



AUTOMATIC SPRINKLER SYSTEM – STORAGE PROTECTION

Sprinklers have a proven record in controlling fires in storage areas and yet reports are often received of sprinkler systems being overwhelmed by a fire because either:

- i) stack heights have been exceeded,
- ii) the configuration of stacks and racks has been altered, resulting in water not being able to penetrate to lower storage levels
- iii) the category of stored goods has been changed without updating the sprinkler system accordingly.

More often than not, these alterations are carried out without companies realising that the efficacy of the sprinkler system could be affected.

The following general guidelines are published to promote a better understanding and interpretation of SABS 0287.



Block stacking

The first thing to understand in respect of storage risks is the various methods of storing.

- a) *Block stacking*
This is where goods are on pallets but the pallets are put one on top of the other
- b) *Free standing storage*
As the title suggests, no pallets are employed and goods are stacked one on top of the other.
- c) *Post pallets*

These are custom made containers similar to large baskets where the support posts of the pallets fit into the top of the support posts of the pallet below. The pallets may or may not have solid bottoms.

d) *Rack storage or beam pallet racking*

Goods are stored on pallets in a metal framework comprising vertical steel columns and horizontal steel beams.

Ordinary hazard sprinkler systems

Depending on the category of goods and the type of storage, there is a definite limitation in respect of the capability of an Ordinary Hazard system (OH) to provide adequate protection. (See **Table I**).

Table I		
<i>Maximum storage heights – Ordinary hazard system</i>		
Category of stored goods	Block stacking of free standing	Post pallets or pallets on beams
1	4,0 m	3,5 m
2	3,0 m	2,0 m
3	2,1 m	1,7 m
4	1,2 m	1,2 m

These are very limiting heights and will very rarely be suitable. However, if these heights are to be exceeded, then a High Hazard sprinkler system (HH) will be required.

The density of water application is relevant to the height of storage and two tables of densities are used where only roof protection is installed. (See **Tables II and III**).

It should be noted that each of these tables give maximum heights which are considered to be those where roof protection only can be installed. Should these heights be exceeded, then in the case of Rack or Post Pallets, "In Rack" sprinkler protection is mandatory. If the storage is Block Stacking or Free Standing, the maximum heights should not be exceeded as it is impossible to position sprinklers within the storage.



Free standing storage

Table II						
<i>Discharge design densities – free standing storage</i>						
The following table lists the design density of discharge and assumed area of operation for high piled storage risks comprising free standing storage where roof or ceiling protection only is provided						
Stack height not exceeding (m) Category*				Design density of discharge required (minimum) (mm/min)	Assumed maximum area of operation (m²)	
1	2	3	4			
5,3	4,1	2,9	1,6	7,5	250	
6,5	5,0	3,5	2,0	10,0		
7,6	5,9	4,1	2,3	12,5		
	6,7	4,7	2,7	15,0		
	7,5	5,2	3,0	17,5		
		5,7	3,3	20,0	300	
		6,3	3,6	22,5		
		6,7	3,8	25,0		
		7,2	4,1	27,5		
			4,4	30,0		

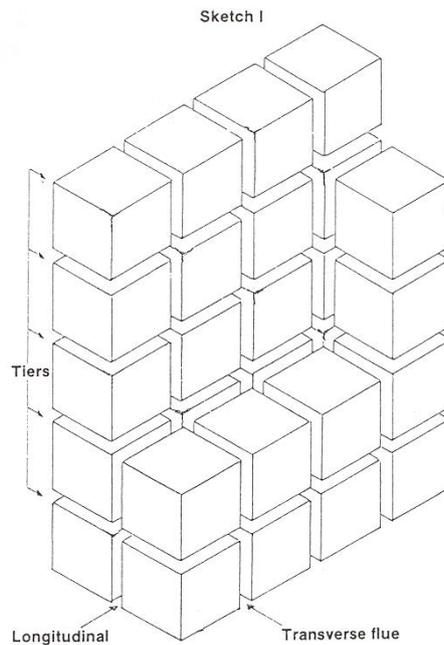
Table III						
<i>Discharge design densities – rack storage</i>						
The following table lists the design density of discharge and assumed area of operation for high piled storage risks comprising storage in single or double row post pallets or palletised rack storage (beam pallet racking) where roof or ceiling protection only is provided						
Stack height not exceeding (m) Category*				Design density of discharge required (minimum) (mm/min)	Assumed maximum area of operation (m²)	
1	2	3	4			
4,7	3,4	2,2	1,6	7,5	260	
5,7	4,2	2,6	2,0	10,0		
6,8	5,0	3,2	2,3	12,5		
	5,6	3,7	2,7	15,0		
	6,0	4,1	3,0	17,5		
		4,4	3,3	20,0	300	
		5,3	3,8	25,0		
		6,0	4,4	30,0		
		7,2	4, 1	27,5		
			4,4	0,0		

Solid shelves or post pallets with solid bottoms

If solid shelves or post pallets with solid bottoms are to exceed 1,0 m in width then intermediate rack storage protection is mandatory.

If solid shelves or pallet bottoms are less than 1,0 m wide, then roof protection only may be installed with the following provisos.

1. Where racks are back to back, a clear longitudinal flue of 350 mm must be maintained and nothing may intrude into this space. Goods should also be stored so that there is a 150 mm clear transverse flue between pallets (See **Sketch 1**)



Sketch 1



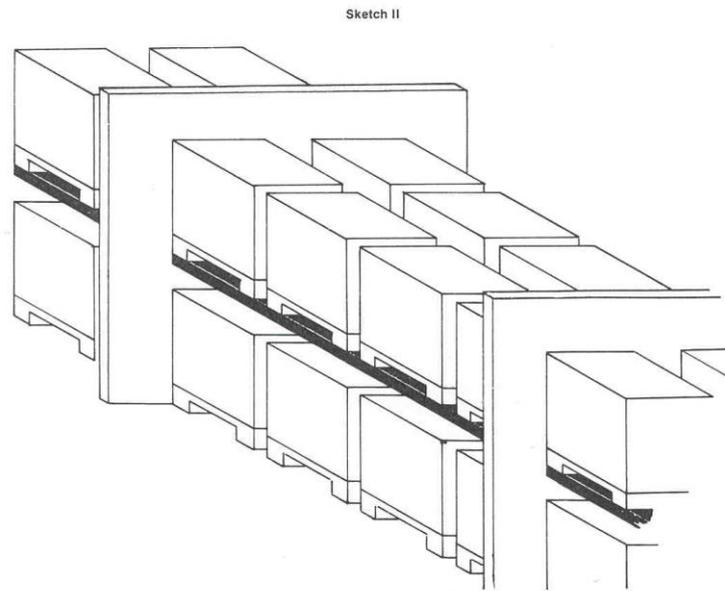
Post Pallets

Areas of free standing or block storage

As only roof protection can be provided the ideal is that no block of storage should exceed 150 m² in area. Surrounding aisles should be at least 2,5 m wide. It is particularly important to avoid storing too close to walls as this will make fire-fighting difficult if not impossible should fire extend to the rear of any stack.

Bulkheads

Bulkheads are physical barriers of non-combustible material used to sub-divide continuous racking configurations where there is little or no separation of stored goods. They extend vertically to the level of the highest storage and extend laterally as far as the storage limits. They are recommended to reduce the rate of fire spread through long lines of racks. (See **Sketch 2**)



Bulkheads sub-dividing long lines of racking

Sketch 2

Temperature ratings of sprinkler heads

In all cases whether there is roof protection or a combination of roof and rack protection in the High Hazard category, the use of high temperature sprinklers which operate at temperatures of 141°C and in the case of bulb type heads are coloured blue, must be used at roof level. The object is to restrict the number of sprinklers in operation to within the design capacity of the system as in all storage risks the heat rise from a fire is excessive.

Where there is roof and rack protection, the sprinkler heads within the racks should be rated at 79°C.

Standing pressure or pump churning pressure

At least 800 kPa should be provided at the valves to ensure an initial surge of sprinkler discharge.

Height of protection

Whilst the average user may nominate a maximum height to which he intends storing it is advisable to protect to at least tie bar level.

Aisle width

The width of the aisle dictates how many operating sprinkler heads must be provided for in rack storage systems, **eg:**

Provision must be made for three sprinkler heads operating at every tier level in racks storing categories 1 to 3 goods. The proviso is that the aisle width is 2,4 m or wider. If the aisle is less than 2,4 m wide but over 1,2 m wide, then two racks must be catered for. If the aisle width is less than 1,2 m wide, then three racks must be assumed to be in operation.

This changes for Category 4 goods where instead of three sprinklers in each row being assumed to operate, only two per row need be catered for, but the aisle width must be taken into consideration in the same way to determine how many racks are assumed to be involved.

Water supply

Water supplies are currently related to water density discharge and to roof protection only.

If for example a design density of 7,5 mm/min at roof level is available and 18 sprinklers in the racks at 5,0 mm/min must be catered for the pump and reservoir capacities must be increased to achieve this.

The following paragraph extracted from the 10th Edition rules is relative:

“The water supply characteristic must be adequate to supply the simultaneous flow to the ceiling sprinklers and the intermediate level sprinklers in both the most remote 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 favourable area for 90 minutes. This will necessitate a full hydraulic calculation of both roof and intermediate level systems in both the hydraulically most remote and favourable areas of operation.”



***Categories of storage**

Category 1	Category 2	Category 3	Category 4
Aerated water manf. Bakers & biscuit Mnf. Bleach dye & printing works Boot & shoe factories Chemists, mnf. & wholesale Department stores Glass factories & warehouses Leather warehouses Tobacco manufacturing Woollen warehouses	Accumulator manufacturing Bonded stores (Spirits) Christmas crackers Cotton warehouses Electric cable works Flax & linen warehouses Kite warehouses Wooden furniture & Upholstery Sugar factories & refineries Waste paper Woodworkers	Carbon paper Paper (vertical storage) Paper surfaces & waxes Radios & TVs in foam plastic Tyre factory & warehouses Firework manufacturing	All plastics or foam rubber have special classifications

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