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PROJECT: 119003 WEPA UK BRIDGEND

EMPLOYER: WEPA UK LIMITED

SUBJECT: CONCEPT FIRE PROTECTION SYSTEM

DOCUMENT: GC_04.02.22_Tech_Spec_Description_Fire_Protection_System

Revision : 00

Project: 119003 WEPA UK BRIDGEND
Employer: WEPA UK Limited
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Index : 00 / 27.05.2020

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Index	description / adjustments	date	editor
00	Document created	27.05.20	JN

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1. GENERAL INFORMATION

1.1. Project

The company WEPA intends to build a second hygiene paper production line at their facility in Bridgend / UK. The extension includes a new pulp storage for bales (virgin fibre), a bale handling area, a new sludge press building, a paper machine building for a second production line (including the stock preparation), a jumbo reel storage, a converting extension for 1 roll line, a high bay storage with a capacity of approx. 35,000 pallets and a shipping area for finished products. Further the mill site underground services incl. roads and parking area shall be adapted to the new mill site layout.

The current existing plant consists of a paper machine (called "JUPITER"), multiple jumbo reel storage areas, several converting lines, a finish product storage and shipping. Further on it is assumed that all relevant existing auxiliary facilities (e.g. waste water treatment plant, etc.) as well as utilities mains have sufficient capacity for the intended expansion of the tissue mill.

The new tissue machine will have a capacity of approx. 75.000 tons and will use a standard-technology. To convert the jumbo reels WEPA intends to install additional converting lines in the existing buildings (converting building, finish product storage), therefore the buildings shall be partially adapted / refurbished in a second phase.

1.2. Description of the Site Development

The concerning "WEPA UK Bridgend" project is developed as a Mill Plant expansion project with the intended start of construction in approx. June 2020 and the TM Start-up approx. at the end of November 2021.

For more information please see attached site development drawing and the attached intended time schedule.

1.3. Contact and intended Contract

The intended execution (by the successful contractor) of "WEPA UK Bridgend project" shall be based on a FIDIC Red Book Contract with approximate quantities (this means -unless otherwise stated- that the contractors invoice shall be based on actual designed/installed/verified quantities and based on agreed BoQ unitary prices per agreed units).

It is the client's intention to provide, during the RFT process, an "Owners Contractor Agreement" (DRAFT) plus "General Conditions of Contract / General Particular Conditions" for review.

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1.4. Intended "Project Time Schedule"

The building permit (including permit for the secondary access road) is expected to be issued in approx. June 2020 by the responsible (local) authorities.

Following RFT intended milestones are:

- | | |
|---|--------------------------------|
| ▪ Submission of GC Quotation / GC RFT | June 19 th , 2020 |
| ▪ Clarification and negotiation process with selected Contractors | June/July 2020 |
| ▪ Awarding of selected General Contractor | July 2020 |
| ▪ Start of construction works by General Contractor | August 15 th , 2020 |

For more detailed information please see attached project time schedule (RFT folder: 07 Time Schedule).

The General Contractor works includes the following buildings/departments and/or slab on grade constructions as indicated in the attached Mill Site Layout drawing:

- Departments A, B2, B3, B4, C, I

It is a requirement that the proposed General Contractor will prepare their GC Tender, based and in reference to the GC-RFT documents, and submit their GC Tender (incl. all requested additional Contractor information/documents) latest by June 19th, 2020 in original paper copy to the client (WEPA in Bridgend) and in parallel (per email in pdf-format) to all contacts mentioned under item 1.3 above.

2. SUMMARIZED BUILDING DESCRIPTIONS

The intended and defined expansion on the existing WEPA UK Ltd. Paper Mill Facility is mainly consisting out of the following department.

2.1. List of buildings and department indication

Description
DEPARTMENT A - Pulp Storage (slab on grade construction)
DEPARTMENTS (B2+B3+B4) - Bale Handling: <ul style="list-style-type: none"> - DEPARTMENT B2 - Bale Handling Building - DEPARTMENT B3 - Canopy - DEPARTMENT B4 - Social rooms, Trafo-box + MCC room + New HV switch room (cable basement + switch gear room)
DEPARTMENT C - Paper Machine Building "Neptune"
DEPARTMENT I - Pipe Bridge (between Dept. B and PM's (Neptune + Jupiter M/C), including some cladding and roof works related to existing MCC (Jupiter) Room / Building.
Note/Info: Dept. T - Parent Reel Storage area (slab on grade) <= ON HOLD! (= not part of GC RFT)
Furthermore: surrounding external areas with roads, retaining walls, fences / gates, light poles, weight brige, demolition works (containing existing buildings/constructions) transitions between existing and new constructions/buildings as well as all related mechanical, electrical, HVAC and fire protection services, etc.

2.2. General description of main (new) building structures and intended materials

2.2.1. DEPARTMENT A – Pulp Storage

The Pulp-Storage-Area (so called “Department A”) is mainly consisting out of a sloped concrete slab on grade (including drainage to handle surface water) and founded on bored piles.

Due to the different levels in height between the slab on grade and adjacent existing natural ground bridging embankments and retaining wall constructions (as shown in the basic design drawings) will be required.

Department A will be mainly used to store raw-materials (virgin fibre pulp bales) and is intended (by WEPA) to be operated with forklifts.

Construction item	Rough Description
Concrete Slab on Grade	Reinforced (sloped) concrete floor slab (= slab on grade) The concrete slab surface shall be treated with Ashford Formula (hardening agent/curing agent) as and if clearly indicated in the concerning GC RFT documents.
Surface water drainage System	Line-drainage with outlets, suitable for forklift traffic as well as for heavy duty traffic.

2.2.2. DEPARTMENTS [B2+B3+B4] (Bale Handling)

Departments B2, B3 and B4 consists out of several building areas/sections designed for various intended purposes.

The building (Dept. B2) is a single storey building and designed for the bale handling (process related) equipment (as for example: Bale-Pulper's, Dump-Towers, Pulper-Dilution tanks, CB-Feed-Chest tanks, etc.).

In parallel and adjacent to the east side of the bale handling building (Dept. B3) is a canopy construction with the purpose to protect the raw material conveyors and other equipment located underneath and within this canopy covered area.

Furthermore, the north-east building portion (Dept. B4) is a two-storey building portion designed and foreseen for the Trafo's and MCC at basement level and social areas located on the ground floor level. Adjacent to the MCC room is the cable basement (approx. level +3,25m) and switch gear room (approx. level +6,30m).

Further design-informations regarding Departments B1, B2, B3 and B4 can be reviewed in the attached (RFT) basic design drawings and related documents.

Construction item	Rough Description
Deep-Foundations / Foundations	Concrete reinforced piles, concrete reinforced foundations as well as single and/or strip foundations as indicated in the attached design drawings.
Concrete floor slabs (slab on grade + elevated slabs)	Concrete reinforced floor slabs Slab surface (partly) with chemical resistant coating, Ashford Formula and/or dust free coating (as indicated in the concerning and attached RFT documents)
Main structural building structure	Main building structure consisting out of structural steel structures as for example: structural steel columns, structural steel joist girders, bracings and steel supporting structures for façade and roofs.
External walls	External walls (as indicated in the GC-RFT basic design): <ul style="list-style-type: none"> - CIP Concrete walls - Brick walls + heat insulation + facing shell - Insulated metal panels (IMP Panels) fixed on Z-profile steel construction
Roofs	<p>Roof coverage (as indicated in the GC-RFT basic design):</p> <p>Main roof system over Bale handling area + Canopy:</p> <ul style="list-style-type: none"> - Roof (EPDM) Membrane - waterproofing layer - Roof insulation (mineral wool) - roof ceiling moisture proof with aluminium inlay - trapezoid metal plate - Steel beam <p>Main roof system over adjacent building (social areas + switch gear room):</p> <ul style="list-style-type: none"> - Roof (EPDM) Membrane - waterproofing layer - Roof insulation (mineral wool) - roof ceiling moisture proof with aluminium inlay - Concrete ceiling <p>Main roof system over sludge press building (B1):</p> <ul style="list-style-type: none"> - Roof (EPDM) Membrane - waterproofing layer - Roof insulation (mineral wool) - roof ceiling moisture proof with aluminium inlay - trapezoid metal plate - Steel beam
Doors / Gates / Windows	Doors / Overhead-Doors / Gates: <ul style="list-style-type: none"> - Interior steel and/or wooden doors with steel block frames incl. fire protection measures - as/if required per

Construction item	Rough Description
	<p>code/regulation</p> <ul style="list-style-type: none"> - Insulated (exterior) steel doors with steel block frames - Exterior insulated sectional overhead doors (with vision panels) and internal/external coiling doors (as defined and indicated in the GC-RFT door schedule) <p>Windows:</p> <ul style="list-style-type: none"> - Aluminium (thermally insulated), windows with turn/tilt functions (as defined and indicated in the GC-RFT window schedule)

2.2.3. DEPARTMENT C – Paper machine Building (Neptune)

Department C consists out of the paper machine with several process related rooms and areas as for example: tissue machine hall, compressor room, blower room, transformer and MV-Rooms, chemical room, control room, several and sanitary rooms and other process related technical rooms.

The PM building is mainly consisting of a two storey building (approx. 0,00m Basement level and approx. +6,00m Operating floor level) furthermore there is a approx. +12,75m Mezzanine floor level for process equipment (which is not a full covered storey/floor level) as well as adjacent technical annex (between the grid lines C-5/C-10 and C-A/C-B) with trafo's + MV switch gear at approx. level 6,80m and MCC at approx. level +14,00, cable floor at approx.. +11,40m) furthermore a few offices and a laboratory (approx. +10,10m level) are defined as indicated in the attached basic design.

Construction item	Rough Description
Deep-Foundations / Foundations	Concrete reinforced piles, concrete reinforced foundations as well as single and/or strip foundations as indicated in the attached design drawings. Secant pile wall (located West and South Side of Dept. C)
Concrete floor slabs (slab on grade + elevated slabs)	Reinforced concrete floor slab Slab surface (partly) with chemical resistant coating, Ashford Formula and/or dust free coating (as indicated in the concerning and attached RFT documents)
Supporting structure	Structural steel structures consisting of steel columns, structural steel joist girders, bracings and steel supporting structures for façade and roofs.
External walls / Internal walls	External walls (as indicated in the attached basic design drawings): <ul style="list-style-type: none"> - Concrete precast wall elements - Vapour barrier (bituminous) at joints - Heat insulation hydrophobic with aluminium inlay - Ventilation layer - Trapezoidal metal sheet CIP Concrete walls (staircases, basement walls, etc.) <ul style="list-style-type: none"> - CIP concrete wall - Heat insulation + ventilation layer - Trapezoidal metal sheet Internal walls (as indicated in the attached basic design drawings):

Construction item	Rough Description
	<ul style="list-style-type: none"> - CIP concrete walls - Brickwork walls / Concrete-Block Masonry walls - Dry-Wall constr. / Plasterboard constr. / WC and/or wet-room partition walls - Insulated metal panels (IMP Panels)
Roofs	<p>Main PM-Roof coverage (as indicated in the attached basic design drawings):</p> <ul style="list-style-type: none"> - Bituminous roof waterproofing (2 layers) sealing - Non-combustible heat insulation (mineral wool) - Bituminous moisture-proof roof sheeting with aluminium inlay (vapor barrier) - Precoat cold asphalt - Hollow core slab (precast) on precast concrete roof girders - Smoke hatches / Roof lights as per design
Doors / Gates / Windows	<p>Doors / Overhead-Doors / Gates:</p> <ul style="list-style-type: none"> - Interior steel and/or wooden doors with steel block frames incl. fire protection measures - as/if required per code/regulation - Insulated (exterior) steel doors with steel block frames - Exterior insulated sectional overhead doors (with vision panels) and internal/external coiling doors (as defined and indicated in the GC-RFT door schedule) <p>Windows:</p> <ul style="list-style-type: none"> - Aluminium (thermally insulated), windows with turn functions (as defined and indicated in the GC-RFT window schedule)

2.2.4. DEPARTMENT I – Pipe Bridge

To feed the existing Paper Producing Building (Jupiter M/C) and the New Paper Producing Building (Neptune) with prepared raw material, as well to run the various supply pipes/cables in between department B and C (incl. existing Jupiter M/C) a new Pipe Bridge Construction (department I1, I2, I3 and I4) shall be routed, as indicated in the attached RFT Layout drawings.

Item	Description
Deep-Foundations / Foundations	Single and/or strip foundations as indicated in the attached RFT design drawings / documents.
Supporting structure	Structural steel construction consisting of steel columns, structural steel beams, bracings and other steel supporting structures for pipe bridge process related pipes/cables.
Existing MCC Room/Building (MCC related to existing Jupiter building).	Wall cladding works (insulation + finishing) related to the exterior existing MCC walls): Roof works (Insulation + Membrane) in reference to the existing concrete slab on garage (existing MCC Room)

3. GENERAL INFORMATION – FIRE PROTECTION SYSTEM

3.1. General

This document intends the technical specification of the sprinkler system and the automatic fire alarm system inside the different departments (Bale handling, Pulp storage and paper machine building).

This document includes the information received by FM Global and the Client up to the date of submission. It is Contractor scope to coordinate and integrate additional requirements coming from FM Global, the Client, the Engineer and the paper machine supplier during the detail design stage. The coordination and approval with the local fire brigade as per UK requirements and regulations is included in Contractor scope too.

On the attached overview drawings the different fire protection system are shown.

The detailed engineering design, layouts, sections and flow sheets incl. the hydraulic calculation must be coordinated with the process layout and approved by FM- global.

3.2. Guidelines and Standards

In general, the design of the fire protection is carried out according to the national guidelines and to the applicable FM-Global standards and regulations.

List of the most important FM-Global standards and regulations:

- FM 2-0 Installation guidelines for automatic sprinklers
- FM 2-8N Installation of sprinkler systems
- FM 2-2 Installation rules for suppression mode automatic sprinklers
- FM 2-8 Earthquake protection
- FM 7-4 Paper machines and pulp dryers
- FM 8-21 Roll paper storage
- FM 8-22 Storage of baled waste paper
- FM 7-29 Flammable liquid storage in portable containers
- FM 3-2 Water tanks for fire protection
- FM 3-7 Fire protection pumps
- FM 5-40 Fire alarm systems
- DS 5-31 Cables and Bus Bars

- DS 3-26 Fire Protection for Nonstorage Occupancies
- DS 8-7 Baled Fibre Storage

List of the most important british standards and regulations:

- BS 336:2010 Specification for hose couplings and ancillary equipment
- BS 5306 Fire extinguishing installations
- BS 5839 Fire detection & alarm systems for building
- BS 5266 Emergency lighting

The lists does not claim to be complete. All applicable guidelines and standards incl. all listed appendices in the last valid version apply. **All materials shall be non-combustible.**

Regarding the execution of the fire walls and fire compartments, the materials and constructions are carried out according to the FM-global guidelines and regulations.

All materials shall be non-combustible. Deviations from FM-approved materials and designs are possible. Deviations must be agreed with the property insurer, the client, the Building Control prior to the execution.

4. SYSTEM DESCRIPTION OF THE FIRE DETECTION AND FIGHTING SYSTEM

4.1. Fire water supply sprinkler system

The fire water supply for the outside hydrants and for the sprinkler systems inside the different building parts / departments are connected to the existing fire water pipework and to the existing fire water pump station.

The existing fire water reservoir and the existing fire water pump stations supplies also the existing departments and the new departments.

The connection point for the new system to the existing Fire System is the Valveset 6. The scope of this functional tender includes the calculation of the water demand of the new system (considering pressures and flow rates required within each departments) and to check and confirm that the water demand is within the Fire Tanks capacity communicated by Wepa. Also in scope of work is to shut off the existing sprinkler system, discharge and refill the existing and also the new sprinkler system with water.

The fire water pipework is routed over the pipe bridge to the different departments.

Inside the department A+B (bale handling + pulp storage) the fire water supply is installed via an not sprinkler protected area into the sprinkler substation for the department A+B. This fire water supply must be installed as a fire protected pipework (incl. fixing) and protected as required by the UK regulation.

Inside the department C (paper machine building) the fire water supply runs inside the building through sprinkler protected areas (machine level) and not sprinklered areas (basement level and other areas, please refer to related drawings). The pipe installed need to be protected as per UK regulation.

Fire water underground lines:

The fire water underground lines are installed in accordance of the requirements of FM- Global.

The pipe pressure is PN16. Foundations at all changes of direction (elbows; t- fittings) are provided in accordance with the specifications from the corresponding FM Global data sheet.

The fire extinguishing pipe is always introduced into the sprinkler sub-stations as a non-combustible pipe (metal pipe).

Fire hydrants:

Around the new building parts and departments fire hydrants (outside hydrants) are located.

A suggestion for the placement / location of the external hydrants is visible at the attached drawings.

The type and product of the fire hydrants around the new departments is carried out analogously to the existing system. Hydrant connections should be compatible with those used by the UK fire and rescue service.

As part of the execution of the project, a meeting with the local fire brigade is to be carried out to fix the hydrant connections and exact position of the hydrants and for the final approval of the Fire System.

Fire water supply to the different sprinkler substations:

All sprinkler substations are built as own fire department with access from outside.

The fire water tie to the different building parts is located in the sprinkler substation for each building.

Inside the sprinkler substation the fire water distribution and the alarm valves for the different sprinkler areas are also installed.

Sprinkler substations:

- DEPT. A-B (Bale Handling and Pulp Storage) axis B4-B5/BH-BI
- DEPT. C (Paper machine hall) axis C12-C13/CB1-CB

The designed position of the outside hydrants, the routing of the pipework and the sprinkler substations are shown on the attached drawings.

Calculation / hydraulic:

Included in the scope of this functional tender is to check / recalculation the hydraulic of the dimension fire water tie in the different sprinkler sub stations.

As starting point of the calculation / hydraulic can be set the point Valveset 6 of the existing fire water system (refer to pictures below):

System flow tests at points:

Valve set 6, pipe DN200 PN16

Source duty: 7636,9 l/min @ 8,714 bar

Fire tanks capacity: 1492000 litres

In course of the execution planning and calculation of hydraulic, the listed mass flows and pressure data at the starting point Valveset 6 are mechanically measured. A record of the measurements is to be made by the General Contractor.







4.2. DEPARTMENT A – Pulp Storage

The fire water supply is carried out as a connection to the existing fire water loop (see chapter 4.1). The alarm valves are located inside the sprinkler substation. The sprinkler substations are built as a separate fire compartments with access from outside.

Around the Department A fire hydrants are located. No part of the storage should be more than 60m from a hydrant.

Fire water supply:

Valve set 6, pipe DN200 PN16

Source duty: 7636,9 l/min @ 8,714 bar

Fire tanks capacity: 1492000 litres

Hydrant pressure:

5.700l/min for 4hours 20min according to the FM Global report

Protection concept Department A+B:

Inside the Department A+B Bale handling and Pulp Storage an area wide automatic fire detection system is installed.

The department B4 (mess room; control room; locker rooms and similar) are also equipped with an automatic sprinkler system.

The sanitary rooms and the staircases are equipped with an automatic fire alarm system.

Transformer stations are equipped with smoke aspiration system.

The cable vault of the MCC room only is protected with a sprinkler system. The switch gear cabinet level is equipped with smoke detectors. The floor separating the MCC cable vault by the upper MCC room is NOT fire rated.

In addition, at all emergency exits push buttons, wall hydrants (hose stations) and fire extinguishers are installed. The number and placement are carried out according to the local regulations and guidelines.

A dry riser pipe at steel structure staircase is installed up to the roof and guaranteed a good fire water supply in case of a fire event on the roof of the department A+B.

The alarm in case of fire is carried out with combined flash lights and alarm sirens. This flash lights and alarm sirens are installed area wide.

In all cases the fire pre-alarms and fire alarms are linked to the main automatic fire alarm system in the main control room of the new paper mill and to the existing fire alarm system and to the gate house main entrance.

The automatic fire alarm system is located in an own technical room. This room is built as an own fire compartment.

Heat and smoke exhaust openings are installed at the roof and they are also used to control the ventilation of the departments. The manually release by the local fire brigade of this heat and smoke exhaust openings are carried out via push buttons.

canopy in front of the bale handling

Provide automatic sprinkler or deluge protection beneath the canopy. The challenge of ordinary closed-head sprinkler systems operating beneath open-sided canopies was discussed; due to high air flows and potential for heat to escape the sides of the canopy, ordinary sprinkler systems can be ineffective.

Provide a zoned deluge system for the canopy; suggested divided into three zones of approx. 500m² each. The deluge system should be activated by a heat detection system – e.g. IR detection or UV detection. A double-knock or coincident system can be provided, requiring two detectors to alarm in order for the deluge protection to activate.

More information can you find at chapter 6 (smoke and heat exhaust openings).

Dimensioning water sprinkler system:

canopy

designed according
system:
triggering sprinkler system

designed to provide a density of
release temperature
RTI- value
effective area

working period

DS 8-7 Baled Fibre Storage
deluge sprinkler system
pneumatic triggering sprinkler system and
additional manual release
6 mm/min over 560m²
74°C
K115
design hydraulics for two zones to operated
concurrently
240 min

social annex

designed according
hazard category
system:
designed to provide a density of
released temperature
RTI- value
working period

DS 3-26
HC 1
wet sprinkler system
4mm/min over 140m²
74°C
K80
60 min

raised floors / cable cellar at the switch gear rooms

designed according
max. Area of coverage
designed to provide a density of
release temperature
RTI- value
effective area
working period

DS 5-31 Cables and bus bars Section 2.3.1
12 m²
8mm/min
74°C
K115
279 m²
60 min

In addition to specific details below, design all sprinkler systems in accordance with FM Global Property Loss Prevention Data Sheet 2-0 Installation Guidelines for Automatic Sprinklers, using FM Approved equipment. Submit all designs and hydraulic calculations for review by FM Global prior to ordering components or commencing installation.

Interlock any pulp / secondary fibre conveyers to shut down automatically if the fire alarm or sprinkler systems activate

4.3. DEPARTMENT C – Paper machine building (Neptune)

The fire water supply is carried out as a connection to the existing fire water loop (see chapter 4.1). The alarm valves are located inside the sprinkler substation. The sprinkler substations are built as a separate fire compartments with access from outside.

Protection concept Department C:

Inside the Department C – paper machine level area wide automatic sprinkler system is installed. For special areas (for example: lube oil systems or hydraulic system) the fire protection is carried out with a sprinkler system with higher designed water capacity.

The basement level of the paper machine building (department C) are detected by smoke or heat detectors.

At the basement level are lube oil and oil storage areas located. This special areas equipped with automatic sprinkler systems.

Inside the reeling hood of the paper machine (Neptune) also a sprinkler protection is installed (Valmet to clarify the system to FM Global directly).

The main control room is also equipped with an automatic sprinkler system.

The technical annex and the staircases are equipped with an automatic fire alarm system (smoke detectors).

Transformer stations are equipped with smoke aspiration system.

The MCC room (mezzanine level) and the corridor in front of the transformer room (machine level) are detected by smoke detectors or smoke aspiration systems.

The cable vault of the MCC room only is protected with a sprinkler system. The switch gear cabinet level is equipped with smoke detectors. The floor separating the MCC cable vault by the upper MCC room is NOT fire rated.

In addition, at all emergency exits push buttons, wall hydrants (hose stations) and fire extinguishers are installed. The number and placement are carried out according to the local regulations and guidelines.

A dry riser pipe at the staircase is installed up to the roof and guaranteed a good fire water supply in case of a fire event on the roof of the department C.

The alarm in case of fire is carried out with combined flash lights and alarm sirens. This flash lights and alarm sirens are installed area wide.

In all cases the fire pre-alarms and fire alarms are linked to the main automatic fire alarm system in the main control room of the new paper mill and to the existing fire alarm system and to the gate house main entrance.

The automatic fire alarm system is located in an own technical room. This room is built as an own fire compartment.

Heat and smoke exhaust openings are installed at the roof and they are normally closed. The manually release by the local fire brigade of this heat and smoke exhaust openings are carried out via push buttons. The outside gates are designed for manually open (by fire brigade) to supply fresh air in case of fire (when open the heat and smoke exhaust openings).

More information can you find at chapter 6 (smoke and heat exhaust openings).

Dimensioning water sprinkler system:

paper machine hall roof level

designed according	DS 7-4
system	wet sprinkler system
designed to provide a density of	6mm/min over 232m ²
release temperature	30°C over highest room temperature [74°C]
RTI- value	K115 or K160
working period	90 min

paper machine mezzanine level

designed according	DS 7-4
system	wet sprinkler system
designed to provide a density of	6mm/min over 232m ²
release temperature	30°C over highest room temperature [74°C]
RTI- value	K115 or K160
working period	90 min

inside reeling hood paper machine (Neptune)

note that automatic sprinkler protection is not required in the Yankee cylinder hood.

designed according	DS 7-4
system	wet sprinkler system
RTI- value	K factor 115
design	8 mm/min over 280m ²
released temperature	141°C
working period	90 min

main control room and small social annex

designed according	DS 3-26
hazard category	HC1
system	wet sprinkler system
designed to provide a density of	4mm/min over 140m ²
released temperature	74°C
RTI- value	K80
working period	60 min

over Hydraulic / lube oil units and 6m beyond

designed according	DS 7-4 Section 2.1.4.3
system	wet sprinkler system
RTI- value	K factor 115 or higher
design	12 mm/min over 370m ² ; max. 9m ² / sprinkler
released temperature	74°C
action time	60 min

raised floors / cable cellar at the switch gear rooms

designed according	DS 5-31 Cables and bus bars Section 2.3.1
max. Area of coverage	12 m ²
designed to provide a density of	8mm/min
release temperature	74°C
RTI- value	K115
effective area	279 m ²
working period	60 min

In addition to specific details below, design all sprinkler systems in accordance with FM Global Property Loss Prevention Data Sheet 2-0 Installation Guidelines for Automatic Sprinklers, using FM Approved equipment. Submit all designs and hydraulic calculations for review by FM Global prior to ordering components or commencing installation.

4.4. DEPARTMENT I – Pipe Bridge

Protection concept Department I:

Inside the pipe bridge a fibre optic linear heat detector is installed directly over the cable trays.

This linear heat detector cable is able to detect a possible fire event on the pipe bridge and forward it to the fire alarm system.

In addition, push buttons, wall hydrants (hose stations) and fire extinguishers are installed. The number and placement are carried out according to the local regulations and guidelines.

The alarm in case of fire is carried out with combined flash lights and alarm sirens. This flash lights and alarm sirens are installed area wide.

In all cases the fire pre-alarms and fire alarms are linked to the main automatic fire alarm system in the main control room of the new paper mill and to the existing fire alarm system and to the gate house main entrance.

5. AUTOMATIC FIRE ALARM SYSTEM

The automatic fire alarm system should be installed in accordance with BS 5839-1:2017 Category M. The automatic fire detection and alarm shall be installed in accordance with BS 5839-1:2017 L2.

The automatic fire alarm system for the two building parts (department A+B and department C) is designed as a cross-linked system.

An own (standalone) automatic fire alarm system is located in the technical room inside the department B (axis B4-B5/ BH-BI) to provide all necessary functions and facilities for the fire alarm, alerting and signalisation inside the bale handling and pup storage.

An additional own (standalone) automatic fire alarm system for the department C (paper machine building) and department I (pipe bridge) is located in the technical room inside the paper machine hall. This automatic fire alarm system is able to provide all necessary functions and facilities for the fire alarm, alerting and signalisation inside the paper machine hall and the pipe bridge.

The two standalone solutions are linked together as a cross-linked automatic fire alarm system. Over a requisite gateway all signals, alarms and datapoints can be transferred to the existing automatic fire alarm system in the existing paper mill.

In addition a control cabinet (as part of the cross-linked automatic fire alarm system) is located inside the main control room of the paper machine Neptune.

In case of maintenance works of the sprinkler system, inside the two different sprinkler substations are also remote-control panels of the automatic alarm system installed.

The fire detection system is triggered by:

- automatic fire detectors
- non-automatic fire detectors (push-buttons), installed in the escape ways and emergency exits
- alarm pressure switches at the alarm control stations
- flow sensors within the object protection systems (oil and lube stations; paper machine hood)

The following areas are equipped with automatic fire detectors.

Basement level of the paper machine building (department C)

The basement level of the department C (paper machine building) are equipped with a area wide automatic fire alarm system (smoke detectors).

Department B4

The sanitary rooms are equipped with a smoke or heat detectors.

Staircase

The staircases are equipped with smoke detectors.

Auxiliary power transformers

The auxiliary power transformers are equipped with a smoke aspiration system.

emergency lighting room

The battery room for emergency lighting are equipped with smoke detectors.

Pipe bridge

The pipe bridge is equipped with smoke detectors or linear measuring detectors.

All smoke detectors must be marked according to the regulations.

6. FACILITIES FOR THE FIRST FIRE FIGHTING

6.1. Dry riser pipe

For the first fire fighting at the roof of the different building parts dry riser pipes are installed. This dry riser pipes are equipped with couplings at the bottom, in all levels (with doors) and at the roof.

According to the British standards BS 336:2010, a female 65mm standard coupling is required at the floor levels.

At outside the installation of the coupling is carried out in coordination with fire brigade.

Location of the dry riser pipes:

- Department A+B (bale handling + pulp storage)
 - at the steel structure stair
 - axis B5 / BI
- Department C (paper machine building)
 - at the steel structure stair
 - Axis C10 / CB

The exact position of dry riser pipe including the coupling for the fire brigade must be checked and fixed in coordination with local fire brigade and with the authorities.

In case of fire the dry risers can be supplied with water from the ground floor (outside of the building). In this case, an underfloor hydrant is located directly in front of the power station.

The exact position of the underfloor hydrant can be seen in the attached drawings.

6.2. Wall hydrants (hose stations)

Inside the different departments and on all levels wall hydrants (hose stations) are located.

All wall hydrants (hose stations) are supplied by an own fire water pipe work inside each building part.

Specification of the wall hydrants (hose station):

- two-leaf steel cabinet, primed, for surface mounting or flush mounting, incl. fastening
- swivel-out hose reel
- red RAL 3000 powder-coated
- 40m high pressure hose reel axle
- multi-purpose nozzle
- fire cock with racord connection and connecting hose
- shield and sign
- pictograms according to relevant standards and guidelines
- place for hand-held fire extinguishers next to the hose reel
- wall or floor console including mounting

The wall hydrants (hose stations) shall be selected and located according to the national guidelines and standards.

The exact position of the wall hydrants (hose stations) can be seen in the attached drawings.

6.3. Fire extinguishers

The total area and all levels are equipped with fire extinguishers.

The exact placement and the type of the fire extinguishers is to be determined together with the local fire brigade. The BHM proposal should be used water mist fire extinguishers.

The fire extinguishers shall be selected and located according to the national guidelines and standards (BS 5306).

7. SMOKE AND HEAT EXHAUST SYSTEM

All departments are equipped with smoke and heat exhaust systems.

This system consists of openings for fresh air supply in the upper level of the building and smoke exhaust openings in the roof.

In case of fire the openings for the smoke and heat exhaust system (fresh air and smoke exhaust openings) can only be opened manually. An automatic opening in the event of a fire alarm is not provided.

The release button of the smoke and heat exhaust system is located at the ground level at the main attack routed of the fire brigade. In the course of project implementation, the exact placements must be coordinated and fixed with the fire brigade.

The design and dimensioning of the fresh air and smoke exhaust is carried out according to the local standards and guidelines.

7.1. Smoke and heat exhaust openings department A+B

The heat and smoke exhaust openings at the roof is carried out with the function for the daily ventilation.

For this proposal the openings are equipped with a second cylinder. This cylinder is carried out as an double action cylinder with the function open and close. In case of a fire alarm (or pre-alarm) the roof openings for daily ventilation are closed automatically.

In case of fire the heat and smoke exhaust openings can be opened by the fire brigade only via push buttons.

Location of the release buttons of the smoke and heat exhaust system:

- for department B2
 - axis B5 / BH
 - axis B4 / BD (both floors)

The designed position of the release button is visible at the attached drawings.

The exact location must be coordinated on site with the local fire brigade.

7.2. Smoke and heat exhaust openings department C

Inside the department C (paper machine building) have only the function smoke and heat extraction.

In case of fire the heat and smoke exhaust openings can be opened by the fire brigade only via push buttons.

Location of the release buttons of the smoke and heat exhaust system:

- for department C
 - basement, axis C3 / CD
 - machine floor, axis C12 / CC4

The designed position of the release button is visible at the attached drawings.

The exact location must be coordinated on site with the local fire brigade.

8. PROCESS CONTROL IN CASE OF FIRE

In case of fire some process components or whole systems switch off or turn into a controlled operation modus.

All process components are controlled by a plant control system. Fire alarms and pre-alarms from the fire detection system are connected to the plant control system. The controlling of the different modes (shut off and running in controlled operation) is operated by the plant control system.

The process control in case of fire must be developed together with the paper machine specialist, the local fire brigade and the client.

The following process controls are finally clarified with FM- Global. Other additional process controls in case of fire can be still arise in the course of the project. The final coordination of the requirements finally requested by FM Global, the Client and the machine supplier Valmet and consider and include in the detail design of the system. It is included in the Contractor scope

Department A+B:

Interlock any pulp / secondary fibre conveyers to shut down automatically if the fire alarm or sprinkler system activate.

Department C:

FM Global requirement – 15: Where conveyer systems take finished rolls through a fire partition, configure them so that they cannot stop or “park” beneath fire shutters and prevent them from closing.

- a. The conveyer control system should stop on activation of fire alarm; however, it should be arranged to clear a fire shutter before stopping.
- b. It may be desirable to link fire shutters to a scanner to prevent the shutter from attempting to close until the area is clear of rolls. If the area is not cleared within a certain period (e.g. 30 seconds), the shutter should release anyway.

FM Global requirement – 24: Where possible, activation of sprinklers on the oil systems should shut down the hydraulic system. However, if this would cause excessive damage to the paper machine, then it is acceptable for it to initiate a controlled stop, immediately followed by all oil system pumps stopping.

FM Global requirement – 25e: Provide fire detection on the shoe press cylinder area, including a waterflow alarm for the shoe press specific sprinkler heads, and also heat detection within the machine, along the line of the cylinder. A number of “pencil”-type heat detectors could be used,

spaced across the machine width, or a continuous “fire-wire” device could be used. Activation of alarm devices should sound a specific alarm in the control room.

FM Global requirement – 25f: Activation of fire detection systems should initiate a controlled shutdown of the machine, including the shoe press loading hydraulics (as quickly as possible) and the lubrication systems once the machine has completely stopped. Operators should also initiate a controlled shut in the event of fire on the shoe press.

9. ALERTING AND SIGNALIZATION

9.1. Alarm horn and flash lights

The complete plant incl. all secondary rooms and all levels is equipped with an alerting and signalization system.

Alarm horns are preferably used. In areas with high noise level there are combined sirens with flashlights installed. The areas with high noise level have to be defined.

The intensity of volume and the arrangement of the sirens and flashlights shall be carried out according to the national guidelines and regulations (BS 5839-1:2011).

9.2. Emergency lighting

The building will be equipped with emergency lighting including safety lights and also self-luminous indication signs which helps to find the escape routes.

The exact set up of the lamps and signs as well as the illumination level can be found in the attachment "emergency lightning calculation" and "emergency lightning plans". Both, safety lights and self-luminous indication signs will be connected to the emergency central battery system.

The connection cable will be classified at least in fire resistance class F60. The emergency central battery system will guarantee autonomous time of 180 minutes. It will be placed in an own room on the ground level, this room will be ventilated and also deaerated.

9.3. Doors

Doors and gates in all fire rated walls are FM global approved fire doors or fire shutters. The fire doors and fire shutters should have the same fire rating as the wall in which they are installed.

The fire shutters are equipped with smoke detectors on both sides to close the fire shutter automatically. This smoke detectors are not linked to the automatic fire alarm system.

10. FIRE SEALING

All openings in fire walls are closed according to the local regulations and standards.

When air ducts cross the fire walls, fire dampers are installed. The fire dampers are equipped with melting solder and limited switches.

11. REFERENCE DOCUMENTS

- A. 56200_OVE_8422_Fire_Suppresion_System_PRE_03_27-05-2020
- B. 56202_FPR_9200_B-Fire-protection-building_RFT_00_25-05-2020
- C. 56203_FPR_9201_C-Fire-protection-building_RFT_00_25-05-2020
- D. 51202_OVE_2208_B-fire-compartmentation_RFT_02_25-05-2020
- E. 51203_OVE_2309_C-fire-compartmentation_RFT_01_14-05-2020

12. ATTACHMENTS

- 12.1. **HNLA Fire Engineering_Dept A&B_Fire Strategy Report_28th May 2020**
- 12.2. **HNLA Fire Engineering_Dept C_Fire Strategy Report_28th May 2020**
- 12.3. **FM - Global Proj Rpt Site Expansion and Neptune Paper
Machine_2020_05_21**
- 12.4. **FM - Global Tissue Machine Protection – Firefly AB – Project
Neptune_2020_05_20**
- 12.5. **FM - Global Plan Rev AS Departments A, B & C PR314322_2020_05_11**

ATTACHMENT 12.1

HNLA Fire Engineering_Dept A&B_Fire Strategy Report_28th May 2020





hnla fire engineering

**WEPA
Dept. A&B
Bridgend Paper Mills
Fire Strategy Report**

May 2020

www.fire-engineering.co.uk

Document Verification				
Document Title		WEPA Bridgend Paper Mill Dept A&B Fire Strategy Report		
Status	Date	Filename	Bridgend paper mills/site expansion/dept A&B	
1 st Issue	28 th May 2020	Description	Fire Strategy Report	
		Name	Prepared By Gareth Lloyd BSc(Hons)FIFireE	Checked By Jon Harding BEng CEng FIFireE
		Signature		
Revision	Date	Filename		
		Description		
		Name	Prepared By	Checked By
		Signature		
Revision	Date	Filename		
		Description		
		Name		
		Signature		

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1 Introduction

HNLA Fire Engineering has been appointed by WEPA UK Ltd. to provide fire safety and fire engineering support for the site expansion project at Bridgend Paper Mills, Llangynwyd, Bridgend.

This report is designed to provide an assessment of the fire safety provisions in the development and to act as a discussion document for the design team.

This report covers Department A+B of the project. This report should be read in conjunction with the relevant plans for the building.

This report is based on plans provided by BHM INGENIEURE.

This report has been prepared and is intended for the sole use of WEPA UK Ltd. and the design team for the project. The information contained herein shall not be relied upon by a third party, HNLA Fire Engineering will not accept any responsibility for matters arising as a result of a third-party use.

The report is based on the following drawings:

51202__LAY_2201_B-ground-views_RFT_02

51202__LAY_2201_B-ground-views_RFT_03

51202__LAY_2201_B-roof-view_RFT_02

51202__LAY_2201_B-roof-view_RFT_03

51202__ELE_2204_B-elevations_RFT_02

51202__ELE_2204_B-elevations_RFT_03

51202__SEC_2203_B-sections_RFT_02

51202__SEC_2203_B-sections_RFT_03

2 Appropriate Guidance

Fire safety provisions for new buildings are enforced under The Building Regulations 2010. The standards laid down under the Regulations are functional and state only the aim to be achieved by the Regulations

Guidance on the design of new buildings is provided in Approved Document Part B Fire Safety to the Building Regulations and also BS9999:2017, *Fire safety in the design, management and use of buildings – Code of practice*.

BS9999 has been used as a basis for the design of the building to comply with Part B (Fire Safety) of the Building Regulation.

Elements of the design may require ongoing discussion with the Building Control Authority and South Wales Fire and Rescue Service.

The Regulatory Reform (Fire Safety) Order 2005 (RRO) will apply to the completed building.

This report is designed to show compliance with the Building Regulations 2010 and the Regulatory Reform (Fire Safety) Order 2005 in terms of the building design.

Interested parties such as insurers may require different standards and should be consulted on these matters.

3 Description of the Project

The project comprises a single building consisting of Ground and upper Ground Floor.

The structure is built on a sloping site with the Ground Floor having access at that level on the North and West elevations.

The upper Ground Floor has level access on the South and East elevation.

The building has a footprint of approximately 3200m² excluding the open pulp storage area.

The upper Ground Floor consists of an open storage for pulp together with an area for processing paper pulp, a control room, welfare facilities and switch room. These areas are under the cover of a canopy

The Ground Floor provides the majority of the building space and is principally used for plant. The process is a 'wet' process and the area is low risk.

The overall height of the building is approximately 11.9m in height. The upper Ground Level is approximately 6m above ground where it coincides with the Ground Floor.

4 Sprinklers

The building will be provided with a sprinkler system installed to FM Global Property Loss Prevention Data Sheets. The hazard category will be 'Baled fibre storage as per FM Global datasheet 8-7.

The sprinkler system will extend to under the canopy and to the office and welfare facilities only. The final sprinkler specification will need to include the requirements of the insurers and these will be included in the sprinkler design document.

The system is installed for property protection purposes.

5 Risk Profile

5.1 Occupancy Characteristics

All areas of the building are classified as **A** – awake and familiar with the building.

5.2 Fire Growth Rate

All areas of the building except hazard rooms would be regarded as Category **2**.

Hazard rooms such as kitchens, laboratories and plant rooms may be regarded as category **3** but will be separated from the remainder of the building by fire resisting construction.

5.3 Risk Profile

A Risk Profile of **A2** has been adopted for all areas.
The overall risk profile for the building is **A2**.

6 Management

Management of fire safety is crucial to the success of any fire safety scheme. Once the building is occupied, management procedures are enforced under the Regulatory Reform (Fire Safety) Order 2005.

BS9999 includes requirements for management of fire safety as part of the overall risk relevant approach.

The minimum Management Level specified in BS9999 is **Level 1**.

A Fire Safety Manual for the building should be developed prior to occupancy by the owners or occupiers. The manual should detail objectives and procedures which achieve a level 1 Management Level as a minimum. The Fire Safety Manual covers the following subjects:

- Planning for changes in Risk Profile
- Resources and authority
- Staffing level (staff–occupant ratio)
- Fire training
- Work control
- Communications procedures
- Maintenance and testing of fire safety systems
- Liaison with the fire and rescue service
- Contingency planning

7 Fire Protection Measures

7.1 Minimum Package of Fire Protection Measures

7.1.1 Fire Detection and Alarm System

From Table 7, a minimum type M fire alarm system is required in accordance BS5839-1:2017. An L2 standard fire detection and alarm system will be provided throughout the building.

7.2 Artificial and Emergency Escape Lighting

Emergency escape lighting will be provided in accordance with BS5266-1:2016 to all escape routes.

7.3 Fire Safety Signage

Every doorway or other exit providing access to a means of escape, other than exits in ordinary use (e.g. main entrances), should be distinctively and conspicuously marked by an exit sign in accordance with BS ISO 3864-1 and BS 5499-4.

7.4 Access Control

Doors affording means of escape provisions will not be fitted with access control systems.

7.5 Subdivision of corridors

There are no corridors that require subdivision.

7.6 Dead-end Corridors

There are no dead-end corridors in the building.

7.7 Other Provisions

All other fire safety provision will be designed in accordance with BS9999.

7.8 Additional Fire Protection Measures

7.8.1 Fire Detection and Alarm System

In addition to a Category M system, automatic fire detection will be provided in all areas of the buildings to an L2 standard in accordance with BS5839-1:2017. The effect of this would be to provide earlier warning of fire and less response time than would otherwise be provided for the minimum standard required. In accordance with BS9999 it is considered appropriate to extend travel distances by 15%. Door widths and stair widths may also be reduced.

8 Means of Escape

8.1 Occupancy

Exact occupancy figures were not available at the time of writing this report.

The maximum occupancy of the building is likely to be less than 20 persons.

8.2 Travel Distances

From Table 11 the travel distances shown below are applied. Travel distances for A2 have been increased by 15% in accordance with BS9999 Clause 18. These extended distances are shown in brackets in the following table.

	Single direction (m)		Two directions (m)	
	Actual	Direct	Actual	Direct
A2	22 (25.3)	15(17.25)	55 (63.25)	37 (42.55)
External Roof	60		200	

All travel distances are within these limits.

8.3 Exit Widths

In accordance with BS9999 Clause 18 it is possible to reduce door widths by 15%. However, given the low occupancy of the building there is no benefit in this. Therefore, exit capacities are as stated in BS9999 without modification.

Doors affording means of escape are a minimum of 850mm wide with final exit doors being 900mm wide. Given the low occupancy levels, this is considered acceptable.

Using equation 1 from Section 16.6 of the standard ($n=500/m$) where 'n' is the number of persons safely accommodated by the exit and where 'm' is the minimum door width per person taken from table 12 of BS9999, it can be seen that even with .85m doors the number of persons safely accommodated by the door $500/3.6=138$.

The occupancy will not exceed 20 persons and therefore all exit widths are satisfactory.

8.3.1 Ground Floor

All areas

The area under the canopy is open sided and as such has exit routes available on the East and South elevations. A control room on grid line B4 opens directly onto the Pulp Storage area. The control room has vision over the Pulp Storage area. A staircase leads from immediately outside the control room to the floor level of the Bale Handling area.

The Bale Handling area has welfare accommodation and a control room along the North elevation. This accommodation is at high level to the machinery spaces at floor level.

There is one exit via the external staircase on the North elevation and a further route at the higher level of Bale handling to the Pulp Storage area.

The switchroom has two three exits, two of which are 1050mm and a third of 1740mm. These are satisfactory.

All exits will be a minimum 850mm.

The exit capacity exceeds the occupancy and is therefore acceptable.

Lower Ground Floor (Bale Handling)

The area has 2 exits, both 900mm wide.

Each exit should be a minimum 850mm.

The exit capacity exceeds the occupancy and is therefore acceptable.

8.4 Vertical Escape

The building is provided with 1 escape stair and two external stairs. Each stair will be at least 1100mm wide between handrails as defined in BS9999/ADB.

The Sludge Press area is served by a single enclosed staircase. The area is a plant area and is generally unoccupied. When occupied a reasonable occupancy level would be 5

persons. The minimum staircase width is 1m. The staircase is 1.1m wide between handrails. The staircase width exceeds the minimum staircase width for the occupancy and is therefore satisfactory.

The welfare and staff area are served by an external staircase on the Northern elevation. The occupancy of the area will not exceed 20 persons. The staircase is 1.1m therefore the staircase capacity exceeds the occupancy and is therefore satisfactory.

The staircases are protected in accordance with BS9999/ADB.

The switchroom is served by an external staircase on the Northern elevation. The occupancy of the area will not exceed 5 persons. The staircase is 1.1m wide therefore the staircase capacity exceeds the occupancy and is therefore satisfactory.

The stairs are not required to be lobbied.

Staircase width reduction has not been applied.

The exits from all stairs are 900mm wide. Given the occupancy levels in the building this is considered acceptable.

8.5 Means of Escape for Disabled Persons

Provisions for non-ambulant people detailed below are in accordance with BS9999.

On occupation, it will be necessary to re-assess provisions based on the actual needs of the building occupants. Some additional provision may be required.

8.6 Ground Floor

It is assumed that level egress will be provided from all exits.

8.7 Upper Floors

The staff rest area has direct access to an external staircase. Due to the nature of the work activities in the area it is considered that disabled persons are extremely unlikely to work in this area. A management strategy will be developed using an evacuation chair will be implemented if necessary. A refuge is therefore not considered necessary for this area.

8.8 Communication

An emergency voice communication (EVC) system is not considered appropriate for these areas. This decision is based on the comments made in 8.7 above. Where necessary, a management strategy will be developed for any particular situation that may present itself in the future.

9 Internal Fire Spread (Linings)

All circulation spaces will be class 0/B-s3, d2.

All other rooms will be a minimum Class1/C-s3, d2; with respect to surface classification.

Materials will be non-combustible.

10 Internal Fire Spread (Structures)

10.1 Structural Fire Resistance

All structural elements that support a floor structure will provide a minimum of 60 minutes fire resistance (structural integrity) in accordance with Table 23 in BS9999.

10.2 Compartmentation

There is no limit on compartment floor areas in buildings with a A2 Risk Profile. There is no requirement for compartment floors.

Rooms such as laboratories, kitchens, plant rooms which are considered to be Category 2 will be separated from Category 1 areas by 30-minute fire resisting construction.

Where fire rated shutters and doors are provided, these will be of the same standard of fire resistance as the wall in which they are fitted. Where shutters are provided these will be linked to the fire alarm system and have smoke detectors fitted either side of the shutter.

Protected Shafts

The building is uncomparted and therefore protected shafts are not required on the grounds of compartmentation.

There is no requirement for firefighting shafts.

Dampers

A review of the ventilation system with regard to fire and smoke dampers should be carried out at detailed design stage.

Ancillary Accommodation

Area of ancillary accommodation such as plant rooms, store rooms and switch rooms will be provided with compartmentation in accordance with BS9999 Table 29.

10.1 Concealed Spaces

Cavity barriers will be provided in accordance with BS9999 Clause 33, Figure 35 and Table 32.

11 External Fire Spread

11.1 Building Envelope

There are no restrictions on the use of combustible insulation in the envelope of non-residential buildings under 18m (highest occupied floor). The current design incorporates materials used in the exterior walls of the building of Class A1/A2 in accordance with BS EN 13501-1.

Cavity barriers and fire stopping should be provided in accordance with BS9999 Figure 35.

11.2 Space Separation

From the information available at the time of writing the report, it is anticipated that there are no boundary conditions requiring fire resistance to the exterior of the building.

11.3 Roof Coverings

All roof coverings should meet as a minimum $C_{ROOF}(t_4)$ (BS EN 13501-5).

12 Firefighting Facilities

The building has a total floor area of approximately 3930 m², is lower than 11m and is not fitted with fire mains. Access for Fire and Rescue Service appliances is therefore required for pumping appliances only to 15% of the perimeter.

Access for pumping appliances is provided to at least 50% of the perimeter.

Access routes will comply with Table 20 of BS9999.

The building has an occupancy Risk Category A and does not have a floor above 11m. Therefore, there is no requirement for firefighting facilities.

12.1 Fire Hydrants

It should be established that there is at least one fire hydrant provided within 90m of all fire main inlets. These should meet the minimum flow requirement of 1500lmin⁻¹ given in BS9990.

13 Ventilation

A system of smoke removal incorporating heat and smoke vents is to be provided for the canopy area. The system will also be used for environmental reasons and may be open or closed as appropriate. On the actuation of the fire alarm system will either remain closed or will close. Subsequent operation of the vents will be under the control of the Fire and Rescue Service. Full details of the system will be included when available.

ATTACHMENT 12.2

HNLA Fire Engineering_Dept C_Fire Strategy Report_28th May 2020





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**WEPA
Dept. C
Bridgend Paper Mills
Fire Strategy Report**

May 2020

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Document Verification				
Document Title		WEPA Bridgend Paper Mill Dept C Fire Strategy Report		
Status	Date	Filename	Bridgend paper mills/site expansion/dept C	
1 st Issue	28 th May 2020	Description	Fire Strategy Report	
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		Description		
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1 Introduction

HNLA Fire Engineering has been appointed by WEPA UK Ltd. to provide fire safety and fire engineering support for the site expansion project at Bridgend Paper Mills, Llangynwyd, Bridgend.

This report is designed to provide an assessment of the fire safety provisions in the development and to act as a discussion document for the design team.

This report covers Department C of the project. This report should be read in conjunction with the relevant plans for the building.

This report is based on plans provided by BHM INGENIEURE.

This report has been prepared and is intended for the sole use of WEPA UK Ltd. and the design team for the project. The information contained herein shall not be relied upon by a third party, HNLA Fire Engineering will not accept any responsibility for matters arising as a result of a third-party use.

The report is based on the following drawings:

51203__LAY_2301 Dept. C Basement and machine floor
51203__LAY_2202 Dept. C Mezzanine floor and roof view
51203__SEC_2303 Dept. C Sections
51203__SEC_2304 Dept. C Sections
51200_OVE_2001 Mill site layout
51203_OVE_2309 Fire compartmentation and escape routes

2 Appropriate Guidance

Fire safety provisions for new buildings are enforced under The Building Regulations 2010. The standards laid down under the Regulations are functional and state only the aim to be achieved by the Regulations

Guidance on the design of new buildings is provided in Approved Document Part B Fire Safety to the Building Regulations and also BS9999:2017, *Fire safety in the design, management and use of buildings – Code of practice*.

BS9999 has been used as a basis for the design of the building to comply with Part B (Fire Safety) of the Building Regulation.

Elements of the design may require ongoing discussion with the Building Control Authority and South Wales Fire and Rescue Service.

The Regulatory Reform (Fire Safety) Order 2005 (RRO) will apply to the completed building.

This report is designed to show compliance with the Building Regulations 2010 and the Regulatory Reform (Fire Safety) Order 2005 in terms of the building design. Interested parties such as insurers may require different standards and should be consulted on these matters.

3 Description of the Project

The project comprises a single building consisting of Lower Ground Floor, Ground Floor Machine Hall and Mezzanine Floor. The structure is an extension of the existing paper making plant and will provide for the provision of an additional paper making machine.

The extension is attached to the existing building and has connections for materials to be brought into the machine hall and for paper reels to be moved to storage.

The structure is built on a sloping site with the Ground Floor having access at that level on the North and West elevations.

The building has a footprint of approximately 4000m².

The upper Ground Floor consists of an open storage for pulp together with an area for processing paper pulp, a control room, welfare facilities and switch room. These areas are under the cover of a canopy

The machine floor provides the majority of the building space and is principally used for the paper making machine and associated equipment. The machine hall largely is full building height. Within the space is a mezzanine level providing plant space for the paper making machine.

The basement area provides for plant and machinery associated with the paper making process.

The overall height of the building is approximately 17.47m from the machine hall floor to the roof of the structure.

The basement floor is 4.65m below the floor of the machine Hall.

The Mezzanine level floor is 6.8m above the Machine Hall floor.

4 Sprinklers

The building will be provided with a sprinkler system installed to FM Global Property Loss Prevention Data Sheets. The final sprinkler specification will need to include the requirements of the insurers and these will be included in the sprinkler design document.

Further discussions will determine the exact nature of the sprinklers in and around the drying hood of the paper making machine.

The system is installed for property protection purposes.

5 Risk Profile

5.1 Occupancy Characteristics

All areas of the building are classified as **A** – awake and familiar with the building.

5.2 Fire Growth Rate

All areas of the building except hazard rooms would be regarded as Category 2.

Hazard rooms such as kitchens, laboratories and plant rooms may be regarded as category 3 but will be separated from the remainder of the building by fire resisting construction. The control room is not considered to be a risk room as the use of the room is essentially an office and continually staffed.

5.3 Risk Profile

A Risk Profile of **A2** has been adopted for all areas of the building.
The overall Risk Profile for the building is **A2**.

6 Management

Management of fire safety is crucial to the success of any fire safety scheme. Once the building is occupied, management procedures are enforced under the Regulatory Reform (Fire Safety) Order 2005.

BS9999 includes requirements for management of fire safety as part of the overall risk relevant approach.

The minimum Management Level specified in BS9999 is **Level 1**.

A Fire Safety Manual for the building should be developed prior to occupancy by the owners or occupiers. The manual should detail objectives and procedures which achieve a level 1 Management Level as a minimum. The Fire Safety Manual covers the following subjects:

- Planning for changes in Risk Profile
- Resources and authority
- Staffing level (staff-occupant ratio)
- Fire training
- Work control
- Communications procedures
- Maintenance and testing of fire safety systems
- Liaison with the fire and rescue service
- Contingency planning

7 Fire Protection Measures

7.1 Minimum Package of Fire Protection Measures

7.1.1 Fire Detection and Alarm System

From Table 7, a minimum type M fire alarm system is required in accordance BS5839-1:2017. An L2 standard fire detection and alarm system will be provided throughout the building.

7.2 Artificial and Emergency Escape Lighting

Emergency escape lighting will be provided in accordance with BS5266-1:2016 to all escape routes.

7.3 Fire Safety Signage

Every doorway or other exit providing access to a means of escape, other than exits in ordinary use (e.g. main entrances), should be distinctively and conspicuously marked by an exit sign in accordance with BS ISO 3864-1 and BS 5499-4.

7.4 Access Control

Doors in the building affording means of escape provision will not be fitted with any access control systems.

7.5 Subdivision of corridors

Corridors connecting storey exits will be separated by FD30s fire doors in accordance with BS9999 Clause 16.3.11.3.

7.6 Dead-end Corridors

There are no dead-end corridors in the building.

7.7 Other Provisions

All other fire safety provision will be designed in accordance with BS9999.

7.8 Additional Fire Protection Measures

7.8.1 Fire Detection and Alarm System

In addition to a Category M system, automatic fire detection will be provided in all areas of the buildings to an L2 standard in accordance with BS5839-1:2017. The effect of this would be to provide earlier warning of fire and less response time than would otherwise be provided for the minimum standard required. In accordance with BS9999 it is possible to extend travel distances by 15%. Door widths and stair widths may also be reduced if necessary.

8 Means of Escape

8.1 Occupancy

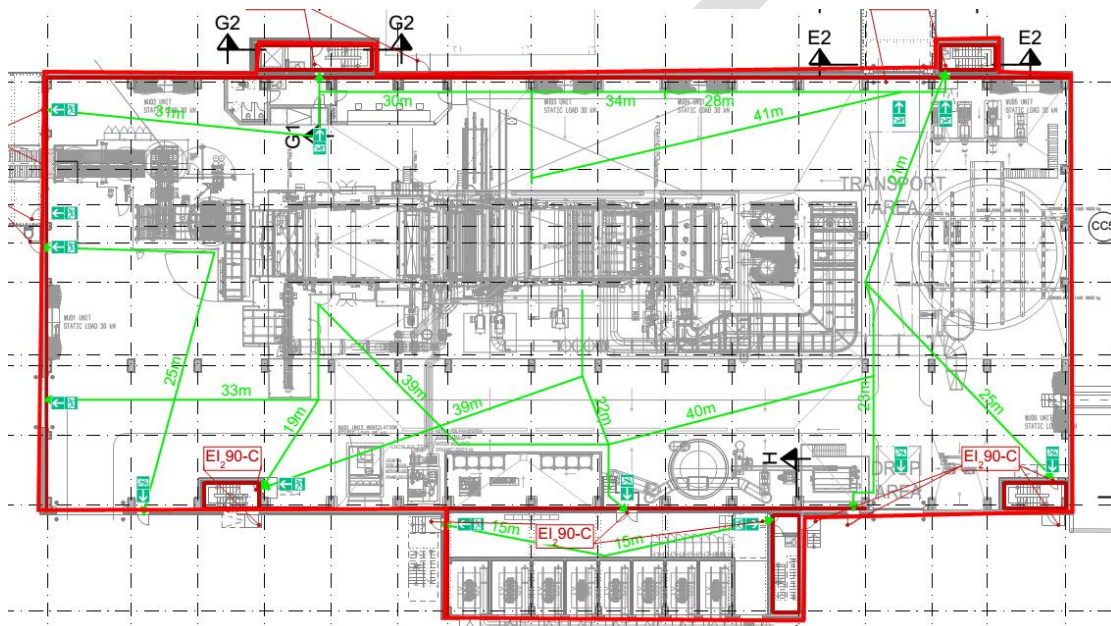
The maximum occupancy of the building will not exceed 30 persons.

8.2 Travel Distances

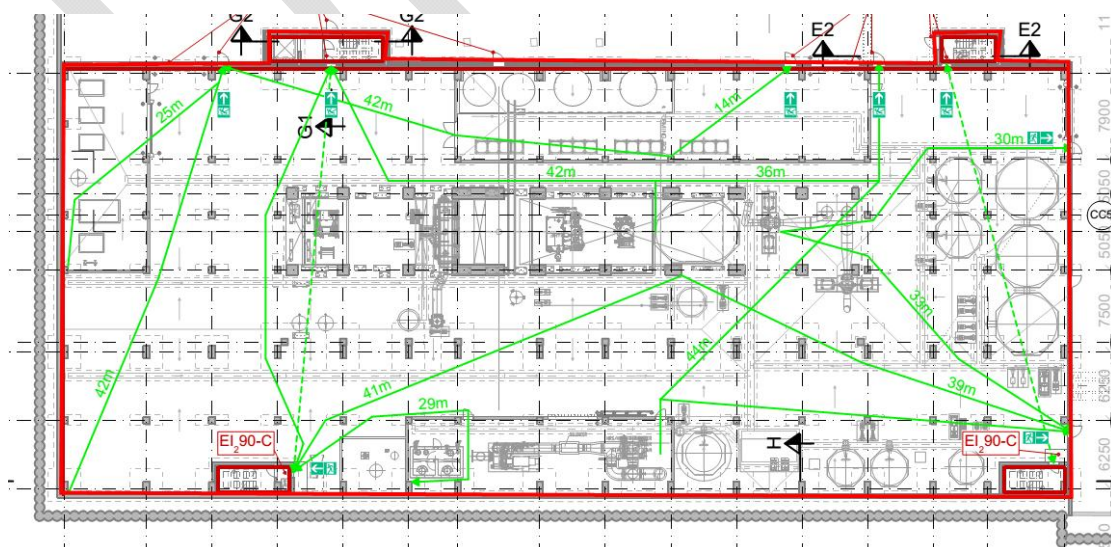
From Table 11 the travel distances shown below are applied. Travel distances for A2 have been increased by 15% in accordance with BS9999 Clause 18. These extended distances are shown in brackets in the following table.

	Single direction (m)		Two directions (m)	
	Actual	Direct	Actual	Direct
A2	22 (25.3)	15 (17.25)	55 (63.25)	37 (42.55)
External Roof	60		200	

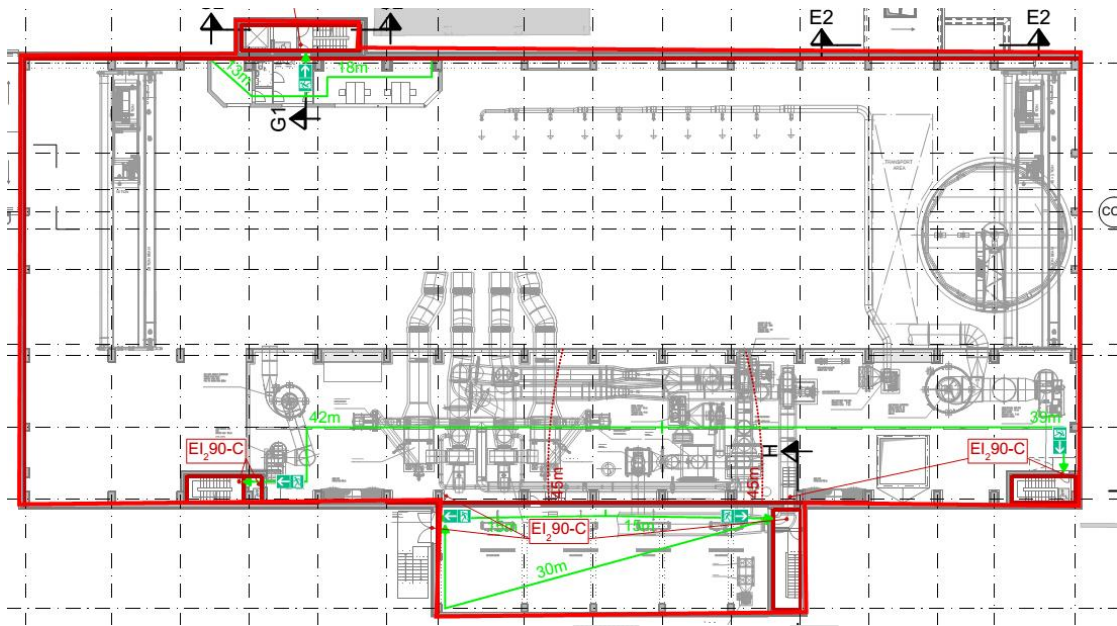
All travel distances are within these limits.



Machine Hall travel distances.



Basement level travel distances.



Mezzanine level travel distances.

8.3 Exit Widths

In accordance with BS9999 Clause 18 it is possible to reduce door widths by 15%. However, doors affording means of escape are a minimum of 850mm wide. However, given the low occupancy of the building there is no benefit in this. Therefore, exit capacities are as stated in BS9999 without modification.

	Exit width per person(mm)	Capacity of 850mm exit	Capacity of 1050mm exit	Capacity of 1500mm exit
A2	3.6	138	338	483

Using equation 1 from Section 16.6 of the standard ($n=500/m$) where 'n' is the number of persons safely accommodated by the exit and where 'm' is the minimum door width per person taken from table 12 of BS9999, it can be seen that even with .85m doors the number of persons safely accommodated by the door $500/3.6=138$. The occupancy will not exceed 30 persons and therefore all exit widths are satisfactory.

8.3.1 Machine Hall

There are a minimum of 10 exits well distributed around the perimeter of the area. All exits will be a minimum of 850mm. Discounting one exit leaves 9 exits.

The exit capacity exceeds the occupancy by a considerable margin.

8.3.2 Mezzanine level

The main area has 4 exits.

Each exit will be a minimum 850mm. Discounting one exit leaves 3 exits.

The exit capacity exceeds the occupancy by a considerable margin.

8.3.3 Basement level

There are 8 exits from the area. All exits will be a minimum of 850mm. Discounting one exit leaves 7 exits.

The exit capacity exceeds the occupancy by a considerable margin.

8.4 Vertical Escape

The Building is provided with 4 escape stairs. Each stair will be at least 1100mm wide between handrails as defined in BS9999/ADB.

The stairs are contained in 30-minute protected shafts.

The exits from all stairs are 900mm wide. Given the occupancy levels in the building this is considered acceptable.

In accordance with BS9999 Clause 18 it is possible to reduce stair widths per person by 15%. The Risk Profile A2 applies to all stairs. Currently, this has not been applied to the project.

The minimum width of a stair per person for an A2 Risk Profile serving 2 floors is 3.8. This gives a capacity of 114 per stair.

There are 4 staircases between the basement and the machine hall. There are 2 staircases serving the mezzanine and a single staircase serving the welfare area on the mezzanine.

Given that the maximum occupancy of the building is 30, it can be seen that there is more than sufficient staircase capacity for the occupancy.

There are sufficient staircases to satisfy travel distance requirements.

8.5 Means of Escape for Disabled Persons

The nature of the activities within the building determine that persons with disabilities are not able to work in this location. There are therefore no provisions made for disabled persons in this building.

The control room on the Machine Hall level is accessible for disabled persons. Access to the machine Hall is at ground level and therefore there are no special arrangements necessary for means of escape for disabled persons.

9 Internal Fire Spread (Linings)

All circulation spaces will be class 0/B-s3, d2.

All other rooms will be a minimum Class1/C-s3, d2; with respect to surface classification.

Materials will be non-combustible.

10 Internal Fire Spread (Structures)

10.1 Structural Fire Resistance

All structural elements that support a floor structure will provide a minimum of 60 minutes fire resistance (structural integrity) in accordance with Table 23 in BS9999.

10.2 Compartmentation

There is no limit on compartment floor areas in buildings with an A1 Risk Profile. There is no requirement for compartment floors. Although the lower level of the building is surrounded by higher ground on the South elevation, final exits are available from that level on other elevations with protected stairs being available on the South elevation.

However, the floor between the lower level and the machine hall is a reinforced concrete structure.

The mezzanine level consists entirely of plant with the exception of a small area for welfare facilities on the North elevation.

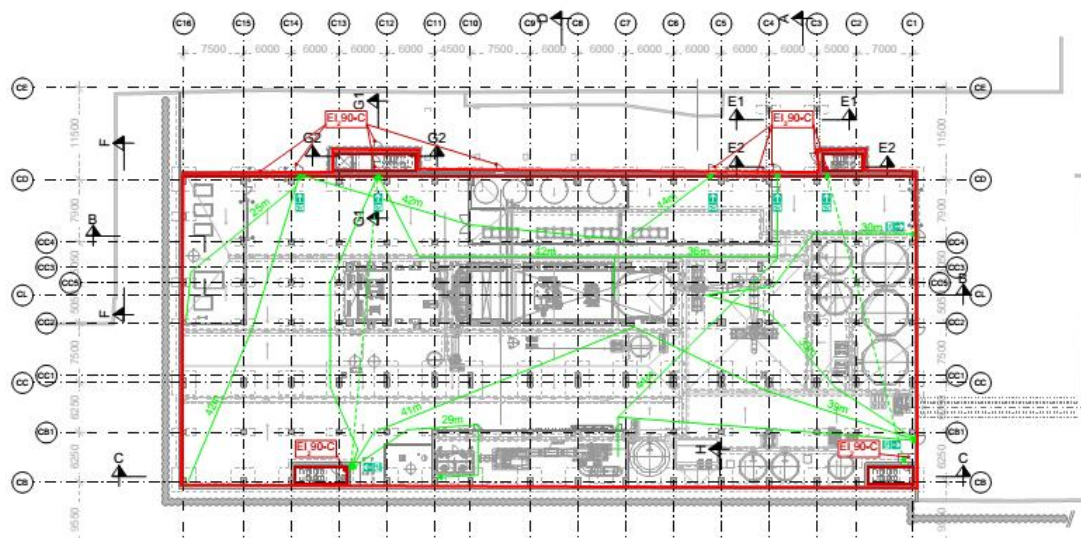
The external elevations between existing and new build will provide 60 minutes fire resistance.

Where fire rated shutters and doors are provided, these will be of the same standard of fire resistance as the wall in which they are fitted. Where shutters are provided these will be linked to the fire alarm system and have smoke detectors fitted either side of the shutter.

Fire resisting elements:

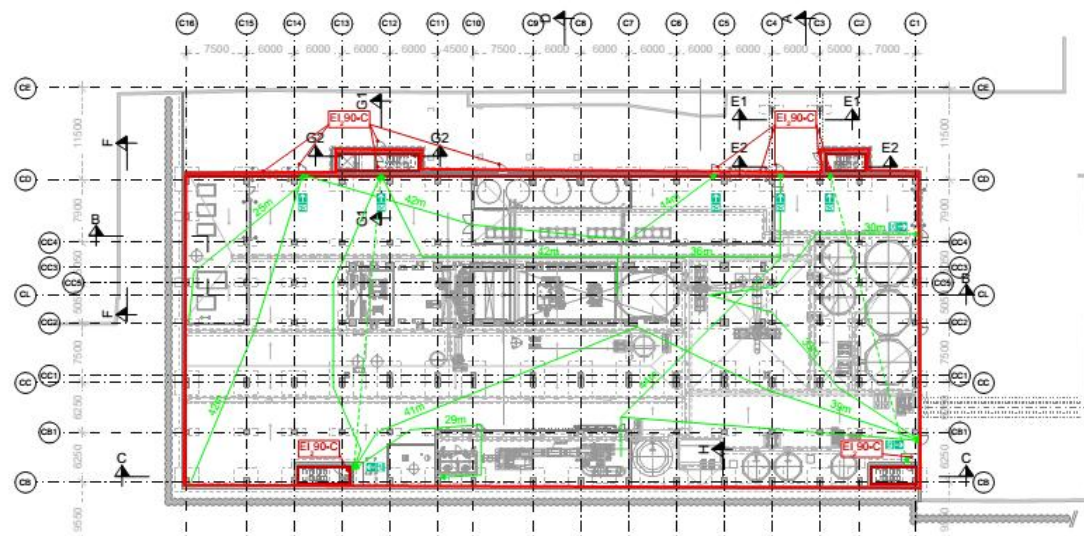
BASEMENT

1:500



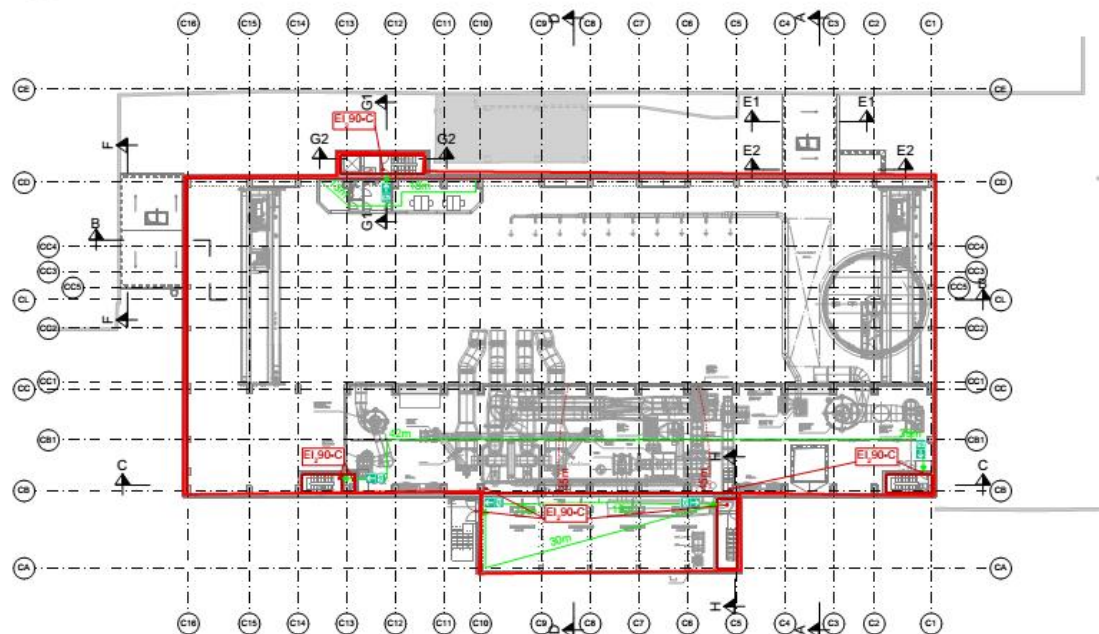
BASEMENT

1:500



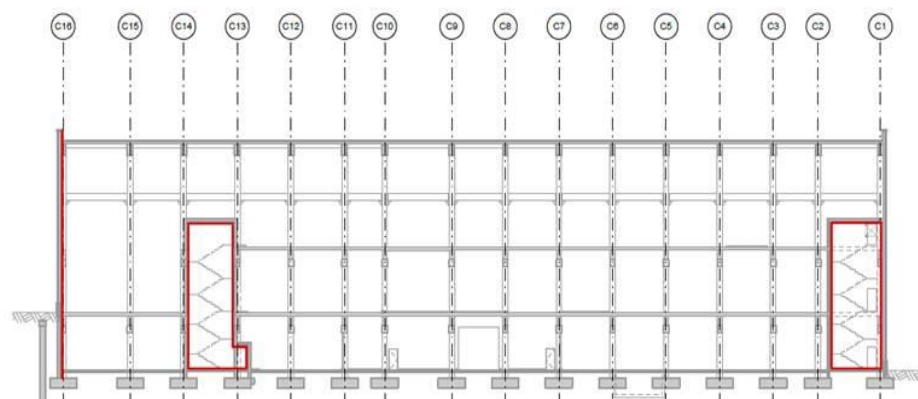
MEZZANINE FLOOR PLAN

1:500

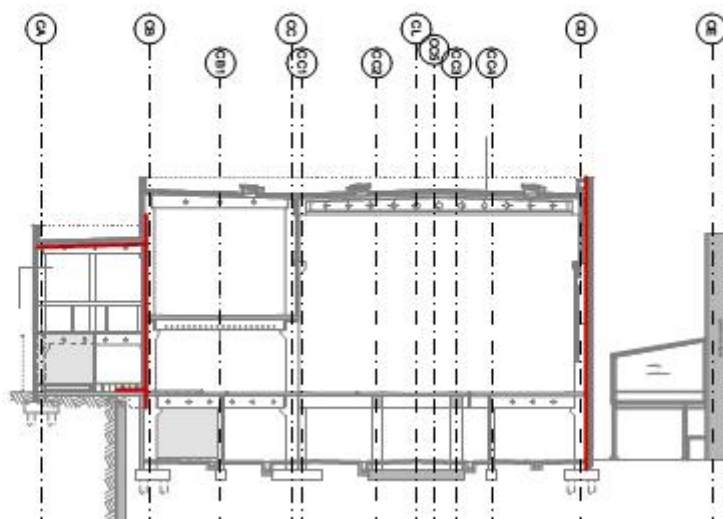


SECTION C-C

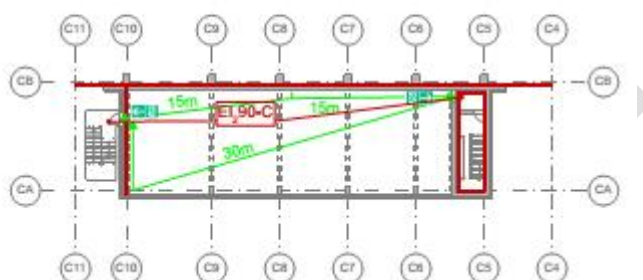
1:500



1:500



1:500



The building is uncomparted and therefore protected shafts are not required on the grounds of compartmentation.

Staircases passing through floors will be constructed as protected stairs.

A review of the ventilation system with regard to fire and smoke dampers should be carried out at detailed design stage.

Area of ancillary accommodation such as plant rooms, store rooms and switch rooms will be provided with compartmentation in accordance with BS9999 Table 29.

10.1 Concealed Spaces

Cavity barriers will be provided in accordance with BS9999 Clause 33, Figure 35 and Table 32.

11 External Fire Spread

11.1 Building Envelope

There are no restrictions on the use of combustible insulation in the envelope of non-residential buildings under 18m (highest occupied floor). The current design incorporates materials used in the exterior walls of the building that are non-combustible exceeding the requirements of the Building Regulations.

Cavity barriers and fire stopping should be provided in accordance with BS9999 Figure 35.

11.2 Space Separation

From the information available at the time of writing the report, it is anticipated that there are no boundary conditions requiring fire resistance to the exterior of the building.

11.3 Roof Coverings

All roof coverings should meet as a minimum $C_{ROOF}(t_4)$ (BS EN 13501-5).

12 Firefighting Facilities

The building does not have a floor above 11m and is in Risk Category A. Therefore, there are requirements for fire-fighting provisions in accordance with Table 17 of BS 9999 other than to provide escape stairs.

The building has a total floor area of approximately 3930 m², is lower than 11m and is not fitted with fire mains. Access for Fire and Rescue Service appliances is therefore required for pumping appliances only to 15% of the perimeter.

Access for pumping appliances is provided to at least 50% of the perimeter.

Access routes will comply with Table 20 of BS9999.

The building has an occupancy Risk Category A and does not have a floor above 11m. Therefore, there is no requirement for firefighting facilities.

12.1 Fire Hydrants

It should be established that there is at least one fire hydrant provided within 90m of all fire main inlets. These should meet the minimum flow requirement of 1500lmin⁻¹ given in BS9990.

The current hydrant positions on site comply with this requirement.

13 Ventilation

A system of smoke removal incorporating heat and smoke vents is to be provided. The system will be normally closed. On the actuation of the fire alarm the vents will remain closed. Subsequent operation of the vents will be under the control of the Fire and Rescue Service. Full details of the system will be included when available.

DRAFT

ATTACHMENT 12.3

FM - Global Proj Rpt Site Expansion and Neptune Paper Machine_2020_05_21

Project Report

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Index-Rec No: UK1830.00-01

Account No: 01-55657

Date of Report: 21 May 2020

Conference With: Tony Curtis, Managing Director, WEPA UK Ltd.

Project Name: Site Expansion and Neptune Paper Machine

Executive Summary

WEPA UK plans to expand the production at Bridgend from 55k tonnes/yr on a single tissue machine (“Jupiter”) to 120 tonnes/yr with the installation of a second machine (“Neptune”). Phase 1A of the project will involve a new fibre plant (virgin fibre and secondary broke fibre) and stock prep. Phase 1B is the installation of “Neptune” machine. Phase 2 is an expansion of converting and jumbo reel storage space on the site. Phase 3 is construction of a new high-bay finished product warehouse.

The pre-project phase has been approved by WEPA Board and is currently underway. A formal planning application to the local authority is in place. The outcome of this application, likely conditions and contingencies will help to determine the Board approval for the next phase of the project. The team is targeting to start production on the Neptune machine at the beginning of Q4 2021.

This report provides an update from the original project report of 4 December 2019, following recent discussions.

Mr. Tony Curtis confirmed that his aim for the project is for the new facilities to be fully protected in accordance with FM Global Property Loss Prevention standards. Where appropriate, responses to the recommendations below are provided *in italics*.

Loss Prevention Recommendations: Pulp Yard (“Department A”)

An outside hard standing will be provided for pulp storage. This will be a combination of virgin pulp bales (up to 4000 tonnes) and recycled broke/secondary fibre (600 tonnes). Virgin pulp use is anticipated to be approx. 350 T/day, and secondary fibre 50 T/day.

Virgin pulp bales will be stored in groups, with each group comprising six units, and each unit 11 bales. Each unit is 3.2m wide, 1.4m deep and 4.8m high.

Construction:

1. FM Global recommends that baled fibre / waste paper is stored in piles not exceeding 680 tonnes, and with 15m spaces between each pile (FM Global Property Loss Prevention Data Sheet 8-22 *Storage of Baled Waste Paper*). The space is to provide for firefighting access and restrict the potential for fire spread between piles in very large pulp yards.

Due to space constraints, this is not feasible at the Bridgend facility. The arrangement shown in the project drawings is tolerable under the following mitigations: -

- a. Fire hydrants for firefighting are provided in the pulp yard as recommended below.
- b. The pulping building is adequately protected against a spreading fire in the pulp yard (see “Pulping Building” section of this report).
- c. All pulp in the yard is assumed lost in a fire event. (With the pulp price at £600/tonne, the loss of pulp would be approx. £2.4m).
- d. The business can recover production using pulp held at local docks (i.e. in the supply chain) within a reasonable period of time. (Mr. Tony Curtis advised that this is the case, and that logistics could be recovered within two days).
- e. Secondary fibre / broke can be purchased on the open market. (Mr. Tony Curtis advised that this is the case).

Clarification provided by FM Global in email of 18 December 2019, in response to specific question from BHM Ingenieure: - 600 tonnes of broke is not a limitation for this area; it is what was reported during the meeting. For outdoor storage of baled waste paper, FM Global recommends a maximum pile size of 680 tonnes, with piles height limited to 6.1m and piles separated by at least 15m. Therefore, in a single area, 680 tonnes would be considered the recommended maximum for waste paper (i.e. broke).

FM Global has no objection to storage of pulp bales in this area; we are not intending to put any restriction on the mix of pulp and broke in the yard. Within the comments given in Section 1 of FM Global report of 4 December 2019, it is acceptable to store more than 4000 tonnes of baled virgin fibre by using some of the secondary fibre / broke storage area for virgin fibre.

Further information provided by email on 23 January 2020: - Additional broke storage in “Area 1” (shown on plan submitted) does not present any additional issues for fire spread which are not already covered by the recommended sprinkler protection beneath the canopy. It would be important to make sure that hydrant coverage for the area also includes Area 1.

Protection:

2. Fire hydrants should be spaced no more than 60m intervals around the pulp yard. No part of the storage should be more than 60m from a hydrant.

Hydrant connections should be compatible with those used by the UK fire and rescue service.

The water supply should be capable of 5700 L/min at 1.4 bar for five hours. This would not normally be possible from a public main system (as feeds your existing fire hydrants). However, it is within the capability of the fire pump and tank systems already at Bridgend (*see point d below*). Therefore, the following approach was discussed: -

- a. Investigate with the local water authority and South Wales Fire & Rescue Service the capability of the existing hydrant supply into the site. (This is fed from the hydrant main running along the A4063 road). Site drawings show bypass valves around the water meters; the capability should be investigated with these bypass valves open.

Update 14 April 2020: - flow test was performed by WEPA's fire protection contractor, showing 310 L/min @ 0.46 bar available. This is extremely low and insufficient for FM Global recommendations. It is thought this may have been done with the bypass closed. A repeat of the test is being discussed with the fire protection contractor. Meanwhile, Mr. Mike Hughes confirmed that the majority of hydrants at the rear of the broke yard are supplied with mill water from pump P10 on Jupiter machine. Further checks are being planned for this area. It is acceptable for these hydrants to be continued to be fed from P10, provided this pump can be assured as operable during foreseeable emergency in the pulp yard (e.g. a protected electrical supply, not shut down on machine stop, and main breaker identified as controlling fire hydrant supplies).

- b. FM Global can attend site to perform pressure and flow tests on the hydrants, with the support of the water authority and the site team.
- c. Hydrants fed from the fire pump supply could be alternated with those from the public supply, or a fire hose connection point put on a header in the Pulping Building. Pressure reducing systems may be required to prevent connection of a 10-bar supply to fire brigade equipment. This should be reviewed with South Wales Fire & Rescue Service.
- d. *Clarification 14 April 2020: - the combined volume of the water tanks at Bridgend Mills is 1710m³, which alone would provide the required hydrant supply for 4 hours and 20 minutes. Although this falls short of the recommended five hours, this situation is tolerable and there is no recommendation to install additional capacity. This was confirmed by email on 18 March 2020.*
- e. *Clarification 14 April 2020: - It is acceptable for fire hydrants in this area to be fed from potable mains water, provided the supply is reliable and of sufficient flow and pressure. This was confirmed by email on 18 March 2020.*

Loss Prevention Recommendations: Pulping Building (“Department B”)

The pulping building will be adjacent to the pulp yard, replacing the stock preparation system for Jupiter with a single system that can feed both Jupiter and Neptune machines. It will comprise a 1500m² canopy for breaking bales of virgin pulp on conveyers into the repulpers, and a conveyer to the secondary fibre repulper which can be loaded by front-loaders from the yard.

Inside the pulping building, the process will be wet with stock held in steel tanks. Bleaching is with sodium hypochlorite. There will be no fibreglass or GRP tanks in the pulping building. A sludge press will also be provided (the existing sludge press is likely to be relocated); this is electrically-driven (not hydraulic) and does not have any GRP hoods or similar.

An electrical substation with two resin-cast transformers, associated 11kV switchgear and 400V switchgear will also be provided.

A control room will be provided beneath the canopy, with welfare facilities (locker rooms, kitchenette, etc.) in the building with the substation.

The pulping building will be a steel portal frame building, with concrete block walls up to 1m and then steel insulated panels above (and for the roof). Conveyers from the canopy will pass through the walls, directly into the repulpers (which will already be water filled). The electrical substation is planned to be concrete block construction with concrete floors.

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Construction:

3. Use non-combustible materials for construction of the pulping building.

Wall and roof panels should have non-combustible insulation (e.g. mineral wool) or FM Approved Class 1 panels. *Mineral wool insulated wall and roof panels are planned to be specified.*

- a. *Clarification 14 April 2020: - there is no requirement for the wall facing the pulping canopy to be fire rated to comply with FM Global standards. This is due to the canopy being sprinkler protected, the pulping department occupancy being non-combustible and there being numerous openings through the facing wall. This was confirmed by email on 30 March 2020.*
- b. *Clarification sent by email on 31 March 2020: - the slab between the electrical room and the cable vault does not need to be fire rated for FM Global requirements. Cable penetrations through the slab should be sealed as much as possible.*
- c. *Update 21 May 2020: - it is acceptable from FM Global for the switch gear room (upper level) and the cable vault (basement beneath the switchgear room) to be a single fire compartment. Where possible, cable penetrations through the floor should be sealed, but it is not essential to create two fire compartments.*

4. Ensure that the substation switchroom emergency exit door facing the pulp yard is a normally closed fire door with at least 2-hour fire rating. Alternatively, relocate the door so that it is not facing the pulp yard. This will prevent radiant heat from a pulp yard fire impinging on the substation. *The door will be fire rated.*

210520-1 The sludge press building will be relocated to an area outside the main development and closer to the effluent plant. The building will contain a screw press and MCC, similar to the existing building.

Providing the building itself is of non-combustible construction, and combustibles in the building are minimised (this assumes that the press is electromechanical, rather than hydraulic) then the omission of sprinkler protection in this building is acceptable to FM Global.

Occupancy:

5. Interlock any pulp / secondary fibre conveyers to shut down automatically if the fire alarm or sprinkler systems activate.

Protection:

6. In addition to specific details below, design all sprinkler systems in accordance with FM Global Property Loss Prevention Data Sheet 2-0 *Installation Guidelines for Automatic Sprinklers*, using FM Approved equipment. Submit all designs and hydraulic calculations for review by FM Global prior to ordering components or commencing installation.
7. Provide automatic sprinkler protection in the cable vault beneath the electrical switchroom. *This is shown on drawing FPR_9200.*

Clarification provided by Email on 23 January 2020: - An aspirating very early fire detection system (e.g. Vesda) is not considered an alternative to fire protection (i.e. sprinkler protection) in the cable vault area.

Clarification provided by email on 31 March 2020: - there is no requirement for sprinkler protection in the electrical room itself, provided there is no oil-filled equipment or significant cable loading

(more than three cable trays stacked vertically above one another).

8. Provide automatic sprinkler protection in the mess room / locker room / control room and similar areas. *This will be incorporated in the design and is shown on drawing FPR_9200.*
9. Provide automatic sprinkler or deluge protection beneath the canopy. The challenge of ordinary closed-head sprinkler systems operating beneath open-sided canopies was discussed during the meeting; due to high air flows and potential for heat to escape the sides of the canopy, ordinary sprinkler systems can be ineffective.
 - a. It was agreed that the north wall of the canopy (where it adjoins the electrical substation) will be closed from the floor to the canopy. There is no benefit to this being open. *This will be incorporated in the design.*
 - b. The east and south walls of the canopy will need to remain open for operational purposes. Along these sides, a solid (e.g. steel) valance approx. 1m deep should be provided to help heat retention beneath the canopy.
 - c. Provide a zoned deluge system for the canopy; suggested divided into three zones of approx. 500m² each. The deluge system should be activated by a heat detection system – e.g. IR detection or UV detection. A double-knock or coincident system can be provided, requiring two detectors to alarm in order for the deluge protection to activate.

Sprinkler protection is shown on drawing FPR_9200. The detailed design will be reviewed when available.

10. Provided the construction materials are non-combustible and the occupancy has no fire load, sprinkler protection is not required in the main pulping hall area. This is based on using steel tanks, no storage of chemicals, empty plastic containers, pallets, etc.; no stacked cable trays; no staging of pulp or secondary fibre bales in the building; no hydraulic equipment; no GRP hoods, tanks or other similar materials. *Based on the review during the project meeting, the occupancy in the pulping area will be free of combustibles and so no sprinkler protection will be required.*
11. Protection criteria for the pulping building are summarized in the table below.

Area referenced	Design density and operating area	Sprinkler head size and nominal temperature rating	FM Global Property Loss Prevention Data Sheet reference
Cable vault	8mm/min over 279m ² (or area of the room if smaller)	K115 74°C Max. 12m ² spacing.	DS 5-31 <i>Cables and Bus Bars</i> Section 2.3.1.
Mess rooms; control room; locker rooms and similar	Hazard Category “HC-1”: - 4mm/min over 140m ²	K80 74°C	DS 3-26 <i>Fire Protection for Nonstorage Occupancies.</i>

Canopy	6mm/min over 560m ² (or the area of the deluge zone if smaller). Design hydraulics for two zones to operate concurrently.	K115 74°C	DS 8-7 <i>Baled Fibre Storage.</i>
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12. A smoke extraction system is to be provided in the pulping building. Since there are no sprinklers inside the main pulping building, it is acceptable for the vent to be used “on demand” for building ventilation. A fireman’s switch should still be provided to give manual control of this vent in a fire scenario. The switch should be located in an area accessible under foreseeable fire conditions, and preferably near a fire panel which is likely to become a main muster point for the emergency team.

This assumes that a smoke extraction / heat vent will not be provided in the canopy, which will be provided with automatic sprinklers.

Loss Prevention Recommendations: Neptune Building (“Department C”)

Neptune building will house a new Valmet tissue machine with 5.6m width (producing two 2.8m wide jumbo rolls). The building will be a concrete frame, with pre-cast concrete wall panels and light-weight pre-cast hollow-core roof panels. The machine operating floor will match the elevation of the Jupiter machine, and will be of reinforced concrete construction. A “basement” (at the ground floor) will be below the machine, housing a broke re-pulper, pumps, etc.

The electrical and MCC rooms will be on a separate steel structure within the building; a concrete floor will be provided between the electrical substation and the MCC room. A cable vault and raised floors will be provided.

The Neptune and Jupiter buildings spaced approx. 8.4m apart. They will be joined through the control room (although each machine will have its own control room on either side of the main wall), and a pedestrian / goods transit passage will also be provided at the east end on the operating floor. The Neptune building will directly about the existing reel stores.

There are no plastic construction materials (e.g. hoods) planned for the Neptune paper machine area.

Neptune machine will have a conventional gas-fired drying hood system (slightly different from the ETAD on Jupiter machine, which is understood to use proprietary Georgia Pacific technology). This will result in higher moisture content at the creping blade, resulting in less risk of contact between the blade and the Yankee cylinder. A hood with dust extraction system will be provided above the reeling end; a wet scrubber will be used for dust separation. The basement will have a wet re-pulper for broke. There will be no broke pits.

No additional steam generating plant will be required; both Jupiter and Neptune machines will be able to run with the two existing gas turbine heat recovery steam generators.

Construction:

13. Provide FM Approved self-closing fire doors or fire shutters at partition walls. The doors or shutters should have the same fire rating as the wall in which they are installed. They can be activated by fusible link, or smoke detection on either side of the partition wall. *Mr. Gareth Lloyd advised that smoke detection activation would be preferred, as it can respond to a fire quickly, on either side of the*

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partition.

14. Provide FM Approved fire door in the partition between the two control rooms, to limit the potential for fire and smoke spread from one machine / control room to the other. *The exact arrangement will need to be determined, as it is desirable to run the two control rooms “as one” and have visibility from one to the other.*
15. Where conveyer systems take finished rolls through a fire partition, configure them so that they cannot stop or “park” beneath fire shutters and prevent them from closing.
 - a. The conveyer control system should stop on activation of fire alarm; however, it should be arranged to clear a fire shutter before stopping.
 - b. It may be desirable to link fire shutters to a scanner to prevent the shutter from attempting to close until the area is clear of rolls. If the area is not cleared within a certain period (e.g. 30 seconds), the shutter should release anyway.

A system is already in place for Jupiter machine, and will be evaluated as part of the Neptune construction.

16. *Clarification sent by email on 6 April 2020: - one-hour fire-rated partition is recommended for the basement chemical room. This room should also have containment (bundling) appropriate for the type of containers and volumes. Please seek further guidance from FM Global once the layout and contents of the chemical room have been determined.*

210520-2 Update 21 May 2020. It is acceptable from FM Global perspective for the basement and machine level to be the same fire compartment. However, please pay special attention to point 24(d) below on management of the oil fire hazard presented by the extended-nip press.

Occupancy:

17. Arrange roof-mounted heat and smoke vents for manual operation.

Heat and smoke vents are to be provided at the machine hall roof level. These can interfere with the operation of automatic sprinklers, by venting the hot gas layer (on which the sprinklers rely) before the sprinklers can operate. This can delay fire control.

- a. Establish procedures that ensure smoke ventilation is not started until the fire is under control, as determined by the fire and rescue service senior commander. This should be written into the fire plan.
- b. Where vents may be used manually for controlling the building environment (e.g. comfort cooling), or to aid in the removal of smaller volumes of smoke (e.g. smoulding on doctor blade; a high-frequency occurrence), it is essential that the vents close in the event of a fire. The following options were discussed: -
 - i. Arrange the vents to close automatically on a signal from the fire alarm system (provided the alarm system can reliably operate before automatic sprinklers).
 - ii. Have a limited number of vents which can be opened manually for small-scale smoke evacuation, and which close automatically on a timer (e.g. 5-minutes).

This was discussed at length. It is planned that smoke / heat vents will be manually operated. Interaction with the fire systems when used for comfort ventilation / smouldering smoke extraction will be reviewed further.

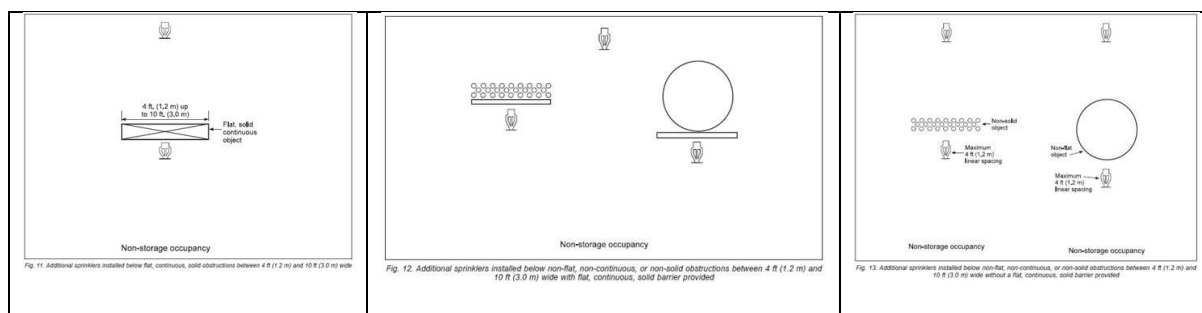
*Update 5 Mar 2020: - the smoke / heat vent will **not** be used for comfort ventilation. In case of fire, it will only be opened by the fire brigade on manual operation. This is acceptable providing robust procedures are in place governing its use. The control switches should be located in a place accessible during all foreseeable fire scenarios, and preferably near a fire alarm control panel which is likely to be a muster point for the emergency team.*

18. Conduct a thorough, documented, oil fire hazard assessment for all flammable lubricating and hydraulic oil systems to identify potential release scenarios, sources of large leak, and determine the specific conditions necessary for the safe shutdown of lube oil and hydraulic oil systems. Additional interlocks or shutdowns may be required. See Section 2.1.4.4 of FM Global Data Sheet 7-4 *Paper Machines and Pulp Dryers*.
 - a. Where possible, use FM Approved industrial fluids (see www.approvalguide.com). These effectively remove the oil fire hazard. *Update 20 May 2020: - Valmet has confirmed that in the majority of instances, there are no FM Approved industrial fluids compatible with the paper machine components. Therefore, automatic sprinklers will be provided for oil hazards.*
 - b. *Clarification 14 April 2020: - it is recommended where possible that hydraulic power packs are not located on the machine floor, but this is not essential. For ease of installation and use, it is preferable to have hydraulic units located close to their point of use.*
19. Arrange gas dryers in accordance with the requirements of FM Global Property Loss Prevention Datasheet 6-9 *Industrial Ovens and Dryers*.
20. Limit finished paper (i.e. “jumbo” rolls awaiting transfer to the roll paper stores) in the Neptune building to a maximum height of 2.8m (i.e. single stacking) and floor area of 20m².

Protection:

21. In addition to specific details below, design all sprinkler systems in accordance with FM Global Property Loss Prevention Data Sheet 2-0 *Installation Guidelines for Automatic Sprinklers*, using FM Approved equipment. Submit all designs and hydraulic calculations for review by FM Global prior to ordering components or commencing installation.
 - a. *Clarification sent by email on 6 April 2020: - if a sprinkler control room (i.e. a cut off room where all sprinkler control valves for the building are located), this can be beneficial if it is accessible from outside the building.*
22. Provide automatic sprinkler protection and the Neptune machine hall roof level above the paper machine. *This is already included in the design.*
 - a. *Clarification sent by email on 31 March 2020: - sprinkler protection should be provided for the area above the mezzanine (holding Valmet processing equipment). It is expected that the sprinkler design at the main roof will cover the mezzanine area, and that this will be open to the ceiling sprinklers.*
 - b. *Clarification sent by email on 31 March 2020: - sprinkler protection is recommended below the mezzanine at the machine hall level, between line CB and CC along section D-D. It is*

understood that this could be a congested area with pipework and cables, and solutions for protecting this area are in FM Global Datasheet 2-0 Section 2.1.3.2.5.2 and Figures 11, 12 and 13 (see below).



Update 21 May 2020: - sprinkler protection in the Neptune building is shown on drawing OVW_9201.

23. Provide automatic sprinkler protection within the Neptune machine extraction hood, above the reeling end of the machine. This will provide protection against a fire in the area being shielded from ceiling sprinklers.

Note that automatic sprinkler protection is not required in the Yankee cylinder hood.

This will be reviewed with Valmet. Update 21 May 2020: - this may be partially provided by the proposed FireFly spark detection and extinguishing system; see FM Global Plan Review letter dated 20 May 2020.

24. Provide local automatic sprinklers for lubrication systems and hydraulic oils, including the “consoles” and pumps for these systems; alternatively, use FM Approved less flammable industrial fluids.

Update 5 March 2020: - where possible, FM Approved hydraulic fluids will be used (as is already the case on Jupiter machine). Marked-up drawings were provided to show areas where hydraulic consoles are understood to be located.

Update 14 April 2020: - where possible, activation of sprinklers on the oil systems should shut down the hydraulic system. However, if this would cause excessive damage to the paper machine, then it is acceptable for it to initiate a controlled stop, immediately followed by all oil system pumps stopping.

Update 21 May 2020: - drawing OVW_9201 shows the planned areas to be protected, where hydraulic oil systems will be located. In the basement, ceiling sprinklers will be provided above and for 6m in all directions. On the machine floor, spot-sprinkler protection will be provided.

25. If an extended-nip-press (“ENP”) or shoe press is to be provided, please refer to Section 2.7 of Datasheet 7-4 for detailed protection requirements. Alternatively, use FM Approved less flammable industrial fluids.

Update 5 March 2020: - FM Approved hydraulic fluids are not compatible with the shoe press systems and therefore additional protection will be required. FM Global recommends as follows: -

- a. *Automatic sprinkler protection around the hydraulic / lube oil system in the machine basement. Design sprinkler protection over the unit and for 6m in all directions from the unit. Design*

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sprinklers for 12mm/min over the protected area.

Update 14 April 2020: - drawings showing sprinkler protection for 6m in all directions from the shoe press hydraulic power unit have been shown. This point is considered completed. Detailed calculations and installation drawings will be required for review at the appropriate time.

- b. Avoid running electrical cables or other services above the shoe press hydraulic unit.*
- c. Provide spot-sprinkler protection at the hydraulic connection on the rear of the shoe press on the machine floor level.*
- d. Arrange the machine floor area to prevent, as far as possible, oil spill from the machine floor to the basement in the event of hydraulic failure on the shoe press.*
- e. Provide fire detection on the shoe press cylinder area, including a waterflow alarm for the shoe press specific sprinkler heads, and also heat detection within the machine, along the line of the cylinder. A number of "pencil"-type heat detectors could be used, spaced across the machine width, or a continuous "fire-wire" device could be used. Activation of alarm devices should sound a specific alarm in the control room.*
- f. Activation of fire detection systems should initiate a controlled shutdown of the machine, including the shoe press loading hydraulics (as quickly as possible) and the lubrication systems once the machine has completely stopped. Operators should also initiate a controlled shut in the event of fire on the shoe press.*

Update 21 May 2020: - part of the protection for the shoe press system may be afforded by the proposed FireFly spark detection and extinguishing system. The outline of this system was reviewed in FM Global Plan Review letter dated 20 May 2020.

- 26. Provide automatic sprinkler protection in the control room, maintenance rooms, welfare areas, offices / meeting rooms, etc. Update 5 March 2020: - this includes the control room, welfare areas shown on the machine level, and the welfare room, tea kitchen etc. on the mezzanine level. This was confirmed by email on 4 March 2020 and on drawing OVW_9201.*
- 27. Provide protection beneath the MCC room raised floor, substation cable vault, and similar cable spaces. This will be provided, consistent with the Jupiter machine MCC. Update 5 March 2020: - this was clarified with mark-ups to the layout drawing for this area and by email. This is shown on drawing OVW_9201.*
- 28. Provide sprinkler protection in the Neptune machine basement, according to the fire need of specific areas (e.g. high cable concentrations, oil fire hazards, etc.). The basement area as a whole is not likely to require full sprinkler protection. Update 5 Mar 2020: - a marked-up copy of the layout drawings was provided by email on 4 March 2020, showing areas likely to require automatic sprinkler protection. This included the hydraulic / lube oil systems identified and also the basement chemical store.*
 - a. Clarification sent by email 31 March 2020: - Although sprinkler protection is not required throughout the basement (see main text in point 28 above), FM Global recommends fire detection where electrical cables or electrical systems are running. A reliable fire detection system can be difficult to install in a congested area (with steam and vapour systems running*

also); sprinklers could be used as a detection system and may be just as cost effective, as the bulk of the infrastructure will already be installed.

- b. Clarification sent by email 6 April 2020: - automatic sprinkler protection is recommended in the chemical room.*

Area referenced	Design density and operating area	Sprinkler head size and nominal temperature rating	FM Global Property Loss Prevention Data Sheet reference
Neptune machine hall roof level	6mm/min over 232m ² .	K115 or K160. 74°C.	DS 7-4 <i>Paper Machines and Pulp Dryers</i>
Neptune machine inside reeling hood	8mm/min over 280m ² (or area of the hood if smaller).	K115 141°C.	DS 7-4 <i>Paper Machines and Pulp Dryers</i> .
Cable vault or below MCC / substation raised floor (and similar cable spaces)	8mm/min over 279m ² (or area of the room if smaller)	K115 74°C Max. 12m ² spacing.	DS 5-31 <i>Cables and Bus Bars</i> Section 2.3.1.
Mess rooms; control room; locker rooms and similar	Hazard Category “HC-1”: - 4mm/min over 140m ²	K80 74°C	DS 3-26 <i>Fire Protection Water Demand for Nonstorage Properties</i> .
Lube oil systems	Localised protection required, according to the arrangement – to be reviewed further. DS 7-4 Section 2.1.4.3.		
Hydraulic systems	Localised protection required, according to the arrangement – to be reviewed further. See DS 7-4 Section 2.1.4.3. Investigate the use of FM Approved industrial fluids.		

29. Provide infrared spark detection over the web at the dry end, arranged to sound an alarm when sparks are detected. When sparks are detected, segregate the roll being wound at the time from other storage, preferably to an outside area away from combustibles, or re-pulp the roll. *Update 21 May 2020: - a FireFly spark detection and extinguishing system has been proposed by Valmet. The preliminary proposal was reviewed by FM Global in plan review dated 20 May 2020.*

Loss Prevention Recommendations: Converting Expansion (“Department D”)

Part of the site expansion requires an increase in converting capability. This was not discussed in detail during the meeting; however, the following outline guidance is provided.

Construction:

- 30. Use non-combustible construction materials (e.g. mineral-wool insulated panels) or FM Approved Class 1 materials.

Occupancy:

- 31. If a smoke control / extract system is provided, it should be normally closed and arranged for manual operation only. (See comments relating to the Neptune machine building).

Protection:

- 32. In addition to specific details below, design all sprinkler systems in accordance with FM Global Property Loss Prevention Data Sheet 2-0 *Installation Guidelines for Automatic Sprinklers*, using FM Approved equipment. Submit all designs and hydraulic calculations for review by FM Global prior to ordering components or commencing installation.
- 33. Provide automatic ceiling sprinkler protection in the converting expansion. Design for FM Global Hazard Category 3 (“HC-3”) per Data Sheet 3-26. Design for 12mm/min over 340m² using FM Approved K160 heads, 74°C nominal temperature rating.
- 34. Enclosures with special protection systems (e.g. water mist, CO₂ or low-level sprinkler heads) may be recommended for hazardous operations, e.g. log saws. This will be discussed in detail as the project progresses.
- 35. A higher sprinkler design may be required for storage / staging / WIP areas, if the height exceeds 1.8m or the storage area of any individual group exceeds 6m². See Section 2.3.2 of Data Sheet 3-26.

Loss Prevention Recommendations: Shipping Expansion (“Department E”)

Part of the site expansion requires a change to the shipping area. This was not discussed in detail during the meeting; however, the following outline guidance is provided.

Storage of finished light-weight paper products such as tissue paper is classified as Cartoned Unexpanded Plastic (“CUP”), per Table 2 of FM Global Data Sheet 8-1 *Commodity Classification*. See Item 113 in Table 2. (This classification is based on fire testing by FM Global; although it is recognised that finished tissue paper is a cellulosic material, the combination of high air volumes in the product and its absorbent nature mean that a sprinkler system designed for CUP is required for proper extinguishing). Plastic shrink-wrapping or bagging does not affect this classification.

Construction:

- 36. Use non-combustible construction materials (e.g. mineral-wool insulated panels) or FM Approved Class 1 materials.

Occupancy:

- 37. If a smoke control / extract system is provided, it should be normally closed and arranged for manual operation only. (See comments relating to the Neptune machine building).

Protection:

- 38. In addition to specific details below, design all sprinkler systems in accordance with FM Global Property Loss Prevention Data Sheet 2-0 *Installation Guidelines for Automatic Sprinklers*, using FM Approved equipment. Submit all designs and hydraulic calculations for review by FM Global prior to ordering components or commencing installation.

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39. It is assumed that products in this area will be stored on pallets, up to 3.6m high (i.e. two pallets high). Ceiling height is specified as 9.5m.

Provide automatic ceiling sprinkler protection in the shipping area. Design for 12 x K200 sprinkler heads to operate at 5.2 bar. Use FM Approved K200 pendent heads, quick-response 74°C nominal temperature rating.

40. Provide automatic sprinkler protection beneath the loading/unloading canopy. Either a dry-pipe system can be used, or a wet system with lagging and trace heating on the pipework.

Loss Prevention Recommendations: Reel Store Expansion (“Department J”)

An expansion of the existing “jumbo” reel storage area is planned. This will allow for additional storage of finished paper reels, stacked up to three high (8.4m overall height).

Tissue paper is considered “absorbent” and is therefore classed as RP-1 per FM Global Data Sheet 8-21 *Roll Paper Storage*.

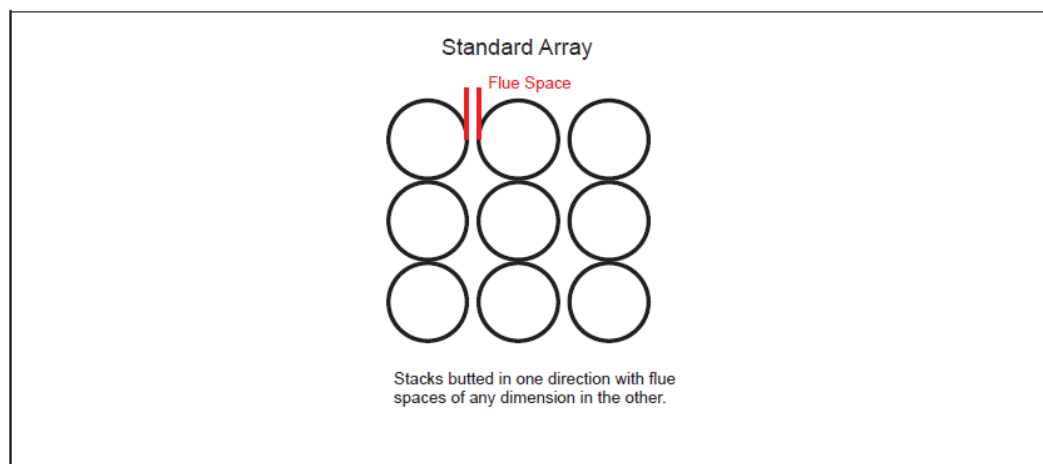
Construction:

41. Use non-combustible construction materials (e.g. mineral-wool insulated panels) or FM Approved Class 1 materials.
42. Roof slope must be less than 10°.
43. The maximum clear ceiling height in this building for sprinklers to operate effectively is 12.2m (measured from the floor slab to the underside of the ceiling at its peak). *Although the original plan was for a taller building, it was agreed by email following the initial meeting that the roof height will be reduced to comply with this requirement.*

Occupancy:

44. Storage of reels must be in “standard array”, as defined in FM Global Data Sheet 8-21 *Roll Paper Storage*.

Standard Array is defined as an on-end storage arrangement of roll paper in which uniform diameter rolls are in vertical stacks butted in one direction and separated by any dimension flue space in the other direction. See figure below for pictorial representation.



45. Appropriate operating instructions must be provided to clamp truck operators, and regular housekeeping checks of the area must be performed to ensure standard array storage.
46. If smoke / heat vents are to be provided at the roof, they should be normally closed and operated manually. See comments for the Neptune machine building.

Protection:

47. In addition to specific details below, design all sprinkler systems in accordance with FM Global Property Loss Prevention Data Sheet 2-0 *Installation Guidelines for Automatic Sprinklers*, using FM Approved equipment. Submit all designs and hydraulic calculations for review by FM Global prior to ordering components or commencing installation. Special care must be taken to ensure that sprinkler heads are not obstructed by ceiling construction or other services; see Section 2.2.3.5 of Data Sheet 2-0.
48. Provide automatic ceiling sprinkler protection designed to operate 25 x K200 sprinkler heads at 5.2 bar. Use FM Approved, quick-response K200 pendent sprinkler heads with nominal 70°C temperature rating.

(Note that FM Global's published Data Sheet 8-21 Table 1 specifies a maximum storage height of 7.6m. Following a review by FM Global for this specific situation, storage up to 8.4m – i.e. three reels high – is considered tolerable, and the sprinkler design recommended will provide an appropriate level of fire protection).

49. Provide permanent small hose lines (40mm) not exceeding 30m in length, capable of reaching all storage areas to aid in potential initial-stage firefighting as well as for after-extinguishment mop-up operations.
 - a. Supply small hose lines from any of the following:
 - i. A separate piping system for small hose stations, or
 - ii. Valved hose connections on sprinkler risers where such connections are made upstream from all sprinkler control valves, or
 - iii. Adjacent sprinkler systems, or
 - iv. Ceiling sprinklers in the protected area.
 - b. Discuss the arrangements for hose reels with the local fire and rescue service, to ensure that the equipment provided is compatible with their procedures. (For example, they may prefer hose "cabinets" with flat-laid fabric-type hoses, rather than small hose reels; pressure reducing valves may also be required).
 - c. Develop a fire plan for the building, in discussion with the fire and rescue service, to include final fire extinguishing.
 - d. As part of the sprinkler system design include a hose stream allowance of 1950 L/min for fire hydrant connections (if they are to come from the sprinkler supply). Allow at least 380 L/min for inside hose stream usage and add the balance of the hose demand to the overall sprinkler demand at the point of connection.

- e. Arrange the water supply to provide the required ceiling sprinkler demand, hydrants and hose stream allowance for a minimum of 120 minutes.

Loss Prevention Recommendations: High Bay Warehouse & Dispatch (“Department F”)

A new high bay warehouse and dispatch area is planned on the north-west of the site. This will comprise a warehouse of approx. 5687m² and a 41.85m clear ceiling height and racking for 38,000 pallets of finished product. Automatic narrow-aisle retrieval systems will be used to handle product.

Pallets will be stored double-stacked in each tier, and racking will be “back-to-back” as shown below. This will therefore be a combination of “double-row” and “multiple-row” racking, as shown in the diagrams below. See “Glossary of Terms” in Data Sheet 8-9 for definition of these terms.

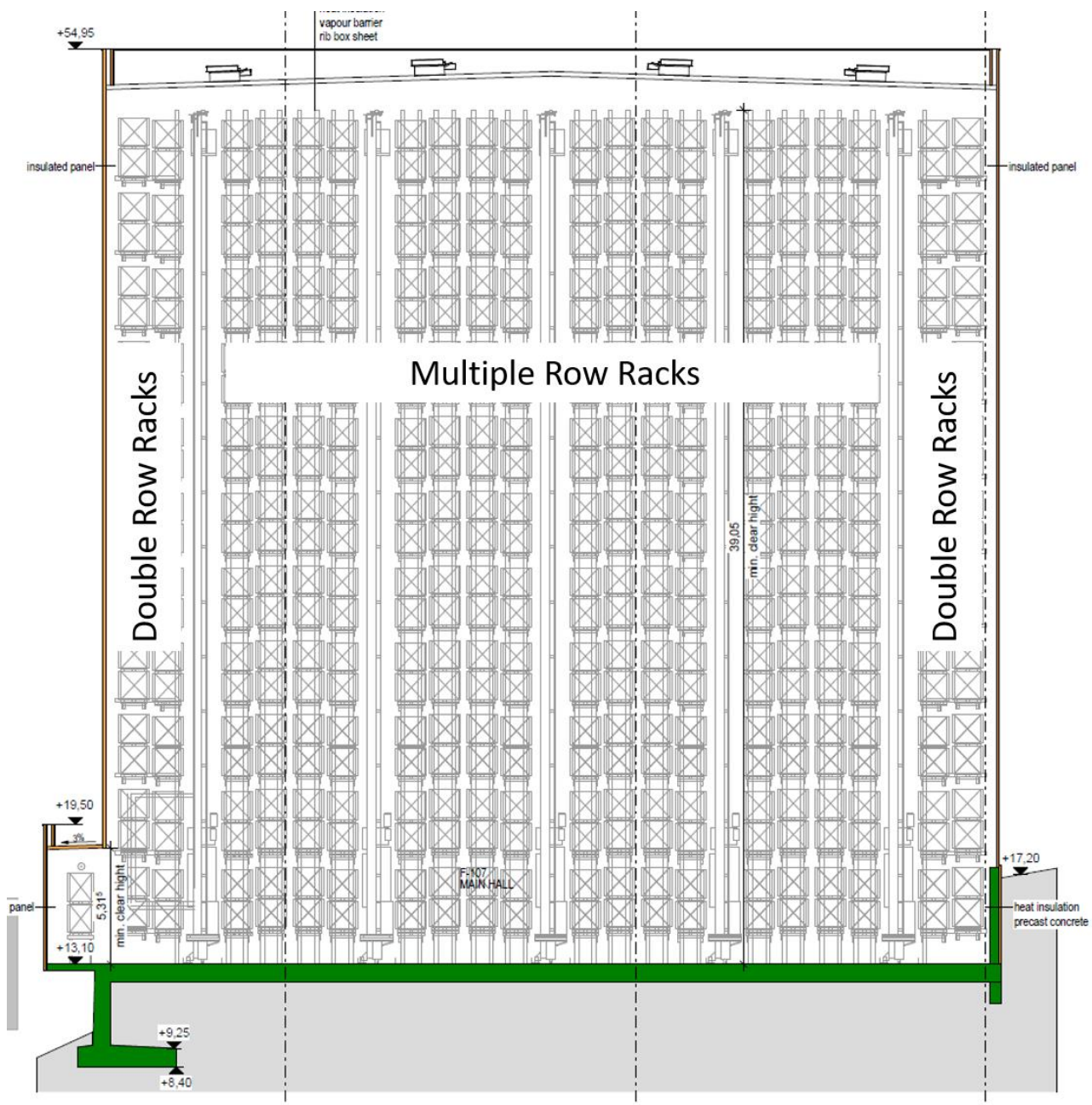


Figure 1 - explanation of types of racking in the warehouse.

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A marshalling area will also be provided, and a canopy for lorry loading.

Construction:

- 50. Use non-combustible construction materials (e.g. mineral-wool insulated panels) or FM Approved Class 1 materials.
- 51. Roof slope must be less than 10°.
- 52. A canopy is to be provided on the west side of the shipping area. This should be enclosed on three sides (i.e. at the west by the main building, and at north and south by the retaining walls) up to the roof of the canopy.

Occupancy:

- 53. All automatic pallet handling systems should stop on activation of fire alarm or sprinkler system within the building.
- 54. If smoke / heat vents are to be provided at the roof, they should be normally closed and operated manually. See comments for the Neptune machine building. *Update: - BHM Ingenieure, the consultants on the project, confirmed by email on 16 December 2019 that smoke/heat vents are not required by Building Control regulations or by FM Global and therefore the building will not be provided with heat/smoke vents. This point is completed.*
- 55. Racking must be “open frame” (see Glossary of Terms in FM Global Data Sheet 8-9). In order for racking to qualify as open-framed, it must:
 - a. Have adequate transverse flue spaces throughout the height of the rack at a maximum of every 2.7m horizontally, and
 - b. Be void of any blocked transverse flue spaces.

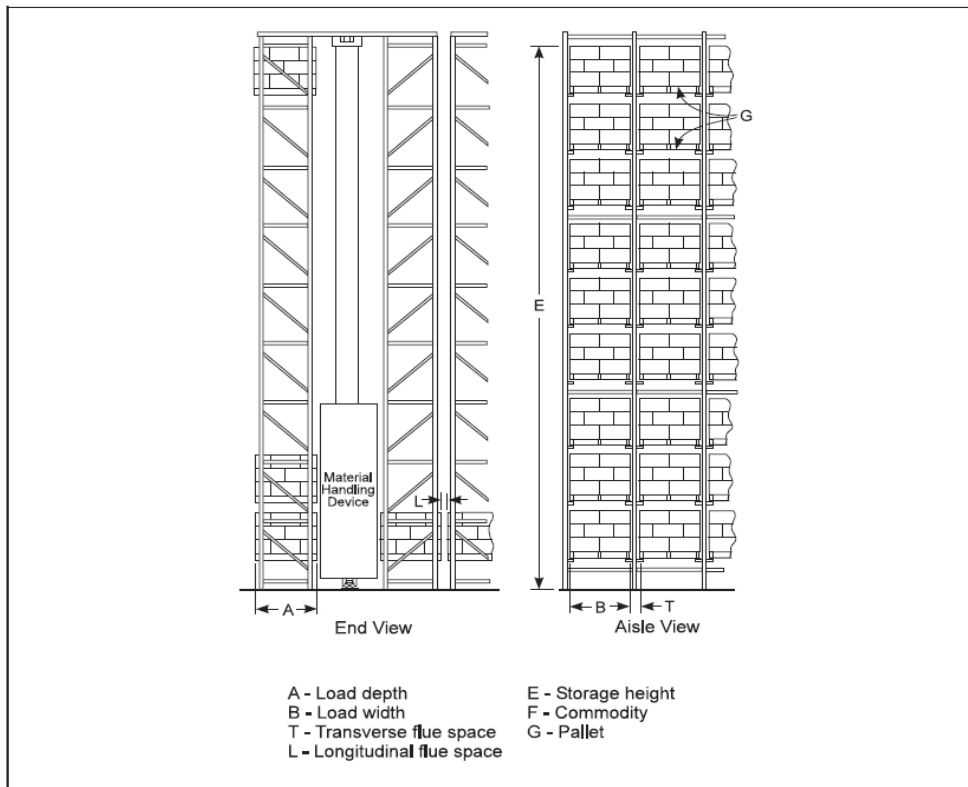


Figure 2 – automatic storage racks, with definitions of key terms. (This is Figure A-6 from Data Sheet 8-9).

- c. Longitudinal flues of 150mm net clear width must be provided every 4.8m horizontally. (This is accommodated in the existing design for the racking).

56. Double-row racking is assumed to be no more than 2.7m from face-to-face. If this is not the case, please advise FM Global as soon as possible.

57. It is assumed that electrical substation (if provided) will use non-oil switchgear (i.e. vacuum or air circuit breakers) and resin-cast transformers. Please seek further guidance from FM Global if this is not the case.

Protection:

Finished tissue paper products have a fire classification commodity of Cartoned Unexpanded Plastic, per Data Sheet 8-1. See comments above for Shipping Department Expansion (Department E).

58. In addition to specific details below, design all sprinkler systems in accordance with FM Global Property Loss Prevention Data Sheet 2-0 *Installation Guidelines for Automatic Sprinklers*, using FM Approved equipment. Submit all designs and hydraulic calculations for review by FM Global prior to ordering components or commencing installation.

- a. Special care must be taken to ensure that sprinkler heads are not obstructed by ceiling construction or other services; see Section 2.2.3.5 of Data Sheet 2-0.
- b. Pay special attention to positioning of in-rack sprinkler heads, as outlined in Section 2.3.4.5 of Data Sheet 8-9.

- i. In-rack sprinklers must be within the rack structure.
- ii. Do not position in-rack sprinklers directly behind rack uprights but offset up to 75mm horizontally from the transverse flue intersection they are intending to protect.
- iii. Position the in-rack sprinkler deflector at or just below the bottom of the rack's horizontal support member when it is under full load conditions.
- iv. Provide 150mm clearance between the top of storage and the bottom of the in-rack sprinkler deflector.
- v. Arrange sprinkler piping and in-rack sprinklers to avoid mechanical damage but ensure proper water distribution from the in-rack sprinkler can be achieved.

59. A combined ceiling and in-rack sprinkler system is required in the high bay warehouse due to the building height. An "Alternative In-Rack Sprinkler Design" per Section 2.3.6.6 is recommended, as this will use significantly fewer sprinkler heads than a more conventional design. Please study carefully Section 2.3.6.6. The key design points are presented below: -

- a. Please note that these specifications are based on a review of preliminary drawings without detailed dimensions. The final specification will be provided following a full review of detailed design drawings of the racking and building.
- b. Design ceiling sprinklers to operate 12 x K320 heads at 1.4 bar. Use FM Approved K320 pendent, quick-response heads with nominal 70°C temperature rating. (Table 8 of Data Sheet 8-9). It is not necessary to balance hydraulically the ceiling sprinklers with the in-rack sprinklers, nor to account for the ceiling and in-rack sprinklers flowing simultaneously.
- c. For all racking, use FM Approved K320 pendent, quick-response heads with nominal 70°C temperature rating. Use a hydraulic design of six most remote sprinkler heads operating at 455 L/min. (Table 15 and 16 of Data Sheet 8-9). It is not necessary to balance hydraulically the in-rack sprinklers with the ceiling sprinklers, nor to account for the in-rack sprinklers and ceiling sprinklers flowing simultaneously
- d. For Multiple Row Racking, position in-rack sprinklers horizontally as shown in Figure 21 of Data Sheet 8-9. This figure is shown below.

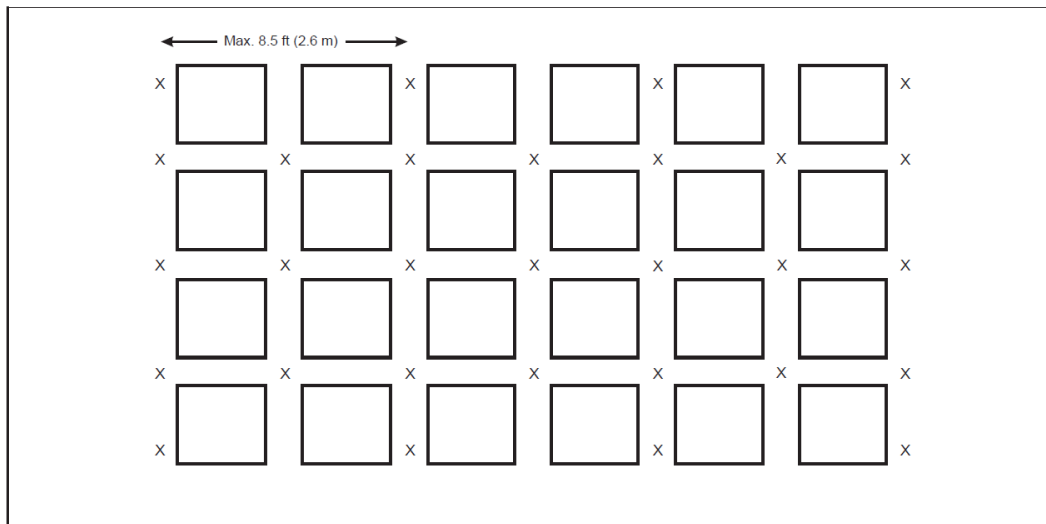


Figure 3 - a copy of Figure 21 from Data Sheet 8-9, showing in-rack sprinkler horizontal positioning for MRR. The loading aisles are running left-to-right along the bottom and top of the figure.

- e. For Multiple Row Racking, position in-rack sprinklers horizontally as shown in Figure 20a of Data Sheet 8-9. This figure is shown below.

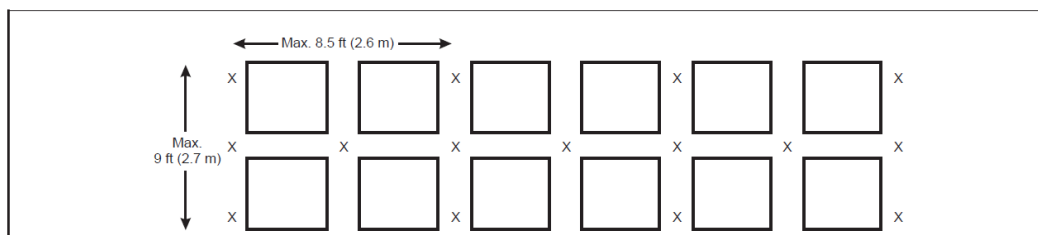


Figure 4 - a copy of Figure 20a from Data Sheet 8-9, showing in-rack sprinkler horizontal positioning for DRR. The loading aisles are running left-to-right along the bottom and top of the figure.

- f. For all racking, space in-rack lines vertically at no more than 12m intervals. In practice in this warehouse, this means every third tier. It would be prudent to allow in the initial costings for four levels of in-rack sprinklers to allow for contingency.
 - g. Ensure 150mm clearance between the top of the storage and the in-rack sprinkler head deflector.
60. Provide ceiling sprinkler protection in the shipping area. Based on a 10m ceiling height and finished products on pallets one or two high (not on racking), design for 12 x K320 sprinkler heads operating at 2.1 bar. Use FM Approved K320 pendent, quick-response heads with 74°C temperature rating.
 61. Provide ceiling sprinkler protection beneath the canopy. Based on a 7.5m ceiling height and finished products on pallets one or two high (not on racking), design for 20 x K160 sprinkler heads at 3.5 bar, on a **dry-pipe system**. Use FM Approved K160 upright, standard-response heads with 141°C temperature rating.

(Alternatively, the pipework could be lagged and trace-heated and a wet sprinkler system provided beneath the canopy; seek further information from FM Global if this is preferred).

62. Provide permanent small hose lines (40mm) not exceeding 30m in length, capable of reaching all storage areas to aid in potential initial-stage firefighting as well as for after-extinguishment mop-up operations.
- a. Supply small hose lines from any of the following:
 - i. A separate piping system for small hose stations, or
 - ii. Valved hose connections on sprinkler risers where such connections are made upstream from all sprinkler control valves, or
 - iii. Adjacent sprinkler systems, or
 - iv. Ceiling sprinklers in the protected area when separately controlled in-rack sprinklers are provided
 - b. Discuss the arrangements for hose reels with the local fire and rescue service, to ensure that the equipment provided is compatible with their procedures. (For example, they may prefer hose “cabinets” with flat-laid fabric-type hoses, rather than small hose reels; pressure reducing valves may also be required). It may be preferable from an operations standpoint to locate hose stations on the ends of racks rather than in aisles.
 - c. Develop an “access plan” for hose reels may also be required, including powering down the automatic retrieval systems. Incorporate this plan into a fire plan for the building, in discussion with the fire and rescue service.
 - d. As part of the sprinkler system design include a hose stream allowance of 950 L/min for manual extinguishment. Allow at least 380 L/min for inside hose stream usage and add the balance of the hose demand to the overall in-rack sprinkler demand (or ceiling demand if higher) at the point of connection.
 - e. Arrange the water supply to provide the required in-rack sprinkler system demand (or ceiling demand if higher) and hose stream allowance for a minimum of 60 minutes.
63. Provide automatic sprinkler protection in the control room, maintenance rooms, welfare areas, offices / meeting rooms, etc. Design for 4mm/min over 140m² using FM Approved K80 sprinkler heads.
64. Provide sprinkler protection beneath the MCC room raised floor, substation cable vault, and similar cable spaces.

Recommendations Relevant to All Areas

Construction:

65. Design roof drainage systems in accordance with Eurocode for rain loads, as modified by Section 2.7.3 of FM Global Property Loss Prevention Data Sheet 1-54 *Roof Loads for New Construction*.
- a. Where roofs are to be provided with parapets which may trap water in the event of blocked or overloaded primary drains, provide secondary drainage (“scuppers”) through the parapets to prevent water ponding.
 - b. Use 100-year, 60-min rainfall intensity for calculations on primary roof drainage.

- c. Use twice this intensity for secondary drainage. Calculate on the basis that the primary drains will be completely blocked (i.e. do not account for relief from primary drains when designing secondary drainage).
66. Design buildings to accommodate snow loads in accordance with “Eurocode” requirements, as modified by Section 2.7 of Data Sheet 1-54.
- a. Ensure proper account of building elevation changes and the potential for drift loads.
 - b. Existing roof sections may need additional reinforcement if a higher roof section is to be built immediately adjacent.
67. Design the buildings to accommodate wind loading in accordance with “Eurocode” requirements, as modified by Section 2.8 of FM Global Property Loss Prevention Data Sheet 1-28 *Wind Design*.

Occupancy:

68. No consideration has been included for bulk storage of idle pallets, either for converting area or for bulk warehouse. Arrange and protect idle pallet storage areas in accordance with FM Global Property Loss Prevention Data Sheet 8-24 *Idle Pallet Storage*.

Protection:

69. In addition to specific details below, design all sprinkler systems in accordance with FM Global Property Loss Prevention Data Sheet 2-0 *Installation Guidelines for Automatic Sprinklers*, using FM Approved equipment. Submit all designs and hydraulic calculations for review by FM Global prior to ordering components or commencing installation.
70. Special care must be taken to ensure that sprinkler heads are not obstructed by ceiling construction or other services: -
- a. For non-storage areas, see Section 2.1.3.2.5 of Data Sheet 2-0.
 - b. For storage areas, see Section 2.2.3.5 of Data Sheet 2-0.
71. The existing site water supply (three 5678 L/min @ 9.5 bar diesel pumps; one 5000L/min @ 8.0 bar electric pump; two 388m³ suction tanks and two 358m³ suction tanks) is expected to provide adequate flow and pressure capacity for the sprinkler systems recommended in this document; however, this will need to be confirmed by full hydraulic calculations at the appropriate time.

Exposure:

72. An initial flood risk assessment has been performed, and this recognises that there is a potential risk from storm water (overland flow) flooding. Some new systems will be incorporated into the existing arrangement of gullies and drainage channels. Consider the following aspects relating to storm water management (see Section 2.2.2 of FM Global Property Loss Prevention Data Sheet 1-40 *Flood*).
- a. Ensure new or existing drainage systems are capable of conveying or storing the 100-year rainfall-induced runoff without causing property damage.
 - b. Ensure the system uses grading sufficient to route predicted rain-water and snow-melt runoff away from buildings, outside storage and equipment.
 - c. Ensure water runoff originating from off-site areas is included in the water management plan.

- d. Arrange systems so that water will not enter or come in to contact with buildings, outside storage or equipment. All possible water ingress points, doors, windows and pipe chases into the building envelope should be at least 0.15m above the 100-year overland flow paths or ponding levels. This is especially important for sensitive equipment which may be at or below grade – e.g. electrical substations.
- e. *Include learning points from the 2020 storm water event at the Bridgend facility in planning for the Neptune project.*

Other Aspects

Temporary reel store (“Department T”)

- 73. A 760m² temporary reel store will be provided to give capacity during the project. This will be a hard standing with a canvas-frame weather-proofing enclosure, to the north of the existing pulp store building.
- 74. Omission of sprinkler protection in this structure is tolerable as it is non-permanent. The value of finished reels in the building should be minimised as far as possible, as in the event of a fire all stock in the store will be lost.
- 75. The facing wall of the pulp building should be upgraded to give 2-hour fire rating. Ensure non-combustible materials are used (e.g. mineral wool panels such as Rockwool or Eurobond). *This is planned to be done as part of asbestos removal around the site.*
- 76. Ensure fire hydrant coverage for the temporary reel store is available. Hydrants should be accessible from both north and east sides.

Loss Prevention Recommendations: Boiler & Machinery and Utility

Water plant:

Existing supply extraction provides sufficient capacity for both paper machines and their associated pulping operations. An addition may be needed to the treatment plant but this is not likely to impact loss prevention.

Steam supply:

Economiser upgrades are currently being planned on two heat recovery steam generators (“HRSG”s) and the single firetube boiler. The HRSGs will generate 11.25Te/hr of steam at 16 bar, and the firetube boiler 10Te/hr. This is not related to this project.

Current calculations suggest that two gas turbines and HSRGs, or one GT/HRSG plus firetube boiler, will meet the two paper machines’ demand.

The project team are currently reviewing options to give more capacity and redundancy. This could be a third GT/HRSG, or perhaps reinstating auxiliary firing on the existing HSRGs, or another firetube boiler. Gas supplies are currently being evaluated for capacity.

Electrical supply:

Current gas turbines (“GTs”) can make up to 10MW total. The three mill grid supplies can give up to 15MW each. An HV specialist has been engaged to review the system options, current equipment suitability for the increased capacity and age of systems. A new WEPA substation will also be constructed, providing three new incoming cables.

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77. FM Global recommends providing thermal imaging ports on HV breakers and any key LV equipment (e.g. production-critical motor drives) to allow periodic thermal imaging of the unit on load. Provision of ports at the specification stage is far more cost effective than retrofit. *Mr. Mike Hughes agreed to review this with the electrical team.*

Effluent:

The effluent plant is under review but is expected to have sufficient capacity based on it having been sized originally for many more paper machines which have since been removed.

Neptune paper machine:

Details on sparing philosophy, condition monitoring and contingency planning will be determined when the OEM has been determined. The machine will not be the same as others in the group. This aspect is still under review.

78. Yankee dryer – the decision on a cast or fabricated Yankee dryer has not yet been made. Although fabricated Yankee cylinders are a relatively new technology, FM Global has not become aware of any significant issues. There are advantages to a fabricated cylinder, including elimination of head-jacking (corrosion between the head and shell), higher elasticity of steel allowing for higher operating pressure and safety margin, less grinding and polishing during shutdowns, the ability to perform weld repairs, and having a thinner shell allowing for more efficient drying.

Compressed air:

Strategy is currently under review. The project team is reviewing cross-connections to give good redundancy.

Upcoming Activities

79. FM Global will continue to discuss queries and review information submitted.
80. Next follow up meeting to be determined.

Managing Hazards During Construction

81. *One fire hydrant in the existing pulp yard is planned to be removed to facilitate the construction project for the pulp yard and Neptune building. This has been discussed with FM Global and the fire strategy team. This is acceptable, provided other hydrants are accessible within 90m and the site emergency plan is updated to show clearly that this hydrant is disconnected.*

Water plant:

Existing supply extraction provides sufficient capacity for both paper machines and their associated pulping operations. An addition

Sincerely,

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Loss Prevention Resources

FM Global Property Loss Prevention Data Sheets ([http://www.fmglobalData Sheets.com](http://www.fmglobalDataSheets.com)). The following Data Sheets were referenced in this report:

1-28 *Wind Design*
1-40 *Flood*
1-54 *Roof Loads for New Construction*
2-0 *Installation Guidelines for Automatic Sprinklers*
3-26 *Fire Protection Water Demand for Nonstorage Properties*
5-31 *Cables and Bus Bars*
7-4 *Paper Machines and Pulp Dryers*
8-1 *Commodity Classification*
8-7 *Baled Fibre Storage*
8-9 *Storage of Class 1, 2, 3, 4 and Plastic Commodities*
8-21 *Roll Paper Storage*
8-22 *Storage of Baled Waste Paper*
8-24 *Idle Pallet Storage*

FM Global Loss Prevention Training (<https://fmglobaltraining.skillport.com>)
Approval Guide (<http://www.approvalguide.com>)
RoofNav (<http://roofnav.fmglobal.com>)

Distribution

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Photos/Attachments



Figure 5 - East end development, showing pulp yard, pulping building and Neptune machine house.



Figure 6 - West end development showing reel store ("J"), converting and shipping and high-bay warehouse ("F").

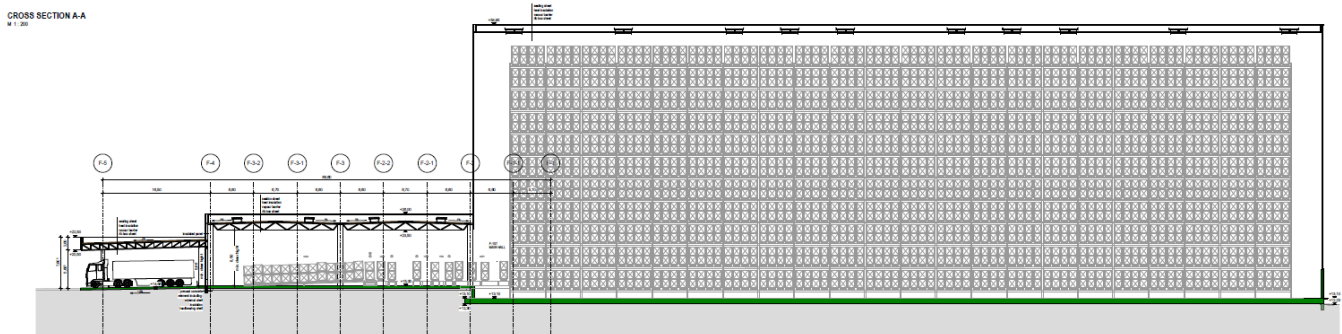


Figure 7 - Cross-section of high bay warehouse and marshalling area ("F").

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Project: 119003 WEPA UK BRIDGEND
Employer: WEPA UK Limited
Principal Designer: BHM INGENIEURE
Content: GC_04.02.22_Tech_Spec_Description_Fire_Protection_System
Index : 00 / 27.05.2020

ATTACHMENT 12.4

FM - Global Tissue Machine Protection – Firefly AB – Project Neptune_2020_05_20

Plan Review

WEPA Hygieneprodukte GmbH – WEPA UK Ltd.
Bridgend Paper Mill, Llangynwyd
Maesteg, Mid Glamorgan, CF34 9RS
United Kingdom

Index-Rec No: UK1830.00-01

Account No: 01-55657

Date of Review: 20 May 2020

Review No: 314294

Plans Submitted By: Mike Hughes, WEPA

Subject: Tissue Machine Protection – Firefly AB – Project Neptune

Executive Summary:

The proposal covers a spark detection and extinguishing system for the Neptune paper machine. At this stage the proposal is in outline, and full technical drawings have not yet been prepared.

Although fundamentally this proposal is in accordance with FM Global standards, please refer carefully to points 1, 2, and 3 below to ensure that the installed system is fully in accordance. Care must be taken to ensure that protection for the extended-nip press (“shoe press”) is adequate for the fire hazard is presents. The proposed water spray system may not be suitable for the sole protection measure beneath the machine dry-end hood, if one is to be fitted.

Please provide detailed designs and hydraulic calculations as outlined in point 4 below, at the appropriate time.

Scope of Review:

This confirms the receipt and review of:

- FireFly document reference 164899FIS, dated 2020-03-31.

FireFly proposes an FM Approved spark detection and extinguishing system for the Neptune tissue machine, to be installed at WEPA Bridgend site.

The control panel, input-output network unit, hydropress pump and water tank are all FM Approved. It should be noted that Approval for this system is in a pneumatic conveying system, rather than on a tissue machine; however the fundamental operation of the system is similar.

The system is proposed to be installed according to the following table. For pictorial representation of these zones, please refer to the drawings at the end of this document.

SYSTEM TABLE – FLAME DETECTION AND WATER MIST SUPPRESSION SYSTEM

Zone	Description	Detection	Suppression	Object/Risk area size	ATEX Zone	Ambient temp (°C)
<u>Eximio Network 1</u> Firefly Quick Suppression System						
Zone 1	Drive side	Flame detectors 2 x FD-UVIR	Water mist nozzles 20 x WNFP-K6 (c-c distance: 1.25 m) (height: min 1.25 m)	*	*	*(Max 60°C)
Zone 2	Doctor Blade	Flame detectors 2 x FD-UVIR SAD detector 2 x SAD	Water mist nozzles 8 x WNFP-K6	-	*	*(Max 60°C)
Zone 3	Web Scan	WebScan detectors 8 x WSD	Detection only	5.5 m	*	*(Max 60°C)
Zone 4	Calender Area / Dry End	Flame detectors 4 x FD-UVIR	Water mist nozzles 18 x WNFP-K6 (c-c distance: 1.25 m (Down) (c-c distance: 1.50 m (Side) (height: min 1.25 m)	3 m	*	*(Max 60°C)
Zone 5	Pope reel area	Flame detectors 2 x FD-UVIR	Water mist nozzles 37 x WNFP-K6 (c-c distance: 1.25 m (Down) (c-c distance: 1.50 m (Side) (height: min 1.25 m)	7.3 m	*	*(Max 60°C)

* Information is missing

Note – Components listed above may be part of integrated packages (see separate 'system components' list)

Review Comments:

1. The following key equipment outlined in the quotation are not listed in the current FM Approval Guide. Please confirm, or propose FM Approved options. (The Approval Guide listing for the system is included in this review as an appendix).
 - a. FD-UVIR – UV / IR flame detector. This unit is considered critical to the proper operation of the system, and therefore its equivalence (in terms of response to IR for spark detection) to the FM Approved systems is critical. Please provide additional information to allow evaluation of this device.
2. The following items are not FM Approved; however their use on this system is considered appropriate within the constraints below. They are accepted due to the fact that the FM Approved systems are for use on pneumatic conveying equipment, rather than a tissue machine.
 - a. TSK – temperature monitoring. However it is not clear from the schematics where the TSK devices will be installed.
 - b. WNFP-K6 – water mist nozzle. This is to be used for extinguishing and appears to provide water spray protection in many areas of the machine.
 - i. This system can be used for protection of the extended-nip press (“shoe press”) which is assumed to be Zone 1. This is subject to the recommendations in Section 2.7 *Shoe Press* of FM Global Property Loss Prevention Datasheet 7-4 *Paper Machines and Pulp Dryers*. These points have already been included in FM Global Project Report (last updated 14 April 2020) point 25.

Critical is that the water spray protection must deliver 12mm/min over the protected area for a duration of 60 minutes. (The hose stream allowance would not be delivered by the water spray system and does not need to be included in the design). If this duration cannot be achieved, supplementary sprinklers (from the mill fire system) may be required over the extended-nip press area.

Please provide additional information to confirm that the water spray system in this section can meet the recommendations of Section 2.7 of FM Global Datasheet 7-4.

- ii. This system can be used for protection on the web, calender area and pope reel area (zones 3, 4 and 5) as an early-response system supplemental to either ceiling sprinkler protection (if this area of the paper machine is open to the ceiling) or sprinkler protection in the hood (if this area of the paper machine is enclosed).

Water spray system is not an alternative to sprinkler protection within machine hoods. See Section 2.1.4 of Datasheet 7-4 and point 28 of FM Global Project Report dated 14 April 2020.

Please provide additional information on how the dry end of the paper machine is to be enclosed and protected.

3. Please ensure that the solenoid valve selected is the FM Approved version with the appropriate suffix to the model number – i.e. WS20-FM.
4. Please provide full, detailed installation and configuration drawings for review by FM Global when these have been prepared.

This review is for property insurance purposes only in accordance with FM Global standards and guidelines. Nothing should be inferred from this review regarding compliance with any rules, regulations or requirements of government agencies, state or local codes or any other jurisdictional authority. We are retaining the copy of your submitted plans for our files.

Sincerely,

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Loss Prevention Resources:

FM Global Property Loss Prevention Data Sheets (<https://www.fmglobal.com/research-and-resources/fm-global-data-sheets>)

FM Global Loss Prevention Training (<https://fmglobaltraining.skillport.com>)

Approval Guide (<http://www.approvalguide.com>)

RoofNav (<http://roofnav.fmglobal.com>)

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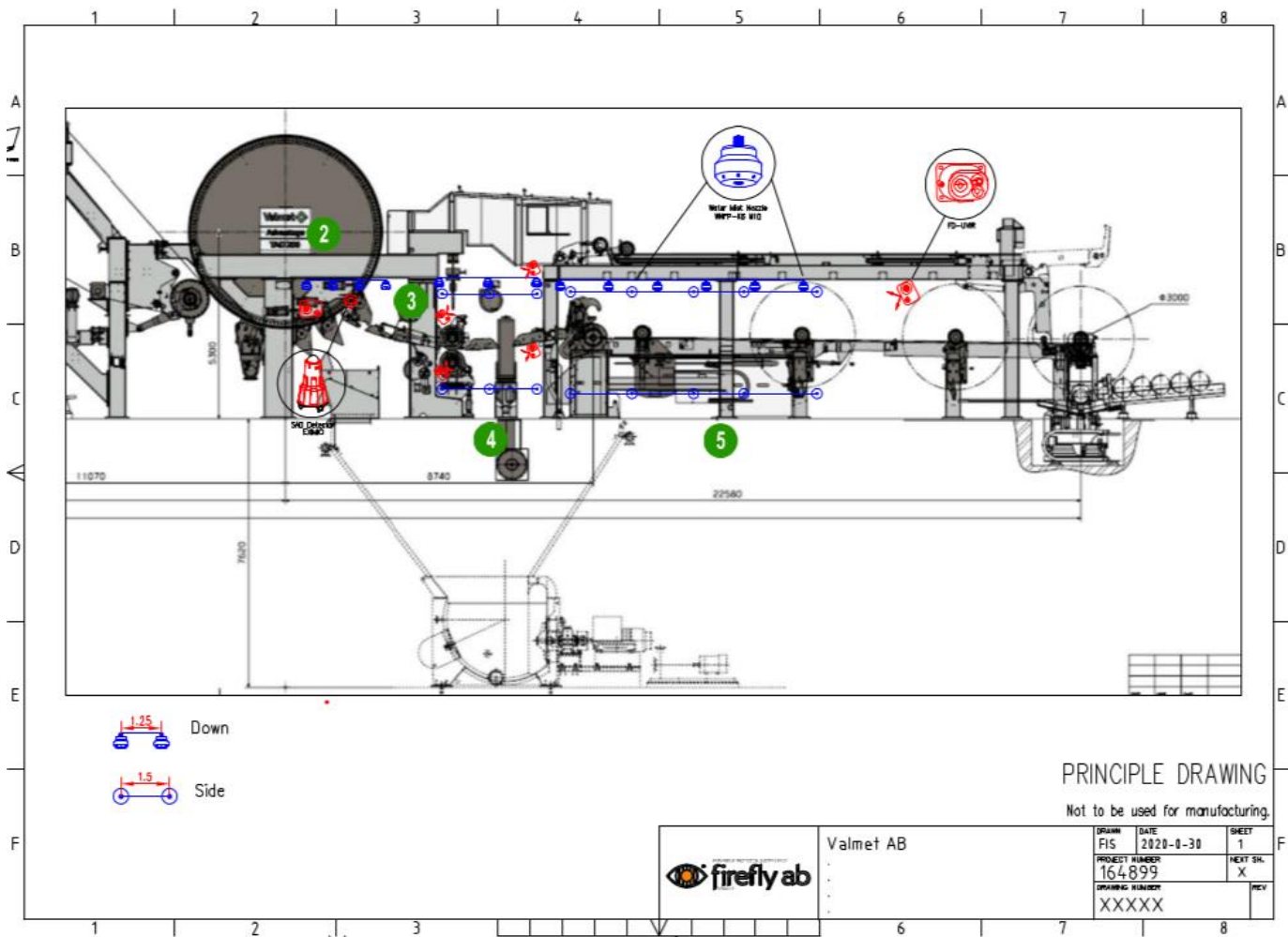


Figure 2 - Zone 2, 3, 4 and 5

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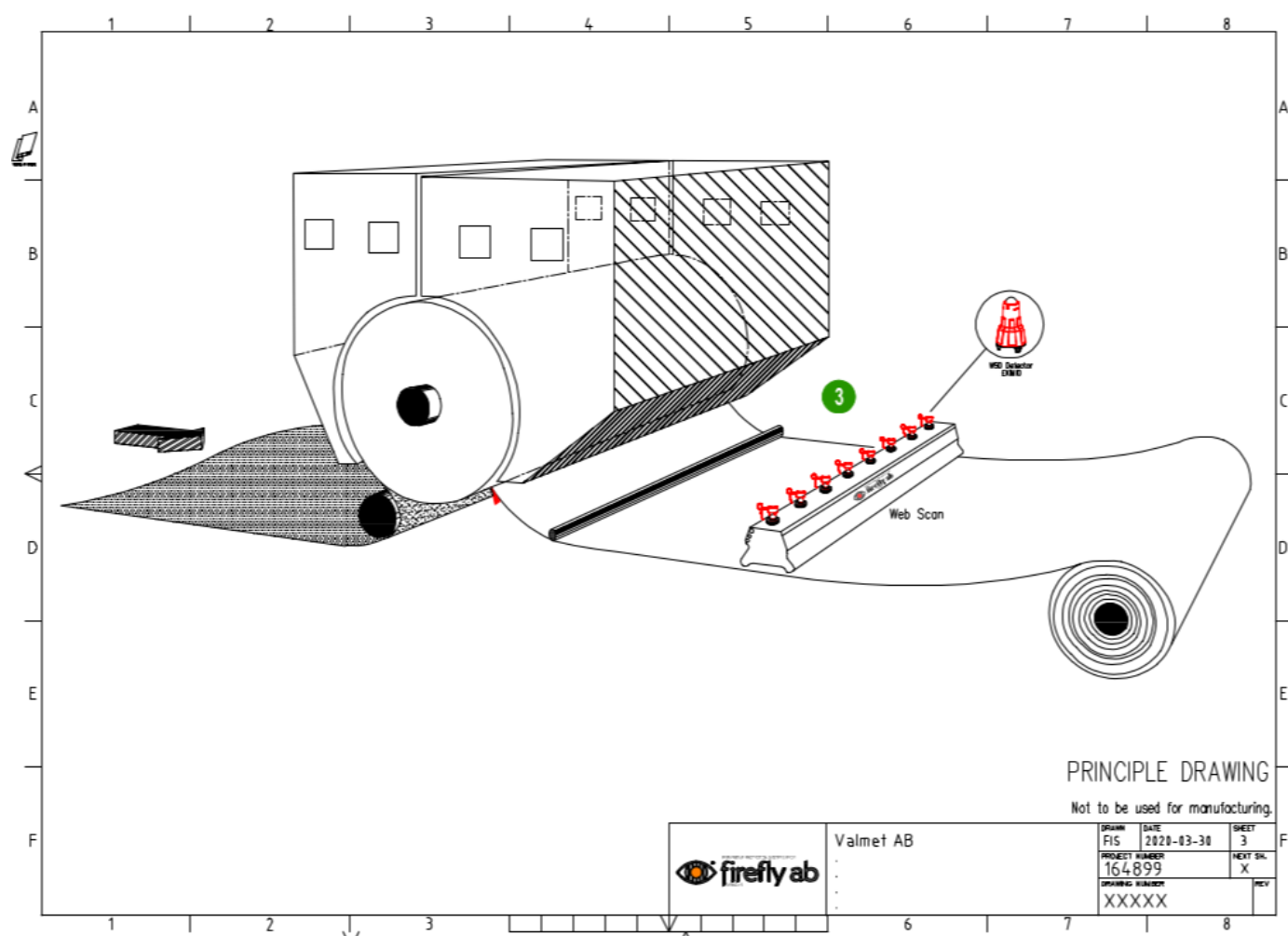


Figure 3 - Zone 3

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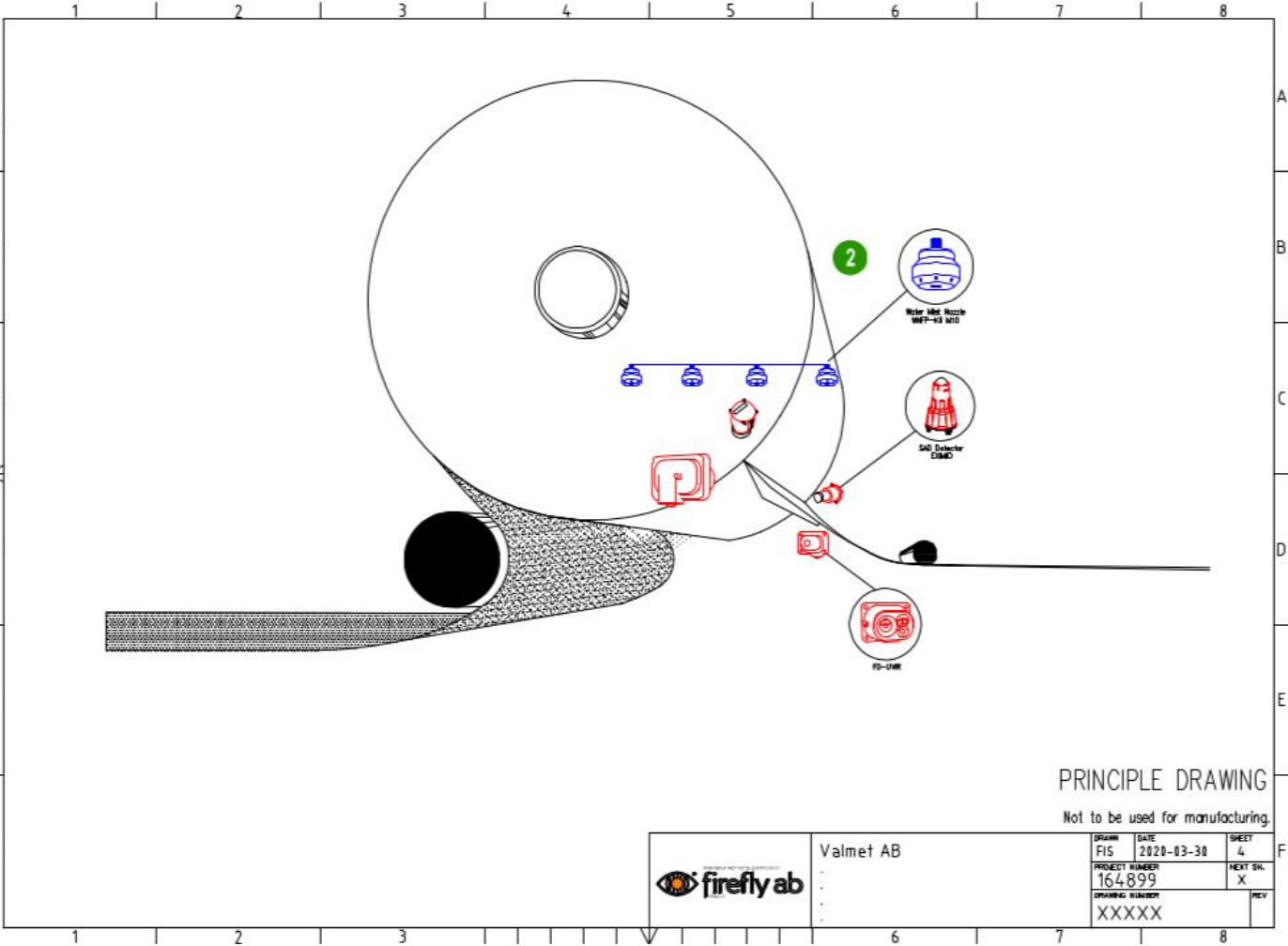


Figure 4 - Zone 2

Project: 119003 WEPA UK BRIDGEND
Employer: WEPA UK Limited
Principal Designer: BHM INGENIEURE
Content: GC_04.02.22_Tech_Spec_Description_Fire_Protection_System
Index : 00 / 27.05.2020

ATTACHMENT 12.5

FM - Global Plan Rev AS Departments A, B & C PR314322_2020_05_11

Plan Review

WEPA Hygieneprodukte GmbH – WEPA UK Ltd.
Bridgend Paper Mill, Llangynwyd
Maesteg, Mid Glamorgan, CF34 9RS
United Kingdom

Index-Rec No: UK1830.00-01
Account No: 01-55657
Date of Review: 11 May 2020
Review No: 314322

Plans Submitted By: Dario Maggiorelli, BHM Ingenieur

Subject: Fire Fighting Initial Submittal – Overall and Departments A&B, and Department C

Executive Summary:

The drawings submitted provide a high-level overview of the areas of Departments A&B, and Department C, which will be provided with fire compartmentation and automatic sprinkler protection.

This submittal is in accordance with FM Global standards subject to receipt of detailed designs and hydraulic calculations as outlined in Review Comments 1 and 2 of this review.

Scope of Review:

This confirms the receipt and review of:

- Drawing 56200_OVE_8422 Revision 02 – General / Overview, Fire Suppression System
- Drawing 56202_FPR_9200 Revision 01 – Dept A+B, Fire Protection Building
- Drawing 56203_FPR_9201 Revision 01 – Dept C, Fire Protection Building

Fire protection systems will be supplied from the existing fire protection system, comprising three 5678 L/min @ 9.5 bar diesel-driven pumps and one 5000 L/min @ 8.0 bar electrically driven fire pump fed from four suction tanks with a combined capacity of 1492 m³.

Fire hydrant supplies may be fed from public hydrant main or a mill supply; tests are currently being conducted to determine the water available from these systems.

Drawing OVE_8422 shows the connection of a new fire main pipe, connecting into the existing site fire main at the corner of the existing Jupiter building. This pipe is then taken to feed the sprinkler valve set for Department C (Neptune building), and the fire hydrants for Department B (Pulp / Bale Handling) and Department A (pulp / broke yard).

Drawing FPR_9200 shows: -

- Cable basement below switchgear room is an area protected with automatic sprinklers; this is in compliance with point 7 of FM Global Project Report dated 14 April 2020.
- Electrical substation, switchgear room and cable basement are separated from the pulp processing building by a fire compartment wall.
- Pulp unloading canopy is protected by automatic sprinklers; this is in compliance with point 9 of FM Global Project Report dated 14 April 2020.

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- Control room, mess area, etc. are protected by automatic sprinklers; this is in compliance with point 8 of FM Global Project Report dated 14 April 2020.

Drawing OVW_9201 shows: -

- Neptune building basement is protected only in part with automatic sprinklers. This is as already agreed with FM Global, as sprinkler protection is only required in specific areas: -
 - The chemical stores – this is shown on the drawing and is in compliance with point 28b of FM Global Project Report dated 14 April 2020. The chemical stores are also fully enclosed in a fire wall (point 16).
 - Specific oil hazards in the basement – e.g. hydraulic power units for the shoe press, or hot oil systems. These are not shown on the drawing as they are currently under review between Valmet (the paper machine manufacturer), WEPA and FM Global. The drawing confirms that the sprinklers will need to extend from the hazard area by 6m in all directions. See Point 24, 25 and 28 of the FM Global Project Report dated 14 April 2020.
- The Neptune building machine hall floor will be fully provided with automatic sprinklers at ceiling level. A 300mm sprinkler main is shown running from the pipe bridge to a valve set on the south wall of the building. Additional low-level sprinkler protection may be required for specific oil hazards (e.g. hydraulic units; extended nip press (“shoe press”). This is currently being reviewed by Valmet, WEPA and FM Global. This is in compliance with point 22 of FM Global Project Report dated 14 April 2020. See also Point 24, 25 and 28 relating to hydraulic oil hazards and the extended nip press.
- The Neptune control room (on both levels) will be protected with automatic sprinklers. This is in compliance with Point 26 of FM Global Project Report dated 14 April 2020.
- The Neptune building mezzanine will be fully provided with automatic sprinklers. This is in compliance with point 22 of FM Global Project Report dated 14 April 2020.
- The cable floor will be provided with automatic sprinklers. This is in compliance with point 27 of FM Global Project Report dated 14 April 2020.

Review Comments:

1. The drawings provided show only in outline the areas to be provided with automatic sprinklers. For technical information on design specifications for these areas, please refer to FM Global Project Report dated 14 April 2020. Full detailed design and hydraulic calculations will be required when available to determine full compliance with FM Global Property Loss Prevention Data Sheets.
2. When specific oil hazards on the Neptune paper machine floor and basement are determined (they are currently under review between Valmet, WEPA and FM Global), the appropriate sprinkler protection will need to be put in place in accordance with points 24, 25 and 28 of FM Global Project Report dated 14 April 2020.

This review is for property insurance purposes only in accordance with FM Global standards and guidelines. Nothing should be inferred from this review regarding compliance with any rules, regulations or requirements of government agencies, state or local codes or any other jurisdictional authority. We are retaining the copy of your submitted plans for our files.

Sincerely,

Barney Weston
Senior Engineering Specialist
barnaby.weston@fmglobal.com
+44 1753 750318

Loss Prevention Resources:

FM Global Property Loss Prevention Data Sheets (<https://www.fmglobal.com/research-and-resources/fm-global-data-sheets>)

FM Global Loss Prevention Training (<https://fmglobaltraining.skillport.com>)

Approval Guide (<http://www.approvalguide.com>)

RoofNav (<http://roofnav.fmglobal.com>)

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Gareth Lloyd, HNLA Fire Engineering, g.lloyd@fire-engineering.co.uk

Barney Weston, FM Global, barnaby.weston@fmglobal.com

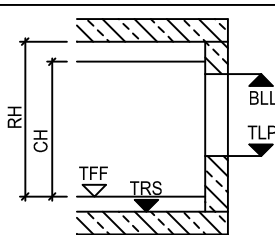
Lee Shaw, FM Global, lee.shaw@fmglobal.com

Gareth Hughes, FM Global, gareth.hughes@fmglobal.com

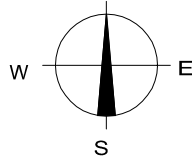
Dirk Legatis, FM Global, dirk.legatis@fmglobal.com

NOTES

1. PIPELINE INTO DEPARTMENT C WILL SUPPLY SPRINKLER SYSTEM. ROUTE REQUIRED ALSO TO ENTER INTO THE BASEMENT.
2. PIPELINE INTO DEPARTMENT B WILL SUPPLY SPRINKLER SYSTEM and HYDRANTS in DEPARTMENT A AND AREA 1 TOO.
3. CONNECTION TO VALVE SET NUMBER 6 (56200_OVE_8426_Sprinkler_System_Fed_Fire_Hydrants_PRE_00).
At the indicated connection point source duty: 7636,9L/min @ 8,714 bar.
Fire tanks capacity: 1492000 litres.
4. EXISTING HYDRANT TO BE MOVED ALONG THE NEW RETAINING WALL (some meters). HYDRANT FED BY TOWN WATER SUPPLY 2. PRESSURE AND FLOW RATE TO BE CONFIRMED BY WEPA.

KEY FIRE COMPARTMENTS			
<div></div>	FIRE MAIN COMPARTMENT	<div></div>	FIRE SUB COMPARTMENT
<div></div>		<div></div>	SMOKE COMPARTMENT
KEY MATERIALS			
<div></div>	REINFORCED CONCRETE	<div></div>	PRECAST CONCRETE ELEMENT
<div></div>	BRICKWORK	<div></div>	PRECAST CONCRETE ELEMENT
<div></div>	PLASTERBOARD	<div></div>	HEAT INSULATION RIGID
<div></div>	EXISTING BUILDING	<div></div>	DEMOLITION
<div></div>		<div></div>	HEAT INSULATION SOFT
<div></div>		<div></div>	SANDWICH PANEL
<div></div>		<div></div>	GLASS
KEY ROOM			
TFF = TOP FINISH FLOOR	RH = ROOM HEIGHT	TL = TOP LEVEL	
TRS = TOP ROUGH SLAB	CH = CLEAR HEIGHT	BL = BOTTOM LEVEL	
A = AREA	TLP = TOP LEVEL PARAPETE		
P = PERIMETER	BLI = BOTTOM LEVEL LINTEL		

OVERVIEW:



OVERVIEW

MILL SITE ±0.00m = 75.15 AOD (above ordnance datum)

PLANNER	<div></div>	<div></div>	<div></div>
<div></div>	<div></div>	<div></div>	<div></div>

PROJECT WEPA UK BRIDGEND



CONTENT OF PLAN GENERAL/OVERVIEW
FIRE SUPPRESSION SYSTEM

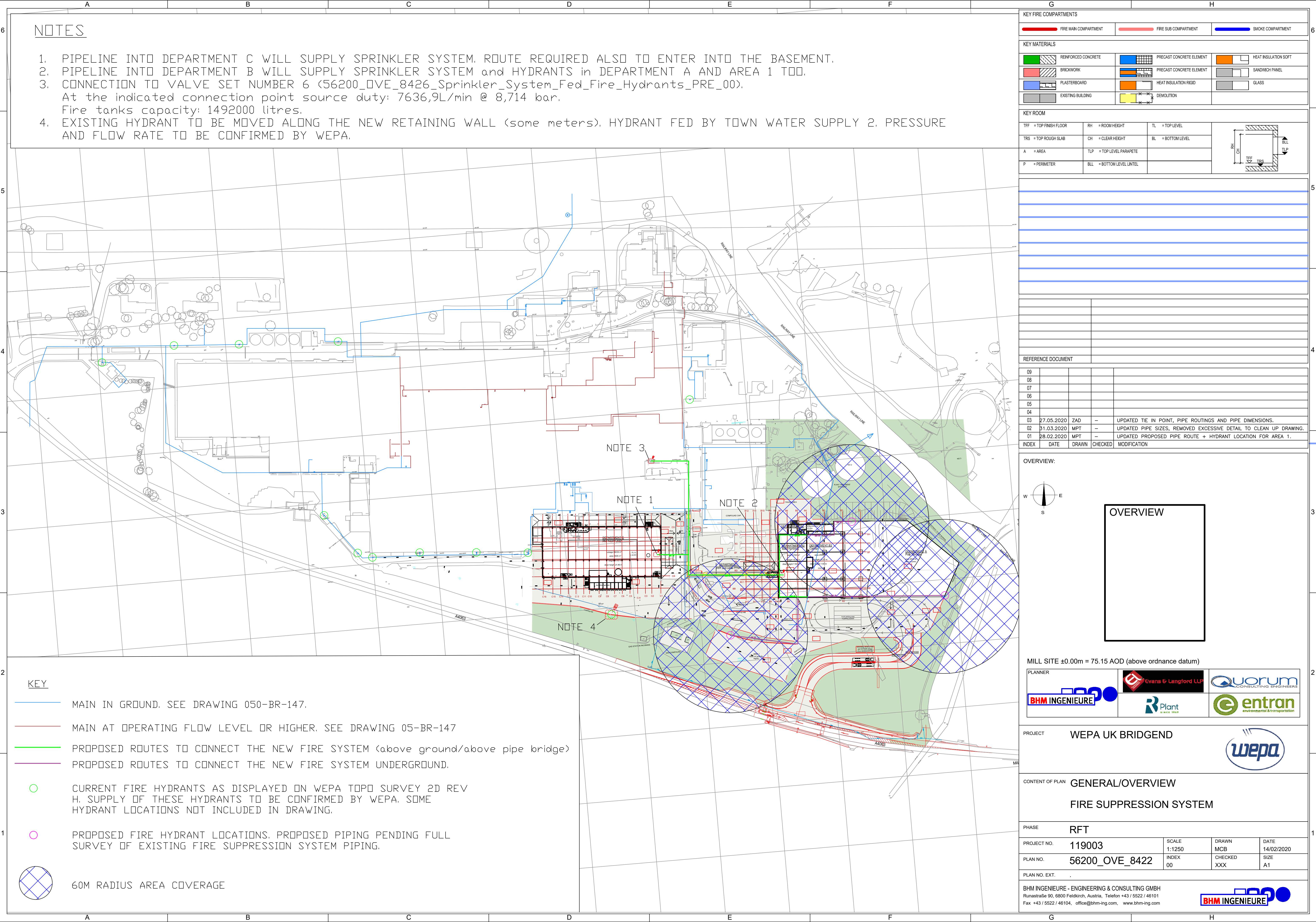
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PROJECT NO.	119003	SCALE	1:1250
PLAN NO.	56200_OVE_8422	INDEX	00
PLAN NO. EXT.		CHECKED	XXX
		DATE	14/02/2020
		SIZE	A1

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Fax +43 / 5522 / 46104, office@bhm-ing.com, www.bhm-ing.com

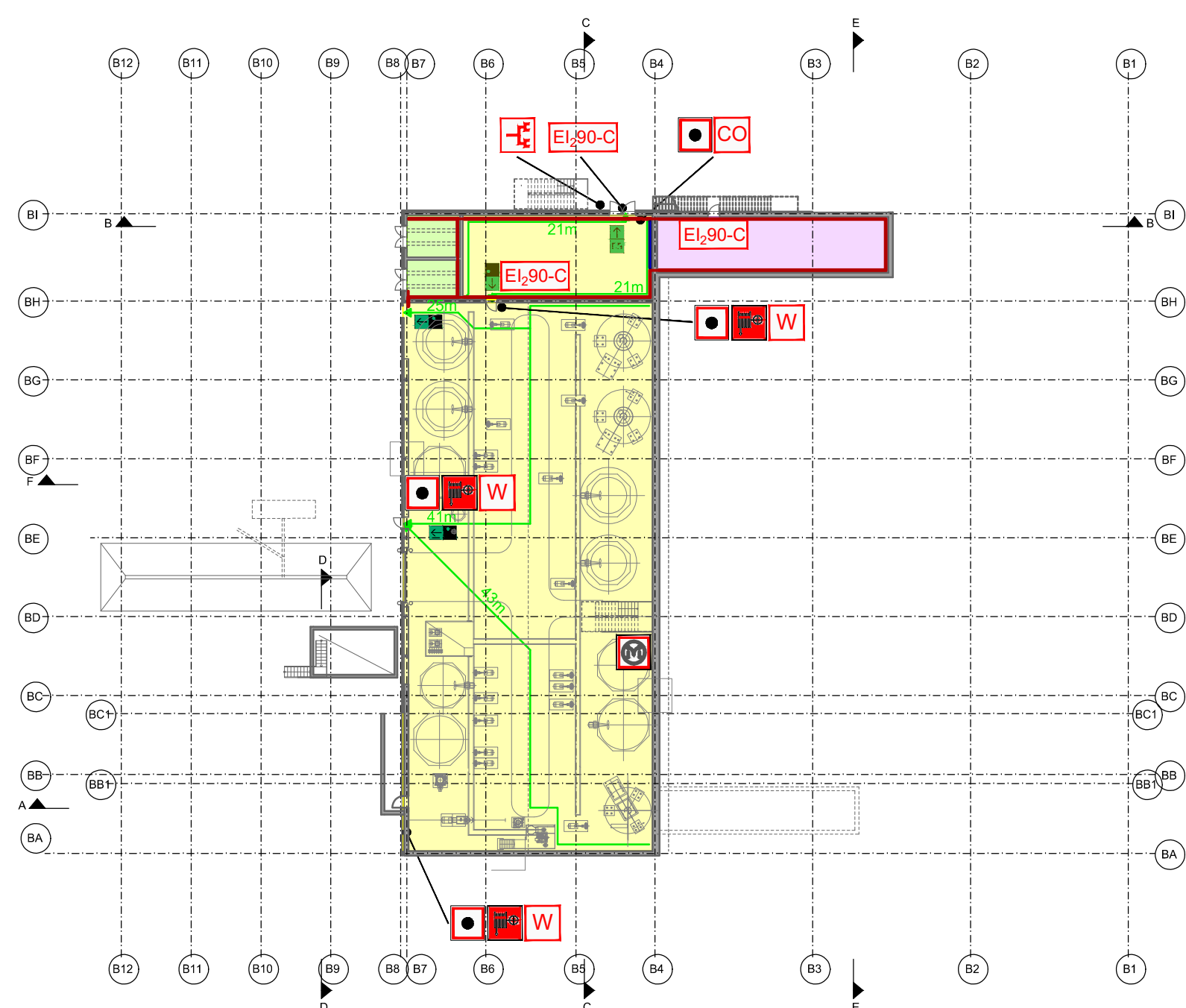


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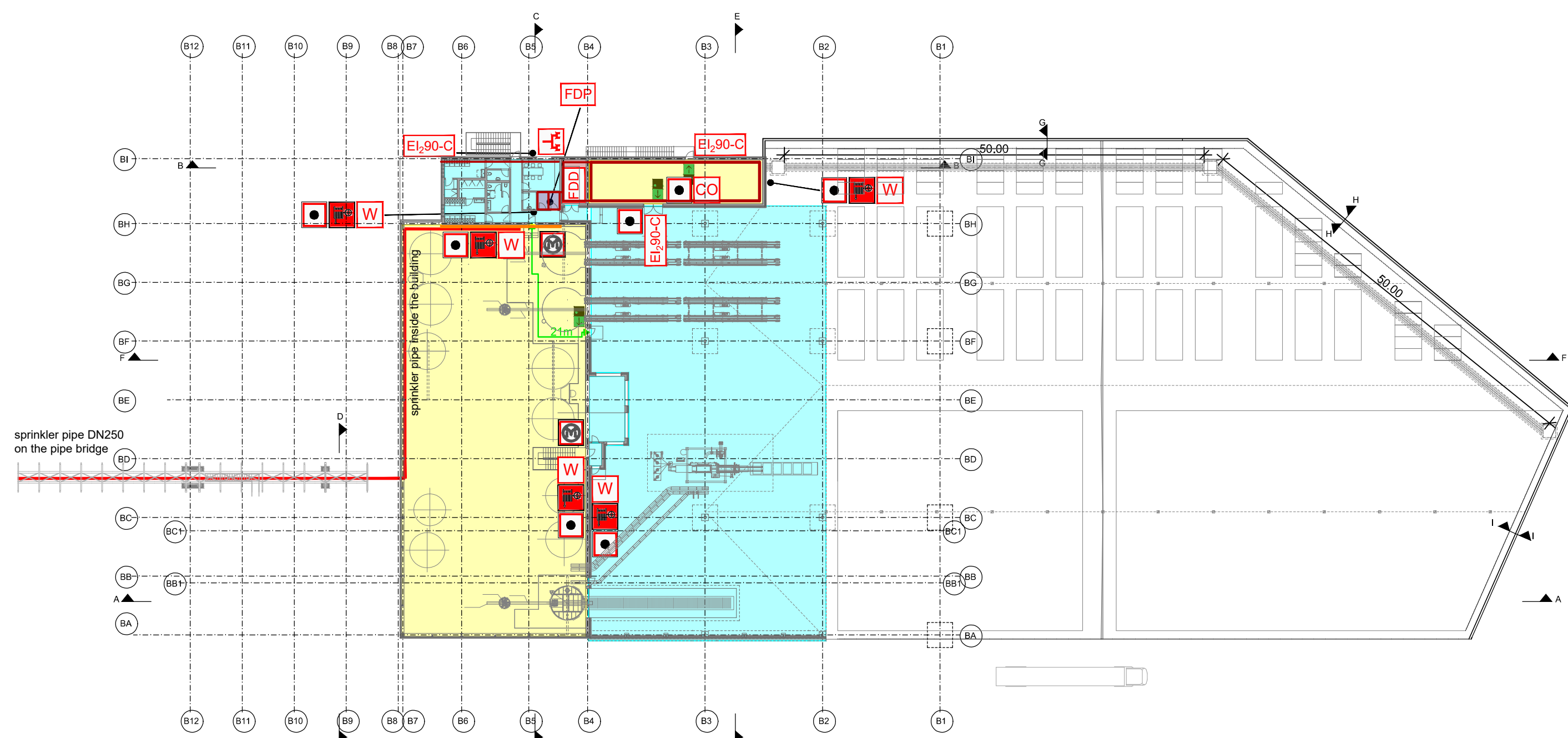
- MAIN IN GROUND. SEE DRAWING 050-BR-147.
- MAIN AT OPERATING FLOW LEVEL OR HIGHER. SEE DRAWING 05-BR-147
- PROPOSED ROUTES TO CONNECT THE NEW FIRE SYSTEM (above ground/above pipe bridge)
- PROPOSED ROUTES TO CONNECT THE NEW FIRE SYSTEM UNDERGROUND.
- CURRENT FIRE HYDRANTS AS DISPLAYED ON WEPA TOPO SURVEY 2D REV H. SUPPLY OF THESE HYDRANTS TO BE CONFIRMED BY WEPA. SOME HYDRANT LOCATIONS NOT INCLUDED IN DRAWING.
- PROPOSED FIRE HYDRANT LOCATIONS. PROPOSED PIPING PENDING FULL SURVEY OF EXISTING FIRE SUPPRESSION SYSTEM PIPING.
- 60M RADIUS AREA COVERAGE



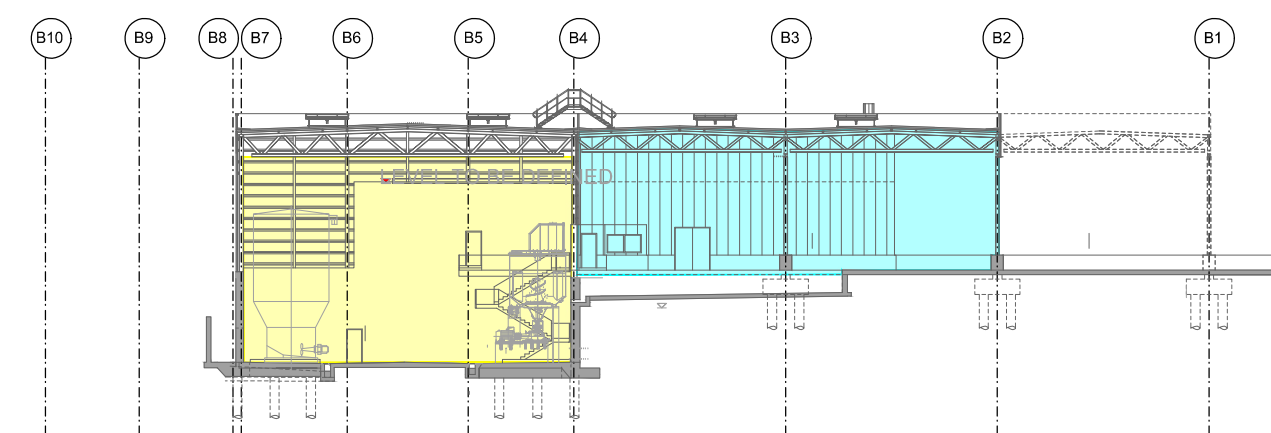
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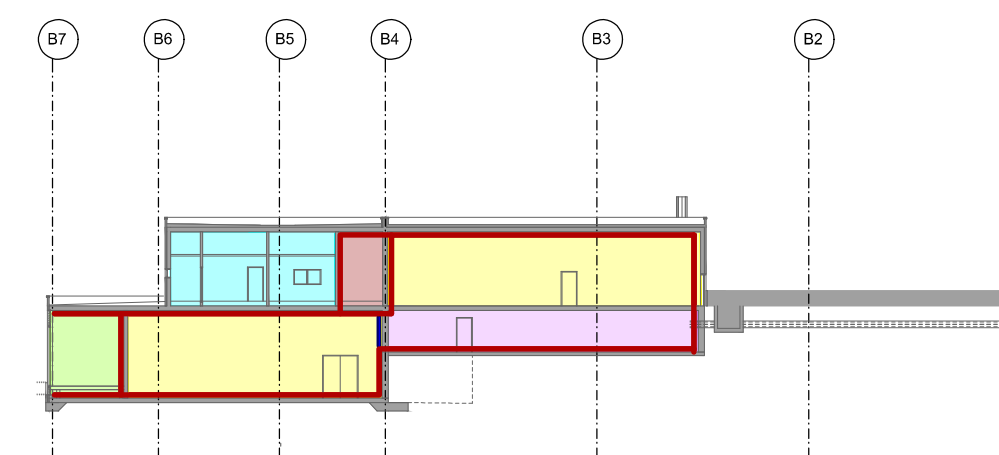
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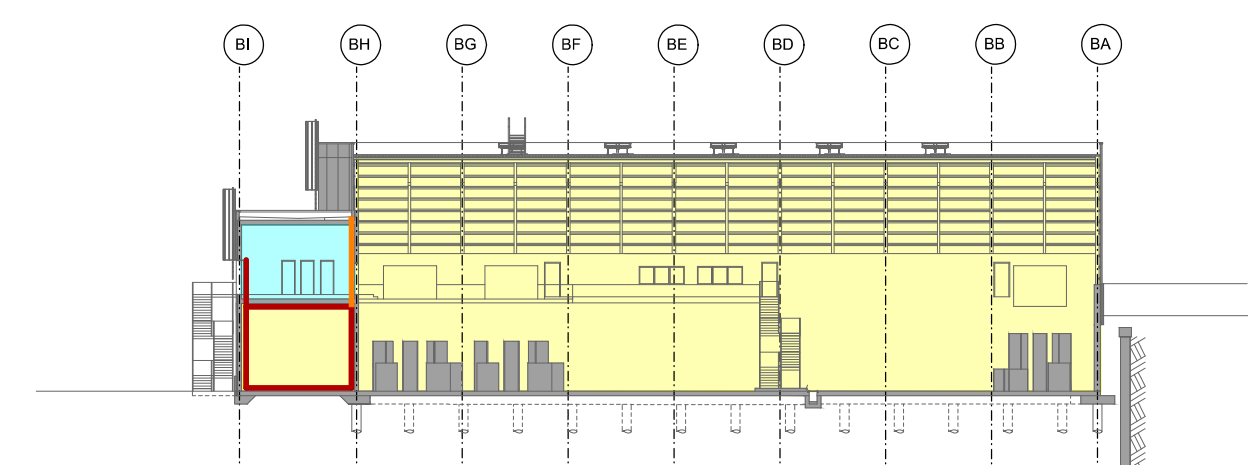
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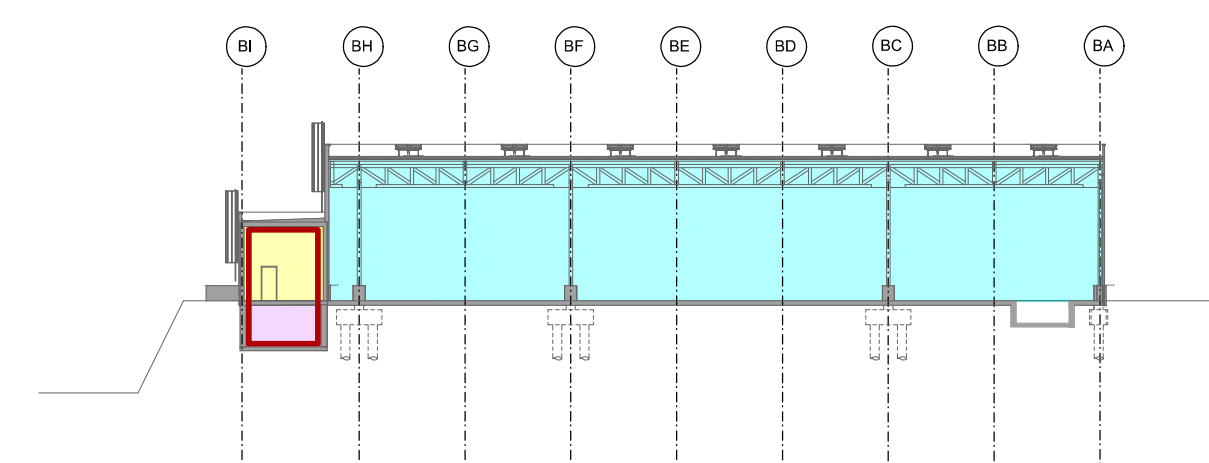
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




1:500



1:500



- | key | |
|---|--|
|  | release heat and smoke extraction |
|  | dry riser pipe with hose connection up to the roof |
|  | fire alarm push button |
|  | wall hydrant (wet) |
|  | female 65mm standard coupling (dry riser pipe) |
|  | fire extinguisher (carbon dioxide) |
|  | fire extinguisher (water misting) |
|  | fire detection panel (mainstation) |
|  | fire detection display (interface) |
|  | escape way |
|  | area detected by smoke or heat detectors |
|  | area detected by aspirating smoke detectors |
|  | area protected by sprinkler system |
|  | switch gear room protected by sprinkler system |
|  | sprinkler substation protected by sprinkler system |
|  | technical room automatic fire alarm system |

Detailed information about the specification of the whole sprinkler system and the fire detection system is visible at the "description_fire_protection_system" document

[illegible]

MILL SITE $\pm 0.00\text{m}$ = 75.15 AOD (above ordnance datum)

<p>PLANNER</p> 	 <p>Evans & Langford LLP</p>	 <p>Quorum CONSULTING ENGINEERS</p>
	 <p>R Plant SINCE 1989</p>	 <p>entran environmental & transportation</p>

PROJECT	WEPA UK BRIDGEND
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CONTENT OF PLAN

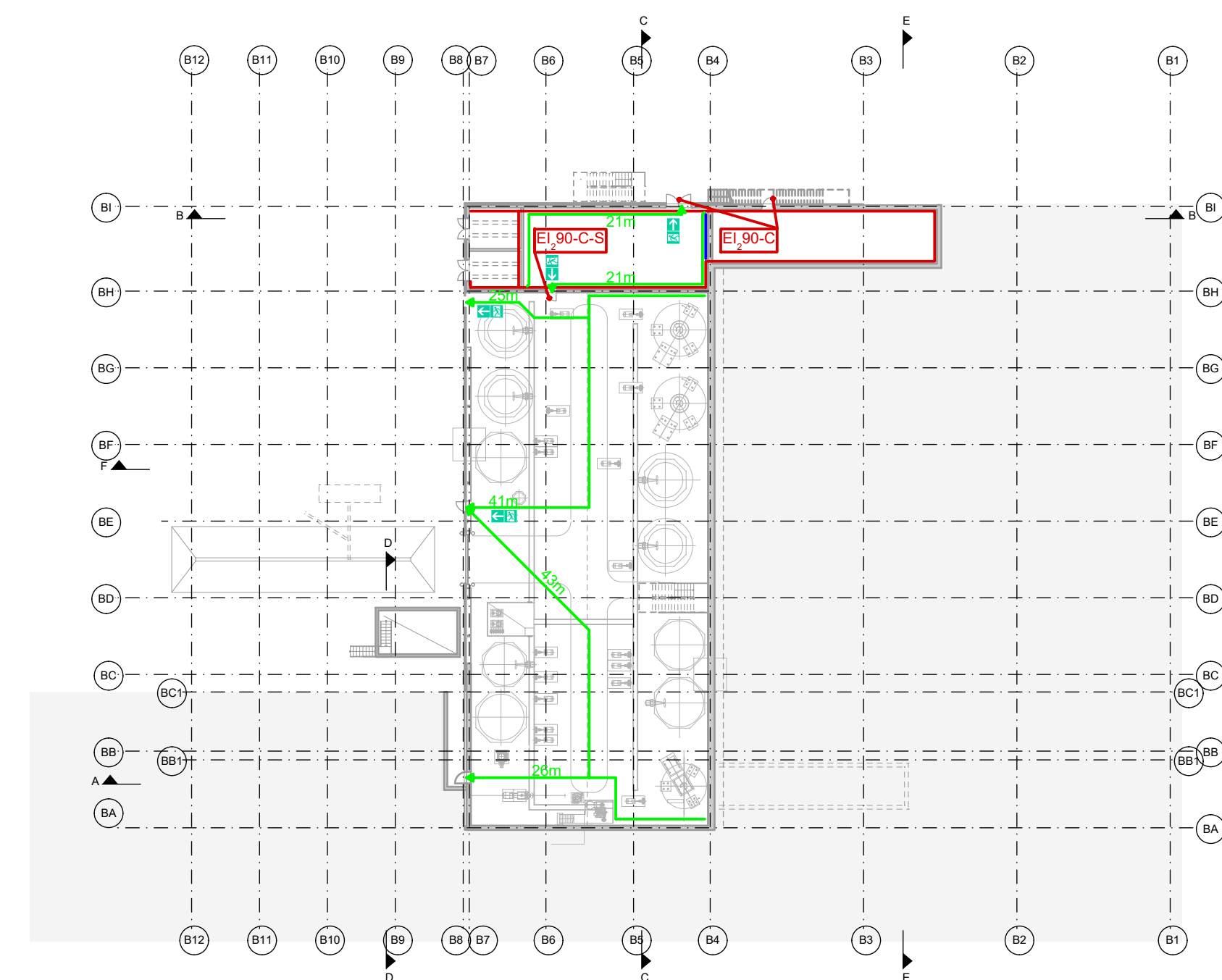
DEPT. A+B
FIRE PROTECTION BUILDING
LEVEL ± 0.00 , +6.00

PHASE	FC		
PROJECT NO.	119003	SCALE 1:500	DRAWN NM DATE 18.01.2021
PLAN NO.	56302 FPR 9200	INDEX 00	CHECKED JN SIZE 0.841x0.594 = 0.50

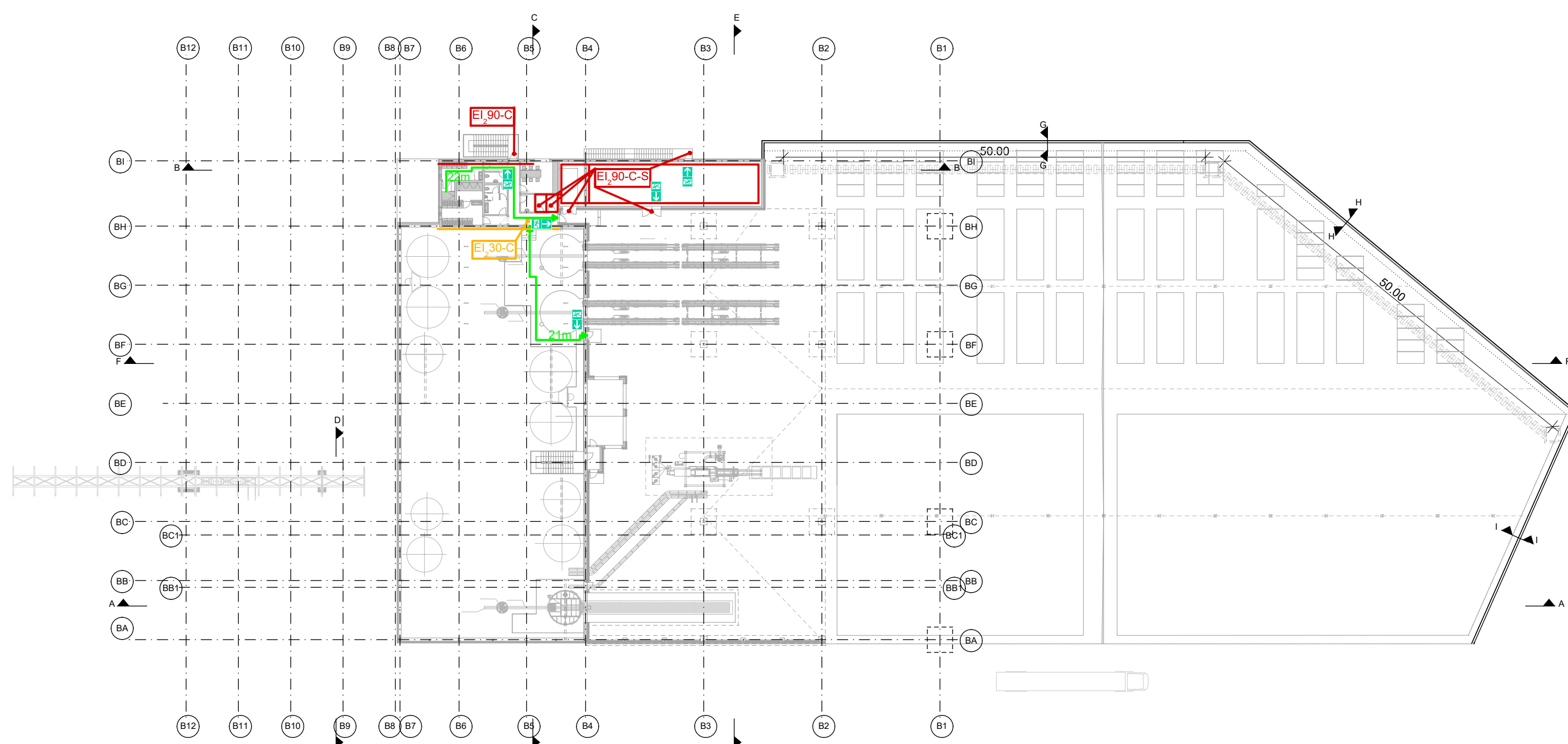
BHM INGENIEURE - ENGINEERING & CONSULTING GMBH
Runastraße 90, 6800 Feldkirch, Austria, Telefon +43 / 5522 / 46101
Fax +43 / 5522 / 46104, office@bhm-ing.com, www.bhm-ing.com



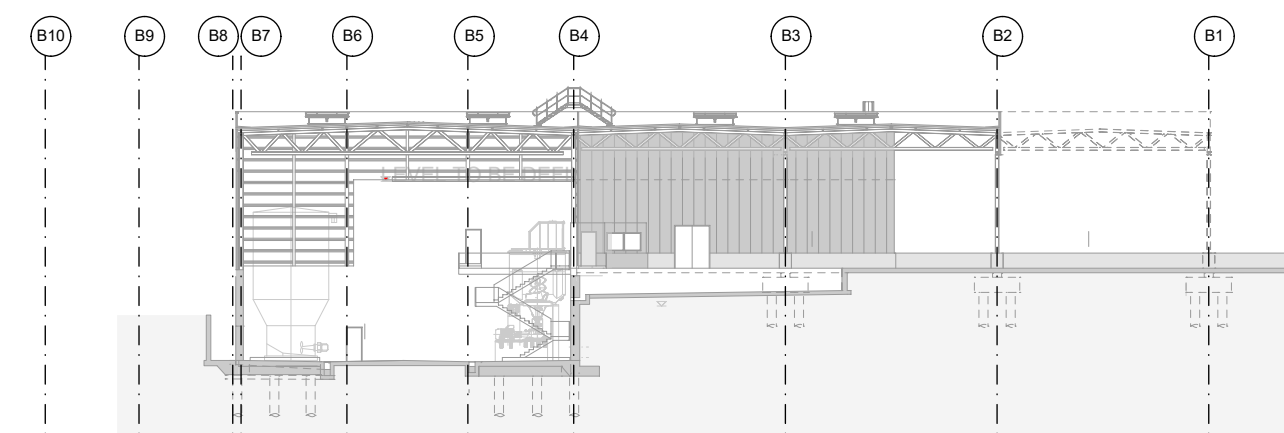
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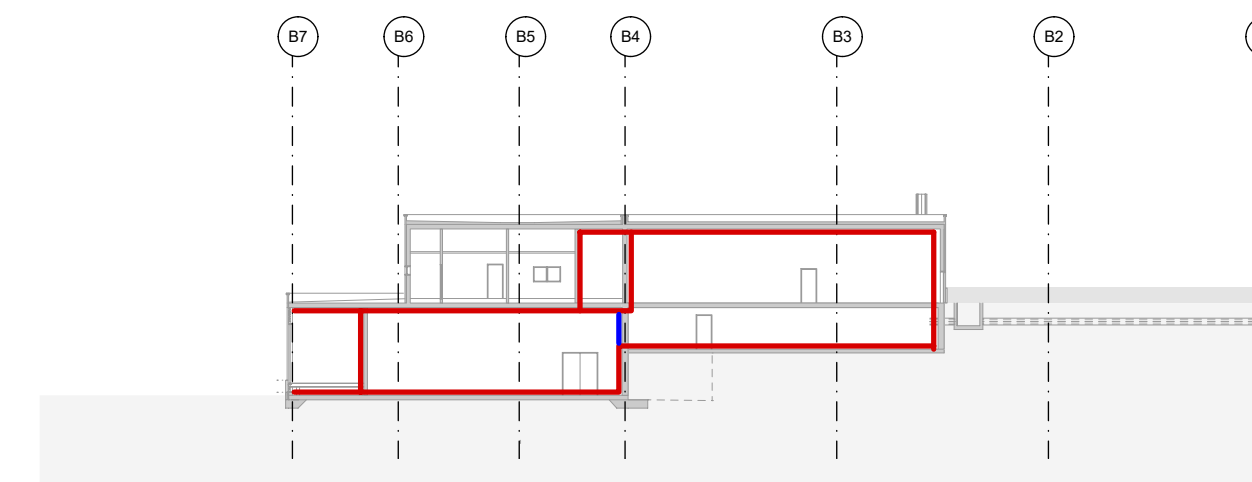
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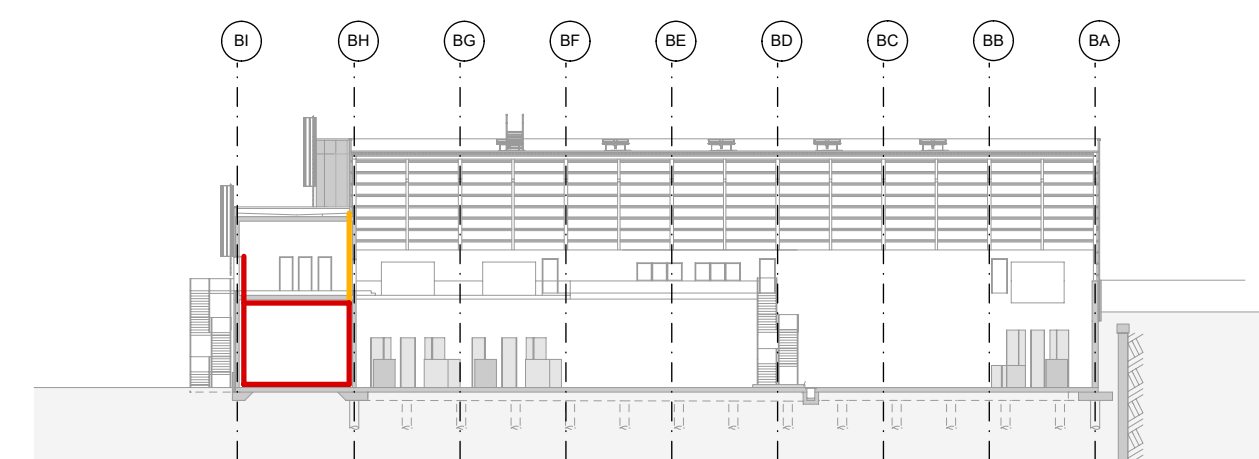
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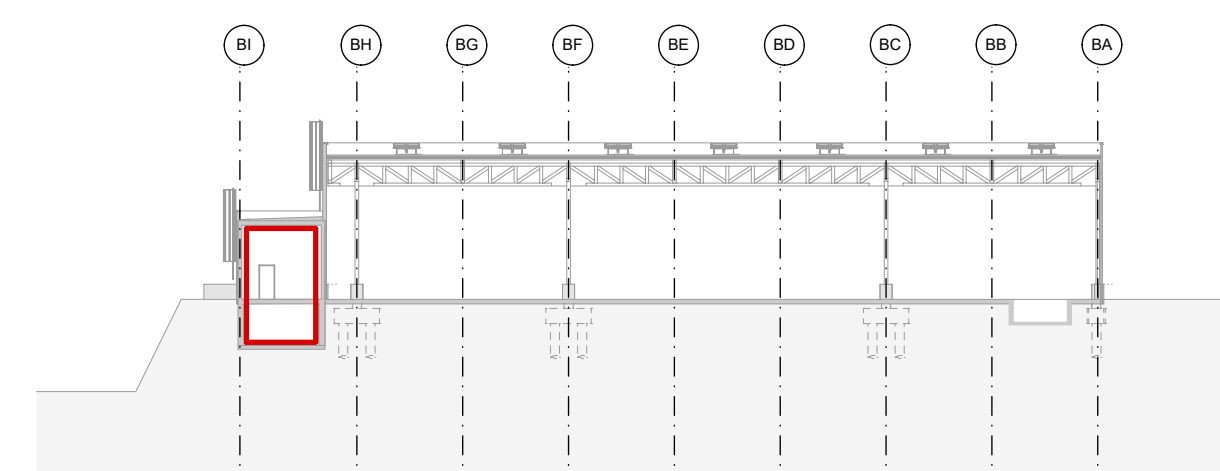
1:500



1:500



1:500



KEY FIRE COMPARTMENTS			
FIRE MAIN COMPARTMENT	FIRE SUB COMPARTMENT	SMOKE COMPARTMENT	

KEY MATERIALS			
	REINFORCED CONCRETE		PRECAST CONCRETE ELEMENT
	BRICKWORK		PRECAST CONCRETE ELEMENT
	PLASTERBOARD		HEAT INSULATION RIGID
	EXISTING BUILDING		DEMOLITION
	HEAT INSULATION SOFT		SANDWICH PANEL
	GLASS		

KEY ROOM			
TFF = TOP FINISH FLOOR	RH = ROOM HEIGHT	TL = TOP LEVEL	
TRS = TOP ROUGH SLAB	CH = CLEAR HEIGHT	BL = BOTTOM LEVEL	
P = AREA	TLP = TOP LEVEL PARAPETE		
P = PERIMETER	BLL = BOTTOM LEVEL LINTEL		

ALL DIMENSIONS MUST BE CHECKED ON SITE.
PROCESS LAYOUT IS SHOWN FOR REFERENCE ONLY

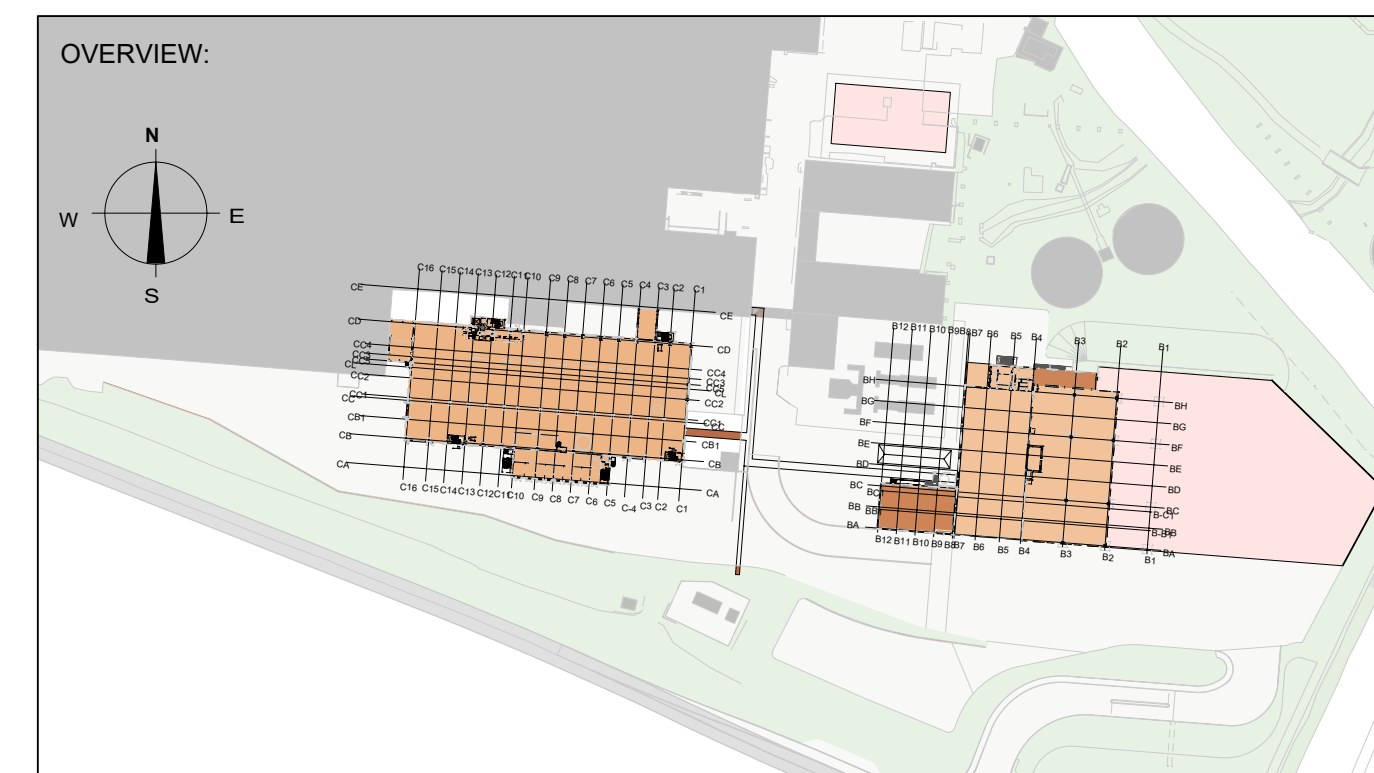
REI30







REI90



ESCAPE ROUTES

REFERENCE DOCUMENT				

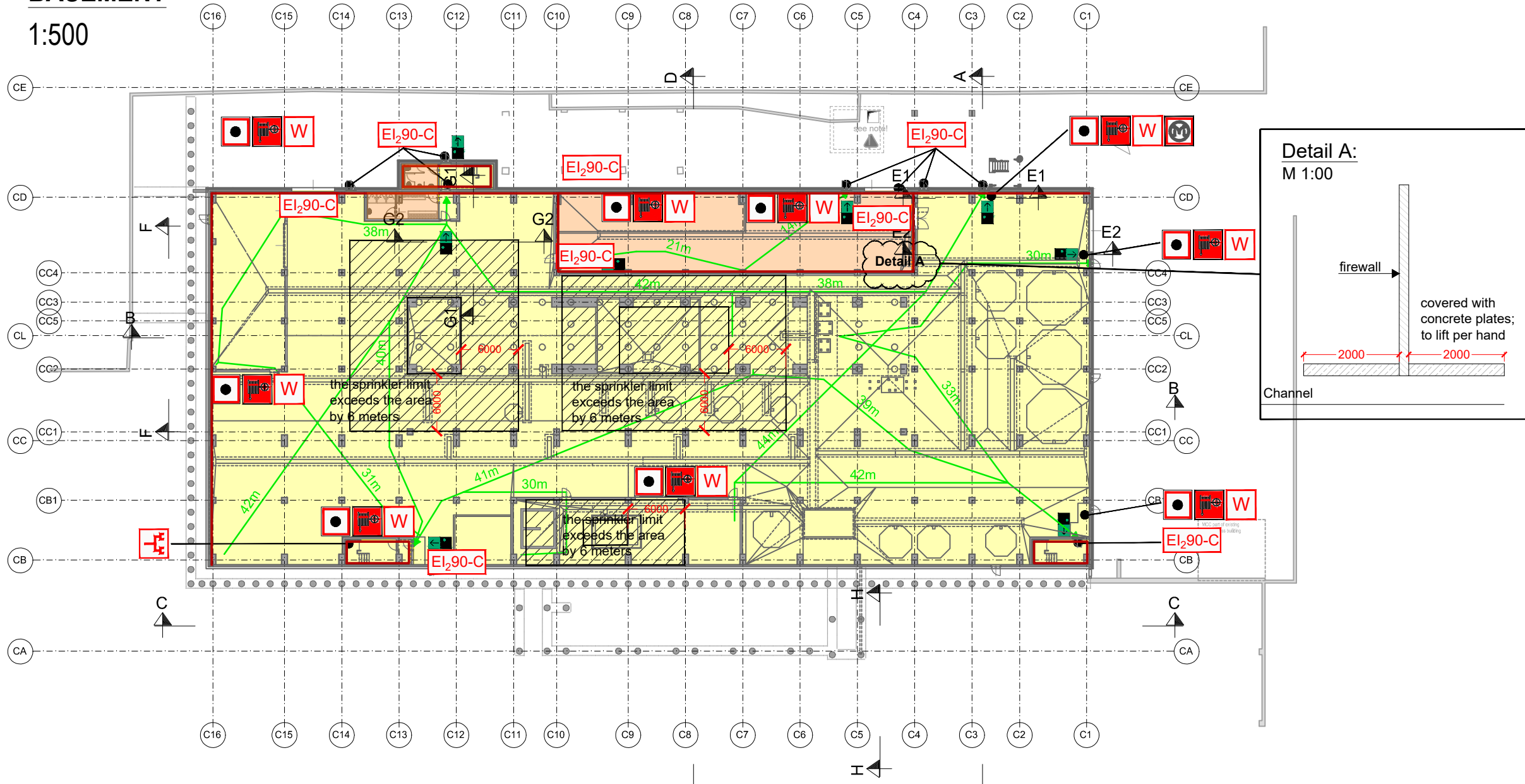
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08				
07				
06				
05				
04				
03				
02				
01				
INDEX	DATE	DRAWN	CHECKED	MODIFICATION



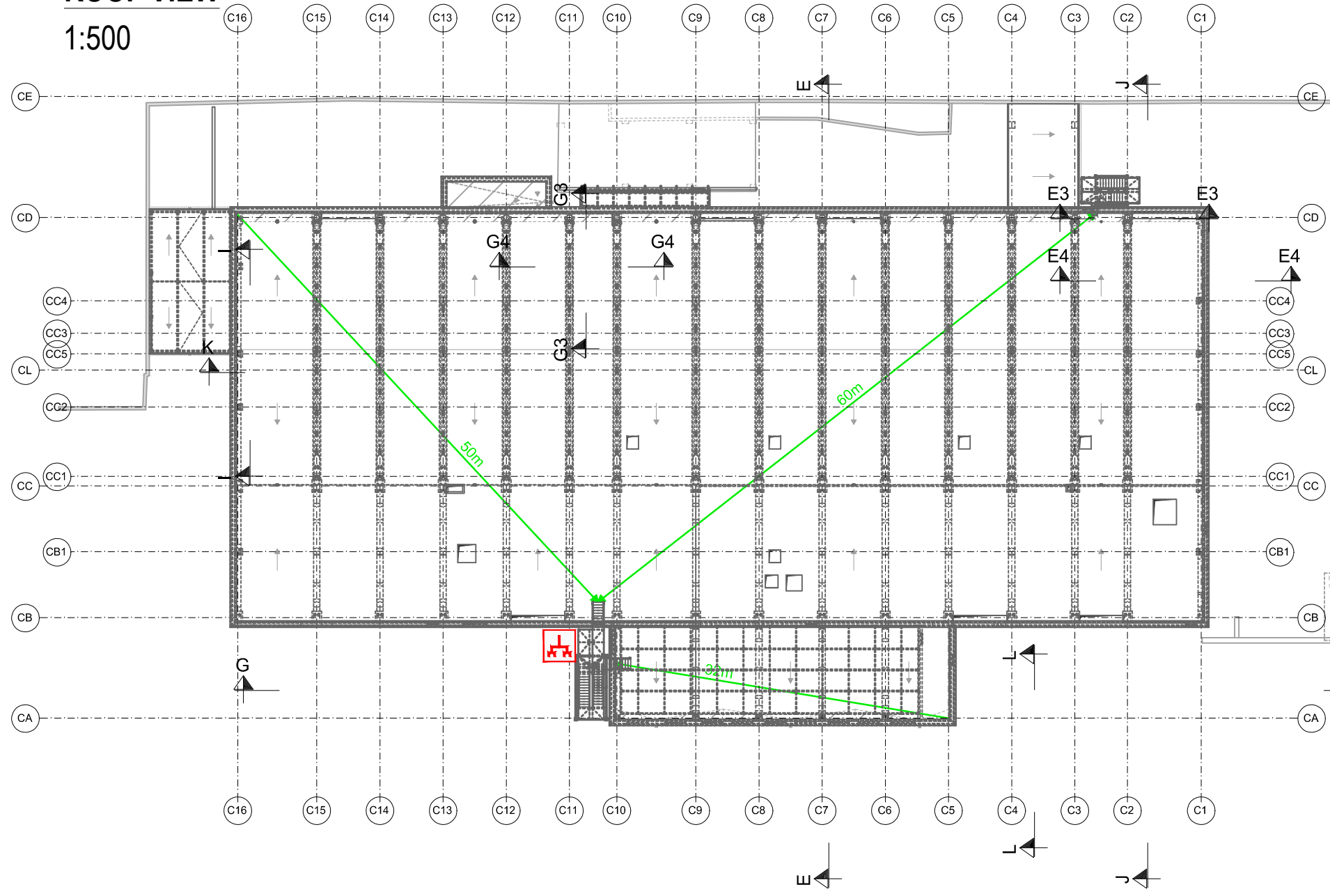
MILL SITE $\pm 0.00m = 75.15$ AOD (above ordnance datum)		
PLANNER 		
		

PROJECT		WEPA UK BRIDGING			
CONTENT OF PLAN		<p>DEPT. A+B bale handling + pulp storage fire compartmentation + escape routes level ± 0.00, +6.30</p>			
PHASE		FC			
PROJECT NO.	119003	SCALE	1:500	DRAWN	SSC
PLAN NO.	51302_OVE_2208	INDEX	00	CHECKED	DM
PLAN NO. EXT.				SIZE	841x594mm
<p>BHM INGENIEURE - ENGINEERING & CONSULTING GMBH Runastraße 90, 6800 Feldkirch, Austria, Telefon +43 / 5522 / 46101 Fax +43 / 5522 / 46104, office@bhm-ing.com, www.bhm-ing.com</p>					
					

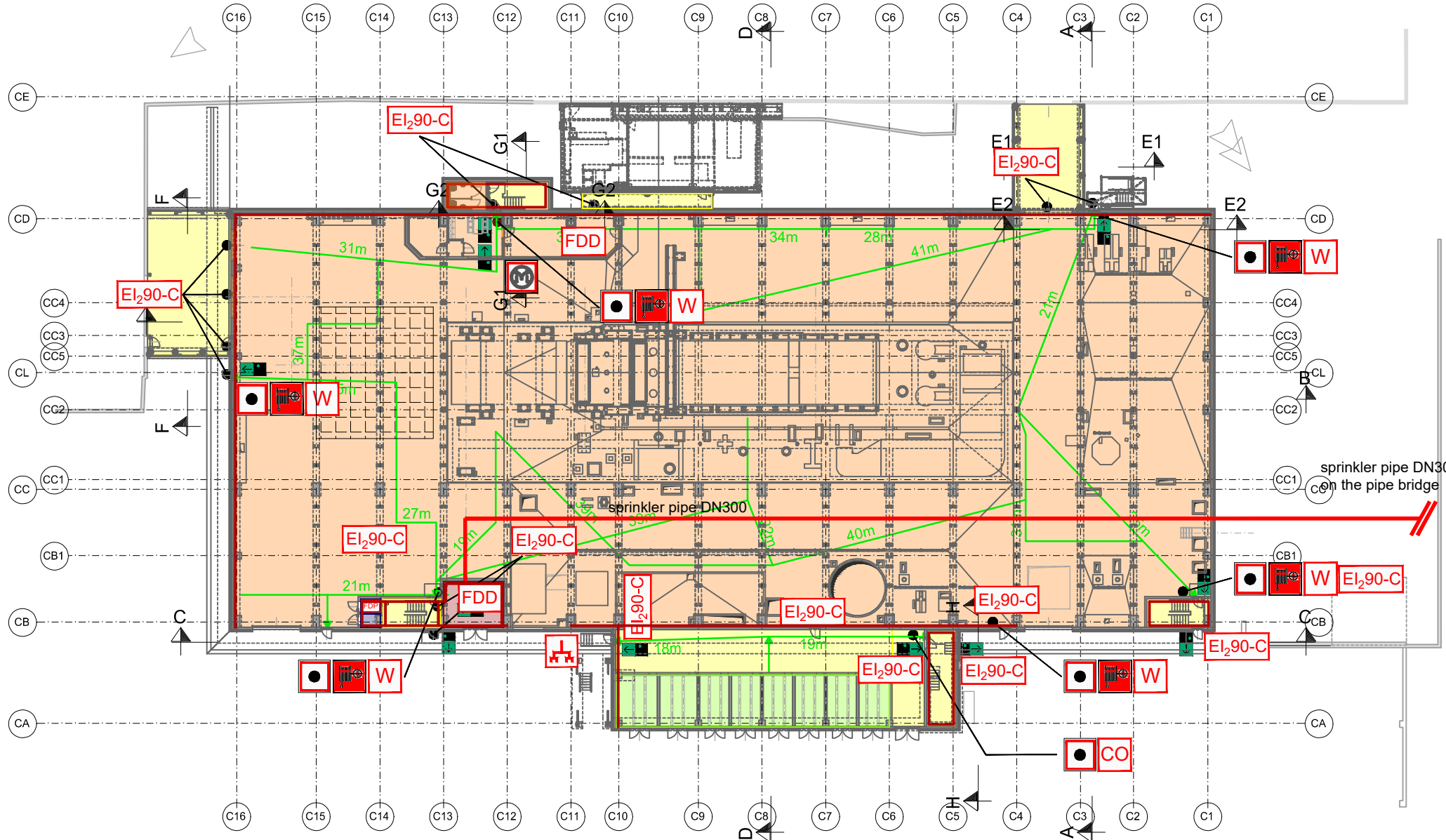
BASEMENT
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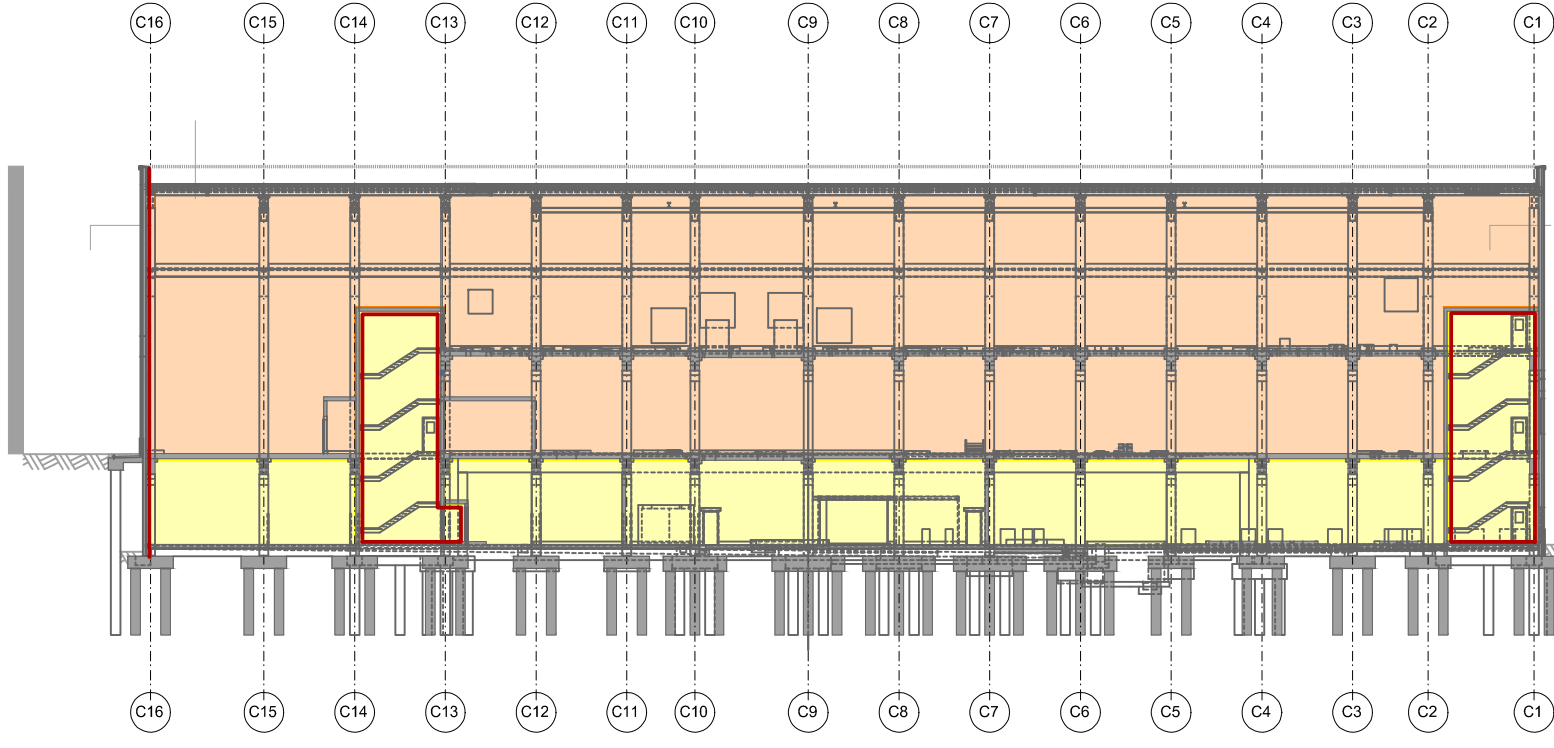
ROOF VIEW
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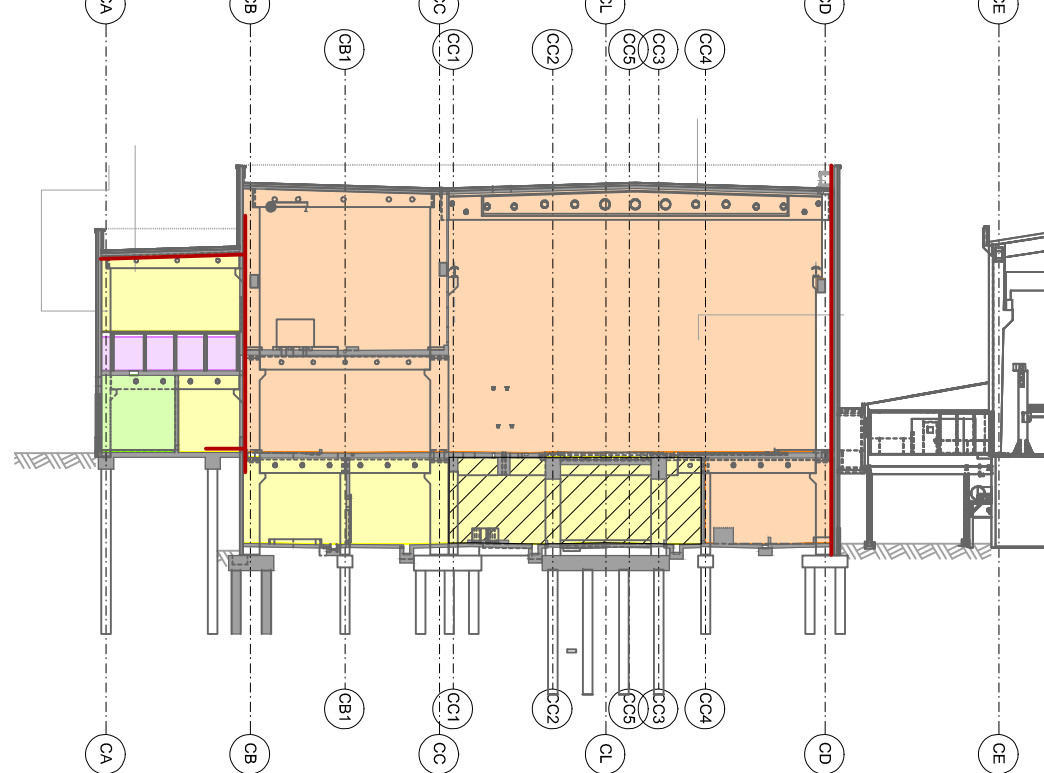
MACHINE FLOOR
1:500



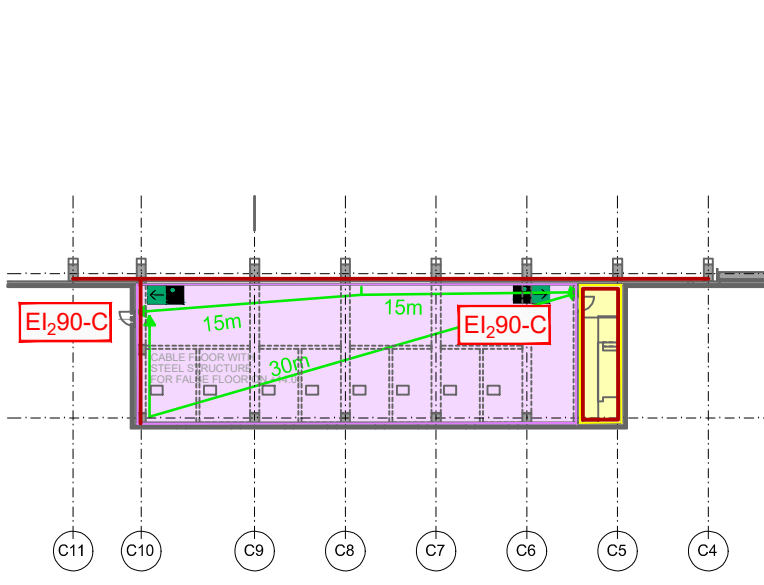
SECTION C-C
1:500



SECTION D-D
1:500



CABLE FLOOR
1:500



- key
- release heat and smoke extraction
 - dry riser pipe with hose connection up to the roof
 - fire alarm push button
 - wall hydrant (wet)
 - female 65mm standard coupling (dry riser pipe)
 - fire extinguisher (carbon dioxide)
 - fire extinguisher (water misting)
 - fire detection panel (mainstation)
 - fire detection display (interface)
 - escape way
 - area detected by smoke or heat detectors
 - area detected by aspirating smoke detectors
 - area protected by sprinkler system
 - switch gear room protected by sprinkler system
 - sprinkler substation protected by sprinkler system
 - technical room automatic fire alarm system
 - hydraulic units with sprinkler system (ceiling level) extending for 6m in all directions
 - low level sprinkler system: spot sprinklers to cover the process equipment installed in this area

Detailed information about the specification of the whole sprinkler system and the fire detection system is visible at the "description_fire_protection_system" document

REFERENCE DOCUMENT				
09				
01				
INDEX	DATE	DRAWN	CHECKED	MODIFICATION



MILL SITE ±0.00m = 75.15 AOD (above ordnance datum)

PLANNER

BHM INGENIEURE

Evans & Langford LLP

Quorum
CONSULTING ENGINEERS

R Plant
SINCE 1988

entran
energy engineering & transport solutions

PROJECT

WEPA UK BRIDGEND

CONTENT OF PLAN

**DEPT. C
FIRE PROTECTION BUILDING
LEVEL ±0.00, +6.00, +12.80, +14.00**

PHASE

FC

PROJECT NO.	119003	SCALE	1:500	DRAWN	NM	DATE	18.01.2021
PLAN NO.	56303_FPR_9201	INDEX	00	CHECKED	JN	SIZE	0.841x0.594 = 0.50m²
PLAN NO. EXT.							

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BHM INGENIEURE

[illegible]

FIRE MAIN COMPARTMENT	FIRE SUB COMPARTMENT	SMOKE COMPARTMENT
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KEY MATERIALS			
	REINFORCED CONCRETE		PRECAST CONCRETE ELEMENT
	BRICKWORK		PRECAST CONCRETE ELEMENT
	PLASTERBOARD		HEAT INSULATION RIGID
	EXISTING BUILDING		DEMOLITION
			HEAT INSULATION SOFT
			SANDWICH PANEL
			GLASS

KEY ROOM			
TFF = TOP FINISH FLOOR	RH = ROOM HEIGHT	TL = TOP LEVEL	
TRS = TOP ROUGH SLAB	CH = CLEAR HEIGHT	BL = BOTTOM LEVEL	
A = AREA	TLP = TOP LEVEL PARAPETE		
P = PERIMETER	BLL = BOTTOM LEVEL LINTEL		

REISO	ESCAPE ROUTES
-------	---------------

ALL COLOURS ACCORDING TO THE COLOUR SCHEDULE.

ALL MEASUREMENTS OF CONNECTIONS AND ATTACHMENTS TO THE EXISTING BUILDING MUST BE VERIFIED ON SITE.

ALL DIMENSIONS MUST BE CHECKED ON SITE.

PROCESS LAYOUT IS SHOWN FOR REFERENCE ONLY.

FOR TREATED SURFACES AND COATINGS SEE SURFACE PLAN.

⚠ NOTE:

THE UNDERGROUND SHAFT ROOF (AXIS CD-CE/C4-C6) NEEDS TO BE SUPPORTED IF THERE IS TRAFFIC ON THE CONCRETE SLAB. USE OF THIS AREA IS IN THE RESPONSIBILITY OF THE GENERAL CONTRACTOR.

REFERENCE DOCUMENT				
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09				
08				
07				
06				
05				
04				
03				
02				
01				
INDEX	DATE	DRAWN	CHECKED	MODIFICATION

[illegible]

PROJECT	WEPA UK BRIDGEND	
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PHASE	FOR CONSTRUCTION			
PROJECT NO.	119003	SCALE	DRAWN	DATE
		1:500	SSC	14.01.2021
PLAN NO.	51303_OVE_2309	INDEX	CHECKED	SIZE
		00	DM	1500x841mm

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