, (kPa).

Q is the flow through the pipe, (litres per minute).

L is the length of the pipe, (metres).

C is the Hazen-Williams roughness coefficient, (See Table 706).

D is the actual inside diameter of the pipe, (mm).

Formula 717: Shortened K friction loss formula

A simplified formula can be used for pipes having the appropriate "K" value as given in the Tables 702, 703, 704 and 705. The value "K" is derived from the Hazen-Williams formula:

$$K = \left(\frac{6,05 \times 10^7}{C^{1,85} \times D^{4,87}}\right)$$

$$P = Q^{1.85} \times K \times L$$

Where: P is the pressure loss over the length of the pipe (kPa).

Q is the flow through the pipe (litres per minute).

K is the constant for the type of pipe contemplated for use, (Tables 702, 703, 704, and 705).

L is the length of the pipe (metres).

Table 702 Pipe mean diameters and value of "K" steel pipe

1	2	3	4	5	6	7	8	9	
Nominal	(SANS 62-1:2003)			Not galvanised heavy (SANS 719:2008)		ed medium 2-1:2003)	Galvanised heavy (SANS 719:2008)		
diameter of pipe (mm)	Mean diameter (mm)	Value of K	Mean diameter (mm)	Value of K	Mean diameter (mm)	Value of K	Mean diameter (mm)	Value of K	
25	27,31	8,72×10 ⁻⁴	25,68	1,18×10 ⁻³	27,14 8,99×10 ⁻⁴		25,51	1,22×10 ⁻³	
32	35,97	2,28×10 ⁻⁴	×10 ⁻⁴ 34,34	2,86×10 ⁻⁴	35,80	2,33×10 ⁻⁴	34,17	2,93×10 ⁻⁴	
40	41,86	1,09×10 ⁻⁴	40,23	1,32×10 ⁻⁴	41,69	41,69 1,11×10 ⁻⁴		1,33×10 ⁻⁴	
50	52,98	3,46×10 ⁻⁵	51,36 4,02×10		52,81	3,51×10 ⁻⁵	51,19	4,09×10 ⁻⁵	
65	68,67	9,78×10 ⁻⁶	67,04	1,10×10 ⁻⁵	68,50 9,90×10 ⁻⁶		68,87	1,11×10 ⁻⁵	
80	80,68	4,46×10 ⁻⁶	79,06	4,92×10 ⁻⁶	80,51	80,51 4,51×10 ⁻⁶		4,97×10 ⁻⁶	
100	105,15	1,23×10 ⁻⁶	103,31	103,31 1,34×10 ⁻⁶		104,97 1,24×10 ⁻⁶		1,35×10 ⁻⁶	
150	155,32	1,84×10 ⁻⁷	154,30	1,90×10 ⁻⁷	155,15	1,85×10 ⁻⁷	154,13	1,91×10 ⁻⁷	

Table 703 Pipe mean diameters and value of "K" cast iron and ductile pipe

1	2	3	4 5		6	7	8	9	
Nominal	Nominal Cast iron flanged diameter of pipe (mm) diameter Value of K (mm)		Grey Cast Iron (Cast flanges)			ast ductile iron d flanges)	Centrifugally cast iron		
of pipe			Mean diameter (mm)	Value of K	Mean diameter (mm)	Value of K	Mean diameter (mm)	Value of K	
50	51,95	5,34×10 ⁻⁵	-	-			-	-	
80	77,41	7,64×10 ⁻⁶	81,23 6,05×10 ⁻⁶		83,31	4,48×10 ⁻⁶	81,90	5,81×10 ⁻⁶	
100	102,87	1,91×10 ⁻⁶	100,45	2,15×10 ⁻⁶	103,91	1,53×10 ⁻⁶	107,33	1,56×10 ⁻⁶	
150	153,96	2,69×10 ⁻⁷	150,56	3,00×10 ⁻⁷	154,68	2,20×10 ⁻⁷	159,73	2,25×10 ⁻⁷	
200	205,01	6,66×10 ⁻⁸	205,50	7,41×10 ⁻⁸	205,23	5,55×10 ⁻⁸	211,62	5,71×10 ⁻⁸	
250	256,00	2,26×10 ⁻⁸	250,60	2,50×10 ⁻⁸	256,03	1,89×10 ⁻⁸	263,49	1,96×10 ⁻⁸	

Table 704 Pipe mean diameters and value of "K" steel pipe

1	4	5	8	9			
Nominal diameter of pipe	Heavy 4,5 mn	Ilvanised n wall thickness 719:2011)	Galvanised Heavy 4,5 mm wall thickness (SANS 719:2011)				
(mm) -	Mean diameter (mm)	Value of K	Mean diameter (mm)	Value of K			
200	210,10	4,22×10 ⁻⁸	209,93	4,23×10 ⁻⁸			
250	264,00	1,39×10 ⁻⁸	263,83	1,39×10 ⁻⁸			
300	314,90	5,88×10 ⁻⁹	314,73	5,89×10 ⁻⁹			
350	346,60	3,68×10 ⁻⁹	346,43	3,69×10 ⁻⁹			
400	397,40	397,40 1,89×10 ⁻⁹		1,89×10 ⁻⁹			
450	448,20	1,04×10 ⁻⁹	448,03	1,06×10 ⁻⁹			
500	499,00	6,24×10 ⁻¹⁰	498,83	6,26×10 ⁻¹⁰			
550	550.00	3.88×10 ⁻¹⁰	549,03	3.92×10 ⁻¹⁰			
600	600,60	2,53×10 ⁻¹⁰	600,43	2,54×10 ⁻¹⁰			

Table 705 Pipe mean diameters and value of "K" CPVC and uPVC

1	2	3	4	5	6	7	8	
Nominal			Nominal diameter	-	VC s 16)	mPVC (Class 16)		
diameter of pipe (mm)	Mean internal diameter (mm)	Value of K	of pipe Mean internal diameter Value of F (mm) (mm)		Value of K	Mean internal diameter (mm)	Value of K	
20	22,199	1,58×10 ⁻³	110	96,6	1,40×10 ⁻⁶	100,6	1,14×10 ⁻⁶	
25	27,965	5,14×10 ⁻⁴	×10 ⁻⁴ 125 109,8 7,48×10 ⁻⁷		7,48×10 ⁻⁷	114,2	6,17×10 ⁻⁷	
32	35,408	1,63×10 ⁻⁴	140	123,0	4,30×10 ⁻⁷	128,0	3,54×10 ⁻⁷	
40	40,589	8,38×10 ⁻⁵	160	140,6	2,24×10 ⁻⁷	146,2	1,85×10 ⁻⁷	
50	50,876	2,79×10 ⁻⁵	200	175,8	7,55×10 ⁻⁸	182,8	6,25×10 ⁻⁸	
65	61,500	1,11×10 ⁻⁵	250	219,8	2,55×10 ⁻⁸	228,6	2,10×10 ⁻⁸	
80	74,900	4,24×10 ⁻⁶	315	277,0	8,25×10 ⁻⁹	288,0	6,83×10 ⁻⁹	
			355	312,2	4,61×10 ⁻⁹	324,6	3,81×10 ⁻⁹	
			400	351,8	2,57×10 ⁻⁹	365,8	2,13×10 ⁻⁹	
			450	-	-	411,6	1,20×10 ⁻⁹	
			500	-	-	457,4	7,17×10 ⁻¹⁰	

Table 706 "C" values for various types of pipes

1	2
Type of pipe	Value of "C"
Cast iron	100
Ductile iron	110
Galvanised steel and mild steel	120
Cement lined cast iron and spun cement	130
Copper, uPVC, mPVC, reinforced glass fibre, stainless steel, CPVC	140
The list is not exhaustive	,

7027 Pressure loss through fittings and valves

Loss of pressure due to a change in the velocity of the flow in pipe fittings or where the direction of water is changed through an angle, (other than the change of direction into a sprinkler or approved sprinkler assembly from an elbow or tee into which the sprinkler assembly is directly fitted), or through valves, shall be calculated by adding the appropriate equivalent lengths of pipe for pipe fittings to the actual length of pipe in the network under consideration. The equivalent length of straight pipe shall be:

- a) Taken from Tables 707, 708 or 709 as appropriate.
- b) As specified by the equipment supplier.

Where there is a bend, tee or fitting or change in direction of flow as well as a change in diameter at the same point, the equivalent length of pipe shall be determined using the smaller diameter pipe.

For dry pipe sprinkler assemblies, the K-Factor shall be considered to apply at the entry to the sprinkler assembly. Allowances shall be made for the head gain or loss due to the length and orientation of the dry pipe or that specified by the manufacturer.

Table 707 Equivalent length of steel pipe fittings

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Fittings and valves		Equivalent length of steel straight pipe for a "C" value of 120 (metres)														
0	Nominal pipe diameter (mm)															
	20	25	32	40	50	65	80	100	150	200	250	300	350	400	500	600
90° screwed elbow (standard)	0,76	0,77	1,0	1,2	1,5	1,9	2,4	3,0	4,3	5,7	7,4	9.1	10.0	11.4	14.3	17.3
90° welded elbow (r/d 1,5)	0,30	0,36	0,49	0,56	0,69	0,88	1,1	1,4	2,0	2,6	3,4	3.6	4.0	4.6	5.2	5.7
45° screwed elbow (standard)	0,34	0,40	0,55	0,66	0,76	1,0	1,3	1,6	2,3	3,1	3,9	4.9	5.3	6.1	7.7	9.2
Standard screwed tee or cross	1,3	1,5	2,1	2,4	2,9	3,8	4,8	6,1	8,6	11,0	14,0	18.2	20.0	22.9	28.7	34.5
Gate valve - straight way	-	-	-	1	0,38	0,51	0,63	0,81	1,1	1,5	2,0	2.4	2.7	3.1	3.8	4.6
Alarm or non-return valve (Swinging type)	-	-	-	-	2,4	3,2	3,9	5,1	7,2	9,4	12,0	15.2	16.7	19.1	21.5	23.9
Alarm or non-return valve (Mushroom type)	-	-	-	-	12,0	19,0	19,7	25,0	35,0	47,0	62,0	72,4	79,7	91,4	114,8	138,1
Butterfly valve	-	-	-	-	2,2	2,9	3,6	4,6	6,4	8,6	9,9	10.6	11.7	13.7	15.0	17.4
Globe valve	-	-	-	-	16,0	21,0	26,0	34,0	48,0	64,0	84,0	103.0	113.5	129.6	145.8	162.6
These equivalent lengths may be co	onverted	d as nece	ssary fo	r pipes v	vith othe	er "C" va	lues by	multiplyi	ng by th	e follow	ing facto	ors		I.	l	
"C" value	100 110				120			130			140					
Factor		1,406			1,17	9		1,	00		C).868			0.755	

Table 708 Equivalent length of CPVC pipe fittings

1	2	3	4	5	6	7		
Fishing	Equivalent length of straight CPVC pipe C factor value 150 - (metres)							
Fitting	Nominal pipe diameter (mm)							
Pipe Diameter	25	32	40	50	65	80		
Tee	1,5	1,8	2,4	3,0	3,6	4,5		
90° elbow	2,1	2,4	2,7	3,3	3,6	3,9		
45° elbow	0,3	0,6	0,6	0,6	0,9	1,2		
Coupling	0,3	0,3	0,3	0,3	0,6	0,6		

Table 709 Equivalent length of PVC-U fittings

•	Ū		Ŭ								
1	2	3	4	5	6	7	8	9	10	11	12
Fitting				Equiva	_	of straight uf actor value 1 (metres)		VC pipe			
_					No	minal diame (mm)	eter				
	110	125	140	160	200	250	315	355	400	450	500
Tee	6,0	6,9	7,7	8,8	11,0	13,7	17,2	19,5	22,0	24,7	27,4
90° elbow	3,0	3,4	3,8	4,4	5,5	6,9	8,6	9,7	11,0	12,3	13,7
45° elbow	1,0	1,1	1,3	1,5	1,8	2,3	2,9	3,2	3,7	4,1	4,6
Coupling	3,0	3,4	3,8	4,4	5,5	6,9	8,6	9,7	11,0	12,3	13,7
Butterfly valve	13,0	14,8	16,6	19,0	23,8	29,7	37,4	42,2	47,6	53,5	59,5
Diaphragm valve	23,1	26,3	29,4	33,6	42,0	52,6	66,2	74,7	84,1	94,7	105,2
Non-return	5,0	5,7	6,4	7,3	9,1	11,4	14,4	16,2	18,3	20,6	22,9

7028 Darcy Weisbach calculation

The Darcy Weisbach formula shall be used to calculate the friction loss in pipes where the fluid medium is not potable water and has a differing density or dynamic viscosity.

Formula 718: Darcy Weisbach formula

$$\Delta P_m = 225,2 \times \frac{fL\rho Q^2}{d^5}$$

Where: ΔPm is the friction loss, (kPa).

f is the friction factor.

L is the length of pipe, (metres).

ρ is the density of the fluid, (kg/m³).

Q is the flow, (litres per minute).

d is the pipe diameter. (mm).

To utilise this formula, the following will need to be calculated:

- a) The Reynolds Number.
- b) The relative roughness of the pipe.
- c) Use the Moody Diagram to determine the value of "f", (friction factor), and
- d) Calculate the friction loss

The Reynolds Number can be used to determine is a flow is laminar, transient, or turbulent. Generally, flows are considered to be:

- a) Laminar when the Reynolds Number is less than 2300.
- b) Transient when the Reynolds Number is greater than 2300 but less than 4000, and
- c) Turbulent when the Reynolds Number is greater than 4000

Formula 719: Calculation for Reynolds Number (a)

The Reynolds Number can be found by using the following formula:

$$Re = 21,22 \times \frac{Q\rho}{d\mu}$$

Where: Re is the Reynolds Number.

Q is the flow, (litres per minute). ρ is the density of the fluid, (kg/m³).

d is the pipe diameter, (mm). μ is the dynamic or absolute viscosity centipoise, (cP).

Formula 720: Calculation for Reynolds Number (b)

Formula 721:

$$Re = \frac{\rho \times v \times d}{\mu}$$

Where: Re is the Reynolds Number. ρ is the density of the fluid, (kg/m^3) . ν is the velocity of the fluid in the pipe. (metres per second). ν is the pipe diameter, ν is the dynamic or absolute viscosity centipoise, ν ν is the dynamic or absolute viscosity centipoise, ν

Calculation for Reynolds Number (c)

If the kinematic viscosity is provided, the Reynolds Number can be derived from the following formula:

$$Re = \frac{v \times d}{k}$$

Where: Re is the Reynolds Number.

v is the velocity of the fluid

v is the velocity of the fluid in the pipe, (metres per second).

d is the pipe diameter, (mm).k is the kinematic viscosity.

Formula 722: Formula for determining the kinematic viscosity

$$k = \frac{\mu}{\rho}$$

Where: k is the kinematic viscosity in Centistokes, (cSt).

 μ is the dynamic or absolute viscosity centipoise, (cP).

 ρ is the density of the fluid, (kg/m³)

The relative roughness of a pipe is its roughness divided by its internal diameter.

Formula 723: Calculation for determining the relative roughness of a pipe

$$Rr = \frac{\varepsilon}{d}$$

Where: Rr is the Relative roughness.

ε is the common roughness value. d is the diameter of the pipe, (mm).

The recommended common values for pipe roughness are detailed in Table 710.

Table 710 Pipe absolute roughness recommended values

1	2				
Material	ε (mm)				
Asphalted cast iron	0,12				
Concrete	0,3 – 3,0				
Cast iron	0,26				
Commercial or welded steel	0,045				
Copper, copper nickel	0,0015				
Galvanised iron	0,15				
Medium quality steel	0,00033				
PVC	0,0015				
Stainless steel drawn tubing	0,0009				
Stainless steel pipe (wrought iron pipe)	0,0451				

7029 Minimum pipe diameters

Distribution pipes shall not be less than 32 mm nominal pipe diameter regardless of whether it can be proven by calculation that a smaller pipe diameter could be used.

Range pipes, arm pipes, riser or droppers may not be less than 25 mm nominal diameter regardless of whether it can be proven by calculation that a smaller pipe diameter could be used.

To restrict Qmax and Pmax to manageable limits, the maximum allowable number of sprinklers fed from any one side of a terminal main or ring or looped main system at roof or ceiling level or as intermediate level protection for racks and shelves shall not exceed six.

7030 Velocity

The effect of velocity head may be ignored.

The water velocity shall not exceed:

- a) 6 metres per second at any multiple-jet-control, flow monitoring device or where stabilised flow is required.
- b) 8 metres per second at any valve, strainer, or trunk, feed, and distribution main.
- c) 10 metres per second at any other point in the system.

Where velocity is exceeded in an installation it shall be reviewed on a case-by-case basis.

Formula 724: Calculation of velocity

The velocity within a pipe can be determined by using the following formula:

$$V = \frac{21,22 \times Q}{D^2}$$

Where: V is the velocity in the pipe (metres per second).

Q is the flow through the orifice (litres per minute).

D is the mean diameter of the pipe in mm.

7031 Orifice plates

The use of orifice plates within the sprinkler system pipework should be avoided and where necessary, the system should be balanced using the feed and distribution pipes.

Where it is considered necessary to fit orifice plates to assist in hydraulically balancing a system or to meet pump characteristic curves, the diameter of the orifice must be not less than 50% of the diameter of the pipe into which the plate is to be fitted.

Orifice plates are allowed in pipes 50 mm diameter or larger. They must be fabricated in brass or stainless steel with plain square edge central holes without burrs and of a thickness as stated in Table 711.

They shall be situated not less than two pipe diameters from any elbow or bend measured in the direction of flow and full details of the orifice plate and positioning within a sprinkler installation must be prominently noted on the block plan which is located at the installation control valve assembly.

Orifice plates must have a projecting identification tag which is readily visible on which is stamped the orifice diameter, the flow through the pipe used to calculate the orifice, the pressure drop across the orifice and the K-Factor for the orifice.

The relationship between the size of the orifice, the flow and the pressure loss are to be calculated based on the information given in these rules.

Table 711 Orifice plate thickness

1	2
Nominal size of pipe (mm)	Orifice plate thickness (mm)
50 – 65 - 80	3
100 - 150	6
200	9

7032 Orifice plate diameters

The following has been produced to assist in calculating the appropriate diameter of an orifice to achieve the desired hydraulic balance as mentioned in these rules:

Formula 725: Calculation of orifice plate diameters

$$d = \frac{D}{\sqrt[4]{\left(\frac{\sqrt{P} \times D^2 \times 0,04024}}{Q}\right)^2 + 1}$$

Where: d is the orifice plate diameter, (mm).

D is the mean diameter of the pipe, (mm).

P is the pressure drop required across the orifice, (kPa).

Q is the flow through the orifice, (litres per minute).

Formula 726: Calculation of the pressure drop through an orifice plate

The pressure drop across the calculated orifice at a differing flow can be determined by using the following formula:

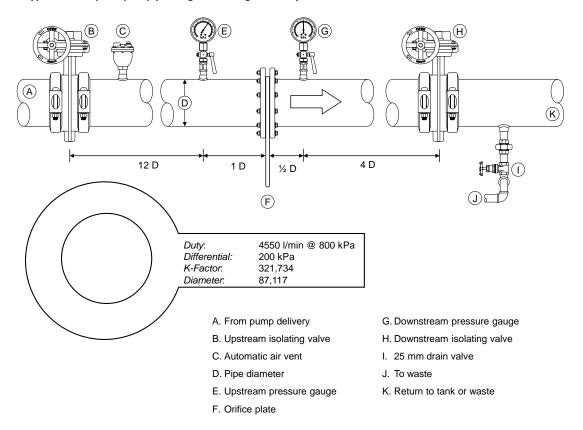
$$P = \frac{(1,5625 \times 10^8 \times Q^2) \times (D^4 - d^4)}{253009 \times d^4 \times D^4}$$

Where: d is the orifice plate diameter, (mm).

D is the mean diameter of the pipe, (mm).

P is the pressure drop required across the orifice, (kPa).
Q is the flow through the orifice, (litres per minute).

Figure 710: Typical orifice plate pump proving test arrangement layout



7033 General requirements for sprinkler system planning and inspection

7034 Consultation

If a new sprinkler installation, extension or alteration to an existing sprinkler installation is being considered for new or existing buildings, the authority having jurisdiction shall be consulted at an early stage.

If there are any proposed deviations from this these rules:

- a) The authority having jurisdiction shall be provided with full written details of such proposed deviation(s) and of the circumstances that gave rise to the deviation(s).
- b) Written approval for the deviation(s) shall be obtained from the authority having jurisdiction.

If the occupancy class of a building or the classification of the fire hazard, (in terms of these rules), should change, the suitability of the original sprinkler installation (in terms of the revised fire hazard) shall be

- a) Re-evaluated by the authority having jurisdiction or inspection authority.
- b) Approved in writing by the authority having jurisdiction.

When the outline design of the sprinkler installation is being done, consideration should be given to any benefits that might be derived from changes to the building design, work procedures, etc. Consideration shall be given to the following:

- a) The hazard classification of the building and of the storage it provides, since the design of the sprinkler installation will be based on these classifications:
- b) The siting of any town main water supply connection(s), water supply tank(s), reservoir(s) and pump rooms.
- c) The maximum quantity of water available and the maximum rate of supply (determined by on-site tests at a time of peak demand from the supply source) compared to installation design requirements.
- d) The location of installation control valve(s) and access to them.
- e) The disposal of drainage and test water.
- f) The protection of valve sets, pipework, and sprinklers against accidental damage.
- g) Sources of electricity.

It is important to consider building design in terms of fire protection, for example the choice of building materials, the support of the sprinkler pipework, (consider the loads imposed on the structure by the weight of the sprinkler pipework and the contained water), the method of heating used in the buildings, the need for inbuilt drainage, (recommended for computer areas), and the possibility of raising the bases of stacked goods above the floor in places where water might cause severe damage to stored goods.

Where the storage of goods is involved, the height of the building and of goods stacks shall be considered, including the height and type of any storage racks.

The design of double-entry storage racks might be influenced by the need to mount sprinklers in them. If sprinklers are fitted in racks, additional structural members might be needed to prevent impact damage to the sprinkler head and pipework.

Interaction with other fire protection measures

Account shall be taken of any possible interaction between sprinkler installations and other fire protection measures.

7035 Preliminary approval

Any person who intends to install an automatic sprinkler installation shall:

- a) Obtain written confirmation of the fire-hazard class(es) for which the protection shall be designed, from the authority having jurisdiction.
- b) Together with the application for preliminary approval, provide the authority having jurisdiction with sufficient detail, which shall include:
 - I. A general specification of the planned installation with plans of each floor, or part thereof, that indicate:
 - i. The extent of the proposed protection with details of any proposed unprotected areas.
 - ii. The class of occupancy, type of storage, (if any), and proposed fire-hazard class classification.
 - iii. The proposed type(s) of sprinkler installation.

A provisional block plan of the premises that indicate:

- a) The extent and type(s) of sprinkler installation.
- b) The type of construction, occupancy class and fire-hazard class of the building(s) or part(s) of building(s).
- c) The type of construction and occupancy class of any communicating buildings or neighbouring buildings (or both).
- d) A cross-section of the full height of the sprinkler-protected building(s), that shows the height of the highest sprinkler above a stated datum level.
- e) Details of the water supplies, which, if they include a town main, shall include pressure-flow data with the date and time of test, and a plan of the test site.
- f) A statement that the installation will comply with these rules, together with details of any deviation(s).
- g) Details of the authorities consulted and their response to such consultation.

7036 Design approval

The owner of the building shall, where possible, immediately after signing the contract, but before building starts, submit the following to the authority having jurisdiction:

- a) The application for the approval of the design:
 - i. A signed declaration that the installation and the water supplies have been designed in accordance with these rules by a competent person.
 - ii. A signed undertaking that the installation and associated water supplies will be installed by an approved installer, in accordance with the appropriate plans and drawings, and as specified in these rules.
 - iii. Appropriate plans, drawings, details, and information required in terms of these rules.
 - iv. Any additional details and information that might be required.
 - v. Only a competent person shall approve any design.

The owner of the building shall, before erection starts, obtain written approval of the design of the proposed installation (including the water supplies) from the authority having jurisdiction.

11/10/2024

7037 Details required for the approval of a design or installation

All drawings, plans and other documents submitted for checking or approval shall contain the following information, where appropriate:

- The name of the occupant of the building, or of part(s) of the building if there is more than one occupant.
- b) The address and location of the premises.
- c) Contact persons details at the premises under consideration.
- d) The occupancy class and the fire-hazard class of the building, or part(s) of the building if there is more than one occupant.
- e) Date of issue.
- f) Name of project.
- g) Drawing or document title.
- h) Installation number or reference.
- i) The name of the designer of the sprinkler installation, who shall be a competent person.
- i) Name of the responsible person who shall not be the designer.
- k) Any additional information that might be required.

7038 Summarized schedule

The authority having jurisdiction shall be provided with a summarized schedule that contains the following information and details:

- a) The name of the project.
- b) The reference number and the issue number of each drawing and each document, together with its title and date of issue.
- c) The type(s) of installation and the nominal diameter(s) of the installation control valve(s).
- d) Regarding each installation control valve, the number and type of sprinklers it controls, and the size of the area that is protected.
- e) Regarding each installation control valve, the height of the highest sprinkler above each valve.
- f) A reference (such as a number) for each installation control valve.
- g) In the event of there being any deviation(s) from these rules, details of the deviation(s), including reasons for the deviation(s).
- h) A list of the water fittings and components deemed suitable for sprinkler use and that are to be installed in the installation, with each fitting and component identified by the manufacturer's name and model or reference number, where appropriate.

7039 General installation layout and working drawings

The general installation layout and working drawings shall contain the following information:

- a) The fire-hazard class(es) of the sprinkler installation, or parts of the sprinkler installation (including the storage class(es) and the storage design height(s).
- b) The occupancy class(es) of the protected area(s).
- c) An indication of all the unprotected areas (such as stairways, lift lobbies and toilets).
- d) Construction details of floors, ceilings, and roofs, and of the walls that separate areas with sprinklers from areas without sprinklers.
- e) A sectional elevation of each floor of each building showing the positioning of sprinklers relative to ceilings, beams and other building elements or components that might affect the sprinkler layout or discharge.
- f) An indication of trunking, staging, platforms, suspended open-cell ceilings and other equipment that might affect sprinkler location or discharge, such as machinery, fluorescent light fittings and heaters.
- g) The location and size of all concealed spaces (such as concealed roof or ceiling voids and including any enclosures sealed at a level lower than the roof or the ceiling proper).
- h) The sprinkler type(s) and temperature rating(s).
- i) The location and type of installation control valve(s), alarm motor(s) and gong(s).
- j) The location and details of alarm switches (such as water, air, pressure, and electric alarm switches).
- k) The location and size of any tail-end air valve(s), subsidiary stop valve(s) and drain valve(s).
- l) In the case of alternate installations (see 3.1.6), the drainage slopes and directions of the pipework.
- m) The specification(s) for and location(s) of any orifice plate(s).
- n) A schedule that lists the number and type of sprinklers, sprayers, and drenchers together with detail of their area of protection.

7040 Details for sprinkler installation pipework and calculations

In the case of sprinkler installation pipework, the following shall be given together with detailed calculations (either on purpose-designed work sheets or as a computer printout):

In respect of each design area of operation:

- a) An area identification.
 - i. The fire-hazard class.
 - ii. The specified density of discharge, in millimetres per minute.
 - iii. The assumed maximum area of operation (AMAO), in square metres.
 - iv. The number of sprinklers in the AMAO.
 - v. The nominal thread diameter of the sprinklers, in millimetres.
 - vi. The maximum area covered per sprinkler, in square metres.

- b) Detailed and dimensioned working drawings that show the following:
 - i. The node or pipe reference scheme used to identify pipes, junctions, sprinkler heads and fittings from a hydraulic engineering point of view.
 - ii. The position of the hydraulically most unfavourable and favourable AMAO.
- c) The position of the hydraulically most favourable AMAO:
 - The four sprinklers upon which the design density of discharge is based (see 8.1); and the height above datum of each point for which the pressure is given.
- d) In respect of each operating sprinkler:
 - i. The sprinkler node or reference number.
 - ii. The flow through the sprinkler, in litres per minute.
 - iii. The nominal k factor.
 - iv. The inlet pressure to the sprinkler or sprinkler assembly, in kilopascals.
- e) In respect of each hydraulically significant pipe:
 - i. The pipe node or reference number.
 - ii. The nominal pipe diameter, in millimetres.
 - iii. The Hazen-Williams constant "C".
 - iv. The flow through the pipe, in litres per minute.
 - v. The nominal fluid velocity, in metres per second.
 - vi. The length of the pipe, in metres.
 - vii. The numbers, types, and equivalent lengths, in metres, of water fittings.
 - viii. The static head change in the pipe, in metres.
 - ix. The pressures at the inlet and the outlet of the pipe, in kilopascals.
 - x. The friction loss in the pipe, in kilopascals.
 - xi. An indication of the flow direction.
- f) A line diagram of the pipe layout shall be prepared and should show the following:
 - i. The reference number of the node or pipe.
 - ii. The distribution pipes.
 - iii. The range pipes.
 - iv. The sprinkler heads under consideration.
 - v. The four hydraulically most unfavourably placed heads.
 - vi. The flow through, and pressure at the end of, each hydraulically significant pipe.

7041 Water supplies

Drawings and details of the water supplies and of the pipework running from them up to the installation control valve(s) shall be provided to indicate the type and position of the following:

- a) Stop valves.
- b) Pressure-reducing valves or non-return valves.
- c) Water meters.
- d) Water locks.
- e) Orifice plates.
- f) Any water connection that supplies water for other services.

7042 Town main

Where the water supplies include a town mains:

- a) The nominal diameter of such mains.
- b) The pressure-flow characteristic graph of the town mains as determined by testing at peak demand:
- c) The graph shall be corrected for friction losses and for the static head difference between the test location and either the installation control valve "C" gauge, or the suction tank inlet valve, as appropriate.
- d) The date and time when the tests were carried out shall be indicated, together with the location of the test point (on the mains) relative to the position of the installation control valve.
- e) Whether the mains are circulating or dead-end. If it is dead-end, details shall be given of the nearest circulating mains connected to it.
- f) A graph showing:
 - i. The pressure/flow characteristic of the town main which shall be determined by test at a period of peak demand, and which shall be adjusted to allow for frictional losses and static head difference between the test location and the installation alarm valve "C" pressure gauge or the relevant suction tank in-fill valve.
 - ii. A modified pressure flow characteristic indicating the usable pressure as defined in these rules at any flow up to the maximum system demand.
 - iii. The system demand pressure/flow characteristic for the hydraulically most unfavourable assumed maximum area of operation with pressures taken as at the installation alarm valve "C" pressure gauge.
 - iv. The date and time of test on town main.
 - v. A diagram showing the town main test location relative to the installation control valve.

7043 Fire pump

If automatic pump sets form one or more of the water supplies, the following shall be provided:

a) A pump characteristic graph for low water that shows the estimated performance of the pump(s) under installed conditions at the installation control valve "C" gauge and the centre line of the pump.

The following details of the automatic pump set:

- a) The pump installer's data sheet containing:
 - i. The continuously rated output power of each prime mover.
 - ii. Graphs for the generated head, power absorption, efficiency, and net positive suction head required (NPSH), and the installed pump set performance pressure to flow characteristics at the centre line of the pump at both the normal water level and the low-water levels and at the pump outlet pressure gauge (at the normal water level).
- b) The difference in height between the installation control valve "C" gauge and the pump delivery pressure gauge.
- c) The sprinkler installation number and the fire-hazard class(es).
- d) The flow demand characteristics for the hydraulically most unfavourable and the hydraulically most favourable AMAO, calculated at the control valve "C" gauge.
- e) The available and the specified NPSH at the maximum flow demand Qmax.

If a diesel engine-driven pump is installed, written confirmation shall be given that:

- a) The engine can operate continuously on full load at the site elevation for at least 6-hours.
- b) The conditions that govern the heating and ventilation of the engine room have been complied with.

7044 Administration and general

7045 Completion certificate and test certificate

On completion of the installation work and after the tests have been carried out successfully, the installer shall provide the owner or the occupant of the building with the following:

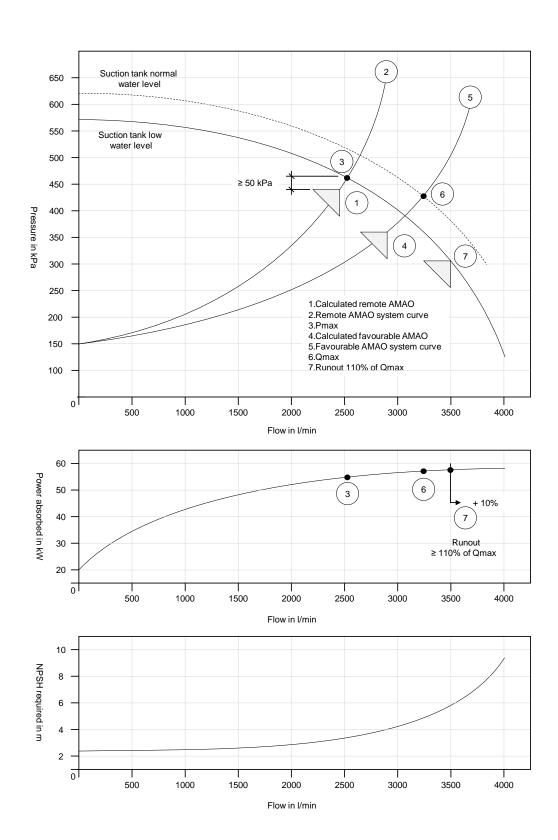
- a) A third-party independent inspectorate completion certificate that states that the installation work has been completed and that it complies with all the appropriate provisions of these rules, together with details of any deviation(s) as accepted by the authority having jurisdiction.
- b) A test certificate to indicate that all tests on the water supplies have been carried out in accordance with the provisions of these rules.
- c) If required by the authority having jurisdiction, a copy of an independent laboratory test report to prove that pipe support assemblies comply with the necessary provisions.
- d) A complete set of as-installed drawings that identify all valves, multiple controls, and instruments to be used for testing purposes by the occupant or the owner of the building.
- e) A user's schedule for inspection and testing.

7046 Notices

A durable notice shall be affixed to the riser pipe immediately adjacent to the alarm valve set, of any installation which has been hydraulically calculated. The notice shall include at least the following information:

- a) Installation number.
- b) Installation hazard classification(s).
- c) For each hazard class within the installations:
- d) The system design requirement at the pump delivery pressure gauge for the most unfavourable and favourable AMAO.
- e) The system design requirements at the installation "C" gauge for the most unfavourable and favourable assumed areas of operation.
- f) Height of the building under consideration.
- g) Height difference between "C" gauge and pump delivery pressure gauge.

Figure 711: Typical pump curve



SECTION 8: SPRINKLER INSTALLATION MAINTENANCE

8000 Maintenance Contracts

Sprinkler systems shall be appropriately maintained, as specified herein and a contract shall be placed for the continuing maintenance of the sprinkler systems, with a sprinkler servicing contractor.

To maintain the validity of any clearance certification, the system must be inspected by an independent third-party inspectorate and serviced and maintained by a sprinkler servicing contractor.

The review of hazard and the re-validation of any clearance certification shall be carried out by a company experienced in this field.

An appointed sprinkler contractor shall not carry out inspections or issue clearance on sprinkler systems.

8001 Third party independent inspections

8002 General

Self-certification of a fixed fire protection, detection or inert gas suppression installation is not acceptable.

A competent person shall approve any design.

A local authority may obtain assistance from other sources, (for example, it may request or purchase services from the private sector), if it does not have within its organization persons who are competent to carry out the tasks envisaged in these rules.

All sprinkler, detection, or inert gas suppression installations, extensions, alterations, service, and maintenance work shall be inspected by a third-party independent inspection body who shall issue a certificate of compliance where such work complies with these rules.

No person shall claim or declare that he or any other person complied with these rules or any other accepted international standard unless such a claim or declaration is true and accurate in all material respects and has been verified by an independent third-party inspection.

Sprinkler, detection, or inert gas suppression installation systems cannot be certified as following or conforming to these rules, for example, by the system or building owner, occupant, sprinkler installer or a competing contractor, a service or maintenance provider or competitor, persons who carry out installation work or who were commercially active in the installation under consideration.

The inspection authority shall have no commercial or vested interests in sprinkler systems or their components. Inspections undertaken by insurers or insurance brokers for their commercial and underwriting purposes cannot be assumed to fulfil the intent of this requirement.

8003 Sprinkler system user personnel

8004 Appointment of fire safety officials by the sprinkler system user

The sprinkler system user shall appoint a fire safety official who shall be responsible for the sprinkler system care and maintenance.

Fire safety officials shall receive formal training and instructions, whether permanent or contract staff.

8005 Staff responsible for weekly testing and emergency actions

Only appropriately trained personnel shall be permitted to undertake weekly testing of sprinkler systems or emergency actions.

It is important that the appropriate staff, including security staff, within a sprinkler protected property are given suitable levels of instruction by the sprinkler servicing contractor on:

- a) The purpose of the sprinkler system.
- b) How the system operates in the event of a fire.
- c) What to do if the system operates either in a fire or accidentally.
- d) Keeping sprinklers clear of obstruction.
- e) The avoidance of damage to sprinklers and pipework.
- f) Upkeep of records and documentation.

8006 Documentation

The following documents are to be provided by the sprinkler installing company:

- a) A maintenance and test schedule for the sprinkler system.
- b) A comprehensive operation and maintenance manual or folder for the sprinkler system which shall contain at least the following at system commissioning:
 - i. As built drawings and hydraulic data/calculations. Proprietary equipment specifications, data sheets, and maintenance requirements, including pump data provided by the pump set supplier. Maintenance, inspection, and test schedules.
 - ii. Where appropriate, a weekly test card.
 - iii. The installing contractor records and reports.
 - iv. Clearance Certificates.
- c) Comprehensive sprinkler system maintenance test schedules for pumped water supplies.

8007 Upkeep of records and documents

Appropriate records including the sprinkler system logbook or folder shall be kept on the sprinkler protected premises and updated by the fire safety official.

When requested by any authority having jurisdiction, these records shall be made available by the fire safety official for inspection.

The records shall be kept up to date and shall include at least the following:

- a) Details of all modifications, changes, and alterations.
- b) Details of all work and inspections carried out on the sprinkler system.
- c) Details of any hazard analysis relevant to the sprinkler protection.
- d) A full and up to date list of emergency contacts, including Insurers, Insurance Brokers, the property owner or their agent, inspection authority, sprinkler servicing company, the sprinkler installer, the pump supplier or pump maintenance company, electrical contractor, central alarm station contact numbers, suction tank supplier, sprinkler monitoring equipment suppliers.
- e) Records detailing calls to and from the central alarm station, taking the station off watch, restoring the station back on watch and notification of alarms or faults. The details recorded shall include at least, the nature of the event, date and time of the call, the name of the caller and recipient, and the central alarm station reference.
- f) Details of staff training.
- g) The master records shall be kept in the sprinkler logbook or folder off site.

8008 Equipment and components

8009 Stock of replacement sprinkler heads

A stock of spare sprinklers shall be maintained on the premises so that any sprinklers that have been operated or have been damaged in any way may be promptly replaced.

Spare sprinklers shall be kept in purpose made cabinets located in a central prominent and easily accessible position where ambient temperature conditions will not exceed 38° C.

To prevent pilfering or misuse of spare sprinklers suitably sized pipe plugs can be kept within the spare's cabinet and the stock of replacement sprinklers may be kept within a remote secure area.

The correct sprinkler spanners as provided by the manufacturer must be kept within the spares box as well as any pipe wrench that may be required to remove any sprinkler of the types installed and replace these or plug off the outlet.

The number of spare sprinklers to be maintained on the premises will largely depend on the size of the protected premises and the Hazard class of the system.

Table 801 provides the minimum number of spare sprinklers and plugs to be maintained for standard temperature ratings used in the installation under consideration:

Systems which include sprinklers of higher temperature ratings as, for example, in boiler rooms or drying ovens an adequate number of spare sprinklers of the appropriate temperature rating shall be maintained.

Similarly, if the systems include differing or special types of sprinklers or if there are any multiple-jet-controls, an adequate number of these spares shall be maintained.

The sprinkler installer must be requested, immediately after an incident, to replenish the spares. Their advice must be sought regarding the possible necessity of replacing sprinklers on the perimeter of the area, which may not have operated, but which might have been affected by the fire.

For roof or ceiling protection, where there is more than one installation, the stock of replacement sprinklers and plugs shall be increased by 50%.

Table 801 Stock of replacement sprinklers

1	2					
Hazard (Roof or ceiling protection only)	Number of spares and plugs					
Ordinary Hazard Systems	24					
High Hazard Systems	36					
ESFR and Special	Assumed Maximum Number of Sprinklers in Operation					
	Intermediate level protection					
≤ 9 sprinklers in operation	12					
≤ 18 sprinklers in operation	24					
≤ 27 sprinklers in operation	36					

8010 Components and replacement parts

Components shall be maintained in accordance with the supplier's instructions, and where replacement parts may be required only proprietary parts provided by the original equipment supplier, shall be used.

8011 Planned shutdown procedures

8012 Preparation for shutdown

Servicing and repairs shall be planned to ensure that work is carried out at an appropriate time and with a minimum of down-time.

During routine inspection and/or testing, several defects may be revealed which require remedial attention.

Any repairs found necessary may require to be undertaken outside of normal working hours due to the possible requirements relating to occupational health and safety or a local authority requirement that systems may not be turned off during times of occupancy, for example, in an enclosed shopping mall.

Liaison with all interested parties is essential prior to the commencement of any tests or repair work.

Any servicing or repair work during weekends or public holidays shall, where possible, only be undertaken after it has been ascertained that all necessary resources are available to complete the task and re-commission the system.

It is important to plan where possible, for work to be carried out, thus ensuring that all procedures are carried out with the minimum of risk and disturbance.

8013 Planning for maintenance

Where maintenance of a sprinkler system or building fabric is anticipated that will result in impairment of the sprinkler protection, a written maintenance plan shall be prepared by the user and agreed with the authorities prior to commencement of the maintenance work. The procedures outlined in this section shall be included in the plan.

8014 Before maintenance begins

The following procedures must be adhered to:

- a) Notification of the authorities (including the insurers) and the central alarm station.
- b) Designation of named personnel to undertake specified tasks.
- c) Identification of resources required for the maintenance period.
- d) Consultation with key personnel.
- e) Inspection and review of passive and other active fire protection measures (including fire doors, gaseous extinguishing systems, and portable fire extinguishing appliances).
- f) Rectification of impaired passive and active fire protection measures.
- g) Reduction of stocking levels of hazardous goods (e.g., flammable liquids, aerosols with flammable contents).
- Notification to the fire engineering sprinkler contractor of the company procedures and regulations with which they are required to comply (e.g. work permits, hot work prohibitions).
- i) Considerations to minimizing the area of coverage isolated at any one time.
- j) The provision and review of a written method statement prepared by the fire engineering sprinkler contractor.
- k) Procedures ensuring all the necessary tools, equipment and trained personnel are available.
- I) Consultation with staff about the work plan, increasing awareness and precautionary measures.
- m) Procurement and placement of additional portable fire extinguishing appliances in the affected areas, ensuring that personnel are trained in their use.
- n) Issue of permits to commence work, whilst maintenance work is in progress.
- o) Suspension of operations, in particular any hazardous processes machinery and plant.
- p) Smoking prohibition.
- q) Implementation of regular fire patrols, during and after re-commissioning the system.
- r) Hydrostatic pressure testing of modified pipework or pipework extensions.
- s) Water supply performance tests if changes have been made to the water supply or the water supply connections.
- t) Notification to all key staff, authorities, and the central alarm station of the reinstatement of the sprinkler protection.
- u) Checks to establish that all valves, switches, and other equipment have been restored to their correct stand-by setting.
- v) Provision of a written statement or certificate by the sprinkler servicing contractor and counter signed by the system user signifying that the work has been completed and that the system is fully operational.
- w) Re-validation of the clearance certificate.
- x) Statements and certificates shall be filed in the sprinkler system logbook.

8015 Permission for installation or zone shutdown

Only the user shall give permission for a sprinkler installation or zone to be shut down for any reason other than an emergency.

Some of the authorities specified may ask to be informed whenever a sprinkler installation is shutdown.

8016 Pre-shutdown checks

Before a system is wholly or partly shutdown every part of the premises shall be checked to ensure that there is no indication of fire.

8017 Notification of shutdown

8018 Advising insurers and the fire authority

Except where there are contingency plans previously agreed with the insurers and fire authority, the fire safety official shall advise the insurers and all the relevant authorities in advance, of any intention to shut down all or part of an installation.

When all or part of a life safety sprinkler installation is not operational the fire authority may wish to restrict access to the premises until the sprinkler installation is fully operational.

8019 Informing other users

Where premises are subdivided into separate occupancies constituting buildings in communication or at risk protected by common sprinkler systems or installations, the fire safety official shall consult the various occupiers about the shutdown plans.

Particular attention is to be given to situations where installation pipework passes through walls or ceilings as these may feed sprinklers in areas needing special consideration, or notification of further personnel may be needed if the water is turned off.

8020 Unplanned shutdown procedure

When an installation is rendered inoperative as a matter of urgency or by accident, the precautions in as far as they are applicable shall be observed with the least possible delay.

8021 Notification of shutdown

8022 Advising insurers and the fire authority

The insurers, and for life safety systems the fire authority, shall be advised by the fire safety official immediately of any emergency shutdown, except where there are contingency plans previously agreed with the insurers and fire authority covering compensating actions.

The plans shall be put into effect immediately following the shutdown.

When all or part of a life safety sprinkler installation is not operational the fire authority may wish to restrict access to the premises until the sprinkler installation is fully operational.

8023 Informing other users

Where premises are subdivided into separate occupancies constituting buildings in communication or a risk protected by common sprinkler system or installations, the fire safety official shall advise the various occupiers that the water is to be turned off.

8024 Precautions and procedures when a system is not operational

8025 Minimizing the effects

Maintenance, alterations, and repair of systems not fully operational shall be carried out in a way that will minimize the time and extent of non-operation.

When an installation is rendered inoperative the user shall implement compensatory measures.

Alterations and repairs to an installation or its water supply (except possibly a life safety installation) shall be carried out during normal working hours.

Supervisory staff in the areas affected is to be notified so that the best possible use may be made of the hand extinguishing appliances in case of fire.

The area affected shall be patrolled continuously.

Any hot work shall be subject to a permit system.

Smoking and naked lights shall be prohibited in the vicinity.

When an installation remains inoperative outside working hours all fire doors and fire shutters shall be closed for the period concerned.

Arrangements shall be made to have fire extinguishing appliances in special readiness with sufficient trained personnel available to handle them.

8026 Reinstatement of serviceable parts of an installation

As much as possible of the installation shall be retained in an operative condition by blanking-off pipework feeding the inoperative part or parts where work is taking place.

Where possible, parts of installations shall be reinstated to provide some protection overnight by using blank spades within the pipework.

8027 Reducing the fire risk in manufacturing premises

In the case of manufacturing premises, where the alterations or repairs are extensive, or it is necessary to disconnect a pipe exceeding 40 mm nominal diameter, or to overhaul or remove a main stop valve, alarm valve or non-return valve, every effort shall be made to carry out the work whilst the machinery is stopped.

8028 Pump isolation

Any pump out of commission shall be isolated by means of the valves provided.

8029 Additional precautions for zoned systems

8030 Systems other than life safety sprinkler installations

Only the smallest part of the installation or zone in a multi-zone installation shall be isolated or shutdown at a time for maintenance. An installation or complete shutdown of a zone shall be avoided where necessary.

8031 Life safety sprinkler systems

Only one zone of a multi-zone installation shall be shut down at a time. An installation or zone shall be shut down for the minimum time necessary for maintenance.

8032 Installation control valves on life safety systems

Duplicate installation control valve sets and alarm valves with a bypass arrangement may have the alarm valves separately serviced at any time, provided the water supply to the installation is maintained.

The following procedure shall be used before servicing duplicate alarm valves:

- a) Check, and if necessary open, the stop valves to the standby alarm valve.
- b) Close one of the stop valves to the alarm valve to be serviced and immediately carry out an alarm test on the other alarm valve.

If water is not available open the stop valve immediately and rectify the fault before proceeding.

8033 Water availability

When a zone (or zones) is charged, or recharged with water after draining, the flushing valve(s) shall be used to check that water is available in the zone (or zones).

The jockey pump and main fire pumps shall not be used for commissioning, filling, or priming any part of the sprinkler system.

8034 Action following sprinkler operation

Following shutdown after operation of an installation, the operated sprinklers shall be replaced by the correct type and temperature rating by a sprinkler installer, and the water supply restored.

Unopened sprinklers around the area in which operation took place shall be checked for damage by heat or other cause and replaced as necessary.

Where incidents occur within a sprinkler protected property resulting in a release of water from a sprinkler installation, consideration should be given to the completion and return of an incident report form.

Development of sprinkler protection technology, in part, depends on having an insight into the performance of sprinklers in buildings.

The water to an installation or zone of an installation that has operated must not be shut off until any fire has been extinguished.

The decision to shut down an installation or zone which has operated because of a fire may only be taken by the fire authority.

Components removed from the system must be retained by the user for possible examination by an authority.

8035 Dry-pipe installations protecting cold storage warehouses (air circulation refrigeration)

The installation shall be dismantled for drying out after each operation.

8036 Maintenance and repairs

8037 Programmed work

The user shall ensure that a programme of inspections and checks is carried out, and arrange for testing, servicing, and maintenance in accordance with a documented schedule.

Regular inspections and tests to be carried out under the instructions of the fire safety official.

Inspections and tests shall be conducted at specified intervals. The tests shall be recorded on the weekly test card or on a dedicated test record sheet.

The central alarm station shall be notified of any system tests which will result in the transmission of an alarm.

The central alarm station shall be requested to verify that an alarm signal has been received. The central alarm station shall be informed immediately that the test procedures have been completed.

The inspection authority or insurer may provide test cards for record keeping purposes by the sprinkler system user.

8038 Programme of inspection and checking

The installer shall provide the user with an inspection and checking programme for the system. The programme shall include instruction on the action to be taken in respect of faults, operation of the system in particular the procedure for emergency manual starting of any pumps.

8039 Daily routine

The daily routine shall be carried out on each day that the premises are in normal use.

8040 Fire authority and remote central station alarm connection

If the circuits are not continuously monitored, the equipment for automatic transmission of alarm signals from a sprinkler installation to a fire authority or remote manned centre shall be checked for:

- a) Continuity of the connection.
- b) Continuity of the connection between the alarm switch and the control unit.

The testing procedure is to be agreed upon with the fire authority or remote central station centre to avoid false calls. The fire authority or remote central station may carry out the test and may be prepared to give an undertaking to do so.

8041 Weekly routine

Each part of the weekly routine shall be carried out at intervals of not more than seven days.

8042 Checks

The following shall be checked and recorded:

- a) Any signs of leakage from the system.
- b) All water and air pressure gauge readings on installations, trunk mains and pressure tanks.
- c) All water levels in elevated private reservoirs, water storage tanks (including pump priming water tanks) and pressure tanks.
- d) The correct position of all main stop valves.

8043 Pump suction tanks

The access ladder to all sprinkler water storage tanks shall be checked for correct housing and security and any tank in-fill flow control or ball valve covers shall be secured and locked.

Checks on the suction tanks shall include:

Ensure all valves are in their correct operative positions specifically:

- a) The incoming town main feed valves to the suction tank, and
- b) The main suction line isolating valves feeding the pumps.

Ensure the tank is full and the level indicators are working correctly.

8044 General check of pump house equipment

- a) Check all main control and isolating valves are in their correct operative positions.
- b) Check the electrical supply on the voltmeters.
- c) Check the isolators on the pump house distribution board.

8045 Automatic pump starting test

Tests on automatic pumps shall include instructions to:

- a) Reduce water pressure on the starting device, thus simulating the condition of automatic starting.
- b) When the pump starts record the starting (cut in) pressure, and check that this is correct.
- c) On diesel pumps, check the oil pressure where gauges are fitted, and the flow of cooling water through open circuit cooling systems.

The typical auto-start tier arrangement can be seen in Figure 801. Testing of each tier arrangement shall proceed as follows:

- a) Close test valve A.
- b) Slowly open test valve B until a pressure drop is noted.
- c) Monitor the pressure drop and note the pressure at which the pump being tested comes into operation.
- d) Close test valve B, and
- e) Open Test valve A.

Test each tier level on the auto-start arrangement making note of:

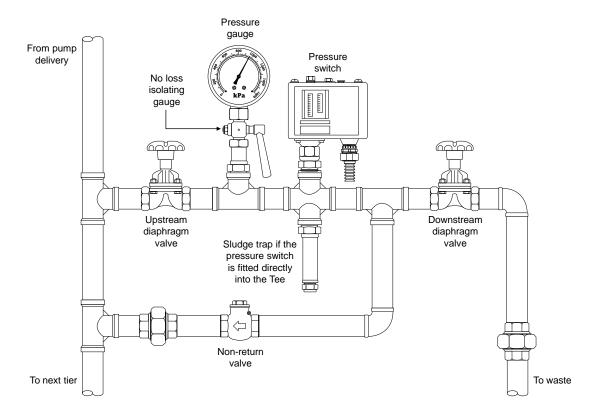
- a) The jockey pump cut in and cut out pressures, and
- b) The main fire pumps cut in pressures manually shutting down each unit before testing the next.

8046 Jockey pump restarting test

Immediately after the pump start test, jockey pumps shall be tested as follows:

- a) Run the jockey pump under supervision for a minimum of 30-seconds, or for the time recommended by the manufacturer, whichever is the longer.
- b) The jockey pump can be tested by using the selector switch on the panel and turning this from "Auto" to "Manual" and then back to "Auto" after the prescribed 30-second period.

Figure 801: Typical tier level of an auto-start arrangement



8047 Diesel engine driven pump restarting test

Immediately after the pump start test, diesel engine driven pumps shall be tested as follows:

- a) Check the fuel and engine lubricating oil levels in diesel engines.
- b) Check the battery build in hydrometer colour against the colour chart on the battery.
- c) Run the engine under supervision for a minimum of 30-minutes, or for the time recommended by the manufacturer, whichever is the longer.
- d) Check the water level in the primary circuit of closed-circuit cooling systems.
- e) Shutdown the engine and immediately use the manual start test button and check that the engine restarts.
- f) Ensure the diesel engine driven pump runs continuously for not less than 30-minutes.

Oil pressure (where gauges are fitted), engine temperatures and coolant flow must be monitored throughout the test.

Oil hoses must be checked, and a general check made for leakage of fuel, coolant, or exhaust fumes.

8048 Electric motor driven pump restarting test

Immediately after the pump start test, electric motor driven pumps shall be tested as follows:

- a) Run the motor under supervision for a minimum of 10-minutes, or for the time recommended by the manufacturer, whichever is the longer.
- b) Check the sight glass to ensure water is discharging from the cooling water line fitted to the pump.
- c) Shutdown and immediately use the manual start test button and check that the electric motor restarts.

8049 Water motor alarm test

Each water motor alarm shall be sounded within a 60-second period and then continuously for not less than 30-seconds, by opening a test valve and flowing water to waste through an open nozzle, 15- or 25-mm test pipe as appropriate.

Where fire pumps are installed, the water motor alarm test must be carried out only after testing the units is complete. It must be ensured that when testing the main fire pump comes into operation and that the water flow to the alarm bell is not maintained by the jockey pump.

This verifies that the alarm will not ring intermittently.

The test may also automatically test any fire authority or remote central station connection.

8050 Monitored systems including zoned and life safety systems

The mode (fully open or fully closed as the case may be) monitoring system for stop valves (including zone valves) on monitored systems, including zoned and life safety installations, shall be tested for satisfactory operation.

The weekly alarm test shall be carried out without alteration of the setting of stop valves to duplicate installation control valve sets.

8051 Trace heating and localised heating systems

Heating systems to prevent freezing in the sprinkler system shall be checked for correct function.

8052 Service maintenance and review schedule

8053 General procedures

In addition to the identified procedures, any valid procedures specified by component suppliers, or the inspection authority shall also be carried out.

8054 Records

Sprinkler servicing contractors shall carry-out the schedule requirements. The sprinkler inspecting authority shall provide advice on any rectification that needs to be carried out or is needed and advise on any external factors, for example, weather conditions, which may have affected the results.

8055 Half-yearly routine

The half-yearly routine shall be carried out and shall include the weekly and daily maintenance procedures.

The half-yearly checks and inspections shall be made at intervals of not more than 6-months by an independent third-party inspectorate.

Before sprinkler servicing contractors test any installation in any way that might release water, they may wish to obtain an indemnity, signed by the person owning the work site or premises at that time. This must also indemnify them from a claim from the tenants of the owner.

8056 Review of hazard

The effect of any changes of structure, occupancy, fire hazard, heating, lighting, or equipment of a building on hazard classification or installation design shall be considered.

Non-compliance's shall be notified to the sprinkler protection user and corrective action initiated immediately.

The sprinkler protection user shall notify any relevant party of the non-compliance.

Non-compliance may invalidate any certification that is in force.

Any assessment of a change in occupancy or fire hazard is to include changes to materials and products used or manufactured method of storage and storage heights.

8057 Sprinklers, multiple-jet-controls, and sprayers

Sprinklers, multiple-jet-controls, and sprayers shall be free from deposits, which may influence their performance.

Dusty components shall be carefully cleaned.

Distorted or contaminated, (e.g., paint, or verdigris), sprinklers, concealed sprinkler cover plates, multiple-jet-controls or sprayers shall be replaced.

Where corrosive conditions occur, petroleum jelly coatings shall be checked.

Where necessary the existing coatings shall be removed and the sprinklers, multiple-jet-controls or sprayers shall be coated twice with good-quality petroleum jelly, (in the case of glass bulb sprinklers to the sprinkler body and yoke only).

Particular attention shall be paid to sprinklers in spray booths, where more frequent cleaning, replacement of paper or cellophane bags and/or protective measures may be necessary.

8058 Pipework and hangers - above ground

8059 Corrosion protection

Pipework and hangers shall be checked for corrosion and painted as necessary.

Bitumen-based paint on pipework, including the threaded ends of galvanized pipework, and hangers in corrosive occupancies shall be renewed as necessary.

Bitumen-based paint may need renewal at intervals varying from 1- to 5-years according to the severity of the conditions.

Tape wrapping on pipes shall be repaired as necessary.

8060 Checks for electrical connections

The pipework shall he checked for electrical earthing connections.

Notify the sprinkler-protection user of any electrical equipment earthing connections on sprinkler pipework.

Alternative electrical earthing arrangements shall be made.

8061 Water supplies and their alarms

Each water supply shall be tested with each installation in the system.

The pump(s), if fitted, in the supply shall start automatically and the supply pressure at the appropriate flow rate shall be not less than the appropriate value given. Corrective action shall be taken it necessary.

Corrective action shall also be taken if the pressure is lower than the value recorded at commissioning or in terms of these rules.

8062 Electrical Supplies

Open nickel-cadmium batteries - where installed.

The electrolyte level and density of all open nickel-cadmium cells (including those in diesel engine starter batteries and those for control panel power supplies) shall be checked.

If the density is low the battery charger shall be checked and if necessary repaired or replaced. If the charger is working correctly, the battery or batteries affected shall be replaced.

8063 Diesel engine fail to start test – abortive start routine

The fail-to-start (pump failure) alarm shall operate after the sixth cycle of cranking, when the following sequence is carried out:

- a) The fuel supply is isolated.
- b) The engine is cranked for not less than 15-seconds.
- c) Cranking is stopped for not less than 6-seconds.

The above is repeated a further five times alternating batteries.

The engine shall start immediately when, after the abortive test is carried out and the fuel supply restored, the manual starting system is operated.

8064 Automatic pump flow test

Each water supply pump in the installation shall be tested at the full load condition by means of the test line connection coupled to the pump delivery branch downstream of the pump outlet non-return valve and shall give the system design requirements.

Allow for pressure losses in the supply pipe and valves between the source and the "C' gauge of each installation and calculate these in accordance with the requirements.

8065 Float valves or automatic flow control valves

Float valves or automatic flow control valves on water storage tanks shall be checked for correct function.

8066 Secondary electrical supplies from diesel generators

The system shall be checked for satisfactory operation.

The sprinkler protection user shall be notified of any faults.

If faults are found for which the sprinkler protection user is responsible for corrective action must be taken.

8067 Stop valves

All stop valves shall be exercised at every periodical inspection to ensure that they are working freely and secured or re-fastened in the correct operative position.

This includes the stop valves on all water supplies, at the alarm valve(s) and all zone or other subsidiary stop valves.

8068 Flow switches

Flow switches shall be operated and if necessary corrected.

8069 Replacement parts

Replacement parts held as spares shall be checked for number and condition and supplemented as required.

8070 Dry alarm valves

Dry alarm valves, accelerators, and exhausters, in dry pipe installations and tail-end extensions shall be exercised.

To exercise the dry alarm valve, either remove the inspection cover plate, if fitted, and manually operate the moving parts or comply with the supplier's instructions. Alternatively, if a subsidiary stop valve is fitted downstream of the alarm valve, close the subsidiary stop valve, prime the space between the dry pipe valve clack and the underside of the subsidiary valve with water, and open the installation drain valve.

Alternate systems need not be tested in this way since they are exercised twice a year because of the change-over from wet to dry operation, and back.

8071 Fire authority and remote central station alarm

The electrical installation shall be checked for satisfactory operation. The sprinkler protection user shall be notified of any faults.

If faults are found, the sprinkler protection user is responsible for, and must take corrective action.

8072 Yearly routine

The yearly routine shall be carried out, and shall include the half-yearly, weekly, and daily maintenance procedures.

The checks and inspections shall be made at intervals of not more than 12-months.

8073 Deluge, recycling, and alternate wet and dry valves

All deluge, recycling and alternate wet and dry valves, alarm and non-return valves shall be examined, tested, and overhauled or replaced if necessary.

8074 Diesel engine and electric motor driver and pump service

The diesel engine and pump must be serviced on an annual basis by a suitably qualified person who is experienced in the requirements relating to sprinkler installation pumped water supplies.

The electric motor and pump must be serviced on an annual basis by a suitably qualified person who is experienced in the requirements relating to sprinkler installation pumped water supplies.

An identifying name and date tag stating when last overhauled must be affixed to the engine.

The data logger shall have its date and time checked and adjusted if necessary.

8075 3-yearly routine

The 3-yearly routine shall be carried out, and shall include the yearly, half-yearly, weekly, and daily maintenance procedures.

All checks and inspections previously noted shall be made at intervals of not more than 3-years.

All batteries within a pump house must be replaced inclusive of the real-time clock data logger battery.

8076 Suction and gravity tanks

Suction tanks shall be:

- a) Examined externally and internally for corrosion, and
- b) Drained if required for cleaning and/or repainting and/or have the corrosion protection refurbished as necessary with an approved specification to prevent the fabric of the tank being attended to for at least a 3-year period.
- c) An identifying name and date tag stating when last inspected/refurbished must be affixed to the valves.

8077 Water supply stop valves, alarm and non-return valves

All water supply stop valves, alarm and non-return valves shall be examined, tested, and overhauled or replaced if necessary.

An identifying name and date tag stating when last overhauled must be affixed to the valves.

8078 Gauges

Pressure gauges shall be tested with a calibrated gauge and shall be replaced or recalibrated if required.

8079 10-yearly routine

8080 Dry barrel sprinklers

Dry barrel sprinklers shall either be replaced at 10-year intervals, or a representative sample shall be tested every 10-years and then at 10-year intervals thereafter.

8081 15-yearly routine

At not more than 15-year intervals, galvanised sectional steel tanks used as pump suction tanks shall be:

- a) Examined externally and internally for corrosion, and
- b) Drained if required for cleaning and/or repainting and/or have the corrosion protection refurbished as necessary.

8082 25-yearly routine

8083 Sprinklers

At not more than 25-year intervals a random selection of ten sprinklers shall be removed from each sprinkler installation and tested for correct operation, operation temperature, variation of K-Factor, spray obstacles and possible lodgement problems.

A smaller population sample, subject to a minimum of two sprinklers per valve set and not less than 10 in total, whichever is the greater, can be taken if there are multiple valves feeding systems with the same year of installation within the same environment.

Should a single control valve feed multiple areas of different occupancy classifications then a minimum of two sprinklers per each different occupancy classification, but not less than 10 in total number of samples, whichever is the greater, must be submitted.

Failure of the sprinklers to operate within the allowable temperature band or any other test that suggests the sprinklers are suspect and may not operate as designed under a fire condition means that replacement of all sprinklers of that installation or, within the area they were removed from, must take place.

Should the sprinklers pass the required testing they shall be retested at 10-year intervals.

8084 Corrosive atmospheres

Where sprinklers are installed in harsh environmental or corrosive atmospheres or water supplies, they shall either be replaced at 5-year intervals, or a representative sample shall be tested every 5-years and then at 5-year intervals thereafter.

8085 Pipework

Ultrasonic wall thickness measurements are not an acceptable means of determining the condition of the pipework.

All installations of 25-years of age or older or where there are obvious signs of corrosion must have sections of pipe removed for inspection and any defect that might adversely affect the performance of the system must be eliminated.

Should pipes from a control valve be present within cold rooms, fridges, delivery bays, especially near coastal regions, which may experience acceleration in the rate of development of corrosion, at least one pipe sample must be submitted from these area/s to be inspected and tested.

For buildings that contain multiple control valves of the same year of installation and same environment: At least one-third of the total number of control valves must be evaluated and can be used as representation for the remaining untested control valves.

The pipes must be clearly marked to identify from which control valve the pipes were removed from.

A representative population of pipework of the following diameters shall be removed from each installation in the area closest to and farthest from the control valve assembly and from the area which is centrally located.

- a) The removal of a section of small diameter pipe between 25 mm to 50 mm.
- b) The removal of a medium diameter pipe between 65 mm and 80 mm.
- c) The removal of a large diameter pipe between 100 mm to 200 mm.

Each pipe sample shall be at least 1,0 metre in length or a full section of pipe between fittings with at least one untouched fitting attached to either end.

If external or internal corrosion is noted, the pipes are to be examined by a corrosion expert or metallurgical engineer for opinion and any recommendations are to be adhered to.

Once approved for use, the pipework shall be thoroughly flushed out and hydrostatically tested to a pressure equal to the maximum static pressure or 1,800 kPa, whichever is the higher.

8086 Corrosion

Anaerobic bacteria is common and relatively easily identified.

Every opportunity shall be taken when examining suction tanks or sprinkler pipework to determine if this is present.

Under normal circumstances and with correct testing procedures being carried out, anaerobic bacteria would not usually be present.