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# CONCEPT OF SPRINKLERS SYSTEM EXTENSION

# TECHNICAL DESCRIPTION

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# 1. GENERAL INFORMATION.

## 1.1 Legal basis of the concept study.

The concept study for Rossmann SDP Sp. Z o.o. made by Minimax Polska Sp.z o.o.

## 1.2 Subject of the concept study.

The subject of the concept study is the design of sprinkler system extension for new high bay warehouse (HRL) and automatic warehouse for small items materials (AKL).

## 1.3 Technical basis of the concept study

- Architectural layouts
- Investor guidelines
- VdS CEA 4001pl : 2024-01 (08)
- The Minister of the Internal Affairs and Administration order from 7th of June 2010 concerning the fire safety of buildings, other construction places and areas
- · The Minister of the Internal Affairs and Administration order from 24th of July 2009 concerning water supply and evacuation routes

Execution design has to be prepared by Contractor based on the newest VdS CEA 4001pl : 2024-01 (08).

# 2. DESIGN ASSUMPTIONS

Assumptions for height of the building and function of the buildings:

Sprinkler system subcentral – manifold room no.2 – **SECTION 6**

- Technical room with manifold and alarm control valves
- Connected with subcentral No.1 manifold by 2x DN250 transit pipes

High bay warehouse (HRL) HBWP1:

Main warehouse area – **SECTION 7 ceiling, SECTION 7.1 to 7.6 in racks**

- In rack storage in warehouse around 110m long, around 39m width and around 44 m height
- Storage of classified to HHS4, K1 (aerosols/sprays) and K7 (plastics)
- Storages ST4 according to VdS – pallet storage in rack
- Levels of storage – 20
- Max storage height on top level – 1,5m
- Max distance between sprinkler levels for K1 – 1,8m, for K7 – 2,0m
- Max distance from top of storage at highest level to celling sprinklers – 4m
- In rack sprinkler system at every level according to VdS 11.5
- Ceiling sprinkler system

Lower part – **SECTION 7A & 7B**

- Building heigh +14,85m, middle level at height +6,50m
- Technology area with tranporters
- Ceiling sprinkler protection at both levels

Gallery to existing part GTP1 – **SECTION 7C**

- Gallery with transporters between existing building HMP1 and new HBWP1
- Ceiling sprinkler system
- Transit pipes 2x DN250 route

Repacking area RAP1:

- Building heigh +14,44m,

Ground level +0,0m – **SECTION 8**

- Height 6,1m,
- Storage ST1 according to VdS
- Ceiling sprinkler system

Upper level +6,5m – **SECTION 8B**

- Height 7,3m,
- Storage ST1 according to VdS
- Ceiling sprinkler system

Entrance area warehouse HMP3 – **SECTION 8A**

- Building heigh +10,44m,
- One story building
- Storage ST1 according to VdS
- Ceiling sprinkler system

Automatic small items materials warehouse (AKL) – AMDP3:

**– SECTION 9 – ceiling sprinkler system**

**– SECTION 9.1 & 9.3 – in-rack sprinkler system**

**– SECTION 9.2 – platforms/mezzanines sprinkler system**

- In rack storage in warehouse around 78m long, around 57m width and around 21,6 m height
- Storage of classified to HHS4, K1 (aerosols/sprays) VdS 11.6
- Levels of storage – to be determined depending on sprinkler system parameters and rack construction.
- Max storage height on top level – 1,5m
- Max distance between sprinkler levels for K1 – 1,8m,
- Max distance from top of storage at highest level to celling sprinklers – 4m
- In rack sprinkler system at every level
- Sprinkler system under platforms
- Ceiling sprinkler system

Technical rooms, boiler house, social area, communication next to AMDP3 – **SECTION 9A**

- Ceiling sprinkler system

Gallery to existing part GKP1 – **SECTION 9B**

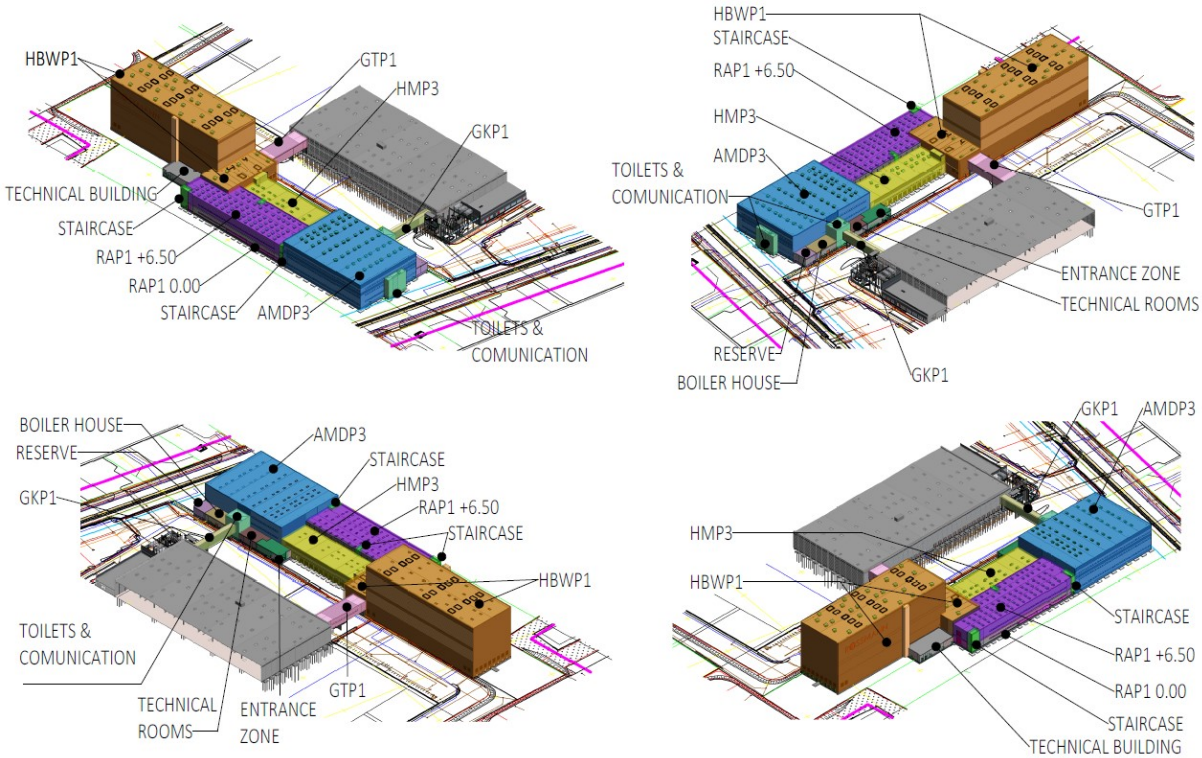
- Gallery with path walk between HMP1 and new AMDP3
- Ceiling sprinkler system

Sprinkler system subcentral – manifold room no.3 – SECTION 10

- Technical room with manifold and alarm control valves

1A; 1B; 1C etc. – subsections (ZONE CHECK)

1; 1.1; 1.2 etc – main sections, alarm control valves (ZKA)




Ilustration of plant extension with names of buidldings/areas

# 3. SPRINKLER INSTALLATION PARAMETERS

Sprinkler system parameters for each section presented in tables below.

## 3.1 SUBCENTRALS (ALV ROOMS)

| | |
|---|---|
| **Sprinkler system** | |
| Area | ALV's rooms |
| Hazard classification | OH3 |
| **Ceiling – SECTION 6 and 10** | |
| Minimal density | 5 mm/min/m$^2$ |
| Calculated operating area | 216 m$^2$ |
| Minimal operating time | 40 min |
| Type of system | wet |
| Sprinkler | K80, RTI>80, pendent or upright, 68°C |
| Notes | ALV's located in separate room divided by firewalls from other areas.<br>Include internal hydrants in calculations according to local regulations. |

## 3.2 HBWP1 (HRL)

| | |
|---|---|
| **Sprinkler system** | |
| Area | HBWP1 |
| Hazard classification | HHS4, K1 & K7 |
| **Ceiling – SECTION 7** | |
| Minimal density | 25 mm/min/m$^2$ |
| Calculated operating area | 300 m$^2$ |
| Minimal operating time | 90 min |
| Type of system | wet |
| Sprinkler | K115/K160/K200, RTI<50, upright or pendent, 68°C, in skylights 93°C |
| **In-rack – SECTIONS 7.1 – 7.6** | |
| Reference | VdS point 11.5 |
| Minimal density | 115 l/min/sprinkler |
| Calculated operating area | 3 racks x 3 sprinklers x 3 levels |
| Minimal operating time | 90 min |
| Type of system | Wet |
| Sprinkler | K115, RTI<50, flat pendent, 68°C |
| Notes | Ceiling and in-rack together.<br>Include internal hydrants in calculations according to local regulations. |

| | |
|---|---|
| **Sprinkler system** | |
| Area | HBWP1 lower part 2 storey |

| | |
|---|---|
| Hazard classification | HHS4, K1 & K7 |
| **Ceiling – SECTION 7A, 7B** | |
| Minimal density | 25 mm/min/m$^2$ |
| Calculated operating area | 300 m$^2$ |
| Minimal operating time | 90 min |
| Type of system | wet |
| Sprinkler | K115/K160/K200, RTI<50, upright or pendent, 68°C, in skylights 93°C |
| Notes | Include internal hydrants in calculations according to local regulations.<br>Aerozol storage:<br>- Use mesh containers,<br>- Divide rack storage area to 260m2 zones using mesh net/partitions.<br>**Max storage height ST1 according to K1 – 1,5m** |

## 3.3 GTP1

| | |
|---|---|
| **Sprinkler system** | |
| Area | GTP1 |
| Hazard classification | HHS4, K1 & K7 |
| **Ceiling – SECTION 7** | |
| Minimal density | 25 mm/min/m$^2$ |
| Calculated operating area | 300 m$^2$ |
| Minimal operating time | 90 min |
| Type of system | Wet |
| Sprinkler | K115/K160, RTI<50, upright or pendent, 68°C, in skylights 93°C |
| Notes | Include internal hydrants in calculations according to local regulations. |

## 3.4 HMP3

| | |
|---|---|
| **Sprinkler system** | |
| Area | HMP3 |
| Hazard classification | HHS4 |
| **Ceiling – SECTION 7** | |
| Minimal density | 33,5 mm/min/m$^2$ (30+2,5+1x1) |
| Calculated operating area | 300 m$^2$ |
| Minimal operating time | 90 min |
| Type of system | Wet |
| Sprinkler | K115/K160/K200, RTI<50, upright or pendent, 68°C, in skylights 93°C |
| Notes | Include internal hydrants in calculations |

| | |
|---|---|
| | according to local regulations.<br>**Max storage height ST1 according for HHS4 – 4,4m**<br>**Max storage for KLT according to K.7.3.3 for room height max 10,5m is up to 4,6m**<br><br>**Plastics (like KLT containers) storage area should be limited up to 150m2. Between these areas 2,4m wide lines free of storage must be maintained.**<br>**Alternatively there is a possibility to create 25m2 storage areas divided by 1,2m wide lines free of storage.**<br>**It is recommended to use closed containers at the highest level.**<br><br>**the concept of protection and the detailed design should always be agreed with the competent authority and the insurer at the planning stage.**<br><br>**Certified foam concentrates should be added to the extinguishing water.** |

## 3.5 RAP1 +6,50m and +0,00m

| | |
|---|---|
| **Sprinkler system** | |
| Area | RAP1 |
| Hazard classification | HHS4, K1 & K7 |
| **Ceiling – SECTION 7** | |
| Minimal density | 25 mm/min/m$^2$ |
| Calculated operating area | 300 m$^2$ |
| Minimal operating time | 90 min |
| Type of system | Wet |
| Sprinkler | K115/K160, RTI<50, upright or pendent, 68°C, in skylights 93°C |
| Notes | Include internal hydrants in calculations according to local regulations.<br>**Max storage height ST1 according to K1 – 1,5m** |

## 3.6 GKP1 and Technical rooms, boiler house, social area, communication next to AMDP3

| |
|---|
| **Sprinkler system** |

| | |
|---|---|
| Area | GKP1 and Technical rooms, boiler house, social area, communication next to AMDP3 |
| Hazard classification | OH2/OH3 |
| **Ceiling – SECTION 9A and 9B** | |
| Minimal density | 5 mm/min/m$^2$ |
| Calculated operating area | 144/216 m$^2$ |
| Minimal operating time | 90 min |
| Type of system | Wet |
| | |
| Notes | Include internal hydrants in calculations according to local regulations.<br>For rooms with suspended ceiling include sprinkler protection of concealed space. |

## 3.7 AMDP3 (AKL)

| | |
|---|---|
| **Sprinkler system** | |
| Area | AMDP3 |
| Hazard classification | HHS4, K1 |
| **Ceiling – SECTION 9** | |
| Minimal density | 25 mm/min/m$^2$ |
| Calculated operating area | 300 m$^2$ |
| Minimal operating time | 90 min |
| Type of system | Wet |
| Sprinkler | K115/K160/K200, RTI<50, upright or pendent, 68°C, in skylights 93°C |
| **In-rack – SECTIONS 9.1 – 9.3** | |
| Reference | VdS point 11.6 and 11.6.5.2 (AKL) |
| Minimal density | 10 mm/min/m2 |
| Calculated operating area | 45m2 on each level + 45m2 under platform next to calculated rack<br>(if ‘face sprinklers’ are present include in calculation on a 14m long line sprinklers on pipe in longitudinal flue space and one pipe with ‘face sprinkler’ + pipe with sprinkler under platform. Include in calculation ever level. |
| Minimal operating time | 90 min |
| Type of system | Wet |
| Sprinkler | K115/K160/K200, RTI<50, upright or pendent, 68°C, in skylights 93°C |
| Notes | Ceiling and in-rack together.<br>Include internal hydrants in calculations according to local regulations.<br>Aerozol storage: |

| | |
|---|---|
| | - Use mesh containers,<br>Divide rack storage area to 260m2 zones using mesh net/partitions. |

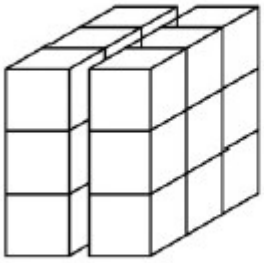
In all sections area of coverage per sprinkler must be according to VdS.

**ATTENTION!**
From 20,000 sprinklers, additional requirements must be implemented in consultation with the competent authority.

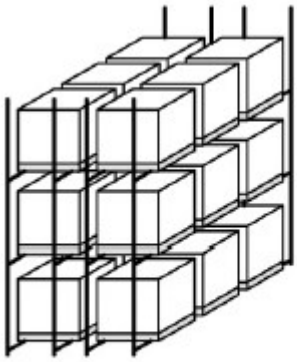
**STOREAGE REQUIREMENTS**
Storage is considered to be when compact storage takes place on an area of more than 2 m² and/or a height of more than 1.2 m.

Storage must be arranged according to VdS requirements point 5.3.2

ST1 – free standing or compact storage
ST4 – storage in racks on pallets



składowanie wolnostojące (ST 1)



składowanie w regałach na paletach (ST 4)

Additional requirements. Storage ST1 should be divided into partial areas of max 150m2 divided by 2,4m wide free lanes with no storage.

Max storage height ST1 according for HHS4 – 4,4m

**Plastics storage -** Ceiling only protection for buildings up to 10,5m:
Max storage ST1 for KLT according to K.7.3.3 for room height max 10,5m is up to 4,6m. K160 sprinklers RTI<50 required.
Plastics (like KLT containers) storage area should be limited up to 150m2. Between these areas 2,4m wide lines free of storage must be maintained.
Alternatively there is a possibility to create 25m2 storage areas divided by 1,2m wide lines free of storage.
It is recommended to use closed containers at the highest level.
The concept of protection and the detailed design should always be agreed with the competent authority and the insurer at the planning stage.

Certified foam concentrates should be added to the extinguishing water.

# 4. INTERNAL AND EXTERNAL HYDRANTS PARAMETERS

External hydrants
Water amount: 1800 l/min
Duration: 240 min

Internal hydrants
Water amount: 4x150 l/min = 600 l/min (4 most remote hydrants)
Duration: 60 min

# 5. HYDRAULIC CALCULATION SUMMARY

Hydraulic calculations made for concept purpose and check of water source possibilities in order to give proper guidelines to rack manufacturer and supplier in line with VdS requirements.
Complete hydraulic calculations according to VdS must be carried out with detailed design stage of sprinkler system (technical design/execution design).

# 6. CALCULATION OF WATER TANK CAPACITY

Existing water supply consist of three water tanks, 1370m3 each. It is 3x 50% for sprinkler system according to VdS. Two of three tanks supply also external hydrant system through a separate pump and suction pipes. So total amount of water available for sprinkler system and hydrants combined is 2x1370m3 that is 2740m3.

Sprinkler installation

- Max flow: 14.850,00 l/min (for ceiling and in-rack combined)
- Max flow 14.850,00 l/min (for ceiling, in-rack and internal hydrants combined)
- Working time: 90 min
- Water tank size required: 1336,50 m3 (100%)

Hydrant installation

- Flow for external hydrants: 1800 l/min (240min)
- Flow for internal hydrants: 600 l/min (60min)
- Water for external hydrants: 432 m3
- Water for internal hydrants: 36 m3

Sum for sprinkler and hydrant for tank one and two

- Max. flow: 17.250,00 l/min (Only for sprinklers and internal hydrants. External hydrants supplied by separate pump)
- Water tank size: 1.804,50 m3 (100%) – 902,25 m3 (50%)

Sum for sprinklers and hydrant for tank three

Amount of water in each tank:

- 1370 m3 (50%)
- Total amount of water available: 2740 m3 (100%)

# 7. PUMP HOUSE

The sprinkler pumping station is equipped with a system of three CPKN-SX 125-315 diesel pumps operating in a 3 x 50% system with the following parameters:
Q = 7950 l/min, H = 8,3 bar
$Q_{100\%}$ = 15.900 l/min

The pumping station technology is also equipped with an ETANORM 80-65-200 G11 electric pump with an ATS system with a dual power supply to power the underground peripheral network of external hydrants. The above-mentioned pump has the following parameters:
Q = 108m3/h, H = 5.6 bar.

From 20,000 sprinklers, additional requirements must be implemented in consultation with the competent authority. Total amount of sprinklers can be calculated from total area protected by sprinklers where one sprinkler protects 9m2 in HH hazard classification.

# 8. ALV STATIONS

Control alarm valve stations will be placed in separate rooms with outside entrance and located on external wall. Two rooms will be provided. One next to HBWP1 and second near AMDP3. All ALV in each valve room (subcentral no.2 and no.3) will be supplied from existing pump house through existing underground network, subcentral no.1 and transit pipes 2x DN250 going through HMP1 and gallery GTP1.
All ALV's must be provide with gate/butterfly valve below and service valve above. Also there should be bypass connection with valve between each pair of ALV's.
All materials must be VdS certified according to VdS

# 9. MATERIALS

All of the materials will have all the certificates and approvals required by law regulations and the main components like pump, sprinklers, hangers and supports, fittings etc. will have CNBOP/CE certificate and have to be VdS approved.
Pipelines and all elements of fittings are adapted for working on nominal pressures P = 1,6 MPa
(unless on the drawings marked others).

# 10. PIPING

For wet sprinkler installations there will be installed black steel pipes. Risers, cross pipes and branch lines at diameters ≤ DN 50 will be made from black steel pipes with seem, connected with each other by threads or grooved. The pipes at diameters ≥ DN 65 will be made from black steel pipes with seem, connected with each other by grooved connections, welded or flange-connected.

The pipe wall thickness should correspond to the VdS requirements.

| Średnica nominalna | Minimalna grubość ścianki w mm | | | |
|---|---|---|---|---|
| | Rowek walcowany, spawany | | Gwint lub wycięty rowek | |
| | DIN EN 10216 Część 1 i 2 DIN EN 10217 Część 1 i 2 | DIN EN 10255 | DIN EN 10216 Część 1 i 2 DIN EN 10217 Część 1 i 2 | DIN EN 10255 |
| DN 20 | 2,6 | - | 3,2 | - |
| DN 25 | 2,6 | 2,6 | 3,2 | 3,2 |
| DN 32 | 2,6 | 2,6 | 3,2 | 3,2 |
| DN 40 | 2,6 | 2,9 | 3,2 | 3,2 |
| DN 50 | 2,6 | 2,9 | 3,6 | 3,6 |
| DN 65 | 2,6 | 3,2 | 3,6 | 3,6 |
| DN 80 | 2,9 | 3,2 | 4 | 4 |
| DN 100 | 3,2 | 3,6 | 4,5 | 4,5 |
| DN 125 | 3,6 | 4,5 | 5 | 5 |
| DN 150 | 4 | 4,5 | 5 | 5 |
| DN 200 | 4,5 | - | 6,3 | - |
| DN 250 | 5 | - | 6,3 | - |
| DN 300 | 5,6 | - | 7,1 | - |
| DN 350 | 5,6 | - | 8 | - |
| DN 400 | 6,3 | - | 8,8 | - |
| DN 450 | 6,3 | - | 10 | - |
| DN 500 | 6,3 | - | 11 | - |

**Tabela 15.01:** Minimalne grubości ścianek w przypadku gwintowanych przewodów rurowych stalowych

# 11. SPRINKLER AND SUPPORT SPACINGS, TEST POINTS

**Sprinklers and spacing**

Sprinklers must be VdS certified and approved for used in construction according to Polish Law.

Sprinkler spacing must be according to VdS requirements.

**Support and hangers**

Supports for sprinkler system piping must be according to VdS guidelines and spaced according to table below:

| Średnica nominalna | Uchwyt<br>m | Uchwyt o 50% wyższej nośności<br>m | Dwa niezależne uchwyty (uchwyt podwójny) [1]<br>m |
|---|---|---|---|
| ≤ DN 50 | 4 | 4 | 4 |
| DN 65 | 4 | 6 | 6 |
| DN 80 – DN 100 | 4 | 6 | 7 |
| D ≥ DN 125 | 4 | 6 | 8 |
| 1) *W razie uszkodzenia pojedynczego uchwytu odległości między pozostałymi uchwytami nie mogą być większe niż 8 m.* | | | |
| **Tabela 15.02** Maksymalne odstępy między uchwytami dla przewodów rurowych stalowych | | | |

**Test points**

All sections must have a test valve with K of sprinkler with lowest K instaled in this section. Test valve should be connected to the most hydraulicaly unfavorable place of range pipe. Should be installed in accesible place close to drain or near exit from building.

**Others**

- - The sprinkler system will be equipped with flushing connections serving for the proper flushing of the system.
- - All the sections will be equipped with the drain valves.

# 12. MONITORING

All valves and alarm control valves should be monitored according to VdS and connected to main FCP (Fire control panel – FMZ sprinkler system monitoring and Fire alarms panel).

# 13. GUIDELINES FOR OTHER SERVICES

## 13.1 Civil works

The fallowing works should be done in connection with sprinkler system extension:

- Room for ALV (alarm control valves) stations next to HBWP1 and AMDP3.
- Water tight tube with drain under manifold with ALV stations
- Constructions able to withstand load from sprinkler piping

## 13.2 Sanitary systems

The fallowing works should be done in connection with sprinkler system extension:

- Drain PVC 160 in each ALV room

## 13.3 HVAC systems

The fallowing works should be done in connection with sprinkler system extension:

- In ALV rooms should be proper temperature – min. +5°C

- In ALV rooms should be gravity ventilation
- Ensure temperature between +5°C and +35°C in all rooms/areas protected by wet sprinkler system

## 13.4 Electrical

The fallowing works should be done in connection with sprinkler system extension:

- In ALV rooms electrical supply must be provided for FMZ sprinkler system monitoring panels
- Provide grounding connection in each ALV rooms for grounding manifolds and sprinkler system pipes.
- Provide room light in ALV Station rooms
- Provide electrical sockets in ALV Station rooms for service purposes
- Pass the signals to monitoring central in room with permanent control 24/7 according to VdS and Local Law requirements.

## 13.5 Obstructions

- All installations must be coordinated with sprinkler system
- Avoid obstructions according to VdS or provide additional sprinkler protection

# 14. GUIDELINES FOR RACKS CONSRUCTION

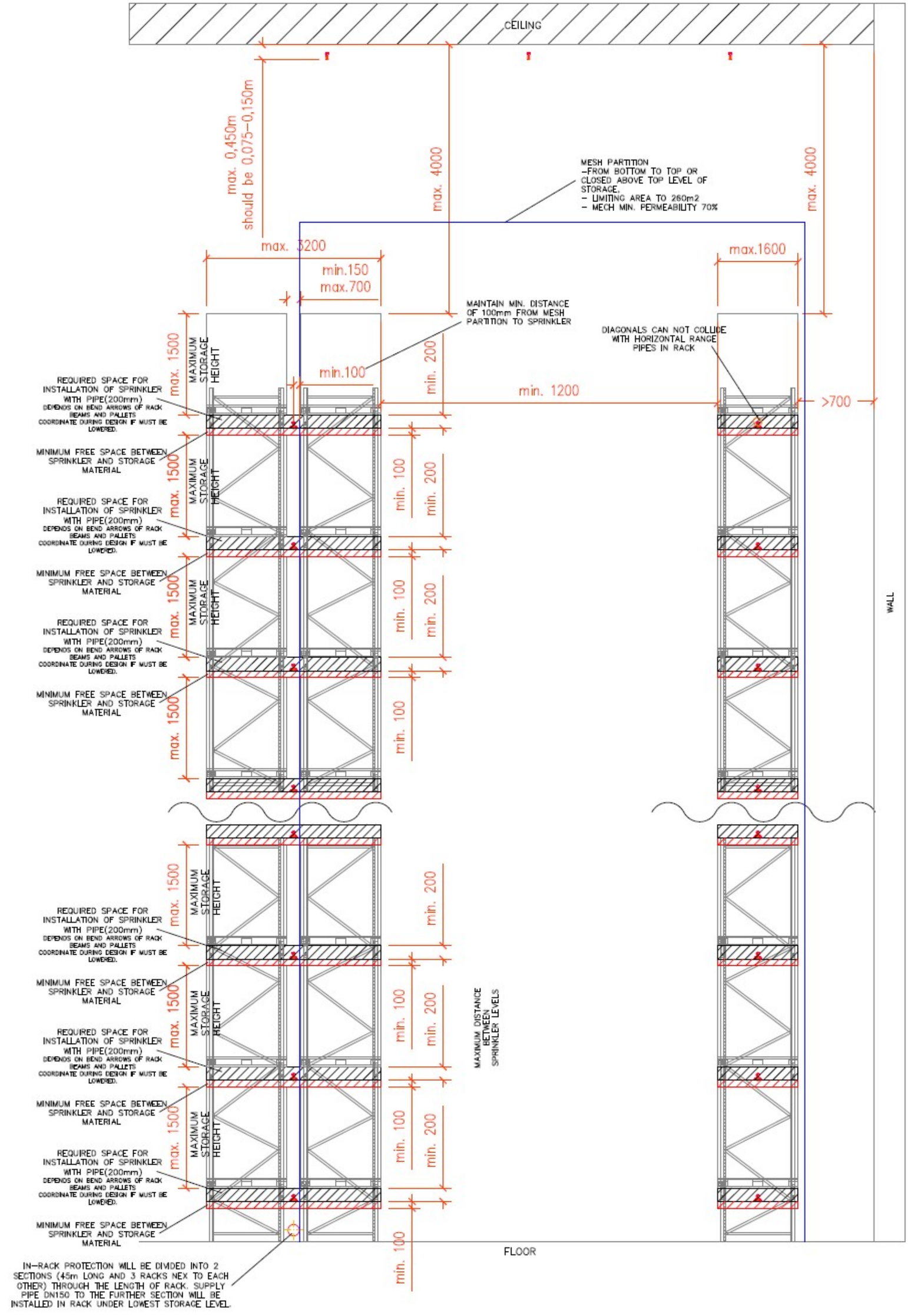
## 14.1 HBWP1 (HRL)

- Ceiling sprinkler protection and in-rack sprinkler protection will be connected to separate wet alarm valves sets.
- Max. 1000 sprinklers calculated from protected surface can be connected to each section (alarm valve set). Estimated sprinkler count per section according to attached drawings.
- In-rack sprinkler protection according to VdS point 11.5 & K1, K7.
- Minimal distance between in-rack sprinkler deflector and top of stored goods is 100mm for FP (flat pendent) sprinkler and 150mm for standard sprinkler.
- Max. distance between top of stored goods in highest level and ceiling sprinkler is 4,0m.
- Avoid structural bracing that obstruct sprinklers. Structural bracing in longitudinal flue spaces that obstruct sprinklers will require additional sprinklers. Position structural bracing above sprinkler flow pattern.
- Maintain temperature in HRL warehouse between +5°C and +30°C.
- HRL warehouse steel construction must be prepared to withstand the loads from sprinkler system pipelines – horizontal and vertical. Placement according to attached drawings. Must also be prepared for sprinkler system hangers based on SIKLA system (technological holes in profiles).
- Maintain 150mm longitudinal flue space on entire height of rack.
- Longitudinal and transverse flue space must be maintained at entire height of rack
- Sprinklers will be placed in longitudinal flue space at each intersection with transverse flue space. Approximately ever 0,9m to 1,0m (max. allowed by VdS 11.5 & K7 is 1,5m). For horizontal distance below 2,0m sprinklers must be protected by omega shield preventing from mutual spraying.

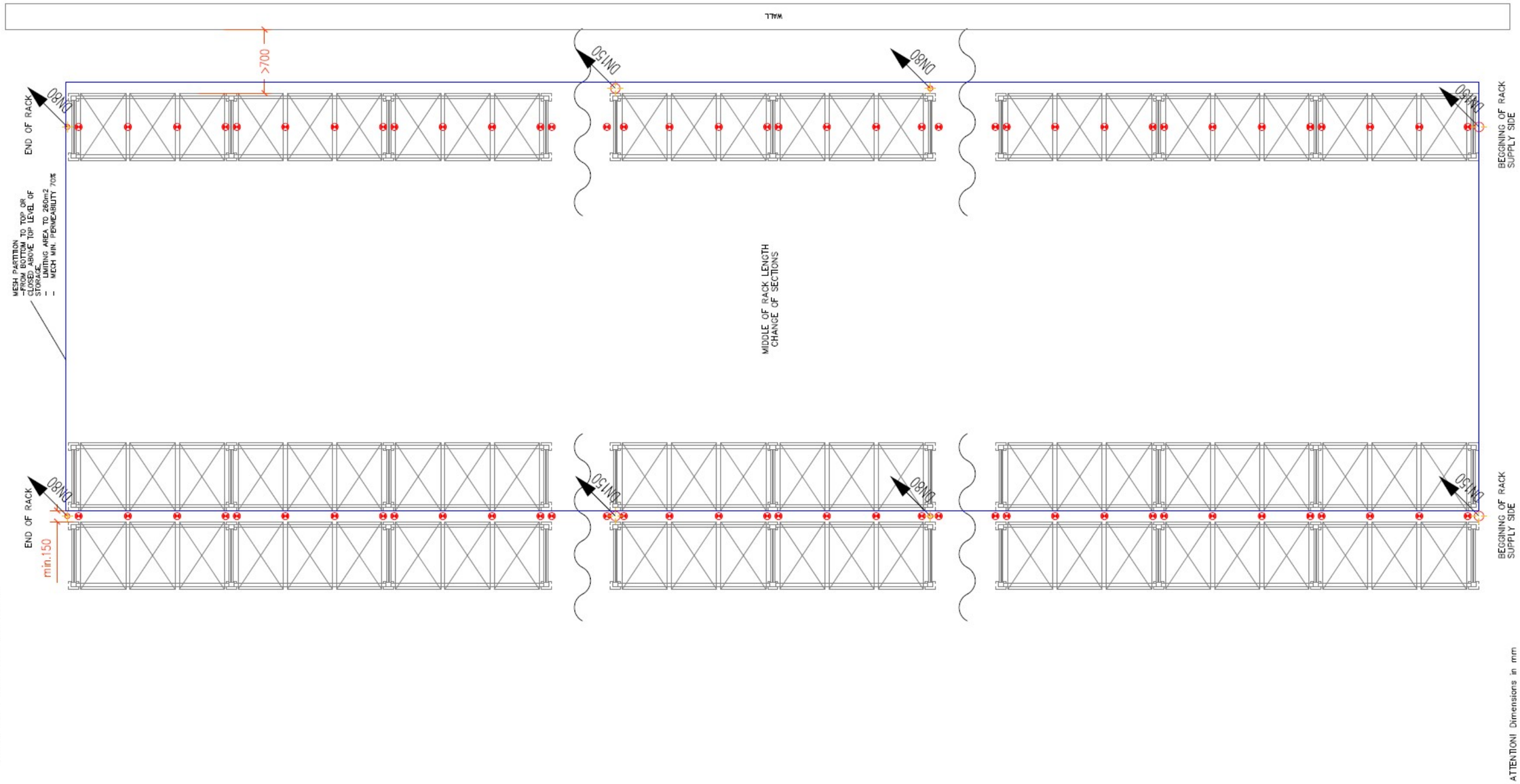
- In-rack storage pallet (ST4) without sprays/aerosols including KLT containers according to 11.5 & K7
    - sprinkler level every 2,0m.
- In-rack storage pallets (ST4) sprays/aerosols according to 11.5 & K1:
    - In-rack sprinkler level every 1,8m, storage height must be adopted to sprinkler levels.
    - storage above the highest level of in-rack sprinkler allowed to max 1,5m.
    - spray/aerosol storage must be limited to an area of 260m2 by making mesh partitions (walls) in the rack
    - double rack in area dividing spray/aerosol storage from other goods storage must be divided by mesh partition (wall) dividing entirely both areas form floor to ceiling.
    - Mesh partition (wall) must be at least 10cm horizontally from sprinkler
    - the mesh size must be selected so that the smallest aerosol container does not get through.
    - Mesh localization must be coordinated with sprinklers
- Avoid placement of diagonal bracing in collision with sprinkler system range pipes.
- Rack construction must be coordinated with sprinkler system

- Estimated water demand for HRL sprinkler system:
    - Ceiling protection requirement: 300m2 x 25mm/min x 1,4 irregularity = 10500 l/min
    - In-rack protection: 3 racks x 3 sprinklers x 3 levels x 1,4 irregularity x 115 l/min = 4350 l/min
    - Total amount = 10500 + 4350 = 14850 l/min
    - Required duration: 90 min
    - Water supply required: 14850 l/min x 90 min = around 1337 m3

HBWP1 (HRL) – CROSS-SECTION (GUIDELINES)




ATTENTION! Dimensions in mm

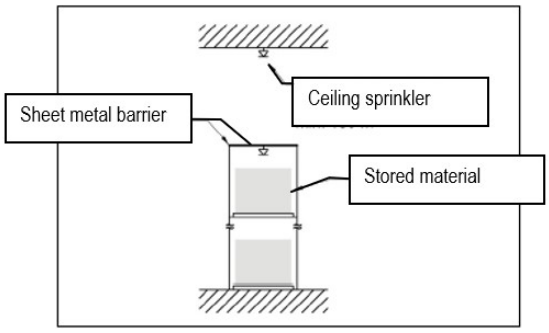



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## 14.2 AMDP3 (AKL)

**Most important:**

According to building height and received architectural drawing assumed number of rack levels will be 9 to 10. According to hydraulic calculations made for concept purposes, existing pump house and planned ALV rooms together with transit pipes are sufficient for sprinkler protection according to VdS if metal sheet barriers will be installed over ever sprinkler level together with sprinkler level above top storage level. Storage above metal sheet barrier above top storage level is forbidden.




Metal sheet barrier above top level of storage

**Guidelines to metal sheet barriers:**

Sheet metal barriers shall be placed directly above the sprinkler level and shall meet the following requirements:

− If the stored material protrudes beyond the shelf, the sheet metal barrier must reach at least to the outer edge of the stored material.

− Barriers should be made of steel sheet. Before using other non-flammable materials, the consent of the competent authority must be obtained.

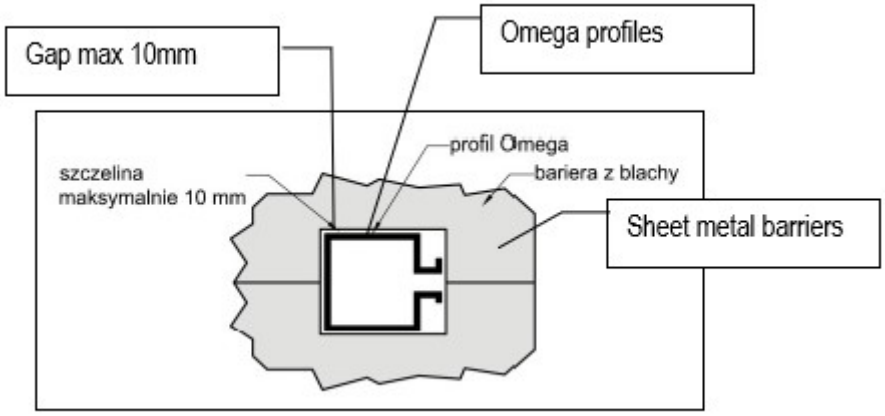
− There cannot be any gaps wider than 10 mm in the horizontal sheet metal barrier through which elements of the shelf structure should be routed.

− The sum of the areas of all openings in the sheet metal barrier cannot be greater than 5% of its total area.

− For racks placed less than 700 mm from the wall, the barriers should be placed up to the wall and sprinklers should be installed in the center of the rack.

− The minimum thickness is at least 0.7 mm.

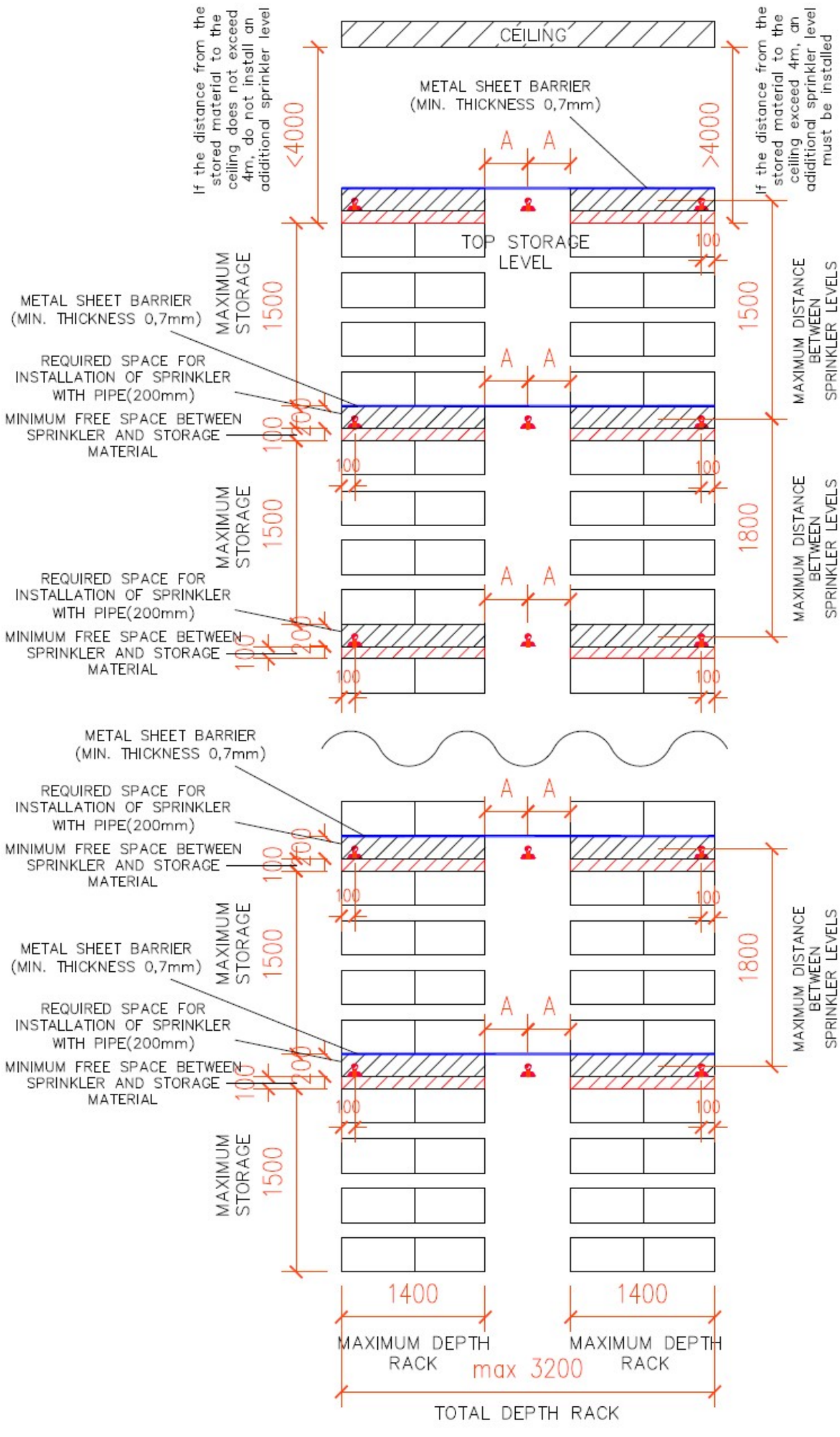
Note: If "Omega" or other similar profiles are used as shelf support elements, there is no need to mount metal sheets inside these profiles (see Figure below).



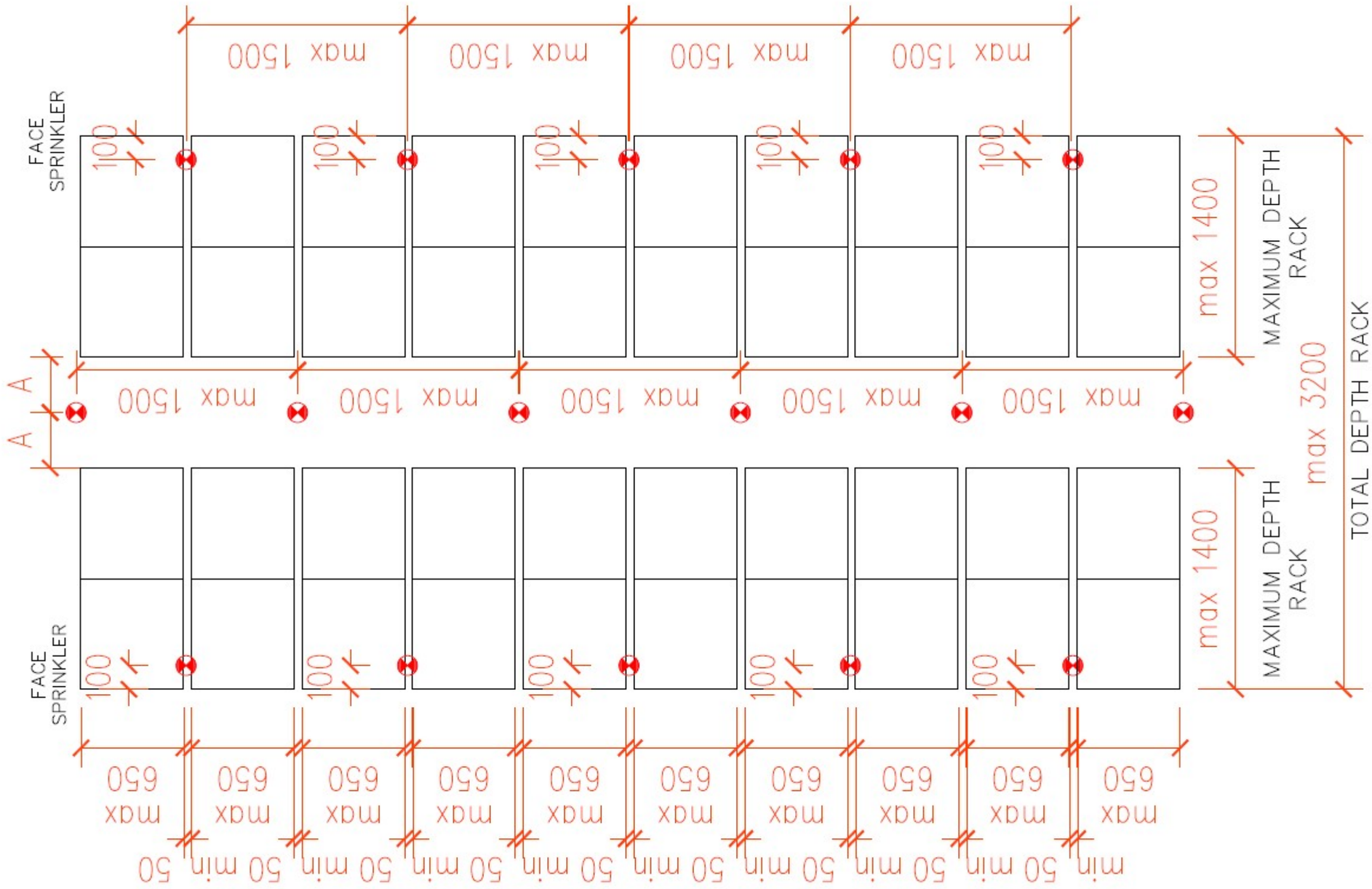

- Ceiling sprinkler protection and in-rack sprinkler protection will be connected to separate wet alarm valves sets (ALV's).
- Max. 1000 sprinklers calculated from protected surface can be connected to each section (alarm valve set - ALV's). Estimated sprinkler count per section according to attached drawings.
- In-rack sprinkler protection according to VdS point 11.6.5.2 & K1.
- Minimal distance between in-rack sprinkler deflector and top of stored goods is 100mm for FP (flat pendent) sprinkler and 150mm for standard sprinkler.
- Storage above top level of in-rack sprinklers is allowed max up to 1,5m
- Max. distance between top of stored goods in highest level and ceiling sprinkler is 4,0m.
- Avoid structural bracing that obstruct sprinklers. Structural bracing in longitudinal flue spaces that obstruct sprinklers will require additional sprinklers. Position structural bracing above sprinkler flow pattern.
- Maintain temperature in AKL warehouse between +5°C and +30°C.
- AKL racks construction must be prepared to withstand the loads from sprinkler system pipelines – horizontal and vertical. Placement according to attached drawings. Must also be prepared for sprinkler system hangers based on SIKLA system (technological holes in profiles). Coordinate during design.
- For AKL racks 5cm vertical flow spaces/clearances (between KTL containers) must be maintained on entire height which should be spaced at a maximum distance of 65cm.
- For AKL rack depth up to 1,4m sprinklers will be placed in longitudinal flue space max. every 1,5m at each intersection with transverse flue space between KLT containers.
- Sprinkler level every 2,0m for KLT containers and every 1,8m for KLT containers with sprays/aerosols.
- If gap between racks is smaller than 700mm, rack depth on each side of gap is up to 1,4m, entire depth is up to 3,2m than one sprinkler line must be placed in the middle of this gap and additional 'face sprinklers' lines on both sides of the rack. 'Face sprinklers' and sprinklers in the middle of the gap must be placed alternately relative to each other – according to attached drawing.
- If rack depth is above 1,4m and up to 3,2m than sprinklers are required in longitudinal flue space and 'face sprinklers'.

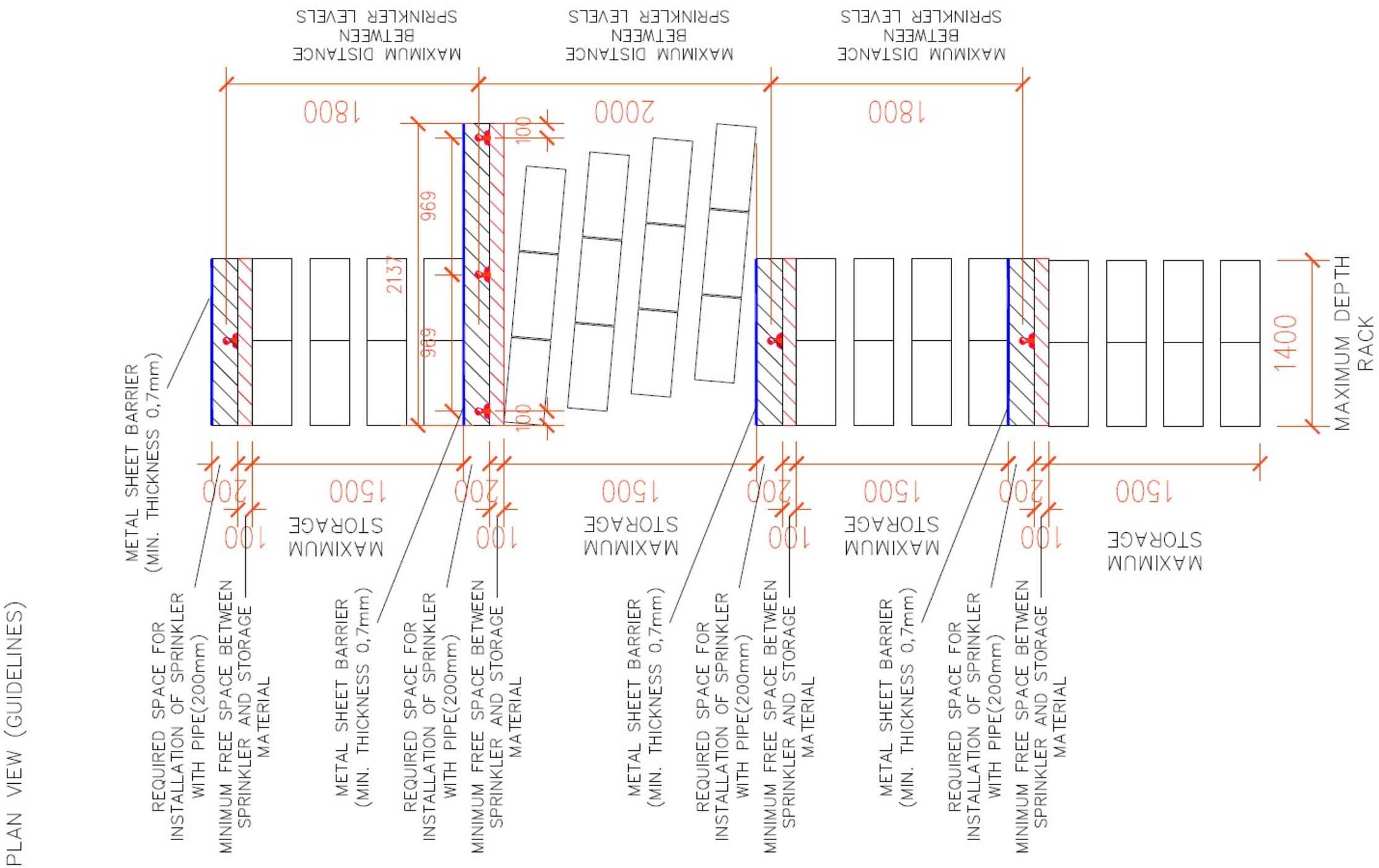
- For the so-called 'face sprinkler' sprinklers, the maximum distance between the sprinkler and the outer edge of the shelf or between the sprinkler and the carriers and material protruding from the shelf should be 100 mm. However, it cannot exceed 200 mm.
- **Requirements for spray/aerosol storage K1:**
    - spray/aerosol storage must be limited to an area of 260m2 by making mesh partitions (walls) in the rack
    - double rack in area dividing spray/aerosol storage from other goods storage must be divided by mesh partition (wall) dividing entirely both areas form floor to ceiling.
    - Mesh partition (wall) must be at least 10cm horizontally from sprinkler
    - the mesh size must be selected so that the smallest aerosol container does not get through.
    - Mesh localization must be coordinated with sprinklers
- Additional sprinklers below platforms between AKL racks must be protected according to VdS point 11.6.4
- Rack construction must be coordinated with sprinkler system
- Estimated water demand for AKL sprinkler system:
    - Ceiling protection requirement: 300m2 x 25mm/min x 1,4 irregularity = 10.500 l/min
    - ~~In-rack protection without barriers (14m line of sprinklers in longitudinal space and 14m line of 'face sprinklers'): 10 levels x 2x 45m2 x 10mm/min x 1,4 irregularity = 12.600 l/min~~
      ~~**Pump house is insufficient for this variant**~~
    - In-rack protection with barriers: 2 levels x 2x45m2 x 10mm/min x 1,4 irregularity = 2.520 l/min
    - Total amount = 10.500 + 2.520 = 13.020 l/min
    - Required duration: 90 min
    - Water supply required: 13.020 l/min x 90 min = around 1.172 m3

DOUBLE RACK – CROSS–SECTION (GUIDELINES)

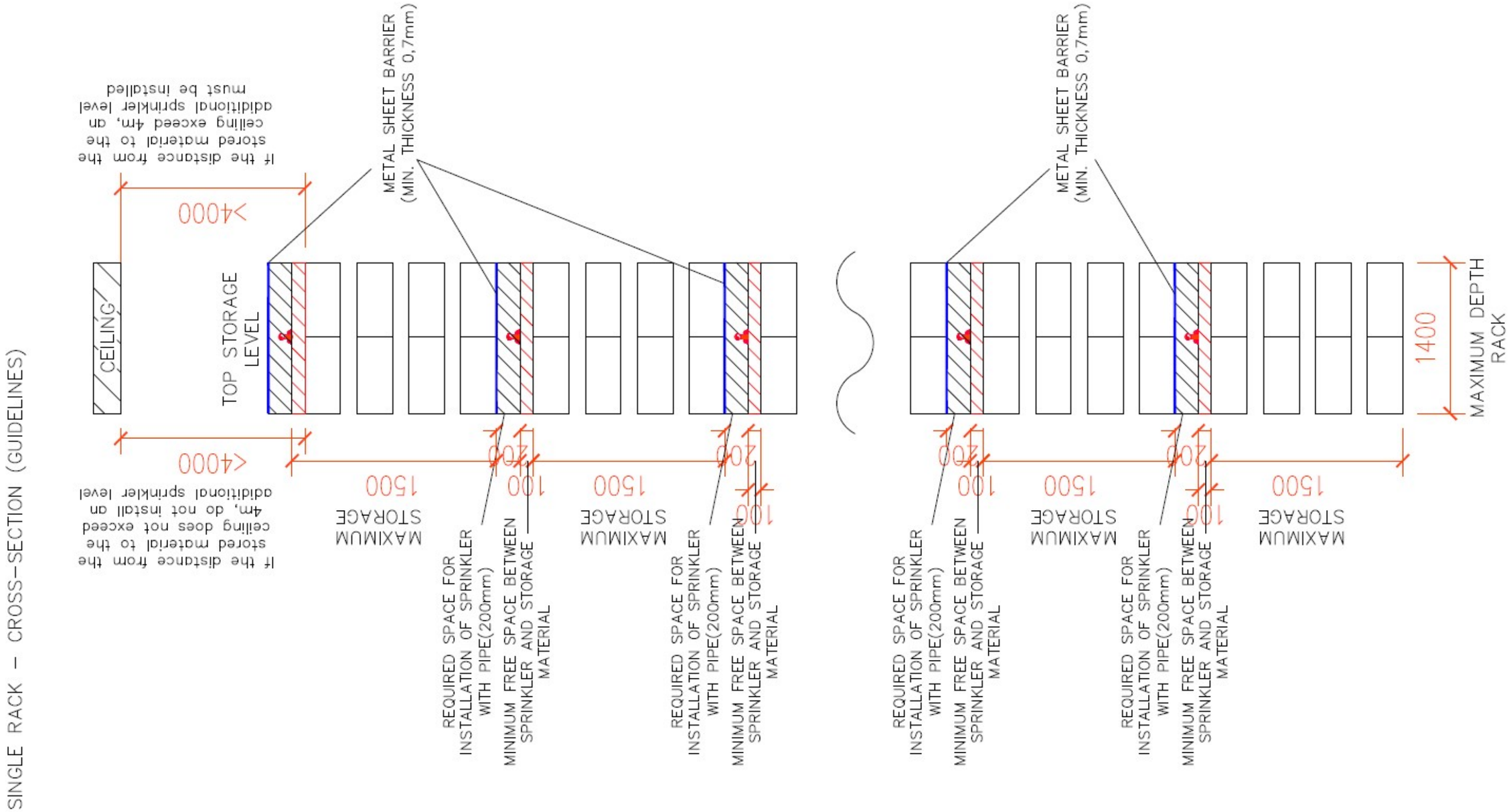


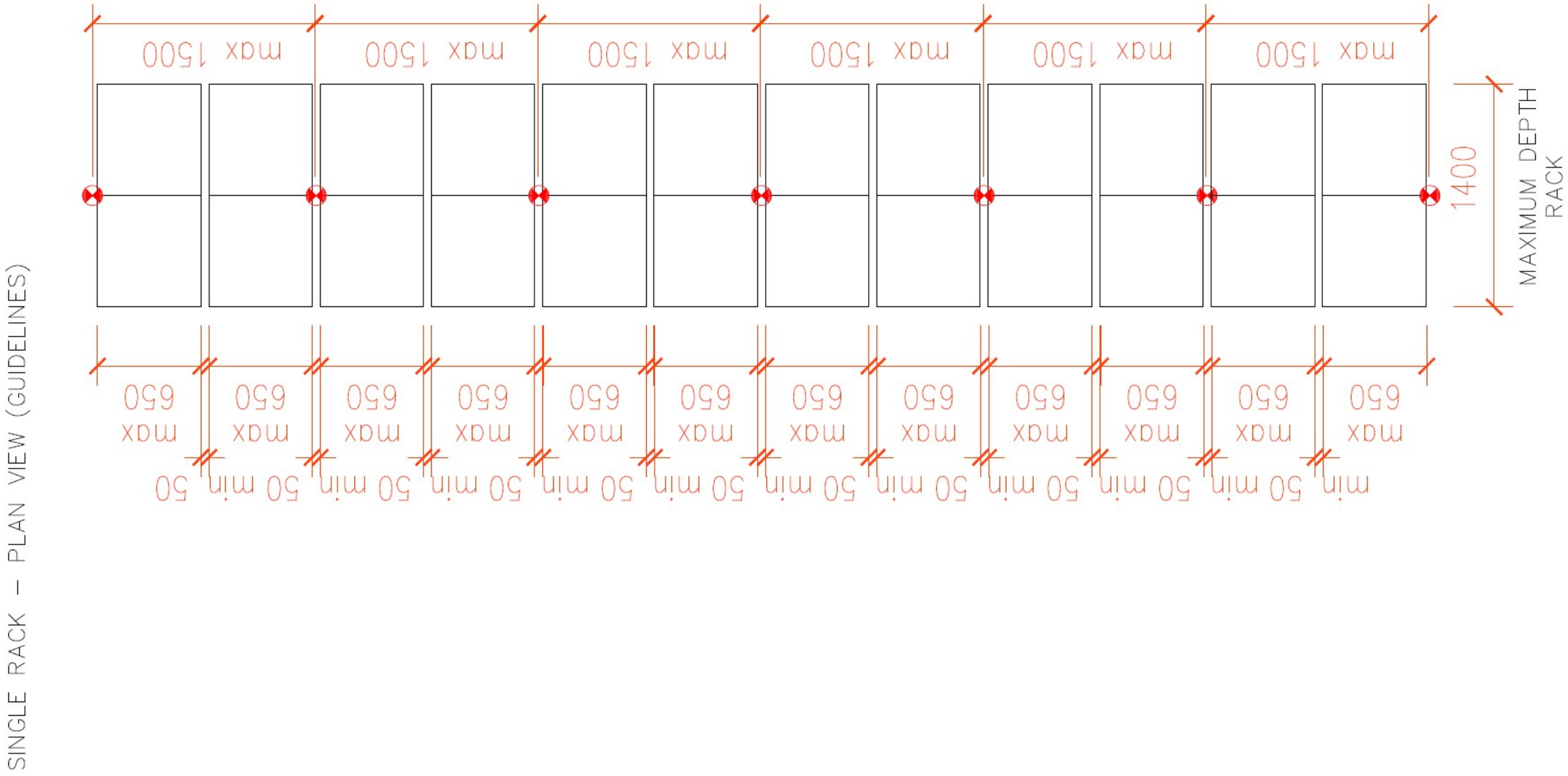
DOUBLE RACK – PLAN VIEW (GUIDELINES)

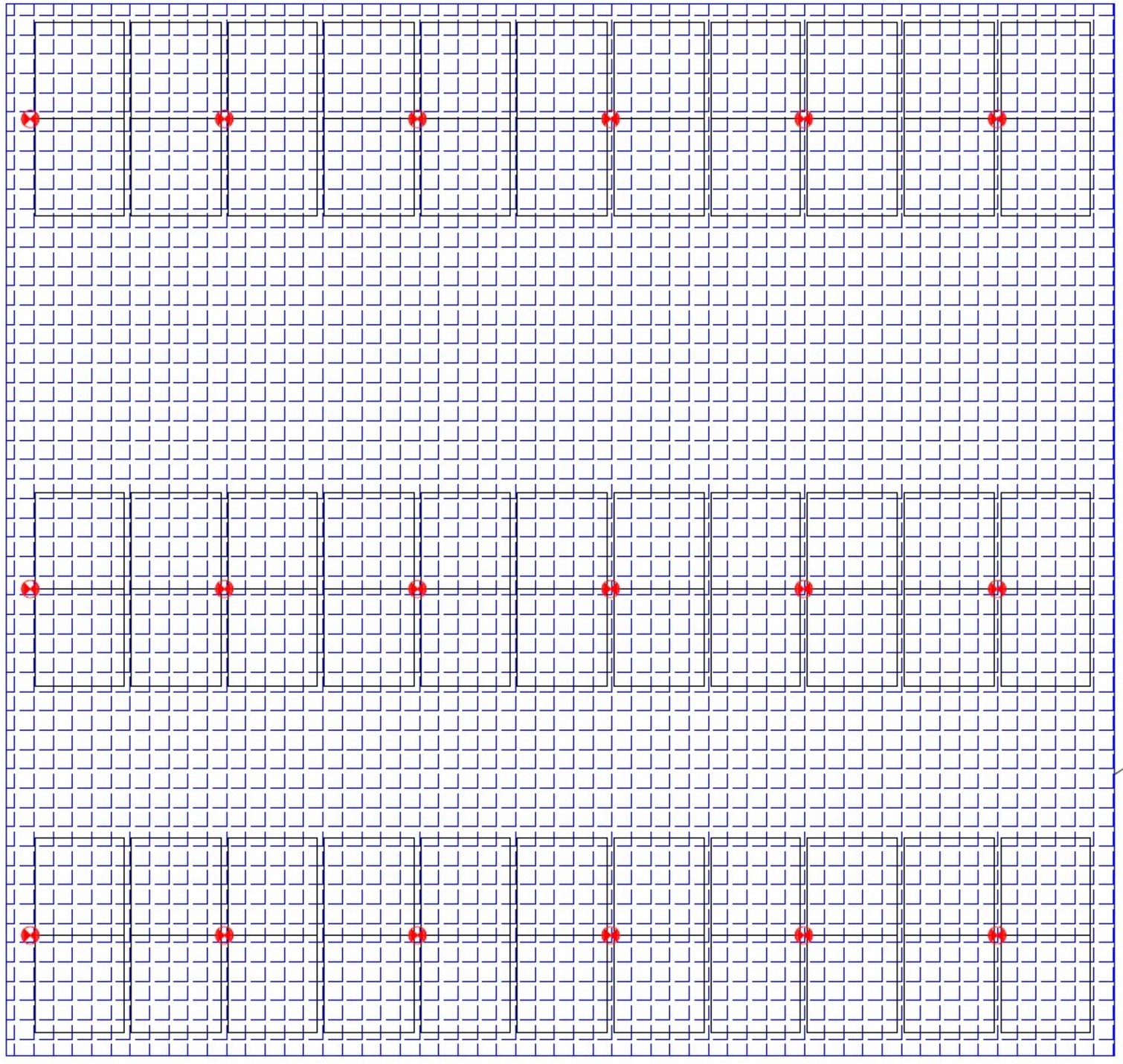





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SINGLE RACK – CROSS–SECTION (GUIDELINES)
If the distance from the stored material to the ceiling does not exceed 4m, do not install an additional sprinkler level must be installed
>4000
<4000
If the distance from the stored material to the ceiling exceed 4m, an additional sprinkler level must be installed
CEILING
TOP STORAGE LEVEL
METAL SHEET BARRIER (MIN. THICKNESS 0,7mm)
MAXIMUM STORAGE
1500
REQUIRED SPACE FOR INSTALLATION OF SPRINKLER WITH PIPE(200mm)
MINIMUM FREE SPACE BETWEEN SPRINKLER AND STORAGE MATERIAL
100
200
1400
MAXIMUM DEPTH RACK


max 1500
max 1500
max 1500
max 1500
max 1500
max 1500
1400
MAXIMUM DEPTH
RACK
650 max
50 min
SINGLE RACK – PLAN VIEW (GUIDELINES)


MESH PARTITIONS LIMITING STORAGE ZONES TO 260m2
MESH PARTITION
–FROM BOTTOM TO TOP OR
CLOSED ABOVE TOP LEVEL OF
STORAGE,
– LIMITING AREA TO 260m2
– MECH MIN. PERMEABILITY 70%

# 15. LIST OF DRAWINGS

**CONCEPT_W_PK_L_001_A – site plan**