Hooton Bio Power Project

Fire Safety Strategy Report

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List of Contents

1. Introduction 5
1.1 General 5
1.2 Purpose group 5
1.3 Building Occupancy 6
1.4 Layout of the Power Plant 6
1.5 Plant description 7
2. Relevant Legislation 8
2.1 Building Regulations 2010 (BR2010) 8
2.2 The Regulatory Reform (Fire Safety) Order 2005 (FSO 2005) 8
2.3 Construction (Design and Management) Regulations 2015 8
2.4 Construction Phase Plan and Health and Safety Manual 9
3. Supplementary Fire Safety Recommendations 9
3.1 Adopted Guidance's 9
4. Risk Profiles – BS 9999 10
4.1 Occupancy characteristic 10
4.2 Fire growth rate 10
4.3 Risk profile 10
5. Means of warning 12
5.1 Requirements 12
5.2 Fire detection and alarm system 12
5.3 Battery room 13
5.4 Fire detectors 13
6. Means of escape 15
6.1 Requirements 15
6.2 Horizontal travel distances 15
6.3 Available Safe Egress Time (ASET) / Required Safe Egress Time (RSET) 19
7. Emergency lighting 21
8. Fire spread 21
8.1 Internal fire spread 21
8.2 External fire spread 22
8.3 Separation and compartmentation - Insures Requirement 24
8.4 Other measures 25
8.5 Ductwork 25
8.6 Fire stopping 25
8.7 Transformer cell 26
8.8 Flue gas treatment 26
8.9 Fire separation (segregation) and compartmentation drawings 26
9. Access and facilities for the Fire Service 26
9.1 Functional requirement 26
9.2 Vehicle access 26
9.3 Access to buildings for firefighting personnel 27
10. Fire main and location of hydrants 28
11. Portable fire extinguishers 29
12. Fire water run-off 29
13. Smoke and heat venting system 29
14. Dangerous Substances and Explosive Atmospheres Regulations 29
14.1 DSEAR report 29
15. References 30
16. Fire safety provisions (Statutory requirement and Insurer's requirement) 31
16.1 Compartmentation – Fire segregation 31
16.2 Hydraulic systems 31
16.3 Fixed fire protection – Sprinkler and Monitor 31
16.4 Waste Fuel Unloading Area - UEA 31
16.5 Shredder Area – UEA/UEB 32
16.6 Waste Fuel Storage Area - UEB 33
16.7 Step-up transformer 34

16.8 Emergency diesel generator 34
16.9 Containerized fire pump unit 35
16.10 Steam turbine generator 35
16.11 Boiler auxiliary burners 35
16.12 Electrical rooms 35
16.13 FGT Bag filter 36
16.14 Smoke and Heat Venting system 36
16.15 Hose reels 36
16.16 Dry riser 36
16.17 Fire department connection 36
16.18 Fire water tank – Spare nozzle for fire water supply to fire department and filling of tank 36
16.19 Water supplies for firefighting purposes 36
17. Impairment procedure 38
18. Follow on design 40
19. Attachments 41
20. Appendix I – ASET calculations 42

1. Introduction

1.1 General

This fire safety strategy report is issued for the development Hooton Bio Power Project waste fueled Power Plant. The Hooton Bio Power Project is located in the Hooton Park Industrial Estate in Eastham, Wirral.

The postal address is:
Hooton Bio Power Project
North Road
Eastham
Wirral
CH65 1AJ

Adjacent property to the Hooton Bio Power Project is the Eastham Oil Refinery which surround the Power Plant site to the West, South and East. Located to the North of the Power Plant site is the Manchester Ship Canal. The total size of the site is approx.10 hectares.

1.2 Purpose group

The purpose of this fire safety strategy report is to outline the fire safety features for the power plant incorporating both life safety and property protection features.

In general the Power Plant will be used for generating power and is classified as Purpose Group 6 – Industrial, according to Approved Document B vol. 2, table D1

The Administration building is classified as Purpose Group 3 – Office, according to Approved Document B vol. 2, table D1 and must meet the requirements of BR2010.

The Power Plant Electrical annex & Service building (compartmentation of the main building) is a mix of uses of Purpose Group 3 – Office and Purpose Group 6 – Industrial.

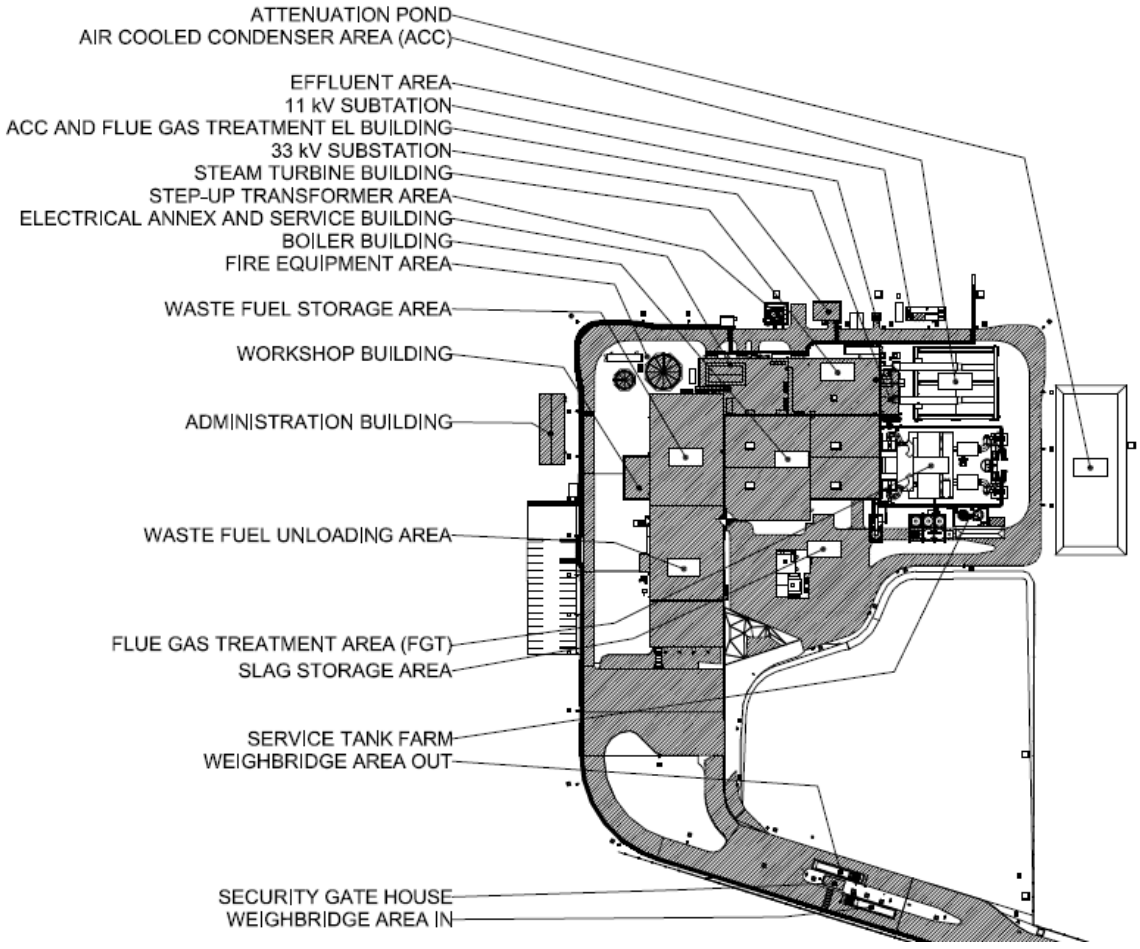
To demonstrated the fulfilment of the functional requirements, the BR2010, BS 9999:2017 and NFPA101:2018 will be used and referred to, where applicable.

With a project of this nature there are additional fire safety features that are recommended for incorporation to limit the potential for loss of productivity and property in the event of fire. In this regard the employer's specification, Insurers requirements and the application of NFPA 850 are described in section 16.

1.3 Building Occupancy

The total occupancy of the Power Plant during normal operation is estimated to be maximum 30 people including operatives and fuel delivery drivers.

1.4 Layout of the Power Plant



The following abbreviations (KKS ID) for the buildings will be used throughout this report:

KKS ID	Building
UAA	33kV Substation
UAB	11kV Substation
UBB	El Annex & Service Building
UBT	Step-Up Transformer Area
UBV	ACC & Flue Gas Treatment El Building
UEA	Waste Fuel Unloading Area
UEB	Waste Fuel Storage Area
UEK	Service Tank Farm
UEW	Slag Storage Area
UGU	Effluent Area
UHA	Boiler Building

UMA	Steam Turbine Building
UMC	Air Cooled Condenser Area (ACC)
USG	Fire Equipment Area
UST	Workshop Building
UVT	Flue Gas Treatment Area (FGT)
UYC	Administration Building
UYE	Weighbridge Area In
UYF	Security Gate House
UYX	Weighbridge Area Out
UZM	Attenuation Pond

1.5 Plant description

The Hooton Bio Power Project is a dual line waste to energy Power Plant, which at full load, generate approximately 24 MW electrical power to the grid. The fuel for the Power Plant will be a mix of e.g. municipal waste and industrial waste (refer to the Feedstock Specification). The Power Plant infeed fuel requirement at full load is some 30 tonnes per hour (15 tonnes per hour per line).

The Power Plant is designed to provide an enclosed process, from delivery, processing and storage of the feedstock, steam production in the boiler to the steam turbine generator set and finally electrical distribution.

Fuel is delivered to the Waste Fuel Unloading Area (Feedstock receiving area) and unloaded into the reception bunker by truck. From here it will be transferred by crane into one of two shredders which reduce any received fuel to a homogeneous size. From the shredders the fuel is screened for non-combustible materials followed by conveying it to the Waste Fuel Storage Area (Feedstock storage area). In the waste fuel bunker the fuel is mixed and finally transferred to the receiving hoppers for the boilers for combustion.
Combustion gas provides the heat to the boiler which produces steam for the steam-turbine-generator set producing electricity.

2. Relevant Legislation

2.1 Building Regulations 2010 (BR2010)

With regard to fire related issues, Hooton Bio Power Project must be demonstrated to achieve compliance with the Building Regulations 2010. For partly guidance in achieving compliance, the Approved Documents has been used.

2.1.1 Approved Document B (ADB)

It should be observed that the ADB is not legislative and provides only one method by which BR2010 compliance can be achieved.

The "Use of Guidance" section of ADB states that:
"*The Approved Documents are intended to provide guidance for some or more common building situations. However, there may well be alternative ways of achieving compliance with the requirements.* ***Thus there is no obligation to adopt any particular solution contained in an Approved Document if you prefer to meet the relevant requirement in some other way.***"

Therefore BR2010 may be demonstrated to have been satisfied by:

- Compliance with the prescriptive guidance contained in the ADB, BS 9999, CIBSE Guide E or any other associated documents referenced therein; or
- A fire engineered solution that is demonstrated to provide an acceptable level of protection to the occupants of the building, by use of the guidance of BS 7974, its associated published documents and/or any other relevant engineering documentation; or
- The use of one document to supplement the other in support of a fire engineered solution.

Where applicable the design of the Power Plant will be based on the recommendations contained in BS 9999. Where an element of the development cannot be assessed against BS 9999 (for example the boiler building, turbine hall, fuel storage etc.) then appropriate alternative guidance will be applied such as NFPA or a risk engineered approach adopted.

2.2 The Regulatory Reform (Fire Safety) Order 2005 (FSO 2005)

Once the building is completed and handed over to the client, the FSO 2005 becomes the governing legislation. The FSO 2005 replaces legislations such as the Fire Precautions (Workplace) Regulation 1997 and the Fire Precaution Act 1971 and imposes the general duty to take relevant fire precautions to ensure the safety of the building users and those in the vicinity.

As mentioned in the FSO 2005, the responsible person is required to carry out a risk assessment of the premises which must suitable and sufficient for the risk and exposure of the occupants to such risks.

In the FSO 2005 "responsible person" means—
(a) in relation to a workplace, the employer, if the workplace is to any extent under his control;
(b) in relation to any premises not falling within paragraph (a)—
  (i) the person who has control of the premises (as occupier or otherwise) in connection with the carrying on by him of a trade, business or other undertaking (for profit or not); or
  (ii) the owner, where the person in control of the premises does not have control in connection with the carrying on by that person of a trade, business or other undertaking.

The order also places responsibility on the relevant person for the servicing and maintenance of all fire safety systems throughout the life of the building.

2.3 Construction (Design and Management) Regulations 2015

Under the Construction (Design and Management) Regulations 2015 (CDM) designers are required to minimize or design out hazards.

2.4 Construction Phase Plan and Health and Safety Manual

During the construction phase the Regulatory Reform (Fire Safety) Order 2005 and the Construction (Design and Management) Regulations 2015 comes into act as well. Please refer to the latest revision of the 2031.TM.101.001 – Construction Phase Plan and 6000.QP.100.0006 BWSC Health and Safety Manual.

3. Supplementary Fire Safety Recommendations

3.1 Adopted Guidance's

In addition to the scope of BR2010 there is a requirement to minimize the potential for loss of production and loss of capital investment in the event of fire. International standards will be adopted for particular risk items (ref. section 16)

The provision of additional fire safety measures is incorporated into the fire safety strategy as a whole and provides an integrated fire safety regime for the Power Plant.

The following guidance has been adopted in this report:

- Employer's Specification, room data sheets etc.
- Guidance Document, Waste Processing Plant – Fire Systems, Issue 2.0, dated 19 May 2017(*1)
- Guidance Document, Energy from Waste – Fire Systems, Issue 3.0, dated 19 May 2017(*1)
- NFPA850 - Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations.

(*1) Deviation: Sprinklers in the main Feedstock receiving and storage area is not required

4. Risk Profiles – BS 9999

Central to the application of the recommendations contained within BS 9999 is a risk assessment of all buildings within the premises recommended to be carried out to determine the risk profile or profiles, as different areas might result in different risk profiles. The risk profiles indicate the potential for fire risk to the building occupants and are used in the design of e.g. fire safety systems, compartmentation, means of escape etc.

Risk profiles are given as a combination of occupancy characteristic and fire growth rate.

4.1 Occupancy characteristic

Ref. table 2
The occupancy characteristic covering all areas within the premises is determined in accordance with Table 2 to be: Occupancy (including people with disabilities) characteristic A
Based on the following:

- Occupants who are awake and familiar with the building
- Office and Industrial premises

Further, the Power Plant occupants will be aware of the fire safety provisions and precautions and visitors including contractors to the site will be accompanied and/or inducted in order to maintain characteristic A.

4.2 Fire growth rate

Ref. table 3
The fire growth rate is the rate at which it is estimated that a fire will grow. The fire growth rates are divided into four categories 1 to 4 as per the following:

Category	Fire growth rate	Fire growth parameter (kJ/s^3)
1	Slow	0.003
2	Medium	0.012
3	Fast	0.047
4	Ultra-fast	0.188

Within table 3 – Descriptions, various types of combustible and flammable materials are listed for each category, as well as Typical examples of commodities

Additionally to assist in determining the fire growth parameter for the various areas the following document has been consulted: 11th IAFSS Symp. pp. 517-530

4.3 Risk profile

The following table indicates the risk profiles allocated to each of the main areas of the Power Plant:

Area	KKS	Risk profile	Comment / Fire growth parameter [kJ/s^3]
33kV Substation - Dry-type transformer	UAA	A1	(2) ~0,0009 (<0,002)
11kV Substation - Dry-type transformer	UAB	A1	(2) ~0,0009 (<0,002)
El Annex & Service Building	UBB	Mixed	Mixed
- Electrical rooms		A1	(2) ~0,0029 (<0,012)
- Compressor room		A1	(2) ~0.00803 (<0,012)
- Control room		A1	(2) ~0,00883 (<0,012)
- Spare part storage		A2	(2) ~0,0232 (<0,047)

room			
Step-Up Transformer Area	UBT	A2 [3]	[1]
ACC & Flue Gas Treatment El Building	UBV	A1	[2] ~0,0029 (<0,012)
Waste Fuel Unloading Area	UEA		[7] Recommended storage time for waste
- Bunker		A3 [5]	[1]
- Tipping hall		A3 [3]	[1]
Waste Fuel Storage Area	UEB		[7] Recommended storage time for waste
- Shredder (hopper)		A3 [3]	
- Shredder		A3 [3]	
- Bunker		A3 [4][5]	[1]
- Boiler feed hopper		A3 [3]	
Service Tank Farm - Diesel oil (combustible liquid with flash point at or above 37.8°C),	UEK	A3	[1]
Slag Storage Area	UEW	NA	
Effluent Area	UGU	NA	
Boiler Building	UHA	A1	Except for the boiler front and the area for the auxiliary burners, the building holds none or limited amount of combustible materials.
Boiler building boiler front and auxiliary burner area.	UHA	A3 [3][4]	[1][6]
Turbine Building.	UMA	A3 [3]	[1][6]
Air Cooled Condenser Area (ACC)	UMC	A1	[2] ~0,0029 (<0,012)
Fire Equipment Area	USG	A2 [3]	[1]
Workshop Building	UST	A2	[2] ~0,0171 (<0,047)
Flue Gas Treatment Area (FGT)	UVT	NA	
Administration Building	UYC	A2	[1]
Weighbridge Area In	UYE	NA	
Security Gate House	UYF	A2	[1]
Weighbridge Area Out	UYX	NA	
Attenuation Pond	UZM	NA	

[1]/[2]/[6]	Fire growth rate (kW/s^2). [1] The fire growth rates are based on BS 9999, table 2 and table 3 [2] The fire growth rates are based the 11th IAFSS Symp. pp. 517-530 [6] Category considered high due to the possible quantities of combustible liquids.	
[3]	Areas are installed with fixed fire suppression system at risk areas. The risk profile has typically been reduced accordingly to the level indicated.	
[4]	Conveyor leading out of or into the building is installed with a fixed fire suppression system.	
[5]	Fire water monitors are installed to cover the area. The fire water monitors will be located to allow for coverage of all pit areas with two (2) streams operating simultaneously. The risk profile has not been reduced.	
[7]	Combustible waste type	Max. storage time
	Non-shredded or similarly treated wastes (that is wastes whose particle size has not been reduced)	6 month

	Baled and compacted wastes	6 month
	Shredded and similarly treated wastes (that is wastes whose particle size has been reduced)	3 month
	Combustible fines/dusts and very small particle size wastes	1 month
	Ref. *WASTE 28 Reducing fire risk at waste management sites issue 2 – April 2017*	

Means of escape provisions are assessed in the following sections using the above risk profiles where appropriate for the area concerned.

5. Means of warning

5.1 Requirements

Ref. ADB (Part B of Schedule 1 to the Building Regulations 2010)
B1,-
The building shall be designed and constructed so that there are appropriate provisions for the early warning of fire, and appropriate means of escape in case of fire from the building to a place of safety outside the building capable of being safely and effectively used at all material times.

5.2 Fire detection and alarm system

A fire detection system is installed for monitoring the power plant. The fire detection system shall -

1) by means of the installed visual and audible devices, alert occupants for evacuation of the area in which the detection system is activated.
2) inform the plant operator about location in which the detection system is activated for immediate action (firefighting, require assistance etc.) to prevent a possible fire to develop.

The fire detection system comprises the following main elements:

- a main fire alarm panel
- a mimic panel for the fire department for easy identification of the area in which the detection system is activated. The mimic panel will be located in the gate house (to be agreed with the local Fire Authority)
- fire control panels
- fire detectors and visual and audible alarm devices.

The following fire detection and alarm provisions are to be included as part of the fire safety measures:

Area	KKS	Manual call point	Automatic detection	Alarm
33kV Substation	UAA	Yes	Yes	Yes
11kV Substation	UAB	Yes	Yes	Yes
El Annex & Service Building	UBB	Yes	Yes	Yes
Step-Up Transformer Area	UBT	Yes	Glass bulb (sprinkler release)	Yes
ACC & Flue Gas Treatment El Building	UBV	Yes	Yes	Yes
Waste Fuel Unloading Area	UEA	Yes	Yes (CO monitoring and thermal camera)	Yes
Waste Fuel Storage Area	UEB	Yes	Yes (CO monitoring and thermal camera)	Yes
Service Tank Farm	UEK	Yes	Yes	Yes
Slag Storage Area	UEW	None	None	None

Effluent Area	UGU	None	None	None
Boiler Building	UHA	Yes	Yes	Yes
Turbine Building.	UMA	Yes	Yes	Yes
Air Cooled Condenser Area (ACC)	UMC	None	None	None
Fire Equipment Area	USG	Yes	Yes	Yes
Workshop Building	UST	Yes	Yes	Yes
Flue Gas Treatment Area (FGT)	UVT	Yes	Yes	Yes
Administration Building	UYC	Yes	Yes	Yes
Weighbridge Area In	UYE	None	None	None
Security Gate House	UYF	Yes	Yes	Yes
Weighbridge Area Out	UYX	None	None	None
Attenuation Pond	UZM	None	None	None

Fire detection and alarm systems are to be designed in accordance with BS5839 Pt 1. Manual call points provided at all storey and final exits, plant stair landings and as required to limit the travel distance to the nearest call point to 30 m.

The following categories of detection and alarm are considered appropriate:

- Administration and ancillary areas (offices etc.). – L1/P1 (systems installed throughout all areas of the building)
  and,-
- Process and plant areas (Indoor,- boiler building, turbine hall, fuel storage and transportation etc.). – L2/P2 (systems installed only in defined parts of the building)

Note:
Designing the fire detection system to comply with level L2/P2 means that, the detection system will be provided and installed to monitor areas that have been identified as risk areas during review of the plant and carrying out the fire risk assessment. As the fire risk assessment most likely will develop throughout execution of the project and should this call for additional areas to be installed with fire detectors, the fire detection system to be installed will allow for extension.

Automatic detection will be selected to minimise the risk of false alarms caused by ambient conditions (e.g. dust levels in fuel storage areas, shredder areas etc.).

5.3 Battery room

In case of black-out of Power Plant various systems e.g. the DC systems are emergency supplied by the batteries (UPS - Uninterruptable Power Supplies) located in the battery room.
Small amounts of hydrogen gas are released during charging of the batteries. As hydrogen gas is flammable with a lower explosive limit of 4 vol. % and an upper explosive limit of 75 vol. %, an explosive mixture with air may form if the room is not sufficiently ventilated.

Battery room - Unclassified
To maintain the hydrogen concentration below the lower explosive limit, the room is subject to monitored ventilation (redundant) with a minimum air exchange rate specified according to BS EN 50272. As the generation of an explosive gas atmosphere will be prevented by the ventilation system, the Battery room is unclassified.

5.4 Fire detectors

The following table provides an indication of the type of detection available to be used depending on perceived risk in the various areas:

Detector type:	Installation area:	Applicable for areas such as:	Not suitable for detection of:
Heat Detector, fixed temperature	Fog- and Misty Areas, Dusty areas, Smoky areas, Steamy areas. In areas/ zones where a rapid (hot) fire is capable to develop more heat than smoke. Process: Rapid oxidation of materials in the exothermic chemical process of combustion releasing heat (Hot Fire).	Outdoor substations. Generators. Solid fuel handling and storage areas.	Slow (shouldering) fires, Low heat fires
Heat Detector, rate-of-raise	Fog- and Misty Areas, Dusty areas, Smoky areas, Steamy areas. In areas/ zones where a rapid (hot) fire is capable to develop more heat than smoke. Process: Rapid oxidation of materials in the exothermic chemical process of combustion releasing heat (Hot Fire).	Outdoor substations. Generators. Solid fuel handling and storage areas.	Slow (shouldering) fires, Low heat fires
Line heat cable, fixed temperature	Small enclosed areas, cable-trays, tunnels etc. Fog- and Misty Areas, Dusty areas, Smoky areas, Steamy areas. In areas/ zones where a rapid (hot) fire is capable to develop more heat than smoke. Process: Rapid oxidation of materials in the exothermic chemical process of combustion releasing heat (Hot Fires).	Enclosed conveyors, Drag Conveyors, Conveyors, Detection in between electrical cables	Slow (shouldering) fires, Low heat fires
Smoke Detection, Ionisation element	Relative clean, steam and dust-free environments/ areas where a fire will develop a concentration of smoke from material emits as it burns.	Switchgear rooms, Offices, Server and computer rooms	Dusty areas with high air velocity, Steamy areas
Smoke Detection, Optical element	Relative clean, steam and dust-free environments/ areas where a fire will develop a concentration of smoke from material emits as it burns.	Electrical cables and machinery, Plastics, Air-conditioned areas, Computer rooms	Dusty areas, Steamy areas
Aspiration detection combined with CO detection	Aspiration detects smoke generated by flaming or smouldering fires. CO detectors detect and warn about dangerous CO-gas build-up	Very Dusty & Smoky Areas e.g. Open structures. Explosion risk areas. Gas accumulation areas.	
Flame	Flammable gases, Explosion risk areas, Smokeless areas, Areas with air movement, Chemical fires, Fuel handling, Hydrocarbon fires	In areas were an open flaming fire flame is a mixture of reacting gases and solids emitting visible, infrared, and sometimes ultraviolet light, the frequency spectrum of which depends on the chemical composition of the burning material and intermediate reaction products.	Smoky fires, Smouldering fires, Areas with obstructions to line of sight
Smoke optical beam	Ducts, Large open areas, Corridors	Warehouses, Computer room, Turbine halls	Dusty areas, Areas with obstructions to line of sight
Flammable & Explosion Gas Detection	Areas where explosion or flammable gases can occur.	Indoors or outdoors, Ventilation plenums	Areas containing Sulphur, Toxic gas detection

Additional to the detector types mentioned above thermal imaging cameras will be used in areas to assist e.g. identifying a hot area/spot in the storage building.

The level of automatic fire detection and alarm provided exceeds the minimum requirements of the Building Regulations.

The fire control panels (sub-panels) and the mimic panel are connected to the main fire alarm panel located in the Control Room.

The mimic panel will be located in the gate house to provide immediate indication of the system status to any personnel (including firefighting personnel) entering the site.

The fire control panels are located in strategic areas for local monitoring of fire detection and alarm devices. Status information from each of the fire control panels is relayed back to the main fire alarm panel in the Control Room

6. Means of escape

6.1 Requirements

Ref. BS9999:16.1

Escape routes from each storey (or level) should be so sited that a person confronted by fire can turn away and make a safe escape through an alternative exit. Routes of travel should be free from any serious obstacle that could cause undue delay, especially to disabled people, e.g. raised thresholds or steps, or doors that are difficult to open.

6.2 Horizontal travel distances

6.2.1 Horizontal escape

Ref. BS9999

Maximum permissible travel distance according to Table 11:

Risk Profile	Travel Distance, in metres (m)	
	Two-way travel	One-way travel
A1	65	26
A2	55	22
A3	45	18

Further, angle between alternative escape routes should be not less than 45° (ref. BS9999, 16.3.2).

The width of escape routes is according to BS9999: 16.6.2
- Corridors accessible for wheel chair users will be 1,200 mm wide.
- Corridors not accessible for wheel chair users will be 1,000 mm wide.

For Industrial Equipment Access the minimum horizontal width of 560 mm of any walkway, landing or platform, is required based on the provisions of NFPA101 (2018) Table 40.2.5.3.1. This reduced width can be used in the Process areas with no public access, and all obstructions are fixed obstructions.

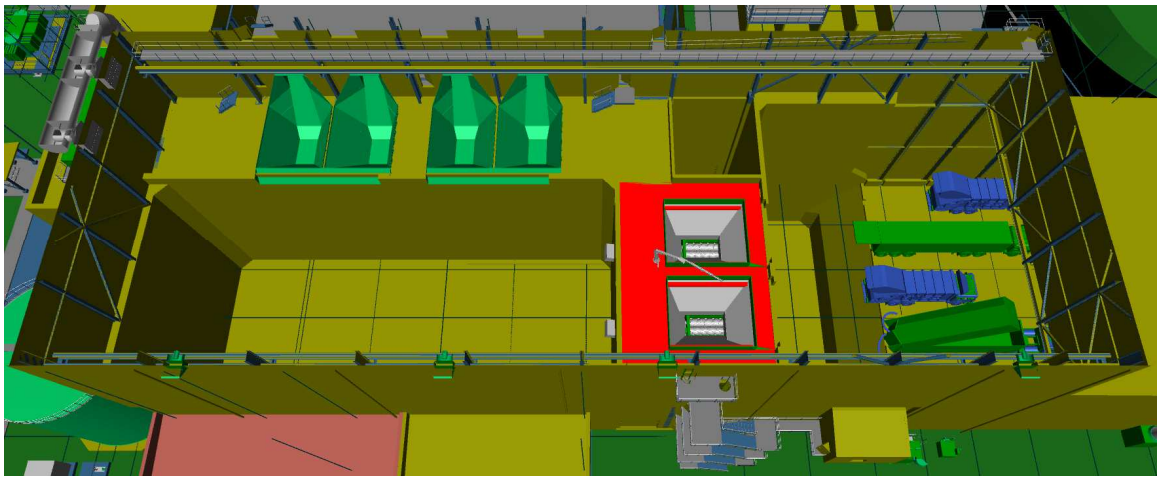
The 560 mm width walkway is restricted to areas adjacent equipment and is limited locations.

Platforms, handrails and stairs shall be designed according to BS EN ISO 14122 and BS5395.

The means of escape drawings for each main area are listed in section 19 and included in the attachment to this report ref. 2031.M0.J01.002 rev.0

6.2.1.1 Waste Fuel Unloading Area and Waste Fuel Storage Area

The waste fuel unloading area and the fuel storage area are located within the same building and as such in open connection. The building is a single storey building holding the bunker for the received fuel, the reviewing hoppers for the shredders, the bunker for the shredded fuel and the infeed hoppers for the boilers. Located within the building is a separate concrete structure (min. 120 minutes fire rated – marked red on the figure below) which serves to enclose the shredders and electrical rooms. Access to the shredders and the electrical room is either from the outdoor staircase or the boiler building.

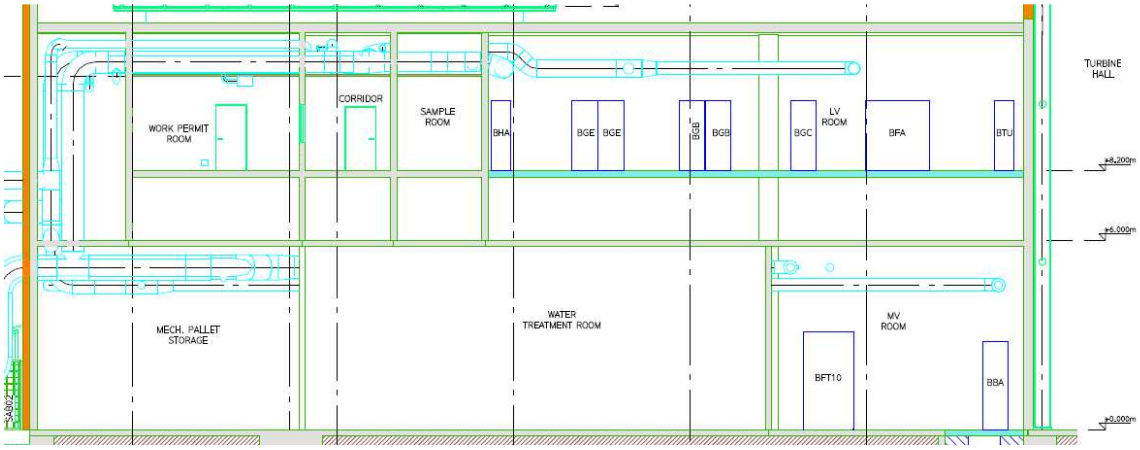


Access into either the waste fuel unloading bunker or the fuel storage bunker is not anticipated required at any time. Consequently no means of escape for these areas will be provided.

6.2.2 Vertical escape - buildings

6.2.2.1 Electrical El Annex & Service Building - UBB

The Electrical El Annex & Service Building is a two storey building (ground floor and 1st floor). Located at 1st floor is the LV Room which is installed with a raised floor (void space height 2.0 m) covering the complete footprint of the room. Any access beneath the raised floor for maintenance will be provided by means of movable ladders. Access shall be supervised and carried out according to Confined Space Regulations 1997.

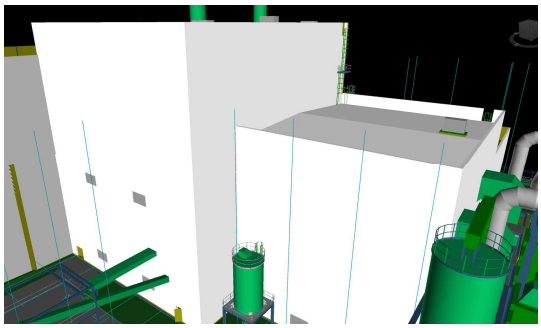


6.2.2.2 Administration building - UYC

The administration building is a single storey building. Vertical escape is not applicable.

6.2.2.3 Boiler building - UHA

The Boiler building is one single storey building with a number of access galleries - the highest of which is some 33.6 m above ground level. Due to the design of the boiler, the building will hold two roof levels as indicated below.

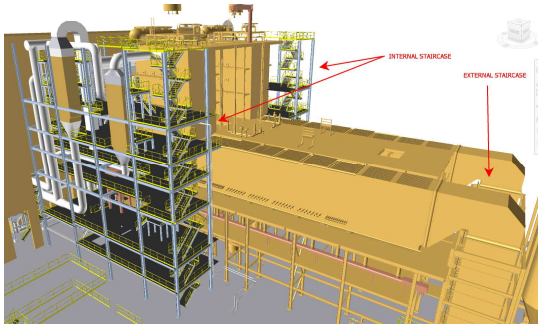


For the highest of the building all main galleries from level +33.600 to ground level +0.000 are vertically linked by means of two internal access and egress stairs (open staircase) positioned on either side of the boiler (north and south). An external access and egress stair (open staircase) is installed at the east end of the lover part of the building serving all main galleries from levels +20.000 to ground level.

Additional stair links are provided between vertically adjacent galleries.

The internal stairs discharge within the boiler building at ground level and alternative directions of escape are provided from the base of each stair. These alternative directions of escape could either be directly leading to outside building or leading into a separate 120 minute fire rated compartment which further lead to the outdoor. Discounting one of the stairs (spatial separation of the stairs and the sheer volume of the building mean that one will always be available for use in the event of a fire) there will always be more than adequate capacity for vertical means of escape within the building.

A small number of dead end conditions exist on the boiler galleries but these are of very short distance and the open nature of the galleries ensures rapid detection of any fire event by personnel in the vicinity; the short single direction travel distances are therefore deemed acceptable.



6.2.2.4 Turbine building – UMA
The turbine building is provided with internal open-grate stairs, again spatially separated to maintain the use of at least one in the event of fire.

6.2.2.5 Fuel storage area (boiler infeed hopper area and shredder hopper area) – UEA and UEB
Escape from the boiler infeed hopper area and shredder hopper area is provided by way of one external stair (open staircase) leading to ground level or through the boiler building. The boiler building is a separate 120 minute fire rated compartment.

6.2.3 Storey exit
Ref. BS9999: 16.6
According to table 13 of BS9999 the minimum door width per person should be for:

- Risk profile A1 – minimum 3.3mm. Hence a 800mm door serve 242 occupants
- Risk profile A2 – minimum 3.6mm. Hence a 800mm door serve 222 occupants

- Risk profile A3 – minimum 4.6mm. Hence a 800mm door serve 173 occupants

El annex & Service building – Minimum required exit clearance width 800 mm:
The Electrical El Annex & Service Building two single storey building. Exits doors from the building are a minimum of 800mm wide which offers a capacity of some 222 occupants - exceeding the actual physical capacity of the office storeys.

Administration building – Minimum required exit clearance width 850 mm:
The administration building is a single storey building. Exits from the building are a minimum of 800mm wide. However, disabled persons e.g. wheelchair users must be expected access to the administration building why minimum required exit clearance width 850 mm shall be provided.

Fuel storage area and process areas:
Storey exits from the fuel storage and process areas will be inherently larger than required for the occupancy of the areas due to the requirement for transportation of equipment to and from the areas.

All doors used as exits, whether they are storey or final exits shall be openable by a single simple operation without requiring the use of tools or keys. Doors held closed for security purposes shall freely open in the event of a fire.

6.2.4 Final exits
All final exits shall be designed to lead to a place of ultimate safety away from the building concerned. Final exits shall lead to the place of safety via hard landscaping and the route provided with emergency lighting.

6.2.5 Means of escape for disabled persons
It is not envisaged that there will be disabled operatives in the El annex & Service building, fuel storage or Process areas however the administration building may well have disable occupants or visitors on occasion and the following measures are recommended.

The evacuation of disabled persons is the responsibility of the building operator; no reliance can be placed on or assumed from the fire authority. The critical issue in terms of structural provisions is designing for the means of escape of mobility-impaired persons, in particular wheelchair users. The strategy for this should be rigorously developed in collaboration with the Building Management. It is also necessary to consider all disabilities, and the general principles for designing effective escape for other types of disability are summarised below.

Hearing and visual impairment: Audible alarms will as well as flashing beacons be installed throughout the plant to notify occupants to evacuate the building. Hearing and visual impaired persons should generally be assisted during evacuation of the building. Successful escape for other impaired persons is helped by ensuring legibility of the building – as recommended in BS 8300.

Disabled staff will be encouraged to produce PEEPS (Personal Emergency Egress Plans) in collaboration with the building operator; this will ensure an appropriate resource and response tailored to the individual needs of the disabled person and the specific features of the building itself (the “Building Capability”). PEEPS can also be prepared for the “generic” types of disability, to ensure the best management response for evacuation of non-staff occupants.

As a single storey building, the administration building will not be provided with refuge points.

6.2.6 Inner rooms
The Electrical El Annex & Service Building and the process areas holds rooms that would be classed as ‘inner rooms’; these specific areas are mitigated by limited occupancy (i.e. less than 60 occupants and infrequent use) and the provision of automatic fire detection and alarm inside these rooms and throughout the premises.

6.2.7 Protection of stairways

6.2.7.1 El Annex & Service Building - UBB
Stairways (staircase or ladders) adjoining the external wall of the building and form part of an escape route will be protected for 30 minutes within 1.8 m of the façade.

6.2.7.2 Plant areas: Boiler building - UHA, Turbine building - UMA etc.
Stairways (staircase or ladders) adjoining the external wall of the building and form part of an escape routes is not considered to be protected. Areas for plant and equipment have been assessed in regard to fire risks and suppression systems installed.

6.3 Available Safe Egress Time (ASET) / Required Safe Egress Time (RSET)

RSET

During normal operation of the plant, few occupants will be within the Boiler building. The majority of the operational staff would normally be within the office/control room section which is fire separated from the Boiler building. Maintenance personnel and visitor access will be restricted; maintenance will be under permit to work and the visitors will be briefed before going into the building, and accompanied. The anticipated occupancy during the routine maintenance period will be more than most other times, but will still be acceptably low.

Required Safe Egress Time (RSET)

Safe egress time required is a combination of several components of time ranging from time to detection up to the actual travel time. They include:

- Detection time
- Alarm time
- Pre movement time
- Walking time
- Detection Time (tdet):

This is the time from onset of fire to the detection by an automatic detection system or by the building occupants. Considered here are the type of the detection system, their effectiveness with time and the fire scenario.

The building will be installed with smoke detectors and will automatically relay an alarm on detection of smoke. Visual evidence will aid early detection by occupants working there.

It is expected that the detection of fire will be quick for the fuel types that could be found in the building. Consequently, 1-minute is taken as the operating time for the detectors within the building.

Time to General Alarm (ta):

With the automatic detection system in place the time to general alarm is taken to be zero as the system will trigger the general alarm to the building immediately.

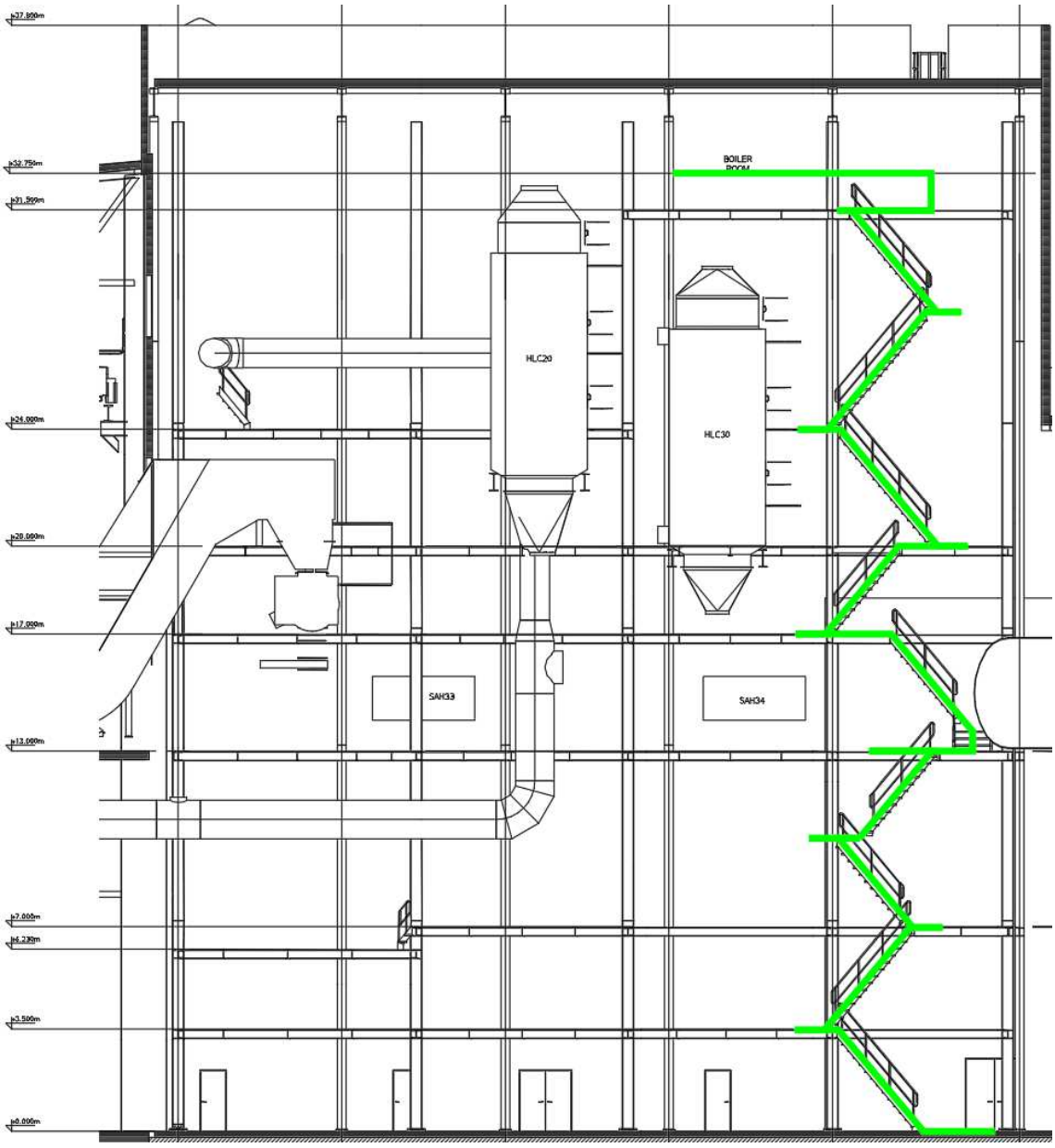
Pre Movement Time (tpre)

For a well-managed enclosure, 1-minute pre movement time for a person to start walking in the building is set.

Travel Time (ttrav)

The travel time, expressed as walking time, is the time required for occupants to walk to an exit that leads to a protected area or final escape exit. The occupants will be escaping from the upper level of the boiler and finally to outside (level +0,000). The occupant numbers are low why crowd is discounted. As per CIBSE guide E – 7.4.1 an average horizontal walking speed of 1.2 m/s and vertical velocity of 0.75 m/s is used.

The maximum travel of 45 m (horizontal) and maximum 41 m (vertical) is identified from the platform level +32.750 to the nearest door leading to a protected area and finally to the outside at level +0,000. The total travel time is approx. 93 seconds.



Calculated Time
The calculated time is therefore:
RSET = tdet + ta + tpre + ttrav
= 60s + 0s + 60s + 93s = 213 seconds (~3 minutes and 33 seconds)

ASET
Available Safe Egress Time (ASET)
The available safe egress time will be calculated based on an oil pool fire sized 3 m in diameter equal to 5.5 MW fire and a fire twice the size equal 11 MW fire (ref. section 19).
ASET = 7 minutes and 40 seconds

RSET <> ASET
RSET (3 minutes and 33 seconds) < ASET (7 minutes and 40 seconds)

7. Emergency lighting

Escape lighting to BS 5266: Part 1 is to be provided following standard guidance in BS 9999 and,-
Emergency light will be provided for critical plant operation areas according to NFPA850; 5.6.2

8. Fire spread

8.1 Internal fire spread

8.1.1 Requirements – Linings
Ref. BR2010
B2,-

1) To inhibit the spread of fire within the building, the internal linings shall:
   a) Adequately resist the spread of flame over their surfaces; and
   b) Have, if ignited, a rate of heat release or a rate of fire growth, which is reasonable in the circumstances.
2) In this paragraph 'internal linings' mean the materials or products used in lining any partition, wall, ceiling or other internal structure.

The classification of the surfaces of the internal walls and ceilings will comply with the requirements of the BS 9999.

These requirements reduce the likelihood of fire spreading in a building due to the combustibility of the internal linings.

The surface linings of the internal walls and ceilings shall comply with the classifications listed below in the following tables (ref. BS9999, table 33)

Table 33 **Classification of linings**[A)]

Location	National class[B)]	European class[C), D)]
Small room of area not exceeding 4 m^2 in a residential building and 30 m^2 in a non-residential building and domestic garages not exceeding 40 m^2	3	D-s3, d2
Other rooms (including garages)	1	C-s3, d2
Circulation spaces within dwellings	1	C-s3, d2
Other circulation spaces[D)] including the common areas of flats	0	B-s3, d2

NOTE Linings which can be effectively tested for "surface spread of flame" are rated for performance by reference to the method specified in BS 476-7:1987, under which materials or products are classified 1, 2, 3 or 4, with Class 1 being the highest. Class 0 is better than Class 1. It is not identified in any BS test standard. A Class 0 product is either:

a) *composed throughout of materials of limited combustibility; or*

b) *a material having a Class 1 surface spread of flame and which has a fire propagation index (I) of not more than 12 and a sub-index (i_1) of not more than 6.*

The fire propagation index is established by reference to the method specified in BS 476-6.

European classifications are described in BS EN 13501-1:2007+A1.

A) Recommendations are given in Clause **33** for linings of concealed voids.

B) The national classifications do not automatically equate with the equivalent classifications in the European column, therefore products cannot typically assume a European class, unless they have been tested accordingly.

C) When a classification includes "s3, d2" this means that there is no limit set for smoke production and/or flaming droplets/particles.

D) Large rooms such as open plan offices, shops display areas and factories need not be regarded as circulation spaces even though there are circulation routes in them.

Note: No lining will be foam based.

8.1.2 Requirements – Structure
Ref. BR2010
B3,-

1) The building shall be designed and constructed so that, in the event of fire, its stability will be maintained for a reasonable period.
2) A wall common to two or more buildings shall be designed and constructed so that it adequately resists the spread of fire between those buildings.
3) Where reasonably necessary to inhibit the spread of fire within the building, measures shall be taken to an extent appropriate to the size and intended use of the building, comprising either or both of the following:
   a) Sub-division of the building with fire resisting construction;
   b) Installation of suitable automatic fire suppression systems
4) The building shall be designed and constructed so that the unseen spread of fire and smoke within concealed spaces in its structure and fabric is inhibited

8.1.2.1 Structure – BS 9999
There are separate requirements for the structural fire performance of the Power Plant in accordance with BS9999, table 25:

- Administration building (single storey): No requirement according to BS9999 30.2.3
- Electrical El Annex & Service Building (ground floor level and 1st floor) - height of top occupied storey 8.6m, unsprinklered: 60 minutes fire resistance for element of structure
- Workshop building (single storey): No requirement according to BS9999 30.2.3
- Boiler Building and Turbine Building (single storey): No requirement according to BS9999 30.2.3
- Fuel storage building (single storey): No requirement according to BS9999: 30.2.3
- Concrete structure holding the shredder (2nd floor), the electrical room (1st floor) and the storage room / reject container (ground floor) - height of top occupied storey 17.7m, unsprinklered: 90 minutes fire resistance for element of structure

Note: Equipment located on other roofs is considered maintenance free during normal operation of the plant. Access to maintenance free equipment is provided, but does not form part of escape routes and will not be fire rated.

8.1.2.2 Structure – Insures requirement
The boiler building, the turbine building and the fuel storage buildings are single storey buildings and not required fire rated as risks inside buildings has been identified and addressed. Identified risks have been installed with fire suppression systems.

8.1.3 Compartmentation – BS 9999 requirements, Table 28
There is no limit on the compartment size for the administration building as the highest occupied storey is less than 30m above ground.

The remainder of the Power Plant:
Single storey buildings within Risk Profile A1, A2 and A3 are not restricted in regard to maximum floor area (no limit).

8.2 External fire spread
Functional Requirement

1) The external walls of the building shall adequately resist the spread of fire over the walls and from one building to another, having regard to the height, use and position of the building.
2) The roof of the building shall adequately resist the spread of fire over the roof and from one building to another, having regard to the use and position of the building.

8.2.1 Construction of external walls

BS9999 fig. 47 recommends that the external cladding of the building to be provided with Class 1 (national class) or Class C-s3, d2 or better (European class) or better up to a height of 18m above ground for buildings with a height of 18m or more. Above this height BS9999 fig. 47 recommends that the external cladding of the building to be provided with Class 0 (National) / B-s3,d2 (European) or better.

8.2.2 Space separation – Building Regulation requirement

A requirement of the Building Regulations is that the external wall of a building shall adequately resist the spread of fire from one building to another. This is achieved by ensuring that the building under consideration has sufficient spatial separation from adjacent buildings.

For the purposes of life safety the separation between buildings on the same site and subject to the same management regime can usually be ignored (BS9999 35.1.2). It is therefore not proposed to analyse the potential for fire spread between the buildings on site for the purposes of the Building Regulations.

For business continuity and consequential loss limitation in the event of a fire, each major element of the plant is provided with fire separation/isolation. Refer to Section 8.9 for details.

Space separation north façades and west façades towards site boundary

Required distances towards the northern and western boundary are calculated according to the appendix A of BRE187:

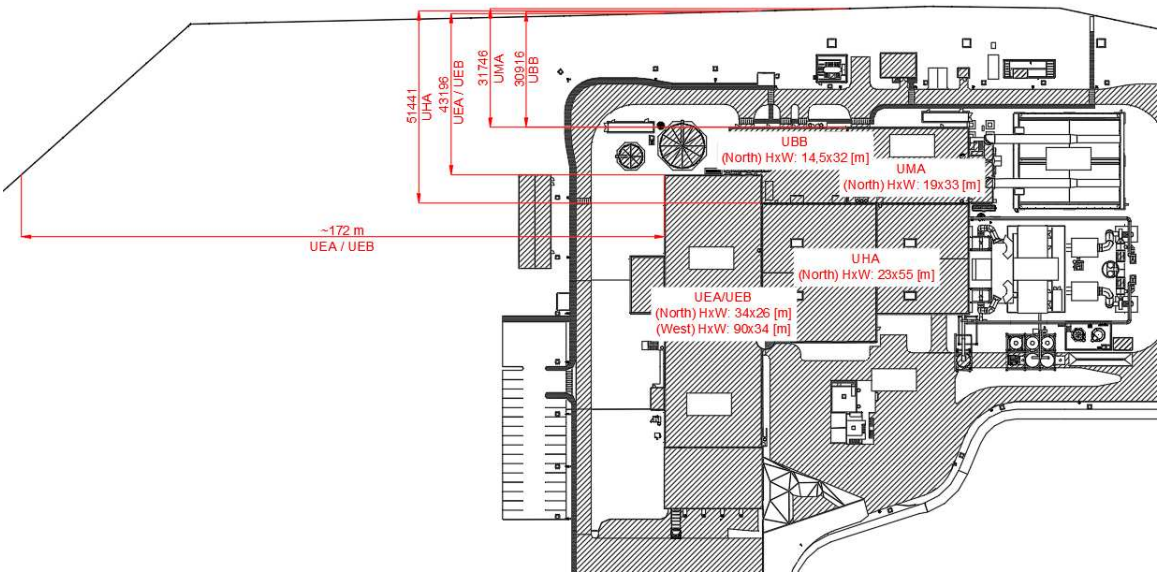
The nearest position of boundary to the building according to equation: $\mathrm{d} = \sqrt{(\mathrm{uwh})}$

d=distance to boundary
u=portion of unprotected area of the enclosing rectangle
w=width of the enclosing rectangle
h=height of the enclosed rectangle
g=factor (table 4 of appendix A of BRE187)

The following buildings have been evaluated:

- The fuel unloading and storage building actual distance to the west boundary is 172 m. The calculated distance required to boundary according to BRE187 is 44 m - accepted
- The fuel unloading and storage building actual distance to the north boundary is 43 m. The calculated distance required to boundary according to BRE187 is 19 m – accepted
- The boiler building actual distance to the north boundary is 51 m. The calculated distance required to boundary according to BRE187 is 35 m - accepted
- The Electrical El Annex & Service Building actual distance to the north boundary is 31 m. The calculated distance required to boundary according to BRE187 is 8 m – accepted
- The Steam Turbine Building actual distance to the north boundary is 32 m. The calculated distance required to boundary according to BRE187 is 25 m – accepted

Note:
The areas indicated on the following figure are the exposing area towards the exposed boundary.



- Others buildings within the boundary is considered acceptable in regard to distances due to their heights and widths.

8.3 Separation and compartmentation - Insures Requirement

Fire areas should be separated from each other by 2 hour fire barriers, 15 m spatial separation or other approved means.

Fire areas to be defined as e.g.:

- Indoor biomass receiving / tipping floor and storage area
- Indoor processed and unprocessed biomass storage (e.g. storage other than in the Bunker or the biomass receiving / tipping floor)
- External processed and unprocessed biomass storage
- Processing area
- Each Shredder and associated dust collection equipment from every other shredder, and from other equipment
- Cable spreading rooms and cable tunnels
- Control Room, Computer Room, or combined Control / Computer Room
- CEMS room
- Rooms with major concentrations of electrical equipment, such as switchgear room and relay room
- Battery rooms
- Maintenance shop
- Fire pumps
- Warehouses
- Emergency diesel generator
- Office buildings
- Turbine-generator and engine-generator

Note 1:
Buildings spaced less than 15m will be fire rated for 2 hours for a fire from outside. One of two opposite buildings spaced less than 15m, shall be fire rated for two hours in regard to a fire from inside and outside or the two buildings shall be fire rated for 2 hours in regard to a fire from outside.

Note 2:

For buildings where the exposing building is of lesser height than the exposed building and where the roof of the exposing building has no fire resistance, the height of the protection above the roof should be 7.5m (ref. NFPA 80A; 4.3.8.2).

Note 3:
Where a façade serves two fire compartments it requires 2 hour fire rating for 7.5m to prevent 180 degree fire spread from one compartment to the other.

8.4 Other measures

8.4.1 Cavity barriers

Where appropriate, suitable provisions will be made to prevent the unseen spread of fire and smoke through cavities or concealed spaces by use of cavity barriers. Cavity barriers will be designed and located to achieve the performance required for Building Regulations compliance e.g. by following the guidance contained in BS9999.

It should be noted that cavity barriers are not required within walls of 'traditional construction' i.e. two leaves of masonry minimum 75mm thickness separated by an internal cavity. In this instance, where cavity closers are required they do not have to be provided with the same performance as a cavity barrier.

8.4.2 Fire doors

A Fire resistant door in compartment walls has the same fire resistance as the wall, e.g. the door in a 60 minuets compartment wall has to be rated FD60S.

8.4.3 Corridors

Corridors exceeding 12m in length that provide access to more than one exit will be subdivided by cross corridor fire doors. The doors should be positioned approximately mid-way along the corridor and should be rated FD 20S (BS9999 16.3.11.3; table 30). This does not mean that corridors are required to be broken down into 12 m segments.

8.4.4 Crane operator room viewing window

To achieve 2 hour fire resistance to the Control Room viewing window will have a glazing system designed to provide at least 60 minutes integrity. The fire resistant glazing will further be protected by a water drenching curtain system mounted on the Bunker side of the glazing (see section 16.3.3)

8.5 Ductwork

Fire protection of ventilation ductwork is needed as an integral part of the building's compartmentation strategy to ensure not to compromise the integrity of the means of escape. As such, the recommendations contained BS 9999 Section 32.5.2 will be adopted.

- Where air handling ducts pass through fire-separating elements such as compartment walls or the enclosures to protected escape routes, then the integrity of those elements should be maintained, using one or a combination of the following four methods:
  - Method 1: thermally actuated fire dampers;
  - Method 2: fire-resisting enclosures;
  - Method 3: protection using fire-resisting ductwork;
  - Method 4: automatically actuated fire and smoke dampers triggered by

Selection or combining the methods 1 to 4 will be evaluated based on the specific application in which they are to be used.

8.6 Fire stopping

All joints between fire separating elements will be adequately fire stopped and all openings for services passing through fire separating elements will be:

- As few in number as possible to serve the building;
- As small as possible to provide the service transit;
- Suitably fire stopped (allowing for thermal movement in the case of pipes and ducts).

8.7 Transformer cell

Requirement transformer cell

The transformer cell will be designed according to the recommendations in NFPA850; 5.1.4. The transformer is installed with a fixed fire suppression system (deluge sprinkler system) which will be release by means of heat detectors (glass bulbs). The transformer cell will be designed according to NFPA850; 5.1.4.3 to protect adjacent structures from exploding transformer bushings.

The transformer holds less than 18,925 litre but more than 1,890 litre oil which require separation of 7.6m (line of sight) for fragments by exploding transformer bushings.

Requirement firewalls

The cell for the oil filled transformer will be designed according to recommendations in NFPA850; 5.1.4.5:

Where a firewall is provided, it should be designed to withstand the effects of projectiles from exploding transformer bushings or lightning arresters.

8.8 Flue gas treatment

The filter bags installed in the filter is designed for high temperatures.

8.9 Fire separation (segregation) and compartmentation drawings

Fire separation of the various elements will be provided by a combination of one or more of the following measures:

Blockwork or concrete construction;
Fire rated cladding;
Spatial separation;
Active fire suppression;
Fire rated cladding

Ventilation ducts passing from one fire separated area to another will be provided with automatic fire dampers. Operation of dampers could either be from the fire detection system or inert gas panel. All dampers in the ventilation system are failsafe closed.

The fire segregation drawings for each main area are listed in section 19 and included in the attachment to this report ref. 2031.M0.J01.002 rev.0

The following colour code indicates the fire resistance indicated on the drawings.

	120 minutes

Note: The 120 minute fire resistance is achieved either by concrete, block wall or cladding (cladding walls 120 minute fire resistance from a fire outside towards inside).

9. Access and facilities for the Fire Service

9.1 Functional requirement

1) The building shall be designed and constructed so as to provide reasonable facilities to assist fire-fighters in the protection of life.
2) Reasonable provision shall be made within the site of the building to enable fire appliances to gain access to the building.

9.2 Vehicle access

The typical design guidance for vehicle access routes is given below table (ref. ADB, table 20), although the route dimensions formally need to be confirmed with the Local Fire Authority. The accessed perimeter affords direct access to the stairs, which will provide a useful opportunity for internal firefighting

Table 20 **Typical fire and rescue service vehicle access route specification**

Appliance type	Minimum width of road between kerbs (m)	Minimum width of gateways (m)	Minimum turning circle between kerbs (m)	Minimum turning circle between walls (m)	Minimum clearance height (m)	Minimum carrying capacity (tonnes)
Pump	3.7	3.1	16.8	19.2	3.7	12.5
High reach	3.7	3.1	26.0	29.0	4.0	17.0

Notes:

1. Fire appliances are not standardised. Some fire services have appliances of greater weight or different size. In consultation with the Fire and Rescue Service, the Building Control Body may adopt other dimensions in such circumstances.
2. Because the weight of high reach appliances is distributed over a number of axles, it is considered that their infrequent use of a carriageway or route designed to 12.5 tonnes should not cause damage. It would therefore be reasonable to design the roadbase to 12.5 tonnes, although structures such as bridges should have the full 17 tonnes capacity.

9.3 Access to buildings for firefighting personnel

The process areas do not have internal storeys that are normally occupied that would require firefighting stairs. Specific risks in the process areas are provided with dedicated fire extinguishing/control systems as described in Section 16 to this report.

With the exception for the Control room (located at first floor of the El Annex & Service Building) the service and office areas that are normally occupied are all situated at ground floor level.

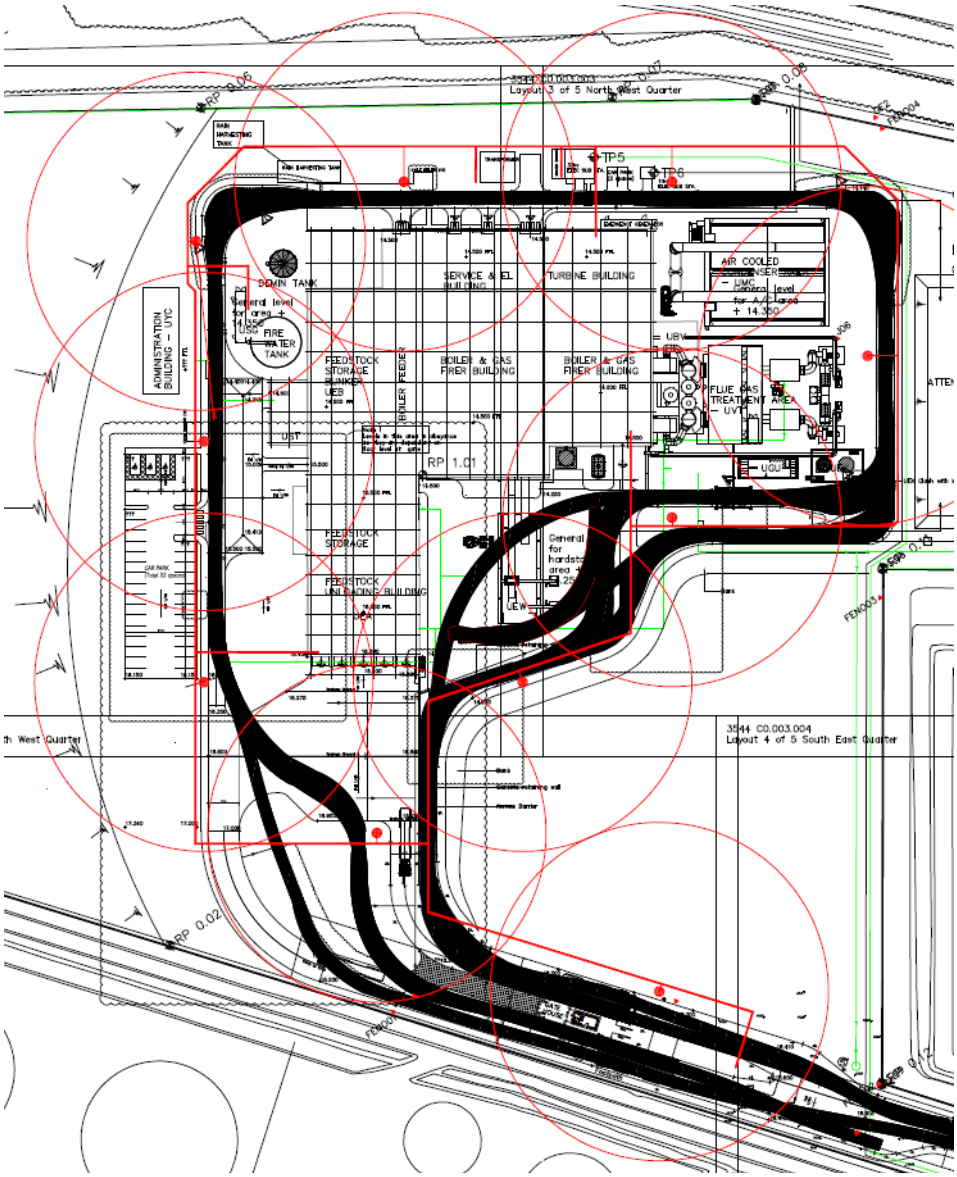
10. Fire main and location of hydrants

The proposed site exceeds 3 hectares in area therefore (in accordance with the guidance contained in Appendix 5 of the National Guidance Document on The Provision of Water for Fire Fighting 2007) a combined hydrant supply of 75 litres per second should ordinarily be provided. This however is based on the assumption that no additional firefighting measure have been provided. The provision of automatic fire suppression systems is based on NFPA850 requirements as detailed in Section 16 therefore the hydrant demand will be based around a hose reel demand of 1890 litres per minutes.

The Power Plant is to be provided with a looped fire hydrant ring main for use by the attending fire Service. Hydrants will be provided as indicated on the following diagram based on the provisions of NFPA850 (2015) Clause 6.4.1

The hydrants will be in accordance with BS 750:2012 to ensure compatibility with the equipment carried by the Local Fire and Rescue Service.

Hose cabinets located in the vicinity of each hydrant will be supplied with one spray nozzle (jet and fog) and a total of 30m hose.



11. Portable fire extinguishers

Portable fire extinguishers will be provided throughout the entire facility, selected according to perceived risk.

Electrical rooms and the boiler building will be equipped with CO2 extinguishers. STG room will be equipped with both dry powder and CO2 extinguishers.

The portable fire extinguisher layout drawings for each main area are listed in section 19 and included in the attachment to this report ref. ~~2031.M0.J01.002 rev. 0~~ Drawings pending design

12. Fire water run-off

Any area inside buildings (except the fuel storage) is drained to the sedimentation basin and treated as foul water.

The transformers are drained to the attenuation pond via the oil separators.

13. Smoke and heat venting system

Boiler building:
The boiler building is installed with four roof ventilation units which also serve as smoke extraction fans. The roof ventilation units are part of the normal ventilation system and for smoke extraction. In the event of a fire and required smoke or heat ventilation is needed the ventilation units can be opened from the DCS. Fresh air is provided either by the installed inlet dampers or by opening the gate at ground floor.
The roof ventilation units are designed as fail safe open. In the event of loss of power supply to the, units these will be forced open and the gate at ground floor will be opened and provide the required draft through the building for extraction.

Steam turbine building:
three fans are installed in the roof of the steam turbine building. The fans are rated as smoke extraction fans designed to operate at 300 °C for 3 hours. In the event of a fire and required smoke or heat ventilation is needed the fans can be started from the DCS. Fresh air is provided by the installed louvres in the wall of the building.
In the event of loss of power supply to the fans the remaining opening in the fans and the louvres will provide the required draft through the building for extraction.

Fuel Storage building:
The storage building is installed with natural ventilation and 4 pc. smoke extraction units. Each smoke extraction unit is sized to 25,000 m3/h and rated for operation for 2 hours at 300 °C (F300)

Control room:
Fresh air is continuously supplied into the MV room (pressurized). The outlet from the MV room is ducted to the battery room for continuously air exchange. In the event of fire all dampers leading to and from the rooms will be closed.

14. Dangerous Substances and Explosive Atmospheres Regulations

14.1 DSEAR report

All areas that are considered as potentially hazardous with regard to explosion risk have been assessed and included in document 2031.S0.X02.001 – Dangerous Substances and Explosive Atmosphere (DSEAR) Pending completion

Equipment and machinery for areas classified as hazardous will be suitable for installation and operation in those areas and supported by relevant markings and certification.

15. References

The following regulations and reference documents have been used in the preparation of this report:

- Guidance Document, Waste Processing Plant – Fire Systems, Issue 2.0, dated 19 May 2017(*1: see section 3.1)
- Guidance Document, Energy from Waste – Fire Systems, Issue 3.0, dated 19 May 2017(*1: see section 3.1)
- S.I. 2010 No. 2214 - The Building Regulations 2010
- S.I. 2005 No. 1541 - The Regulatory Reform (Fire Safety) Order 2005
- The Building Regulations 2010, Approved Document B Volume 2 - Fire Safety; (2006 edition incorporating 2007, 2010 and 2013 amendments)
- National Guidance Document on The Provision of Water for Fire Fighting (January 2007, 3rd edition)
- BS 9999: 2017; Code of Practice for Fire Safety in the Design, Management and Use of Buildings
- BS5839-1:2002; Fire detection and alarm systems for buildings Part 1 – Code of practice for system design, installation, commissioning and maintenance
- BS8300: 2009; Design of buildings and their approaches to meet the needs of disabled people. Code of Practice
- NFPA850: 2015; Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations
- NFPA13: 2016; Standard for the Installation of Sprinkler Systems
- NFPA14: 2016; Standard for the Installation of Standpipe and Hose Systems
- NFPA15: 2012; Standard for Water Spray Fixed systems for Fire Protection
- NFPA16: 2011; Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
- NFPA20: 2010; Standard for the Installation of Stationary Pumps for Fire Fighting
- NFPA101: 2018; Life Safety Code
- Research Establishment Report BRE187 (1991 – External fire spread: Building separation and boundary distances)
- CIBSE Guide E; Fire engineering
- WASTE 28 Reducing fire risk at waste management sites issue 2 – April 2017

16. Fire safety provisions (Statutory requirement and Insurer's requirement)

The following describes each of the additionally fire safety measures to be incorporated in the design of the power plant for life safety and property protection (the figures mentioned for the water based fire suppression systems would not necessarily be accurate however, they does provide sufficient information for the design and sizing of the fire water requirement i.e. fire water storage tank and fire pump capacity).

Fire suppression systems will be designed in accordance with the recommendations of NFPA with the exception of the inert gas systems which will be designed in accordance with BS EN15004.

Note: Any water filled pipe, valve, deluge valve etc. serving fire suppression systems and dry risers with risk of being exposed to low temperature (frost) shall be properly heat traced.

16.1 Compartmentation – Fire segregation

Refer to section 8.9

16.2 Hydraulic systems

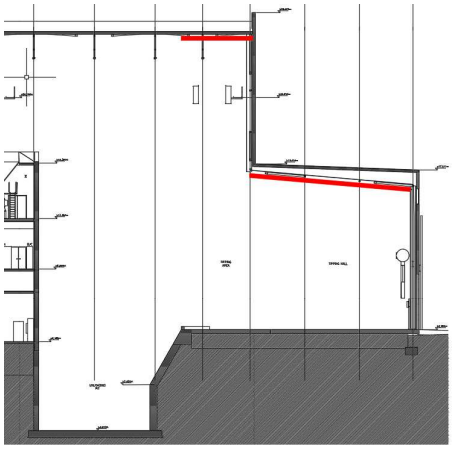
Listed Fire resistant hydraulic fluids will be used for hydraulic systems.

16.3 Fixed fire protection – Sprinkler and Monitor

In order to minimise losses to plant, production and personnel, certain areas and risks in a Power Plant of this type are recommended to be provided with fixed fire protection systems (manual or automatic in operation as appropriate).

16.4 Waste Fuel Unloading Area - UEA

16.4.1 Tipping hall

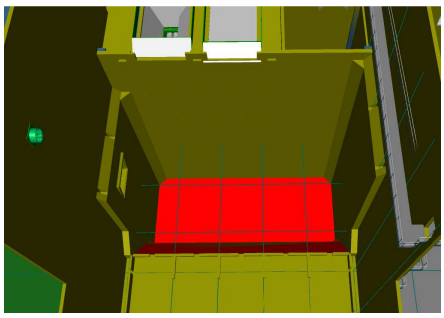


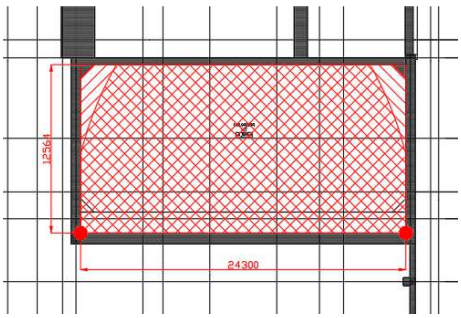
The tipping Hall will be provided with automatic sprinkler protection throughout. The systems will be designed for a minimum of 10.2 mm/min over the most remote 279 m2 of floor area with the protection area per sprinkler not to exceed 12.0 m2. High temperature sprinklers 121°C to 149°C should be used.

The system will be designed as a dry pipe system why the water consumption calculated below is increased by 30%

Water consumption ~222 m3/h

16.4.2 Bunker





The fuel bunker will be installed with two monitors each with a capacity of minimum 946 l/min at 6.89 bar. The monitors will be located to allow for coverage of all pit areas with both streams operating simultaneously.

Upon detection of fire and automatic start of the monitors, the monitor nozzles will automatic start oscillating. Manual override will be provided and the monitors will be capable of remote operation from the crane operator room and the central control room.

Water consumption ~114 m3/h

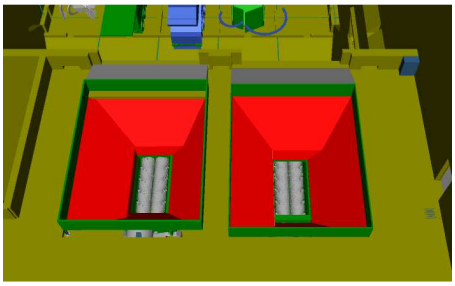
16.4.3 Crane operator room viewing window

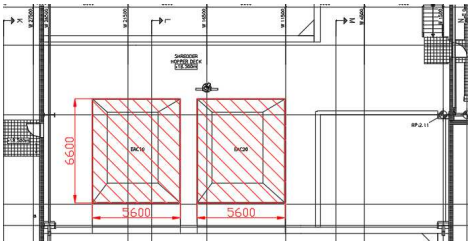
Additional to the fire rated glazing for 60 minutes for the viewing window towards the bunker, a water drenching curtain system will be mounted on the bunker side of the glazing designed for a density of 10.2 mm/min over the window area. The water drenching system will be automatically activated via the bunker fire detection system linked to a deluge valve. In addition, a manual initiation system will be installed inside the crane operator room and the central control Room.

Water consumption ~5.8 m3/h

16.5 Shredder Area – UEA/UEB

16.5.1 Shredder hopper 1 and 2

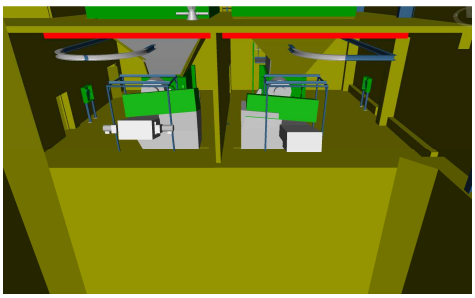


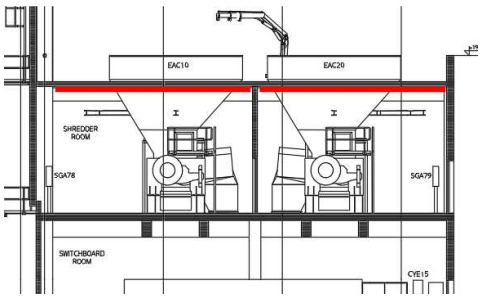


Each of the feed hoppers for the shredders will have automatic deluge protection designed for a minimum of 8.1 mm/min over the entire Hopper, with the protection area per deluge head not to exceed 12.0 m2. Manual activation of the Hopper deluge system will be possible from the Control Room

Water consumption ~18 m3/h (each)

16.5.2 Shredder enclosures





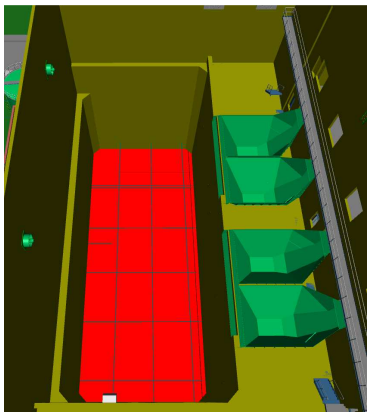
Each shredder enclosure (area 7.850mm x 11.700mm) will be provided with automatic sprinkler. The systems will be designed for a minimum of 10.2 mm/min over the most remote 279 m2 of floor area with the protection area per sprinkler not to exceed 9.3 m2.

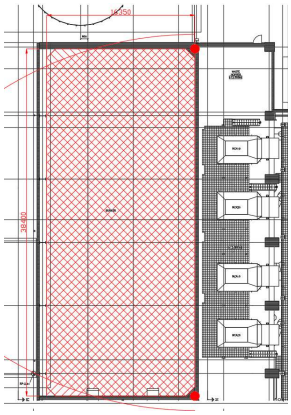
The system will be designed as a dry pipe system why the water consumption calculated below is increase by 30%

Water consumption ~ 73 m3/h (each)

16.6 Waste Fuel Storage Area - UEB

16.6.1 Bunker



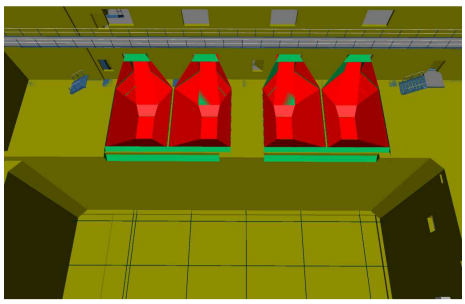


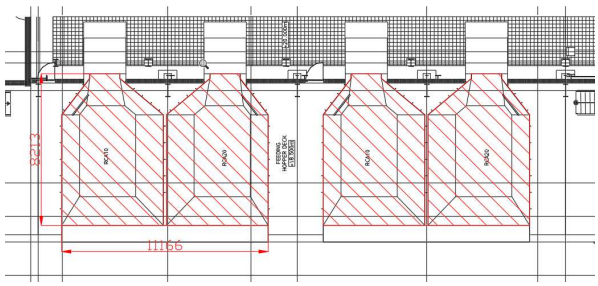
The fuel bunker will be installed with two monitors each with a capacity of minimum 946 l/min at 6.89 bar. The monitors will be located to allow for coverage of all pit areas with both streams operating simultaneously

Upon detection of fire and automatic start of the monitors, the monitor nozzles will automatic start oscillating. Manual override will be provided and the monitors will be capable of remote operation from the central Control Room.

Water consumption ~114 m3/h

16.6.2 Boiler hopper line 1 and line 2

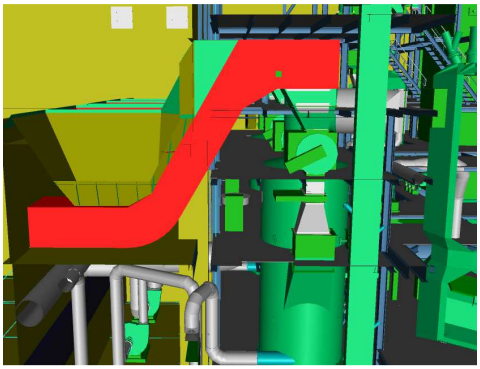




Each of the feed hoppers for the boiler will have automatic deluge protection designed for a minimum of 8.1 mm/min over the entire Hopper, with the protection area per deluge head not to exceed 12.0 m2. Manual activation of the Hopper deluge system will be possible from the Control Room

Water consumption ~45 m3/h (each)

16.6.3 Feeding conveyor to boiler



Each of the conveyors for feeding the boiler will be installed with a sprinkler system. The sprinkler system covers the complete length of the conveyor.
Sprinkled conveyor area approximately: 2.3 m x 18 m ~41.5 m2
The systems will be designed for automatic release and a minimum of 10.2 mm/min.

Water consumption ~25 m3/h (each)

16.7 Step-up transformer

The sprinkler system covers the complete transformer cell.
Enveloped transformer area: 148 m2. Surrounding area: 53 m2
Sprinkler water demand enveloped area 10.2 mm/min and surrounding area 6.1 mm/min as according to NFPA 15 section 7.4.4.
The sprinkler system will be designed as a deluge system for automatic release. Automatic release will be by means of a pressurized (service air) trigger line connected to the deluge valve. Activating the trigger line is by means of sprinkler heads with release temperature at 30 °C above ambient temperature.
Deluge valve to be pneumatically released

Fire water consumption ~110 m3/h Exact size of the transformer has not been confirmed.

16.8 Emergency diesel generator

The emergency diesel generator is installed outdoor in a weather proof and non-combustible enclosure (Canopy) and is a standard package unit. The unit will be equipped with smoke

detectors for early warning and an internal sprinkler system. The sprinkler system will be release by means of heat detectors (glass bulbs, set point 30 °C above ambient temperature.

16.9 Containerized fire pump unit

The containerised fire pump unit will be designed according to NFPA20. This includes fire protection of the interior of the containerized unit with automatic sprinklers to all areas including the fuel tank.

16.10 Steam turbine generator

16.10.1 Turbine bearings, generator bearings, gearbox and main steam valve

Turbine bearings, generator bearings and gearbox will be protected by an automatic low pressure pre-action closed head sprinkler system.

The fire protection system for the gearbox and main turbine hydraulic valve will be designed for a density 12.2 mm/min accordance to NFPA850 (2015); 7.7.4.1 through 7.7.4.3.

The fire protection system for the turbine generator bearings will be designed for a density 10.2 mm/min accordance to NFPA850 (2015); 7.7.4.2

16.10.2 The area beneath the turbine table, the purifier- and the Lube Oil units.

The area beneath the turbine table, the purifier- and the Lube Oil units will be protected by a foam based fire protection system

The fire protection system will be designed for a density of minimum 6.5 mm/min in accordance to NFPA16 (2015); 7.3.2.1 and a duration of minimum 10 minutes in accordance to NFPA16 (2015); 7.3.3.1

The foam system will be for automatic will be by means of (combination of) smoke and flame detectors through a deluge valve as well as manual release. Manual release points will be located inside the room in the vicinity of the risk.

16.10.3 Spray guides

To reduce the risk of aerosols from oil originated from a leaking flange assembly in the turbine building, flange assemblies will be installed with spray guides.

16.11 Boiler auxiliary burners

The auxiliary burners for the boiler will be provided with a foam based automatic fire protection system. The fire protection system will be designed for a density of minimum 6.5 mm/min in accordance to NFPA16 (2015); 7.3.2.1 and a duration of minimum 10 minutes in accordance to NFPA16 (2015); 7.3.3.1

The foam system will be designed to cover an area in a distance of 6.1 m from the auxiliary burner.

The foam system will be for automatic release by means of (combination of) smoke and flame detectors through a deluge valve as well as manual release. Manual release points will be located inside the room in the vicinity of the risk.

16.12 Electrical rooms

A total flooding inert gas system will be provided for the following rooms:

MV room*
LV room*
DCS equipment room *
Battery room*
SAT room (building)*
Feedstock handling SWBD. room

ACC / Steam Turbine SWBD. room
FGT Area SWBD. room
CEMS

*The area is served from one central bank.

The gaseous extinguishing systems will be designed according to EN15004-2009 and based on discharge of Inergen (IG541).

Coverage will include floor voids and ceiling voids where applicable.

Automatic systems must be interlocked such that when the room is occupied, extinguishant discharge cannot occur. The system may operate in fully automatic mode when such rooms are unoccupied.

16.13 FGT Bag filter

A N2 extinguishing system will be installed for protection of the Bag filter. The system will be designed to flood one compartment out of six. The system will be released based on temperature switches monitoring each compartment.

16.14 Smoke and Heat Venting system

Refer to section 13

16.15 Hose reels

Hose reels are provided for manual fire-fighting in the following areas:

- Boiler building
- Steam turbine building
- Fuel unloading area

The hose reels inside the process buildings will be designed so that all areas are within the range of a fire hose.

Size of hoses will be 1” (DN25) semi ridged rubber hoses.

16.16 Dry riser

Dry risers with landing valves located at each level will be installed at the two internal staircases inside the boiler building (UHA) and at the external staircase located east of the boiler building (UHA) and west of the fuel storage building (UEA/UEB) for the use of the attending Fire Service.

16.17 Fire department connection

Two 2-way inlet breeching valves will be available on site allowing for charging the fire main. One will be available at the gate to enter the power plant and one will be available next to the steam turbine building (UMA). The connections will be 2 1/2” and according to BS336.

16.18 Fire water tank – Spare nozzle for fire water supply to fire department and filling of tank

The fire water storage tank will be equipped with a spare connection to allow the fire department to connect directly to the tank for dragging water to the fire engines. Type of coupling to be agreed.
The fire water storage tank will normally be filled and refilled through a fixed connection to the site water supply from the public water supplier. To allow for additional filling the fire water storage tank will equipped with a separate connection installed with a 2-way inlet breeching valve. The connection will be 2 1/2” and according to BS336.

16.19 Water supplies for firefighting purposes

The firefighting water supply is to comprise a water storage facility for the fire main (and standby fire pumps (100% duty) and a jockey pump to maintain quiescent ring main pressure). The supply design for the Power Plant is based on the requirements of NFPA850:

The water supply for the permanent fire protection installation should be based on providing a 2-hour supply for:

- Either the largest fixed fire suppression system demand or any fixed fire suppression system demands that could reasonably be expected to operate simultaneously during a single event.

And

- The hose stream demand of not less than 500 gpm (1893 L/min) (113.6 m3/h)

In this context this is likely to be:

- The required water consumption for the sprinkler system for the tipping hall 222 m3/h
- The hose stream demand of 113.4 m3/h

Required water supply for firefighting purpose: 2 hours x (222 + 113.6) ~671 m3
As per the above calculations the required pump capacity will be based on the water requirement for the tipping hall sprinkler system and the hose stream demand.

Total static water supply volume for fire-fighting will be minimum 671 m3 and fire pump duty rating to be 335.5 m3/h at 10.3 bar(g).

The fire water storage tank (SGA11 BB001) combines provision for both sprinkler and hydrants.

Requirement according to Approved Document B Vol. 2; B5; 15.8

Where no piped water supply is available, or there is insufficient pressure and flow in the water main, or an alternative arrangement is proposed or an alternative source of supply is proposed, the alternative source of supply should be provided in accordance with the following recommendations e.g. a charged static water tank of at least 45,000 litre capacity.

Note:
It is considered reasonable and adequate that the combined firewater storage tank includes water for the hydrant installation, as the calculated firewater storage for hydrants is 226.8 m3 (exceeding 45 m3 as per APD B).

17. Impairment procedure

NFPA25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, provides guidelines in regard to how to act in case of impairment. Based on these guidelines the O&M Contractor should prepare and issue procedures, so that these are in place before actually needed. Further, the O&M Contractor and his team should be familiar with these procedures and responsible members should be appointed before an actual event would occur. The following from NFPA 25 – Definition:

Impairment. A condition where a fire protection system or unit or portion thereof is out of order, and the condition can result in the fire protection system or unit not functioning in a fire event.
Emergency Impairment. A condition where a water-based fire protection system or portion thereof is out of order due to an unplanned occurrence or the impairment is found while performing inspection testing or maintenance activities.
Preplanned Impairment. A condition where a water-based fire protection system or a portion thereof is out of service due to work planned in advance, such as revisions to the water supply or sprinkler system piping.

As mentioned in NFPA25 section 15.4.2 impaired equipment shall include, but shall not be limited to:

(1) Sprinkler systems
(2) Standpipe systems
(3) Fire hose systems
(4) Underground fire service mains
(5) Fire pumps
(6) Water storage tanks
(7) Water spray fixed systems
(8) Foam-water systems
(9) Water mist systems
(10) Fire service control valves

NFPA 25, section 15.6 Emergency Impairments
15.6.1 Emergency impairments shall include, but are not limited to, interruption of water supply, frozen or ruptured piping, and equipment failure, and includes impairments found during inspection, testing, or maintenance activities
15.6.2 The coordinator shall implement the steps outlined in section 15.5

NFPA 25 section 15.5 Preplanned impairment program
15.5.1 All preplanned impairments shall be authorized by the impairment coordinator.
15.5.2 Before authorization is given, the impairment coordinator shall be responsible for verifying that the following procedures have been implemented:

(1) The extend and expected duration of the impairment have been determined.
(2) The areas or buildings involved have been inspected and the increased risks determined.
(3) Recommendations to mitigate any increased risks have been submitted to management or the property owner or his designated representative.
(4) Where a fire protection system is out of service for more than 10 hours in a 24-hour period, the impairment coordinator (see NFPA25 (2014) section 15.2) shall arrange for one of the following:
    (a) Evacuation of the building or portion of the building affected by the system out of service
    (b) An approved fire watch
    (c) Establishment of a temporary water supply
    (d) Establishment and implementation of an approved program to eliminate potential ignition sources and limit the amount of fuel available to the fire.
(5) The fire department has been notified
(6) The insurance carrier, the alarm company, property owner or designated representative, and other

authorities having jurisdiction have been notified.
(7) The supervisors in the areas to be affected have been notified.
(8) A tag impairment system has been implemented.
(9) All necessary tools and materials have been assembled on the impairment site.

NFPA 25 section 15.7 Restoring systems to service
When all impaired equipment is restored to normal working order, the impairment coordinator shall verify that the following procedures have been implemented:

(1) Any necessary inspections and tests have been conducted to verify that affected systems are operational. The appropriate chapter of NFPA 25 shall be consulted for guidance on the type inspection and test required.
(2) Supervisors have been advised that protection is restored.
(3) The fire department has been advised that protection is restored.
(4) The property owner or designated representative, insurance carrier, alarm company, and other authorities having jurisdiction have been advised that protection is restored.
(5) The impairment tag has been removed

Definitions:
NFPA25 (2014) Definitions 3.3.21: Impairment. A condition where a fire protection system or unit or portion thereof is out of order, and the condition can result in a fire protection system or unit not functioning in a fire event.

3.3.21.1 Emergency Impairment. A condition where a water based fire protection system or portion thereof is out of order due to an unplanned occurrence, or the impairment is found while performing inspection testing or maintenance activities.

NFPA 25, 15.2 Impairment Coordinator.
15.2.1 The property owner or designated representative shall assign an impairment coordinator to comply with the requirements of this chapter.
15.2.2 In the absence of a specific designee, the property owner or designated representative shall be considered the impairment coordinator.

Note: This section 14 should not be considered fulfilling all requirements within NFPA25. NFPA 25 should be reviewed in its full length and be implemented in the impairment procedures where applicable.

18. Follow on design

The purpose of this report is to support Building Regulations application and Local Fire and Rescue Service discussions.

The actual design and specification of the systems and fire safety provisions described herein are required to be carried out during the detailed design stage of the project and are likely to form part of the M&E package, otherwise specialist fire alarm and protection design input should be sought.

Any fire safety designs will be required to be submitted to Building Control for areas that are subject to the Building Regulations; i.e. permanently occupied buildings and facilities such as administration and offices etc. Where not covered by the Building Regulations, the designer is required to ensure that a suitable level of fire safety has been provided to safeguard any persons who may occasion the affected areas – this may be demonstrated by following established published guidance or performance based design and should be the subject of discussion with the Local Fire and Rescue Service.

Where fire safety provisions have been made purely for the protection of property or business continuity the design should be in accordance with both the Client's requirements and those of the eventual insurer.

Prior to full operation of the plant and occupation of the administration and office areas a documented fire risk assessment is required under the Regulatory Reform (Fire Safety) Order 2005. The fire risk assessment should be carried out by a person or persons conversant with the fire safety provisions and operating procedures for the installation. The Local Fire and Rescue Service will not provide a fire risk assessment but will require its availability for inspection at any reasonable time during the occupation and operation of the installation.

19. Attachments

(separate document – 2031.M0.J01.002)

Drawing Number	Drawing Title
2031.M4.J01.001 R0	Fire Main layout
2031.M4.J05.101 to 111.R0	Escape and egress Boiler building (UHA)
2031.M4.J05.211 to 215.R0	Escape and egress Waste fuel storage area (UEB)
2031.M4.J05.661.R0	Escape and egress Workshop building (UST)
2031.M4.J05.251 to 256.R0	Escape and egress Fuel unloading area (UEA) and fuel storage area (UEB)
2031.M4.J05.301 to 304.R0	Escape and egress Air cooled condenser (UMC) and ACC Ext. El annex (UBV)
2031.M4.J05.401.R0	Escape and egress Flue gas treatment area (UEH, UEK, UVT)
2031.M4.J05.501 to 502.R0	Escape and egress Steam turbine building (UMA)
2031.M4.J05.505.R0	Escape and egress Steam turbine building (UMA)
2031.M4.J05.611 to 613.R0	Escape and egress Slag area (UEW)
2031.M4.J05.711 to 714.R0	Escape and egress Service building / El annex (UBB)
2031.M4.J05.751.R0	Escape and egress Step-up transformer area (UBT)
2031.M4.J05.761.R0	Escape and egress 33 kV Sub-station (UAA)
2031.M4.J05.771.R0	Escape and egress 11 kV Sub-station (UAB)
2031.M4.J05.801.R0	Escape and egress Administration building (UYC)
2031.M4.J05.850.R0	Escape and egress Site entrance (UZA-1), Security gate house (UYF) and Weighbridge area (UYE/UYX)
2031.M4.J07.XXX R0	Portable extinguisher location Drawings pending design Boiler building (UHA) and slag storage (UEW), level +0.000
2031.M4.J09.XXX R0	Hose reel layout UHA – Level 0.000 Drawings pending design
2031.M4.J12.101 to 110.R1	Fire segregation
2031.E4.F01.001 R0	Equipment layout of Fire Detection System Drawings pending design
2031.E4.F02.001 R0	Aspiration equipment layout Drawings pending design
2031.E4.S11.XXX R0	Light & Small Power UBB, UBD & UBT Drawings pending design
2031.C0.110.001 R0	Swept Path Analysis Drawings pending design
ASET calculation part 1a to 1d.	

20. Appendix I – ASET calculations

Detailed calculations are part of the attachment in section 19.

MEMO

Job	**Hooton Bio Power Project**
Client	**BWSC**
Memo no.	**Appendix I**
Date	**2018-12-12**
Version	**1.0**
From	**Michael Gould Bøeg Christiansen**
Reviewed by	**Carsten Hald (BWSC)**

1. Introduction

This memo is Appendix I to the Fire Safety Strategy Report for the Hooton Bio Power Project.

The purpose of this memo is to describe the effect of a fire in the boiler building (UHA), in regards to the smoke filling in the Boiler room, were the temperature of the smoke layer and critical condition is assessed.

The effects are found using the software "Argos" with is a 2-zone model.

2. Argos software

For this memo The Argos software[1] version 5.9.96.421 developed by "DBI" is used. Argos software is at 2-zone model in which a fire in an enclosed room can be model.

When using a 2-zone model the enclosed room is divided into two distinct compartment gas zones: an upper (hot) volume and a lower (cool) volume resulting from thermal stratification. See Conservation equations are applied to each zone and serves to embrace the various transport and combustion processes that apply. The fire is represented as a source of energy and mass, and manifests itself as a plume which acts as a "pump" of mass from the lower level zone to the upper zone.

[1] http://en.dbi-net.dk/argos/

Date

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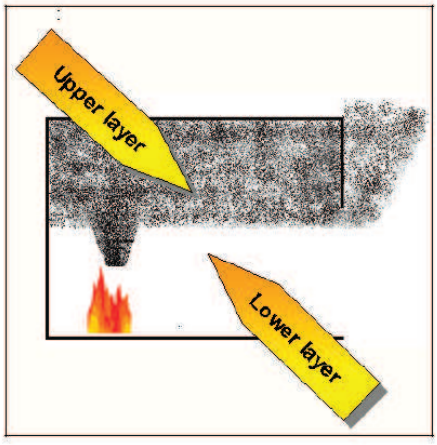


Figure 1, a 2-zone model. Figure from the Argos User Guide.

3. Fire used in model

In the Boiler building there will not be stored combustible materials, but there is a risk of an oil leak from the Boiler auxiliary oil burner placed in the centre of the building. The auxiliary burner for the boiler will be provided with a foam based automatic fire suppression system in accordance with NFPA 850. Since there is a fire suppression system, the fire from the oil spill will be controlled and not become a large fire, corresponding to a pool of oil with a diameter of 3 m. There is also an emergency cut-off valve that will prevent further oil been spilled on the floor of the Boiler Building.

The risk profile of the boiler building is A3, so the fire growth rate is "fast". In the Argos model an Energy formula fire is used, so to fire the Convective energy release rate of a pool fire from an oil spill with a diameter of 3 m, is calculated below.

Fireload in compartment, Pool Fire				
Material data from Table 3.3 "Enclosure Fire Dynamics":				
Transformer oil; hydrocarbon	Density =	760	kg/m^3	
	$\dot{m}''_{inf\infty}$=	0,039	kg/(m^{2}s)	
	ΔH_c =	46,4	MJ/kg	
	kβ =	0,7	m^{-1}	
Calculations:				
Diameter of fuel source, Pool fire	D=	3	m	
Spill area	$A = \pi/4 \cdot D^2$ =	7,1	m^2	
Free bure mass loss rate	$\dot{m}''_{inf} = \dot{m}''_{inf\infty} \cdot (1-\exp(-k\beta D))$ =	0,034	kg/(m^{2}s)	
Total energy release rate				
(assuming the combustion effecincy to be 70%)	$Q = A \cdot \dot{m}''_{inf} \cdot 0{,}7 \cdot \Delta H_c$ =	7857	kW	
Convective energy release rate factor	F_{Qc} =	0,7		
Convective energy release rate	$Q_c = Q \cdot F_{Qc}$ =	5500	kW	

To see the effect of the size of the fire, a fire with the double convective energy release rate is also used.

4. Boiler Building (UHA)

The boiler building is a building with to heights.
The tall part (Part I) has a with a length of 30,5 m a width of 36 m and a height of 36 m.
The area of Part I is app. 1.098 m^2 and has a perimeter is 152 m.
The lower part (Part II) has a with a length of 25 m a width of 29 m and a height of 24 m.
The area of Part II is app. 725 m^2 and has a perimeter is 108 m. Se Figure 2.

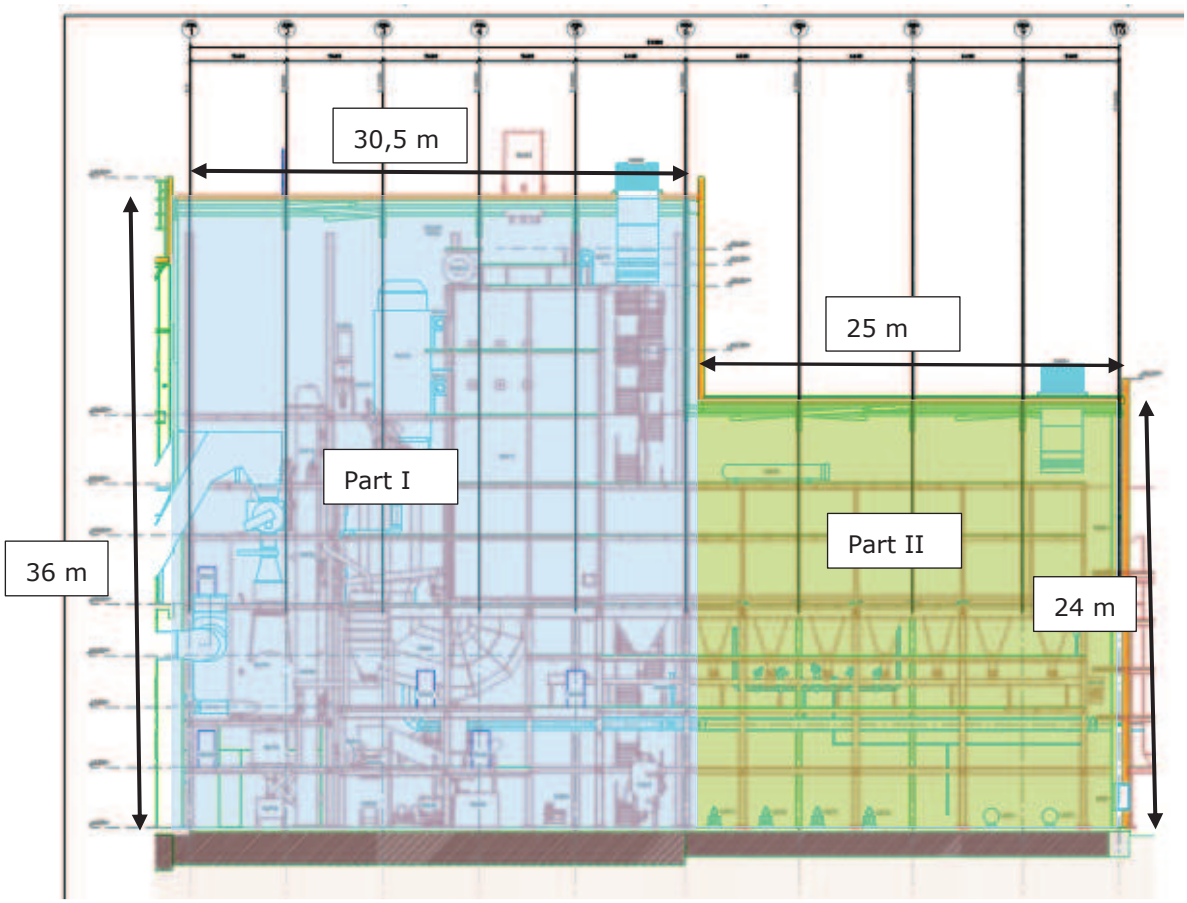


Figure 2, Building geometry

The building is a steel building with a steel-plate wall and roof. Note that Argos those not have this "Basic building construction", and a concrete building has been used.

To take the smoke spread between the two building parts into account in Argos, the Boiler Building is regarded as a two large rooms in regards to smoke filling, with an opening (29 m x 24 m) between the two rooms, corresponding to open the areal between the two "rooms".

The Boiler room as openings in the roof, but these openings are consisted as closed and no smoke loss through these opening are not taken into account in the calculations, with is a conservative way of modelling the building.
In the Argos model only one door opening of 2 m is used to the surroundings, since the Argos program needs an at least 1 opening to run the calculations, but there is no smoke loss through this opening.

In the Argos calculations the fire is stared in both rooms, to insure the smoke spread between the two "rooms" are taken into account.

5. Critical conditions

The looking at critical conditions in the Boiler building there flowing criteria are used.

- **Visibility**. If the visibility is less than 10 m, conditions are considered to be critical.
- **Distance from floor to smoke layer**. If the distance reaches less than 1.6 m + 10 % of the height of the room, conditions are considered to be critical.
- **Temperature in smoke free zone (lower zone)**. If the temperature in the smoke free zone reaches 60-80 °C, conditions are considered to be critical.
- **Heat radiation from smoke layers**. If the radiation surpasses is more than 2.5 kW/m^2, conditions are considered to be critical.
- **Oxygen level**. When the oxygen level is less than 15 % in the lower level, conditions are considered to be critical.
- **Carbon Dioxide (CO_2) level**. When the CO_2 level in the air is higher than 5 %, conditions are considered to be critical.
- **Carbon Monoxide (CO) level**. When the CO level in the air is higher than 200 ppm, conditions are considered to be critical.

6. Results Argos

A summary of the results from the 2-zone Argos model can be seen in Table 1 and Table 2. A complete report of the results can be seen in the Argos calculation report in Appendix Ia to Id, with are appendix to this report.

Table 1, results from the 2-zone model part I

Fire size	Time to critical conditions	Critical conditions due to	Temperature in upper smoke layer at 30 min.	Temperature in upper smoke layer at 60 min.
5,5 MW, fire started in part I	10 min. 11 sec.	Smoke free height less than 5,2 m.	76 °C	118 °C
11 MW, fire started in part I	8 min. 57 sec.	Smoke free height less than 5,2 m.	128 °C	219 °C
5,5 MW, fire started in part II	8 min. 14 sec.	Smoke free height less than 5,2 m.	72 °C	116 °C
11 MW, fire started in part II	7 min. 40 sec.	Smoke free height less than 5,2 m.	121 °C	213 °C

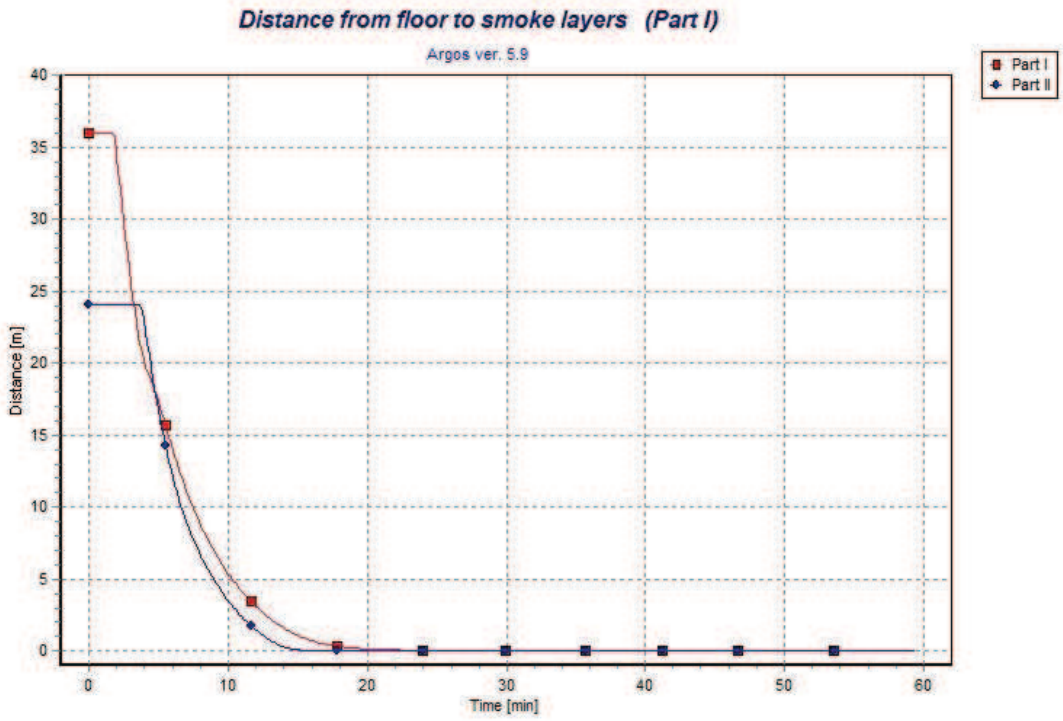
Table 2, results from the 2-zone model part II

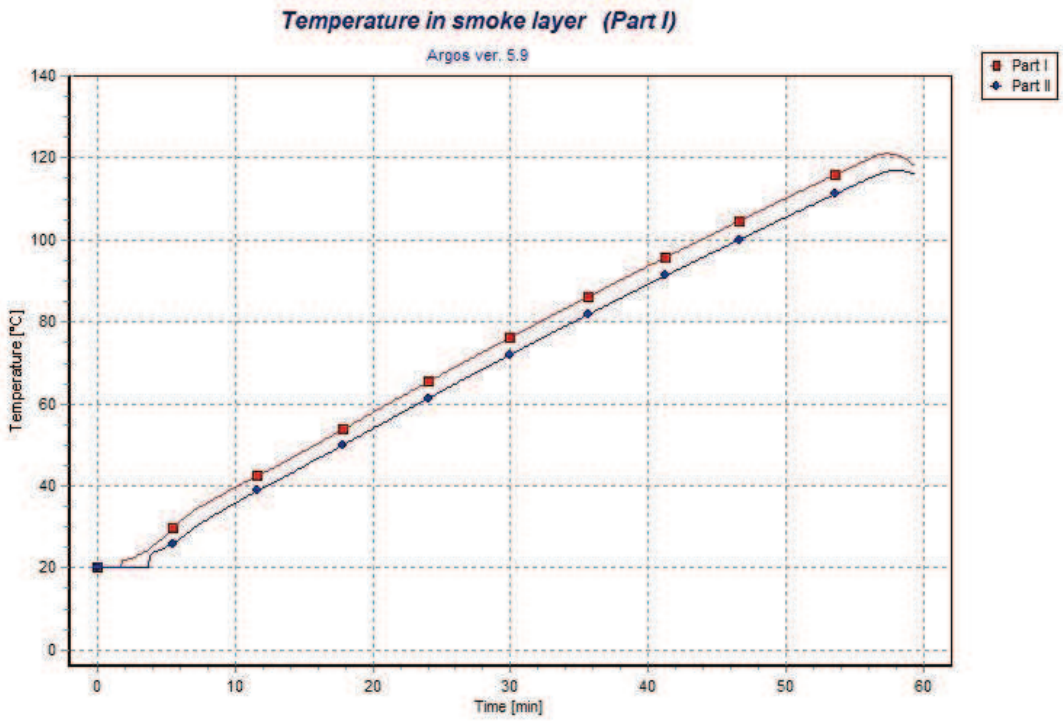
Fire size	Time to critical conditions	Critical conditions due to	Temperature in upper smoke layer at 30 min.	Temperature in upper smoke layer at 60 min.
5,5 MW, fire started in part I	9 min. 40 sec.	Smoke free height less than 4,0 m.	73 °C	117 °C
11 MW, fire started in part I	8 min. 27 sec.	Smoke free height less than 4,0 m.	121 °C	212 °C
5,5 MW, fire started in part II	10 min. 31 sec.	Smoke free height less than 4,0 m.	79 °C	118 °C
11 MW, fire started in part II	9 min. 11 sec.	Smoke free height less than 4,0 m.	134 °C	221 °C

It can be seen that the size of the fire has little effect on the time to critical conditions, so a ASET time a 7 minutes and 40 seconds can be used for the Boiler Building.

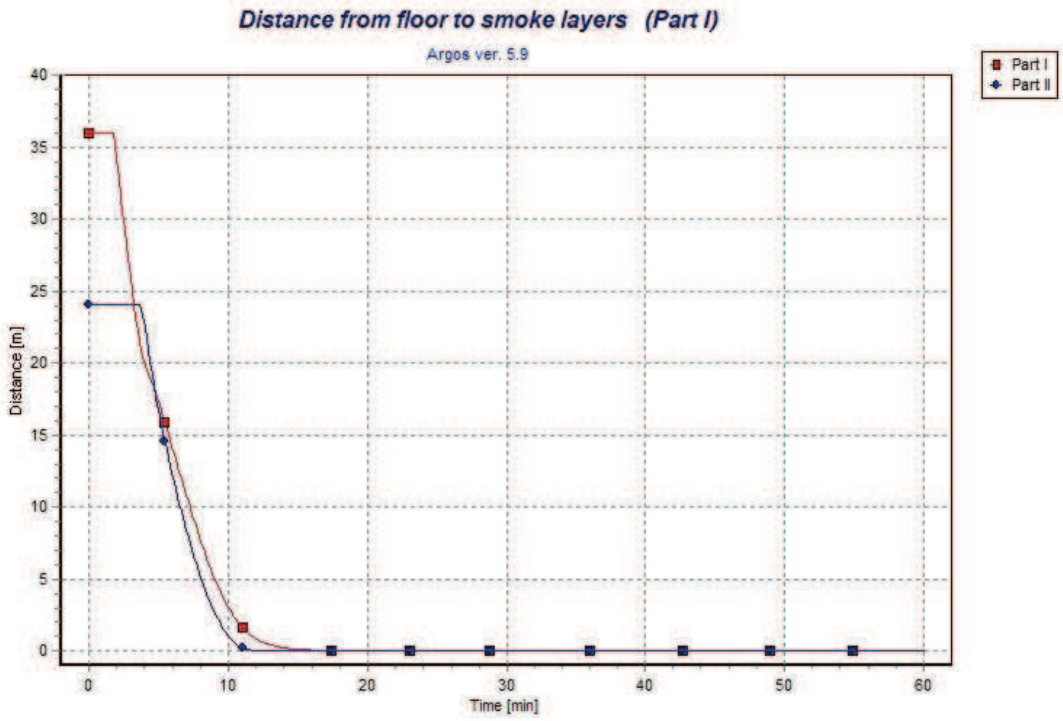
In the following sections the smoke level from the floor and temperature in the smoke layer is shown.

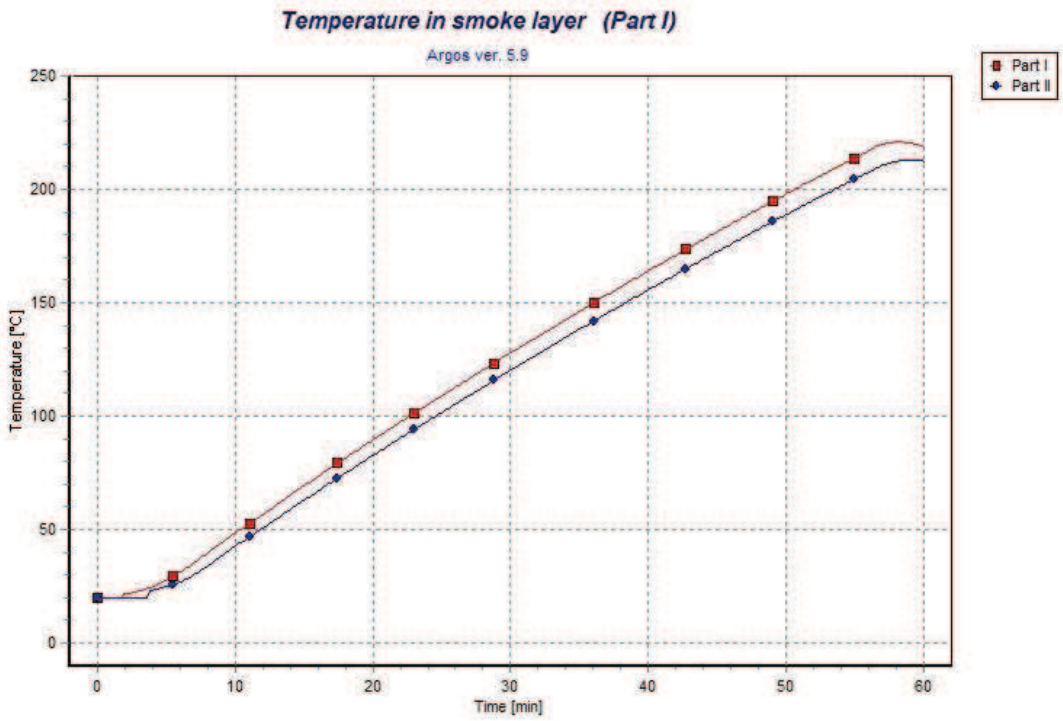
6.1 Graphs of the 5.5 MW fire started in part I



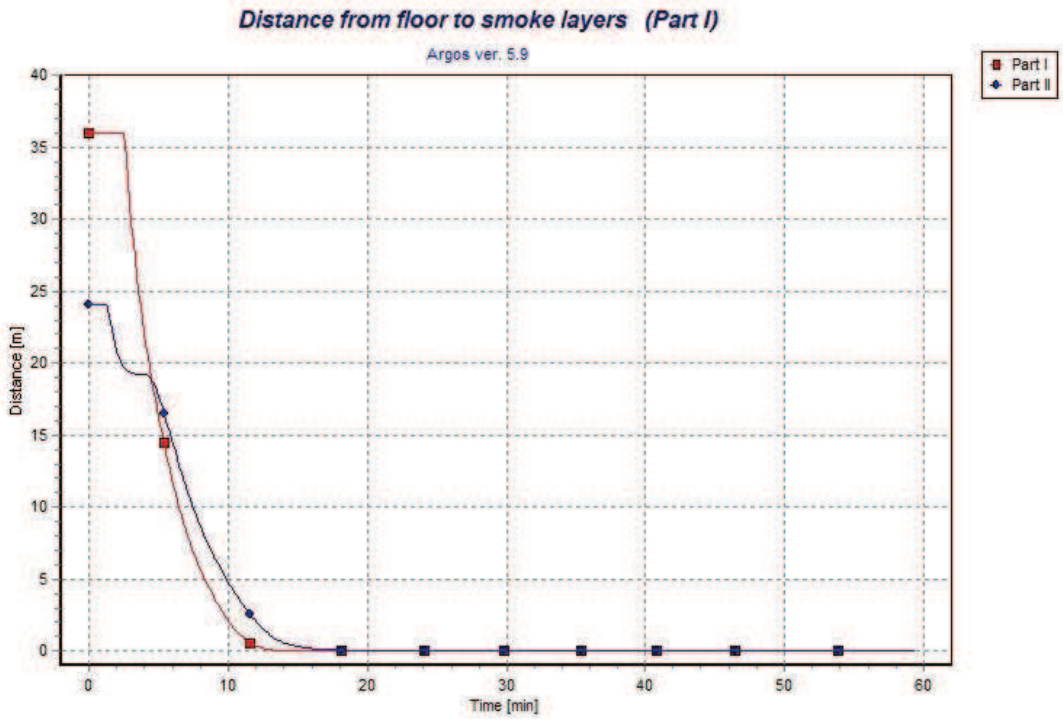


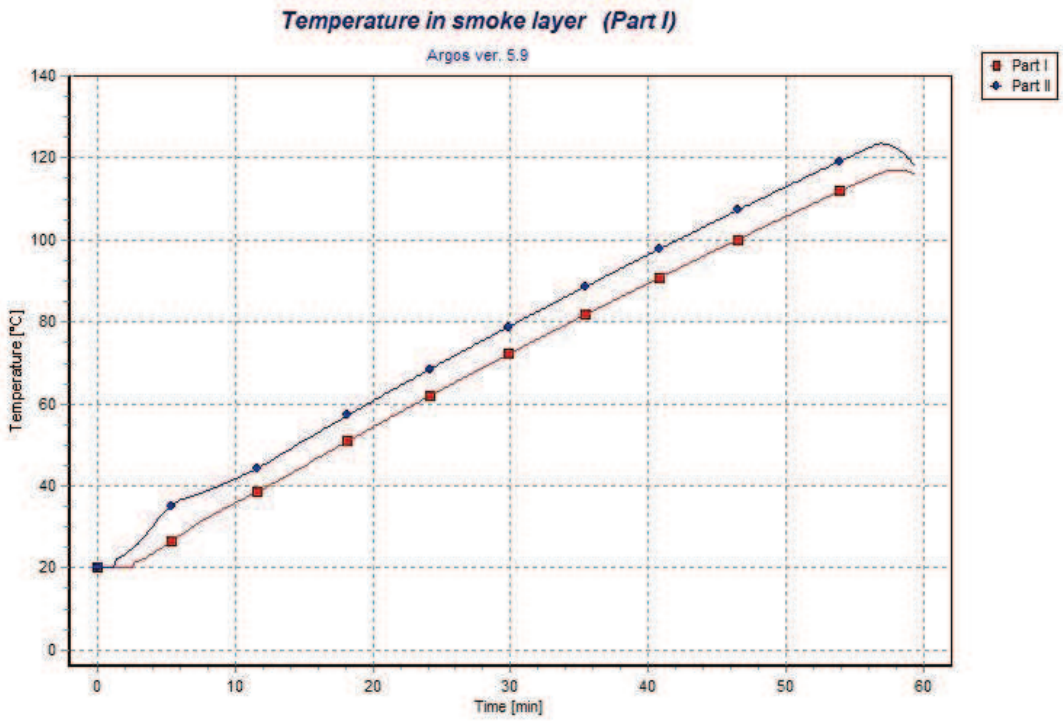
6.2 Graphs of the 11 MW fire started in part I



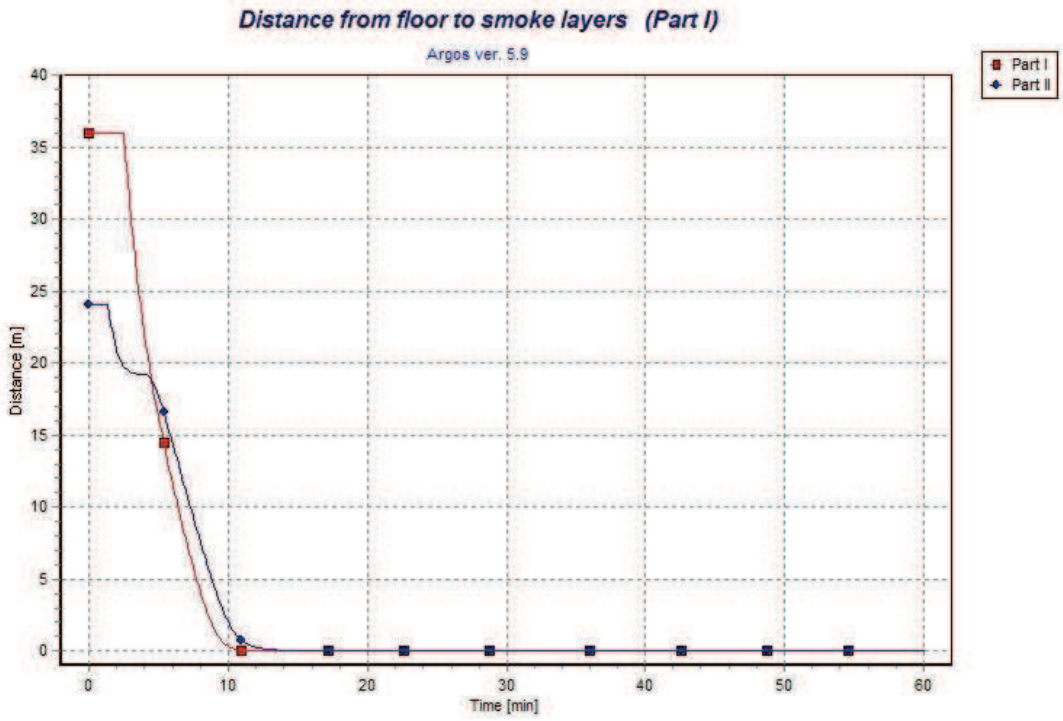


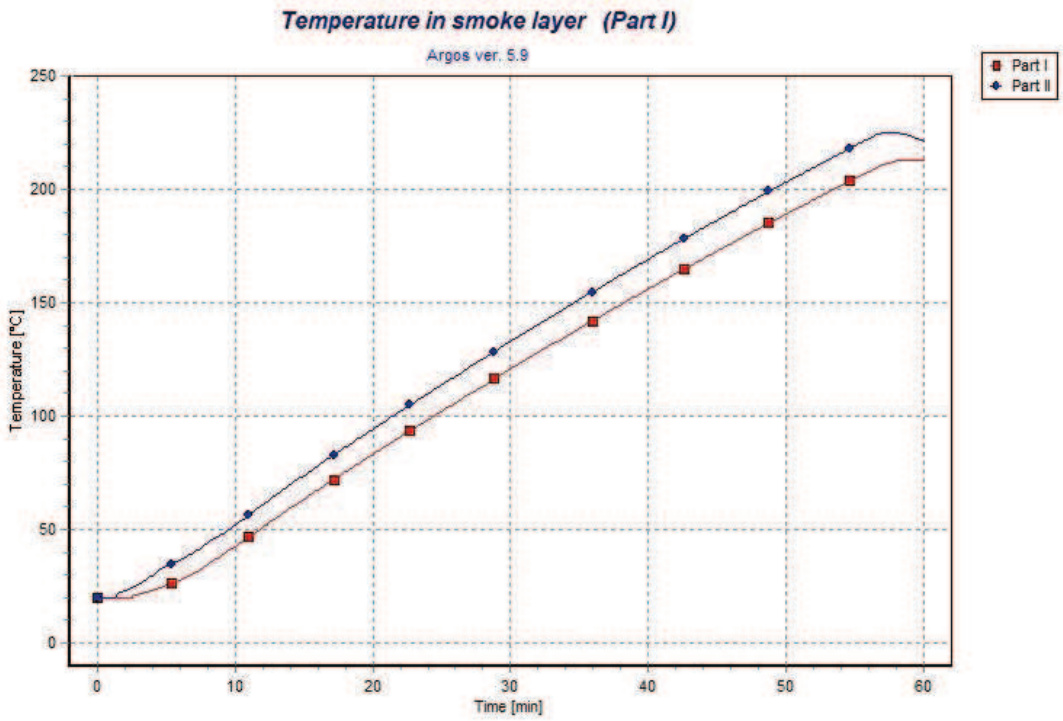
6.3 Graphs of the 5.5 MW fire started in part II





6.4 Graphs of the 11 MW fire started in part II

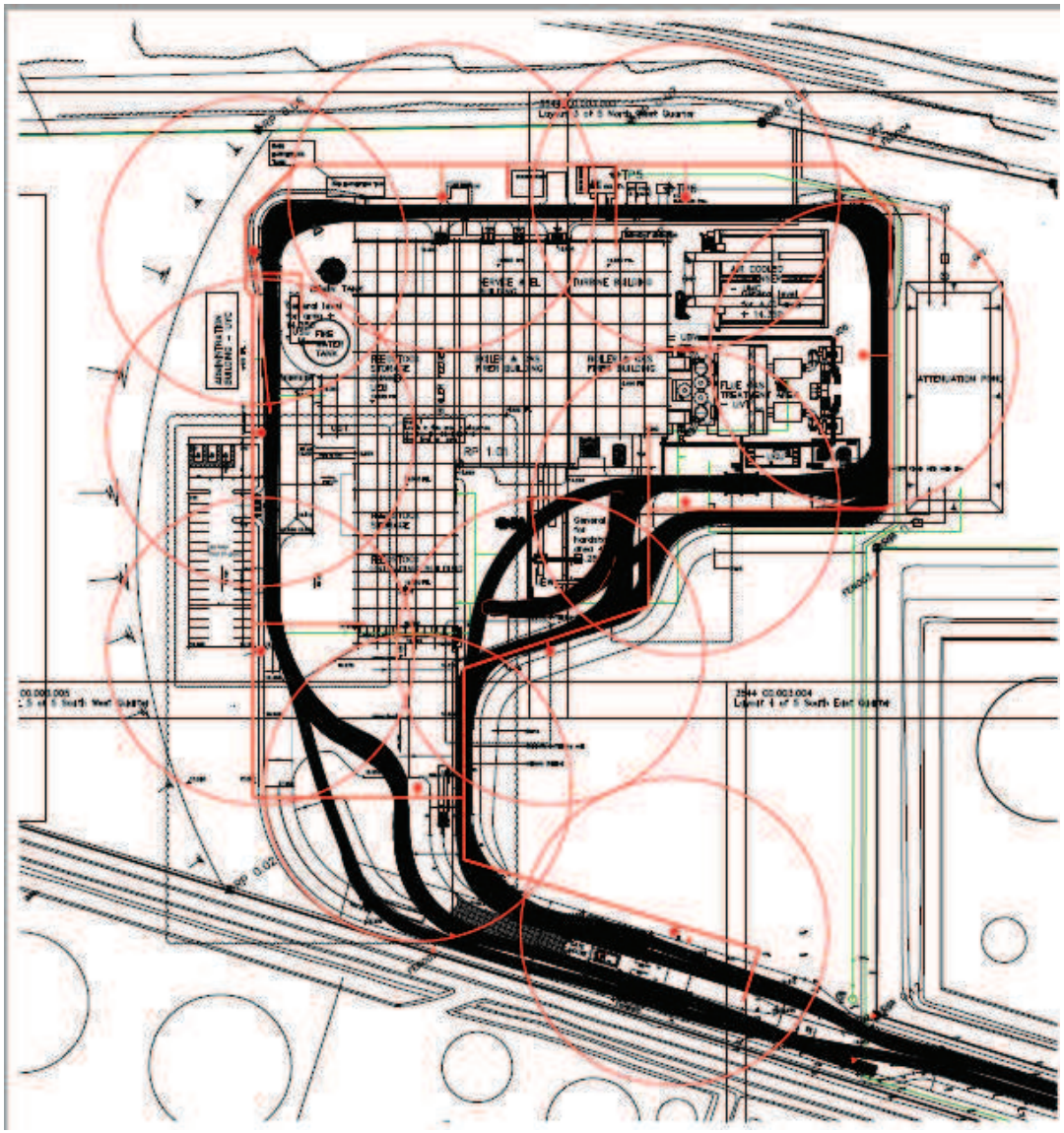




Hooton Bio Power Project

Attachment to Fire Safety Strategy Report

Project:	Project No.	2031
Hooton Bio Power Project	Document No.	2031.M0.J01.002
	Revision:	2
	First issue:	October, 2018
	Last update	December, 2018



GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
1					
0	2018.08.26	CNH	JEOH	FIRST ISSUE	MRC

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HOOTON BIO POWER PROJECT

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FIRE MAIN

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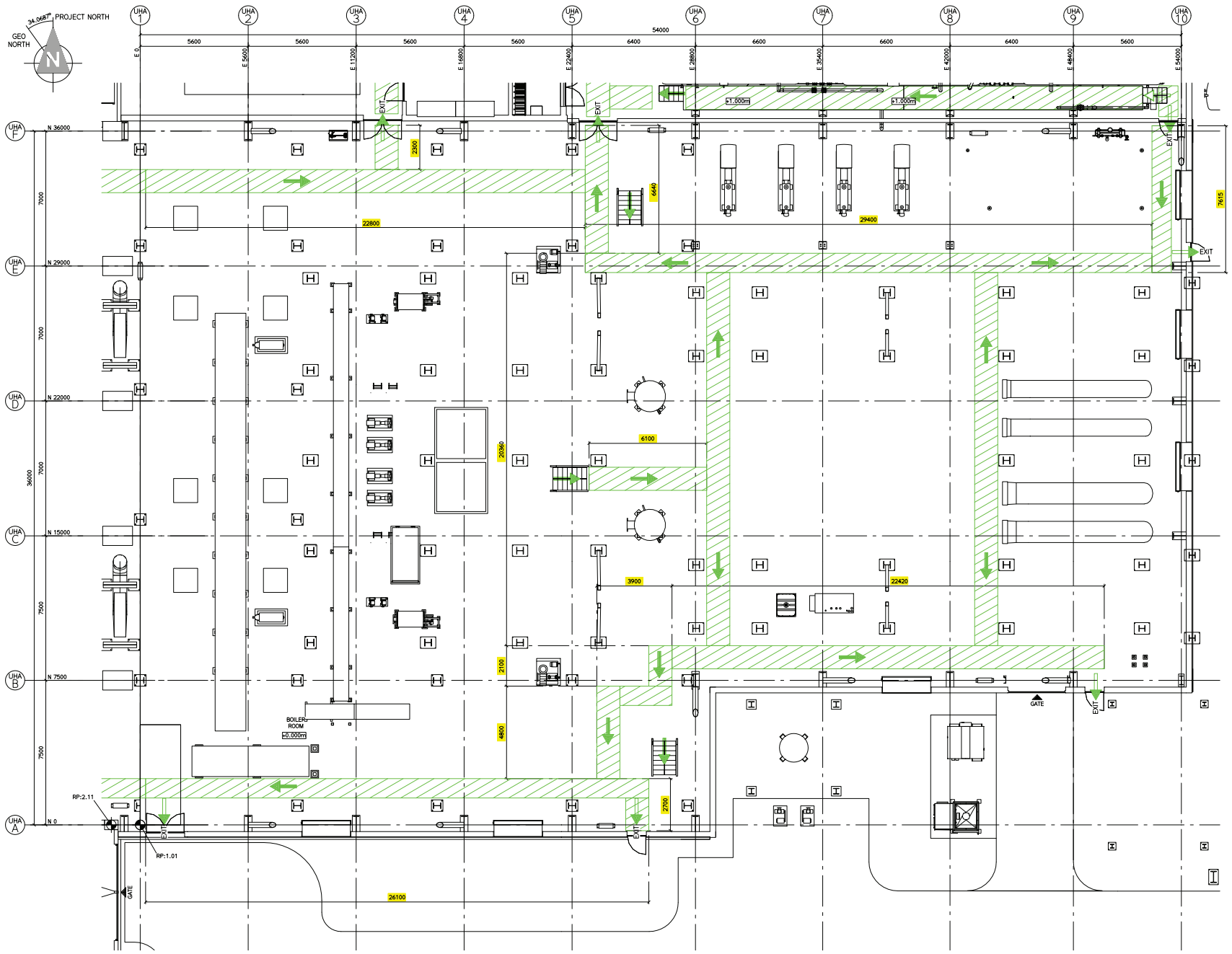

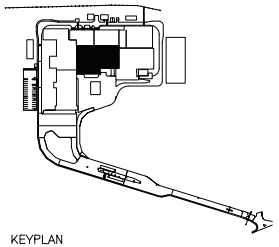

KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

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PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

BOILER BUILDING (UHA)
ESCAPE AND EGRESS ROUTES
GROUND FLOOR PLAN, LEVEL +0.000m

SCALE:
A1=1:100
A3=1:200

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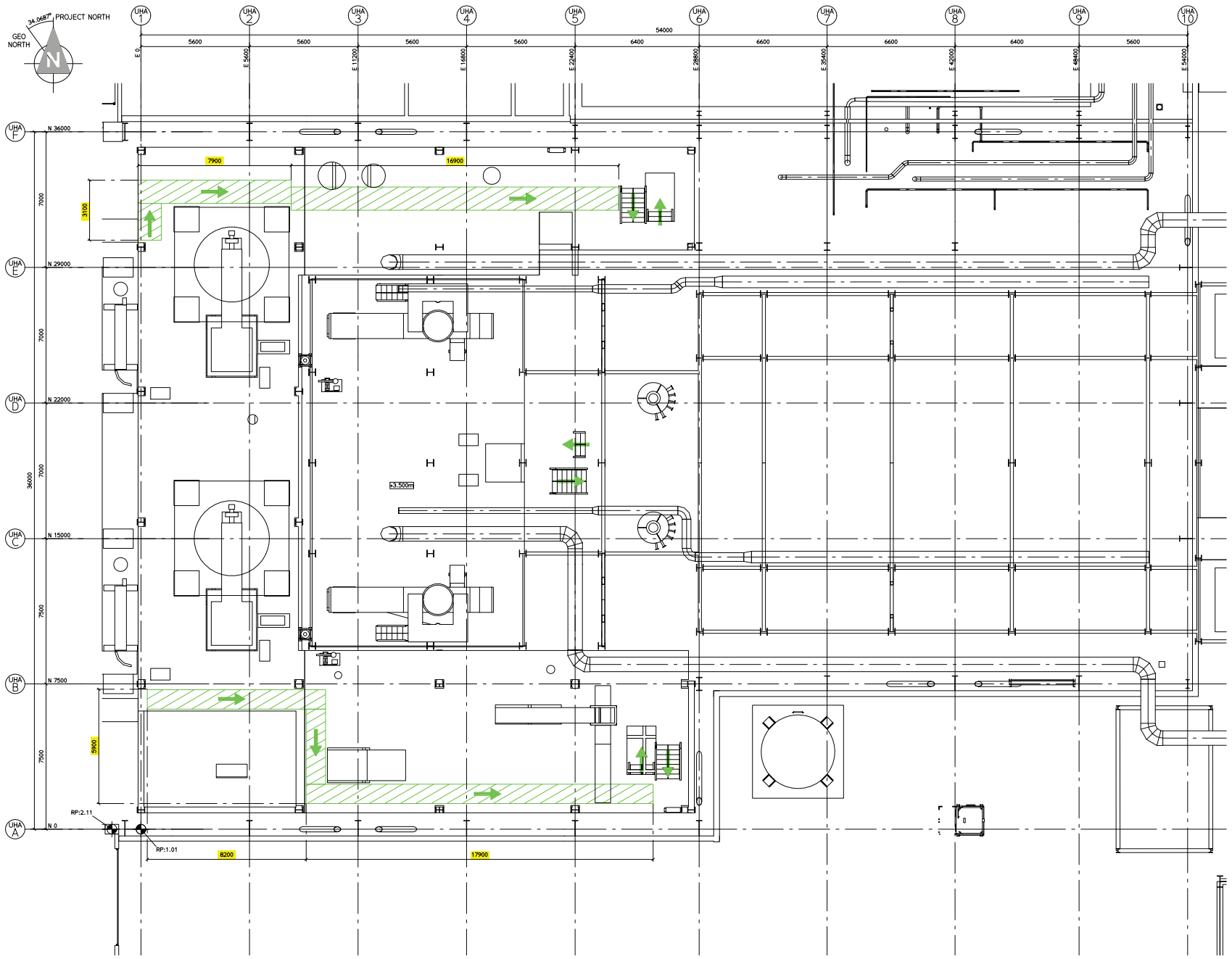

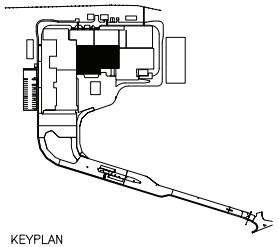

KEYPLAN

LEGEND:

ESCAPE ROUTES

EMERGENCY DIRECTION

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

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HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

BOILER BUILDING (UHA)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL +3.500m

SCALE:
A1=1:100
A3=1:200

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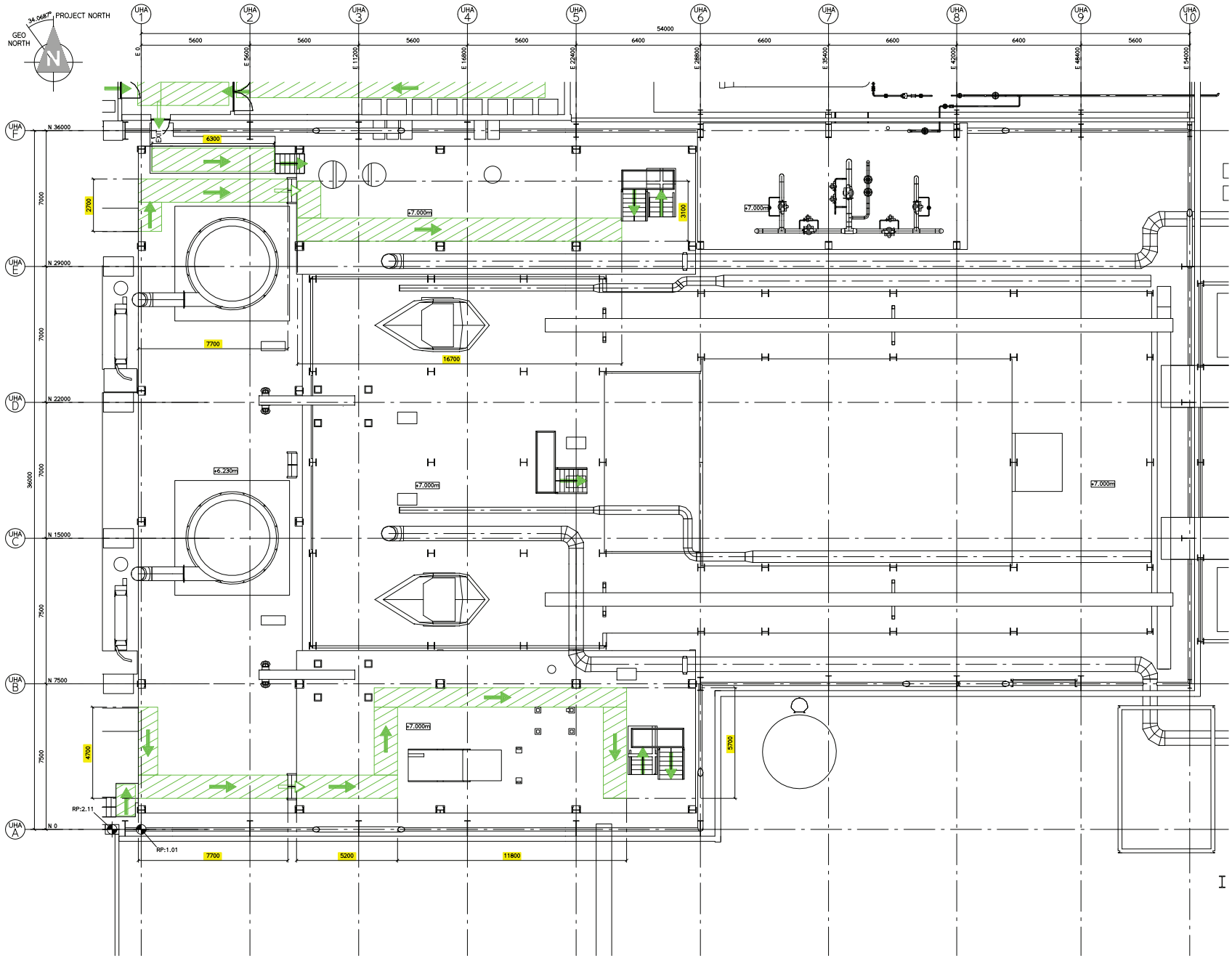

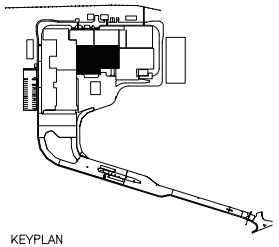

KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY DIRECTION UP

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

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HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

BOILER BUILDING (UHA)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL +7.000m

SCALE: A1=1:100 A3=1:200

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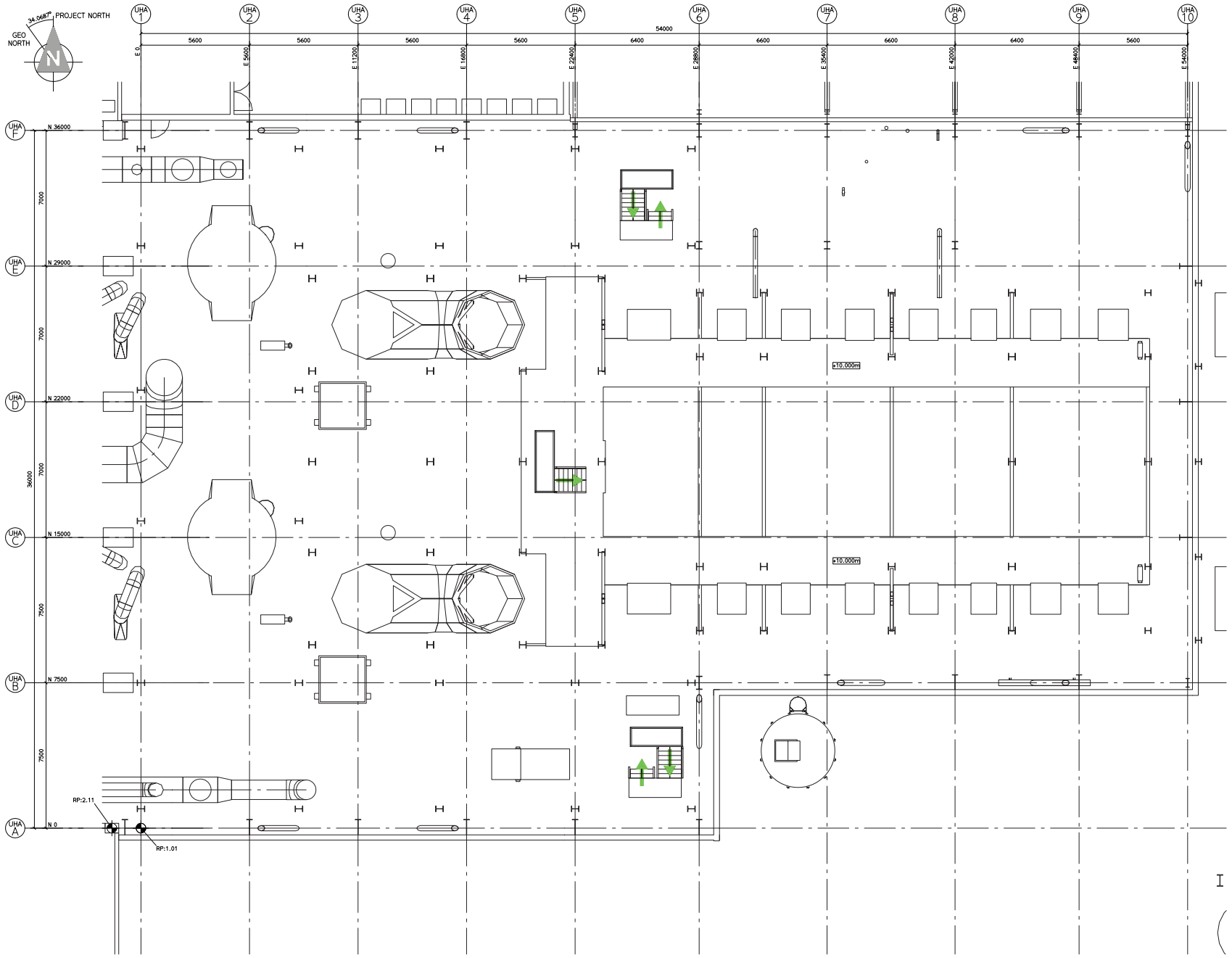

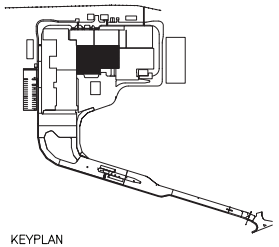

KEYPLAN

LEGEND:

EMERGENCY DIRECTION

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE
0 2 4 6 8 10

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HOOTON BIO POWER PROJECT

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SUBJECT:

BOILER BUILDING (UHA)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL +10.000m

SCALE:
A1=1:100
A3=1:200

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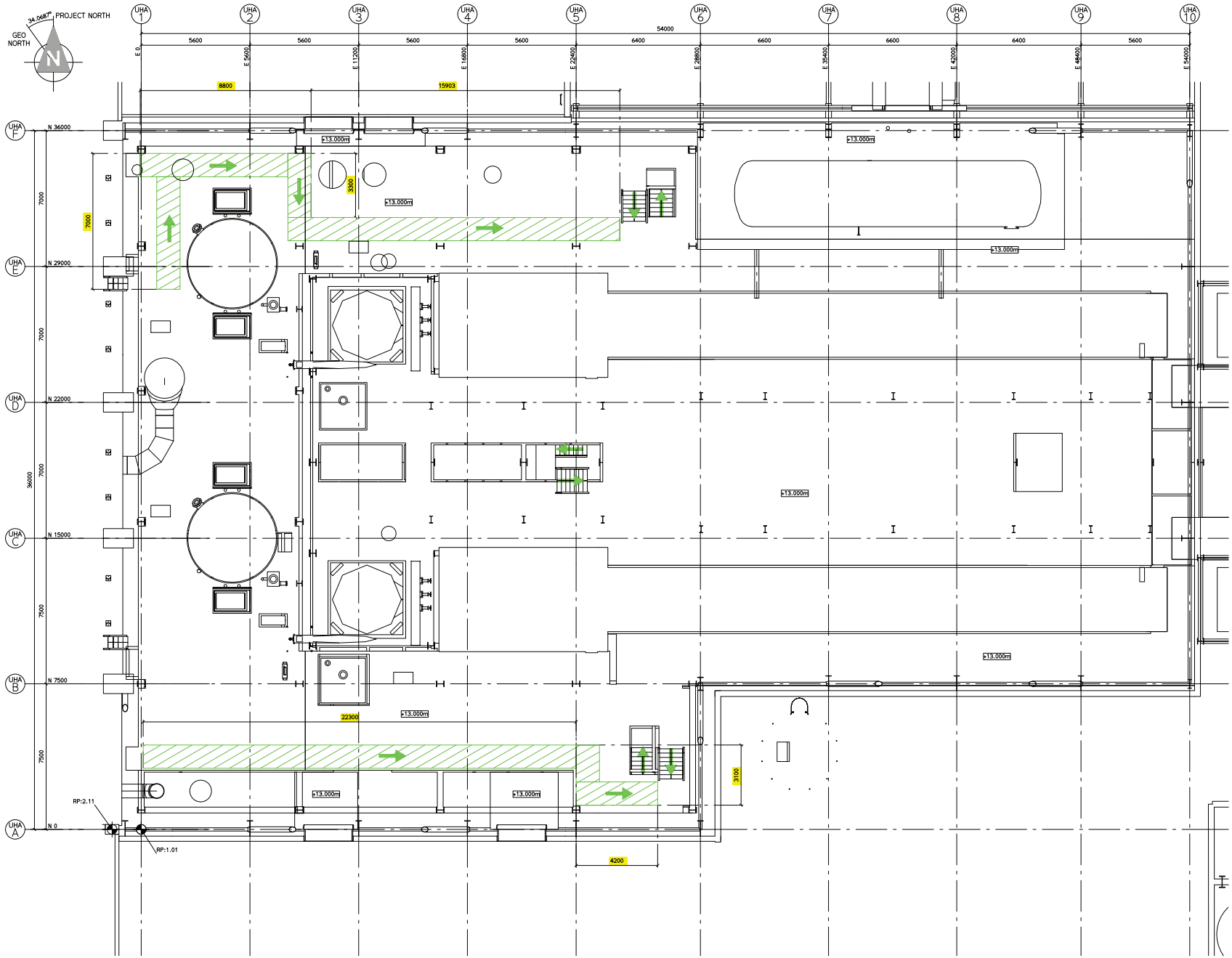

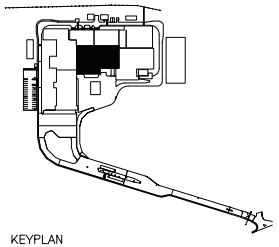

KEYPLAN

LEGEND:

ESCAPE ROUTES

EMERGENCY DIRECTION

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

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SUBJECT:

BOILER BUILDING (UHA)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL +13.000m

SCALE:
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A3=1:200

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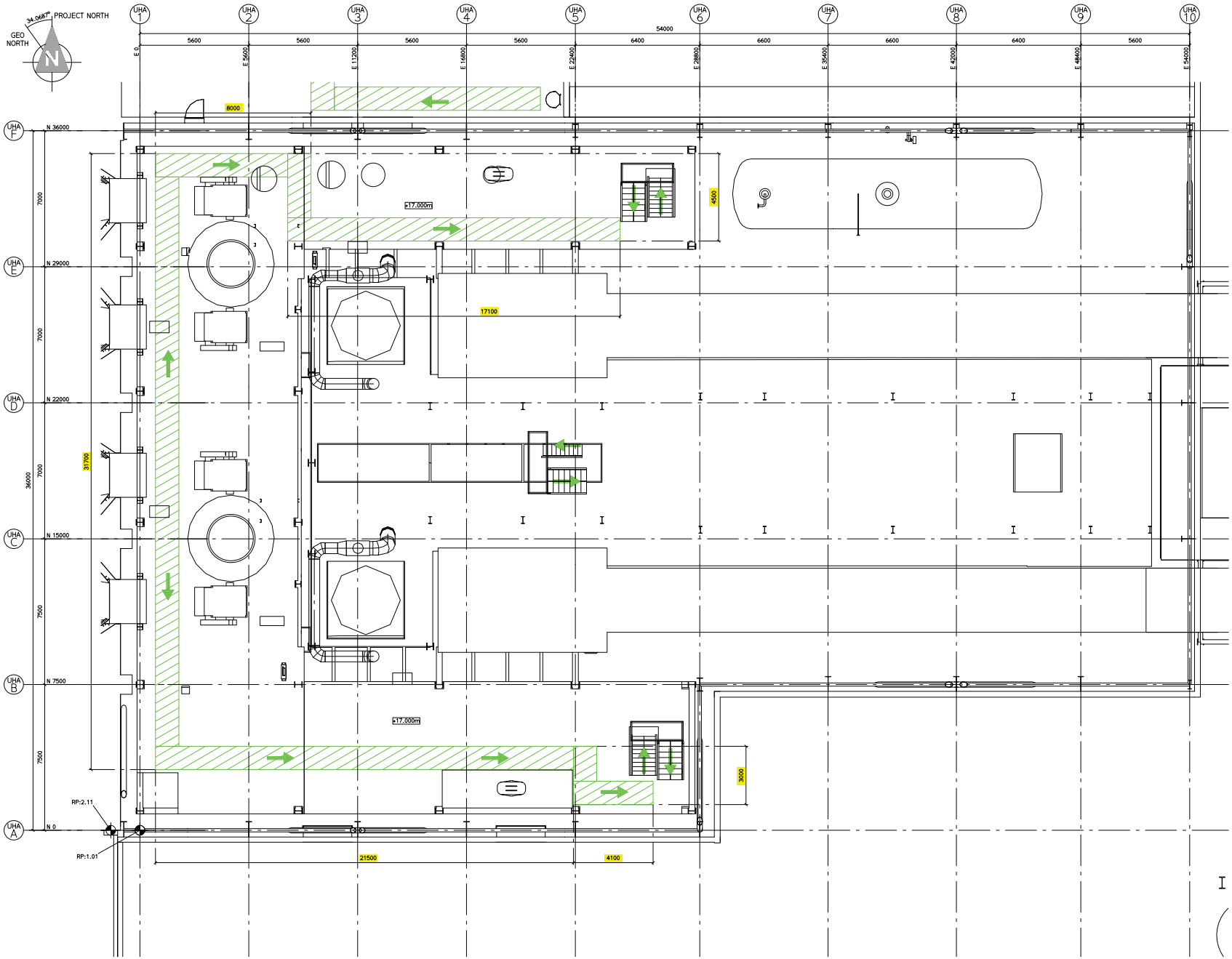

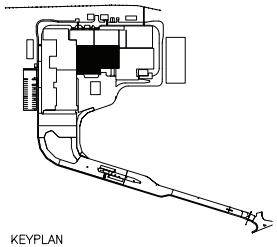

KEYPLAN

LEGEND:

ESCAPE ROUTES

EMERGENCY DIRECTION

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE
0 2 4 6 8 10

PRELIMINARY

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PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

BOILER BUILDING (UHA)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL +17.000m

SCALE:
A1=1:100
A3=1:200

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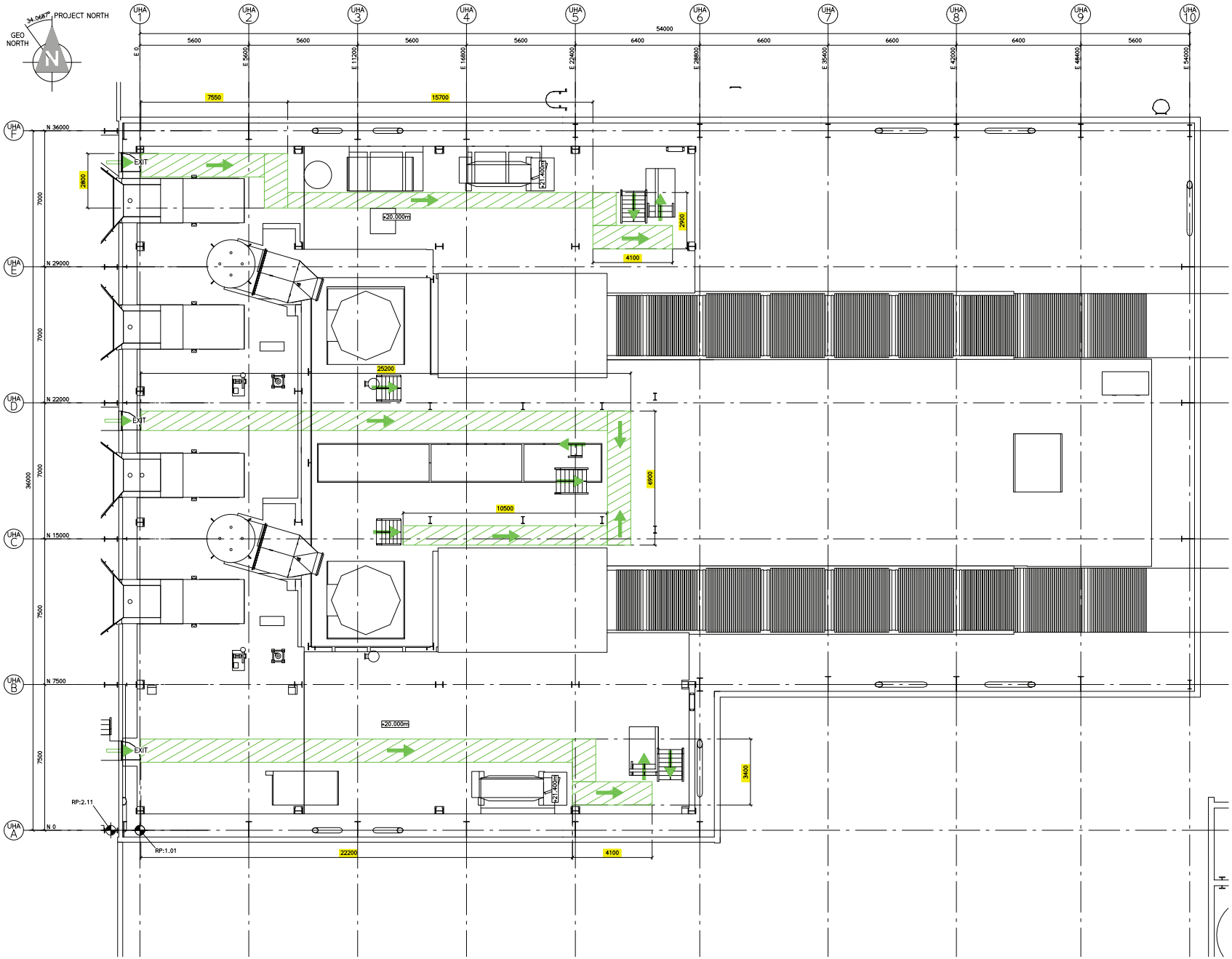

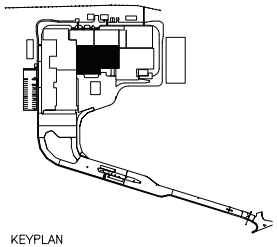

KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

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PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

BOILER BUILDING (UHA)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL +20.000m

SCALE: A1=1:100 A3=1:200

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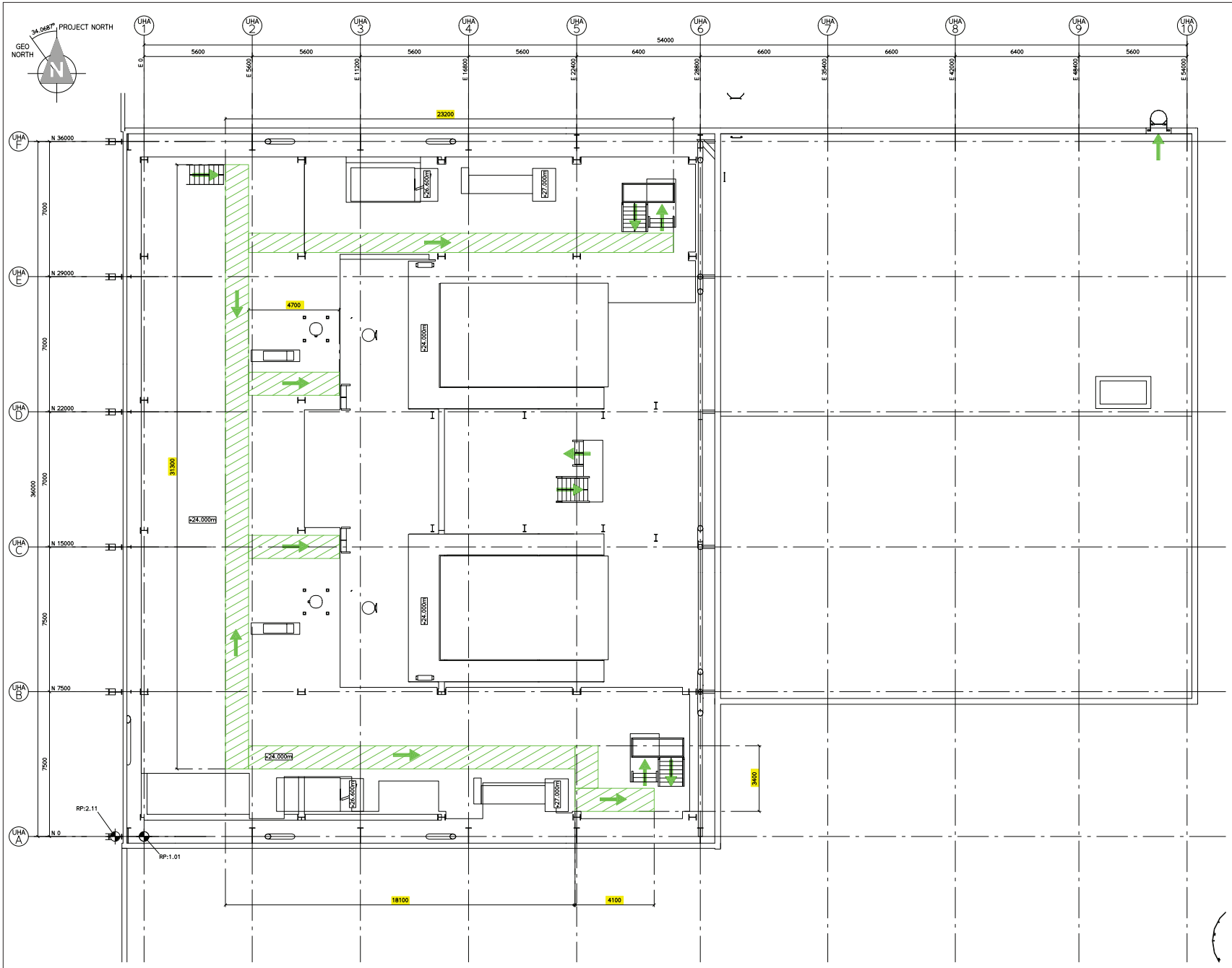

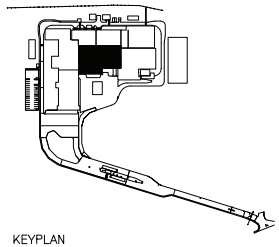

KEYPLAN

LEGEND:

ESCAPE ROUTES

EMERGENCY DIRECTION

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

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CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

BOILER BUILDING (UHA)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL +24.000m

SCALE:
A1=1:100
A3=1:200

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PROJECT NO. GR. NO. SHT. REV.

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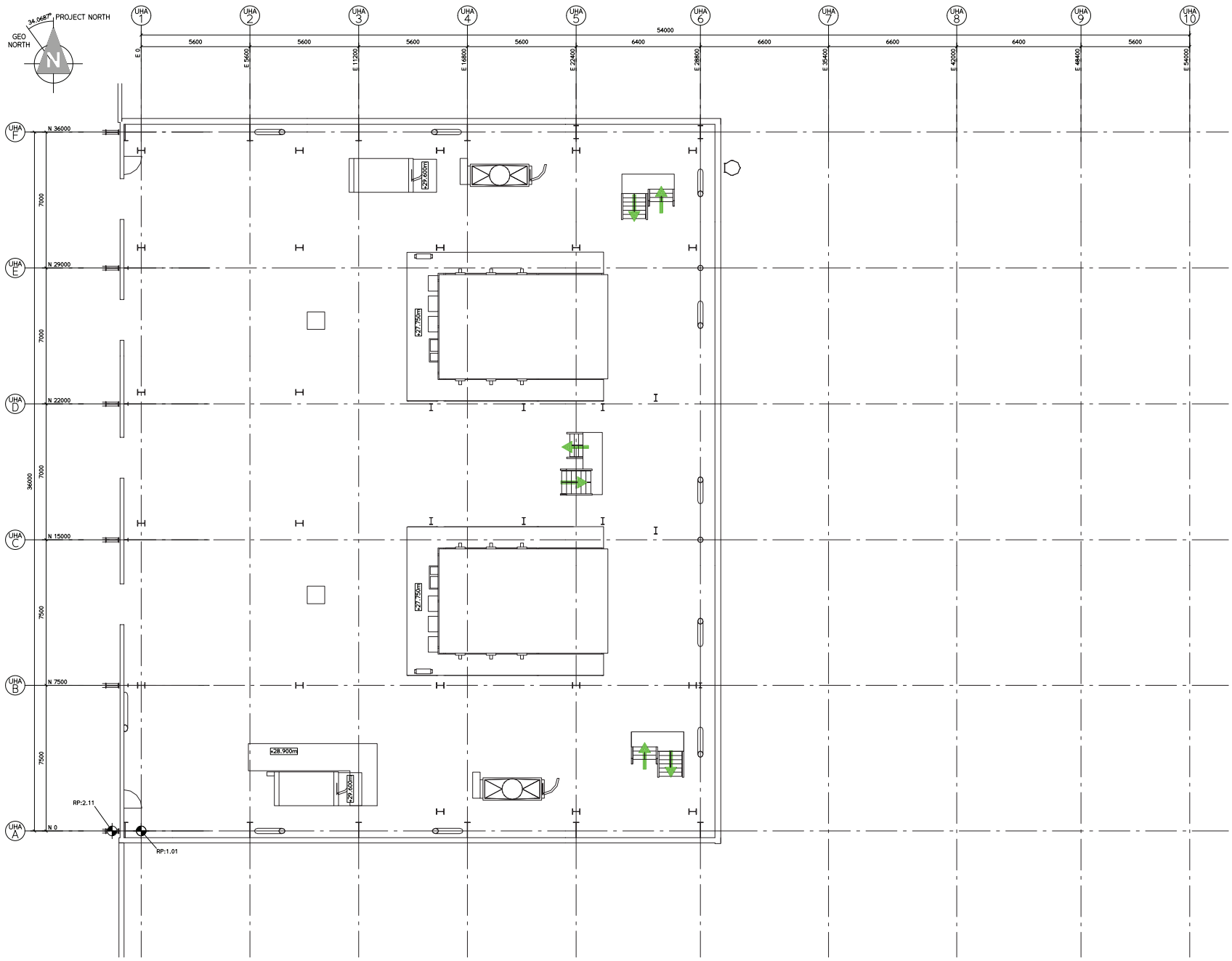

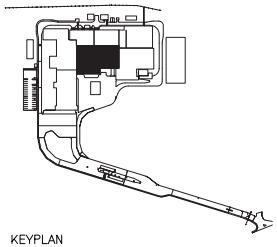

KEYPLAN

LEGEND:

EMERGENCY DIRECTION

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE
0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

BOILER BUILDING (UHA)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL +27.750m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 : M4 . J05 . 109 . 0
PROJECT NO. GR. NO. SHT. REV.

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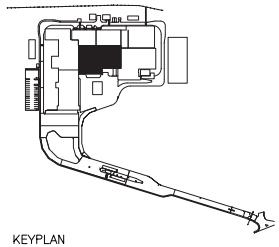

KEYPLAN

LEGEND:

EMERGENCY DIRECTION

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

BOILER BUILDING (UHA)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL +33.630m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 : M4 . J05 . 110 . 0
PROJECT NO. GR. NO. SHT. REV.

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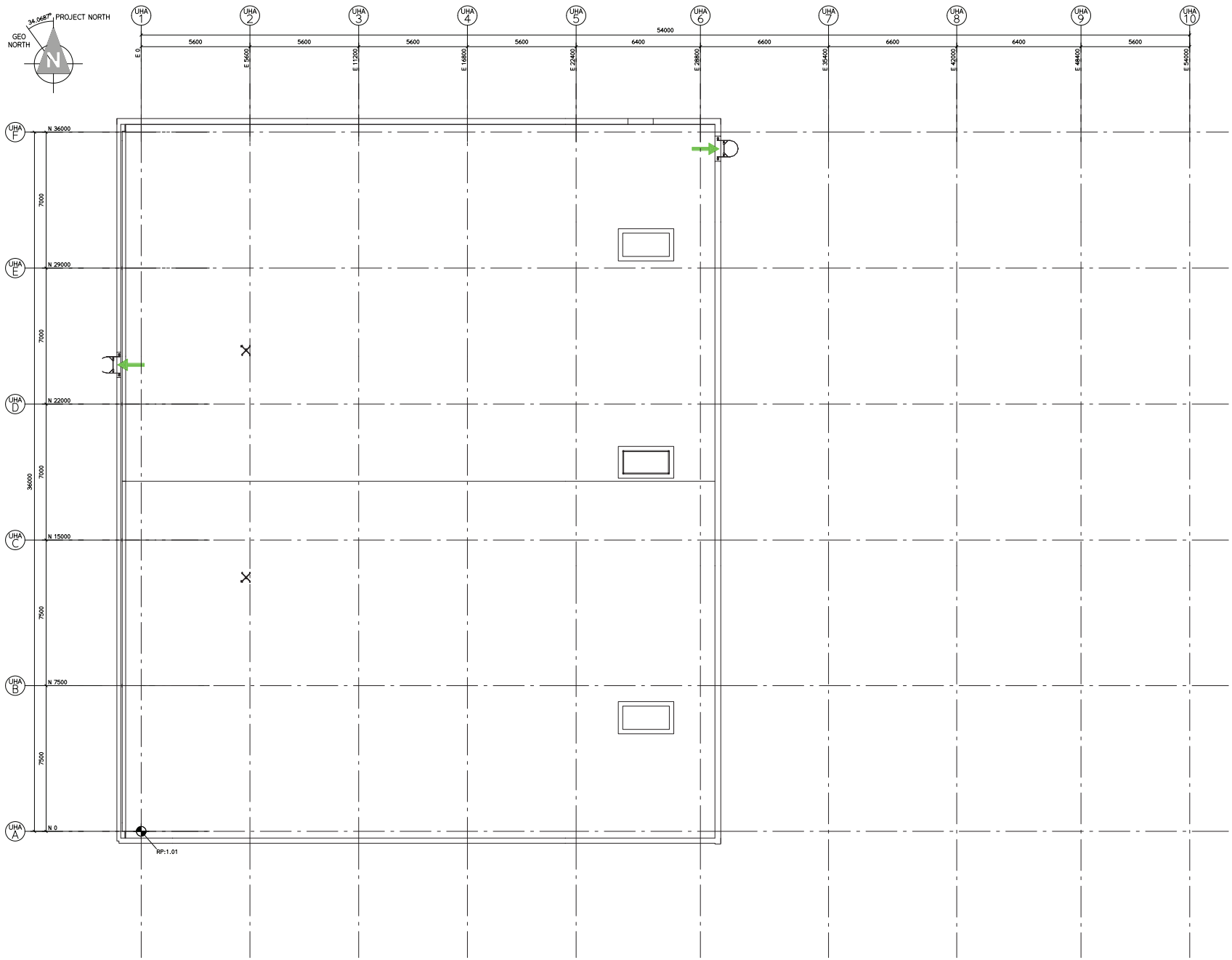

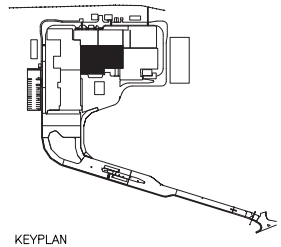

KEYPLAN

LEGEND:

EMERGENCY DIRECTION

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE
0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

BOILER BUILDING (UHA)
ESCAPE AND EGRESS ROUTES
MAIN ROOF PLAN

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 : M4 . J05 . 111 . 0
PROJECT NO. GR. NO. SHT. REV.

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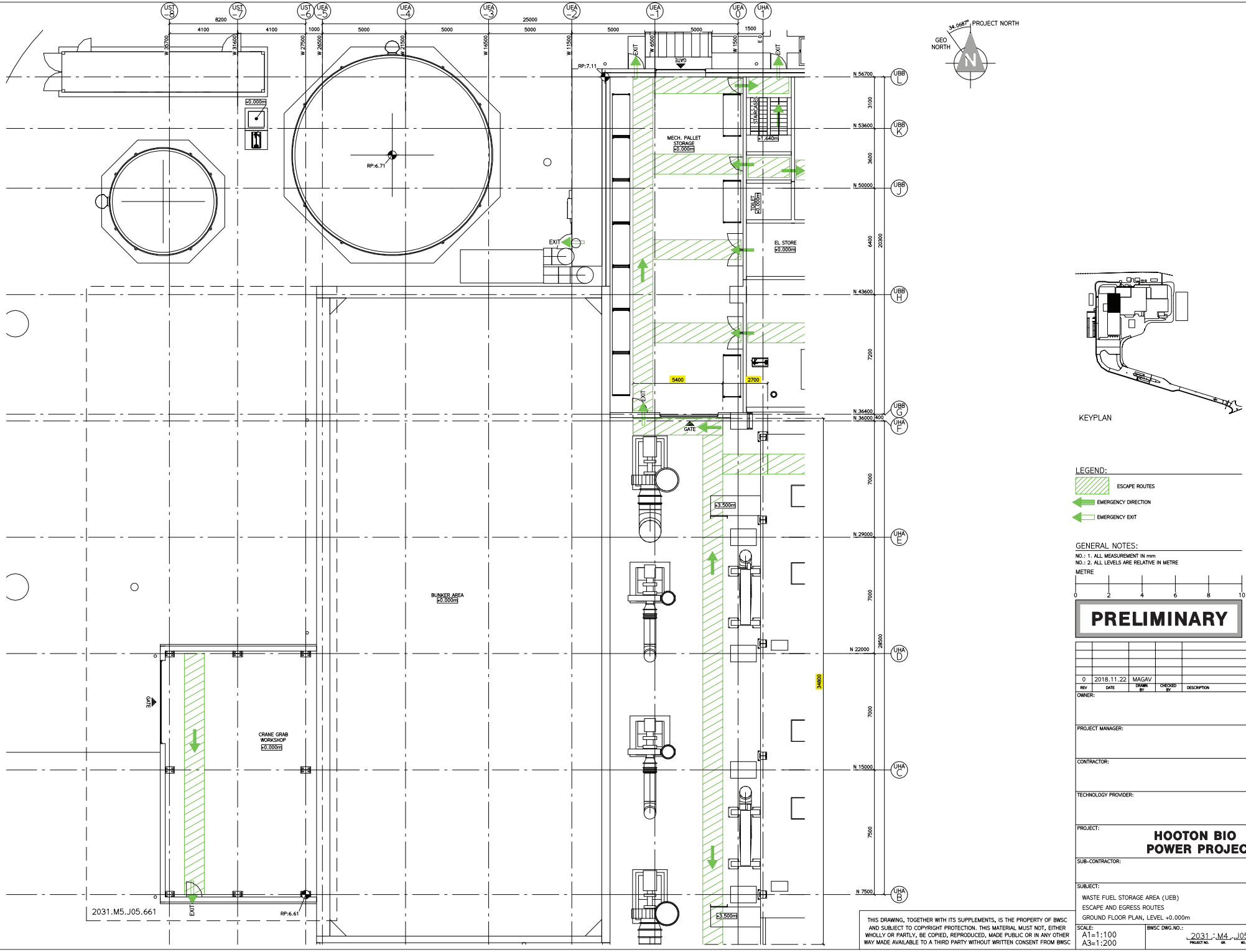

KEYPLAN

LEGEND:

ESCAPE ROUTES

EMERGENCY DIRECTION

EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm

NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

WASTE FUEL STORAGE AREA (UEB)

ESCAPE AND EGRESS ROUTES

GROUND FLOOR PLAN, LEVEL +0.000m

SCALE:

A1=1:100

A3=1:200

BWSC DWG.NO.: 2031 . M4 . J05 . 211 . 0

PROJECT NO. | GR. | NO. | SHT. | REV.

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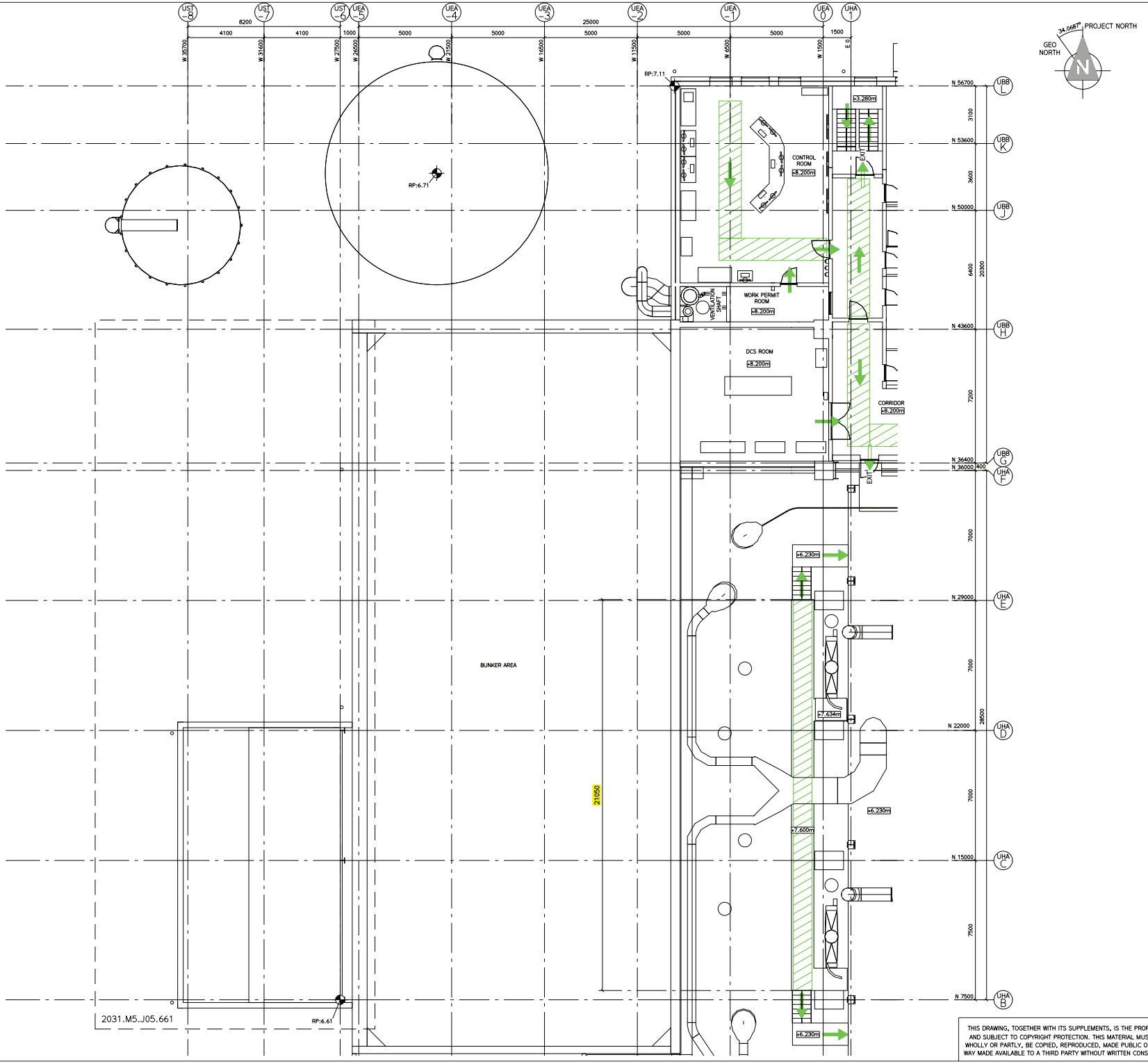

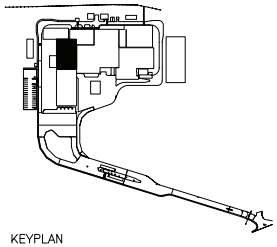

KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

WASTE FUEL STORAGE AREA (UEB)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL: +8.000m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.: 2031 . M4 . J05 . 212 . 0
PROJECT NO. | GR. | NO. | SHT. | REV.

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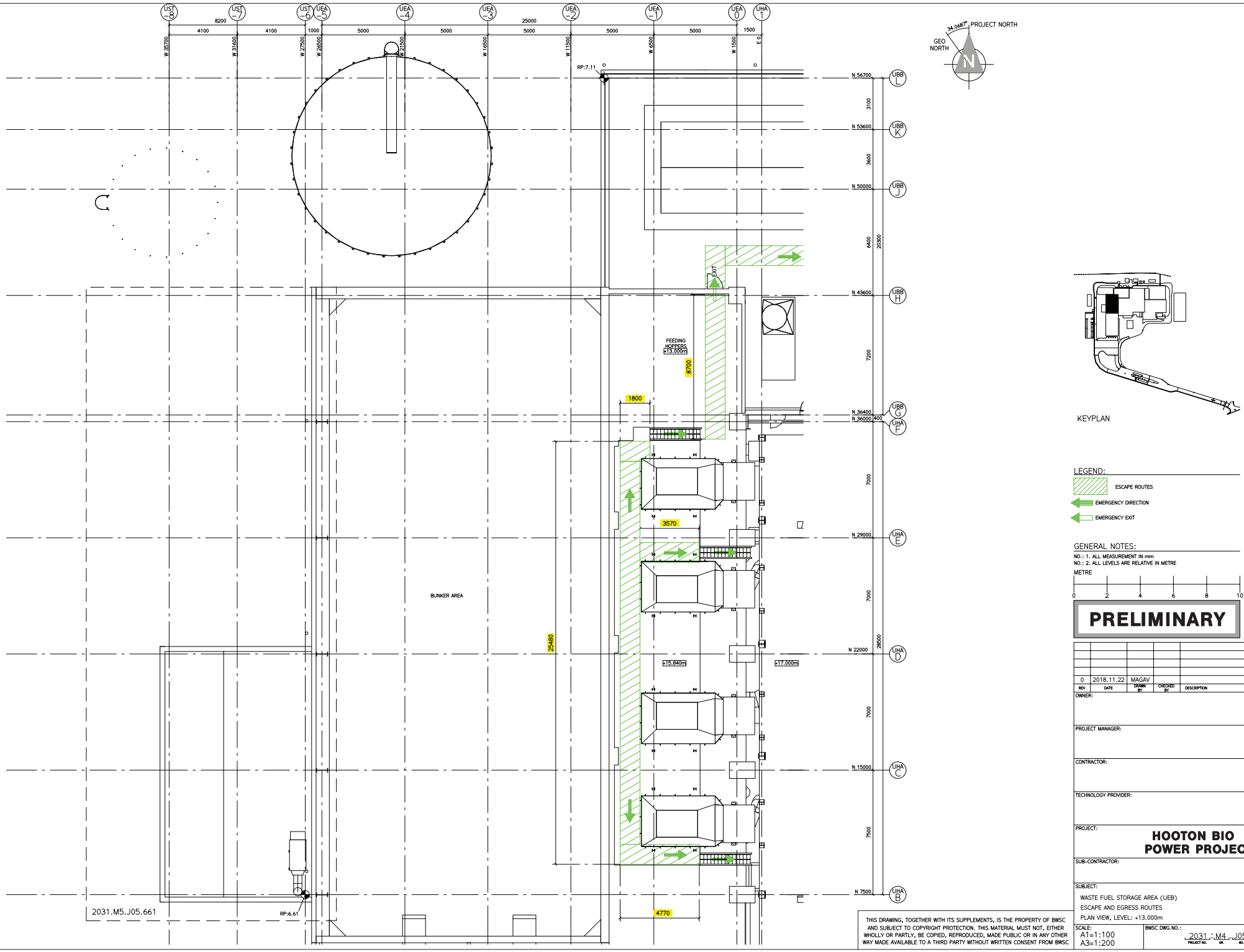

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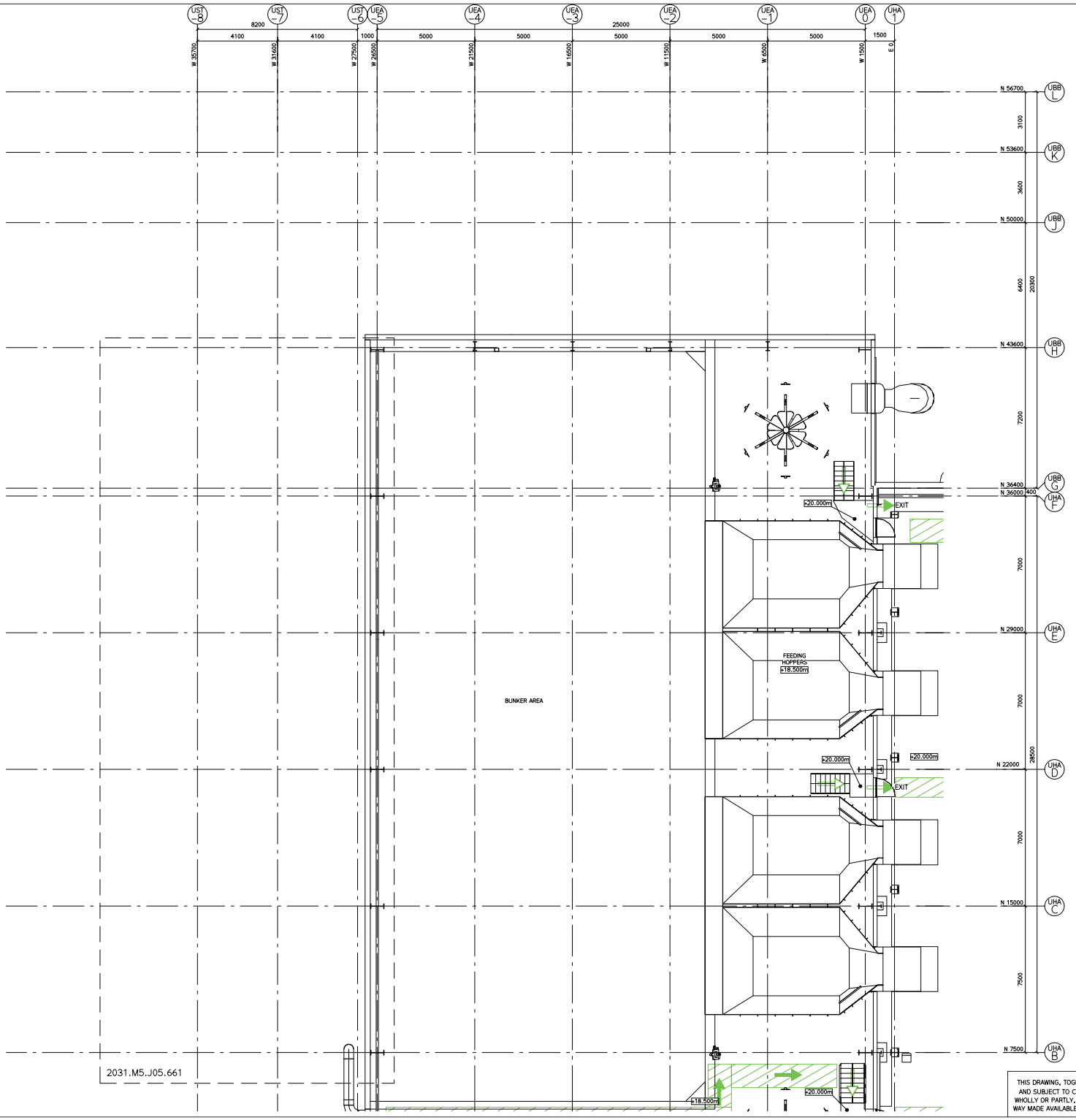

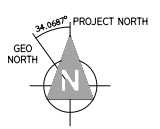

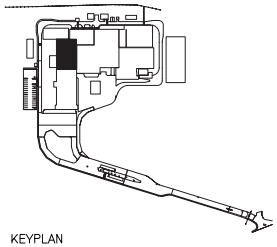

KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY DIRECTION UP
- EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

WASTE FUEL STORAGE AREA (UEB)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL: +18.500m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.: 2031 . M4 . J05 . 214 (PROJECT NO. . GR. . NO. . SHT.)

REV. 0

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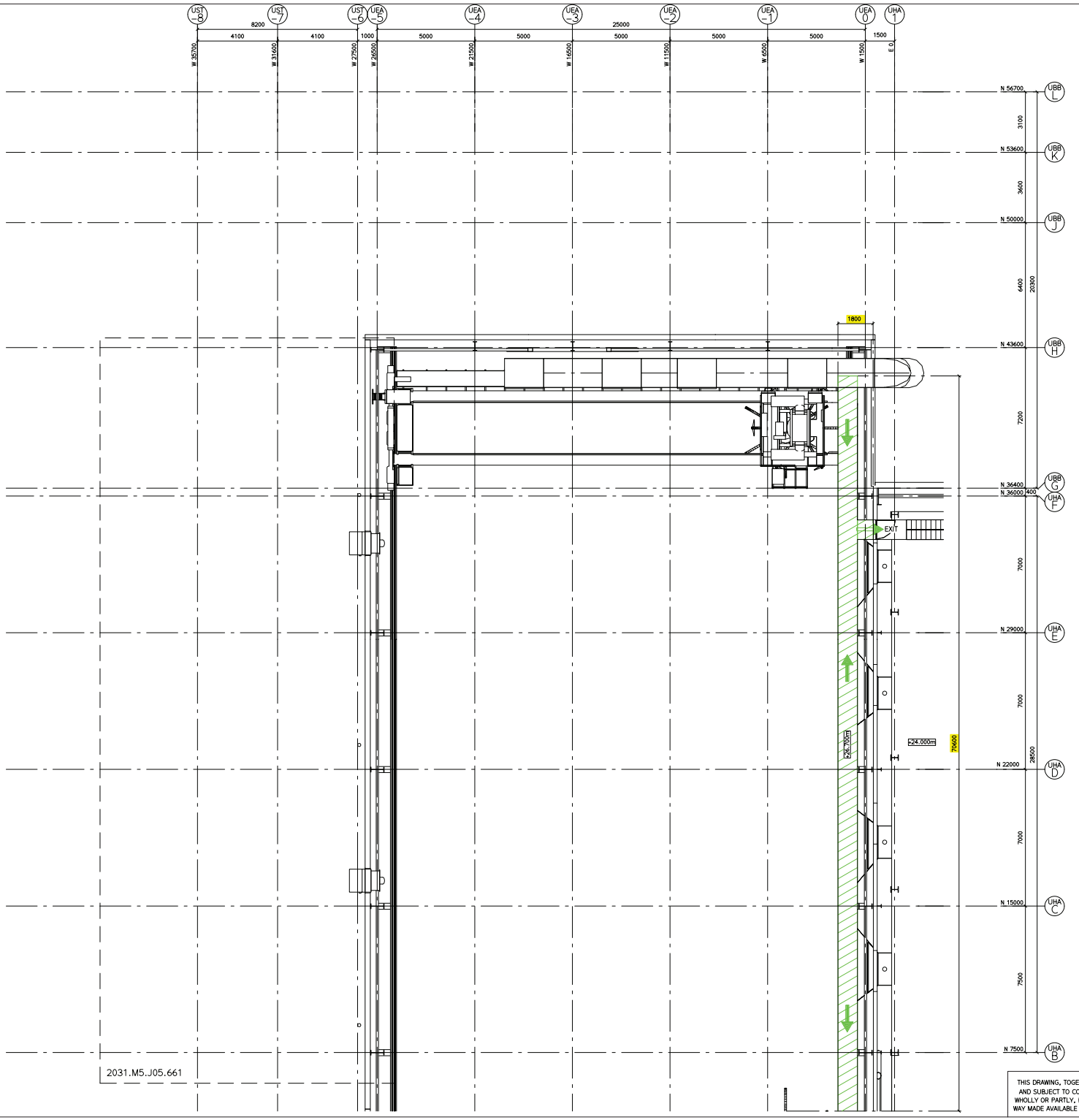

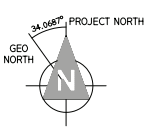

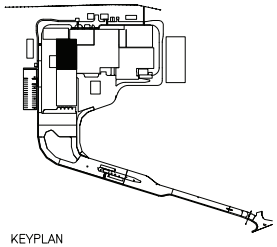

KEYPLAN

LEGEND:

ESCAPE ROUTES

EMERGENCY DIRECTION

EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

WASTE FUEL STORAGE AREA (UEB)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL: TOP OF CRANE

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 . M4 . J05 . 215 . 0
PROJECT NO. GR. NO. SHT. REV.

2031.M5.J05.661

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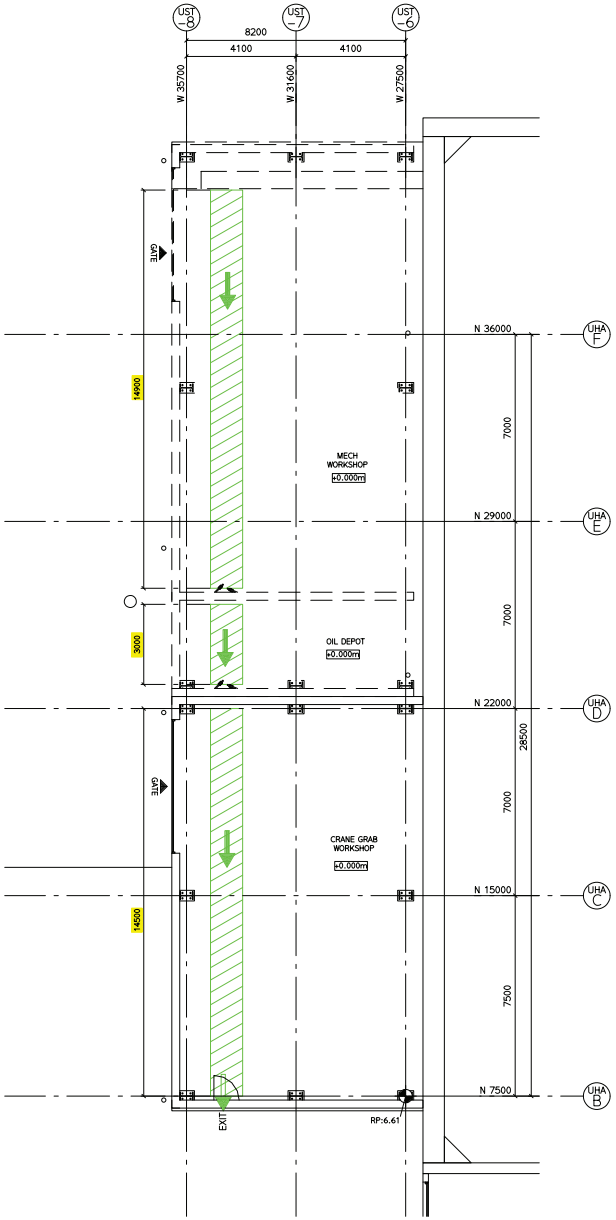


LEGEND:

ESCAPE ROUTES

EMERGENCY DIRECTION

EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

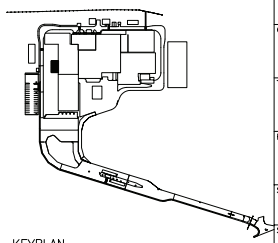
CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:



KEYPLAN

SUBJECT:

WORKSHOP BUILDING (UST)
ESCAPE AND EGRESS ROUTES
GROUND FLOOR PLAN, LEVEL +0.000m

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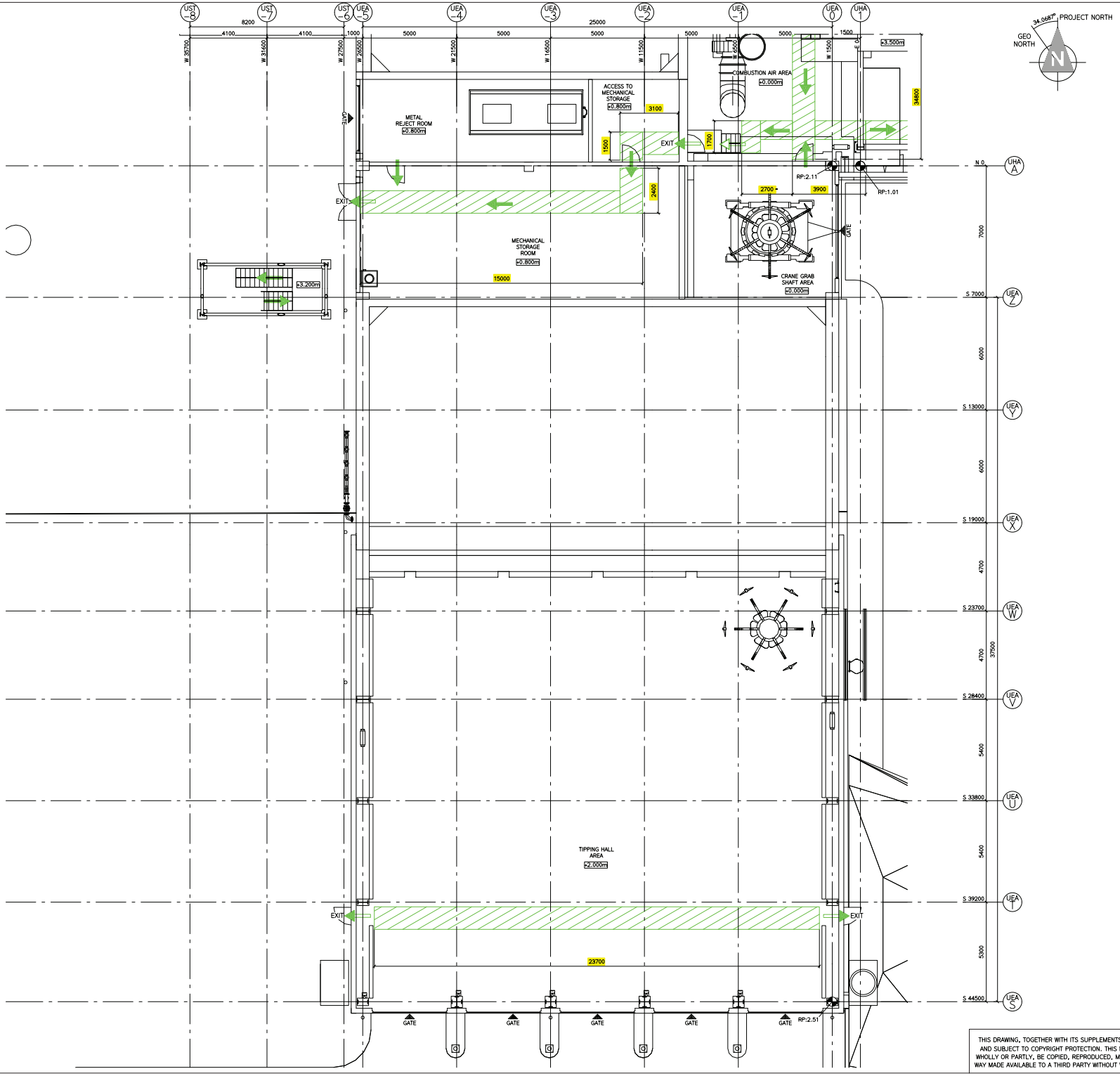
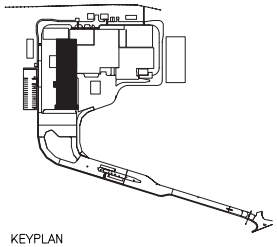
SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 : M4 . J05 . 661 . 0
PROJECT NO. | GR. | NO. | SHT. | REV.





KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY DIRECTION UP
- EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

FUEL UNLOADING AREA(UEA) & FUEL STORAGE AREA(UEB)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL: +2.000m & +3.200m

SCALE: A1=1:100 A3=1:200

BWSC DWG.NO.: 2031 (PROJECT NO.) M4 (GR.) J05 (NO.) 251 (SHT.) 0 (REV.)

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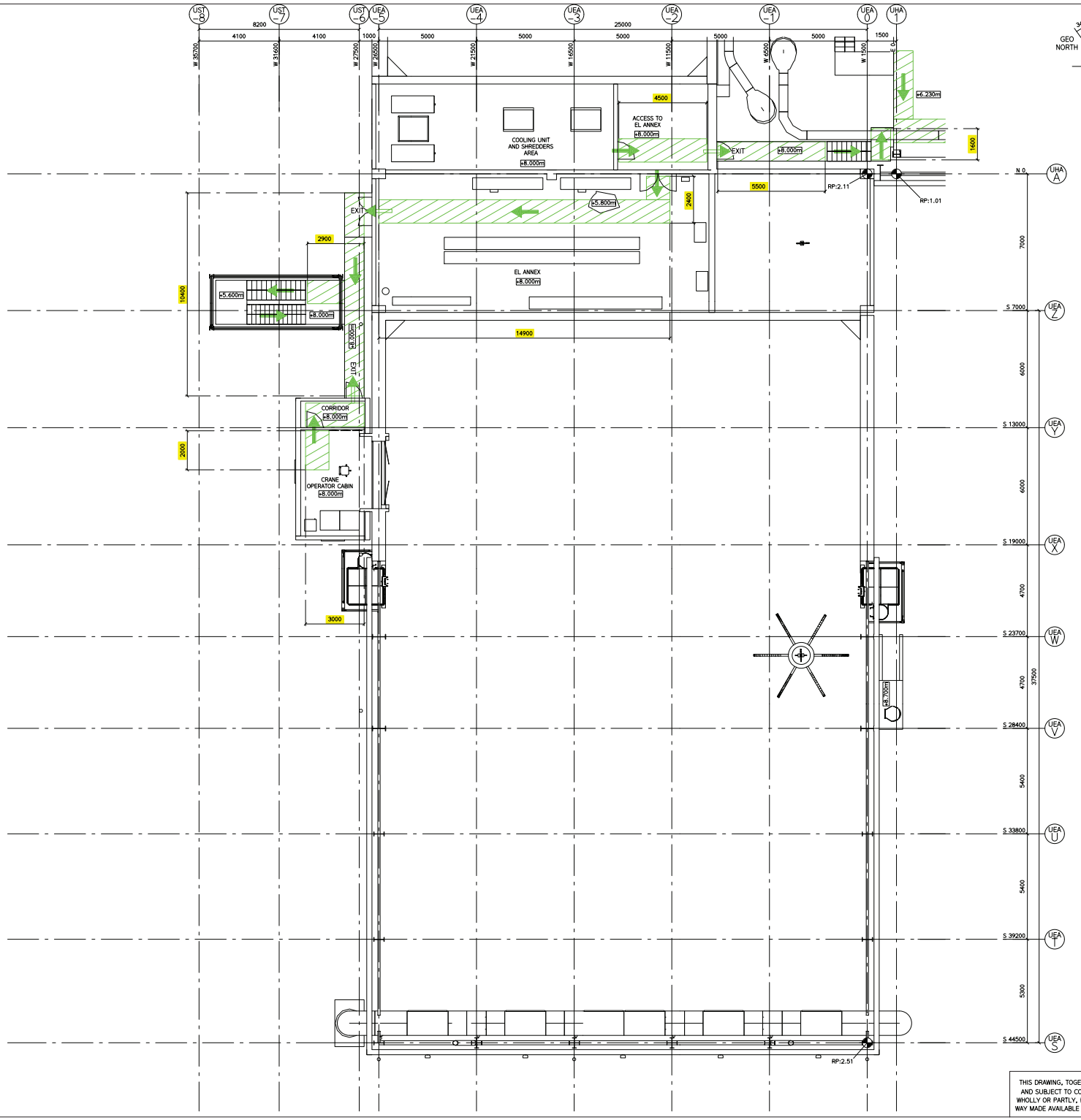

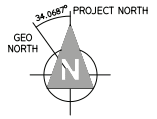

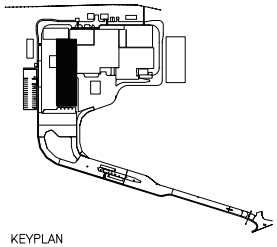

KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE
METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

FUEL UNLOADING AREA(UEA) & FUEL STORAGE AREA(UEB)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL: +8.000m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.: 2031 (PROJECT NO.) : M4 (GR.) . J05 (NO.) . 252 (SHT.) 0 (REV.)

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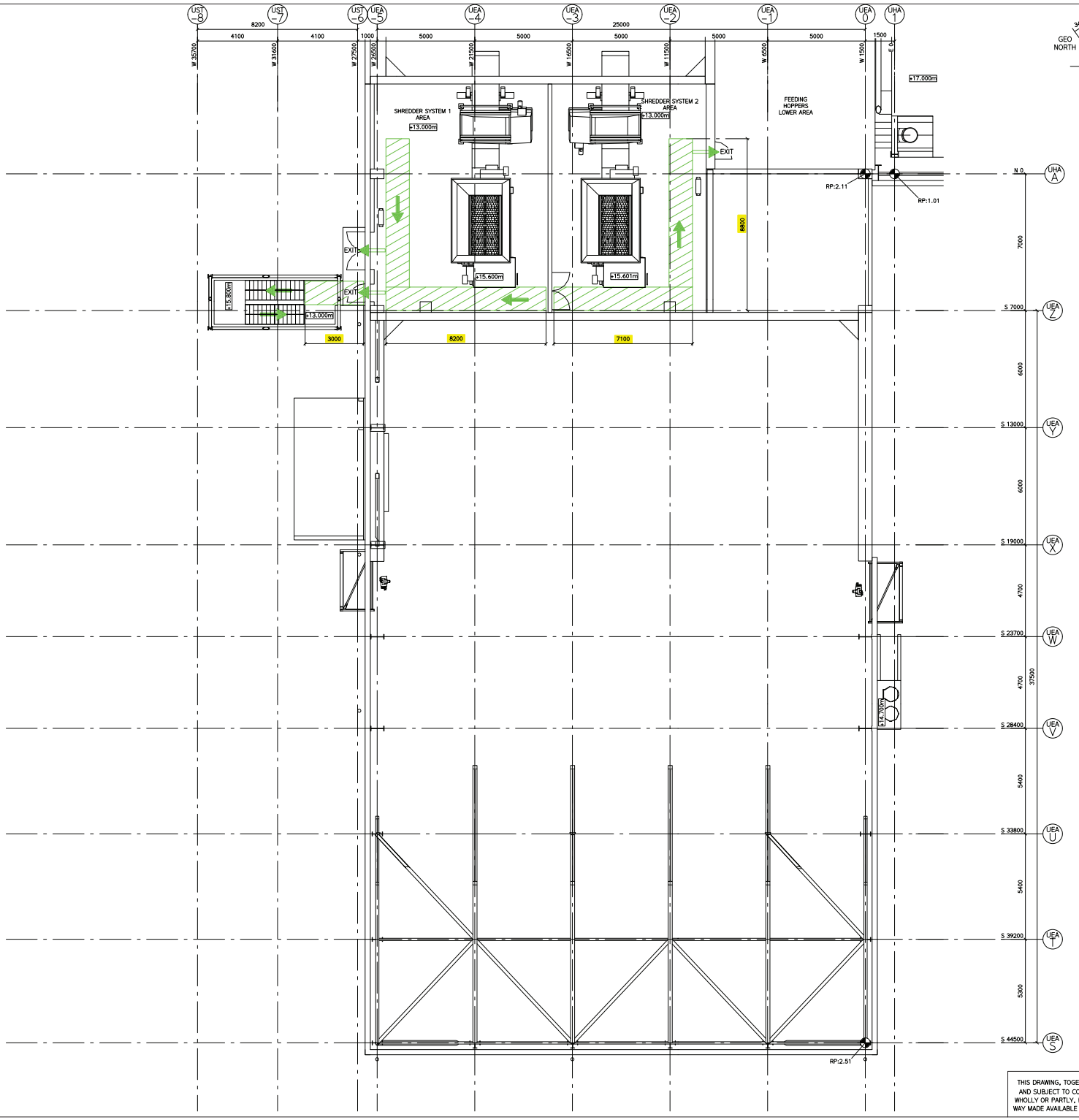

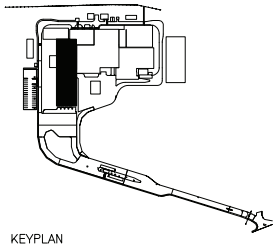

KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

FUEL UNLOADING AREA(UEA) & FUEL STORAGE AREA(UEB)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL: +13.000m

SCALE: A1=1:100 A3=1:200

BWSC DWG.NO.: 2031 (PROJECT NO.) : M4 (GR.) . J05 (NO.) . 253 (SHT.) REV. 0

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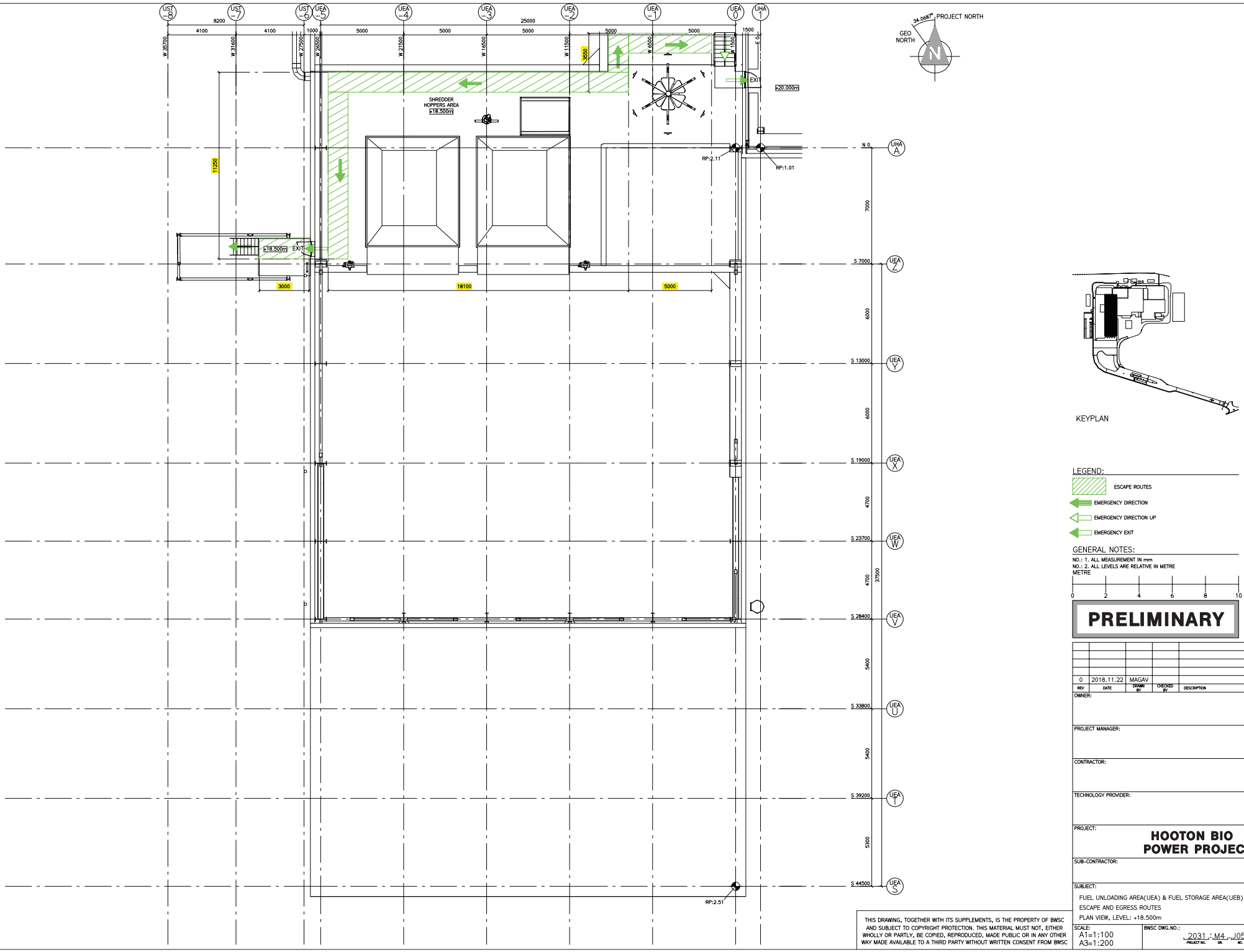

KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY DIRECTION UP
- EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE
0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

FUEL UNLOADING AREA(UEA) & FUEL STORAGE AREA(UEB)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL: +18.500m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.: 2031 (PROJECT NO.) : M4 (GR.) . J05 (NO.) . 254 (SHT.) 0 (REV.)

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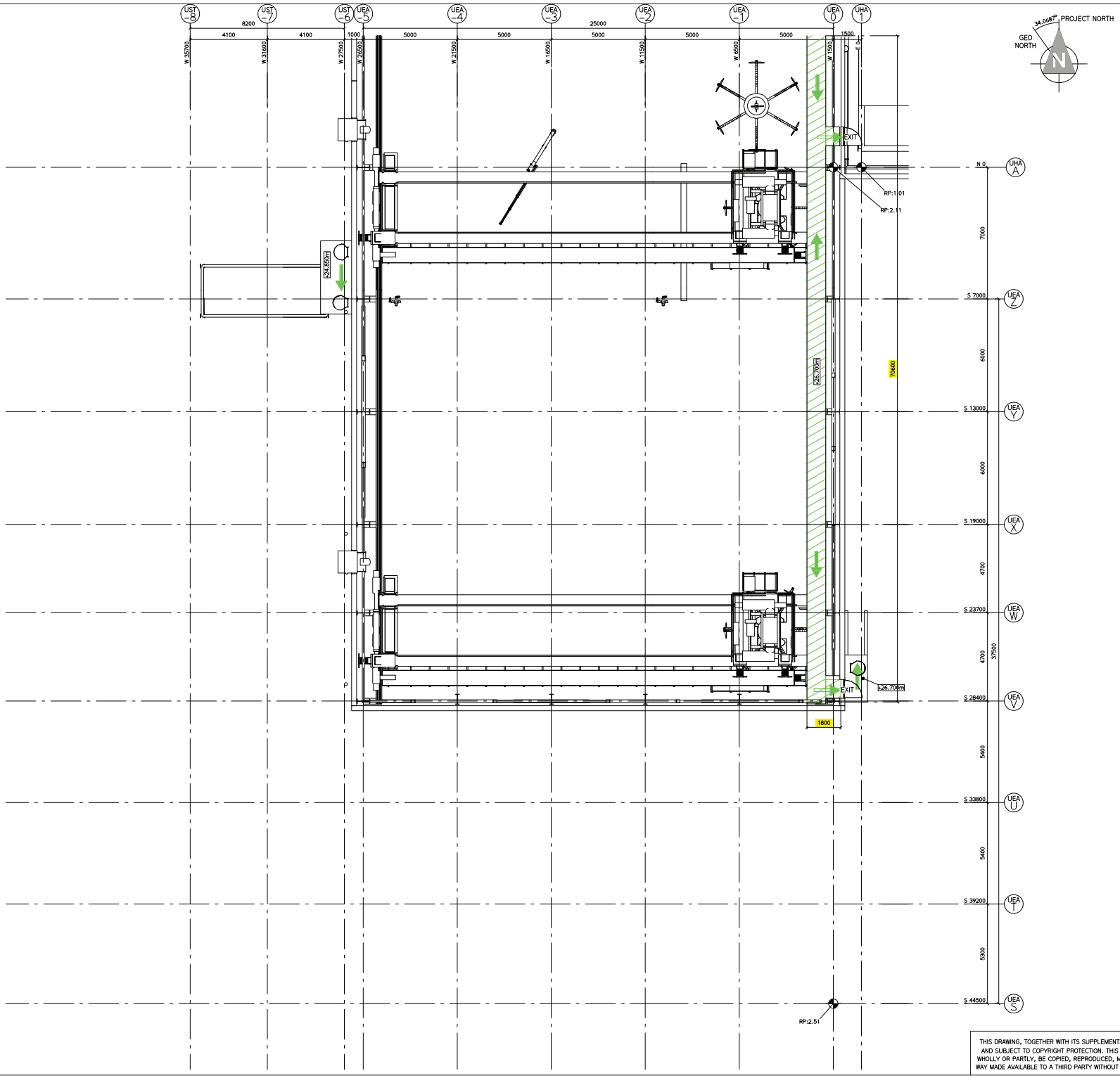

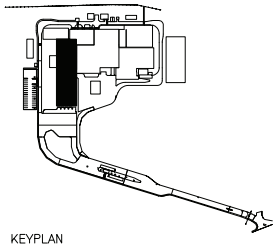

KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

FUEL UNLOADING AREA(UEA) & FUEL STORAGE AREA(UEB)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL: TOP OF CRANE

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.: 2031 : M4 . J05 . 255 (PROJECT NO. / GR. / NO. / SHT.) 0 REV.

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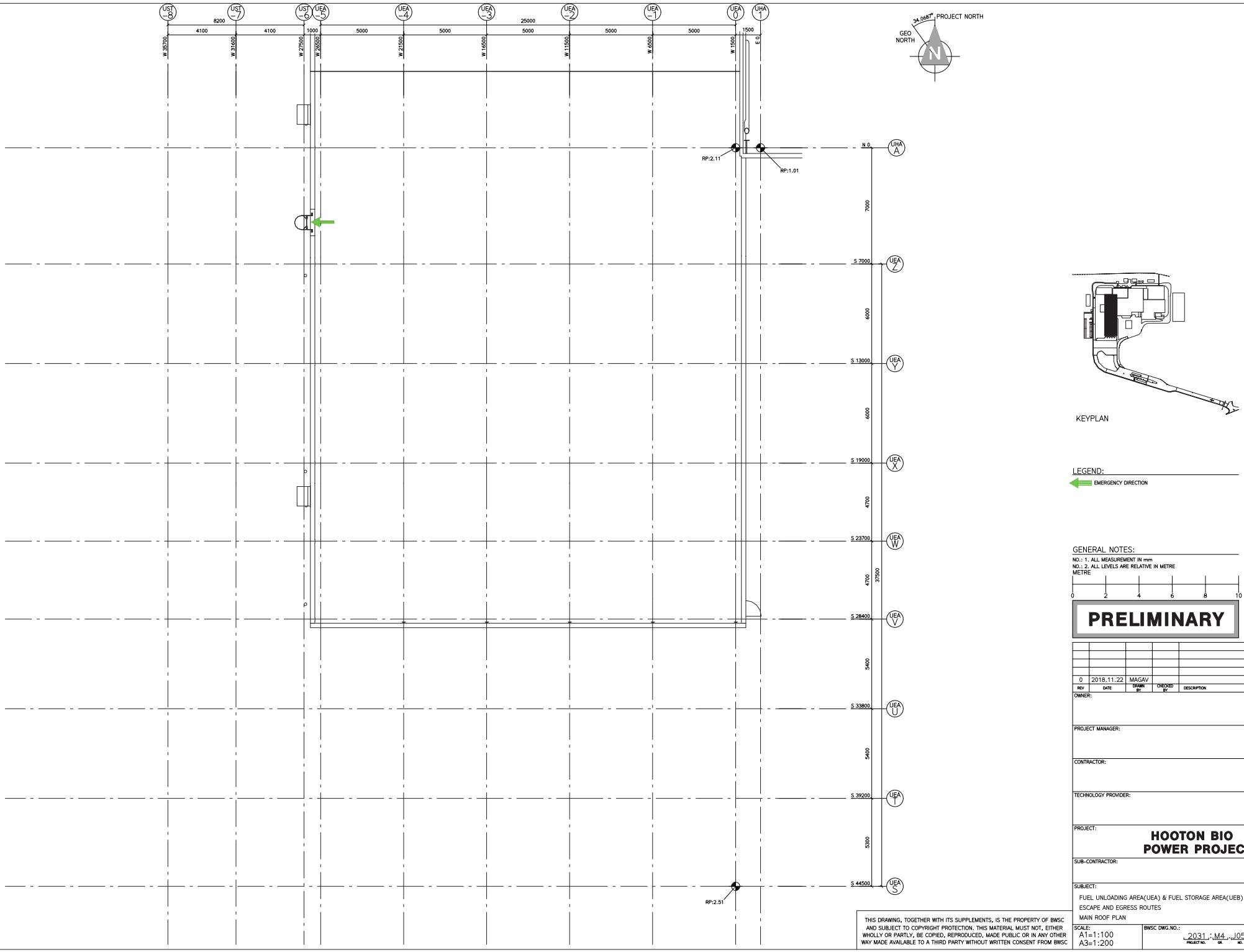

KEYPLAN

LEGEND:

EMERGENCY DIRECTION

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

FUEL UNLOADING AREA(UEA) & FUEL STORAGE AREA(UEB)
ESCAPE AND EGRESS ROUTES
MAIN ROOF PLAN

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.: 2031 : M4 . J05 . 256 (PROJECT NO. : GR. . NO. . SHT.)

REV. 0

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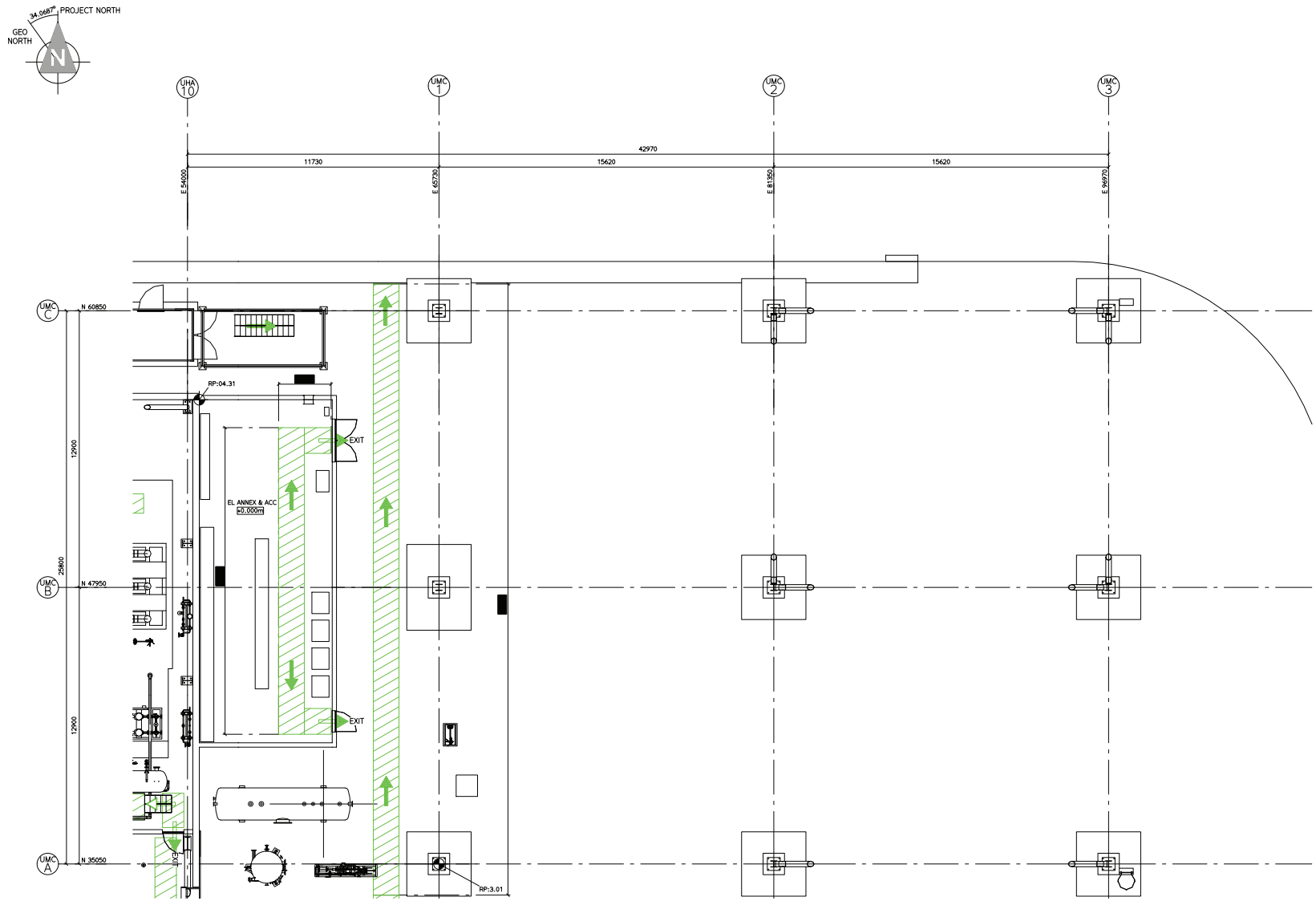

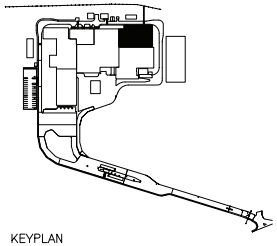

KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	JOEFA			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

AIR COOLED CONDENSER (UMC) & ACC EXT. EL ANNEX (UBV)
ESCAPE AND EGRESS ROUTES
GROUND FLOOR PLAN, LEVEL: +0.000m

SCALE: A1=1:100 A3=1:200

BWSC DWG.NO.: 2031 . M5 . J05 . 301 (PROJECT NO. . GR. . NO. . SHT.) 0 REV.

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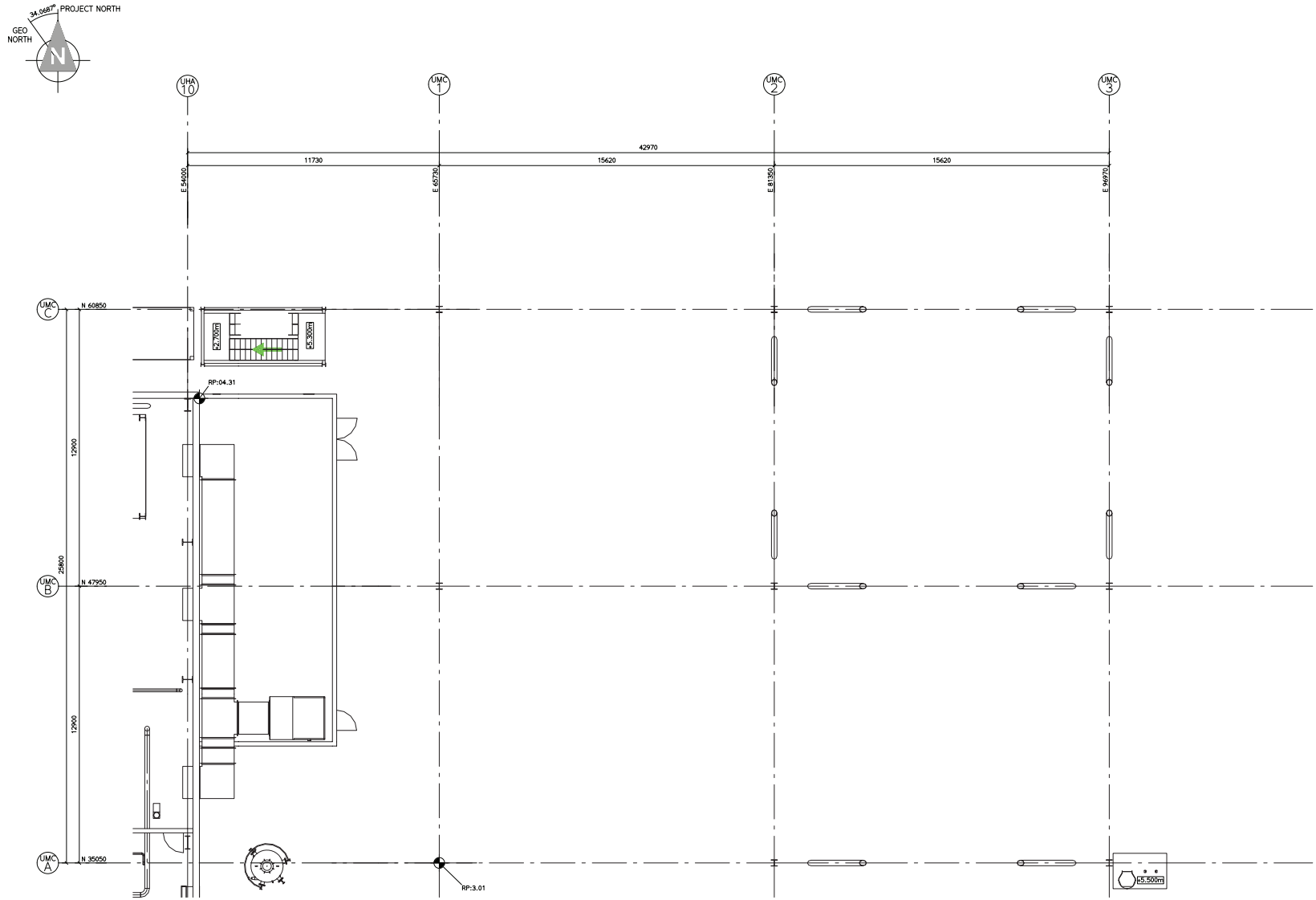

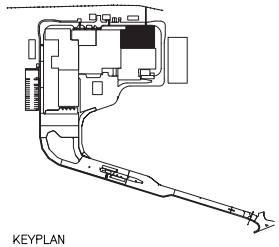

KEYPLAN

LEGEND:

EMERGENCY DIRECTION

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	JOEFA			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

AIR COOLED CONDENSER (UMC) & ACC EXT. EL ANNEX (UBV)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL: +2.600m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 - M5 - J05 - 302 - 0
PROJECT NO. | GR. | NO. | SHT. | REV.

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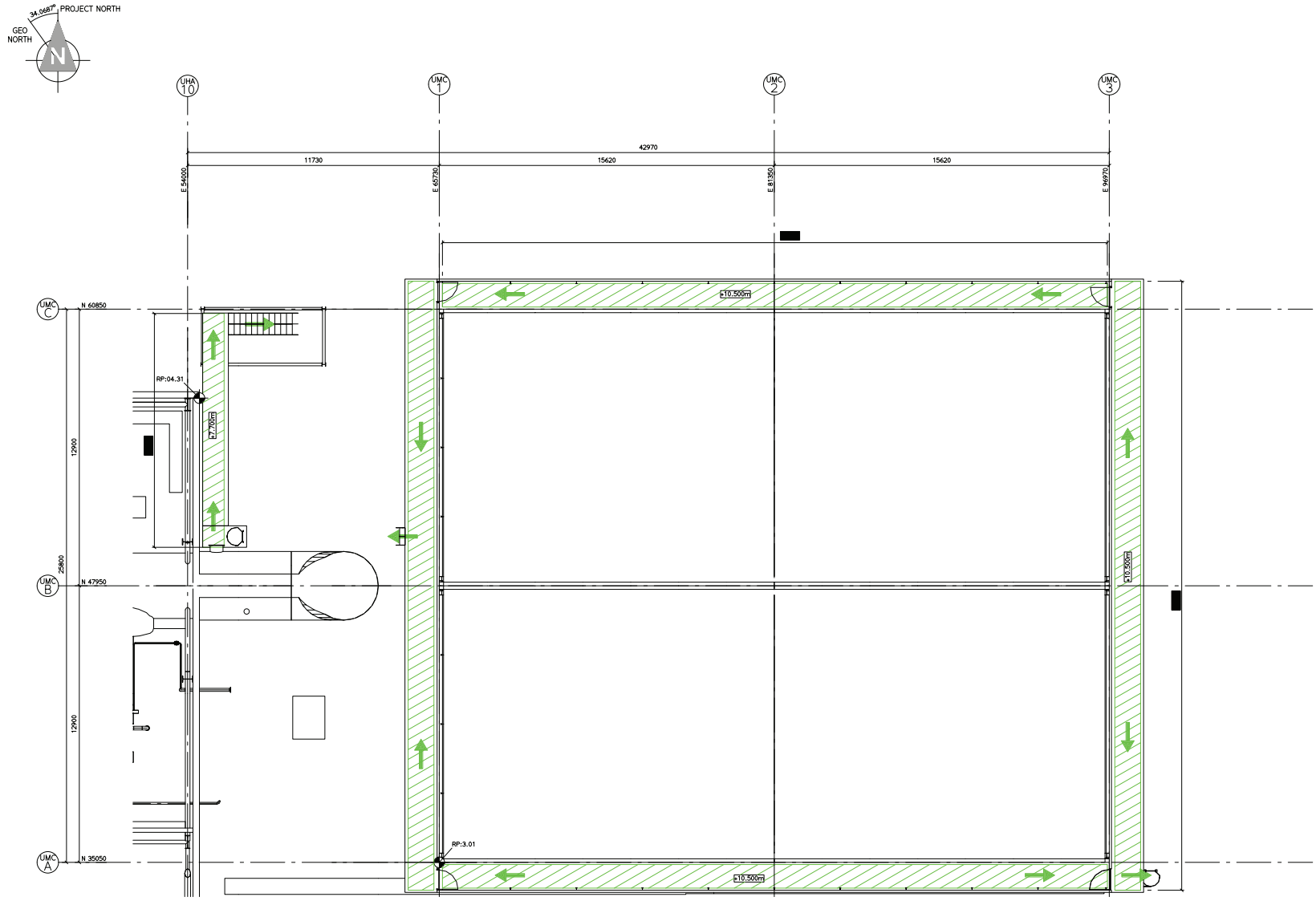

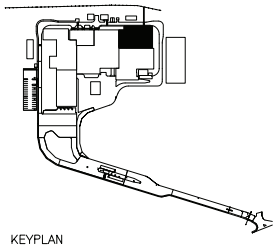

KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY DIRECTION UP

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	JOEFA			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

AIR COOLED CONDENSER (UMC) & ACC EXT. EL ANNEX (UBV)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL: +7.700m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 - M5 - J05 - 303 (PROJECT NO. - GR. - NO. - SHT.)
0 REV.

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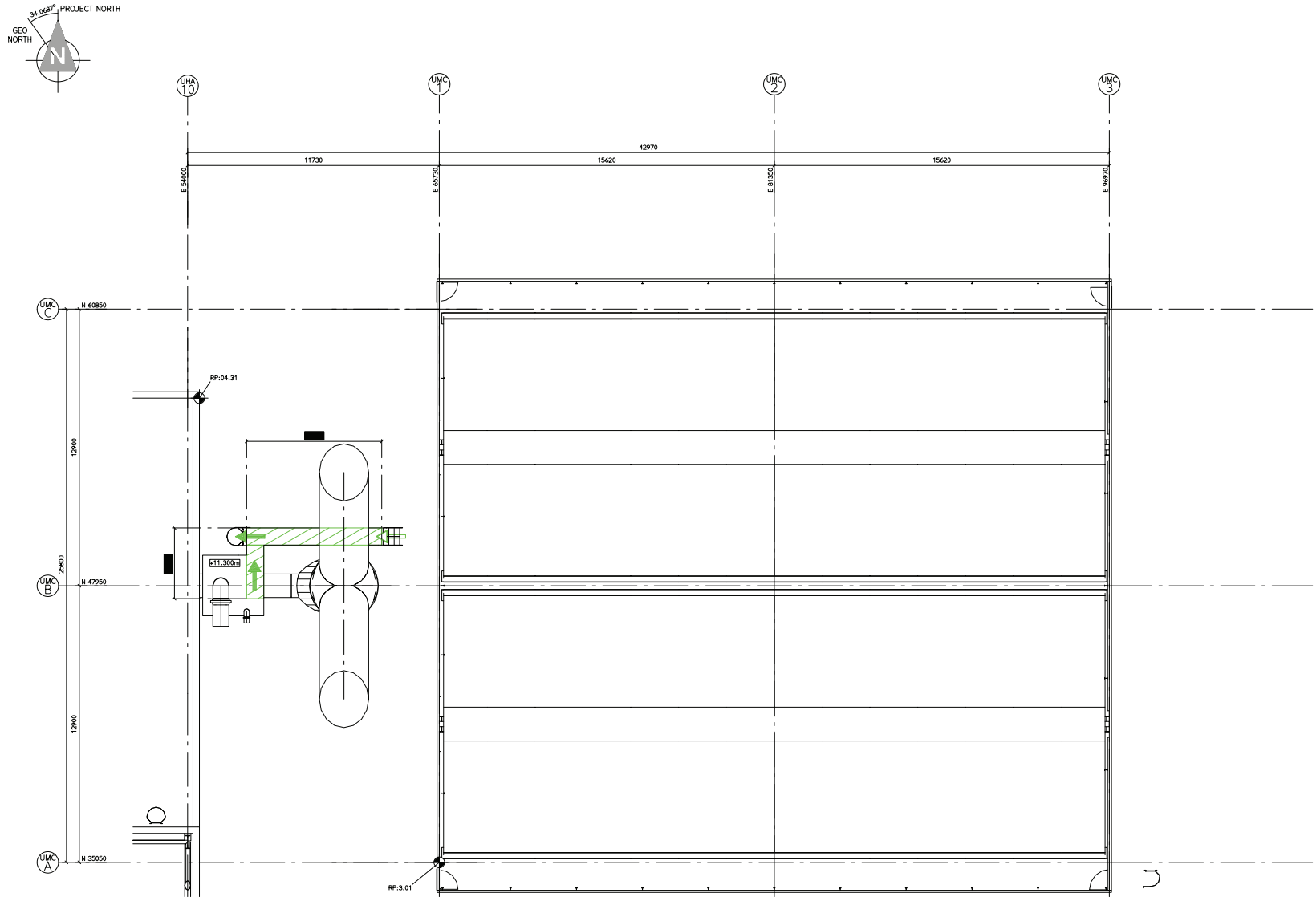

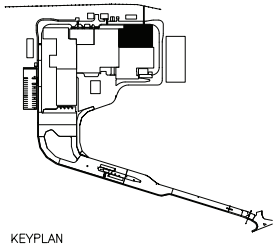

KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY DIRECTION UP

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	JOEFA			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

AIR COOLED CONDENSER (UMC) & ACC EXT. EL ANNEX (UBV)
ESCAPE AND EGRESS ROUTES
TOP VIEW

SCALE: A1=1:100 A3=1:200

BWSC DWG.NO.: 2031 . M5 . J05 . 304 (PROJECT NO. . GR. . NO. . SHT.) 0 REV.

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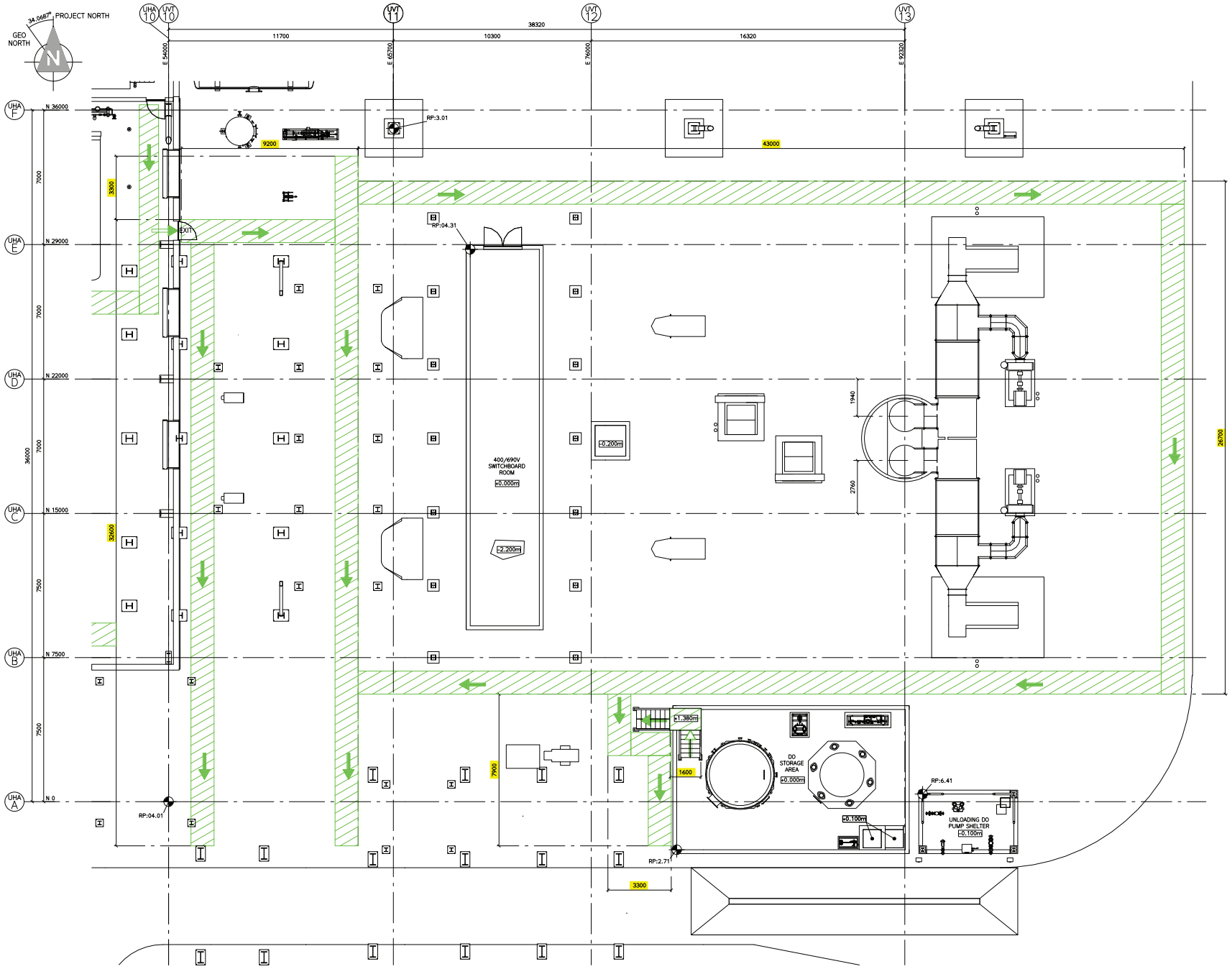

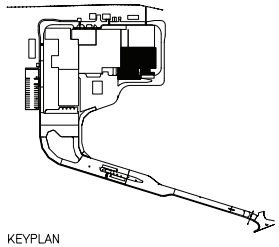

KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY DIRECTION UP
- EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE
METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	JOEFA			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

FLUE GAS TREATMENT AREA (UEH, UEK, UVT)
ESCAPE AND EGRESS ROUTES
GROUND FLOOR PLAN, LEVEL: +0.000m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.: 2031 (PROJECT NO.) . M4 (GR.) . J05 (NO.) . 401 (SHT.) . 0 (REV.)

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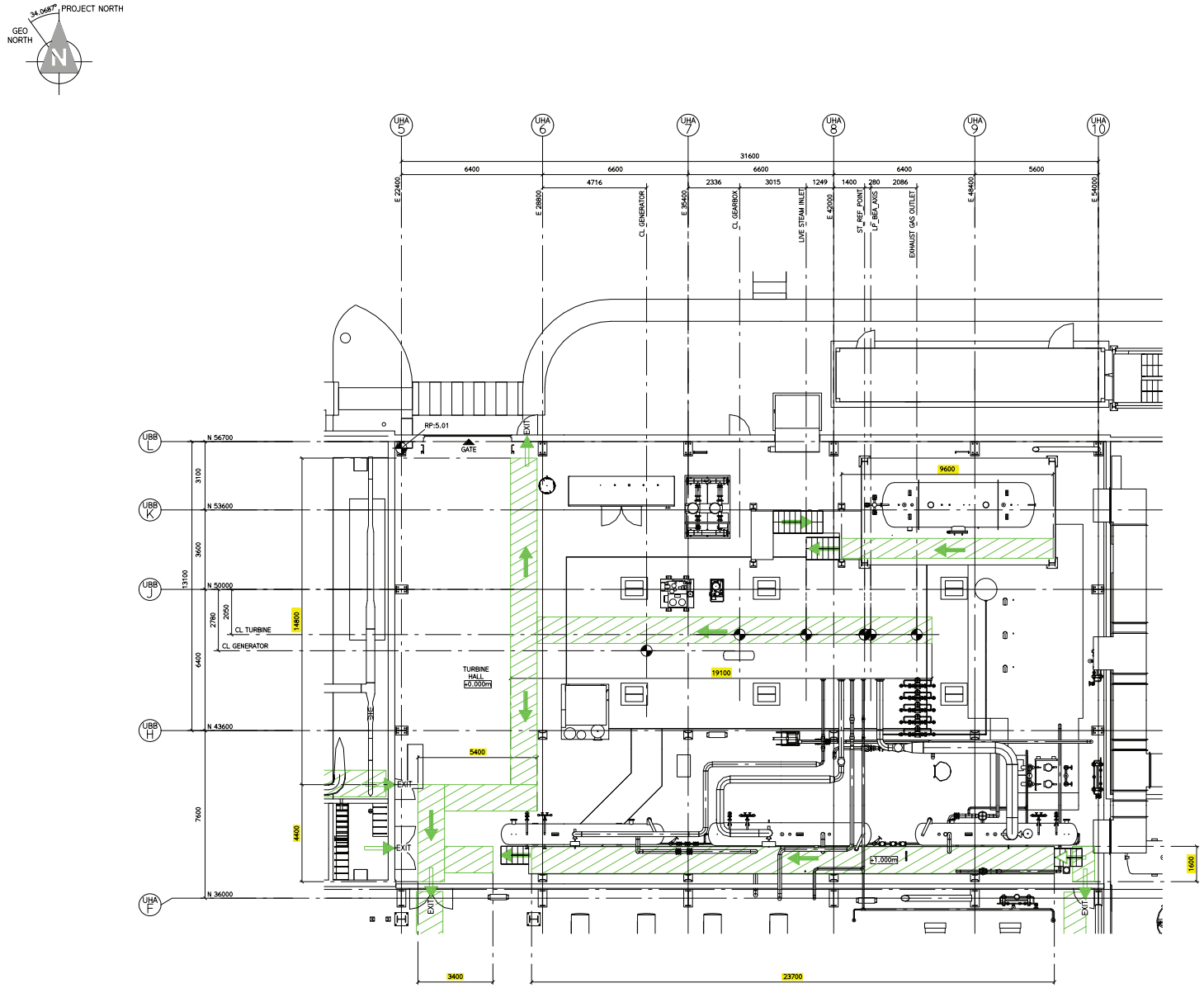

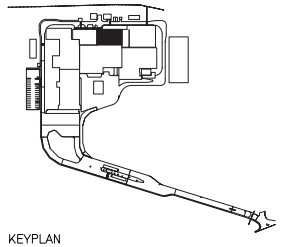

KEYPLAN

LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY EXIT
- EMERGENCY DIRECTION UP

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE
METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

STEAM TURBINE BUILDING (UMA)
ESCAPE AND EGRESS ROUTES
GROUND FLOOR PLAN, LEVEL: +0.000m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 : M4 . J05 . 501 . 0
PROJECT NO. GR. NO. SHT. REV.

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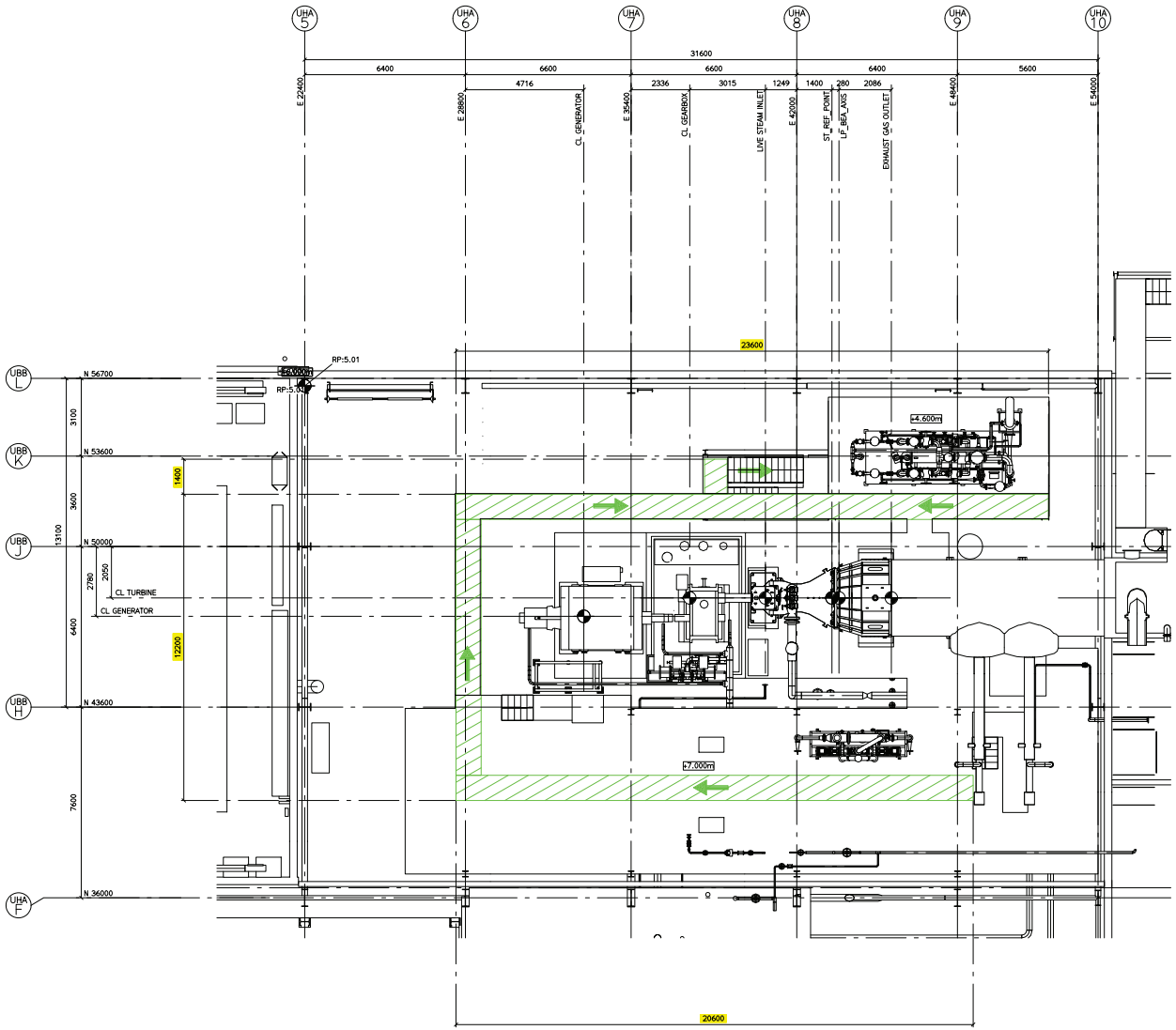

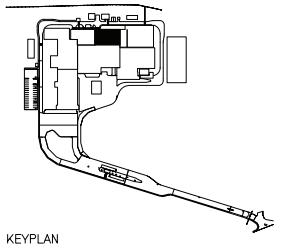

KEYPLAN

LEGEND:

ESCAPE ROUTES

EMERGENCY DIRECTION

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

STEAM TURBINE BUILDING (UMA)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL: +6.000m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.: 2031 (PROJECT NO.) . M4 (GR.) . J05 (NO.) . 502 (SHT.) 0 (REV.)

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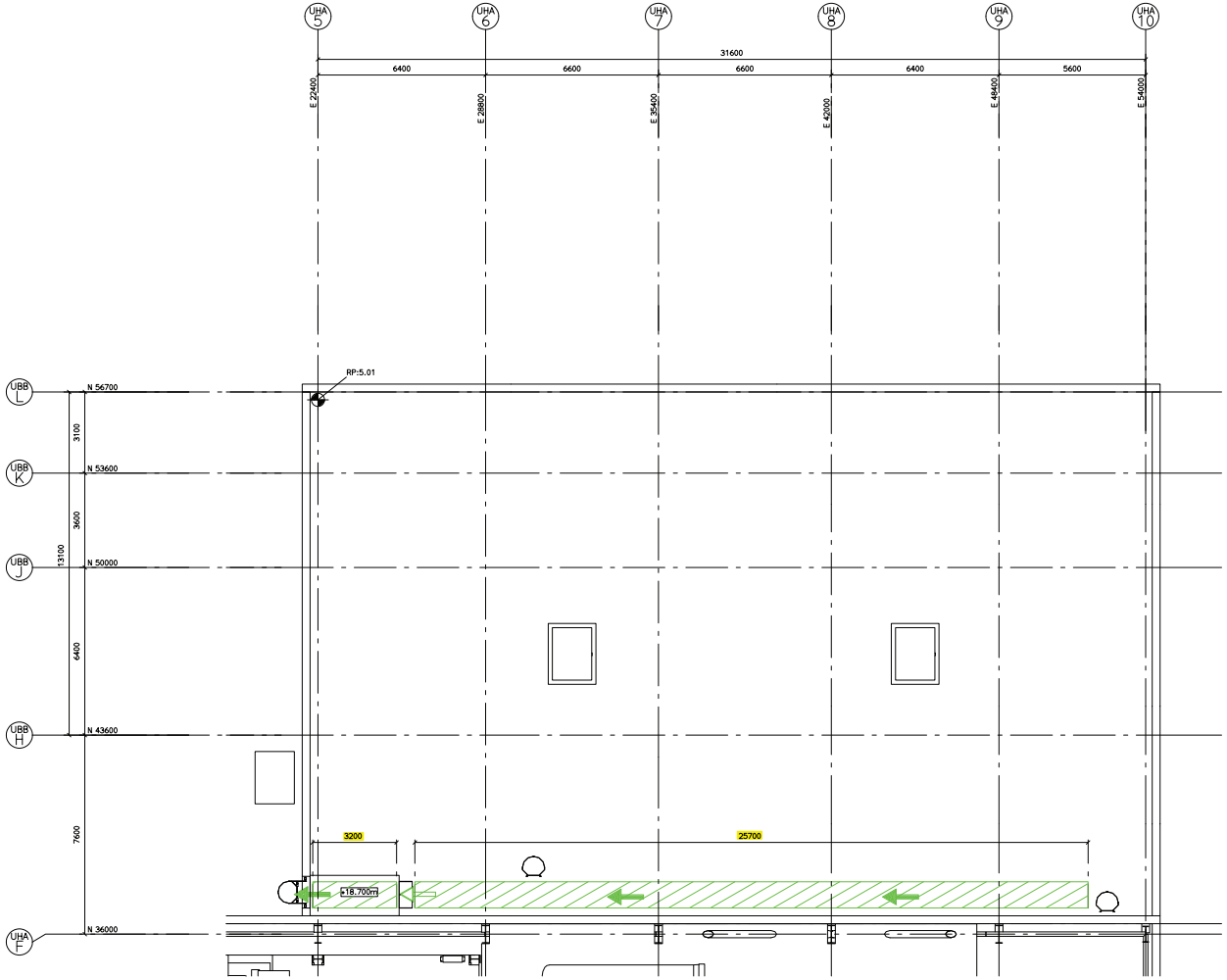

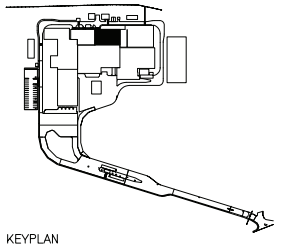

KEYPLAN

LEGEND:

ESCAPE ROUTES

EMERGENCY DIRECTION

EMERGENCY DIRECTION UP

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

STEAM TURBINE BUILDING (UMA)
ESCAPE AND EGRESS ROUTES
MAIN ROOF PLAN

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.: 2031 . M4 . J05 . 505 . 0
PROJECT NO. GR. NO. SHT. REV.

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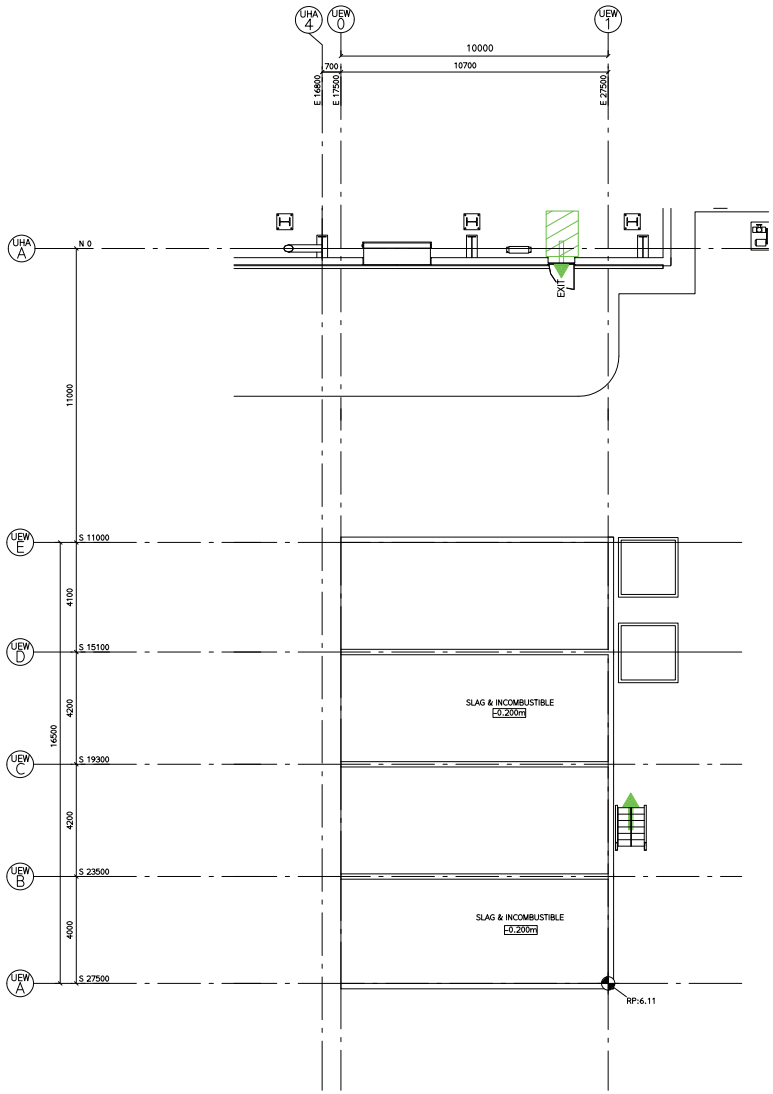


LEGEND:

EMERGENCY DIRECTION

EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE
0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

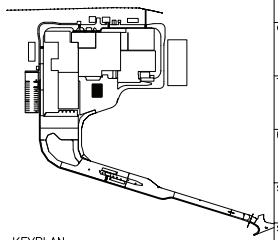
PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

SLAG AREA (UEW)
ESCAPE AND EGRESS ROUTES
GROUND FLOOR PLAN, LEVEL: -0.200m



KEYPLAN

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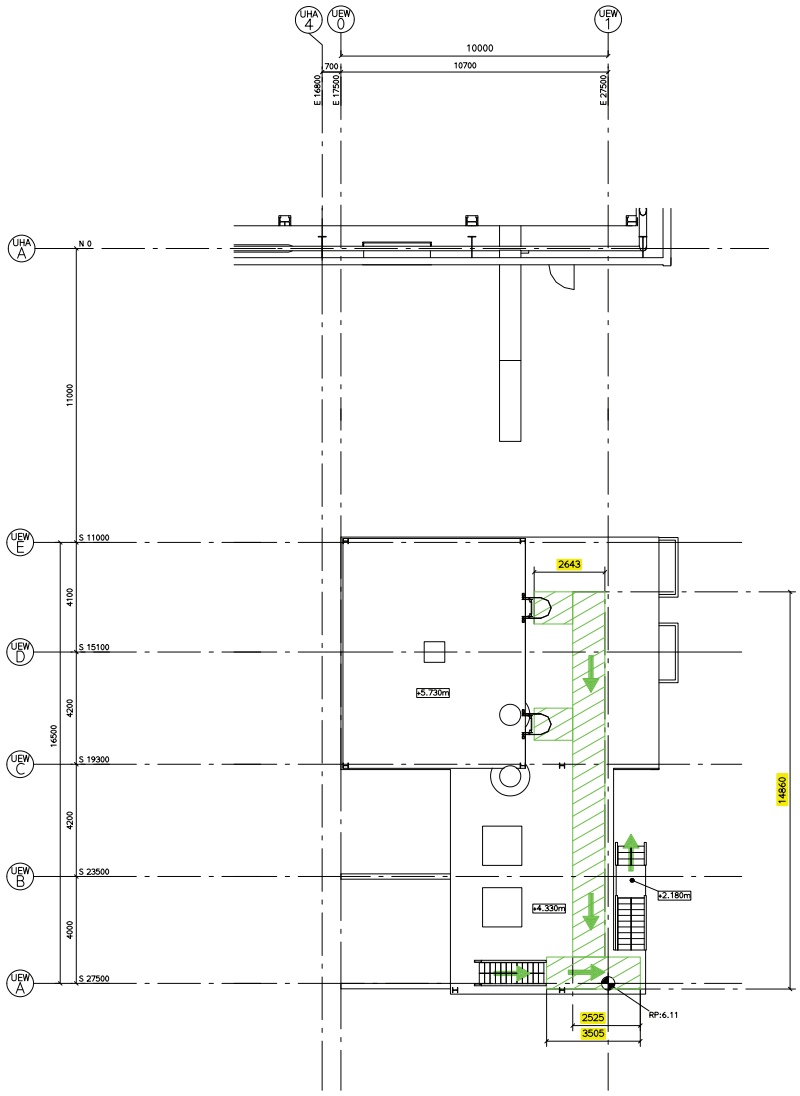
SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 : M4 . J05 . 611 . 0
PROJECT NO. GR. NO. SHT. REV.



LEGEND:

ESCAPE ROUTES

EMERGENCY DIRECTION

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

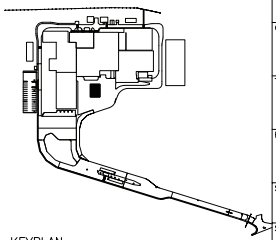
PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

SLAG AREA (UEW)
ESCAPE AND EGRESS ROUTES
PLAN VIEW: LEVEL +4.330m & +5.730m



KEYPLAN

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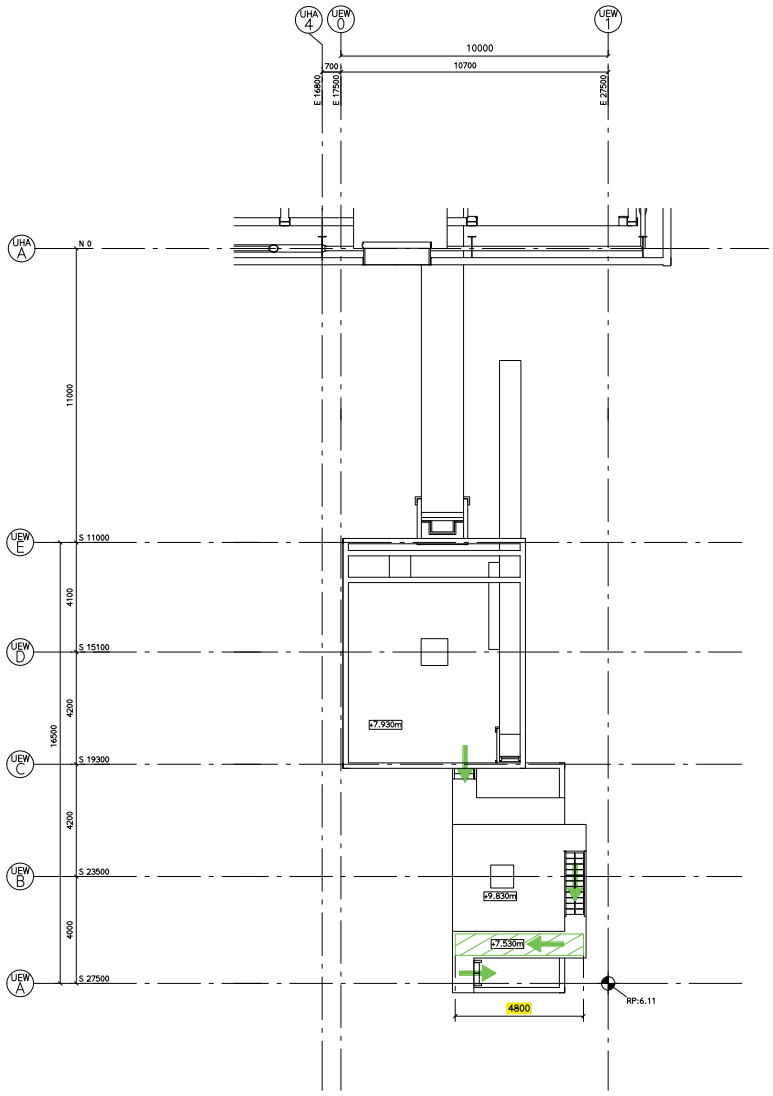
SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 : M4 . J05 . 612 . 0
PROJECT NO. | GR. | NO. | SHT. | REV.



LEGEND:

ESCAPE ROUTES

EMERGENCY DIRECTION

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE
0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

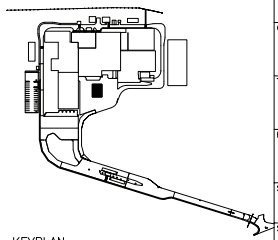
PROJECT:
HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:
SLAG AREA (UEW)
ESCAPE AND EGRESS ROUTES
PLAN VIEW: LEVEL +7.530m, 7.930m & +9.830m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 : M4 . J05 . 613 . 0
PROJECT NO. GR. NO. SHT. REV.



KEYPLAN

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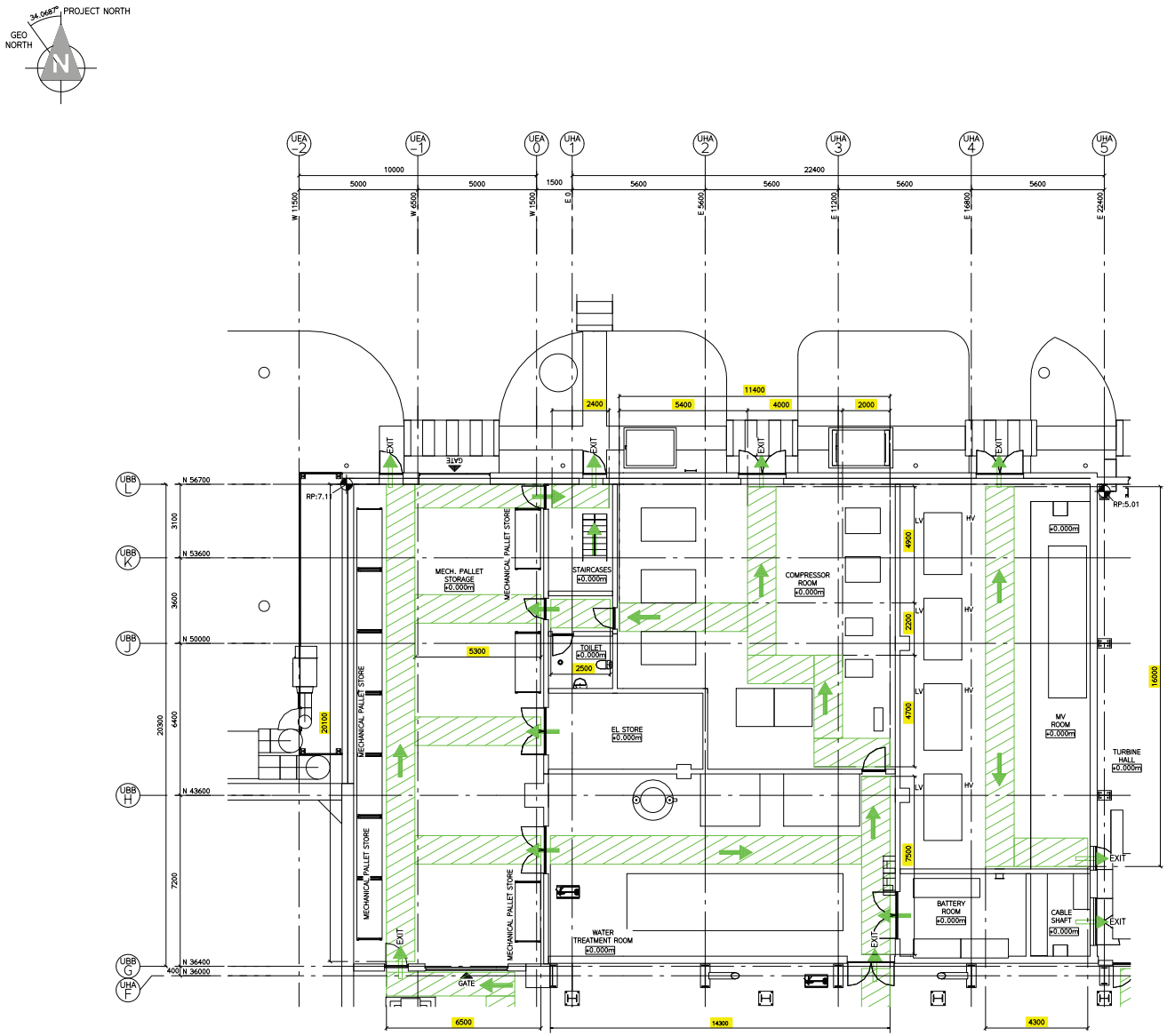


LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY EXIT

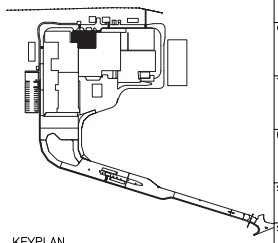
GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			



KEYPLAN

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

SERVICE BUILDING / EL ANNEX (UBB)
ESCAPE AND EGRESS ROUTES
GROUND FLOOR PLAN, LEVEL: +0.000m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.: 2031 : M4 . J05 . 711 (PROJECT NO. / GR. / NO. / SHT.) REV. 0

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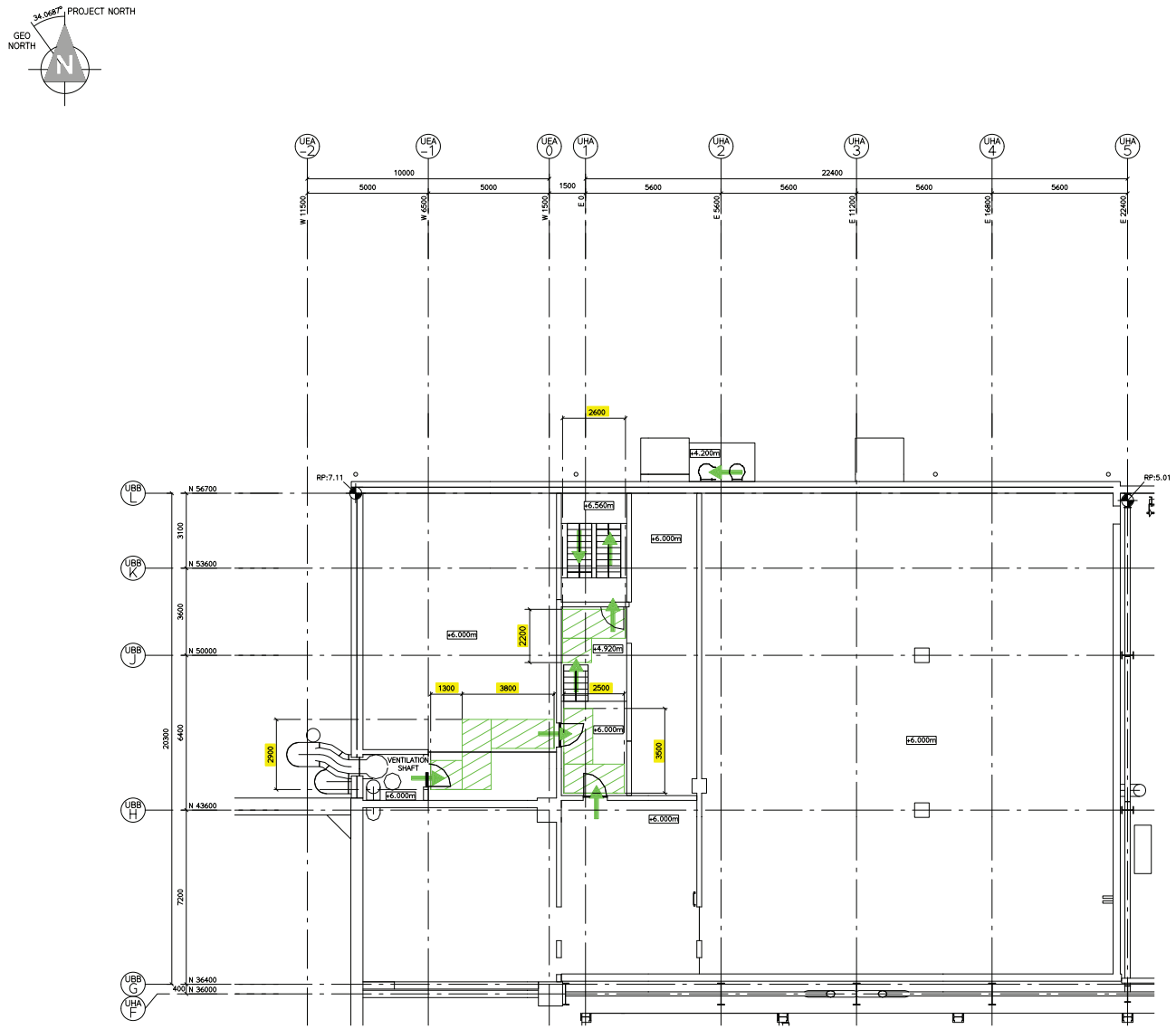


LEGEND:

ESCAPE ROUTES

EMERGENCY DIRECTION

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

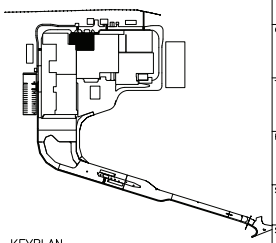
PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

SERVICE BUILDING / EL ANNEX (UBB)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL: +6.000m



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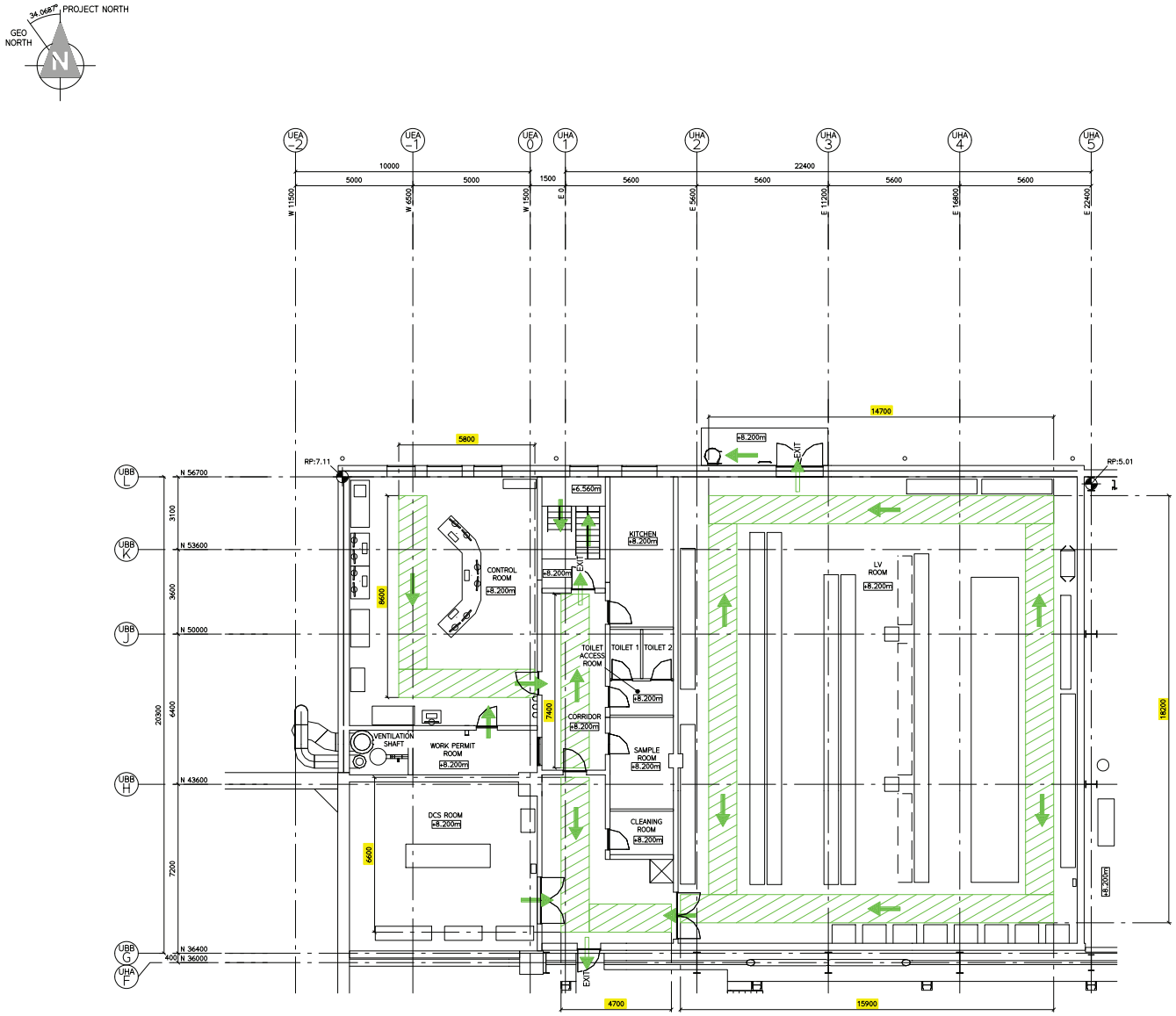
SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 (PROJECT NO.) : M4 (GR.) . J05 (NO.) . 712 (SHT.)

0 REV.



LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

SERVICE BUILDING / EL ANNEX (UBB)
ESCAPE AND EGRESS ROUTES
PLAN VIEW, LEVEL: +8.200m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 : M4 . J05 . 713 . 0
PROJECT NO. GR. NO. SHT. REV.

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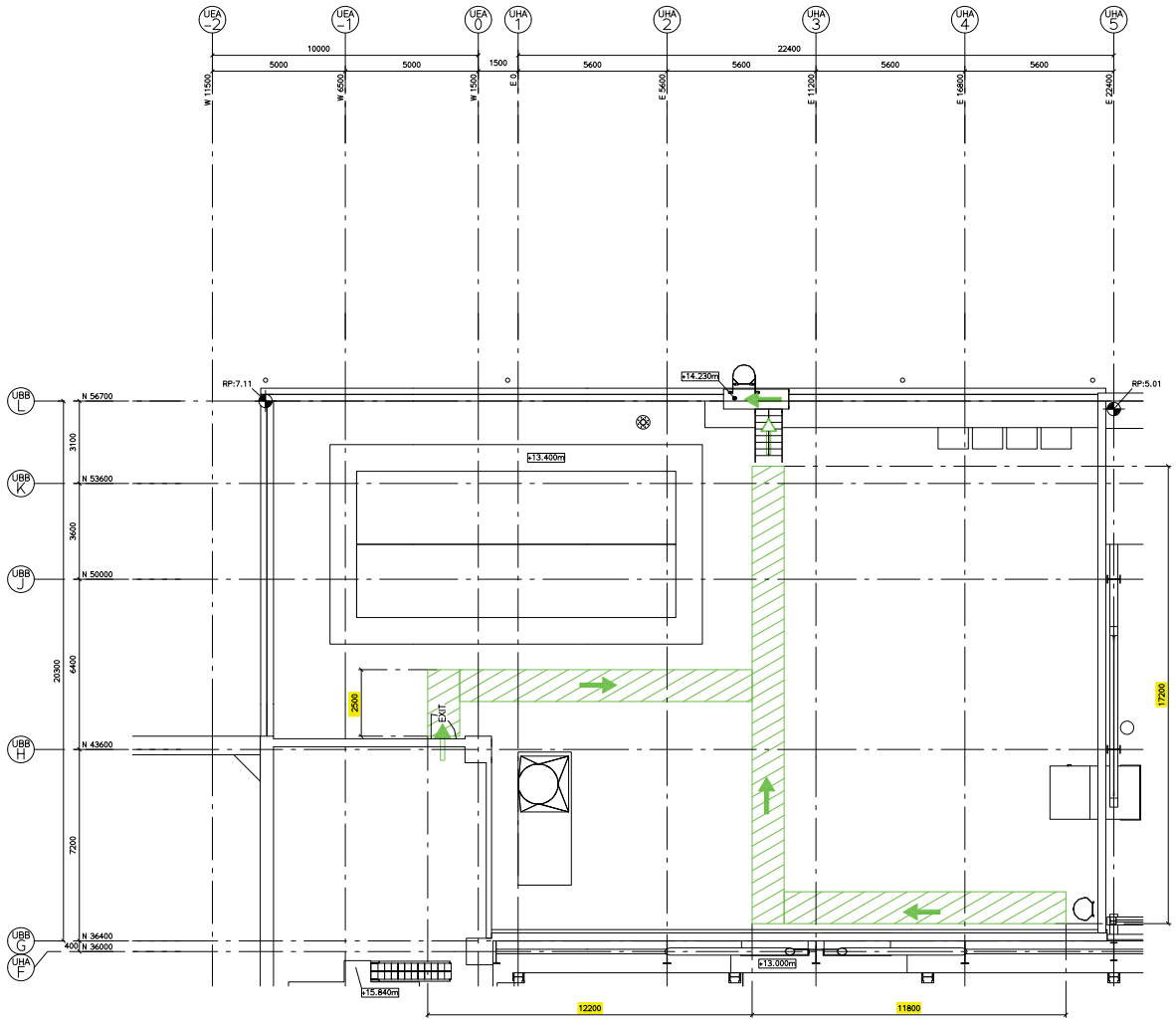


LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY DIRECTION UP
- EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

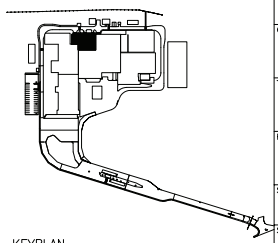
PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

SERVICE BUILDING / EL ANNEX (UBB)
ESCAPE AND EGRESS ROUTES
EL ANNEX MAIN ROOF PLAN



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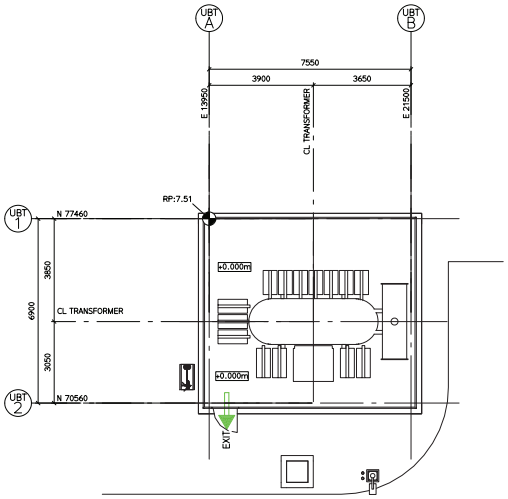
SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 : M4 . J05 . 714 . 0
PROJECT NO. GR. NO. SHT. REV.

PROJECT NORTH



ROAD

LEGEND:

EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE
0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

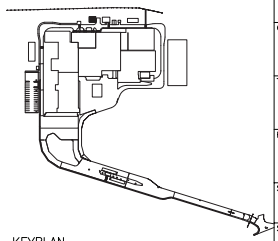
PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

STEP-UP TRANSFORMER AREA (UBT)
ESCAPE AND EGRESS ROUTES
PLAN VIEW



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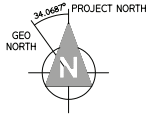
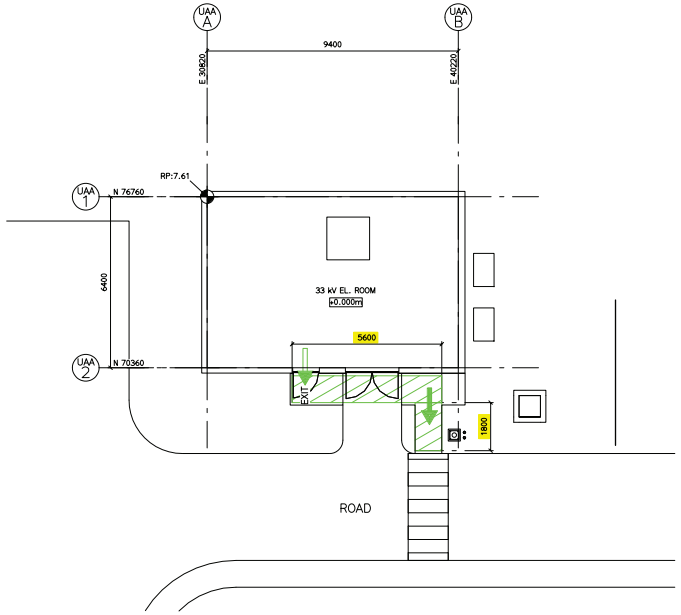
SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 : M4 . J05 . 751 . 0
PROJECT NO. GR. NO. SHT. REV.





LEGEND:

ESCAPE ROUTES

EMERGENCY DIRECTION

EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

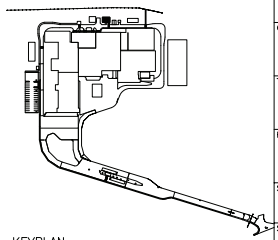
SUB-CONTRACTOR:

SUBJECT:

33kV SUB STATION (UAA)

ESCAPE AND EGRESS ROUTES

PLAN VIEW



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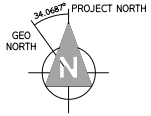
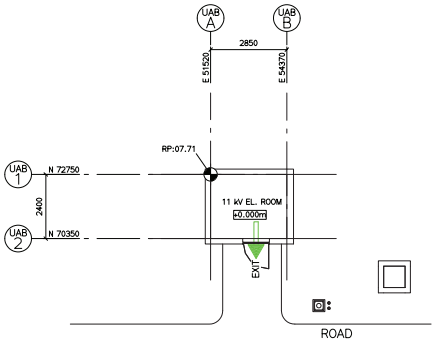
SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.: 2031 (PROJECT NO.) : M4 (GR.) . J05 (NO.) . 761 (SHT.)

0 REV.





LEGEND:

EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

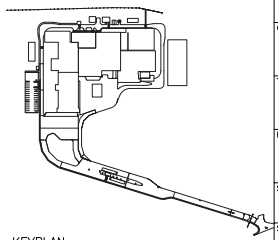
PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

11kV SUB STATION (UAB)
ESCAPE AND EGRESS ROUTES
PLAN VIEW



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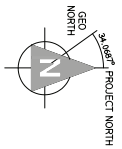
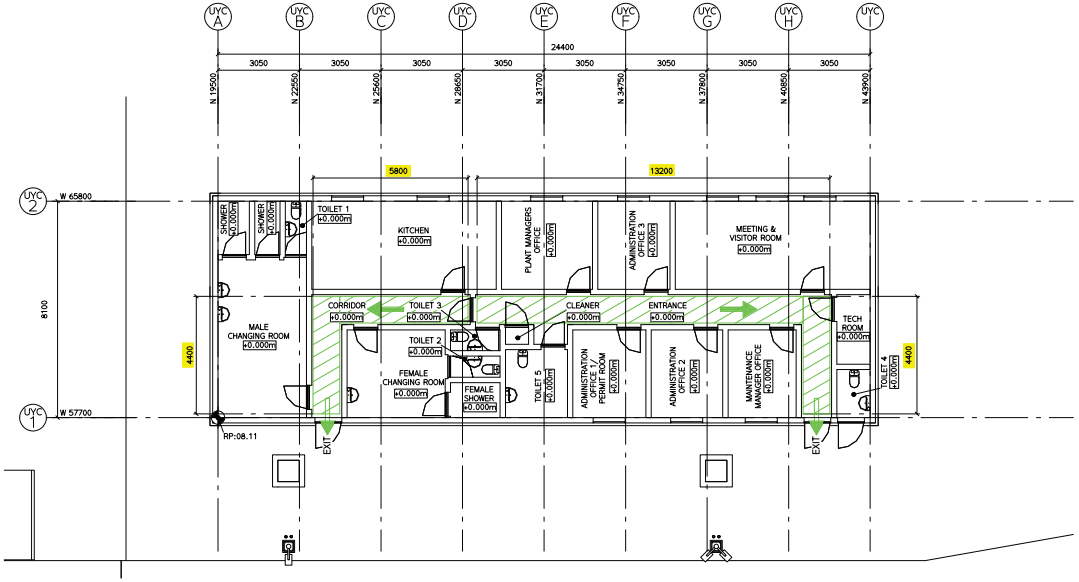
SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.: 2031 (PROJECT NO.) : M4 (GR.) . J05 (NO.) . 771 (SHT.)

0 REV.





LEGEND:

- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY EXIT

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

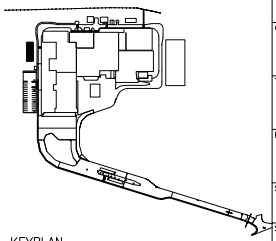
PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

ADMINISTRATION BUILDING (UYC)
ESCAPE AND EGRESS ROUTES
PLAN VIEW



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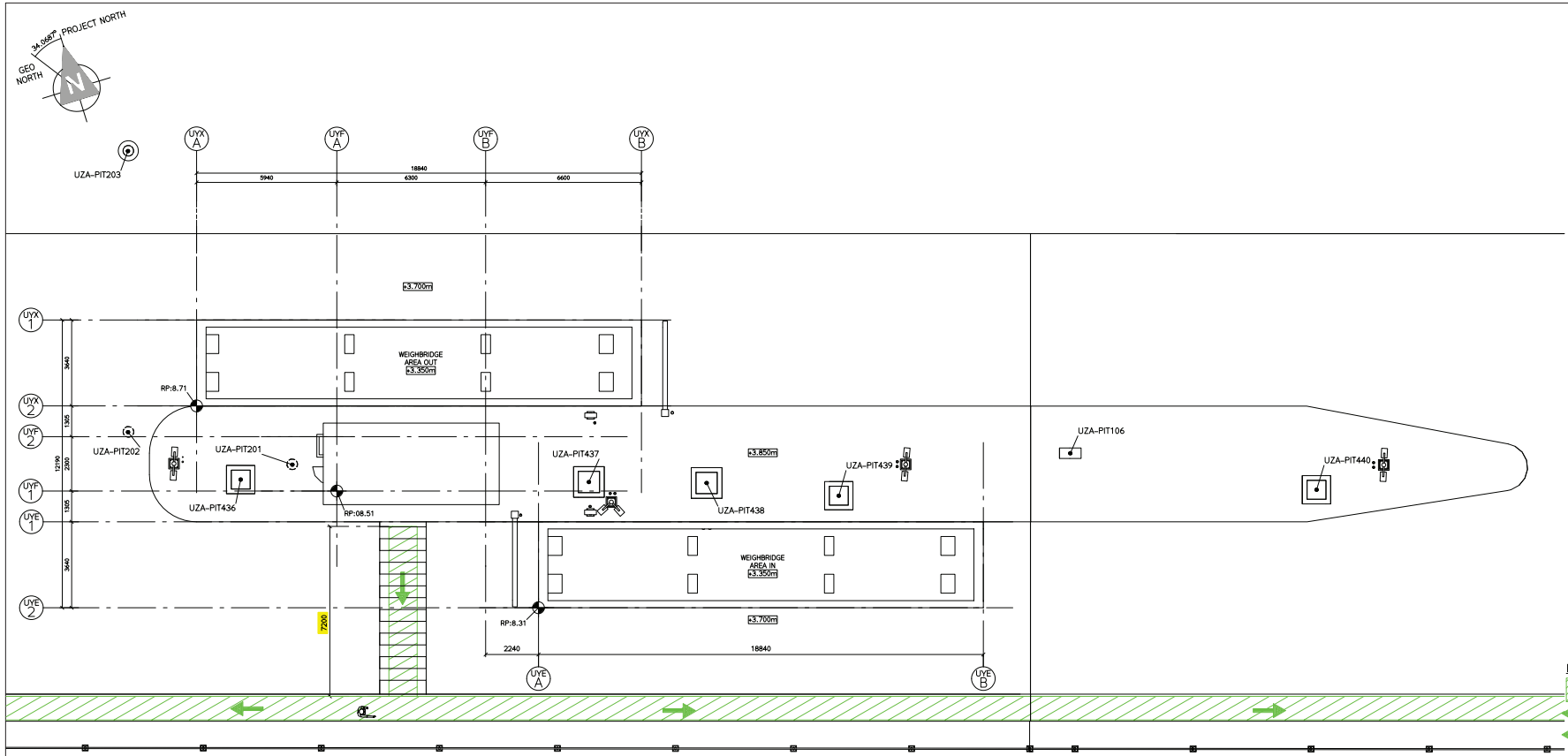
SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.: 2031 (PROJECT NO.) : M4 (DR.) . J05 (NO.) . 801 (SHT.)

0 REV.



GATE HOUSE & WEIGHBRIDGE AREA OVERVIEW
A1=1:100
A3=1:200

LEGEND:

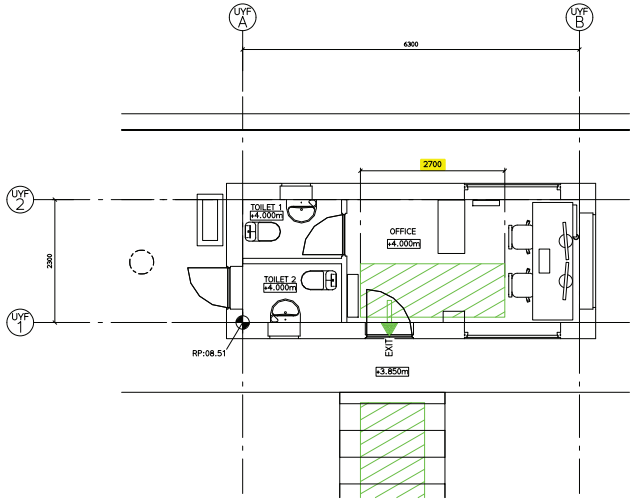
- ESCAPE ROUTES
- EMERGENCY DIRECTION
- EMERGENCY EXIT

GENERAL NOTES:

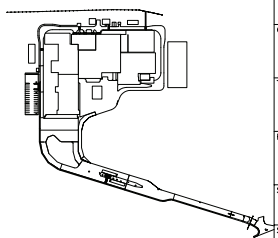
NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY



GROUND FLOOR PLAN, LEVEL: +4.000m
A1=1:50
A3=1:100



KEYPLAN

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.11.22	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

SITE ENTRANCE(UZA-1), SECURITY GATE HOUSE(UYF) & WEIGHBRIDGE AREA(UYE/UYX)
ESCAPE AND EGRESS ROUTES
PLAN VIEWS

SCALE:

BWSC DWG.NO.: 2031 (PROJECT NO.) M4 (GR.) J05 (NO.) 850 (SHT.) 0 (REV.)

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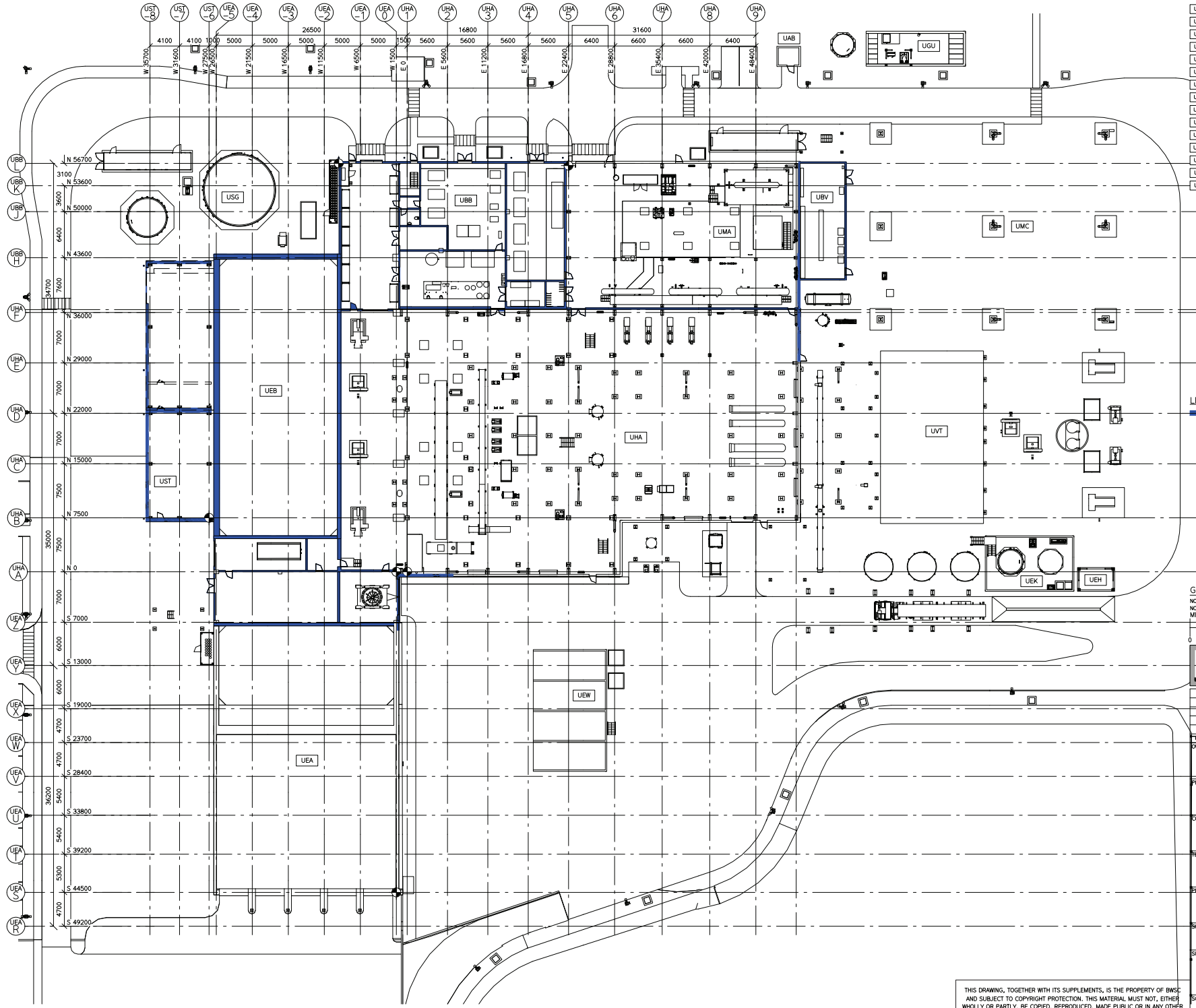

UAB	11kV SUBSTATION
UBB	EL ANNEX & SERVICE BUILDING
UBV	ACC & TURBINE BUILDING EL ROOM
UEA	WASTE FUEL UNLOADING AREA
UEB	WASTE FUEL STORAGE AREA
UEH	DO & AMMONIA UNLOADING AREA
UEK	DO & AMMONIA TANK AREA
UEW	SLAG STORAGE AREA
UGU	EFFLUENT AREA
UHA	BOILER BUILDING
UMA	STEAM TURBINE BUILDING
UMC	AIR COOLED CONDENSER AREA (ACC)
USG	FIRE EQUIPMENT AREA
UST	WORKSHOP BUILDING
UVT	FLUE GAS TREATMENT AREA (FGT)

LEGEND:

120 MINUTES FIRE RESISTING CONSTRUCTION (E.G. CONCRETE, BLOCK STONE) FOR FIRE SEGREGATION (NFPA RECOMENDATIONS)

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 5 10 15 20 25

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
1	2018.12.14	CAGCX			
0	2018.10.04	CAGCX	FEMB		CNH

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

MAIN BUILDING
FIRE SEGREGATION
GROUND FLOOR PLAN, LEVEL +0.000

SCALE: A1=1:250 A3=1:500

BWSC DWG.NO.: 2031 (PROJECT NO.) M4 (GR.) J12 (NO.) 101 (SHT.) 1 (REV.)

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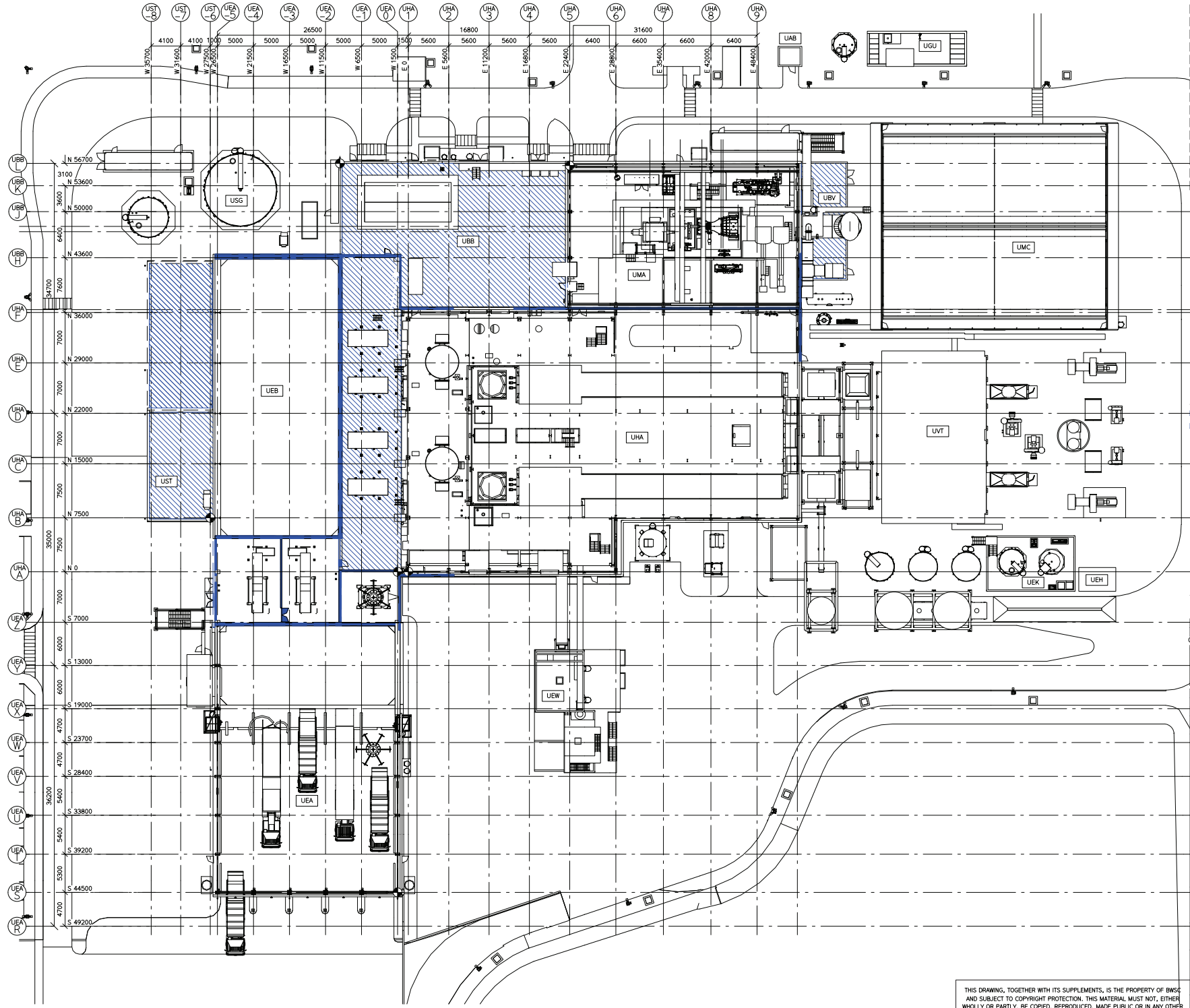

UAB	11kV SUBSTATION
UBB	EL ANNEX & SERVICE BUILDING
UBV	ACC & TURBINE BUILDING EL ROOM
UEA	WASTE FUEL UNLOADING AREA
UEB	WASTE FUEL STORAGE AREA
UEH	DO & AMMONIA UNLOADING AREA
UEK	DO & AMMONIA TANK AREA
UEW	SLAG STORAGE AREA
UGU	EFFLUENT AREA
UHA	BOILER BUILDING
UMA	STEAM TURBINE BUILDING
UMC	AIR COOLED CONDENSER AREA (ACC)
USG	FIRE EQUIPMENT AREA
UST	WORKSHOP BUILDING
UVT	FLUE GAS TREATMENT AREA (FGT)

LEGEND:

120 MINUTES FIRE RESISTING CONSTRUCTION (E.G. CONCRETE, BLOCK STONE) FOR FIRE SEGREGATION (NFPA RECOMMENDATIONS)

120 MINUTES FIRE RESISTANT CONCRETE ROOF

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 5 10 15 20 25

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
1	2018.12.14	CAGCX			
0	2018.10.04	CAGCX	FEMB		CNH

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

MAIN BUILDING
FIRE SEGREGATION
PLAN, LEVEL +13.000

SCALE:
A1=1:250
A3=1:500

BWSC DWG.NO.: 2031 - M4 - J12 - 102 (PROJECT NO. - GR. - NO. - SHT.) REV. 1

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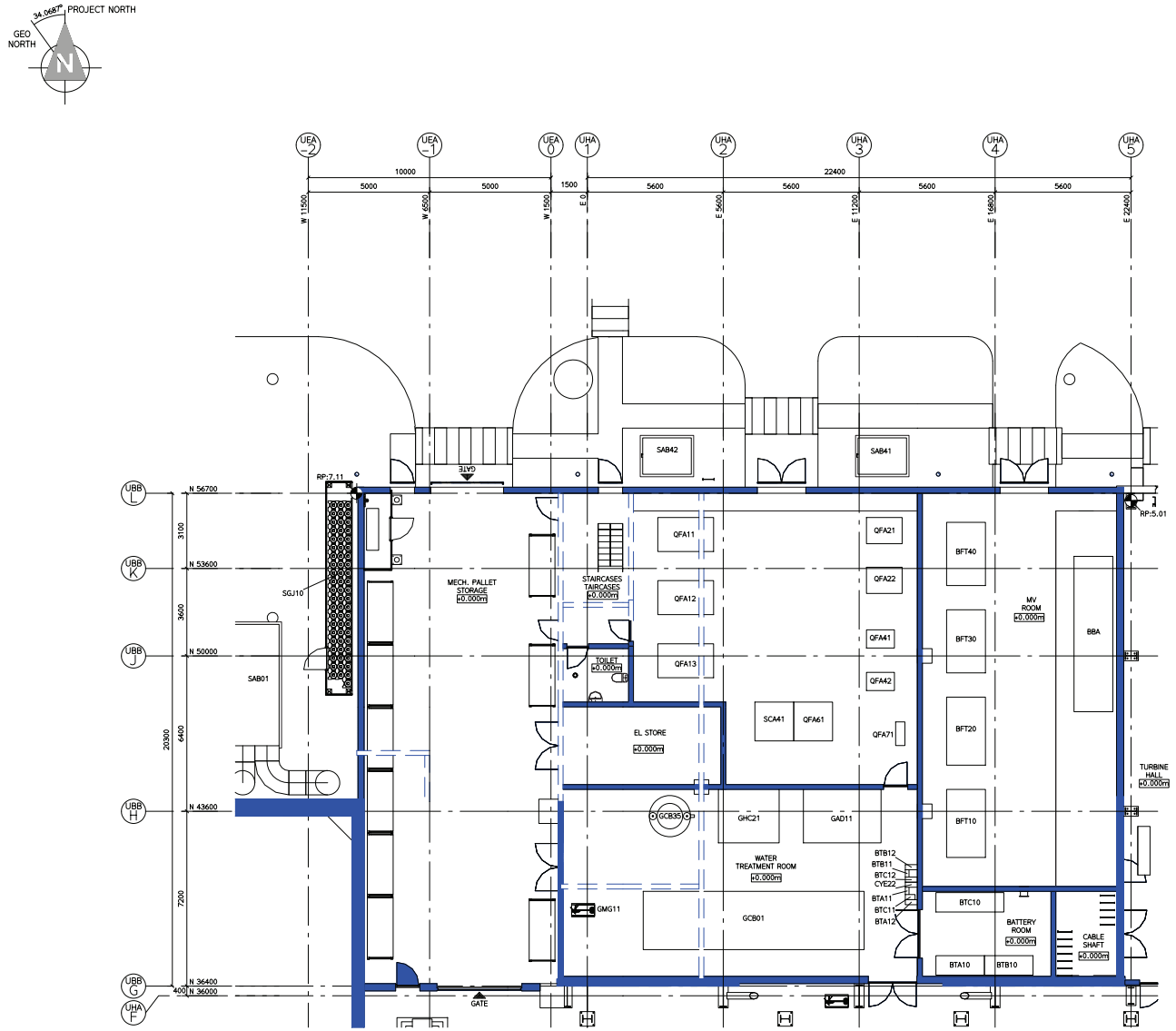


MECHANICAL EQUIPMENT		WEIGHT
GAD11	BREAK WATER TANK UNIT	7825 kg
GCB01	WATER TREATMENT PLANT UNIT	12000 kg
GCB35	BRINE MAKER TANK	3600 kg
GHC21	DEMIN WATER PUMP UNIT	7825 kg
GMG11	WATER TREATMENT PIT PUMP UNIT	100 kg
QFA11	AIR COMPRESSOR 1 UNIT	2050 kg
QFA12	AIR COMPRESSOR 2 UNIT	2050 kg
QFA13	AIR COMPRESSOR 3 UNIT	2050 kg
QFA21	REFRIGERANT AIR DRYER 1	410 kg
QFA22	REFRIGERANT AIR DRYER 2	410 kg
QFA41	ADSORPTION AIR DRYER UNIT 1	815 kg
QFA42	ADSORPTION AIR DRYER UNIT 2	815 kg
QFA61	INSTRUMENT AIR RECEIVER UNIT	0 kg
QFA71	OW SEPARATOR	unset kg
SAB01	EL ANNEX MAIN AHU	unset kg
SAB41	EL ANNEX MAIN AHU	unset kg
SAB42	EL ANNEX MAIN AHU	unset kg
SCA41	SERVICE AIR RECEIVER UNIT	unset kg
SGJ10	INERT GAS UNIT NO.1	0 kg

ELECTRICAL EQUIPMENT		WEIGHT
BBA	11 kV SWITCHGEAR	5500 kg
BFT10	400 V STATION AUX. TRANSFORMER 1	8400 kg
BFT20	400 V STATION AUX. TRANSFORMER 2	8400 kg
BFT30	690 V STATION AUX. TRANSFORMER 1	6300 kg
BFT40	690 V STATION AUX. TRANSFORMER 2	6300 kg
BTA10	DC BATTERY 1	1500 kg
BTA11	DC CONNECTION BOX 1	15 kg
BTA12	DC FUSE BOX 1	50 kg
BTB10	DC BATTERY 2	1500 kg
BTB11	DC CONNECTION BOX 2	15 kg
BTB12	DC FUSE BOX 2	50 kg
BTC10	UPS BATTERY	1500 kg
BTC11	UPS CONNECTION BOX	15 kg
BTC12	UPS FUSEBOX	25 kg
CYE22	INERT GAS PANEL	275 kg

LEGEND:

120 MINUTES FIRE RESISTING CONSTRUCTION (E.G. CONCRETE, BLOCK STONE) FOR FIRE SEGREGATION (NFPA RECOMENDATIONS)

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE
0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
1	2018.12.14	CAGCX			
0	2018.10.08	MAGAV			

OWNER:

PROJECT MANAGER:

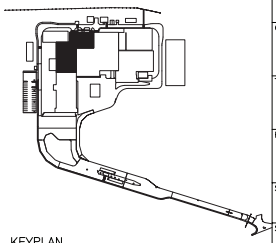
CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:
HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:
SERVICE BUILDING / EL ANNEX (UBB)
FIRE SEGREGATION
GROUND FLOOR PLAN, LEVEL: +0.000m



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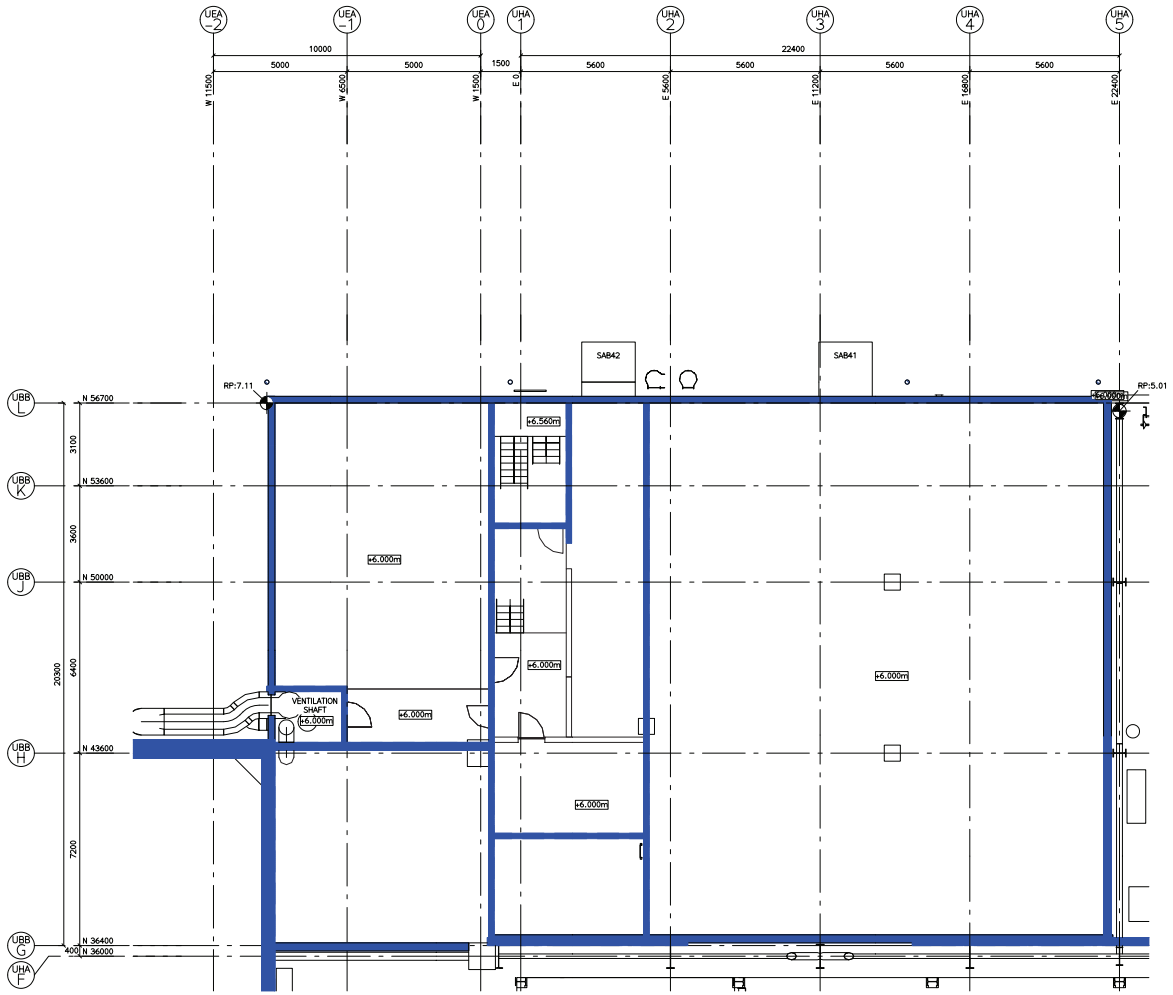
SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 (PROJECT NO.) : M4 (GR.) . J12 (NO.) . 103 (SHT.)

1 REV.



MECHANICAL EQUIPMENT

		WEIGHT
SAB41	EL ANNEX MAIN AHU	unset kg
SAB42	EL ANNEX MAIN AHU	unset kg

LEGEND:

120 MINUTES FIRE RESISTING CONSTRUCTION (E.G. CONCRETE, BLOCK STONE) FOR FIRE SEGREGATION (NFPA RECOMENDATIONS)

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
1	2018.12.14	CAGCX			
0	2018.10.08	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

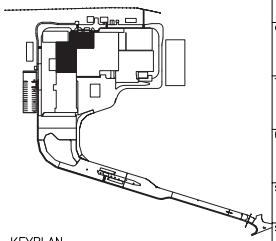
PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

SERVICE BUILDING / EL ANNEX (UBB)
FIRE SEGREGATION
PLAN VIEW, LEVEL: +6.000m



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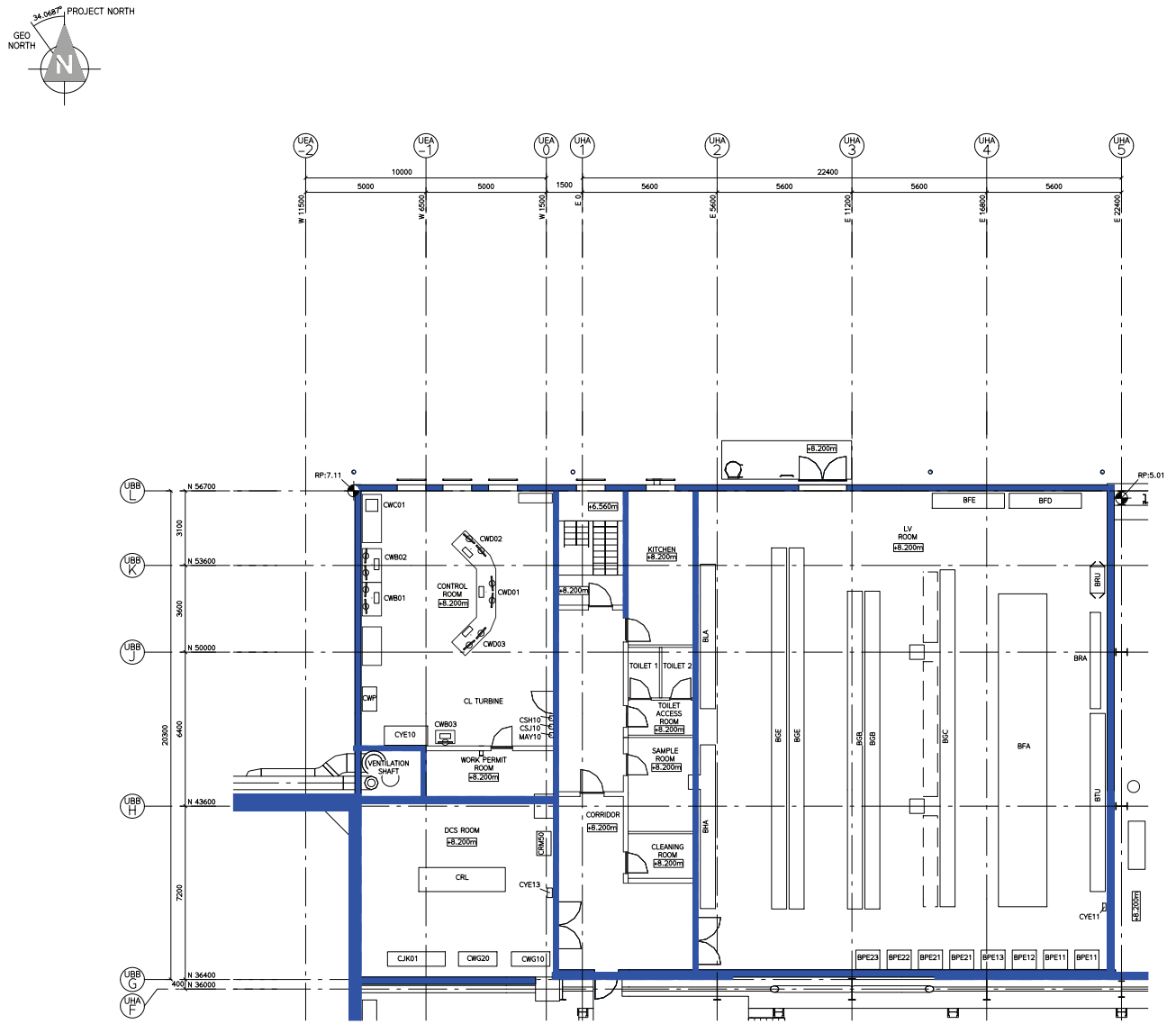
SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 (PROJECT NO.) : M4 (DR.) . J12 (NO.) . 104 (SHT.)

1 REV.



ELECTRICAL EQUIPMENT

		WEIGHT
BFA	400 V LV MAIN DIST. SWBD.	13000 kg
BFD	690 V LV MAIN SWBD. NO. 1	3500 kg
BFE	690 V LV MAIN SWBD. NO. 2	3500 kg
BGB	BOILER SWBD. NO. 1	7000 kg
BGC	COMMON AUX SWBD.	7000 kg
BGE	FEEDER LINE & GASIFIER SWBD. NO. 2	8000 kg
BHA	BUILDING SERVICE SWBD.	2500 kg
BLA	L&SP SERVICE BUILDING (UBB)	1900 kg
BPE11	FEED WATER PUMP VFD 1A	800 kg
BPE11	FEED WATER PUMP VFD 1B	800 kg
BPE12	COMBUSTION AIR BLOWERS VFD 1	800 kg
BPE13	FLUIDIZING AIR BLOWERS VFD 1	800 kg
BPE21	FEED WATER PUMP VFD 2A	800 kg
BPE21	FEED WATER PUMP VFD 2B	800 kg
BPE22	COMBUSTION AIR BLOWER VFD 2	800 kg
BPE23	FLUIDIZING AIR BLOWERS VFD 2	800 kg
BRA	400 / 230 V UPS PANEL	1000 kg
BRU	UPS, UNIT	300 kg
BTU	110/24V DC PANEL	2500 kg
CJK01	TURBINE CONTROL PANEL 1	2000 kg
CRL	DCS CPU & SERVER PANEL	300 kg
CRM50	LV MAIN DCS RIO PANEL	300 kg
CSH10	EMG. STOP PUSH BUTTON	25 kg
CSJ10	EMG. STOP PUSH BUTTON	25 kg
CWB01	SHIFT MANAGER OPW3	25 kg
CWB02	STG OPERATOR	25 kg
CWB03	FIRE DETECTION STATION	25 kg
CWC01	PRINTERS	25 kg
CWD01	OPW1 CCTV	25 kg
CWD02	OPW2	25 kg
CWD03	OPW3 ENGINEER	25 kg
CWG10	GASIFIER CONTROL PANEL NO. 1	350 kg
CWG20	GASIFIER CONTROL PANEL NO. 2	350 kg
CWP	CONTROL PANELS	200 kg
CYE10	FIRE ALARM PANEL	200 kg
CYE11	INERT GAS PANEL, ELECTRICAL SWBD ROOM	10 kg
CYE13	INERT GAS PANEL, DCS EQUIPMENT ROOM	15 kg
MAY10	EMG. STOP PUSH BUTTON	25 kg

LEGEND:

120 MINUTES FIRE RESISTING CONSTRUCTION (E.G. CONCRETE, BLOCK STONE) FOR FIRE SEGREGATION (NFPA RECOMENDATIONS)

REFERENCE:

2031:02.721.001 SECTION A-A: LOOK NORTH
2031:02.722.001 SECTION B-B: LOOK NORTH
2031:02.723.001 SECTION C-C: LOOK NORTH
2031:02.724.001 SECTION D-D: LOOK SOUTH
2031:02.731.001 SECTION E-E: LOOK EAST
2031:02.732.001 SECTION F-F: LOOK EAST
2031:02.733.001 SECTION G-G: LOOK EAST
2031:02.734.001 SECTION H-H: LOOK EAST

GENERAL NOTES:

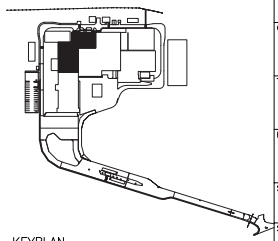
NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
1	2018.12.14	CAGCX			
0	2018.10.08	MAGAV			



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OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:
HOOTON BIO POWER PROJECT

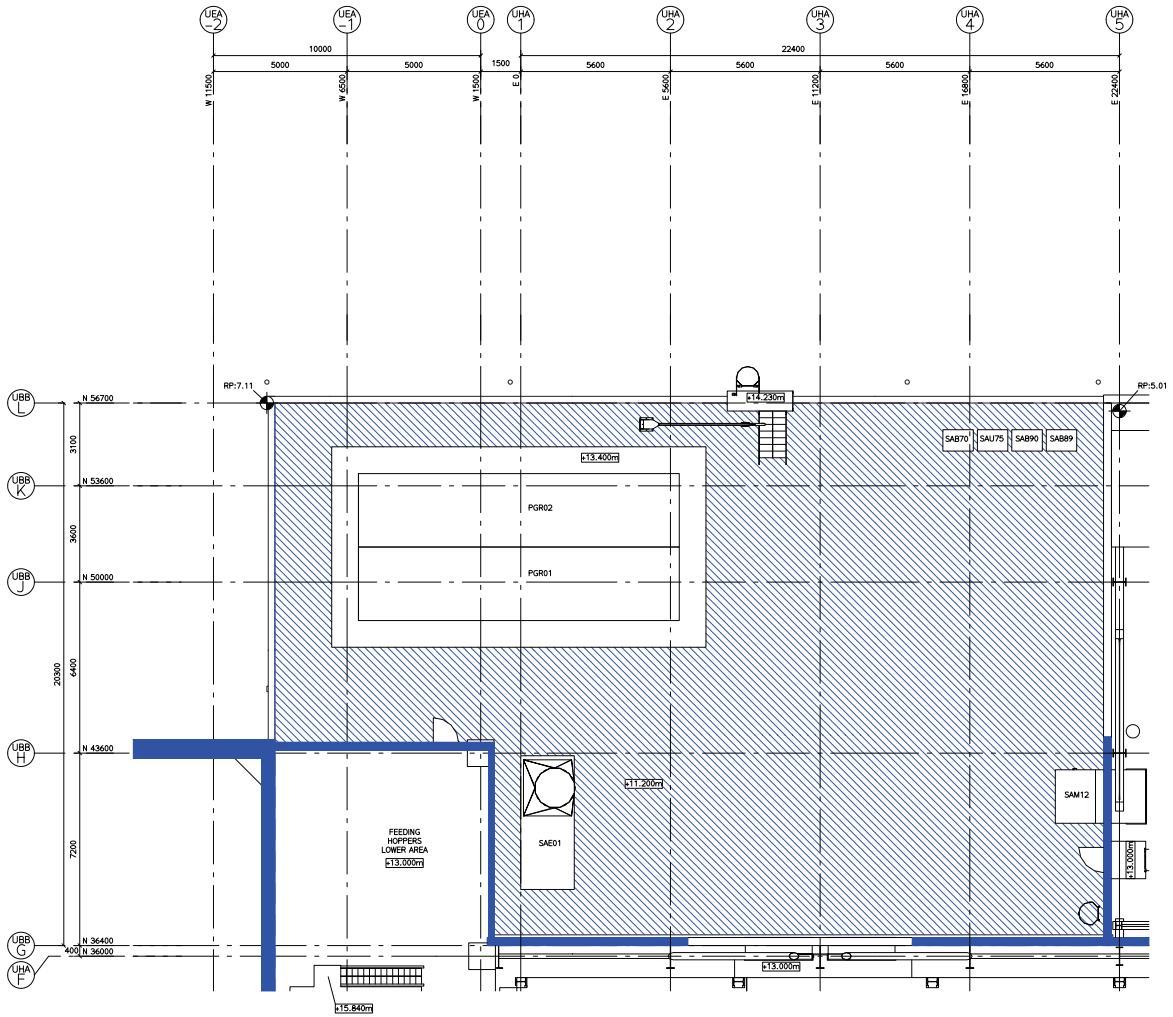
SUB-CONTRACTOR:

SUBJECT:
SERVICE BUILDING / EL ANNEX (UBB)
FIRE SEGREGATION
PLAN VIEW, LEVEL: +8.200m

SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 : M4 . J12 . 105 .
PROJECT NO. GR. NO. SHT.

1
REV.



MECHANICAL EQUIPMENT		WEIGHT
PGR01	RADIATOR COOLER UNIT 1	8500 kg
PGR02	RADIATOR COOLER UNIT 2	8500 kg
SAB70	CONDENSING UNIT 4	unset kg
SAB89	CONDENSING UNIT 1	unset kg
SAB90	CONDENSING UNIT 2	unset kg
SAE01	DIRTY EXTRACTION AHU	unset kg
SAM12	STG VENT. INTAKE	600 kg
SAU75	CONDENSING UNIT 3	unset kg

LEGEND:

120 MINUTES FIRE RESISTING CONSTRUCTION (E.G. CONCRETE, BLOCK STONE) FOR FIRE SEGREGATION (NFPA RECOMENDATIONS)

120 MINUTES FIRE RESISTANT CONCRETE ROOF

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE

0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
1	2018.12.14	CAGCX			
0	2018.10.08	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

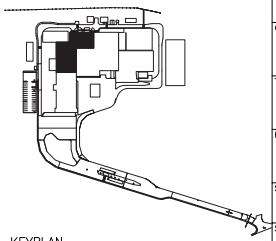
PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

SERVICE BUILDING / EL ANNEX (UBB)
FIRE SEGREGATION
EL ANNEX MAIN ROOF PLAN



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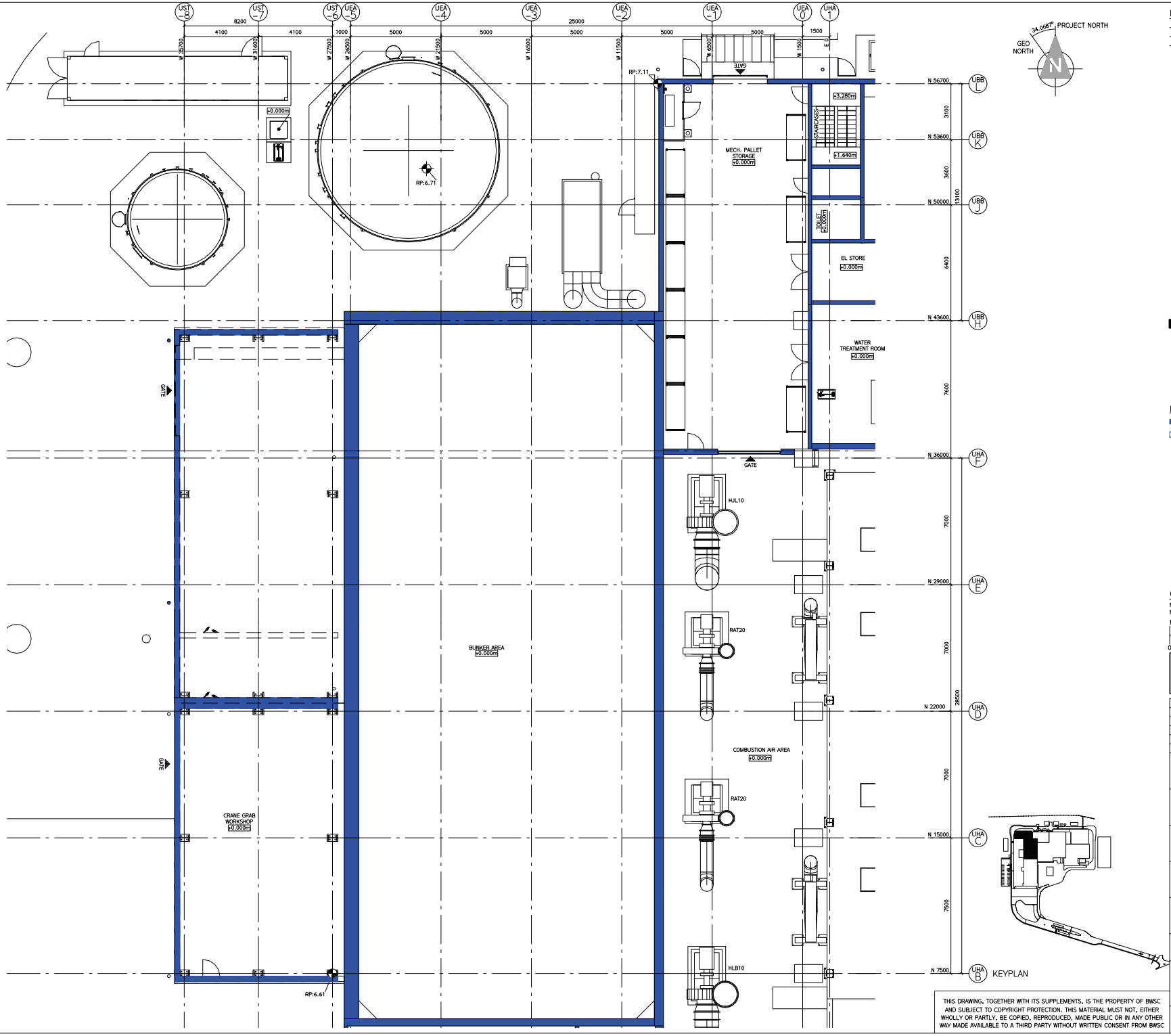
SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 : M4 . J12 . 106 . 1
PROJECT NO. GR. NO. SHT. REV.



MECHANICAL EQUIPMENT		WEIGHT
HJL10	COMBUSTION AIR BLOWER	0 kg
HLB10	COMBUSTION AIR BLOWER	0 kg
RAT20	FLUIDIZING AIR BLOWER	0 kg

NOTE:. ONLY VALID FOR UEA PIT AREA

LEGEND:

- 120 MINUTES FIRE RESISTING CONSTRUCTION (E.G. CONCRETE, BLOCK STONE) FOR FIRE SEGREGATION (NFPA RECOMENDATIONS)
- 120 MINUTES FIRE RESISTANT CONCRETE ROOF

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
1	2018.12.14	CAGCX			
0	2018.10.08	MAGAV	FEMB		CNH

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:
HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:
WASTE FUEL STORAGE AREA (UEB)
FIRE SEGREGATION
GROUND FLOOR PLAN, LEVEL +0.000m

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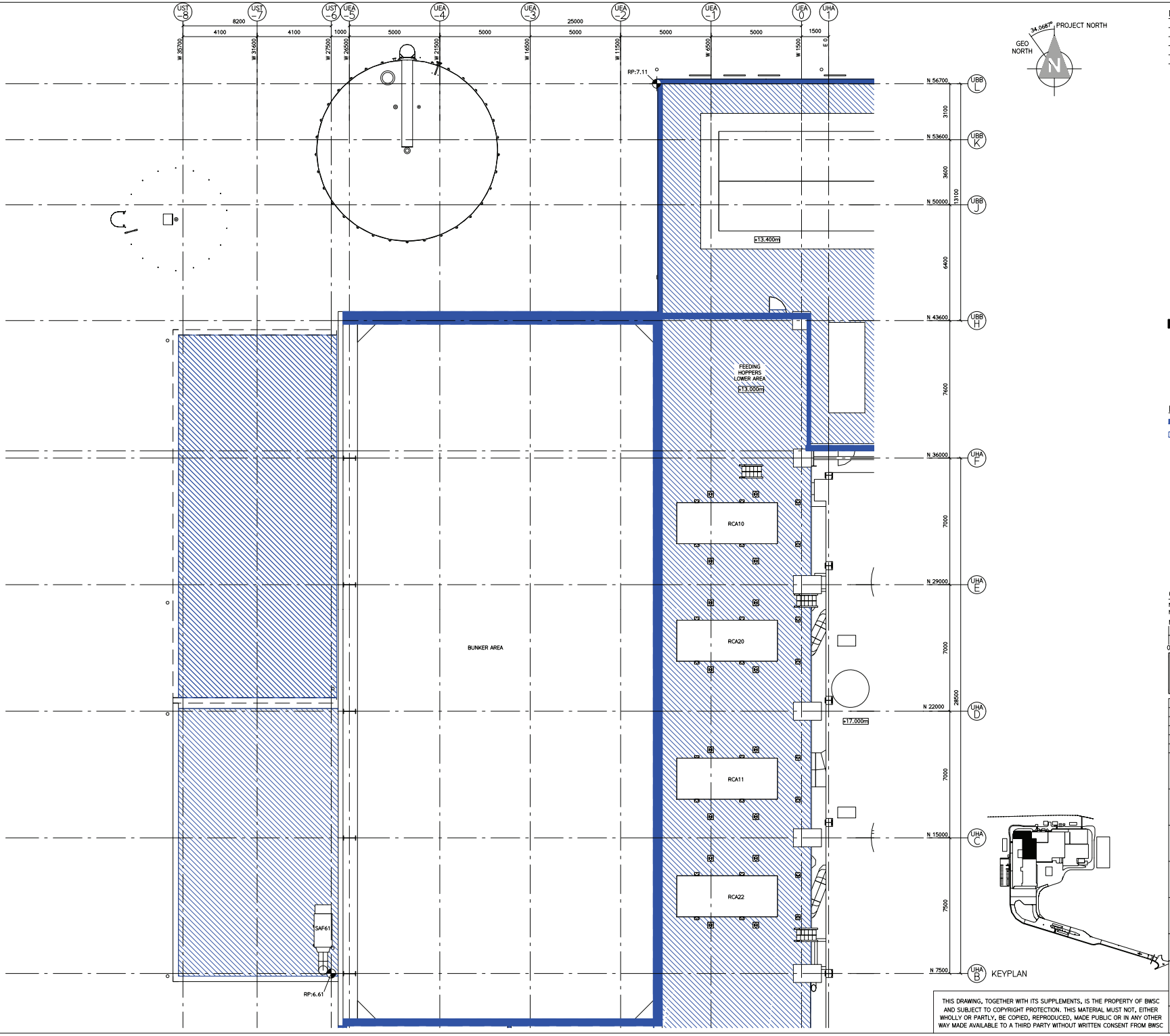
SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.: 2031 : M4 : J12 : 107 (PROJECT NO. : GR. : NO. : SHT.)

REV. 1



MECHANICAL EQUIPMENT		WEIGHT
RCA10	WASTE FEEDER 1	0 kg
RCA11	WASTE FEEDER 1	0 kg
RCA20	WASTE FEEDER 2	0 kg
RCA22	WASTE FEEDER 2	0 kg
SAF61	SHREDDER SYSTEM AREA AHU INLET	400 kg

NOTE:. ONLY VALID FOR UEA PIT AREA

LEGEND:

- 120 MINUTES FIRE RESISTING CONSTRUCTION (E.G. CONCRETE, BLOCK STONE) FOR FIRE SEGREGATION (NFPA RECOMENDATIONS)
- 120 MINUTES FIRE RESISTANT CONCRETE ROOF

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
1	2018.12.14	CAGCX			
0	2018.10.08	MAGAV			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

WASTE FUEL STORAGE AREA (UEB)
FIRE SEGREGATION
PLAN VIEW, LEVEL: +13.000m

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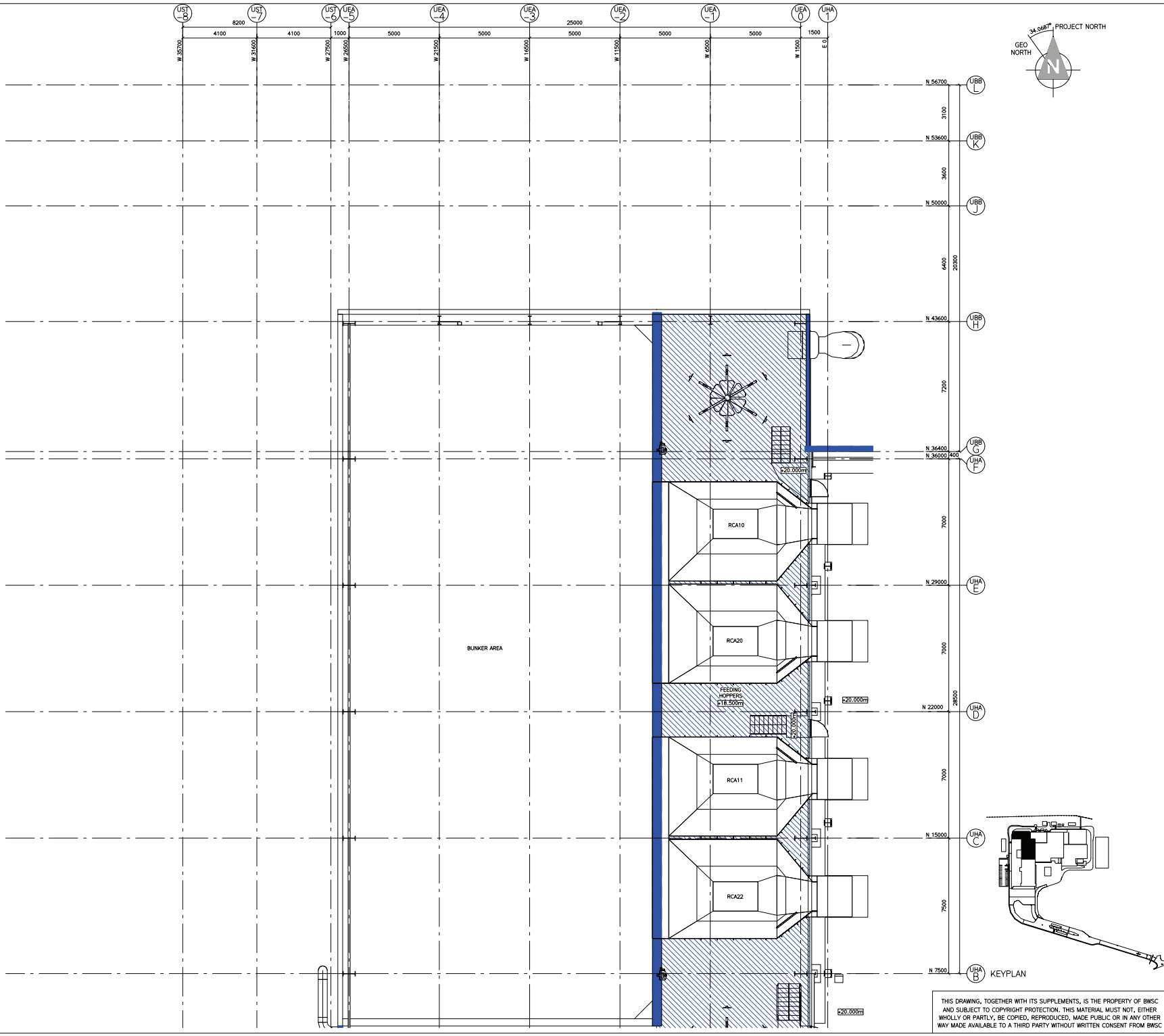
SCALE: A1=1:100 A3=1:200

BWSC DWG.NO.: 2031 (PROJECT NO.) : M4 (GR.) . J12 (NO.) . 108 (SHT.) 1 (REV.)



MECHANICAL EQUIPMENT		WEIGHT
RCA10	WASTE FEEDER 1	0 kg
RCA11	WASTE FEEDER 1	0 kg
RCA20	WASTE FEEDER 2	0 kg
RCA22	WASTE FEEDER 2	0 kg

NOTE:. ONLY VALID FOR UEA PIT AREA

LEGEND:

120 MINUTES FIRE RESISTING CONSTRUCTION (E.G. CONCRETE, BLOCK STONE) FOR FIRE SEGREGATION (NFPA RECOMENDATIONS)

120 MINUTES FIRE RESISTANT CONCRETE ROOF

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE
0 2 4 6 8 10

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
1	2018.12.14	CAGCX			
0	2018.10.11	CAGCX			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:
HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:
WASTE FUEL STORAGE AREA (UEB)
FIRE SEGREGATION
PLAN VIEW, LEVEL: +18.500m

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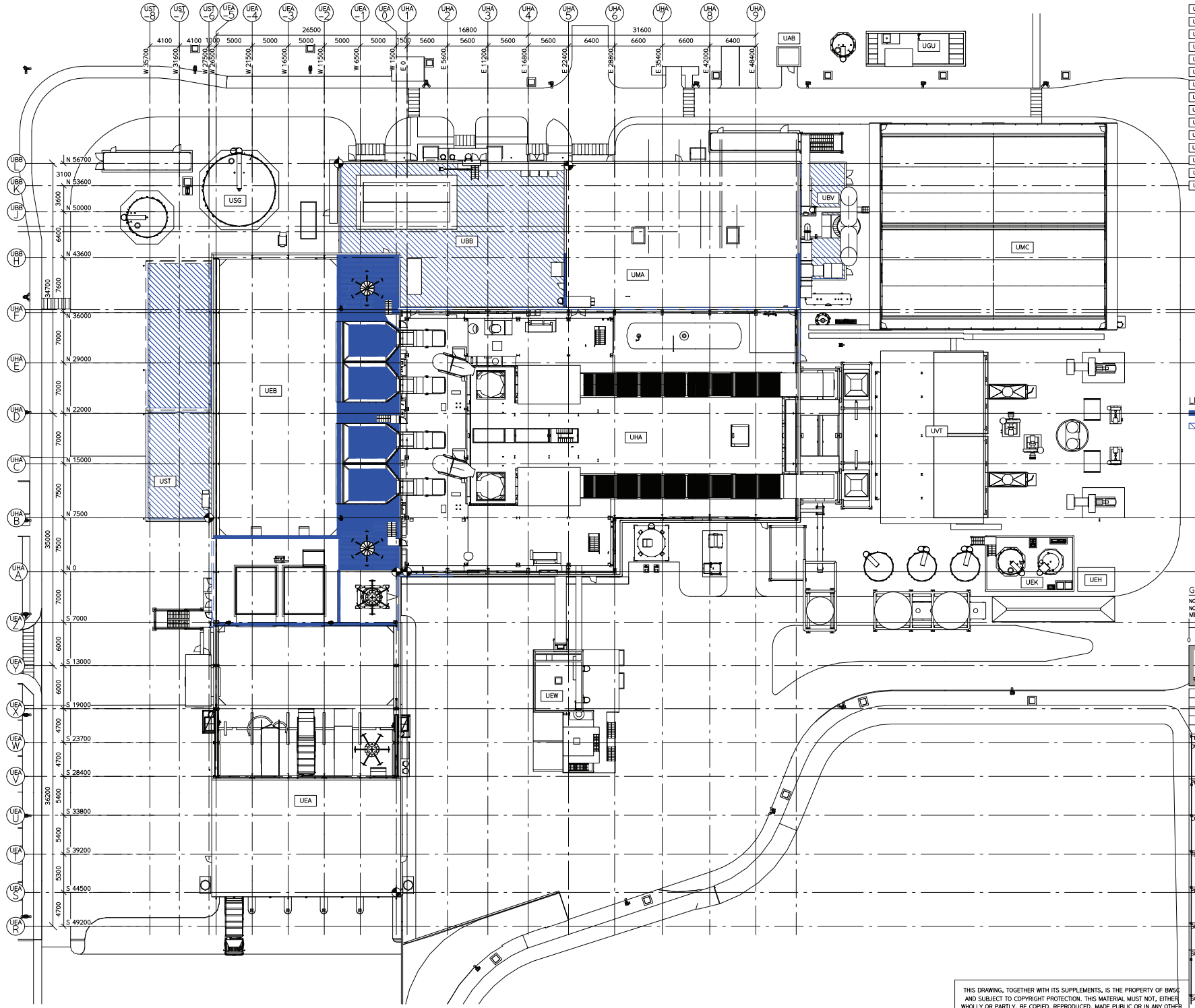
SCALE:
A1=1:100
A3=1:200

BWSC DWG.NO.:
2031 : M4 . J12 . 109 .
PROJECT NO. GR. NO. SHT.

1 REV.



UAB	11kV SUBSTATION
UBB	EL ANNEX & SERVICE BUILDING
UBV	ACC & TURBINE BUILDING EL ROOM
UEA	WASTE FUEL UNLOADING AREA
UEB	WASTE FUEL STORAGE AREA
UEH	DO & AMMONIA UNLOADING AREA
UEK	DO & AMMONIA TANK AREA
UEW	SLAG STORAGE AREA
UGU	EFFLUENT AREA
UHA	BOILER BUILDING
UMA	STEAM TURBINE BUILDING
UMC	AIR COOLED CONDENSER AREA (ACC)
USG	FIRE EQUIPMENT AREA
UST	WORKSHOP BUILDING
UVT	FLUE GAS TREATMENT AREA (FGT)

LEGEND:

120 MINUTES FIRE RESISTING CONSTRUCTION (E.G. CONCRETE, BLOCK STONE) FOR FIRE SEGREGATION (NFPA RECOMENDATIONS)

120 MINUTES FIRE RESISTANT CONCRETE ROOF

GENERAL NOTES:

NO.: 1. ALL MEASUREMENT IN mm
NO.: 2. ALL LEVELS ARE RELATIVE IN METRE

METRE 0 5 10 15 20 25

PRELIMINARY

REV	DATE	DRAWN BY	CHECKED BY	DESCRIPTION	APPROVED BY
0	2018.10.12	CAGCX			

OWNER:

PROJECT MANAGER:

CONTRACTOR:

TECHNOLOGY PROVIDER:

PROJECT:

HOOTON BIO POWER PROJECT

SUB-CONTRACTOR:

SUBJECT:

MAIN BUILDING
FIRE SEGREGATION
PLAN, LEVEL +18.500

SCALE:
A1=1:250
A3=1:500

BWSC DWG.NO.: 2031 (PROJECT NO.) : M4 (GR.) . J12 (NO.) . 110 (SHT.)

0 REV.

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Calculation

Basic information

Client:	BWSC
Scenario name:	Part I
Consultant:	Rambøll
Reference no.:	
Company type:	Industry, chemical
Basic bldg. construction:	Brick-wall/concrete-roof
Last revision:	12-12-2018 14:27:23
Revision No.:	40

Calculation options

Post flash-over model enabled:	x
Time limit [min]:	60
Plumemodel:	Heskestad

Fire brigade

Fire brigade active:	-
City area:	-
24 hour:	-
Distance/fire station [km]:	10,0
Calculated response time [min]:	15
Time before manual alarm [min]:	40

Fire start

Fire start room:	Part I
Fire start, type:	Energy formula fire
Fire start, name:	5,5 MW Fast
Fire start, code:	-
Optical smoke potential [dB/m]:	100,0
Maximum Q(t) [MW]:	5,50
Parabolic growth [MW/min²]:	0,1692
Parabolic growth [kW/s²]:	0,0470
Linear growth [MW/min]:	0,0000
Constant fire [MW]:	0,0000
Initial fire [kW]:	0,00
Doubling time [min]:	0,00

Fire installations

	[---------- In operation ----------]						
Room name	AFV Heat	AFV Smoke	AFV Timer	Sprinkler	AFA Heat	AFA Smoke	Windload [m/s]
Part I	-	-	-	-	-	-	0,00
Part II	-	-	-	-	-	-	0,00

Events

Fire progression:
Energy formula fire > 5,5 MW Fast
Plumemodel > Heskestad
00:09:40 : Critical condition in room 'Part II': Smoke free height less than 4,00 m
00:10:11 : Critical condition in room 'Part I': Smoke free height less than 5,20 m
00:17:24 : Room 'Part II' is now filled with smoke
00:31:47 : Room 'Part I' is now filled with smoke
00:40:00 : Fire brigade is alarmed
00:55:00 : Fire brigade arrived, preparing extinguishing
00:56:00 : Fire brigade ready, extinguishing started
00:56:31 : Fire is declining
00:59:15 : Fire has been put out

RHR and smoke layer temperature in all rooms

Time	Rate of heat release [kW]	Smoke layer temp. [ºC] Part I	Smoke layer temp. [ºC] Part II
00:00:00	0	20	20
00:00:09	4	20	20
00:00:19	18	20	20
00:00:28	39	20	20
00:00:38	70	20	20
00:00:48	111	20	20
00:00:58	160	20	20
00:01:07	216	20	20
00:01:17	279	20	20
00:01:27	356	20	20
00:01:36	439	20	20
00:01:45	528	20	20
00:01:55	624	22	20
00:02:05	737	22	20
00:02:14	854	22	20
00:02:24	975	22	20
00:02:33	1.111	22	20
00:02:43	1.251	23	20
00:02:53	1.408	23	20
00:03:02	1.569	23	20
00:03:12	1.735	23	20
00:03:22	1.920	24	20
00:03:31	2.112	24	20
00:03:41	2.314	24	20
00:03:51	2.521	25	23
00:04:01	2.734	25	24
00:04:10	2.961	26	24
00:04:20	3.199	26	24
00:04:30	3.442	26	24
00:04:40	3.689	27	25
00:04:49	3.946	27	25
00:04:59	4.216	28	25
00:05:09	4.493	29	25
00:05:18	4.774	29	26
00:05:28	5.076	30	26
00:05:38	5.383	30	26
00:05:48	5.500	31	27
00:05:58	5.500	31	27
00:06:07	5.500	32	27
00:06:16	5.500	32	28
00:06:24	5.500	32	28
00:06:34	5.500	33	29
00:06:44	5.500	33	29
00:06:52	5.500	34	29
00:07:00	5.500	34	30
00:07:09	5.500	34	30
00:07:18	5.500	35	30

00:07:28	5.500	35	31
00:07:38	5.500	35	31
00:07:46	5.500	35	31
00:07:53	5.500	36	32
00:08:02	5.500	36	32
00:08:10	5.500	36	32
00:08:18	5.500	36	32
00:08:27	5.500	37	33
00:08:36	5.500	37	33
00:08:46	5.500	37	33
00:08:55	5.500	38	34
00:09:05	5.500	38	34
00:09:12	5.500	38	34
00:09:19	5.500	38	34
00:09:26	5.500	39	35
00:09:33	5.500	39	35
00:09:40	5.500	39	35
00:09:40		Critical condition in room 'Part II': Smoke free height less than 4,00 m	
00:09:48	5.500	39	35
00:09:55	5.500	39	36
00:10:03	5.500	40	36
00:10:11	5.500	40	36
00:10:11		Critical condition in room 'Part I': Smoke free height less than 5,20 m	
00:10:19	5.500	40	36
00:10:27	5.500	40	37
00:10:35	5.500	41	37
00:10:44	5.500	41	37
00:10:52	5.500	41	37
00:11:01	5.500	41	38
00:11:10	5.500	42	38
00:11:19	5.500	42	38
00:11:28	5.500	42	38
00:11:35	5.500	42	39
00:11:42	5.500	43	39
00:11:50	5.500	43	39
00:11:58	5.500	43	39
00:12:06	5.500	43	40
00:12:14	5.500	44	40
00:12:22	5.500	44	40
00:12:30	5.500	44	40
00:12:39	5.500	44	41
00:12:47	5.500	44	41
00:12:55	5.500	45	41
00:13:03	5.500	45	41
00:13:12	5.500	45	42
00:13:20	5.500	45	42
00:13:28	5.500	46	42
00:13:36	5.500	46	42
00:13:44	5.500	46	43
00:13:52	5.500	46	43
00:14:00	5.500	47	43
00:14:08	5.500	47	43
00:14:16	5.500	47	43
00:14:25	5.500	47	44
00:14:33	5.500	48	44
00:14:42	5.500	48	44
00:14:51	5.500	48	44
00:15:00	5.500	48	45
00:15:10	5.500	49	45

00:15:15	5.500	49	45
00:15:20	5.500	49	45
00:15:26	5.500	49	46
00:15:31	5.500	49	46
00:15:37	5.500	50	46
00:15:43	5.500	50	46
00:15:49	5.500	50	46
00:15:55	5.500	50	46
00:16:01	5.500	50	47
00:16:08	5.500	51	47
00:16:13	5.500	51	47
00:16:21	5.500	51	47
00:16:29	5.500	51	47
00:16:35	5.500	51	48
00:16:40	5.500	52	48
00:16:49	5.500	52	48
00:16:57	5.500	52	48
00:17:07	5.500	52	49
00:17:16	5.500	53	49
00:17:24	5.500	53	49
00:17:24		Room 'Part II' is now filled with smoke	
00:17:33	5.500	53	49
00:17:43	5.500	54	50
00:17:51	5.500	54	50
00:18:00	5.500	54	50
00:18:09	5.500	54	51
00:18:18	5.500	55	51
00:18:27	5.500	55	51
00:18:36	5.500	55	51
00:18:45	5.500	56	52
00:18:54	5.500	56	52
00:19:03	5.500	56	52
00:19:12	5.500	56	52
00:19:21	5.500	57	53
00:19:30	5.500	57	53
00:19:38	5.500	57	53
00:19:47	5.500	58	54
00:19:56	5.500	58	54
00:20:05	5.500	58	54
00:20:14	5.500	58	54
00:20:23	5.500	59	55
00:20:31	5.500	59	55
00:20:40	5.500	59	55
00:20:49	5.500	59	55
00:20:58	5.500	60	56
00:21:06	5.500	60	56
00:21:15	5.500	60	56
00:21:24	5.500	61	57
00:21:33	5.500	61	57
00:21:42	5.500	61	57
00:21:50	5.500	61	57
00:21:59	5.500	62	58
00:22:08	5.500	62	58
00:22:16	5.500	62	58
00:22:25	5.500	62	58
00:22:34	5.500	63	59
00:22:42	5.500	63	59
00:22:51	5.500	63	59
00:23:00	5.500	64	60

00:23:08	5.500	64	60
00:23:17	5.500	64	60
00:23:26	5.500	64	60
00:23:34	5.500	65	61
00:23:43	5.500	65	61
00:23:52	5.500	65	61
00:24:00	5.500	65	61
00:24:09	5.500	66	62
00:24:18	5.500	66	62
00:24:26	5.500	66	62
00:24:35	5.500	66	62
00:24:43	5.500	67	63
00:24:52	5.500	67	63
00:25:00	5.500	67	63
00:25:09	5.500	67	63
00:25:17	5.500	68	64
00:25:26	5.500	68	64
00:25:35	5.500	68	64
00:25:43	5.500	69	64
00:25:52	5.500	69	65
00:26:00	5.500	69	65
00:26:09	5.500	69	65
00:26:17	5.500	70	65
00:26:26	5.500	70	66
00:26:34	5.500	70	66
00:26:43	5.500	70	66
00:26:51	5.500	71	66
00:27:00	5.500	71	67
00:27:08	5.500	71	67
00:27:16	5.500	71	67
00:27:25	5.500	72	67
00:27:33	5.500	72	68
00:27:42	5.500	72	68
00:27:50	5.500	72	68
00:27:58	5.500	73	68
00:28:07	5.500	73	69
00:28:15	5.500	73	69
00:28:24	5.500	73	69
00:28:32	5.500	74	69
00:28:40	5.500	74	70
00:28:49	5.500	74	70
00:28:57	5.500	74	70
00:29:05	5.500	75	70
00:29:14	5.500	75	71
00:29:22	5.500	75	71
00:29:30	5.500	75	71
00:29:39	5.500	76	71
00:29:47	5.500	76	72
00:29:55	5.500	76	72
00:30:04	5.500	76	72
00:30:12	5.500	77	72
00:30:20	5.500	77	73
00:30:29	5.500	77	73
00:30:37	5.500	77	73
00:30:45	5.500	78	73
00:30:53	5.500	78	74
00:31:02	5.500	78	74
00:31:10	5.500	78	74
00:31:18	5.500	79	74

00:31:26	5.500	79	75
00:31:35	5.500	79	75
00:31:43	5.500	79	75
00:31:47	5.500	79	75
00:31:47		Room 'Part I' is now filled with smoke	
00:31:55	5.500	80	75
00:32:03	5.500	80	76
00:32:12	5.500	80	76
00:32:20	5.500	80	76
00:32:28	5.500	81	76
00:32:36	5.500	81	77
00:32:44	5.500	81	77
00:32:52	5.500	81	77
00:33:01	5.500	82	77
00:33:09	5.500	82	78
00:33:17	5.500	82	78
00:33:25	5.500	82	78
00:33:33	5.500	83	78
00:33:41	5.500	83	78
00:33:49	5.500	83	79
00:33:57	5.500	83	79
00:34:06	5.500	83	79
00:34:14	5.500	84	79
00:34:22	5.500	84	80
00:34:30	5.500	84	80
00:34:38	5.500	84	80
00:34:46	5.500	85	80
00:34:54	5.500	85	81
00:35:02	5.500	85	81
00:35:10	5.500	85	81
00:35:18	5.500	86	81
00:35:26	5.500	86	81
00:35:34	5.500	86	82
00:35:42	5.500	86	82
00:35:50	5.500	87	82
00:35:58	5.500	87	82
00:36:06	5.500	87	83
00:36:14	5.500	87	83
00:36:22	5.500	87	83
00:36:30	5.500	88	83
00:36:38	5.500	88	84
00:36:46	5.500	88	84
00:36:54	5.500	88	84
00:37:02	5.500	89	84
00:37:10	5.500	89	84
00:37:18	5.500	89	85
00:37:26	5.500	89	85
00:37:34	5.500	89	85
00:37:42	5.500	90	85
00:37:50	5.500	90	86
00:37:58	5.500	90	86
00:38:06	5.500	90	86
00:38:14	5.500	91	86
00:38:22	5.500	91	86
00:38:29	5.500	91	87
00:38:37	5.500	91	87
00:38:45	5.500	92	87
00:38:53	5.500	92	87
00:39:01	5.500	92	88

00:39:09	5.500	92	88
00:39:17	5.500	92	88
00:39:25	5.500	93	88
00:39:32	5.500	93	88
00:39:40	5.500	93	89
00:39:48	5.500	93	89
00:39:56	5.500	94	89
00:40:00	5.500	94	89
00:40:00		Fire brigade is alarmed	
00:40:07	5.500	94	89
00:40:15	5.500	94	90
00:40:23	5.500	94	90
00:40:31	5.500	95	90
00:40:39	5.500	95	90
00:40:46	5.500	95	91
00:40:54	5.500	95	91
00:41:02	5.500	95	91
00:41:10	5.500	96	91
00:41:18	5.500	96	91
00:41:25	5.500	96	92
00:41:33	5.500	96	92
00:41:41	5.500	96	92
00:41:49	5.500	97	92
00:41:56	5.500	97	92
00:42:04	5.500	97	93
00:42:12	5.500	97	93
00:42:20	5.500	98	93
00:42:27	5.500	98	93
00:42:35	5.500	98	94
00:42:43	5.500	98	94
00:42:50	5.500	98	94
00:42:58	5.500	99	94
00:43:06	5.500	99	94
00:43:14	5.500	99	95
00:43:21	5.500	99	95
00:43:29	5.500	99	95
00:43:37	5.500	100	95
00:43:44	5.500	100	95
00:43:52	5.500	100	96
00:44:00	5.500	100	96
00:44:07	5.500	101	96
00:44:15	5.500	101	96
00:44:23	5.500	101	96
00:44:30	5.500	101	97
00:44:38	5.500	101	97
00:44:46	5.500	102	97
00:44:53	5.500	102	97
00:45:01	5.500	102	98
00:45:08	5.500	102	98
00:45:16	5.500	102	98
00:45:24	5.500	103	98
00:45:31	5.500	103	98
00:45:39	5.500	103	99
00:45:46	5.500	103	99
00:45:54	5.500	103	99
00:46:02	5.500	104	99
00:46:09	5.500	104	99
00:46:17	5.500	104	100
00:46:24	5.500	104	100

00:46:32	5.500	105	100
00:46:39	5.500	105	100
00:46:47	5.500	105	100
00:46:54	5.500	105	101
00:47:02	5.500	105	101
00:47:10	5.500	106	101
00:47:17	5.500	106	101
00:47:25	5.500	106	101
00:47:32	5.500	106	102
00:47:40	5.500	106	102
00:47:47	5.500	107	102
00:47:55	5.500	107	102
00:48:02	5.500	107	102
00:48:10	5.500	107	103
00:48:17	5.500	107	103
00:48:25	5.500	108	103
00:48:32	5.500	108	103
00:48:40	5.500	108	103
00:48:47	5.500	108	104
00:48:55	5.500	108	104
00:49:02	5.500	109	104
00:49:10	5.500	109	104
00:49:17	5.500	109	104
00:49:24	5.500	109	105
00:49:32	5.500	109	105
00:49:39	5.500	110	105
00:49:47	5.500	110	105
00:49:54	5.500	110	105
00:50:02	5.500	110	106
00:50:09	5.500	110	106
00:50:16	5.500	111	106
00:50:24	5.500	111	106
00:50:31	5.500	111	106
00:50:39	5.500	111	107
00:50:46	5.500	111	107
00:50:54	5.500	112	107
00:51:01	5.500	112	107
00:51:08	5.500	112	107
00:51:16	5.500	112	108
00:51:23	5.500	112	108
00:51:30	5.500	113	108
00:51:38	5.500	113	108
00:51:45	5.500	113	108
00:51:52	5.500	113	109
00:52:00	5.500	113	109
00:52:07	5.500	114	109
00:52:14	5.500	114	109
00:52:22	5.500	114	109
00:52:29	5.500	114	109
00:52:37	5.500	114	110
00:52:44	5.500	115	110
00:52:51	5.500	115	110
00:52:58	5.500	115	110
00:53:06	5.500	115	110
00:53:13	5.500	115	111
00:53:20	5.500	116	111
00:53:28	5.500	116	111
00:53:35	5.500	116	111
00:53:42	5.500	116	111

00:53:50	5.500	116	112
00:53:57	5.500	116	112
00:54:04	5.500	117	112
00:54:11	5.500	117	112
00:54:19	5.500	117	112
00:54:26	5.500	117	113
00:54:33	5.500	117	113
00:54:41	5.500	118	113
00:54:48	5.500	118	113
00:54:55	5.500	118	113
00:55:00	5.500	118	113
00:55:00		Fire brigade arrived, preparing extinguishing	
00:55:07	5.500	118	114
00:55:14	5.500	118	114
00:55:21	5.500	119	114
00:55:28	5.500	119	114
00:55:36	5.500	119	114
00:55:43	5.500	119	114
00:55:50	5.500	119	115
00:56:00	5.500	120	115
00:56:00		Fire brigade ready, extinguishing started	
00:56:07	5.500	120	115
00:56:14	5.500	120	115
00:56:21	5.500	120	115
00:56:30	5.500	120	116
00:56:31	5.441	120	116
00:56:31		Fire is declining	
00:56:41	5.124	121	116
00:56:50	4.808	121	116
00:57:00	4.491	121	116
00:57:09	4.175	121	117
00:57:19	3.858	121	117
00:57:28	3.542	121	117
00:57:38	3.226	121	117
00:57:47	2.909	121	117
00:57:57	2.593	121	117
00:58:06	2.276	121	117
00:58:16	1.960	120	117
00:58:25	1.643	120	117
00:58:35	1.327	120	117
00:58:45	995	120	117
00:58:54	679	119	117
00:59:04	363	119	116
00:59:13	46	118	116
00:59:15	0	118	116
00:59:15		Fire has been put out	

Simulation results for each room

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:00:00	0,00		36,00	20		-0,010
00:00:09	0,00		36,00	20		0,000
00:00:19	0,00		36,00	20		0,000
00:00:28	0,00		36,00	20		0,000
00:00:38	0,00		36,00	20		0,000
00:00:48	0,00		36,00	20		0,000
00:00:58	0,00		36,00	20		0,000
00:01:07	0,00		36,00	20		0,000
00:01:17	0,01		36,00	20		0,000
00:01:27	0,01		36,00	20		0,000
00:01:36	0,01		36,00	20		0,000
00:01:45	0,01		36,00	20		0,000
00:01:55	0,01	0,11	34,87	22		0,083
00:02:05	0,01	0,12	33,37	22	0,09	0,115
00:02:14	0,01	0,13	31,95	22	0,10	0,154
00:02:24	0,01	0,14	30,61	22	0,10	0,199
00:02:33	0,01	0,15	29,23	22	0,11	0,258
00:02:43	0,01	0,17	27,93	23	0,12	0,325
00:02:53	0,01	0,18	26,61	23	0,13	0,409
00:03:02	0,01	0,19	25,37	23	0,14	0,505
00:03:12	0,01	0,21	24,20	23	0,15	0,614
00:03:22	0,01	0,23	23,03	24	0,16	0,712
00:03:31	0,01	0,25	22,01	24	0,16	0,767
00:03:41	0,01	0,27	21,15	24	0,17	0,801
00:03:51	0,01	0,29	20,46	25	0,18	1,197
00:04:01	0,01	0,31	19,91	25	0,19	1,395
00:04:10	0,01	0,33	19,44	26	0,19	1,623
00:04:20	0,01	0,36	19,04	26	0,20	1,881
00:04:30	0,01	0,38	18,66	26	0,20	2,165
00:04:40	0,01	0,41	18,28	27	0,21	2,474
00:04:49	0,01	0,44	17,84	27	0,21	2,821
00:04:59	0,01	0,47	17,34	28	0,22	3,208
00:05:09	0,01	0,50	16,83	29	0,23	3,627
00:05:18	0,01	0,53	16,31	29	0,24	4,077
00:05:28	0,01	0,56	15,78	30	0,25	4,587
00:05:38	0,01	0,59	15,25	30	0,26	5,134
00:05:48	0,01	0,62	14,71	31	0,26	5,253
00:05:58	0,01	0,65	14,19	31	0,27	5,116
00:06:07	0,01	0,68	13,69	32	0,28	4,990
00:06:16	0,01	0,71	13,26	32	0,29	4,888
00:06:24	0,01	0,73	12,81	32	0,30	4,788
00:06:34	0,01	0,75	12,36	33	0,31	4,689
00:06:44	0,01	0,78	11,89	33	0,32	4,593
00:06:52	0,01	0,80	11,51	34	0,32	4,517
00:07:00	0,01	0,82	11,13	34	0,33	4,443
00:07:09	0,01	0,84	10,74	34	0,34	4,370
00:07:18	0,01	0,86	10,35	35	0,35	4,299
00:07:28	0,01	0,88	9,97	35	0,35	4,230
00:07:38	0,01	0,91	9,58	35	0,36	4,162
00:07:46	0,01	0,92	9,29	35	0,37	4,112
00:07:53	0,01	0,94	9,01	36	0,37	4,063
00:08:02	0,01	0,96	8,72	36	0,38	4,015
00:08:10	0,01	0,98	8,43	36	0,39	3,967

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:08:18	0,01	1,00	8,15	36	0,39	3,920
00:08:27	0,01	1,02	7,87	37	0,40	3,874
00:08:36	0,01	1,04	7,59	37	0,40	3,829
00:08:46	0,01	1,06	7,31	37	0,41	3,785
00:08:55	0,01	1,08	7,03	38	0,41	3,741
00:09:05	0,01	1,10	6,75	38	0,42	3,698
00:09:12	0,01	1,11	6,57	38	0,42	3,669
00:09:19	0,01	1,13	6,39	38	0,43	3,641
00:09:26	0,01	1,14	6,20	39	0,43	3,613
00:09:33	0,01	1,16	6,02	39	0,44	3,585
00:09:40	0,01	1,18	5,84	39	0,44	3,558
00:09:40	Critical condition in room 'Part II': Smoke free height less than 4,00 m					
00:09:48	0,01	1,19	5,66	39	0,44	3,530
00:09:55	0,01	1,21	5,49	39	0,45	3,503
00:10:03	0,01	1,22	5,31	40	0,45	3,476
00:10:11	0,01	1,24	5,13	40	0,45	3,449
00:10:11	Critical condition in room 'Part I': Smoke free height less than 5,20 m					
00:10:19	0,01	1,26	4,96	40	0,46	3,423
00:10:27	0,01	1,28	4,78	40	0,46	3,397
00:10:35	0,01	1,29	4,61	41	0,46	3,370
00:10:44	0,01	1,31	4,44	41	0,47	3,345
00:10:52	0,01	1,33	4,27	41	0,47	3,319
00:11:01	0,01	1,35	4,10	41	0,48	3,293
00:11:10	0,01	1,37	3,93	42	0,48	3,268
00:11:19	0,01	1,39	3,76	42	0,48	3,242
00:11:28	0,01	1,41	3,61	42	0,49	3,212
00:11:35	0,01	1,42	3,49	42	0,49	3,184
00:11:42	0,01	1,44	3,36	43	0,49	3,152
00:11:50	0,01	1,45	3,24	43	0,49	3,117
00:11:58	0,01	1,47	3,11	43	0,50	3,080
00:12:06	0,01	1,49	2,99	43	0,50	3,041
00:12:14	0,01	1,51	2,87	44	0,50	3,000
00:12:22	0,01	1,52	2,75	44	0,50	2,958
00:12:30	0,01	1,54	2,64	44	0,51	2,914
00:12:39	0,01	1,56	2,52	44	0,51	2,868
00:12:47	0,01	1,58	2,41	44	0,51	2,821
00:12:55	0,01	1,60	2,31	45	0,51	2,774
00:13:03	0,01	1,61	2,20	45	0,52	2,725
00:13:12	0,01	1,63	2,10	45	0,52	2,676
00:13:20	0,01	1,65	2,01	45	0,52	2,626
00:13:28	0,01	1,67	1,91	46	0,52	2,571
00:13:36	0,01	1,68	1,83	46	0,52	2,515
00:13:44	0,00	1,70	1,74	46	0,53	2,457
00:13:52	0,00	1,72	1,66	46	0,53	2,398
00:14:00	0,00	1,74	1,58	47	0,53	2,337
00:14:08	0,00	1,76	1,50	47	0,53	2,274
00:14:16	0,00	1,77	1,42	47	0,53	2,210
00:14:25	0,00	1,79	1,35	47	0,54	2,145
00:14:33	0,00	1,81	1,27	48	0,54	2,077
00:14:42	0,00	1,83	1,20	48	0,54	2,007
00:14:51	0,00	1,85	1,12	48	0,54	1,935
00:15:00	0,00	1,87	1,05	48	0,54	1,861
00:15:10	0,00	1,90	0,98	49	0,55	1,784
00:15:15	0,00	1,91	0,95	49	0,55	1,744
00:15:20	0,00	1,92	0,91	49	0,55	1,704
00:15:26	0,00	1,93	0,87	49	0,55	1,663

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:15:31	0,00	1,94	0,84	49	0,55	1,621
00:15:37	0,00	1,96	0,81	50	0,55	1,579
00:15:43	0,00	1,97	0,77	50	0,55	1,536
00:15:49	0,00	1,99	0,74	50	0,56	1,493
00:15:55	0,00	2,00	0,70	50	0,56	1,449
00:16:01	0,00	2,01	0,67	50	0,56	1,405
00:16:08	0,00	2,03	0,64	51	0,56	1,363
00:16:13	0,00	2,04	0,61	51	0,56	1,325
00:16:21	0,00	2,06	0,58	51	0,56	1,273
00:16:29	0,00	2,08	0,55	51	0,56	1,222
00:16:35	0,00	2,09	0,53	51	0,57	1,191
00:16:40	0,00	2,11	0,51	52	0,57	1,159
00:16:49	0,00	2,13	0,47	52	0,57	1,107
00:16:57	0,00	2,15	0,45	52	0,57	1,060
00:17:07	0,00	2,17	0,42	52	0,57	1,006
00:17:16	0,00	2,19	0,39	53	0,58	0,958
00:17:24	0,00	2,21	0,37	53	0,58	0,916
00:17:24	Room 'Part II' is now filled with smoke					
00:17:33	0,00	2,23	0,34	53	0,58	0,869
00:17:43	0,00	2,26	0,32	54	0,58	0,825
00:17:51	0,00	2,28	0,31	54	0,58	0,786
00:18:00	0,00	2,30	0,29	54	0,59	0,744
00:18:09	0,00	2,32	0,27	54	0,59	0,705
00:18:18	0,00	2,34	0,25	55	0,59	0,670
00:18:27	0,00	2,36	0,24	55	0,59	0,632
00:18:36	0,00	2,38	0,23	55	0,59	0,597
00:18:45	0,00	2,40	0,21	56	0,60	0,565
00:18:54	0,00	2,43	0,20	56	0,60	0,531
00:19:03	0,00	2,45	0,19	56	0,60	0,499
00:19:12	0,00	2,47	0,18	56	0,60	0,469
00:19:21	0,00	2,49	0,17	57	0,60	0,439
00:19:30	0,00	2,51	0,16	57	0,61	0,410
00:19:38	0,00	2,53	0,15	57	0,61	0,383
00:19:47	0,00	2,55	0,14	58	0,61	0,355
00:19:56	0,00	2,58	0,14	58	0,61	0,328
00:20:05	0,00	2,60	0,13	58	0,61	0,303
00:20:14	0,00	2,62	0,12	58	0,62	0,278
00:20:23	0,00	2,64	0,12	59	0,62	0,253
00:20:31	0,00	2,66	0,11	59	0,62	0,230
00:20:40	0,00	2,68	0,10	59	0,62	0,207
00:20:49	0,00	2,70	0,10	59	0,62	0,184
00:20:58	0,00	2,72	0,09	60	0,63	0,163
00:21:06	0,00	2,75	0,09	60	0,63	0,142
00:21:15	0,00	2,77	0,09	60	0,63	0,121
00:21:24	0,00	2,79	0,08	61	0,63	0,101
00:21:33	0,00	2,81	0,08	61	0,63	0,082
00:21:42	0,00	2,83	0,07	61	0,64	0,063
00:21:50	0,00	2,85	0,07	61	0,64	0,045
00:21:59	0,00	2,87	0,07	62	0,64	0,028
00:22:08	0,00	2,89	0,06	62	0,64	0,011
00:22:16	0,00	2,91	0,06	62	0,65	-0,002
00:22:25	0,00	2,93	0,06	62	0,65	-0,016
00:22:34	0,00	2,96	0,05	63	0,65	-0,031
00:22:42	0,00	2,98	0,05	63	0,65	-0,046
00:22:51	0,00	3,00	0,05	63	0,65	-0,060
00:23:00	0,00	3,02	0,05	64	0,66	-0,075

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:23:08	0,00	3,04	0,05	64	0,66	-0,089
00:23:17	0,00	3,06	0,04	64	0,66	-0,103
00:23:26	0,00	3,08	0,04	64	0,66	-0,117
00:23:34	0,00	3,10	0,04	65	0,66	-0,131
00:23:43	0,00	3,12	0,04	65	0,67	-0,145
00:23:52	0,00	3,14	0,04	65	0,67	-0,158
00:24:00	0,00	3,16	0,04	65	0,67	-0,172
00:24:09	0,00	3,18	0,03	66	0,67	-0,185
00:24:18	0,00	3,20	0,03	66	0,67	-0,198
00:24:26	0,00	3,22	0,03	66	0,68	-0,211
00:24:35	0,00	3,24	0,03	66	0,68	-0,223
00:24:43	0,00	3,27	0,03	67	0,68	-0,236
00:24:52	0,00	3,29	0,03	67	0,68	-0,248
00:25:00	0,00	3,31	0,03	67	0,69	-0,261
00:25:09	0,00	3,33	0,02	67	0,69	-0,273
00:25:17	0,00	3,35	0,02	68	0,69	-0,285
00:25:26	0,00	3,37	0,02	68	0,69	-0,297
00:25:35	0,00	3,39	0,02	68	0,69	-0,309
00:25:43	0,00	3,41	0,02	69	0,70	-0,321
00:25:52	0,00	3,43	0,02	69	0,70	-0,332
00:26:00	0,00	3,45	0,02	69	0,70	-0,344
00:26:09	0,00	3,47	0,02	69	0,70	-0,355
00:26:17	0,00	3,49	0,02	70	0,70	-0,367
00:26:26	0,00	3,51	0,02	70	0,71	-0,378
00:26:34	0,00	3,53	0,02	70	0,71	-0,389
00:26:43	0,00	3,55	0,01	70	0,71	-0,400
00:26:51	0,00	3,57	0,01	71	0,71	-0,411
00:27:00	0,00	3,59	0,01	71	0,71	-0,422
00:27:08	0,00	3,61	0,01	71	0,72	-0,433
00:27:16	0,00	3,63	0,01	71	0,72	-0,444
00:27:25	0,00	3,65	0,01	72	0,72	-0,455
00:27:33	0,00	3,67	0,01	72	0,72	-0,465
00:27:42	0,00	3,69	0,01	72	0,73	-0,476
00:27:50	0,00	3,71	0,01	72	0,73	-0,487
00:27:58	0,00	3,73	0,01	73	0,73	-0,497
00:28:07	0,00	3,75	0,01	73	0,73	-0,507
00:28:15	0,00	3,77	0,01	73	0,73	-0,518
00:28:24	0,00	3,79	0,01	73	0,74	-0,528
00:28:32	0,00	3,81	0,01	74	0,74	-0,538
00:28:40	0,00	3,83	0,01	74	0,74	-0,548
00:28:49	0,00	3,84	0,01	74	0,74	-0,558
00:28:57	0,00	3,86	0,01	74	0,74	-0,568
00:29:05	0,00	3,88	0,01	75	0,75	-0,578
00:29:14	0,00	3,90	0,01	75	0,75	-0,588
00:29:22	0,00	3,92	0,01	75	0,75	-0,598
00:29:30	0,00	3,94	0,01	75	0,75	-0,608
00:29:39	0,00	3,96		76	0,76	-0,618
00:29:47	0,00	3,98		76	0,76	-0,627
00:29:55	0,00	4,00		76	0,76	-0,637
00:30:04	0,00	4,02		76	0,76	-0,647
00:30:12	0,00	4,04		77	0,76	-0,656
00:30:20	0,00	4,06		77	0,77	-0,666
00:30:29	0,00	4,08		77	0,77	-0,675
00:30:37	0,00	4,10		77	0,77	-0,685
00:30:45	0,00	4,12		78	0,77	-0,694
00:30:53	0,00	4,13		78	0,77	-0,703

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:31:02	0,00	4,15		78	0,78	-0,713
00:31:10	0,00	4,17		78	0,78	-0,722
00:31:18	0,00	4,19		79	0,78	-0,731
00:31:26	0,00	4,21		79	0,78	-0,740
00:31:35	0,00	4,23		79	0,79	-0,749
00:31:43	0,00	4,25		79	0,79	-0,759
00:31:47	0,00	4,26		79	0,79	-0,765
00:31:47	Room 'Part I' is now filled with smoke					
00:31:55	0,00	4,28		80	0,79	-0,774
00:32:03	0,00	4,30		80	0,79	-0,782
00:32:12	0,00	4,32		80	0,80	-0,791
00:32:20	0,00	4,33		80	0,80	-0,799
00:32:28	0,00	4,35		81	0,80	-0,808
00:32:36	0,00	4,37		81	0,80	-0,817
00:32:44	0,00	4,39		81	0,80	-0,825
00:32:52	0,00	4,41		81	0,81	-0,833
00:33:01	0,00	4,43		82	0,81	-0,842
00:33:09	0,00	4,45		82	0,81	-0,850
00:33:17	0,00	4,47		82	0,81	-0,859
00:33:25	0,00	4,48		82	0,81	-0,867
00:33:33	0,00	4,50		83	0,82	-0,875
00:33:41	0,00	4,52		83	0,82	-0,884
00:33:49	0,00	4,54		83	0,82	-0,892
00:33:57	0,00	4,56		83	0,82	-0,900
00:34:06	0,00	4,58		83	0,83	-0,908
00:34:14	0,00	4,60		84	0,83	-0,917
00:34:22	0,00	4,61		84	0,83	-0,925
00:34:30	0,00	4,63		84	0,83	-0,933
00:34:38	0,00	4,65		84	0,83	-0,941
00:34:46	0,00	4,67		85	0,84	-0,949
00:34:54	0,00	4,69		85	0,84	-0,957
00:35:02	0,00	4,71		85	0,84	-0,965
00:35:10	0,00	4,72		85	0,84	-0,973
00:35:18	0,00	4,74		86	0,85	-0,981
00:35:26	0,00	4,76		86	0,85	-0,989
00:35:34	0,00	4,78		86	0,85	-0,997
00:35:42	0,00	4,80		86	0,85	-1,005
00:35:50	0,00	4,82		87	0,85	-1,013
00:35:58	0,00	4,83		87	0,86	-1,021
00:36:06	0,00	4,85		87	0,86	-1,028
00:36:14	0,00	4,87		87	0,86	-1,036
00:36:22	0,00	4,89		87	0,86	-1,044
00:36:30	0,00	4,91		88	0,86	-1,052
00:36:38	0,00	4,92		88	0,87	-1,060
00:36:46	0,00	4,94		88	0,87	-1,067
00:36:54	0,00	4,96		88	0,87	-1,075
00:37:02	0,00	4,98		89	0,87	-1,083
00:37:10	0,00	5,00		89	0,88	-1,090
00:37:18	0,00	5,01		89	0,88	-1,098
00:37:26	0,00	5,03		89	0,88	-1,105
00:37:34	0,00	5,05		89	0,88	-1,113
00:37:42	0,00	5,07		90	0,88	-1,120
00:37:50	0,00	5,09		90	0,89	-1,128
00:37:58	0,00	5,10		90	0,89	-1,135
00:38:06	0,00	5,12		90	0,89	-1,143
00:38:14	0,00	5,14		91	0,89	-1,150

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:38:22	0,00	5,16		91	0,90	-1,158
00:38:29	0,00	5,17		91	0,90	-1,165
00:38:37	0,00	5,19		91	0,90	-1,172
00:38:45	0,00	5,21		92	0,90	-1,180
00:38:53	0,00	5,23		92	0,90	-1,187
00:39:01	0,00	5,25		92	0,91	-1,194
00:39:09	0,00	5,26		92	0,91	-1,202
00:39:17	0,00	5,28		92	0,91	-1,209
00:39:25	0,00	5,30		93	0,91	-1,216
00:39:32	0,00	5,32		93	0,92	-1,223
00:39:40	0,00	5,33		93	0,92	-1,230
00:39:48	0,00	5,35		93	0,92	-1,237
00:39:56	0,00	5,37		94	0,92	-1,245
00:40:00	0,00	5,38		94	0,92	-1,248
00:40:00	Fire brigade is alarmed					
00:40:07	0,00	5,39		94	0,93	-1,255
00:40:15	0,00	5,41		94	0,93	-1,262
00:40:23	0,00	5,43		94	0,93	-1,269
00:40:31	0,00	5,45		95	0,93	-1,276
00:40:39	0,00	5,46		95	0,93	-1,283
00:40:46	0,00	5,48		95	0,94	-1,290
00:40:54	0,00	5,50		95	0,94	-1,296
00:41:02	0,00	5,51		95	0,94	-1,303
00:41:10	0,00	5,53		96	0,94	-1,310
00:41:18	0,00	5,55		96	0,95	-1,317
00:41:25	0,00	5,57		96	0,95	-1,324
00:41:33	0,00	5,58		96	0,95	-1,330
00:41:41	0,00	5,60		96	0,95	-1,337
00:41:49	0,00	5,62		97	0,95	-1,344
00:41:56	0,00	5,63		97	0,96	-1,350
00:42:04	0,00	5,65		97	0,96	-1,357
00:42:12	0,00	5,67		97	0,96	-1,363
00:42:20	0,00	5,69		98	0,96	-1,369
00:42:27	0,00	5,70		98	0,97	-1,375
00:42:35	0,00	5,72		98	0,97	-1,382
00:42:43	0,00	5,74		98	0,97	-1,388
00:42:50	0,00	5,75		98	0,97	-1,394
00:42:58	0,00	5,77		99	0,97	-1,400
00:43:06	0,00	5,79		99	0,98	-1,406
00:43:14	0,00	5,80		99	0,98	-1,412
00:43:21	0,00	5,82		99	0,98	-1,418
00:43:29	0,00	5,84		99	0,98	-1,424
00:43:37	0,00	5,86		100	0,99	-1,430
00:43:44	0,00	5,87		100	0,99	-1,436
00:43:52	0,00	5,89		100	0,99	-1,442
00:44:00	0,00	5,91		100	0,99	-1,448
00:44:07	0,00	5,92		101	1,00	-1,454
00:44:15	0,00	5,94		101	1,00	-1,460
00:44:23	0,00	5,96		101	1,00	-1,465
00:44:30	0,00	5,97		101	1,00	-1,471
00:44:38	0,00	5,99		101	1,00	-1,477
00:44:46	0,00	6,01		102	1,01	-1,483
00:44:53	0,00	6,02		102	1,01	-1,489
00:45:01	0,00	6,04		102	1,01	-1,495
00:45:08	0,00	6,06		102	1,01	-1,500
00:45:16	0,00	6,07		102	1,02	-1,506

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:45:24	0,00	6,09		103	1,02	-1,512
00:45:31	0,00	6,11		103	1,02	-1,518
00:45:39	0,00	6,12		103	1,02	-1,523
00:45:46	0,00	6,14		103	1,02	-1,529
00:45:54	0,00	6,15		103	1,03	-1,535
00:46:02	0,00	6,17		104	1,03	-1,540
00:46:09	0,00	6,19		104	1,03	-1,546
00:46:17	0,00	6,20		104	1,03	-1,552
00:46:24	0,00	6,22		104	1,04	-1,557
00:46:32	0,00	6,24		105	1,04	-1,563
00:46:39	0,00	6,25		105	1,04	-1,568
00:46:47	0,00	6,27		105	1,04	-1,574
00:46:54	0,00	6,29		105	1,05	-1,580
00:47:02	0,00	6,30		105	1,05	-1,585
00:47:10	0,00	6,32		106	1,05	-1,591
00:47:17	0,00	6,33		106	1,05	-1,596
00:47:25	0,00	6,35		106	1,05	-1,602
00:47:32	0,00	6,37		106	1,06	-1,607
00:47:40	0,00	6,38		106	1,06	-1,613
00:47:47	0,00	6,40		107	1,06	-1,618
00:47:55	0,00	6,42		107	1,06	-1,624
00:48:02	0,00	6,43		107	1,07	-1,629
00:48:10	0,00	6,45		107	1,07	-1,635
00:48:17	0,00	6,46		107	1,07	-1,640
00:48:25	0,00	6,48		108	1,07	-1,646
00:48:32	0,00	6,50		108	1,07	-1,651
00:48:40	0,00	6,51		108	1,08	-1,656
00:48:47	0,00	6,53		108	1,08	-1,662
00:48:55	0,00	6,54		108	1,08	-1,667
00:49:02	0,00	6,56		109	1,08	-1,673
00:49:10	0,00	6,58		109	1,09	-1,678
00:49:17	0,00	6,59		109	1,09	-1,683
00:49:24	0,00	6,61		109	1,09	-1,689
00:49:32	0,00	6,62		109	1,09	-1,694
00:49:39	0,00	6,64		110	1,10	-1,699
00:49:47	0,00	6,66		110	1,10	-1,705
00:49:54	0,00	6,67		110	1,10	-1,710
00:50:02	0,00	6,69		110	1,10	-1,715
00:50:09	0,00	6,70		110	1,10	-1,720
00:50:16	0,00	6,72		111	1,11	-1,726
00:50:24	0,00	6,73		111	1,11	-1,731
00:50:31	0,00	6,75		111	1,11	-1,736
00:50:39	0,00	6,77		111	1,11	-1,741
00:50:46	0,00	6,78		111	1,12	-1,747
00:50:54	0,00	6,80		112	1,12	-1,752
00:51:01	0,00	6,81		112	1,12	-1,757
00:51:08	0,00	6,83		112	1,12	-1,762
00:51:16	0,00	6,84		112	1,13	-1,768
00:51:23	0,00	6,86		112	1,13	-1,773
00:51:30	0,00	6,88		113	1,13	-1,778
00:51:38	0,00	6,89		113	1,13	-1,783
00:51:45	0,00	6,91		113	1,13	-1,788
00:51:52	0,00	6,92		113	1,14	-1,793
00:52:00	0,00	6,94		113	1,14	-1,798
00:52:07	0,00	6,95		114	1,14	-1,804
00:52:14	0,00	6,97		114	1,14	-1,809

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:52:22	0,00	6,98		114	1,15	-1,814
00:52:29	0,00	7,00		114	1,15	-1,819
00:52:37	0,00	7,02		114	1,15	-1,824
00:52:44	0,00	7,03		115	1,15	-1,829
00:52:51	0,00	7,05		115	1,16	-1,834
00:52:58	0,00	7,06		115	1,16	-1,839
00:53:06	0,00	7,08		115	1,16	-1,844
00:53:13	0,00	7,09		115	1,16	-1,849
00:53:20	0,00	7,11		116	1,16	-1,854
00:53:28	0,00	7,12		116	1,17	-1,859
00:53:35	0,00	7,14		116	1,17	-1,864
00:53:42	0,00	7,15		116	1,17	-1,869
00:53:50	0,00	7,17		116	1,17	-1,874
00:53:57	0,00	7,18		116	1,18	-1,879
00:54:04	0,00	7,20		117	1,18	-1,884
00:54:11	0,00	7,21		117	1,18	-1,889
00:54:19	0,00	7,23		117	1,18	-1,894
00:54:26	0,00	7,24		117	1,19	-1,899
00:54:33	0,00	7,26		117	1,19	-1,904
00:54:41	0,00	7,27		118	1,19	-1,909
00:54:48	0,00	7,29		118	1,19	-1,914
00:54:55	0,00	7,30		118	1,19	-1,919
00:55:00	0,00	7,31		118	1,20	-1,924
00:55:00	Fire brigade arrived, preparing extinguishing					
00:55:07	0,00	7,33		118	1,20	-1,927
00:55:14	0,00	7,34		118	1,20	-1,932
00:55:21	0,00	7,36		119	1,20	-1,937
00:55:28	0,00	7,37		119	1,21	-1,942
00:55:36	0,00	7,39		119	1,21	-1,947
00:55:43	0,00	7,40		119	1,21	-1,951
00:55:50	0,00	7,42		119	1,21	-1,956
00:56:00	0,00	7,44		120	1,22	-1,964
00:56:00	Fire brigade ready, extinguishing started					
00:56:07	0,00	7,45		120	1,22	-1,968
00:56:14	0,00	7,47		120	1,22	-1,972
00:56:21	0,00	7,48		120	1,22	-1,977
00:56:30	0,00	7,50		120	1,22	-1,984
00:56:31	0,00	7,50		120	1,23	-2,034
00:56:31	Fire is declining					
00:56:41	0,00	7,52		121	1,23	-2,290
00:56:50	0,00	7,54		121	1,23	-2,528
00:57:00	0,00	7,56		121	1,23	-2,752
00:57:09	0,00	7,57		121	1,23	-2,964
00:57:19	0,00	7,59		121	1,23	-3,165
00:57:28	0,00	7,60		121	1,23	-3,357
00:57:38	0,00	7,61		121	1,23	-3,540
00:57:47	0,00	7,62		121	1,23	-3,716
00:57:57	0,00	7,63		121	1,23	-3,885
00:58:06	0,00	7,64		121	1,23	-4,048
00:58:16	0,00	7,65		120	1,22	-4,206
00:58:25	0,00	7,65		120	1,22	-4,359
00:58:35	0,00	7,66		120	1,22	-4,508
00:58:45	0,00	7,66		120	1,21	-4,651
00:58:54	0,00	7,65		119	1,21	-4,761
00:59:04	0,00	7,65		119	1,20	-4,877
00:59:13	0,00	7,64		118	1,20	-4,999

Part I

Time	*Smoke room [dB/m]*	*Smoke layer [dB/m]*	*Floor layer [m]*	*Layer temp. [ºC]*	*Heat radiation [kW/m²]*	*Floor pressure [N/m²]*
00:59:15	0,00	7,64		118	1,20	-5,021
00:59:15	Fire has been put out					

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:00:00	0,00		24,00	20		-0,005
00:00:09	0,00		24,00	20		0,000
00:00:19	0,00		24,00	20		0,000
00:00:28	0,00		24,00	20		0,000
00:00:38	0,00		24,00	20		0,000
00:00:48	0,00		24,00	20		0,000
00:00:58	0,00		24,00	20		0,000
00:01:07	0,00		24,00	20		0,000
00:01:17	0,00		24,00	20		0,000
00:01:27	0,00		24,00	20		0,000
00:01:36	0,00		24,00	20		0,000
00:01:45	0,00		24,00	20		0,000
00:01:55	0,00		24,00	20		0,083
00:02:05	0,00		24,00	20		0,115
00:02:14	0,00		24,00	20		0,154
00:02:24	0,00		24,00	20		0,199
00:02:33	0,00		24,00	20		0,258
00:02:43	0,00		24,00	20		0,325
00:02:53	0,00		24,00	20		0,409
00:03:02	0,00		24,00	20		0,505
00:03:12	0,00		24,00	20		0,614
00:03:22	0,00		24,00	20		0,712
00:03:31	0,00		24,00	20		0,768
00:03:41	0,01		24,00	20		0,805
00:03:51	0,01	0,23	23,34	23		1,205
00:04:01	0,01	0,25	22,49	24	0,12	1,408
00:04:10	0,01	0,26	21,50	24	0,13	1,641
00:04:20	0,01	0,28	20,45	24	0,14	1,902
00:04:30	0,01	0,30	19,41	24	0,15	2,187
00:04:40	0,01	0,32	18,43	25	0,16	2,495
00:04:49	0,01	0,33	17,52	25	0,17	2,839
00:04:59	0,01	0,35	16,70	25	0,18	3,224
00:05:09	0,01	0,37	15,92	25	0,19	3,644
00:05:18	0,01	0,38	15,17	26	0,20	4,094
00:05:28	0,01	0,40	14,42	26	0,21	4,605
00:05:38	0,01	0,42	13,69	26	0,22	5,152
00:05:48	0,01	0,45	12,97	27	0,24	5,272
00:05:58	0,01	0,47	12,32	27	0,25	5,134
00:06:07	0,01	0,50	11,71	27	0,26	5,007
00:06:16	0,01	0,52	11,21	28	0,27	4,904
00:06:24	0,01	0,54	10,71	28	0,28	4,804
00:06:34	0,01	0,57	10,22	29	0,29	4,705
00:06:44	0,01	0,59	9,73	29	0,30	4,608
00:06:52	0,01	0,61	9,34	29	0,31	4,532
00:07:00	0,01	0,64	8,95	30	0,31	4,458
00:07:09	0,01	0,66	8,57	30	0,32	4,385
00:07:18	0,01	0,68	8,19	30	0,33	4,313
00:07:28	0,01	0,71	7,81	31	0,34	4,244
00:07:38	0,01	0,73	7,44	31	0,35	4,176
00:07:46	0,01	0,75	7,16	31	0,36	4,126
00:07:53	0,01	0,77	6,89	32	0,36	4,077
00:08:02	0,01	0,79	6,61	32	0,37	4,028
00:08:10	0,01	0,81	6,34	32	0,37	3,981
00:08:18	0,01	0,83	6,07	32	0,38	3,934
00:08:27	0,01	0,85	5,81	33	0,39	3,888
00:08:36	0,01	0,87	5,54	33	0,39	3,843

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:08:46	0,01	0,90	5,28	33	0,40	3,799
00:08:55	0,01	0,92	5,02	34	0,41	3,755
00:09:05	0,01	0,94	4,77	34	0,41	3,712
00:09:12	0,01	0,96	4,59	34	0,42	3,684
00:09:19	0,01	0,97	4,43	34	0,42	3,656
00:09:26	0,01	0,99	4,26	35	0,42	3,628
00:09:33	0,01	1,01	4,09	35	0,43	3,601
00:09:40	0,01	1,02	3,92	35	0,43	3,573
00:09:40	Critical condition in room 'Part II': Smoke free height less than 4,00 m					
00:09:48	0,01	1,04	3,76	35	0,43	3,546
00:09:55	0,01	1,06	3,59	36	0,44	3,520
00:10:03	0,01	1,07	3,43	36	0,44	3,493
00:10:11	0,01	1,09	3,27	36	0,45	3,467
00:10:11	Critical condition in room 'Part I': Smoke free height less than 5,20 m					
00:10:19	0,01	1,11	3,11	36	0,45	3,441
00:10:27	0,01	1,13	2,95	37	0,45	3,416
00:10:35	0,01	1,15	2,79	37	0,46	3,390
00:10:44	0,01	1,17	2,63	37	0,46	3,365
00:10:52	0,01	1,19	2,48	37	0,46	3,340
00:11:01	0,01	1,21	2,33	38	0,46	3,316
00:11:10	0,01	1,22	2,17	38	0,47	3,292
00:11:19	0,01	1,24	2,02	38	0,47	3,268
00:11:28	0,01	1,26	1,89	38	0,47	3,240
00:11:35	0,01	1,28	1,78	39	0,48	3,214
00:11:42	0,01	1,30	1,67	39	0,48	3,185
00:11:50	0,01	1,31	1,56	39	0,48	3,153
00:11:58	0,01	1,33	1,45	39	0,48	3,119
00:12:06	0,01	1,35	1,34	40	0,48	3,084
00:12:14	0,01	1,37	1,24	40	0,49	3,048
00:12:22	0,00	1,38	1,14	40	0,49	3,011
00:12:30	0,00	1,40	1,04	40	0,49	2,973
00:12:39	0,00	1,42	0,95	41	0,49	2,935
00:12:47	0,00	1,44	0,86	41	0,49	2,897
00:12:55	0,00	1,46	0,78	41	0,50	2,859
00:13:03	0,00	1,47	0,70	41	0,50	2,821
00:13:12	0,00	1,49	0,63	42	0,50	2,785
00:13:20	0,00	1,51	0,56	42	0,50	2,751
00:13:28	0,00	1,53	0,49	42	0,50	2,712
00:13:36	0,00	1,55	0,43	42	0,50	2,674
00:13:44	0,00	1,56	0,38	43	0,51	2,636
00:13:52	0,00	1,58	0,33	43	0,51	2,598
00:14:00	0,00	1,60	0,28	43	0,51	2,562
00:14:08	0,00	1,62	0,24	43	0,51	2,526
00:14:16	0,00	1,64	0,20	43	0,51	2,492
00:14:25	0,00	1,65	0,17	44	0,51	2,459
00:14:33	0,00	1,67	0,14	44	0,52	2,427
00:14:42	0,00	1,69	0,11	44	0,52	2,396
00:14:51	0,00	1,71	0,09	44	0,52	2,366
00:15:00	0,00	1,73	0,07	45	0,52	2,336
00:15:10	0,00	1,76	0,05	45	0,52	2,308
00:15:15	0,00	1,77	0,05	45	0,52	2,293
00:15:20	0,00	1,78	0,04	45	0,53	2,279
00:15:26	0,00	1,79	0,03	46	0,53	2,265
00:15:31	0,00	1,81	0,03	46	0,53	2,250
00:15:37	0,00	1,82	0,02	46	0,53	2,236
00:15:43	0,00	1,83	0,02	46	0,53	2,221

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:15:49	0,00	1,85	0,02	46	0,53	2,206
00:15:55	0,00	1,86	0,01	46	0,53	2,191
00:16:01	0,00	1,88	0,01	47	0,53	2,176
00:16:08	0,00	1,89	0,01	47	0,53	2,161
00:16:13	0,00	1,90	0,01	47	0,54	2,148
00:16:21	0,00	1,92	0,01	47	0,54	2,129
00:16:29	0,00	1,94		47	0,54	2,110
00:16:35	0,00	1,95		48	0,54	2,098
00:16:40	0,00	1,97		48	0,54	2,085
00:16:49	0,00	1,99		48	0,54	2,064
00:16:57	0,00	2,01		48	0,54	2,045
00:17:07	0,00	2,03		49	0,55	2,022
00:17:16	0,00	2,05		49	0,55	1,999
00:17:24	0,00	2,07		49	0,55	1,980
00:17:24	Room 'Part II' is now filled with smoke					
00:17:33	0,00	2,09		49	0,55	1,958
00:17:43	0,00	2,11		50	0,55	1,936
00:17:51	0,00	2,13		50	0,56	1,917
00:18:00	0,00	2,16		50	0,56	1,896
00:18:09	0,00	2,18		51	0,56	1,875
00:18:18	0,00	2,20		51	0,56	1,856
00:18:27	0,00	2,22		51	0,56	1,835
00:18:36	0,00	2,24		51	0,57	1,813
00:18:45	0,00	2,26		52	0,57	1,794
00:18:54	0,00	2,29		52	0,57	1,774
00:19:03	0,00	2,31		52	0,57	1,754
00:19:12	0,00	2,33		52	0,57	1,737
00:19:21	0,00	2,35		53	0,58	1,718
00:19:30	0,00	2,37		53	0,58	1,699
00:19:38	0,00	2,39		53	0,58	1,680
00:19:47	0,00	2,42		54	0,58	1,661
00:19:56	0,00	2,44		54	0,58	1,643
00:20:05	0,00	2,46		54	0,59	1,625
00:20:14	0,00	2,48		54	0,59	1,609
00:20:23	0,00	2,50		55	0,59	1,592
00:20:31	0,00	2,52		55	0,59	1,575
00:20:40	0,00	2,54		55	0,59	1,557
00:20:49	0,00	2,57		55	0,60	1,540
00:20:58	0,00	2,59		56	0,60	1,524
00:21:06	0,00	2,61		56	0,60	1,508
00:21:15	0,00	2,63		56	0,60	1,492
00:21:24	0,00	2,65		57	0,60	1,478
00:21:33	0,00	2,67		57	0,61	1,463
00:21:42	0,00	2,69		57	0,61	1,448
00:21:50	0,00	2,71		57	0,61	1,433
00:21:59	0,00	2,74		58	0,61	1,419
00:22:08	0,00	2,76		58	0,61	1,406
00:22:16	0,00	2,78		58	0,61	1,396
00:22:25	0,00	2,80		58	0,62	1,386
00:22:34	0,00	2,82		59	0,62	1,374
00:22:42	0,00	2,84		59	0,62	1,361
00:22:51	0,00	2,86		59	0,62	1,349
00:23:00	0,00	2,88		60	0,62	1,335
00:23:08	0,00	2,90		60	0,63	1,323
00:23:17	0,00	2,93		60	0,63	1,310
00:23:26	0,00	2,95		60	0,63	1,298

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:23:34	0,00	2,97		61	0,63	1,286
00:23:43	0,00	2,99		61	0,63	1,275
00:23:52	0,00	3,01		61	0,64	1,263
00:24:00	0,00	3,03		61	0,64	1,251
00:24:09	0,00	3,05		62	0,64	1,239
00:24:18	0,00	3,07		62	0,64	1,226
00:24:26	0,00	3,09		62	0,64	1,214
00:24:35	0,00	3,11		62	0,65	1,203
00:24:43	0,00	3,13		63	0,65	1,191
00:24:52	0,00	3,15		63	0,65	1,179
00:25:00	0,00	3,17		63	0,65	1,169
00:25:09	0,00	3,20		63	0,65	1,158
00:25:17	0,00	3,22		64	0,66	1,146
00:25:26	0,00	3,24		64	0,66	1,135
00:25:35	0,00	3,26		64	0,66	1,124
00:25:43	0,00	3,28		64	0,66	1,111
00:25:52	0,00	3,30		65	0,66	1,100
00:26:00	0,00	3,32		65	0,67	1,088
00:26:09	0,00	3,34		65	0,67	1,077
00:26:17	0,00	3,36		65	0,67	1,066
00:26:26	0,00	3,38		66	0,67	1,055
00:26:34	0,00	3,40		66	0,67	1,046
00:26:43	0,00	3,42		66	0,68	1,035
00:26:51	0,00	3,44		66	0,68	1,024
00:27:00	0,00	3,46		67	0,68	1,013
00:27:08	0,00	3,48		67	0,68	1,002
00:27:16	0,00	3,50		67	0,68	0,991
00:27:25	0,00	3,52		67	0,69	0,979
00:27:33	0,00	3,54		68	0,69	0,968
00:27:42	0,00	3,56		68	0,69	0,958
00:27:50	0,00	3,58		68	0,69	0,947
00:27:58	0,00	3,60		68	0,70	0,937
00:28:07	0,00	3,62		69	0,70	0,926
00:28:15	0,00	3,64		69	0,70	0,916
00:28:24	0,00	3,66		69	0,70	0,905
00:28:32	0,00	3,68		69	0,70	0,897
00:28:40	0,00	3,70		70	0,71	0,886
00:28:49	0,00	3,72		70	0,71	0,876
00:28:57	0,00	3,74		70	0,71	0,865
00:29:05	0,00	3,76		70	0,71	0,855
00:29:14	0,00	3,78		71	0,71	0,845
00:29:22	0,00	3,80		71	0,72	0,835
00:29:30	0,00	3,82		71	0,72	0,825
00:29:39	0,00	3,84		71	0,72	0,815
00:29:47	0,00	3,86		72	0,72	0,804
00:29:55	0,00	3,88		72	0,72	0,793
00:30:04	0,00	3,90		72	0,73	0,783
00:30:12	0,00	3,92		72	0,73	0,773
00:30:20	0,00	3,94		73	0,73	0,763
00:30:29	0,00	3,96		73	0,73	0,753
00:30:37	0,00	3,98		73	0,73	0,743
00:30:45	0,00	3,99		73	0,74	0,733
00:30:53	0,00	4,01		74	0,74	0,723
00:31:02	0,00	4,03		74	0,74	0,713
00:31:10	0,00	4,05		74	0,74	0,703
00:31:18	0,00	4,07		74	0,74	0,694

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:31:26	0,00	4,09		75	0,75	0,684
00:31:35	0,00	4,11		75	0,75	0,674
00:31:43	0,00	4,13		75	0,75	0,665
00:31:47	0,00	4,14		75	0,75	0,662
00:31:47	Room 'Part I' is now filled with smoke					
00:31:55	0,00	4,16		75	0,75	0,652
00:32:03	0,00	4,18		76	0,76	0,643
00:32:12	0,00	4,20		76	0,76	0,633
00:32:20	0,00	4,22		76	0,76	0,624
00:32:28	0,00	4,24		76	0,76	0,614
00:32:36	0,00	4,25		77	0,76	0,605
00:32:44	0,00	4,27		77	0,77	0,595
00:32:52	0,00	4,29		77	0,77	0,586
00:33:01	0,00	4,31		77	0,77	0,577
00:33:09	0,00	4,33		78	0,77	0,567
00:33:17	0,00	4,35		78	0,77	0,558
00:33:25	0,00	4,37		78	0,78	0,549
00:33:33	0,00	4,39		78	0,78	0,540
00:33:41	0,00	4,41		78	0,78	0,530
00:33:49	0,00	4,43		79	0,78	0,521
00:33:57	0,00	4,44		79	0,78	0,512
00:34:06	0,00	4,46		79	0,79	0,503
00:34:14	0,00	4,48		79	0,79	0,494
00:34:22	0,00	4,50		80	0,79	0,485
00:34:30	0,00	4,52		80	0,79	0,476
00:34:38	0,00	4,54		80	0,79	0,467
00:34:46	0,00	4,56		80	0,80	0,458
00:34:54	0,00	4,57		81	0,80	0,449
00:35:02	0,00	4,59		81	0,80	0,440
00:35:10	0,00	4,61		81	0,80	0,431
00:35:18	0,00	4,63		81	0,81	0,422
00:35:26	0,00	4,65		81	0,81	0,413
00:35:34	0,00	4,67		82	0,81	0,405
00:35:42	0,00	4,69		82	0,81	0,396
00:35:50	0,00	4,70		82	0,81	0,387
00:35:58	0,00	4,72		82	0,82	0,378
00:36:06	0,00	4,74		83	0,82	0,370
00:36:14	0,00	4,76		83	0,82	0,361
00:36:22	0,00	4,78		83	0,82	0,352
00:36:30	0,00	4,80		83	0,82	0,344
00:36:38	0,00	4,81		84	0,83	0,335
00:36:46	0,00	4,83		84	0,83	0,327
00:36:54	0,00	4,85		84	0,83	0,318
00:37:02	0,00	4,87		84	0,83	0,310
00:37:10	0,00	4,89		84	0,83	0,301
00:37:18	0,00	4,91		85	0,84	0,293
00:37:26	0,00	4,92		85	0,84	0,282
00:37:34	0,00	4,94		85	0,84	0,274
00:37:42	0,00	4,96		85	0,84	0,265
00:37:50	0,00	4,98		86	0,84	0,257
00:37:58	0,00	5,00		86	0,85	0,249
00:38:06	0,00	5,01		86	0,85	0,240
00:38:14	0,00	5,03		86	0,85	0,232
00:38:22	0,00	5,05		86	0,85	0,224
00:38:29	0,00	5,07		87	0,86	0,216
00:38:37	0,00	5,09		87	0,86	0,207

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:38:45	0,00	5,10		87	0,86	0,201
00:38:53	0,00	5,12		87	0,86	0,193
00:39:01	0,00	5,14		88	0,86	0,185
00:39:09	0,00	5,16		88	0,87	0,177
00:39:17	0,00	5,18		88	0,87	0,169
00:39:25	0,00	5,19		88	0,87	0,161
00:39:32	0,00	5,21		88	0,87	0,153
00:39:40	0,00	5,23		89	0,87	0,145
00:39:48	0,00	5,25		89	0,88	0,137
00:39:56	0,00	5,26		89	0,88	0,127
00:40:00	0,00	5,27		89	0,88	0,125
00:40:00	Fire brigade is alarmed					
00:40:07	0,00	5,29		89	0,88	0,118
00:40:15	0,00	5,31		90	0,88	0,110
00:40:23	0,00	5,32		90	0,89	0,102
00:40:31	0,00	5,34		90	0,89	0,095
00:40:39	0,00	5,36		90	0,89	0,087
00:40:46	0,00	5,38		91	0,89	0,077
00:40:54	0,00	5,40		91	0,89	0,069
00:41:02	0,00	5,41		91	0,90	0,061
00:41:10	0,00	5,43		91	0,90	0,054
00:41:18	0,00	5,45		91	0,90	0,046
00:41:25	0,00	5,46		92	0,90	0,039
00:41:33	0,00	5,48		92	0,91	0,034
00:41:41	0,00	5,50		92	0,91	0,026
00:41:49	0,00	5,52		92	0,91	0,019
00:41:56	0,00	5,53		92	0,91	0,011
00:42:04	0,00	5,55		93	0,91	0,004
00:42:12	0,00	5,57		93	0,92	-0,003
00:42:20	0,00	5,59		93	0,92	-0,012
00:42:27	0,00	5,60		93	0,92	-0,020
00:42:35	0,00	5,62		94	0,92	-0,026
00:42:43	0,00	5,64		94	0,92	-0,033
00:42:50	0,00	5,66		94	0,93	-0,038
00:42:58	0,00	5,67		94	0,93	-0,045
00:43:06	0,00	5,69		94	0,93	-0,051
00:43:14	0,00	5,71		95	0,93	-0,058
00:43:21	0,00	5,72		95	0,94	-0,065
00:43:29	0,00	5,74		95	0,94	-0,074
00:43:37	0,00	5,76		95	0,94	-0,081
00:43:44	0,00	5,78		95	0,94	-0,088
00:43:52	0,00	5,79		96	0,94	-0,092
00:44:00	0,00	5,81		96	0,95	-0,099
00:44:07	0,00	5,83		96	0,95	-0,105
00:44:15	0,00	5,84		96	0,95	-0,112
00:44:23	0,00	5,86		96	0,95	-0,118
00:44:30	0,00	5,88		97	0,95	-0,127
00:44:38	0,00	5,89		97	0,96	-0,134
00:44:46	0,00	5,91		97	0,96	-0,140
00:44:53	0,00	5,93		97	0,96	-0,144
00:45:01	0,00	5,94		98	0,96	-0,151
00:45:08	0,00	5,96		98	0,97	-0,157
00:45:16	0,00	5,98		98	0,97	-0,164
00:45:24	0,00	5,99		98	0,97	-0,173
00:45:31	0,00	6,01		98	0,97	-0,179
00:45:39	0,00	6,03		99	0,97	-0,186

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:45:46	0,00	6,04		99	0,98	-0,190
00:45:54	0,00	6,06		99	0,98	-0,196
00:46:02	0,00	6,08		99	0,98	-0,202
00:46:09	0,00	6,09		99	0,98	-0,208
00:46:17	0,00	6,11		100	0,98	-0,218
00:46:24	0,00	6,13		100	0,99	-0,224
00:46:32	0,00	6,14		100	0,99	-0,230
00:46:39	0,00	6,16		100	0,99	-0,234
00:46:47	0,00	6,18		100	0,99	-0,240
00:46:54	0,00	6,19		101	1,00	-0,246
00:47:02	0,00	6,21		101	1,00	-0,255
00:47:10	0,00	6,23		101	1,00	-0,261
00:47:17	0,00	6,24		101	1,00	-0,268
00:47:25	0,00	6,26		101	1,00	-0,271
00:47:32	0,00	6,28		102	1,01	-0,277
00:47:40	0,00	6,29		102	1,01	-0,283
00:47:47	0,00	6,31		102	1,01	-0,292
00:47:55	0,00	6,33		102	1,01	-0,298
00:48:02	0,00	6,34		102	1,02	-0,305
00:48:10	0,00	6,36		103	1,02	-0,308
00:48:17	0,00	6,37		103	1,02	-0,314
00:48:25	0,00	6,39		103	1,02	-0,320
00:48:32	0,00	6,41		103	1,02	-0,329
00:48:40	0,00	6,42		103	1,03	-0,335
00:48:47	0,00	6,44		104	1,03	-0,338
00:48:55	0,00	6,46		104	1,03	-0,344
00:49:02	0,00	6,47		104	1,03	-0,350
00:49:10	0,00	6,49		104	1,03	-0,356
00:49:17	0,00	6,50		104	1,04	-0,365
00:49:24	0,00	6,52		105	1,04	-0,371
00:49:32	0,00	6,54		105	1,04	-0,374
00:49:39	0,00	6,55		105	1,04	-0,380
00:49:47	0,00	6,57		105	1,05	-0,386
00:49:54	0,00	6,58		105	1,05	-0,395
00:50:02	0,00	6,60		106	1,05	-0,401
00:50:09	0,00	6,62		106	1,05	-0,404
00:50:16	0,00	6,63		106	1,05	-0,410
00:50:24	0,00	6,65		106	1,06	-0,416
00:50:31	0,00	6,66		106	1,06	-0,424
00:50:39	0,00	6,68		107	1,06	-0,430
00:50:46	0,00	6,70		107	1,06	-0,433
00:50:54	0,00	6,71		107	1,07	-0,439
00:51:01	0,00	6,73		107	1,07	-0,445
00:51:08	0,00	6,74		107	1,07	-0,453
00:51:16	0,00	6,76		108	1,07	-0,459
00:51:23	0,00	6,78		108	1,07	-0,462
00:51:30	0,00	6,79		108	1,08	-0,468
00:51:38	0,00	6,81		108	1,08	-0,474
00:51:45	0,00	6,82		108	1,08	-0,482
00:51:52	0,00	6,84		109	1,08	-0,488
00:52:00	0,00	6,85		109	1,08	-0,491
00:52:07	0,00	6,87		109	1,09	-0,497
00:52:14	0,00	6,89		109	1,09	-0,502
00:52:22	0,00	6,90		109	1,09	-0,511
00:52:29	0,00	6,92		109	1,09	-0,517
00:52:37	0,00	6,93		110	1,10	-0,520

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:52:44	0,00	6,95		110	1,10	-0,525
00:52:51	0,00	6,96		110	1,10	-0,531
00:52:58	0,00	6,98		110	1,10	-0,539
00:53:06	0,00	7,00		110	1,10	-0,542
00:53:13	0,00	7,01		111	1,11	-0,548
00:53:20	0,00	7,03		111	1,11	-0,553
00:53:28	0,00	7,04		111	1,11	-0,562
00:53:35	0,00	7,06		111	1,11	-0,568
00:53:42	0,00	7,07		111	1,12	-0,570
00:53:50	0,00	7,09		112	1,12	-0,576
00:53:57	0,00	7,10		112	1,12	-0,581
00:54:04	0,00	7,12		112	1,12	-0,590
00:54:11	0,00	7,13		112	1,12	-0,593
00:54:19	0,00	7,15		112	1,13	-0,598
00:54:26	0,00	7,16		113	1,13	-0,604
00:54:33	0,00	7,18		113	1,13	-0,612
00:54:41	0,00	7,20		113	1,13	-0,618
00:54:48	0,00	7,21		113	1,14	-0,620
00:54:55	0,00	7,23		113	1,14	-0,626
00:55:00	0,00	7,24		113	1,14	-0,634
00:55:00	Fire brigade arrived, preparing extinguishing					
00:55:07	0,00	7,25		114	1,14	-0,634
00:55:14	0,00	7,27		114	1,14	-0,643
00:55:21	0,00	7,28		114	1,15	-0,648
00:55:28	0,00	7,30		114	1,15	-0,651
00:55:36	0,00	7,31		114	1,15	-0,656
00:55:43	0,00	7,33		114	1,15	-0,665
00:55:50	0,00	7,34		115	1,15	-0,670
00:56:00	0,00	7,36		115	1,16	-0,678
00:56:00	Fire brigade ready, extinguishing started					
00:56:07	0,00	7,38		115	1,16	-0,683
00:56:14	0,00	7,39		115	1,16	-0,685
00:56:21	0,00	7,41		115	1,16	-0,690
00:56:30	0,00	7,42		116	1,17	-0,698
00:56:31	0,00	7,43		116	1,17	-0,750
00:56:31	Fire is declining					
00:56:41	0,00	7,45		116	1,17	-1,015
00:56:50	0,00	7,47		116	1,17	-1,269
00:57:00	0,00	7,49		116	1,17	-1,518
00:57:09	0,00	7,50		117	1,18	-1,761
00:57:19	0,00	7,52		117	1,18	-1,994
00:57:28	0,00	7,53		117	1,18	-2,220
00:57:38	0,00	7,55		117	1,18	-2,437
00:57:47	0,00	7,56		117	1,18	-2,651
00:57:57	0,00	7,57		117	1,18	-2,859
00:58:06	0,00	7,59		117	1,18	-3,066
00:58:16	0,00	7,60		117	1,18	-3,265
00:58:25	0,00	7,60		117	1,18	-3,458
00:58:35	0,00	7,61		117	1,18	-3,650
00:58:45	0,00	7,62		117	1,18	-3,847
00:58:54	0,00	7,62		117	1,18	-4,026
00:59:04	0,00	7,63		116	1,17	-4,203
00:59:13	0,00	7,63		116	1,17	-4,380
00:59:15	0,00	7,63		116	1,17	-4,410
00:59:15	Fire has been put out					

Calculation

Basic information

Client:	BWSC
Scenario name:	Part I
Consultant:	Rambøll
Reference no.:	
Company type:	Industry, chemical
Basic bldg. construction:	Brick-wall/concrete-roof
Last revision:	12-12-2018 14:27:23
Revision No.:	40

Calculation options

Post flash-over model enabled:	x
Time limit [min]:	60
Plumemodel:	Heskestad

Fire brigade

Fire brigade active:	-
City area:	-
24 hour:	-
Distance/fire station [km]:	10,0
Calculated response time [min]:	15
Time before manual alarm [min]:	40

Fire start

Fire start room:	Part II
Fire start, type:	Energy formula fire
Fire start, name:	5,5 MW Fast
Fire start, code:	-
Optical smoke potential [dB/m]:	100,0
Maximum Q(t) [MW]:	5,50
Parabolic growth [MW/min²]:	0,1692
Parabolic growth [kW/s²]:	0,0470
Linear growth [MW/min]:	0,0000
Constant fire [MW]:	0,0000
Initial fire [kW]:	0,00
Doubling time [min]:	0,00

Fire installations

	[---------- In operation ----------]						
Room name	AFV Heat	AFV Smoke	AFV Timer	Sprinkler	AFA Heat	AFA Smoke	Windload [m/s]
Part I	-	-	-	-	-	-	0,00
Part II	-	-	-	-	-	-	0,00

Events

Fire progression:
Energy formula fire > 5,5 MW Fast
Plumemodel > Heskestad
00:08:14 : Critical condition in room 'Part I': Smoke free height less than 5,20 m
00:10:31 : Critical condition in room 'Part II': Smoke free height less than 4,00 m
00:15:29 : Room 'Part I' is now filled with smoke
00:23:45 : Room 'Part II' is now filled with smoke
00:40:00 : Fire brigade is alarmed
00:55:00 : Fire brigade arrived, preparing extinguishing
00:56:00 : Fire brigade ready, extinguishing started
00:56:31 : Fire is declining
00:59:15 : Fire has been put out

RHR and smoke layer temperature in all rooms

Time	Rate of heat release [kW]	Smoke layer temp. [ºC] Part I	Smoke layer temp. [ºC] Part II
00:00:00	0	20	20
00:00:09	4	20	20
00:00:18	17	20	20
00:00:28	38	20	20
00:00:37	67	20	20
00:00:47	104	20	20
00:00:56	150	20	20
00:01:05	202	20	20
00:01:15	269	20	20
00:01:25	344	20	22
00:01:35	425	20	22
00:01:44	517	20	23
00:01:54	618	20	23
00:02:04	729	20	23
00:02:13	843	20	24
00:02:23	968	20	24
00:02:33	1.105	21	25
00:02:42	1.247	21	25
00:02:52	1.395	22	26
00:03:02	1.560	22	26
00:03:11	1.731	22	27
00:03:21	1.908	22	28
00:03:30	2.090	23	28
00:03:40	2.292	23	29
00:03:50	2.499	23	29
00:04:00	2.713	24	30
00:04:09	2.930	24	31
00:04:19	3.167	24	32
00:04:29	3.406	25	32
00:04:38	3.655	25	33
00:04:48	3.918	25	33
00:04:58	4.189	26	34
00:05:08	4.465	26	34
00:05:17	4.746	26	35
00:05:27	5.048	27	35
00:05:37	5.354	27	36
00:05:47	5.500	27	36
00:05:55	5.500	28	36
00:06:05	5.500	28	37
00:06:14	5.500	29	37
00:06:22	5.500	29	37
00:06:31	5.500	29	37
00:06:40	5.500	30	37
00:06:49	5.500	30	37
00:06:59	5.500	30	38
00:07:08	5.500	31	38
00:07:17	5.500	31	38

00:07:27	5.500	31	38
00:07:37	5.500	32	38
00:07:45	5.500	32	38
00:07:52	5.500	32	39
00:08:00	5.500	32	39
00:08:08	5.500	33	39
00:08:14	5.500	33	39
00:08:14		Critical condition in room 'Part I': Smoke free height less than 5,20 m	
00:08:22	5.500	33	39
00:08:30	5.500	33	40
00:08:39	5.500	33	40
00:08:48	5.500	34	40
00:08:57	5.500	34	40
00:09:06	5.500	34	40
00:09:16	5.500	35	41
00:09:26	5.500	35	41
00:09:32	5.500	35	41
00:09:39	5.500	35	41
00:09:46	5.500	35	41
00:09:53	5.500	36	42
00:10:00	5.500	36	42
00:10:07	5.500	36	42
00:10:14	5.500	36	42
00:10:21	5.500	36	42
00:10:27	5.500	37	42
00:10:31	5.500	37	42
00:10:31		Critical condition in room 'Part II': Smoke free height less than 4,00 m	
00:10:38	5.500	37	43
00:10:44	5.500	37	43
00:10:52	5.500	37	43
00:10:59	5.500	38	43
00:11:06	5.500	38	43
00:11:13	5.500	38	44
00:11:19	5.500	38	44
00:11:26	5.500	38	44
00:11:33	5.500	38	44
00:11:40	5.500	39	44
00:11:46	5.500	39	45
00:11:53	5.500	39	45
00:12:00	5.500	39	45
00:12:09	5.500	40	45
00:12:18	5.500	40	46
00:12:27	5.500	40	46
00:12:37	5.500	40	46
00:12:46	5.500	41	46
00:12:55	5.500	41	47
00:13:05	5.500	41	47
00:13:15	5.500	42	47
00:13:22	5.500	42	48
00:13:29	5.500	42	48
00:13:36	5.500	42	48
00:13:44	5.500	42	48
00:13:51	5.500	43	49
00:13:59	5.500	43	49
00:14:08	5.500	43	49
00:14:16	5.500	43	49
00:14:25	5.500	44	50
00:14:35	5.500	44	50
00:14:40	5.500	44	50

00:14:45	5.500	44	50
00:14:51	5.500	45	51
00:14:56	5.500	45	51
00:15:02	5.500	45	51
00:15:08	5.500	45	51
00:15:14	5.500	45	51
00:15:21	5.500	46	52
00:15:29	5.500	46	52
00:15:29		Room 'Part I' is now filled with smoke	
00:15:36	5.500	46	52
00:15:43	5.500	46	52
00:15:50	5.500	46	53
00:16:00	5.500	47	53
00:16:06	5.500	47	53
00:16:14	5.500	47	53
00:16:22	5.500	47	54
00:16:32	5.500	48	54
00:16:41	5.500	48	54
00:16:49	5.500	48	55
00:16:59	5.500	49	55
00:17:08	5.500	49	55
00:17:16	5.500	49	55
00:17:26	5.500	49	56
00:17:35	5.500	50	56
00:17:43	5.500	50	56
00:17:52	5.500	50	57
00:18:02	5.500	51	57
00:18:10	5.500	51	57
00:18:19	5.500	51	57
00:18:28	5.500	51	58
00:18:36	5.500	52	58
00:18:45	5.500	52	58
00:18:54	5.500	52	59
00:19:03	5.500	53	59
00:19:12	5.500	53	59
00:19:21	5.500	53	59
00:19:29	5.500	53	60
00:19:38	5.500	54	60
00:19:47	5.500	54	60
00:19:56	5.500	54	61
00:20:04	5.500	54	61
00:20:14	5.500	55	61
00:20:22	5.500	55	61
00:20:31	5.500	55	62
00:20:40	5.500	56	62
00:20:48	5.500	56	62
00:20:57	5.500	56	63
00:21:06	5.500	56	63
00:21:14	5.500	57	63
00:21:23	5.500	57	63
00:21:32	5.500	57	64
00:21:40	5.500	57	64
00:21:49	5.500	58	64
00:21:58	5.500	58	64
00:22:06	5.500	58	65
00:22:15	5.500	58	65
00:22:24	5.500	59	65
00:22:32	5.500	59	65
00:22:41	5.500	59	66

00:22:49	5.500	60	66
00:22:58	5.500	60	66
00:23:06	5.500	60	67
00:23:15	5.500	60	67
00:23:24	5.500	61	67
00:23:32	5.500	61	67
00:23:41	5.500	61	68
00:23:45	5.500	61	68
00:23:45		Room 'Part II' is now filled with smoke	
00:23:54	5.500	61	68
00:24:02	5.500	62	68
00:24:11	5.500	62	69
00:24:19	5.500	62	69
00:24:28	5.500	63	69
00:24:36	5.500	63	69
00:24:45	5.500	63	70
00:24:53	5.500	63	70
00:25:02	5.500	64	70
00:25:10	5.500	64	70
00:25:19	5.500	64	71
00:25:27	5.500	64	71
00:25:36	5.500	65	71
00:25:44	5.500	65	71
00:25:53	5.500	65	72
00:26:01	5.500	65	72
00:26:09	5.500	66	72
00:26:18	5.500	66	72
00:26:26	5.500	66	73
00:26:35	5.500	66	73
00:26:43	5.500	67	73
00:26:51	5.500	67	73
00:27:00	5.500	67	74
00:27:08	5.500	67	74
00:27:17	5.500	68	74
00:27:25	5.500	68	74
00:27:33	5.500	68	75
00:27:42	5.500	68	75
00:27:50	5.500	69	75
00:27:58	5.500	69	75
00:28:07	5.500	69	76
00:28:15	5.500	69	76
00:28:23	5.500	70	76
00:28:32	5.500	70	76
00:28:40	5.500	70	77
00:28:48	5.500	70	77
00:28:56	5.500	71	77
00:29:05	5.500	71	77
00:29:13	5.500	71	78
00:29:21	5.500	71	78
00:29:29	5.500	71	78
00:29:38	5.500	72	78
00:29:46	5.500	72	79
00:29:54	5.500	72	79
00:30:02	5.500	72	79
00:30:11	5.500	73	79
00:30:19	5.500	73	80
00:30:27	5.500	73	80
00:30:35	5.500	73	80
00:30:43	5.500	74	80

00:30:52	5.500	74	81
00:31:00	5.500	74	81
00:31:08	5.500	74	81
00:31:16	5.500	75	81
00:31:24	5.500	75	82
00:31:32	5.500	75	82
00:31:41	5.500	75	82
00:31:49	5.500	76	82
00:31:57	5.500	76	83
00:32:05	5.500	76	83
00:32:13	5.500	76	83
00:32:21	5.500	76	83
00:32:29	5.500	77	83
00:32:37	5.500	77	84
00:32:45	5.500	77	84
00:32:54	5.500	77	84
00:33:02	5.500	78	84
00:33:10	5.500	78	85
00:33:18	5.500	78	85
00:33:26	5.500	78	85
00:33:34	5.500	79	85
00:33:42	5.500	79	86
00:33:50	5.500	79	86
00:33:58	5.500	79	86
00:34:06	5.500	79	86
00:34:14	5.500	80	87
00:34:22	5.500	80	87
00:34:30	5.500	80	87
00:34:38	5.500	80	87
00:34:46	5.500	81	87
00:34:54	5.500	81	88
00:35:02	5.500	81	88
00:35:10	5.500	81	88
00:35:18	5.500	82	88
00:35:26	5.500	82	89
00:35:34	5.500	82	89
00:35:42	5.500	82	89
00:35:50	5.500	82	89
00:35:58	5.500	83	90
00:36:06	5.500	83	90
00:36:14	5.500	83	90
00:36:22	5.500	83	90
00:36:30	5.500	84	90
00:36:38	5.500	84	91
00:36:45	5.500	84	91
00:36:53	5.500	84	91
00:37:01	5.500	84	91
00:37:09	5.500	85	92
00:37:17	5.500	85	92
00:37:25	5.500	85	92
00:37:33	5.500	85	92
00:37:41	5.500	86	92
00:37:49	5.500	86	93
00:37:56	5.500	86	93
00:38:04	5.500	86	93
00:38:12	5.500	86	93
00:38:20	5.500	87	94
00:38:28	5.500	87	94
00:38:36	5.500	87	94

00:38:43	5.500	87	94
00:38:51	5.500	88	95
00:38:59	5.500	88	95
00:39:07	5.500	88	95
00:39:15	5.500	88	95
00:39:22	5.500	88	95
00:39:30	5.500	89	96
00:39:38	5.500	89	96
00:39:46	5.500	89	96
00:39:53	5.500	89	96
00:40:00	5.500	89	96
00:40:00		Fire brigade is alarmed	
00:40:07	5.500	90	97
00:40:15	5.500	90	97
00:40:23	5.500	90	97
00:40:31	5.500	90	97
00:40:38	5.500	91	98
00:40:46	5.500	91	98
00:40:54	5.500	91	98
00:41:01	5.500	91	98
00:41:09	5.500	91	98
00:41:17	5.500	92	99
00:41:24	5.500	92	99
00:41:32	5.500	92	99
00:41:40	5.500	92	99
00:41:48	5.500	92	99
00:41:55	5.500	93	100
00:42:03	5.500	93	100
00:42:11	5.500	93	100
00:42:18	5.500	93	100
00:42:26	5.500	93	101
00:42:34	5.500	94	101
00:42:41	5.500	94	101
00:42:49	5.500	94	101
00:42:57	5.500	94	101
00:43:04	5.500	95	102
00:43:12	5.500	95	102
00:43:19	5.500	95	102
00:43:27	5.500	95	102
00:43:35	5.500	95	102
00:43:42	5.500	96	103
00:43:50	5.500	96	103
00:43:58	5.500	96	103
00:44:05	5.500	96	103
00:44:13	5.500	96	104
00:44:20	5.500	97	104
00:44:28	5.500	97	104
00:44:36	5.500	97	104
00:44:43	5.500	97	104
00:44:51	5.500	97	105
00:44:58	5.500	98	105
00:45:06	5.500	98	105
00:45:13	5.500	98	105
00:45:21	5.500	98	105
00:45:29	5.500	98	106
00:45:36	5.500	99	106
00:45:43	5.500	99	106
00:45:51	5.500	99	106
00:45:58	5.500	99	106

00:46:06	5.500	99	107
00:46:14	5.500	100	107
00:46:21	5.500	100	107
00:46:29	5.500	100	107
00:46:36	5.500	100	107
00:46:44	5.500	100	108
00:46:51	5.500	101	108
00:46:59	5.500	101	108
00:47:06	5.500	101	108
00:47:13	5.500	101	108
00:47:21	5.500	101	109
00:47:28	5.500	102	109
00:47:36	5.500	102	109
00:47:43	5.500	102	109
00:47:51	5.500	102	109
00:47:58	5.500	102	110
00:48:06	5.500	103	110
00:48:13	5.500	103	110
00:48:21	5.500	103	110
00:48:28	5.500	103	110
00:48:35	5.500	103	111
00:48:43	5.500	104	111
00:48:50	5.500	104	111
00:48:58	5.500	104	111
00:49:05	5.500	104	111
00:49:13	5.500	104	112
00:49:20	5.500	105	112
00:49:27	5.500	105	112
00:49:35	5.500	105	112
00:49:42	5.500	105	112
00:49:49	5.500	105	113
00:49:57	5.500	106	113
00:50:04	5.500	106	113
00:50:11	5.500	106	113
00:50:19	5.500	106	113
00:50:26	5.500	106	114
00:50:33	5.500	107	114
00:50:41	5.500	107	114
00:50:48	5.500	107	114
00:50:55	5.500	107	114
00:51:03	5.500	107	115
00:51:10	5.500	108	115
00:51:17	5.500	108	115
00:51:25	5.500	108	115
00:51:32	5.500	108	115
00:51:39	5.500	108	116
00:51:47	5.500	109	116
00:51:54	5.500	109	116
00:52:01	5.500	109	116
00:52:09	5.500	109	116
00:52:16	5.500	109	117
00:52:23	5.500	109	117
00:52:30	5.500	110	117
00:52:38	5.500	110	117
00:52:45	5.500	110	117
00:52:52	5.500	110	118
00:53:00	5.500	110	118
00:53:07	5.500	111	118
00:53:14	5.500	111	118

00:53:21	5.500	111	118
00:53:28	5.500	111	119
00:53:36	5.500	111	119
00:53:43	5.500	112	119
00:53:50	5.500	112	119
00:53:57	5.500	112	119
00:54:05	5.500	112	119
00:54:12	5.500	112	120
00:54:19	5.500	112	120
00:54:26	5.500	113	120
00:54:33	5.500	113	120
00:54:41	5.500	113	120
00:54:48	5.500	113	121
00:54:55	5.500	113	121
00:55:00	5.500	114	121
00:55:00		Fire brigade arrived, preparing extinguishing	
00:55:07	5.500	114	121
00:55:14	5.500	114	121
00:55:21	5.500	114	121
00:55:28	5.500	114	122
00:55:35	5.500	114	122
00:55:43	5.500	115	122
00:55:50	5.500	115	122
00:56:00	5.500	115	122
00:56:00		Fire brigade ready, extinguishing started	
00:56:07	5.500	115	123
00:56:14	5.500	115	123
00:56:21	5.500	116	123
00:56:30	5.500	116	123
00:56:31	5.440	116	123
00:56:31		Fire is declining	
00:56:41	5.123	116	123
00:56:50	4.807	116	124
00:57:00	4.490	117	124
00:57:09	4.174	117	123
00:57:19	3.858	117	123
00:57:28	3.541	117	123
00:57:38	3.225	117	123
00:57:47	2.908	117	123
00:57:57	2.592	117	122
00:58:06	2.275	117	122
00:58:16	1.959	117	122
00:58:25	1.642	117	121
00:58:35	1.326	117	121
00:58:45	998	117	120
00:58:54	682	117	120
00:59:04	365	116	119
00:59:13	49	116	118
00:59:15	0	116	118
00:59:15		Fire has been put out	

Simulation results for each room

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:00:00	0,00		36,00	20		-0,010
00:00:09	0,00		36,00	20		0,000
00:00:18	0,00		36,00	20		0,000
00:00:28	0,00		36,00	20		0,000
00:00:37	0,00		36,00	20		0,000
00:00:47	0,00		36,00	20		0,000
00:00:56	0,00		36,00	20		0,000
00:01:05	0,00		36,00	20		0,000
00:01:15	0,00		36,00	20		0,000
00:01:25	0,00		36,00	20		0,022
00:01:35	0,00		36,00	20		0,029
00:01:44	0,00		36,00	20		0,035
00:01:54	0,00		36,00	20		0,039
00:02:04	0,00		36,00	20		0,044
00:02:13	0,01		36,00	20		0,047
00:02:23	0,01		36,00	20		0,050
00:02:33	0,01	0,09	35,53	21		0,240
00:02:42	0,01	0,10	33,51	21	0,09	0,303
00:02:52	0,01	0,11	31,66	22	0,10	0,375
00:03:02	0,01	0,12	29,85	22	0,11	0,464
00:03:11	0,01	0,14	28,21	22	0,12	0,565
00:03:21	0,01	0,15	26,73	22	0,13	0,680
00:03:30	0,01	0,17	25,39	23	0,14	0,808
00:03:40	0,01	0,19	24,10	23	0,15	0,963
00:03:50	0,01	0,21	22,92	23	0,15	1,136
00:04:00	0,01	0,23	21,84	24	0,16	1,327
00:04:09	0,01	0,25	20,84	24	0,17	1,537
00:04:19	0,01	0,28	19,83	24	0,18	1,784
00:04:29	0,01	0,30	18,88	25	0,20	2,051
00:04:38	0,01	0,32	18,00	25	0,21	2,353
00:04:48	0,01	0,34	17,16	25	0,22	2,699
00:04:58	0,01	0,36	16,35	26	0,23	3,085
00:05:08	0,01	0,38	15,58	26	0,24	3,505
00:05:17	0,01	0,40	14,83	26	0,25	3,959
00:05:27	0,01	0,43	14,07	27	0,26	4,477
00:05:37	0,01	0,45	13,33	27	0,27	5,034
00:05:47	0,01	0,48	12,61	27	0,28	5,239
00:05:55	0,01	0,50	12,02	28	0,29	5,140
00:06:05	0,01	0,53	11,35	28	0,30	5,033
00:06:14	0,01	0,55	10,81	29	0,31	4,950
00:06:22	0,01	0,57	10,27	29	0,32	4,869
00:06:31	0,01	0,59	9,75	29	0,33	4,793
00:06:40	0,01	0,61	9,25	30	0,34	4,720
00:06:49	0,01	0,63	8,78	30	0,35	4,651
00:06:59	0,01	0,66	8,31	30	0,36	4,585
00:07:08	0,01	0,68	7,86	31	0,37	4,520
00:07:17	0,01	0,70	7,42	31	0,37	4,458
00:07:27	0,01	0,72	6,99	31	0,38	4,398
00:07:37	0,01	0,74	6,57	32	0,39	4,339
00:07:45	0,01	0,76	6,26	32	0,39	4,295
00:07:52	0,01	0,78	5,96	32	0,40	4,253
00:08:00	0,01	0,79	5,66	32	0,40	4,211
00:08:08	0,01	0,81	5,36	33	0,41	4,169

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:08:14	0,01	0,82	5,17	33	0,41	4,142
00:08:14	Critical condition in room 'Part I': Smoke free height less than 5,20 m					
00:08:22	0,01	0,84	4,88	33	0,42	4,102
00:08:30	0,01	0,86	4,59	33	0,42	4,063
00:08:39	0,01	0,88	4,31	33	0,43	4,024
00:08:48	0,01	0,89	4,03	34	0,43	3,986
00:08:57	0,01	0,91	3,75	34	0,44	3,948
00:09:06	0,01	0,93	3,48	34	0,44	3,912
00:09:16	0,01	0,95	3,21	35	0,44	3,876
00:09:26	0,01	0,97	2,95	35	0,45	3,841
00:09:32	0,01	0,99	2,78	35	0,45	3,818
00:09:39	0,01	1,00	2,61	35	0,45	3,796
00:09:46	0,01	1,01	2,44	35	0,45	3,775
00:09:53	0,01	1,03	2,27	36	0,46	3,754
00:10:00	0,01	1,04	2,11	36	0,46	3,734
00:10:07	0,01	1,06	1,94	36	0,46	3,712
00:10:14	0,00	1,07	1,80	36	0,46	3,686
00:10:21	0,00	1,08	1,66	36	0,46	3,659
00:10:27	0,00	1,10	1,53	37	0,47	3,630
00:10:31	0,00	1,11	1,46	37	0,47	3,616
00:10:31	Critical condition in room 'Part II': Smoke free height less than 4,00 m					
00:10:38	0,00	1,12	1,34	37	0,47	3,587
00:10:44	0,00	1,13	1,22	37	0,47	3,557
00:10:52	0,00	1,15	1,08	37	0,47	3,523
00:10:59	0,00	1,16	0,98	38	0,47	3,495
00:11:06	0,00	1,18	0,88	38	0,48	3,469
00:11:13	0,00	1,19	0,79	38	0,48	3,444
00:11:19	0,00	1,20	0,70	38	0,48	3,421
00:11:26	0,00	1,22	0,62	38	0,48	3,401
00:11:33	0,00	1,23	0,55	38	0,48	3,383
00:11:40	0,00	1,25	0,48	39	0,48	3,368
00:11:46	0,00	1,26	0,42	39	0,48	3,357
00:11:53	0,00	1,27	0,36	39	0,48	3,348
00:12:00	0,00	1,29	0,31	39	0,49	3,343
00:12:09	0,00	1,31	0,25	40	0,49	3,328
00:12:18	0,00	1,33	0,20	40	0,49	3,310
00:12:27	0,00	1,35	0,16	40	0,49	3,291
00:12:37	0,00	1,37	0,13	40	0,49	3,271
00:12:46	0,00	1,39	0,10	41	0,49	3,249
00:12:55	0,00	1,41	0,07	41	0,50	3,226
00:13:05	0,00	1,43	0,06	41	0,50	3,202
00:13:15	0,00	1,45	0,04	42	0,50	3,176
00:13:22	0,00	1,47	0,03	42	0,50	3,157
00:13:29	0,00	1,49	0,03	42	0,50	3,138
00:13:36	0,00	1,50	0,02	42	0,50	3,118
00:13:44	0,00	1,52	0,02	42	0,51	3,096
00:13:51	0,00	1,54	0,01	43	0,51	3,074
00:13:59	0,00	1,56	0,01	43	0,51	3,051
00:14:08	0,00	1,58	0,01	43	0,51	3,026
00:14:16	0,00	1,60	0,01	43	0,51	2,999
00:14:25	0,00	1,62		44	0,51	2,972
00:14:35	0,00	1,64		44	0,52	2,942
00:14:40	0,00	1,65		44	0,52	2,927
00:14:45	0,00	1,67		44	0,52	2,911
00:14:51	0,00	1,68		45	0,52	2,895
00:14:56	0,00	1,69		45	0,52	2,878

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:15:02	0,00	1,71		45	0,52	2,861
00:15:08	0,00	1,72		45	0,52	2,843
00:15:14	0,00	1,74		45	0,52	2,824
00:15:21	0,00	1,75		46	0,53	2,802
00:15:29	0,00	1,77		46	0,53	2,781
00:15:29	Room 'Part I' is now filled with smoke					
00:15:36	0,00	1,79		46	0,53	2,761
00:15:43	0,00	1,81		46	0,53	2,738
00:15:50	0,00	1,82		46	0,53	2,720
00:16:00	0,00	1,85		47	0,53	2,691
00:16:06	0,00	1,86		47	0,54	2,677
00:16:14	0,00	1,88		47	0,54	2,653
00:16:22	0,00	1,90		47	0,54	2,631
00:16:32	0,00	1,93		48	0,54	2,605
00:16:41	0,00	1,95		48	0,54	2,582
00:16:49	0,00	1,97		48	0,55	2,561
00:16:59	0,00	1,99		49	0,55	2,537
00:17:08	0,00	2,02		49	0,55	2,514
00:17:16	0,00	2,04		49	0,55	2,494
00:17:26	0,00	2,06		49	0,55	2,473
00:17:35	0,00	2,08		50	0,55	2,452
00:17:43	0,00	2,10		50	0,56	2,434
00:17:52	0,00	2,13		50	0,56	2,415
00:18:02	0,00	2,15		51	0,56	2,395
00:18:10	0,00	2,17		51	0,56	2,379
00:18:19	0,00	2,19		51	0,56	2,365
00:18:28	0,00	2,21		51	0,57	2,347
00:18:36	0,00	2,23		52	0,57	2,332
00:18:45	0,00	2,26		52	0,57	2,316
00:18:54	0,00	2,28		52	0,57	2,301
00:19:03	0,00	2,30		53	0,57	2,286
00:19:12	0,00	2,32		53	0,58	2,270
00:19:21	0,00	2,34		53	0,58	2,255
00:19:29	0,00	2,36		53	0,58	2,240
00:19:38	0,00	2,39		54	0,58	2,223
00:19:47	0,00	2,41		54	0,58	2,208
00:19:56	0,00	2,43		54	0,59	2,194
00:20:04	0,00	2,45		54	0,59	2,180
00:20:14	0,00	2,47		55	0,59	2,165
00:20:22	0,00	2,49		55	0,59	2,151
00:20:31	0,00	2,51		55	0,59	2,135
00:20:40	0,00	2,54		56	0,60	2,120
00:20:48	0,00	2,56		56	0,60	2,107
00:20:57	0,00	2,58		56	0,60	2,094
00:21:06	0,00	2,60		56	0,60	2,080
00:21:14	0,00	2,62		57	0,60	2,066
00:21:23	0,00	2,64		57	0,61	2,051
00:21:32	0,00	2,66		57	0,61	2,037
00:21:40	0,00	2,69		57	0,61	2,025
00:21:49	0,00	2,71		58	0,61	2,012
00:21:58	0,00	2,73		58	0,61	1,998
00:22:06	0,00	2,75		58	0,62	1,983
00:22:15	0,00	2,77		58	0,62	1,970
00:22:24	0,00	2,79		59	0,62	1,958
00:22:32	0,00	2,81		59	0,62	1,944
00:22:41	0,00	2,83		59	0,62	1,932

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:22:49	0,00	2,85		60	0,63	1,917
00:22:58	0,00	2,87		60	0,63	1,904
00:23:06	0,00	2,89		60	0,63	1,893
00:23:15	0,00	2,92		60	0,63	1,880
00:23:24	0,00	2,94		61	0,63	1,867
00:23:32	0,00	2,96		61	0,64	1,853
00:23:41	0,00	2,98		61	0,64	1,841
00:23:45	0,00	2,99		61	0,64	1,833
00:23:45	Room 'Part II' is now filled with smoke					
00:23:54	0,00	3,01		61	0,64	1,821
00:24:02	0,00	3,03		62	0,64	1,810
00:24:11	0,00	3,05		62	0,64	1,797
00:24:19	0,00	3,07		62	0,65	1,783
00:24:28	0,00	3,09		63	0,65	1,771
00:24:36	0,00	3,11		63	0,65	1,760
00:24:45	0,00	3,13		63	0,65	1,748
00:24:53	0,00	3,15		63	0,65	1,736
00:25:02	0,00	3,17		64	0,66	1,722
00:25:10	0,00	3,19		64	0,66	1,711
00:25:19	0,00	3,21		64	0,66	1,699
00:25:27	0,00	3,23		64	0,66	1,685
00:25:36	0,00	3,25		65	0,66	1,674
00:25:44	0,00	3,27		65	0,67	1,663
00:25:53	0,00	3,29		65	0,67	1,651
00:26:01	0,00	3,31		65	0,67	1,638
00:26:09	0,00	3,33		66	0,67	1,628
00:26:18	0,00	3,35		66	0,67	1,616
00:26:26	0,00	3,37		66	0,68	1,604
00:26:35	0,00	3,39		66	0,68	1,591
00:26:43	0,00	3,41		67	0,68	1,581
00:26:51	0,00	3,43		67	0,68	1,569
00:27:00	0,00	3,45		67	0,68	1,556
00:27:08	0,00	3,47		67	0,69	1,546
00:27:17	0,00	3,49		68	0,69	1,535
00:27:25	0,00	3,51		68	0,69	1,521
00:27:33	0,00	3,53		68	0,69	1,512
00:27:42	0,00	3,55		68	0,69	1,500
00:27:50	0,00	3,57		69	0,70	1,489
00:27:58	0,00	3,59		69	0,70	1,476
00:28:07	0,00	3,61		69	0,70	1,466
00:28:15	0,00	3,63		69	0,70	1,455
00:28:23	0,00	3,65		70	0,70	1,442
00:28:32	0,00	3,67		70	0,71	1,433
00:28:40	0,00	3,69		70	0,71	1,422
00:28:48	0,00	3,71		70	0,71	1,409
00:28:56	0,00	3,73		71	0,71	1,399
00:29:05	0,00	3,75		71	0,71	1,389
00:29:13	0,00	3,77		71	0,72	1,375
00:29:21	0,00	3,79		71	0,72	1,366
00:29:29	0,00	3,81		71	0,72	1,356
00:29:38	0,00	3,83		72	0,72	1,343
00:29:46	0,00	3,85		72	0,72	1,334
00:29:54	0,00	3,86		72	0,73	1,323
00:30:02	0,00	3,88		72	0,73	1,310
00:30:11	0,00	3,90		73	0,73	1,301
00:30:19	0,00	3,92		73	0,73	1,291

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:30:27	0,00	3,94		73	0,73	1,278
00:30:35	0,00	3,96		73	0,74	1,269
00:30:43	0,00	3,98		74	0,74	1,259
00:30:52	0,00	4,00		74	0,74	1,246
00:31:00	0,00	4,02		74	0,74	1,237
00:31:08	0,00	4,04		74	0,74	1,227
00:31:16	0,00	4,06		75	0,75	1,214
00:31:24	0,00	4,08		75	0,75	1,206
00:31:32	0,00	4,09		75	0,75	1,194
00:31:41	0,00	4,11		75	0,75	1,185
00:31:49	0,00	4,13		76	0,75	1,175
00:31:57	0,00	4,15		76	0,76	1,162
00:32:05	0,00	4,17		76	0,76	1,154
00:32:13	0,00	4,19		76	0,76	1,144
00:32:21	0,00	4,21		76	0,76	1,131
00:32:29	0,00	4,23		77	0,76	1,123
00:32:37	0,00	4,24		77	0,77	1,111
00:32:45	0,00	4,26		77	0,77	1,103
00:32:54	0,00	4,28		77	0,77	1,092
00:33:02	0,00	4,30		78	0,77	1,080
00:33:10	0,00	4,32		78	0,77	1,072
00:33:18	0,00	4,34		78	0,78	1,060
00:33:26	0,00	4,36		78	0,78	1,052
00:33:34	0,00	4,37		79	0,78	1,042
00:33:42	0,00	4,39		79	0,78	1,030
00:33:50	0,00	4,41		79	0,79	1,022
00:33:58	0,00	4,43		79	0,79	1,010
00:34:06	0,00	4,45		79	0,79	1,002
00:34:14	0,00	4,47		80	0,79	0,992
00:34:22	0,00	4,49		80	0,79	0,981
00:34:30	0,00	4,50		80	0,80	0,973
00:34:38	0,00	4,52		80	0,80	0,961
00:34:46	0,00	4,54		81	0,80	0,953
00:34:54	0,00	4,56		81	0,80	0,943
00:35:02	0,00	4,58		81	0,80	0,934
00:35:10	0,00	4,60		81	0,81	0,924
00:35:18	0,00	4,61		82	0,81	0,912
00:35:26	0,00	4,63		82	0,81	0,905
00:35:34	0,00	4,65		82	0,81	0,893
00:35:42	0,00	4,67		82	0,81	0,885
00:35:50	0,00	4,69		82	0,82	0,876
00:35:58	0,00	4,70		83	0,82	0,866
00:36:06	0,00	4,72		83	0,82	0,857
00:36:14	0,00	4,74		83	0,82	0,845
00:36:22	0,00	4,76		83	0,82	0,838
00:36:30	0,00	4,78		84	0,83	0,826
00:36:38	0,00	4,79		84	0,83	0,819
00:36:45	0,00	4,81		84	0,83	0,808
00:36:53	0,00	4,83		84	0,83	0,800
00:37:01	0,00	4,85		84	0,83	0,791
00:37:09	0,00	4,87		85	0,84	0,782
00:37:17	0,00	4,88		85	0,84	0,772
00:37:25	0,00	4,90		85	0,84	0,763
00:37:33	0,00	4,92		85	0,84	0,754
00:37:41	0,00	4,94		86	0,85	0,745
00:37:49	0,00	4,96		86	0,85	0,736

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:37:56	0,00	4,97		86	0,85	0,724
00:38:04	0,00	4,99		86	0,85	0,717
00:38:12	0,00	5,01		86	0,85	0,706
00:38:20	0,00	5,03		87	0,86	0,699
00:38:28	0,00	5,04		87	0,86	0,688
00:38:36	0,00	5,06		87	0,86	0,681
00:38:43	0,00	5,08		87	0,86	0,670
00:38:51	0,00	5,10		88	0,86	0,663
00:38:59	0,00	5,11		88	0,87	0,652
00:39:07	0,00	5,13		88	0,87	0,645
00:39:15	0,00	5,15		88	0,87	0,634
00:39:22	0,00	5,17		88	0,87	0,627
00:39:30	0,00	5,18		89	0,87	0,616
00:39:38	0,00	5,20		89	0,88	0,610
00:39:46	0,00	5,22		89	0,88	0,599
00:39:53	0,00	5,24		89	0,88	0,592
00:40:00	0,00	5,25		89	0,88	0,581
00:40:00	Fire brigade is alarmed					
00:40:07	0,00	5,27		90	0,88	0,574
00:40:15	0,00	5,28		90	0,89	0,568
00:40:23	0,00	5,30		90	0,89	0,557
00:40:31	0,00	5,32		90	0,89	0,551
00:40:38	0,00	5,34		91	0,89	0,540
00:40:46	0,00	5,35		91	0,89	0,533
00:40:54	0,00	5,37		91	0,90	0,522
00:41:01	0,00	5,39		91	0,90	0,516
00:41:09	0,00	5,40		91	0,90	0,508
00:41:17	0,00	5,42		92	0,90	0,499
00:41:24	0,00	5,44		92	0,91	0,491
00:41:32	0,00	5,46		92	0,91	0,482
00:41:40	0,00	5,47		92	0,91	0,474
00:41:48	0,00	5,49		92	0,91	0,466
00:41:55	0,00	5,51		93	0,91	0,457
00:42:03	0,00	5,52		93	0,92	0,449
00:42:11	0,00	5,54		93	0,92	0,440
00:42:18	0,00	5,56		93	0,92	0,432
00:42:26	0,00	5,57		93	0,92	0,424
00:42:34	0,00	5,59		94	0,92	0,413
00:42:41	0,00	5,61		94	0,93	0,407
00:42:49	0,00	5,63		94	0,93	0,396
00:42:57	0,00	5,64		94	0,93	0,391
00:43:04	0,00	5,66		95	0,93	0,380
00:43:12	0,00	5,68		95	0,93	0,374
00:43:19	0,00	5,69		95	0,94	0,366
00:43:27	0,00	5,71		95	0,94	0,358
00:43:35	0,00	5,73		95	0,94	0,350
00:43:42	0,00	5,74		96	0,94	0,342
00:43:50	0,00	5,76		96	0,95	0,334
00:43:58	0,00	5,78		96	0,95	0,323
00:44:05	0,00	5,79		96	0,95	0,318
00:44:13	0,00	5,81		96	0,95	0,307
00:44:20	0,00	5,83		97	0,95	0,302
00:44:28	0,00	5,84		97	0,96	0,294
00:44:36	0,00	5,86		97	0,96	0,286
00:44:43	0,00	5,88		97	0,96	0,278
00:44:51	0,00	5,89		97	0,96	0,271

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:44:58	0,00	5,91		98	0,96	0,263
00:45:06	0,00	5,93		98	0,97	0,252
00:45:13	0,00	5,94		98	0,97	0,247
00:45:21	0,00	5,96		98	0,97	0,239
00:45:29	0,00	5,97		98	0,97	0,231
00:45:36	0,00	5,99		99	0,98	0,224
00:45:43	0,00	6,01		99	0,98	0,213
00:45:51	0,00	6,02		99	0,98	0,208
00:45:58	0,00	6,04		99	0,98	0,201
00:46:06	0,00	6,06		99	0,98	0,193
00:46:14	0,00	6,07		100	0,99	0,185
00:46:21	0,00	6,09		100	0,99	0,175
00:46:29	0,00	6,11		100	0,99	0,170
00:46:36	0,00	6,12		100	0,99	0,163
00:46:44	0,00	6,14		100	0,99	0,155
00:46:51	0,00	6,15		101	1,00	0,148
00:46:59	0,00	6,17		101	1,00	0,138
00:47:06	0,00	6,19		101	1,00	0,133
00:47:13	0,00	6,20		101	1,00	0,126
00:47:21	0,00	6,22		101	1,01	0,118
00:47:28	0,00	6,23		102	1,01	0,111
00:47:36	0,00	6,25		102	1,01	0,101
00:47:43	0,00	6,27		102	1,01	0,096
00:47:51	0,00	6,28		102	1,01	0,089
00:47:58	0,00	6,30		102	1,02	0,082
00:48:06	0,00	6,32		103	1,02	0,074
00:48:13	0,00	6,33		103	1,02	0,065
00:48:21	0,00	6,35		103	1,02	0,060
00:48:28	0,00	6,36		103	1,02	0,053
00:48:35	0,00	6,38		103	1,03	0,043
00:48:43	0,00	6,40		104	1,03	0,039
00:48:50	0,00	6,41		104	1,03	0,032
00:48:58	0,00	6,43		104	1,03	0,025
00:49:05	0,00	6,44		104	1,04	0,018
00:49:13	0,00	6,46		104	1,04	0,011
00:49:20	0,00	6,47		105	1,04	0,004
00:49:27	0,00	6,49		105	1,04	-0,002
00:49:35	0,00	6,51		105	1,04	-0,012
00:49:42	0,00	6,52		105	1,05	-0,016
00:49:49	0,00	6,54		105	1,05	-0,022
00:49:57	0,00	6,55		106	1,05	-0,032
00:50:04	0,00	6,57		106	1,05	-0,035
00:50:11	0,00	6,59		106	1,05	-0,042
00:50:19	0,00	6,60		106	1,06	-0,051
00:50:26	0,00	6,62		106	1,06	-0,054
00:50:33	0,00	6,63		107	1,06	-0,061
00:50:41	0,00	6,65		107	1,06	-0,070
00:50:48	0,00	6,66		107	1,07	-0,074
00:50:55	0,00	6,68		107	1,07	-0,080
00:51:03	0,00	6,69		107	1,07	-0,086
00:51:10	0,00	6,71		108	1,07	-0,093
00:51:17	0,00	6,73		108	1,07	-0,099
00:51:25	0,00	6,74		108	1,08	-0,105
00:51:32	0,00	6,76		108	1,08	-0,111
00:51:39	0,00	6,77		108	1,08	-0,117
00:51:47	0,00	6,79		109	1,08	-0,124

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:51:54	0,00	6,80		109	1,09	-0,133
00:52:01	0,00	6,82		109	1,09	-0,136
00:52:09	0,00	6,83		109	1,09	-0,142
00:52:16	0,00	6,85		109	1,09	-0,151
00:52:23	0,00	6,86		109	1,09	-0,154
00:52:30	0,00	6,88		110	1,10	-0,161
00:52:38	0,00	6,90		110	1,10	-0,167
00:52:45	0,00	6,91		110	1,10	-0,173
00:52:52	0,00	6,93		110	1,10	-0,179
00:53:00	0,00	6,94		110	1,10	-0,185
00:53:07	0,00	6,96		111	1,11	-0,194
00:53:14	0,00	6,97		111	1,11	-0,197
00:53:21	0,00	6,99		111	1,11	-0,203
00:53:28	0,00	7,00		111	1,11	-0,209
00:53:36	0,00	7,02		111	1,12	-0,215
00:53:43	0,00	7,03		112	1,12	-0,221
00:53:50	0,00	7,05		112	1,12	-0,227
00:53:57	0,00	7,06		112	1,12	-0,236
00:54:05	0,00	7,08		112	1,12	-0,239
00:54:12	0,00	7,09		112	1,13	-0,244
00:54:19	0,00	7,11		112	1,13	-0,250
00:54:26	0,00	7,12		113	1,13	-0,259
00:54:33	0,00	7,14		113	1,13	-0,262
00:54:41	0,00	7,15		113	1,14	-0,268
00:54:48	0,00	7,17		113	1,14	-0,274
00:54:55	0,00	7,18		113	1,14	-0,280
00:55:00	0,00	7,19		114	1,14	-0,285
00:55:00	Fire brigade arrived, preparing extinguishing					
00:55:07	0,00	7,21		114	1,14	-0,289
00:55:14	0,00	7,22		114	1,15	-0,295
00:55:21	0,00	7,24		114	1,15	-0,301
00:55:28	0,00	7,25		114	1,15	-0,306
00:55:35	0,00	7,27		114	1,15	-0,312
00:55:43	0,00	7,28		115	1,15	-0,318
00:55:50	0,00	7,30		115	1,16	-0,324
00:56:00	0,00	7,32		115	1,16	-0,332
00:56:00	Fire brigade ready, extinguishing started					
00:56:07	0,00	7,33		115	1,16	-0,337
00:56:14	0,00	7,35		115	1,16	-0,343
00:56:21	0,00	7,36		116	1,17	-0,349
00:56:30	0,00	7,38		116	1,17	-0,357
00:56:31	0,00	7,38		116	1,17	-0,411
00:56:31	Fire is declining					
00:56:41	0,00	7,40		116	1,17	-0,683
00:56:50	0,00	7,42		116	1,17	-0,951
00:57:00	0,00	7,44		117	1,18	-1,212
00:57:09	0,00	7,46		117	1,18	-1,467
00:57:19	0,00	7,48		117	1,18	-1,714
00:57:28	0,00	7,49		117	1,18	-1,955
00:57:38	0,00	7,51		117	1,18	-2,189
00:57:47	0,00	7,52		117	1,18	-2,418
00:57:57	0,00	7,53		117	1,18	-2,642
00:58:06	0,00	7,54		117	1,18	-2,865
00:58:16	0,00	7,55		117	1,18	-3,081
00:58:25	0,00	7,56		117	1,18	-3,294
00:58:35	0,00	7,57		117	1,18	-3,504

Part I

Time	*Smoke room [dB/m]*	*Smoke layer [dB/m]*	*Floor layer [m]*	*Layer temp. [ºC]*	*Heat radiation [kW/m²]*	*Floor pressure [N/m²]*
00:58:45	0,00	7,58		117	1,18	-3,720
00:58:54	0,00	7,58		117	1,18	-3,926
00:59:04	0,00	7,59		116	1,18	-4,127
00:59:13	0,00	7,59		116	1,17	-4,325
00:59:15	0,00	7,59		116	1,17	-4,358
00:59:15	Fire has been put out					

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:00:00	0,00		24,00	20		-0,005
00:00:09	0,00		24,00	20		0,000
00:00:18	0,00		24,00	20		0,000
00:00:28	0,00		24,00	20		0,000
00:00:37	0,00		24,00	20		0,000
00:00:47	0,00		24,00	20		0,000
00:00:56	0,00		24,00	20		0,000
00:01:05	0,01		24,00	20		0,000
00:01:15	0,01		24,00	20		0,000
00:01:25	0,01	0,14	23,43	22		0,022
00:01:35	0,01	0,15	22,57	22	0,12	0,028
00:01:44	0,01	0,17	21,78	23	0,13	0,034
00:01:54	0,01	0,19	21,13	23	0,13	0,037
00:02:04	0,01	0,21	20,60	23	0,14	0,038
00:02:13	0,01	0,23	20,20	24	0,14	0,039
00:02:23	0,01	0,26	19,89	24	0,15	0,038
00:02:33	0,01	0,28	19,66	25	0,15	0,224
00:02:42	0,01	0,31	19,50	25	0,15	0,283
00:02:52	0,01	0,34	19,39	26	0,15	0,351
00:03:02	0,01	0,37	19,31	26	0,15	0,436
00:03:11	0,01	0,40	19,27	27	0,16	0,534
00:03:21	0,01	0,43	19,24	28	0,16	0,645
00:03:30	0,01	0,47	19,22	28	0,16	0,770
00:03:40	0,01	0,50	19,22	29	0,16	0,922
00:03:50	0,01	0,54	19,21	29	0,16	1,092
00:04:00	0,01	0,57	19,19	30	0,16	1,282
00:04:09	0,01	0,60	19,14	31	0,17	1,492
00:04:19	0,01	0,64	19,05	32	0,17	1,738
00:04:29	0,01	0,68	18,89	32	0,17	2,008
00:04:38	0,01	0,71	18,62	33	0,18	2,313
00:04:48	0,01	0,74	18,23	33	0,18	2,661
00:04:58	0,01	0,77	17,78	34	0,19	3,045
00:05:08	0,01	0,79	17,30	34	0,20	3,464
00:05:17	0,01	0,81	16,81	35	0,20	3,916
00:05:27	0,01	0,84	16,28	35	0,21	4,431
00:05:37	0,01	0,86	15,74	36	0,22	4,984
00:05:47	0,01	0,89	15,20	36	0,23	5,187
00:05:55	0,01	0,90	14,74	36	0,24	5,087
00:06:05	0,01	0,92	14,19	37	0,25	4,982
00:06:14	0,01	0,93	13,71	37	0,26	4,899
00:06:22	0,01	0,94	13,22	37	0,26	4,818
00:06:31	0,01	0,95	12,74	37	0,27	4,741
00:06:40	0,01	0,96	12,26	37	0,28	4,668
00:06:49	0,01	0,97	11,80	37	0,29	4,598
00:06:59	0,01	0,99	11,34	38	0,30	4,531
00:07:08	0,01	1,00	10,90	38	0,31	4,466
00:07:17	0,01	1,01	10,46	38	0,32	4,402
00:07:27	0,01	1,03	10,02	38	0,33	4,340
00:07:37	0,01	1,04	9,59	38	0,34	4,280
00:07:45	0,01	1,06	9,28	38	0,35	4,235
00:07:52	0,01	1,07	8,96	39	0,35	4,190
00:08:00	0,01	1,08	8,65	39	0,36	4,146
00:08:08	0,01	1,09	8,34	39	0,37	4,103
00:08:14	0,01	1,10	8,13	39	0,37	4,074
00:08:14	Critical condition in room 'Part I': Smoke free height less than 5,20 m					
00:08:22	0,01	1,12	7,83	39	0,38	4,031

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:08:30	0,01	1,13	7,52	40	0,39	3,989
00:08:39	0,01	1,15	7,22	40	0,40	3,946
00:08:48	0,01	1,16	6,92	40	0,40	3,904
00:08:57	0,01	1,18	6,62	40	0,41	3,861
00:09:06	0,01	1,20	6,33	40	0,42	3,819
00:09:16	0,01	1,21	6,03	41	0,42	3,776
00:09:26	0,01	1,23	5,74	41	0,43	3,732
00:09:32	0,01	1,24	5,54	41	0,44	3,703
00:09:39	0,01	1,25	5,35	41	0,44	3,674
00:09:46	0,01	1,27	5,15	41	0,45	3,643
00:09:53	0,01	1,28	4,96	42	0,45	3,613
00:10:00	0,01	1,29	4,77	42	0,45	3,582
00:10:07	0,01	1,31	4,57	42	0,46	3,546
00:10:14	0,01	1,32	4,40	42	0,46	3,506
00:10:21	0,01	1,33	4,22	42	0,47	3,462
00:10:27	0,01	1,34	4,05	42	0,47	3,415
00:10:31	0,01	1,35	3,97	42	0,47	3,390
00:10:31	Critical condition in room 'Part II': Smoke free height less than 4,00 m					
00:10:38	0,01	1,36	3,80	43	0,48	3,338
00:10:44	0,01	1,38	3,63	43	0,48	3,283
00:10:52	0,01	1,39	3,44	43	0,48	3,215
00:10:59	0,01	1,41	3,29	43	0,49	3,156
00:11:06	0,01	1,42	3,14	43	0,49	3,094
00:11:13	0,01	1,43	2,99	44	0,49	3,031
00:11:19	0,01	1,45	2,84	44	0,50	2,966
00:11:26	0,01	1,46	2,70	44	0,50	2,900
00:11:33	0,01	1,47	2,55	44	0,50	2,833
00:11:40	0,01	1,49	2,42	44	0,51	2,765
00:11:46	0,01	1,50	2,28	45	0,51	2,697
00:11:53	0,01	1,52	2,15	45	0,51	2,628
00:12:00	0,01	1,53	2,02	45	0,51	2,559
00:12:09	0,01	1,55	1,85	45	0,52	2,451
00:12:18	0,01	1,57	1,69	46	0,52	2,343
00:12:27	0,01	1,59	1,54	46	0,52	2,230
00:12:37	0,01	1,62	1,40	46	0,53	2,115
00:12:46	0,01	1,64	1,27	46	0,53	1,999
00:12:55	0,00	1,66	1,15	47	0,53	1,883
00:13:05	0,00	1,68	1,03	47	0,53	1,766
00:13:15	0,00	1,71	0,92	47	0,54	1,651
00:13:22	0,00	1,73	0,86	48	0,54	1,574
00:13:29	0,00	1,74	0,79	48	0,54	1,498
00:13:36	0,00	1,76	0,73	48	0,54	1,423
00:13:44	0,00	1,78	0,67	48	0,54	1,348
00:13:51	0,00	1,80	0,62	49	0,55	1,274
00:13:59	0,00	1,82	0,57	49	0,55	1,200
00:14:08	0,00	1,84	0,52	49	0,55	1,127
00:14:16	0,00	1,86	0,47	49	0,55	1,054
00:14:25	0,00	1,88	0,42	50	0,55	0,982
00:14:35	0,00	1,90	0,38	50	0,56	0,910
00:14:40	0,00	1,92	0,36	50	0,56	0,874
00:14:45	0,00	1,93	0,34	50	0,56	0,839
00:14:51	0,00	1,94	0,32	51	0,56	0,803
00:14:56	0,00	1,96	0,31	51	0,56	0,767
00:15:02	0,00	1,97	0,29	51	0,56	0,732
00:15:08	0,00	1,99	0,27	51	0,56	0,696
00:15:14	0,00	2,00	0,25	51	0,57	0,661

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:15:21	0,00	2,02	0,24	52	0,57	0,620
00:15:29	0,00	2,04	0,22	52	0,57	0,580
00:15:29	Room 'Part I' is now filled with smoke					
00:15:36	0,00	2,05	0,20	52	0,57	0,544
00:15:43	0,00	2,07	0,19	52	0,57	0,507
00:15:50	0,00	2,09	0,18	53	0,57	0,474
00:16:00	0,00	2,11	0,16	53	0,58	0,429
00:16:06	0,00	2,13	0,15	53	0,58	0,406
00:16:14	0,00	2,15	0,14	53	0,58	0,371
00:16:22	0,00	2,17	0,13	54	0,58	0,338
00:16:32	0,00	2,19	0,12	54	0,58	0,300
00:16:41	0,00	2,21	0,11	54	0,59	0,268
00:16:49	0,00	2,23	0,10	55	0,59	0,240
00:16:59	0,00	2,26	0,09	55	0,59	0,208
00:17:08	0,00	2,28	0,08	55	0,59	0,179
00:17:16	0,00	2,30	0,08	55	0,59	0,153
00:17:26	0,00	2,32	0,07	56	0,60	0,126
00:17:35	0,00	2,35	0,07	56	0,60	0,100
00:17:43	0,00	2,37	0,06	56	0,60	0,078
00:17:52	0,00	2,39	0,06	57	0,60	0,054
00:18:02	0,00	2,41	0,05	57	0,61	0,031
00:18:10	0,00	2,43	0,05	57	0,61	0,012
00:18:19	0,00	2,45	0,05	57	0,61	-0,004
00:18:28	0,00	2,47	0,04	58	0,61	-0,023
00:18:36	0,00	2,49	0,04	58	0,61	-0,040
00:18:45	0,00	2,52	0,04	58	0,62	-0,057
00:18:54	0,00	2,54	0,03	59	0,62	-0,075
00:19:03	0,00	2,56	0,03	59	0,62	-0,091
00:19:12	0,00	2,58	0,03	59	0,62	-0,108
00:19:21	0,00	2,60	0,03	59	0,62	-0,124
00:19:29	0,00	2,62	0,03	60	0,63	-0,139
00:19:38	0,00	2,64	0,02	60	0,63	-0,155
00:19:47	0,00	2,67	0,02	60	0,63	-0,170
00:19:56	0,00	2,69	0,02	61	0,63	-0,185
00:20:04	0,00	2,71	0,02	61	0,64	-0,199
00:20:14	0,00	2,73	0,02	61	0,64	-0,214
00:20:22	0,00	2,75	0,02	61	0,64	-0,228
00:20:31	0,00	2,77	0,02	62	0,64	-0,242
00:20:40	0,00	2,79	0,01	62	0,64	-0,256
00:20:48	0,00	2,81	0,01	62	0,65	-0,270
00:20:57	0,00	2,83	0,01	63	0,65	-0,283
00:21:06	0,00	2,85	0,01	63	0,65	-0,297
00:21:14	0,00	2,88	0,01	63	0,65	-0,310
00:21:23	0,00	2,90	0,01	63	0,65	-0,322
00:21:32	0,00	2,92	0,01	64	0,66	-0,336
00:21:40	0,00	2,94	0,01	64	0,66	-0,348
00:21:49	0,00	2,96	0,01	64	0,66	-0,360
00:21:58	0,00	2,98	0,01	64	0,66	-0,373
00:22:06	0,00	3,00	0,01	65	0,66	-0,385
00:22:15	0,00	3,02	0,01	65	0,67	-0,397
00:22:24	0,00	3,04		65	0,67	-0,410
00:22:32	0,00	3,06		65	0,67	-0,422
00:22:41	0,00	3,08		66	0,67	-0,433
00:22:49	0,00	3,10		66	0,68	-0,445
00:22:58	0,00	3,12		66	0,68	-0,457
00:23:06	0,00	3,14		67	0,68	-0,468

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:23:15	0,00	3,16		67	0,68	-0,480
00:23:24	0,00	3,18		67	0,68	-0,492
00:23:32	0,00	3,20		67	0,69	-0,503
00:23:41	0,00	3,22		68	0,69	-0,514
00:23:45	0,00	3,23		68	0,69	-0,521
00:23:45	Room 'Part II' is now filled with smoke					
00:23:54	0,00	3,25		68	0,69	-0,532
00:24:02	0,00	3,27		68	0,69	-0,542
00:24:11	0,00	3,30		69	0,70	-0,553
00:24:19	0,00	3,31		69	0,70	-0,563
00:24:28	0,00	3,33		69	0,70	-0,574
00:24:36	0,00	3,36		69	0,70	-0,584
00:24:45	0,00	3,37		70	0,70	-0,594
00:24:53	0,00	3,39		70	0,71	-0,605
00:25:02	0,00	3,42		70	0,71	-0,615
00:25:10	0,00	3,43		70	0,71	-0,625
00:25:19	0,00	3,45		71	0,71	-0,635
00:25:27	0,00	3,47		71	0,71	-0,646
00:25:36	0,00	3,49		71	0,72	-0,655
00:25:44	0,00	3,51		71	0,72	-0,665
00:25:53	0,00	3,53		72	0,72	-0,676
00:26:01	0,00	3,55		72	0,72	-0,685
00:26:09	0,00	3,57		72	0,73	-0,695
00:26:18	0,00	3,59		72	0,73	-0,705
00:26:26	0,00	3,61		73	0,73	-0,715
00:26:35	0,00	3,63		73	0,73	-0,725
00:26:43	0,00	3,65		73	0,73	-0,735
00:26:51	0,00	3,67		73	0,74	-0,744
00:27:00	0,00	3,69		74	0,74	-0,754
00:27:08	0,00	3,71		74	0,74	-0,764
00:27:17	0,00	3,73		74	0,74	-0,773
00:27:25	0,00	3,75		74	0,74	-0,783
00:27:33	0,00	3,77		75	0,75	-0,793
00:27:42	0,00	3,79		75	0,75	-0,802
00:27:50	0,00	3,81		75	0,75	-0,811
00:27:58	0,00	3,83		75	0,75	-0,821
00:28:07	0,00	3,85		76	0,76	-0,830
00:28:15	0,00	3,87		76	0,76	-0,840
00:28:23	0,00	3,88		76	0,76	-0,849
00:28:32	0,00	3,90		76	0,76	-0,859
00:28:40	0,00	3,92		77	0,76	-0,868
00:28:48	0,00	3,94		77	0,77	-0,877
00:28:56	0,00	3,96		77	0,77	-0,886
00:29:05	0,00	3,98		77	0,77	-0,896
00:29:13	0,00	4,00		78	0,77	-0,905
00:29:21	0,00	4,02		78	0,78	-0,914
00:29:29	0,00	4,04		78	0,78	-0,923
00:29:38	0,00	4,06		78	0,78	-0,932
00:29:46	0,00	4,07		79	0,78	-0,941
00:29:54	0,00	4,09		79	0,78	-0,950
00:30:02	0,00	4,11		79	0,79	-0,960
00:30:11	0,00	4,13		79	0,79	-0,969
00:30:19	0,00	4,15		80	0,79	-0,977
00:30:27	0,00	4,17		80	0,79	-0,987
00:30:35	0,00	4,19		80	0,79	-0,995
00:30:43	0,00	4,21		80	0,80	-1,004

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:30:52	0,00	4,23		81	0,80	-1,013
00:31:00	0,00	4,24		81	0,80	-1,022
00:31:08	0,00	4,26		81	0,80	-1,031
00:31:16	0,00	4,28		81	0,81	-1,040
00:31:24	0,00	4,30		82	0,81	-1,048
00:31:32	0,00	4,32		82	0,81	-1,057
00:31:41	0,00	4,34		82	0,81	-1,066
00:31:49	0,00	4,36		82	0,81	-1,075
00:31:57	0,00	4,37		83	0,82	-1,083
00:32:05	0,00	4,39		83	0,82	-1,092
00:32:13	0,00	4,41		83	0,82	-1,100
00:32:21	0,00	4,43		83	0,82	-1,109
00:32:29	0,00	4,45		83	0,83	-1,118
00:32:37	0,00	4,47		84	0,83	-1,126
00:32:45	0,00	4,48		84	0,83	-1,135
00:32:54	0,00	4,50		84	0,83	-1,143
00:33:02	0,00	4,52		84	0,83	-1,152
00:33:10	0,00	4,54		85	0,84	-1,160
00:33:18	0,00	4,56		85	0,84	-1,169
00:33:26	0,00	4,58		85	0,84	-1,177
00:33:34	0,00	4,59		85	0,84	-1,185
00:33:42	0,00	4,61		86	0,85	-1,194
00:33:50	0,00	4,63		86	0,85	-1,202
00:33:58	0,00	4,65		86	0,85	-1,210
00:34:06	0,00	4,67		86	0,85	-1,219
00:34:14	0,00	4,68		87	0,85	-1,227
00:34:22	0,00	4,70		87	0,86	-1,235
00:34:30	0,00	4,72		87	0,86	-1,243
00:34:38	0,00	4,74		87	0,86	-1,251
00:34:46	0,00	4,76		87	0,86	-1,259
00:34:54	0,00	4,77		88	0,87	-1,268
00:35:02	0,00	4,79		88	0,87	-1,276
00:35:10	0,00	4,81		88	0,87	-1,284
00:35:18	0,00	4,83		88	0,87	-1,292
00:35:26	0,00	4,85		89	0,87	-1,300
00:35:34	0,00	4,86		89	0,88	-1,308
00:35:42	0,00	4,88		89	0,88	-1,316
00:35:50	0,00	4,90		89	0,88	-1,324
00:35:58	0,00	4,92		90	0,88	-1,332
00:36:06	0,00	4,93		90	0,89	-1,340
00:36:14	0,00	4,95		90	0,89	-1,348
00:36:22	0,00	4,97		90	0,89	-1,355
00:36:30	0,00	4,99		90	0,89	-1,364
00:36:38	0,00	5,00		91	0,89	-1,371
00:36:45	0,00	5,02		91	0,90	-1,379
00:36:53	0,00	5,04		91	0,90	-1,387
00:37:01	0,00	5,06		91	0,90	-1,395
00:37:09	0,00	5,07		92	0,90	-1,402
00:37:17	0,00	5,09		92	0,91	-1,410
00:37:25	0,00	5,11		92	0,91	-1,418
00:37:33	0,00	5,13		92	0,91	-1,425
00:37:41	0,00	5,14		92	0,91	-1,433
00:37:49	0,00	5,16		93	0,91	-1,441
00:37:56	0,00	5,18		93	0,92	-1,448
00:38:04	0,00	5,20		93	0,92	-1,456
00:38:12	0,00	5,21		93	0,92	-1,464

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:38:20	0,00	5,23		94	0,92	-1,471
00:38:28	0,00	5,25		94	0,93	-1,479
00:38:36	0,00	5,27		94	0,93	-1,486
00:38:43	0,00	5,28		94	0,93	-1,494
00:38:51	0,00	5,30		95	0,93	-1,501
00:38:59	0,00	5,32		95	0,93	-1,509
00:39:07	0,00	5,33		95	0,94	-1,516
00:39:15	0,00	5,35		95	0,94	-1,524
00:39:22	0,00	5,37		95	0,94	-1,531
00:39:30	0,00	5,39		96	0,94	-1,538
00:39:38	0,00	5,40		96	0,95	-1,546
00:39:46	0,00	5,42		96	0,95	-1,553
00:39:53	0,00	5,44		96	0,95	-1,560
00:40:00	0,00	5,45		96	0,95	-1,568
00:40:00	Fire brigade is alarmed					
00:40:07	0,00	5,47		97	0,95	-1,573
00:40:15	0,00	5,48		97	0,96	-1,580
00:40:23	0,00	5,50		97	0,96	-1,588
00:40:31	0,00	5,52		97	0,96	-1,595
00:40:38	0,00	5,53		98	0,96	-1,602
00:40:46	0,00	5,55		98	0,97	-1,609
00:40:54	0,00	5,57		98	0,97	-1,616
00:41:01	0,00	5,58		98	0,97	-1,623
00:41:09	0,00	5,60		98	0,97	-1,630
00:41:17	0,00	5,62		99	0,97	-1,638
00:41:24	0,00	5,63		99	0,98	-1,645
00:41:32	0,00	5,65		99	0,98	-1,652
00:41:40	0,00	5,67		99	0,98	-1,659
00:41:48	0,00	5,68		99	0,98	-1,666
00:41:55	0,00	5,70		100	0,99	-1,673
00:42:03	0,00	5,72		100	0,99	-1,680
00:42:11	0,00	5,73		100	0,99	-1,686
00:42:18	0,00	5,75		100	0,99	-1,693
00:42:26	0,00	5,77		101	1,00	-1,700
00:42:34	0,00	5,78		101	1,00	-1,707
00:42:41	0,00	5,80		101	1,00	-1,714
00:42:49	0,00	5,82		101	1,00	-1,721
00:42:57	0,00	5,83		101	1,00	-1,728
00:43:04	0,00	5,85		102	1,01	-1,735
00:43:12	0,00	5,87		102	1,01	-1,741
00:43:19	0,00	5,88		102	1,01	-1,748
00:43:27	0,00	5,90		102	1,01	-1,755
00:43:35	0,00	5,92		102	1,02	-1,762
00:43:42	0,00	5,93		103	1,02	-1,768
00:43:50	0,00	5,95		103	1,02	-1,775
00:43:58	0,00	5,97		103	1,02	-1,782
00:44:05	0,00	5,98		103	1,02	-1,788
00:44:13	0,00	6,00		104	1,03	-1,795
00:44:20	0,00	6,01		104	1,03	-1,801
00:44:28	0,00	6,03		104	1,03	-1,808
00:44:36	0,00	6,05		104	1,03	-1,815
00:44:43	0,00	6,06		104	1,04	-1,821
00:44:51	0,00	6,08		105	1,04	-1,828
00:44:58	0,00	6,10		105	1,04	-1,834
00:45:06	0,00	6,11		105	1,04	-1,841
00:45:13	0,00	6,13		105	1,05	-1,847

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:45:21	0,00	6,14		105	1,05	-1,853
00:45:29	0,00	6,16		106	1,05	-1,860
00:45:36	0,00	6,18		106	1,05	-1,866
00:45:43	0,00	6,19		106	1,05	-1,873
00:45:51	0,00	6,21		106	1,06	-1,879
00:45:58	0,00	6,22		106	1,06	-1,885
00:46:06	0,00	6,24		107	1,06	-1,892
00:46:14	0,00	6,26		107	1,06	-1,898
00:46:21	0,00	6,27		107	1,07	-1,904
00:46:29	0,00	6,29		107	1,07	-1,910
00:46:36	0,00	6,30		107	1,07	-1,917
00:46:44	0,00	6,32		108	1,07	-1,923
00:46:51	0,00	6,34		108	1,08	-1,929
00:46:59	0,00	6,35		108	1,08	-1,935
00:47:06	0,00	6,37		108	1,08	-1,941
00:47:13	0,00	6,38		108	1,08	-1,947
00:47:21	0,00	6,40		109	1,08	-1,954
00:47:28	0,00	6,41		109	1,09	-1,959
00:47:36	0,00	6,43		109	1,09	-1,965
00:47:43	0,00	6,45		109	1,09	-1,972
00:47:51	0,00	6,46		109	1,09	-1,977
00:47:58	0,00	6,48		110	1,10	-1,983
00:48:06	0,00	6,49		110	1,10	-1,989
00:48:13	0,00	6,51		110	1,10	-1,995
00:48:21	0,00	6,52		110	1,10	-2,001
00:48:28	0,00	6,54		110	1,11	-2,007
00:48:35	0,00	6,56		111	1,11	-2,013
00:48:43	0,00	6,57		111	1,11	-2,019
00:48:50	0,00	6,59		111	1,11	-2,025
00:48:58	0,00	6,60		111	1,11	-2,030
00:49:05	0,00	6,62		111	1,12	-2,036
00:49:13	0,00	6,63		112	1,12	-2,042
00:49:20	0,00	6,65		112	1,12	-2,047
00:49:27	0,00	6,66		112	1,12	-2,053
00:49:35	0,00	6,68		112	1,13	-2,058
00:49:42	0,00	6,70		112	1,13	-2,063
00:49:49	0,00	6,71		113	1,13	-2,069
00:49:57	0,00	6,73		113	1,13	-2,074
00:50:04	0,00	6,74		113	1,14	-2,079
00:50:11	0,00	6,76		113	1,14	-2,085
00:50:19	0,00	6,77		113	1,14	-2,090
00:50:26	0,00	6,79		114	1,14	-2,095
00:50:33	0,00	6,80		114	1,14	-2,100
00:50:41	0,00	6,82		114	1,15	-2,105
00:50:48	0,00	6,83		114	1,15	-2,111
00:50:55	0,00	6,85		114	1,15	-2,116
00:51:03	0,00	6,86		115	1,15	-2,121
00:51:10	0,00	6,88		115	1,16	-2,126
00:51:17	0,00	6,90		115	1,16	-2,131
00:51:25	0,00	6,91		115	1,16	-2,136
00:51:32	0,00	6,93		115	1,16	-2,141
00:51:39	0,00	6,94		116	1,17	-2,146
00:51:47	0,00	6,96		116	1,17	-2,151
00:51:54	0,00	6,97		116	1,17	-2,156
00:52:01	0,00	6,99		116	1,17	-2,161
00:52:09	0,00	7,00		116	1,18	-2,166

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:52:16	0,00	7,02		117	1,18	-2,171
00:52:23	0,00	7,03		117	1,18	-2,176
00:52:30	0,00	7,05		117	1,18	-2,181
00:52:38	0,00	7,06		117	1,18	-2,186
00:52:45	0,00	7,08		117	1,19	-2,191
00:52:52	0,00	7,09		118	1,19	-2,196
00:53:00	0,00	7,11		118	1,19	-2,201
00:53:07	0,00	7,12		118	1,19	-2,206
00:53:14	0,00	7,14		118	1,20	-2,211
00:53:21	0,00	7,15		118	1,20	-2,215
00:53:28	0,00	7,17		119	1,20	-2,220
00:53:36	0,00	7,18		119	1,20	-2,225
00:53:43	0,00	7,20		119	1,21	-2,230
00:53:50	0,00	7,21		119	1,21	-2,235
00:53:57	0,00	7,23		119	1,21	-2,240
00:54:05	0,00	7,24		119	1,21	-2,244
00:54:12	0,00	7,26		120	1,21	-2,249
00:54:19	0,00	7,27		120	1,22	-2,254
00:54:26	0,00	7,29		120	1,22	-2,259
00:54:33	0,00	7,30		120	1,22	-2,263
00:54:41	0,00	7,31		120	1,22	-2,268
00:54:48	0,00	7,33		121	1,23	-2,273
00:54:55	0,00	7,34		121	1,23	-2,278
00:55:00	0,00	7,35		121	1,23	-2,282
00:55:00	Fire brigade arrived, preparing extinguishing					
00:55:07	0,00	7,37		121	1,23	-2,285
00:55:14	0,00	7,38		121	1,23	-2,290
00:55:21	0,00	7,40		121	1,24	-2,295
00:55:28	0,00	7,41		122	1,24	-2,300
00:55:35	0,00	7,43		122	1,24	-2,304
00:55:43	0,00	7,44		122	1,24	-2,309
00:55:50	0,00	7,46		122	1,25	-2,314
00:56:00	0,00	7,48		122	1,25	-2,320
00:56:00	Fire brigade ready, extinguishing started					
00:56:07	0,00	7,49		123	1,25	-2,325
00:56:14	0,00	7,51		123	1,25	-2,329
00:56:21	0,00	7,52		123	1,26	-2,334
00:56:30	0,00	7,54		123	1,26	-2,341
00:56:31	0,00	7,54		123	1,26	-2,392
00:56:31	Fire is declining					
00:56:41	0,00	7,56		123	1,26	-2,645
00:56:50	0,00	7,57		124	1,26	-2,871
00:57:00	0,00	7,59		124	1,26	-3,078
00:57:09	0,00	7,60		123	1,26	-3,268
00:57:19	0,00	7,61		123	1,26	-3,447
00:57:28	0,00	7,62		123	1,26	-3,614
00:57:38	0,00	7,62		123	1,26	-3,773
00:57:47	0,00	7,63		123	1,25	-3,923
00:57:57	0,00	7,63		122	1,25	-4,066
00:58:06	0,00	7,64		122	1,25	-4,203
00:58:16	0,00	7,64		122	1,24	-4,333
00:58:25	0,00	7,64		121	1,24	-4,458
00:58:35	0,00	7,64		121	1,23	-4,577
00:58:45	0,00	7,63		120	1,22	-4,682
00:58:54	0,00	7,62		120	1,21	-4,742
00:59:04	0,00	7,60		119	1,21	-4,814

Part II

Time	*Smoke room [dB/m]*	*Smoke layer [dB/m]*	*Floor layer [m]*	*Layer temp. [ºC]*	*Heat radiation [kW/m²]*	*Floor pressure [N/m²]*
00:59:13	0,00	7,59		118	1,20	-4,898
00:59:15	0,00	7,58		118	1,20	-4,915
00:59:15	Fire has been put out					

Calculation

Basic information

Client:	BWSC
Scenario name:	Part I
Consultant:	Rambøll
Reference no.:	
Company type:	Industry, chemical
Basic bldg. construction:	Brick-wall/concrete-roof
Last revision:	12-12-2018 14:27:23
Revision No.:	40

Calculation options

Post flash-over model enabled:	x
Time limit [min]:	60
Plumemodel:	Heskestad

Fire brigade

Fire brigade active:	-
City area:	-
24 hour:	-
Distance/fire station [km]:	10,0
Calculated response time [min]:	15
Time before manual alarm [min]:	40

Fire start

Fire start room:	Part I
Fire start, type:	Energy formula fire
Fire start, name:	11 MW Fast
Fire start, code:	-
Optical smoke potential [dB/m]:	100,0
Maximum Q(t) [MW]:	11,00
Parabolic growth [MW/min²]:	0,1692
Parabolic growth [kW/s²]:	0,0470
Linear growth [MW/min]:	0,0000
Constant fire [MW]:	0,0000
Initial fire [kW]:	0,00
Doubling time [min]:	0,00

Fire installations

	[---------- In operation ----------]						
Room name	AFV Heat	AFV Smoke	AFV Timer	Sprinkler	AFA Heat	AFA Smoke	Windload [m/s]
Part I	-	-	-	-	-	-	0,00
Part II	-	-	-	-	-	-	0,00

Events

Fire progression:
Energy formula fire > 11 MW Fast
Plumemodel > Heskestad
00:08:27 : Critical condition in room 'Part II': Smoke free height less than 4,00 m
00:08:57 : Critical condition in room 'Part I': Smoke free height less than 5,20 m
00:13:25 : Room 'Part II' is now filled with smoke
00:20:12 : Room 'Part I' is now filled with smoke
00:40:00 : Fire brigade is alarmed
00:49:49 : Critical condition in room 'Part I': Heat radiation from smoke layer greater than 2,5 kW/m²
00:52:40 : Critical condition in room 'Part II': Heat radiation from smoke layer greater than 2,5 kW/m²
00:55:00 : Fire brigade arrived, preparing extinguishing
00:56:00 : Fire brigade ready, extinguishing started
00:56:32 : Fire is declining
01:00:00 : MAX. CALCULATION TIME - CALCULATION ABORTED!

RHR and smoke layer temperature in all rooms

Time	Rate of heat release [kW]	Smoke layer temp. [ºC] Part I	Smoke layer temp. [ºC] Part II
00:00:00	0	20	20
00:00:09	4	20	20
00:00:19	18	20	20
00:00:28	39	20	20
00:00:37	68	20	20
00:00:47	105	20	20
00:00:56	151	20	20
00:01:06	206	20	20
00:01:15	269	20	20
00:01:25	340	20	20
00:01:34	419	20	20
00:01:43	505	20	20
00:01:52	600	22	20
00:02:01	699	22	20
00:02:11	815	22	20
00:02:21	935	22	20
00:02:30	1.058	22	20
00:02:39	1.201	23	20
00:02:49	1.349	23	20
00:02:58	1.500	23	20
00:03:07	1.656	23	20
00:03:17	1.830	24	20
00:03:27	2.020	24	20
00:03:37	2.218	24	20
00:03:47	2.424	25	23
00:03:56	2.634	25	23
00:04:06	2.859	25	24
00:04:16	3.094	26	24
00:04:25	3.325	26	24
00:04:35	3.579	27	25
00:04:45	3.838	27	25
00:04:55	4.105	28	25
00:05:04	4.372	28	25
00:05:14	4.646	29	25
00:05:23	4.924	29	26
00:05:33	5.231	30	26
00:05:43	5.541	30	26
00:05:52	5.857	31	27
00:06:02	6.176	32	27
00:06:11	6.500	32	28
00:06:21	6.853	33	28
00:06:31	7.211	33	29
00:06:41	7.574	34	29
00:06:51	7.941	35	30
00:07:00	8.312	35	30
00:07:09	8.687	36	31
00:07:19	9.094	37	31

00:07:29	9.506	38	32
00:07:39	9.922	38	33
00:07:49	10.343	39	33
00:07:58	10.768	40	34
00:08:08	11.000	41	35
00:08:17	11.000	41	35
00:08:27	11.000	42	36
00:08:27		Critical condition in room 'Part II': Smoke free height less than 4,00 m	
00:08:35	11.000	43	37
00:08:44	11.000	43	37
00:08:53	11.000	44	38
00:08:57	11.000	44	38
00:08:57		Critical condition in room 'Part I': Smoke free height less than 5,20 m	
00:09:07	11.000	45	39
00:09:17	11.000	46	40
00:09:26	11.000	46	40
00:09:36	11.000	47	41
00:09:44	11.000	48	42
00:09:53	11.000	48	42
00:10:01	11.000	49	43
00:10:10	11.000	49	44
00:10:19	11.000	50	44
00:10:28	11.000	51	45
00:10:37	11.000	51	45
00:10:46	11.000	52	46
00:10:55	11.000	52	47
00:11:05	11.000	53	47
00:11:12	11.000	54	48
00:11:20	11.000	54	48
00:11:29	11.000	55	49
00:11:37	11.000	55	49
00:11:47	11.000	56	50
00:11:54	11.000	56	50
00:12:01	11.000	57	51
00:12:08	11.000	57	51
00:12:16	11.000	58	52
00:12:24	11.000	59	53
00:12:33	11.000	59	53
00:12:42	11.000	60	54
00:12:52	11.000	60	54
00:12:57	11.000	61	55
00:13:02	11.000	61	55
00:13:07	11.000	62	55
00:13:13	11.000	62	56
00:13:19	11.000	62	56
00:13:25	11.000	63	57
00:13:25		Room 'Part II' is now filled with smoke	
00:13:31	11.000	63	57
00:13:37	11.000	64	57
00:13:43	11.000	64	58
00:13:49	11.000	64	58
00:13:57	11.000	65	59
00:14:05	11.000	66	59
00:14:10	11.000	66	60
00:14:15	11.000	66	60
00:14:24	11.000	67	61
00:14:32	11.000	68	61
00:14:42	11.000	68	62
00:14:51	11.000	69	62

00:14:59	11.000	69	63
00:15:09	11.000	70	64
00:15:18	11.000	71	64
00:15:26	11.000	71	65
00:15:35	11.000	72	65
00:15:44	11.000	73	66
00:15:53	11.000	73	67
00:16:02	11.000	74	67
00:16:11	11.000	74	68
00:16:19	11.000	75	68
00:16:28	11.000	76	69
00:16:37	11.000	76	70
00:16:45	11.000	77	70
00:16:54	11.000	77	71
00:17:03	11.000	78	71
00:17:11	11.000	78	72
00:17:20	11.000	79	72
00:17:29	11.000	80	73
00:17:37	11.000	80	74
00:17:46	11.000	81	74
00:17:54	11.000	81	75
00:18:03	11.000	82	75
00:18:11	11.000	82	76
00:18:20	11.000	83	76
00:18:28	11.000	84	77
00:18:36	11.000	84	77
00:18:45	11.000	85	78
00:18:53	11.000	85	79
00:19:01	11.000	86	79
00:19:10	11.000	86	80
00:19:18	11.000	87	80
00:19:26	11.000	88	81
00:19:35	11.000	88	81
00:19:43	11.000	89	82
00:19:51	11.000	89	82
00:20:00	11.000	90	83
00:20:08	11.000	90	83
00:20:12	11.000	91	84
00:20:12		Room 'Part I' is now filled with smoke	
00:20:20	11.000	91	84
00:20:28	11.000	92	85
00:20:36	11.000	92	85
00:20:45	11.000	93	86
00:20:53	11.000	93	86
00:21:01	11.000	94	87
00:21:09	11.000	94	87
00:21:17	11.000	95	88
00:21:25	11.000	95	88
00:21:33	11.000	96	89
00:21:41	11.000	96	89
00:21:49	11.000	97	90
00:21:57	11.000	97	90
00:22:05	11.000	98	91
00:22:13	11.000	98	91
00:22:21	11.000	99	92
00:22:29	11.000	99	92
00:22:37	11.000	100	93
00:22:45	11.000	100	93
00:22:53	11.000	101	94

00:23:01	11.000	102	94
00:23:09	11.000	102	95
00:23:16	11.000	103	95
00:23:24	11.000	103	96
00:23:32	11.000	104	96
00:23:40	11.000	104	97
00:23:48	11.000	105	97
00:23:56	11.000	105	98
00:24:03	11.000	106	98
00:24:11	11.000	106	99
00:24:19	11.000	107	99
00:24:27	11.000	107	100
00:24:35	11.000	108	100
00:24:42	11.000	108	101
00:24:50	11.000	109	101
00:24:58	11.000	109	102
00:25:05	11.000	110	102
00:25:13	11.000	110	103
00:25:21	11.000	110	103
00:25:28	11.000	111	104
00:25:36	11.000	111	104
00:25:44	11.000	112	105
00:25:51	11.000	112	105
00:25:59	11.000	113	106
00:26:07	11.000	113	106
00:26:14	11.000	114	107
00:26:22	11.000	114	107
00:26:29	11.000	115	107
00:26:37	11.000	115	108
00:26:44	11.000	116	108
00:26:52	11.000	116	109
00:26:59	11.000	117	109
00:27:07	11.000	117	110
00:27:14	11.000	118	110
00:27:22	11.000	118	111
00:27:29	11.000	119	111
00:27:37	11.000	119	112
00:27:44	11.000	120	112
00:27:52	11.000	120	113
00:27:59	11.000	121	113
00:28:07	11.000	121	113
00:28:14	11.000	121	114
00:28:21	11.000	122	114
00:28:29	11.000	122	115
00:28:36	11.000	123	115
00:28:44	11.000	123	116
00:28:51	11.000	124	116
00:28:58	11.000	124	117
00:29:06	11.000	125	117
00:29:13	11.000	125	118
00:29:20	11.000	126	118
00:29:28	11.000	126	118
00:29:35	11.000	126	119
00:29:42	11.000	127	119
00:29:49	11.000	127	120
00:29:57	11.000	128	120
00:30:04	11.000	128	121
00:30:11	11.000	129	121
00:30:18	11.000	129	121

00:30:26	11.000	130	122
00:30:33	11.000	130	122
00:30:40	11.000	131	123
00:30:47	11.000	131	123
00:30:54	11.000	131	124
00:31:01	11.000	132	124
00:31:09	11.000	132	125
00:31:16	11.000	133	125
00:31:23	11.000	133	125
00:31:30	11.000	134	126
00:31:37	11.000	134	126
00:31:44	11.000	134	127
00:31:52	11.000	135	127
00:31:59	11.000	135	128
00:32:06	11.000	136	128
00:32:13	11.000	136	128
00:32:20	11.000	137	129
00:32:27	11.000	137	129
00:32:34	11.000	138	130
00:32:41	11.000	138	130
00:32:48	11.000	138	130
00:32:55	11.000	139	131
00:33:02	11.000	139	131
00:33:09	11.000	140	132
00:33:16	11.000	140	132
00:33:23	11.000	141	133
00:33:30	11.000	141	133
00:33:37	11.000	141	133
00:33:44	11.000	142	134
00:33:51	11.000	142	134
00:33:58	11.000	143	135
00:34:04	11.000	143	135
00:34:11	11.000	143	135
00:34:18	11.000	144	136
00:34:25	11.000	144	136
00:34:32	11.000	145	137
00:34:39	11.000	145	137
00:34:46	11.000	146	138
00:34:53	11.000	146	138
00:34:59	11.000	146	138
00:35:06	11.000	147	139
00:35:13	11.000	147	139
00:35:20	11.000	148	140
00:35:27	11.000	148	140
00:35:34	11.000	148	140
00:35:40	11.000	149	141
00:35:47	11.000	149	141
00:35:54	11.000	150	142
00:36:01	11.000	150	142
00:36:07	11.000	150	142
00:36:14	11.000	151	143
00:36:21	11.000	151	143
00:36:28	11.000	152	144
00:36:34	11.000	152	144
00:36:41	11.000	152	144
00:36:48	11.000	153	145
00:36:54	11.000	153	145
00:37:01	11.000	154	145
00:37:08	11.000	154	146

00:37:18	11.000	155	146
00:37:25	11.000	155	147
00:37:34	11.000	156	147
00:37:44	11.000	156	148
00:37:54	11.000	157	149
00:38:04	11.000	157	149
00:38:14	11.000	158	150
00:38:24	11.000	159	150
00:38:34	11.000	159	151
00:38:44	11.000	160	151
00:38:54	11.000	160	152
00:39:03	11.000	161	153
00:39:13	11.000	161	153
00:39:23	11.000	162	154
00:39:33	11.000	163	154
00:39:43	11.000	163	155
00:39:52	11.000	164	155
00:40:00	11.000	164	156
00:40:00		Fire brigade is alarmed	
00:40:09	11.000	165	156
00:40:19	11.000	165	157
00:40:29	11.000	166	157
00:40:38	11.000	166	158
00:40:48	11.000	167	159
00:40:57	11.000	168	159
00:41:07	11.000	168	160
00:41:17	11.000	169	160
00:41:26	11.000	169	161
00:41:36	11.000	170	161
00:41:45	11.000	170	162
00:41:55	11.000	171	162
00:42:04	11.000	171	163
00:42:14	11.000	172	163
00:42:23	11.000	172	164
00:42:33	11.000	173	164
00:42:42	11.000	174	165
00:42:52	11.000	174	166
00:43:01	11.000	175	166
00:43:11	11.000	175	167
00:43:20	11.000	176	167
00:43:29	11.000	176	168
00:43:39	11.000	177	168
00:43:48	11.000	177	169
00:43:57	11.000	178	169
00:44:07	11.000	178	170
00:44:16	11.000	179	170
00:44:25	11.000	179	171
00:44:35	11.000	180	171
00:44:44	11.000	180	172
00:44:53	11.000	181	172
00:45:02	11.000	182	173
00:45:12	11.000	182	173
00:45:21	11.000	183	174
00:45:30	11.000	183	174
00:45:39	11.000	184	175
00:45:48	11.000	184	175
00:45:58	11.000	185	176
00:46:07	11.000	185	176
00:46:16	11.000	186	177

00:46:25	11.000	186	177
00:46:34	11.000	187	178
00:46:43	11.000	187	178
00:46:52	11.000	188	179
00:47:01	11.000	188	179
00:47:11	11.000	189	180
00:47:20	11.000	189	180
00:47:29	11.000	190	181
00:47:38	11.000	190	181
00:47:47	11.000	191	182
00:47:56	11.000	191	182
00:48:05	11.000	192	183
00:48:14	11.000	192	183
00:48:23	11.000	193	184
00:48:32	11.000	193	184
00:48:40	11.000	194	185
00:48:49	11.000	194	185
00:48:58	11.000	195	186
00:49:07	11.000	195	186
00:49:16	11.000	196	187
00:49:25	11.000	196	187
00:49:34	11.000	197	188
00:49:43	11.000	197	188
00:49:49	11.000	197	188
00:49:49		Critical condition in room 'Part I': Heat radiation from smoke layer greater than 2,5 kW/m²	
00:49:57	11.000	198	189
00:50:06	11.000	198	189
00:50:15	11.000	199	190
00:50:24	11.000	199	190
00:50:33	11.000	200	191
00:50:41	11.000	200	191
00:50:50	11.000	201	192
00:50:59	11.000	201	192
00:51:08	11.000	202	193
00:51:16	11.000	202	193
00:51:25	11.000	203	193
00:51:34	11.000	203	194
00:51:43	11.000	204	194
00:51:51	11.000	204	195
00:52:00	11.000	204	195
00:52:08	11.000	205	196
00:52:17	11.000	205	196
00:52:26	11.000	206	197
00:52:35	11.000	206	197
00:52:40	11.000	207	197
00:52:40		Critical condition in room 'Part II': Heat radiation from smoke layer greater than 2,5 kW/m²	
00:52:49	11.000	207	198
00:52:57	11.000	208	198
00:53:06	11.000	208	199
00:53:15	11.000	208	199
00:53:23	11.000	209	200
00:53:32	11.000	209	200
00:53:40	11.000	210	201
00:53:49	11.000	210	201
00:53:57	11.000	211	201
00:54:06	11.000	211	202
00:54:14	11.000	212	202

00:54:23	11.000	212	203
00:54:31	11.000	213	203
00:54:40	11.000	213	204
00:54:48	11.000	213	204
00:54:57	11.000	214	204
00:55:00	11.000	214	205
00:55:00		Fire brigade arrived, preparing extinguishing	
00:55:08	11.000	214	205
00:55:16	11.000	215	205
00:55:25	11.000	215	206
00:55:33	11.000	216	206
00:55:42	11.000	216	207
00:55:50	11.000	217	207
00:56:00	11.000	217	208
00:56:00		Fire brigade ready, extinguishing started	
00:56:08	11.000	218	208
00:56:16	11.000	218	209
00:56:25	11.000	218	209
00:56:32	10.906	219	209
00:56:32		Fire is declining	
00:56:42	10.587	219	210
00:56:51	10.269	220	210
00:57:01	9.950	220	211
00:57:11	9.632	220	211
00:57:20	9.313	220	211
00:57:30	8.995	221	212
00:57:39	8.676	221	212
00:57:49	8.357	221	212
00:57:58	8.039	221	212
00:58:08	7.720	221	213
00:58:17	7.402	221	213
00:58:27	7.083	221	213
00:58:37	6.765	221	213
00:58:46	6.446	221	213
00:58:56	6.128	221	213
00:59:05	5.809	220	213
00:59:15	5.491	220	213
00:59:24	5.172	220	213
00:59:34	4.854	220	213
00:59:43	4.535	219	213
00:59:53	4.216	219	213
01:00:00	4.000	219	212
01:00:00		MAX. CALCULATION TIME - CALCULATION ABORTED!	

Simulation results for each room

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:00:00	0,00		36,00	20		-0,010
00:00:09	0,00		36,00	20		0,000
00:00:19	0,00		36,00	20		0,000
00:00:28	0,00		36,00	20		0,000
00:00:37	0,00		36,00	20		0,000
00:00:47	0,00		36,00	20		0,000
00:00:56	0,00		36,00	20		0,000
00:01:06	0,00		36,00	20		0,000
00:01:15	0,00		36,00	20		0,000
00:01:25	0,01		36,00	20		0,000
00:01:34	0,01		36,00	20		0,000
00:01:43	0,01		36,00	20		0,000
00:01:52	0,01	0,11	35,27	22		0,077
00:02:01	0,01	0,12	33,92	22	0,09	0,104
00:02:11	0,01	0,13	32,46	22	0,10	0,141
00:02:21	0,01	0,14	31,09	22	0,10	0,184
00:02:30	0,01	0,15	29,80	22	0,11	0,234
00:02:39	0,01	0,16	28,43	23	0,12	0,300
00:02:49	0,01	0,17	27,14	23	0,12	0,376
00:02:58	0,01	0,19	25,93	23	0,13	0,463
00:03:07	0,01	0,20	24,79	23	0,14	0,561
00:03:17	0,01	0,22	23,62	24	0,15	0,675
00:03:27	0,01	0,24	22,50	24	0,16	0,748
00:03:37	0,01	0,26	21,55	24	0,17	0,791
00:03:47	0,01	0,28	20,78	25	0,18	1,110
00:03:56	0,01	0,30	20,16	25	0,18	1,301
00:04:06	0,01	0,32	19,65	25	0,19	1,520
00:04:16	0,01	0,35	19,22	26	0,20	1,766
00:04:25	0,01	0,37	18,85	26	0,20	2,026
00:04:35	0,01	0,40	18,46	27	0,21	2,334
00:04:45	0,01	0,42	18,04	27	0,21	2,673
00:04:55	0,01	0,45	17,56	28	0,22	3,046
00:05:04	0,01	0,48	17,06	28	0,23	3,441
00:05:14	0,01	0,51	16,55	29	0,23	3,870
00:05:23	0,01	0,54	16,05	29	0,24	4,328
00:05:33	0,01	0,57	15,52	30	0,25	4,859
00:05:43	0,01	0,61	14,99	30	0,26	5,426
00:05:52	0,01	0,64	14,46	31	0,27	6,031
00:06:02	0,01	0,67	13,94	32	0,28	6,674
00:06:11	0,01	0,71	13,43	32	0,29	7,355
00:06:21	0,01	0,74	12,88	33	0,30	8,133
00:06:31	0,01	0,78	12,34	33	0,31	8,956
00:06:41	0,01	0,82	11,82	34	0,32	9,826
00:06:51	0,01	0,85	11,30	35	0,33	10,743
00:07:00	0,01	0,89	10,80	35	0,34	11,708
00:07:09	0,01	0,93	10,30	36	0,35	12,720
00:07:19	0,01	0,97	9,78	37	0,37	13,859
00:07:29	0,01	1,01	9,28	38	0,38	15,053
00:07:39	0,01	1,06	8,78	38	0,39	16,303
00:07:49	0,01	1,10	8,30	39	0,40	17,610
00:07:58	0,01	1,15	7,83	40	0,41	18,973
00:08:08	0,01	1,19	7,37	41	0,43	19,507
00:08:17	0,01	1,24	6,92	41	0,44	19,020

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:08:27	0,01	1,28	6,48	42	0,45	18,558
00:08:27	Critical condition in room 'Part II': Smoke free height less than 4,00 m					
00:08:35	0,01	1,32	6,12	43	0,46	18,188
00:08:44	0,01	1,35	5,75	43	0,47	17,819
00:08:53	0,01	1,39	5,38	44	0,48	17,453
00:08:57	0,01	1,41	5,19	44	0,48	17,272
00:08:57	Critical condition in room 'Part I': Smoke free height less than 5,20 m					
00:09:07	0,01	1,45	4,82	45	0,49	16,914
00:09:17	0,01	1,50	4,45	46	0,50	16,564
00:09:26	0,01	1,53	4,13	46	0,51	16,233
00:09:36	0,01	1,58	3,80	47	0,51	15,822
00:09:44	0,01	1,61	3,54	48	0,52	15,479
00:09:53	0,01	1,65	3,29	48	0,53	15,132
00:10:01	0,01	1,68	3,04	49	0,53	14,786
00:10:10	0,01	1,72	2,80	49	0,54	14,440
00:10:19	0,01	1,76	2,58	50	0,54	14,098
00:10:28	0,01	1,80	2,36	51	0,55	13,759
00:10:37	0,01	1,84	2,15	51	0,56	13,424
00:10:46	0,01	1,88	1,95	52	0,56	13,073
00:10:55	0,00	1,92	1,76	52	0,57	12,684
00:11:05	0,00	1,96	1,59	53	0,57	12,289
00:11:12	0,00	1,99	1,46	54	0,58	11,986
00:11:20	0,00	2,03	1,33	54	0,58	11,676
00:11:29	0,00	2,07	1,20	55	0,59	11,357
00:11:37	0,00	2,11	1,08	55	0,59	11,028
00:11:47	0,00	2,15	0,97	56	0,60	10,690
00:11:54	0,00	2,18	0,89	56	0,60	10,459
00:12:01	0,00	2,21	0,82	57	0,60	10,223
00:12:08	0,00	2,25	0,74	57	0,61	9,984
00:12:16	0,00	2,29	0,68	58	0,61	9,742
00:12:24	0,00	2,32	0,61	59	0,62	9,497
00:12:33	0,00	2,36	0,55	59	0,62	9,250
00:12:42	0,00	2,41	0,49	60	0,63	9,000
00:12:52	0,00	2,45	0,44	60	0,63	8,749
00:12:57	0,00	2,48	0,41	61	0,63	8,622
00:13:02	0,00	2,50	0,39	61	0,64	8,495
00:13:07	0,00	2,53	0,36	62	0,64	8,367
00:13:13	0,00	2,55	0,34	62	0,64	8,239
00:13:19	0,00	2,58	0,32	62	0,65	8,107
00:13:25	0,00	2,61	0,30	63	0,65	7,974
00:13:25	Room 'Part II' is now filled with smoke					
00:13:31	0,00	2,64	0,28	63	0,65	7,842
00:13:37	0,00	2,67	0,26	64	0,66	7,722
00:13:43	0,00	2,69	0,24	64	0,66	7,597
00:13:49	0,00	2,72	0,23	64	0,66	7,489
00:13:57	0,00	2,76	0,20	65	0,67	7,330
00:14:05	0,00	2,80	0,19	66	0,67	7,186
00:14:10	0,00	2,82	0,18	66	0,67	7,099
00:14:15	0,00	2,85	0,17	66	0,68	7,007
00:14:24	0,00	2,89	0,15	67	0,68	6,853
00:14:32	0,00	2,93	0,14	68	0,69	6,724
00:14:42	0,00	2,97	0,12	68	0,69	6,572
00:14:51	0,00	3,02	0,11	69	0,70	6,432
00:14:59	0,00	3,05	0,10	69	0,70	6,313
00:15:09	0,00	3,10	0,09	70	0,71	6,180
00:15:18	0,00	3,14	0,08	71	0,71	6,055

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:15:26	0,00	3,18	0,08	71	0,72	5,945
00:15:35	0,00	3,22	0,07	72	0,72	5,827
00:15:44	0,00	3,27	0,06	73	0,73	5,713
00:15:53	0,00	3,31	0,06	73	0,73	5,611
00:16:02	0,00	3,35	0,05	74	0,74	5,505
00:16:11	0,00	3,39	0,05	74	0,74	5,400
00:16:19	0,00	3,43	0,04	75	0,75	5,306
00:16:28	0,00	3,47	0,04	76	0,75	5,210
00:16:37	0,00	3,51	0,04	76	0,76	5,113
00:16:45	0,00	3,55	0,03	77	0,76	5,026
00:16:54	0,00	3,59	0,03	77	0,77	4,938
00:17:03	0,00	3,63	0,03	78	0,78	4,848
00:17:11	0,00	3,67	0,02	78	0,78	4,767
00:17:20	0,00	3,71	0,02	79	0,79	4,685
00:17:29	0,00	3,75	0,02	80	0,79	4,602
00:17:37	0,00	3,79	0,02	80	0,80	4,526
00:17:46	0,00	3,83	0,02	81	0,80	4,449
00:17:54	0,00	3,87	0,01	81	0,81	4,372
00:18:03	0,00	3,91	0,01	82	0,81	4,301
00:18:11	0,00	3,95	0,01	82	0,82	4,229
00:18:20	0,00	3,99	0,01	83	0,82	4,157
00:18:28	0,00	4,03	0,01	84	0,83	4,089
00:18:36	0,00	4,07	0,01	84	0,83	4,022
00:18:45	0,00	4,11	0,01	85	0,84	3,954
00:18:53	0,00	4,14	0,01	85	0,84	3,890
00:19:01	0,00	4,18	0,01	86	0,85	3,826
00:19:10	0,00	4,22	0,01	86	0,85	3,761
00:19:18	0,00	4,26		87	0,86	3,700
00:19:26	0,00	4,30		88	0,86	3,640
00:19:35	0,00	4,33		88	0,87	3,579
00:19:43	0,00	4,37		89	0,87	3,521
00:19:51	0,00	4,41		89	0,88	3,463
00:20:00	0,00	4,45		90	0,88	3,405
00:20:08	0,00	4,48		90	0,89	3,349
00:20:12	0,00	4,50		91	0,89	3,320
00:20:12	Room 'Part I' is now filled with smoke					
00:20:20	0,00	4,54		91	0,90	3,265
00:20:28	0,00	4,58		92	0,90	3,212
00:20:36	0,00	4,61		92	0,91	3,160
00:20:45	0,00	4,65		93	0,91	3,108
00:20:53	0,00	4,69		93	0,92	3,057
00:21:01	0,00	4,72		94	0,92	3,007
00:21:09	0,00	4,76		94	0,93	2,957
00:21:17	0,00	4,80		95	0,94	2,907
00:21:25	0,00	4,83		95	0,94	2,859
00:21:33	0,00	4,87		96	0,95	2,811
00:21:41	0,00	4,91		96	0,95	2,763
00:21:49	0,00	4,94		97	0,96	2,717
00:21:57	0,00	4,98		97	0,96	2,670
00:22:05	0,00	5,01		98	0,97	2,624
00:22:13	0,00	5,05		98	0,97	2,579
00:22:21	0,00	5,09		99	0,98	2,535
00:22:29	0,00	5,12		99	0,98	2,490
00:22:37	0,00	5,16		100	0,99	2,446
00:22:45	0,00	5,19		100	0,99	2,403
00:22:53	0,00	5,23		101	1,00	2,360

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:23:01	0,00	5,26		102	1,01	2,318
00:23:09	0,00	5,30		102	1,01	2,276
00:23:16	0,00	5,33		103	1,02	2,234
00:23:24	0,00	5,37		103	1,02	2,193
00:23:32	0,00	5,40		104	1,03	2,152
00:23:40	0,00	5,44		104	1,03	2,112
00:23:48	0,00	5,47		105	1,04	2,072
00:23:56	0,00	5,51		105	1,04	2,032
00:24:03	0,00	5,54		106	1,05	1,993
00:24:11	0,00	5,58		106	1,06	1,954
00:24:19	0,00	5,61		107	1,06	1,916
00:24:27	0,00	5,64		107	1,07	1,878
00:24:35	0,00	5,68		108	1,07	1,840
00:24:42	0,00	5,71		108	1,08	1,803
00:24:50	0,00	5,75		109	1,08	1,766
00:24:58	0,00	5,78		109	1,09	1,730
00:25:05	0,00	5,81		110	1,09	1,693
00:25:13	0,00	5,85		110	1,10	1,657
00:25:21	0,00	5,88		110	1,11	1,622
00:25:28	0,00	5,92		111	1,11	1,587
00:25:36	0,00	5,95		111	1,12	1,551
00:25:44	0,00	5,98		112	1,12	1,517
00:25:51	0,00	6,02		112	1,13	1,483
00:25:59	0,00	6,05		113	1,13	1,449
00:26:07	0,00	6,08		113	1,14	1,415
00:26:14	0,00	6,12		114	1,14	1,382
00:26:22	0,00	6,15		114	1,15	1,348
00:26:29	0,00	6,18		115	1,16	1,315
00:26:37	0,00	6,21		115	1,16	1,283
00:26:44	0,00	6,25		116	1,17	1,251
00:26:52	0,00	6,28		116	1,17	1,219
00:26:59	0,00	6,31		117	1,18	1,187
00:27:07	0,00	6,34		117	1,18	1,156
00:27:14	0,00	6,38		118	1,19	1,124
00:27:22	0,00	6,41		118	1,20	1,094
00:27:29	0,00	6,44		119	1,20	1,063
00:27:37	0,00	6,47		119	1,21	1,033
00:27:44	0,00	6,51		120	1,21	1,003
00:27:52	0,00	6,54		120	1,22	0,973
00:27:59	0,00	6,57		121	1,23	0,943
00:28:07	0,00	6,60		121	1,23	0,914
00:28:14	0,00	6,63		121	1,24	0,884
00:28:21	0,00	6,67		122	1,24	0,856
00:28:29	0,00	6,70		122	1,25	0,827
00:28:36	0,00	6,73		123	1,25	0,798
00:28:44	0,00	6,76		123	1,26	0,770
00:28:51	0,00	6,79		124	1,27	0,742
00:28:58	0,00	6,83		124	1,27	0,714
00:29:06	0,00	6,86		125	1,28	0,687
00:29:13	0,00	6,89		125	1,28	0,659
00:29:20	0,00	6,92		126	1,29	0,632
00:29:28	0,00	6,95		126	1,30	0,606
00:29:35	0,00	6,98		126	1,30	0,579
00:29:42	0,00	7,01		127	1,31	0,552
00:29:49	0,00	7,04		127	1,31	0,527
00:29:57	0,00	7,07		128	1,32	0,501

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:30:04	0,00	7,11		128	1,33	0,474
00:30:11	0,00	7,14		129	1,33	0,449
00:30:18	0,00	7,17		129	1,34	0,424
00:30:26	0,00	7,20		130	1,34	0,398
00:30:33	0,00	7,23		130	1,35	0,374
00:30:40	0,00	7,26		131	1,35	0,349
00:30:47	0,00	7,29		131	1,36	0,324
00:30:54	0,00	7,32		131	1,37	0,300
00:31:01	0,00	7,35		132	1,37	0,277
00:31:09	0,00	7,38		132	1,38	0,252
00:31:16	0,00	7,41		133	1,38	0,229
00:31:23	0,00	7,44		133	1,39	0,206
00:31:30	0,00	7,47		134	1,40	0,183
00:31:37	0,00	7,50		134	1,40	0,160
00:31:44	0,00	7,53		134	1,41	0,137
00:31:52	0,00	7,56		135	1,42	0,115
00:31:59	0,00	7,59		135	1,42	0,093
00:32:06	0,00	7,62		136	1,43	0,071
00:32:13	0,00	7,65		136	1,43	0,049
00:32:20	0,00	7,68		137	1,44	0,028
00:32:27	0,00	7,71		137	1,45	0,008
00:32:34	0,00	7,74		138	1,45	-0,013
00:32:41	0,00	7,77		138	1,46	-0,032
00:32:48	0,00	7,80		138	1,46	-0,051
00:32:55	0,00	7,83		139	1,47	-0,070
00:33:02	0,00	7,86		139	1,48	-0,089
00:33:09	0,00	7,89		140	1,48	-0,107
00:33:16	0,00	7,92		140	1,49	-0,126
00:33:23	0,00	7,94		141	1,49	-0,144
00:33:30	0,00	7,97		141	1,50	-0,162
00:33:37	0,00	8,00		141	1,51	-0,180
00:33:44	0,00	8,03		142	1,51	-0,198
00:33:51	0,00	8,06		142	1,52	-0,215
00:33:58	0,00	8,09		143	1,52	-0,233
00:34:04	0,00	8,12		143	1,53	-0,251
00:34:11	0,00	8,15		143	1,54	-0,268
00:34:18	0,00	8,18		144	1,54	-0,285
00:34:25	0,00	8,20		144	1,55	-0,302
00:34:32	0,00	8,23		145	1,56	-0,319
00:34:39	0,00	8,26		145	1,56	-0,336
00:34:46	0,00	8,29		146	1,57	-0,353
00:34:53	0,00	8,32		146	1,57	-0,370
00:34:59	0,00	8,35		146	1,58	-0,386
00:35:06	0,00	8,38		147	1,59	-0,403
00:35:13	0,00	8,40		147	1,59	-0,419
00:35:20	0,00	8,43		148	1,60	-0,435
00:35:27	0,00	8,46		148	1,61	-0,452
00:35:34	0,00	8,49		148	1,61	-0,468
00:35:40	0,00	8,52		149	1,62	-0,484
00:35:47	0,00	8,54		149	1,62	-0,500
00:35:54	0,00	8,57		150	1,63	-0,516
00:36:01	0,00	8,60		150	1,64	-0,531
00:36:07	0,00	8,63		150	1,64	-0,547
00:36:14	0,00	8,66		151	1,65	-0,563
00:36:21	0,00	8,68		151	1,66	-0,578
00:36:28	0,00	8,71		152	1,66	-0,594

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:36:34	0,00	8,74		152	1,67	-0,609
00:36:41	0,00	8,77		152	1,67	-0,624
00:36:48	0,00	8,79		153	1,68	-0,640
00:36:54	0,00	8,82		153	1,69	-0,655
00:37:01	0,00	8,85		154	1,69	-0,670
00:37:08	0,00	8,88		154	1,70	-0,685
00:37:18	0,00	8,92		155	1,71	-0,707
00:37:25	0,00	8,94		155	1,72	-0,722
00:37:34	0,00	8,98		156	1,72	-0,744
00:37:44	0,00	9,03		156	1,73	-0,766
00:37:54	0,00	9,07		157	1,74	-0,788
00:38:04	0,00	9,11		157	1,75	-0,809
00:38:14	0,00	9,15		158	1,76	-0,831
00:38:24	0,00	9,19		159	1,77	-0,852
00:38:34	0,00	9,23		159	1,78	-0,873
00:38:44	0,00	9,27		160	1,79	-0,894
00:38:54	0,00	9,31		160	1,80	-0,915
00:39:03	0,00	9,35		161	1,81	-0,936
00:39:13	0,00	9,39		161	1,82	-0,956
00:39:23	0,00	9,43		162	1,83	-0,977
00:39:33	0,00	9,47		163	1,84	-0,997
00:39:43	0,00	9,51		163	1,85	-1,017
00:39:52	0,00	9,54		164	1,86	-1,037
00:40:00	0,00	9,57		164	1,87	-1,057
00:40:00	Fire brigade is alarmed					
00:40:09	0,00	9,61		165	1,88	-1,071
00:40:19	0,00	9,65		165	1,89	-1,091
00:40:29	0,00	9,69		166	1,90	-1,111
00:40:38	0,00	9,73		166	1,91	-1,130
00:40:48	0,00	9,77		167	1,91	-1,149
00:40:57	0,00	9,81		168	1,92	-1,168
00:41:07	0,00	9,84		168	1,93	-1,187
00:41:17	0,00	9,88		169	1,94	-1,206
00:41:26	0,00	9,92		169	1,95	-1,225
00:41:36	0,00	9,96		170	1,96	-1,243
00:41:45	0,00	10,00		170	1,97	-1,262
00:41:55	0,00	10,04		171	1,98	-1,280
00:42:04	0,00	10,07		171	1,99	-1,298
00:42:14	0,00	10,11		172	2,00	-1,317
00:42:23	0,00	10,15		172	2,01	-1,335
00:42:33	0,00	10,19		173	2,02	-1,352
00:42:42	0,00	10,22		174	2,03	-1,370
00:42:52	0,00	10,26		174	2,04	-1,388
00:43:01	0,00	10,30		175	2,05	-1,405
00:43:11	0,00	10,34		175	2,06	-1,423
00:43:20	0,00	10,37		176	2,07	-1,440
00:43:29	0,00	10,41		176	2,08	-1,457
00:43:39	0,00	10,45		177	2,09	-1,474
00:43:48	0,00	10,49		177	2,10	-1,491
00:43:57	0,00	10,52		178	2,11	-1,508
00:44:07	0,00	10,56		178	2,12	-1,524
00:44:16	0,00	10,60		179	2,13	-1,541
00:44:25	0,00	10,63		179	2,14	-1,557
00:44:35	0,00	10,67		180	2,15	-1,574
00:44:44	0,00	10,71		180	2,16	-1,590
00:44:53	0,00	10,74		181	2,17	-1,606

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:45:02	0,00	10,78		182	2,18	-1,622
00:45:12	0,00	10,81		182	2,19	-1,638
00:45:21	0,00	10,85		183	2,20	-1,654
00:45:30	0,00	10,89		183	2,21	-1,669
00:45:39	0,00	10,92		184	2,22	-1,685
00:45:48	0,00	10,96		184	2,23	-1,700
00:45:58	0,00	10,99		185	2,24	-1,715
00:46:07	0,00	11,03		185	2,25	-1,730
00:46:16	0,00	11,07		186	2,26	-1,745
00:46:25	0,00	11,10		186	2,27	-1,759
00:46:34	0,00	11,14		187	2,28	-1,773
00:46:43	0,00	11,17		187	2,29	-1,787
00:46:52	0,00	11,21		188	2,30	-1,801
00:47:01	0,00	11,24		188	2,31	-1,815
00:47:11	0,00	11,28		189	2,32	-1,828
00:47:20	0,00	11,31		189	2,33	-1,842
00:47:29	0,00	11,35		190	2,34	-1,855
00:47:38	0,00	11,38		190	2,35	-1,869
00:47:47	0,00	11,42		191	2,36	-1,882
00:47:56	0,00	11,45		191	2,37	-1,895
00:48:05	0,00	11,49		192	2,38	-1,908
00:48:14	0,00	11,52		192	2,39	-1,921
00:48:23	0,00	11,56		193	2,40	-1,934
00:48:32	0,00	11,59		193	2,41	-1,947
00:48:40	0,00	11,62		194	2,42	-1,960
00:48:49	0,00	11,66		194	2,43	-1,972
00:48:58	0,00	11,69		195	2,44	-1,985
00:49:07	0,00	11,73		195	2,45	-1,997
00:49:16	0,00	11,76		196	2,46	-2,010
00:49:25	0,00	11,80		196	2,47	-2,022
00:49:34	0,00	11,83		197	2,48	-2,035
00:49:43	0,00	11,86		197	2,49	-2,047
00:49:49	0,00	11,89		197	2,50	-2,055
00:49:49	Critical condition in room 'Part I': Heat radiation from smoke layer greater than 2,5 kW/m²					
00:49:57	0,00	11,92		198	2,51	-2,067
00:50:06	0,00	11,95		198	2,52	-2,080
00:50:15	0,00	11,99		199	2,53	-2,092
00:50:24	0,00	12,02		199	2,54	-2,104
00:50:33	0,00	12,05		200	2,55	-2,116
00:50:41	0,00	12,09		200	2,56	-2,127
00:50:50	0,00	12,12		201	2,57	-2,139
00:50:59	0,00	12,15		201	2,58	-2,151
00:51:08	0,00	12,19		202	2,59	-2,163
00:51:16	0,00	12,22		202	2,60	-2,174
00:51:25	0,00	12,25		203	2,61	-2,186
00:51:34	0,00	12,29		203	2,62	-2,197
00:51:43	0,00	12,32		204	2,64	-2,209
00:51:51	0,00	12,35		204	2,65	-2,220
00:52:00	0,00	12,39		204	2,66	-2,232
00:52:08	0,00	12,42		205	2,67	-2,243
00:52:17	0,00	12,45		205	2,68	-2,254
00:52:26	0,00	12,48		206	2,69	-2,266
00:52:35	0,00	12,52		206	2,70	-2,277
00:52:40	0,00	12,54		207	2,70	-2,284
00:52:40						

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
	Critical condition in room 'Part II': Heat radiation from smoke layer greater than 2,5 kW/m²					
00:52:49	0,00	12,57		207	2,71	-2,295
00:52:57	0,00	12,60		208	2,72	-2,306
00:53:06	0,00	12,63		208	2,74	-2,317
00:53:15	0,00	12,67		208	2,75	-2,328
00:53:23	0,00	12,70		209	2,76	-2,339
00:53:32	0,00	12,73		209	2,77	-2,350
00:53:40	0,00	12,76		210	2,78	-2,361
00:53:49	0,00	12,79		210	2,79	-2,372
00:53:57	0,00	12,83		211	2,80	-2,382
00:54:06	0,00	12,86		211	2,81	-2,393
00:54:14	0,00	12,89		212	2,82	-2,404
00:54:23	0,00	12,92		212	2,83	-2,414
00:54:31	0,00	12,95		213	2,84	-2,425
00:54:40	0,00	12,99		213	2,85	-2,435
00:54:48	0,00	13,02		213	2,86	-2,446
00:54:57	0,00	13,05		214	2,87	-2,456
00:55:00	0,00	13,06		214	2,87	-2,459
00:55:00	Fire brigade arrived, preparing extinguishing					
00:55:08	0,00	13,09		214	2,88	-2,470
00:55:16	0,00	13,12		215	2,89	-2,480
00:55:25	0,00	13,15		215	2,91	-2,490
00:55:33	0,00	13,18		216	2,92	-2,500
00:55:42	0,00	13,21		216	2,93	-2,511
00:55:50	0,00	13,25		217	2,94	-2,521
00:56:00	0,00	13,28		217	2,95	-2,534
00:56:00	Fire brigade ready, extinguishing started					
00:56:08	0,00	13,31		218	2,96	-2,542
00:56:16	0,00	13,34		218	2,97	-2,552
00:56:25	0,00	13,37		218	2,98	-2,562
00:56:32	0,00	13,40		219	2,99	-2,663
00:56:32	Fire is declining					
00:56:42	0,00	13,44		219	3,00	-2,960
00:56:51	0,00	13,47		220	3,01	-3,230
00:57:01	0,00	13,50		220	3,02	-3,477
00:57:11	0,00	13,54		220	3,02	-3,704
00:57:20	0,00	13,57		220	3,03	-3,914
00:57:30	0,00	13,60		221	3,03	-4,111
00:57:39	0,00	13,63		221	3,04	-4,295
00:57:49	0,00	13,66		221	3,04	-4,468
00:57:58	0,00	13,68		221	3,04	-4,632
00:58:08	0,00	13,71		221	3,04	-4,789
00:58:17	0,00	13,74		221	3,04	-4,938
00:58:27	0,00	13,76		221	3,04	-5,081
00:58:37	0,00	13,78		221	3,04	-5,219
00:58:46	0,00	13,81		221	3,03	-5,353
00:58:56	0,00	13,83		221	3,03	-5,482
00:59:05	0,00	13,85		220	3,03	-5,607
00:59:15	0,00	13,87		220	3,02	-5,730
00:59:24	0,00	13,89		220	3,02	-5,849
00:59:34	0,00	13,90		220	3,01	-5,967
00:59:43	0,00	13,92		219	3,00	-6,081
00:59:53	0,00	13,93		219	3,00	-6,194
01:00:00	0,00	13,94		219	2,99	-6,272
01:00:00	MAX. CALCULATION TIME - CALCULATION ABORTED!					

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:00:00	0,00		24,00	20		-0,005
00:00:09	0,00		24,00	20		0,000
00:00:19	0,00		24,00	20		0,000
00:00:28	0,00		24,00	20		0,000
00:00:37	0,00		24,00	20		0,000
00:00:47	0,00		24,00	20		0,000
00:00:56	0,00		24,00	20		0,000
00:01:06	0,00		24,00	20		0,000
00:01:15	0,00		24,00	20		0,000
00:01:25	0,00		24,00	20		0,000
00:01:34	0,00		24,00	20		0,000
00:01:43	0,00		24,00	20		0,000
00:01:52	0,00		24,00	20		0,077
00:02:01	0,00		24,00	20		0,104
00:02:11	0,00		24,00	20		0,141
00:02:21	0,00		24,00	20		0,184
00:02:30	0,00		24,00	20		0,234
00:02:39	0,00		24,00	20		0,300
00:02:49	0,00		24,00	20		0,376
00:02:58	0,00		24,00	20		0,463
00:03:07	0,00		24,00	20		0,561
00:03:17	0,00		24,00	20		0,675
00:03:27	0,00		24,00	20		0,748
00:03:37	0,00		24,00	20		0,793
00:03:47	0,01	0,22	23,70	23		1,116
00:03:56	0,01	0,24	22,92	23		1,311
00:04:06	0,01	0,26	21,97	24	0,13	1,535
00:04:16	0,01	0,28	20,93	24	0,14	1,786
00:04:25	0,01	0,29	19,93	24	0,14	2,048
00:04:35	0,01	0,31	18,87	25	0,16	2,357
00:04:45	0,01	0,33	17,90	25	0,17	2,692
00:04:55	0,01	0,34	17,04	25	0,18	3,063
00:05:04	0,01	0,36	16,27	25	0,19	3,458
00:05:14	0,01	0,38	15,52	25	0,20	3,887
00:05:23	0,01	0,39	14,80	26	0,21	4,346
00:05:33	0,01	0,41	14,06	26	0,22	4,877
00:05:43	0,01	0,44	13,34	26	0,23	5,445
00:05:52	0,01	0,46	12,66	27	0,24	6,051
00:06:02	0,01	0,48	12,00	27	0,25	6,694
00:06:11	0,01	0,51	11,37	28	0,26	7,376
00:06:21	0,01	0,54	10,72	28	0,28	8,154
00:06:31	0,01	0,57	10,10	29	0,29	8,979
00:06:41	0,01	0,60	9,50	29	0,30	9,850
00:06:51	0,01	0,63	8,92	30	0,32	10,768
00:07:00	0,01	0,67	8,37	30	0,33	11,734
00:07:09	0,01	0,70	7,84	31	0,34	12,748
00:07:19	0,01	0,74	7,29	31	0,35	13,888
00:07:29	0,01	0,78	6,76	32	0,37	15,085
00:07:39	0,01	0,82	6,25	33	0,38	16,337
00:07:49	0,01	0,86	5,75	33	0,39	17,647
00:07:58	0,01	0,90	5,28	34	0,40	19,014
00:08:08	0,01	0,94	4,82	35	0,41	19,551
00:08:17	0,01	0,98	4,38	35	0,43	19,065
00:08:27	0,01	1,03	3,96	36	0,44	18,604
00:08:27	Critical condition in room 'Part II': Smoke free height less than 4,00 m					
00:08:35	0,01	1,07	3,63	37	0,44	18,236

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:08:44	0,01	1,11	3,30	37	0,45	17,870
00:08:53	0,01	1,15	2,97	38	0,46	17,508
00:08:57	0,01	1,17	2,81	38	0,46	17,329
00:08:57	Critical condition in room 'Part I': Smoke free height less than 5,20 m					
00:09:07	0,01	1,21	2,49	39	0,47	16,977
00:09:17	0,01	1,26	2,17	40	0,48	16,635
00:09:26	0,01	1,30	1,90	40	0,49	16,313
00:09:36	0,01	1,34	1,63	41	0,49	15,917
00:09:44	0,01	1,38	1,42	42	0,50	15,593
00:09:53	0,01	1,42	1,22	42	0,50	15,269
00:10:01	0,00	1,46	1,03	43	0,51	14,952
00:10:10	0,00	1,50	0,87	44	0,51	14,643
00:10:19	0,00	1,54	0,71	44	0,52	14,345
00:10:28	0,00	1,57	0,58	45	0,52	14,062
00:10:37	0,00	1,62	0,46	45	0,52	13,794
00:10:46	0,00	1,66	0,35	46	0,53	13,524
00:10:55	0,00	1,70	0,27	47	0,53	13,222
00:11:05	0,00	1,74	0,20	47	0,54	12,925
00:11:12	0,00	1,77	0,15	48	0,54	12,703
00:11:20	0,00	1,81	0,12	48	0,54	12,481
00:11:29	0,00	1,85	0,08	49	0,55	12,256
00:11:37	0,00	1,89	0,06	49	0,55	12,028
00:11:47	0,00	1,93	0,04	50	0,56	11,796
00:11:54	0,00	1,96	0,03	50	0,56	11,637
00:12:01	0,00	1,99	0,02	51	0,56	11,475
00:12:08	0,00	2,03	0,02	51	0,57	11,310
00:12:16	0,00	2,06	0,01	52	0,57	11,142
00:12:24	0,00	2,10	0,01	53	0,57	10,969
00:12:33	0,00	2,14	0,01	53	0,58	10,792
00:12:42	0,00	2,18		54	0,58	10,611
00:12:52	0,00	2,23		54	0,59	10,425
00:12:57	0,00	2,25		55	0,59	10,330
00:13:02	0,00	2,28		55	0,59	10,234
00:13:07	0,00	2,30		55	0,59	10,136
00:13:13	0,00	2,33		56	0,60	10,035
00:13:19	0,00	2,36		56	0,60	9,932
00:13:25	0,00	2,39		57	0,60	9,828
00:13:25	Room 'Part II' is now filled with smoke					
00:13:31	0,00	2,42		57	0,61	9,724
00:13:37	0,00	2,44		57	0,61	9,625
00:13:43	0,00	2,47		58	0,61	9,526
00:13:49	0,00	2,50		58	0,62	9,435
00:13:57	0,00	2,54		59	0,62	9,303
00:14:05	0,00	2,58		59	0,62	9,183
00:14:10	0,00	2,60		60	0,63	9,108
00:14:15	0,00	2,63		60	0,63	9,031
00:14:24	0,00	2,67		61	0,63	8,898
00:14:32	0,00	2,71		61	0,64	8,784
00:14:42	0,00	2,76		62	0,64	8,650
00:14:51	0,00	2,80		62	0,65	8,528
00:14:59	0,00	2,84		63	0,65	8,422
00:15:09	0,00	2,88		64	0,66	8,301
00:15:18	0,00	2,93		64	0,66	8,185
00:15:26	0,00	2,97		65	0,67	8,084
00:15:35	0,00	3,01		65	0,67	7,977
00:15:44	0,00	3,05		66	0,68	7,871

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:15:53	0,00	3,09		67	0,68	7,775
00:16:02	0,00	3,14		67	0,68	7,674
00:16:11	0,00	3,18		68	0,69	7,574
00:16:19	0,00	3,22		68	0,69	7,487
00:16:28	0,00	3,26		69	0,70	7,394
00:16:37	0,00	3,30		70	0,70	7,299
00:16:45	0,00	3,34		70	0,71	7,215
00:16:54	0,00	3,39		71	0,71	7,131
00:17:03	0,00	3,43		71	0,72	7,044
00:17:11	0,00	3,47		72	0,72	6,962
00:17:20	0,00	3,51		72	0,73	6,881
00:17:29	0,00	3,55		73	0,73	6,802
00:17:37	0,00	3,59		74	0,74	6,726
00:17:46	0,00	3,63		74	0,74	6,648
00:17:54	0,00	3,67		75	0,75	6,573
00:18:03	0,00	3,71		75	0,75	6,502
00:18:11	0,00	3,75		76	0,76	6,428
00:18:20	0,00	3,79		76	0,76	6,357
00:18:28	0,00	3,83		77	0,77	6,289
00:18:36	0,00	3,87		77	0,77	6,219
00:18:45	0,00	3,91		78	0,78	6,152
00:18:53	0,00	3,95		79	0,78	6,087
00:19:01	0,00	3,99		79	0,79	6,020
00:19:10	0,00	4,03		80	0,79	5,957
00:19:18	0,00	4,06		80	0,80	5,894
00:19:26	0,00	4,10		81	0,80	5,830
00:19:35	0,00	4,14		81	0,80	5,770
00:19:43	0,00	4,18		82	0,81	5,710
00:19:51	0,00	4,22		82	0,81	5,649
00:20:00	0,00	4,26		83	0,82	5,591
00:20:08	0,00	4,30		83	0,82	5,534
00:20:12	0,00	4,31		84	0,83	5,505
00:20:12	Room 'Part I' is now filled with smoke					
00:20:20	0,00	4,35		84	0,83	5,448
00:20:28	0,00	4,39		85	0,84	5,392
00:20:36	0,00	4,43		85	0,84	5,338
00:20:45	0,00	4,47		86	0,85	5,280
00:20:53	0,00	4,50		86	0,85	5,228
00:21:01	0,00	4,54		87	0,86	5,176
00:21:09	0,00	4,58		87	0,86	5,123
00:21:17	0,00	4,62		88	0,87	5,071
00:21:25	0,00	4,65		88	0,87	5,018
00:21:33	0,00	4,69		89	0,88	4,969
00:21:41	0,00	4,73		89	0,88	4,916
00:21:49	0,00	4,76		90	0,89	4,870
00:21:57	0,00	4,80		90	0,89	4,821
00:22:05	0,00	4,84		91	0,90	4,772
00:22:13	0,00	4,87		91	0,90	4,724
00:22:21	0,00	4,91		92	0,91	4,677
00:22:29	0,00	4,95		92	0,91	4,630
00:22:37	0,00	4,98		93	0,92	4,581
00:22:45	0,00	5,02		93	0,92	4,538
00:22:53	0,00	5,05		94	0,93	4,489
00:23:01	0,00	5,09		94	0,93	4,447
00:23:09	0,00	5,13		95	0,94	4,400
00:23:16	0,00	5,16		95	0,94	4,358

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:23:24	0,00	5,20		96	0,95	4,312
00:23:32	0,00	5,23		96	0,95	4,272
00:23:40	0,00	5,27		97	0,96	4,226
00:23:48	0,00	5,30		97	0,96	4,186
00:23:56	0,00	5,34		98	0,97	4,142
00:24:03	0,00	5,37		98	0,97	4,103
00:24:11	0,00	5,41		99	0,98	4,059
00:24:19	0,00	5,44		99	0,98	4,021
00:24:27	0,00	5,48		100	0,99	3,977
00:24:35	0,00	5,51		100	0,99	3,940
00:24:42	0,00	5,55		101	1,00	3,898
00:24:50	0,00	5,58		101	1,00	3,861
00:24:58	0,00	5,62		102	1,01	3,822
00:25:05	0,00	5,65		102	1,01	3,783
00:25:13	0,00	5,69		103	1,02	3,745
00:25:21	0,00	5,72		103	1,02	3,707
00:25:28	0,00	5,76		104	1,03	3,669
00:25:36	0,00	5,79		104	1,03	3,629
00:25:44	0,00	5,82		105	1,04	3,595
00:25:51	0,00	5,86		105	1,04	3,555
00:25:59	0,00	5,89		106	1,05	3,522
00:26:07	0,00	5,93		106	1,05	3,486
00:26:14	0,00	5,96		107	1,06	3,450
00:26:22	0,00	5,99		107	1,07	3,415
00:26:29	0,00	6,03		107	1,07	3,377
00:26:37	0,00	6,06		108	1,08	3,345
00:26:44	0,00	6,09		108	1,08	3,310
00:26:52	0,00	6,13		109	1,09	3,276
00:26:59	0,00	6,16		109	1,09	3,242
00:27:07	0,00	6,19		110	1,10	3,205
00:27:14	0,00	6,23		110	1,10	3,175
00:27:22	0,00	6,26		111	1,11	3,142
00:27:29	0,00	6,29		111	1,11	3,109
00:27:37	0,00	6,33		112	1,12	3,076
00:27:44	0,00	6,36		112	1,12	3,044
00:27:52	0,00	6,39		113	1,13	3,012
00:27:59	0,00	6,42		113	1,13	2,980
00:28:07	0,00	6,46		113	1,14	2,946
00:28:14	0,00	6,49		114	1,15	2,917
00:28:21	0,00	6,52		114	1,15	2,886
00:28:29	0,00	6,55		115	1,16	2,852
00:28:36	0,00	6,59		115	1,16	2,824
00:28:44	0,00	6,62		116	1,17	2,794
00:28:51	0,00	6,65		116	1,17	2,761
00:28:58	0,00	6,68		117	1,18	2,734
00:29:06	0,00	6,72		117	1,18	2,705
00:29:13	0,00	6,75		118	1,19	2,672
00:29:20	0,00	6,78		118	1,19	2,646
00:29:28	0,00	6,81		118	1,20	2,617
00:29:35	0,00	6,84		119	1,20	2,588
00:29:42	0,00	6,88		119	1,21	2,559
00:29:49	0,00	6,91		120	1,22	2,532
00:29:57	0,00	6,94		120	1,22	2,504
00:30:04	0,00	6,97		121	1,23	2,472
00:30:11	0,00	7,00		121	1,23	2,448
00:30:18	0,00	7,03		121	1,24	2,421

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:30:26	0,00	7,06		122	1,24	2,393
00:30:33	0,00	7,09		122	1,25	2,367
00:30:40	0,00	7,13		123	1,25	2,340
00:30:47	0,00	7,16		123	1,26	2,313
00:30:54	0,00	7,19		124	1,27	2,284
00:31:01	0,00	7,22		124	1,27	2,261
00:31:09	0,00	7,25		125	1,28	2,235
00:31:16	0,00	7,28		125	1,28	2,210
00:31:23	0,00	7,31		125	1,29	2,185
00:31:30	0,00	7,34		126	1,29	2,159
00:31:37	0,00	7,37		126	1,30	2,135
00:31:44	0,00	7,40		127	1,30	2,110
00:31:52	0,00	7,43		127	1,31	2,086
00:31:59	0,00	7,46		128	1,32	2,062
00:32:06	0,00	7,49		128	1,32	2,038
00:32:13	0,00	7,53		128	1,33	2,014
00:32:20	0,00	7,56		129	1,33	1,988
00:32:27	0,00	7,59		129	1,34	1,969
00:32:34	0,00	7,62		130	1,34	1,947
00:32:41	0,00	7,65		130	1,35	1,926
00:32:48	0,00	7,68		130	1,35	1,905
00:32:55	0,00	7,71		131	1,36	1,884
00:33:02	0,00	7,74		131	1,37	1,863
00:33:09	0,00	7,77		132	1,37	1,843
00:33:16	0,00	7,80		132	1,38	1,822
00:33:23	0,00	7,83		133	1,38	1,802
00:33:30	0,00	7,86		133	1,39	1,783
00:33:37	0,00	7,89		133	1,39	1,762
00:33:44	0,00	7,91		134	1,40	1,743
00:33:51	0,00	7,94		134	1,41	1,723
00:33:58	0,00	7,97		135	1,41	1,704
00:34:04	0,00	8,00		135	1,42	1,681
00:34:11	0,00	8,03		135	1,42	1,665
00:34:18	0,00	8,06		136	1,43	1,646
00:34:25	0,00	8,09		136	1,43	1,627
00:34:32	0,00	8,12		137	1,44	1,608
00:34:39	0,00	8,15		137	1,45	1,590
00:34:46	0,00	8,18		138	1,45	1,567
00:34:53	0,00	8,21		138	1,46	1,553
00:34:59	0,00	8,24		138	1,46	1,534
00:35:06	0,00	8,27		139	1,47	1,516
00:35:13	0,00	8,29		139	1,47	1,498
00:35:20	0,00	8,32		140	1,48	1,480
00:35:27	0,00	8,35		140	1,49	1,461
00:35:34	0,00	8,38		140	1,49	1,444
00:35:40	0,00	8,41		141	1,50	1,426
00:35:47	0,00	8,44		141	1,50	1,408
00:35:54	0,00	8,47		142	1,51	1,391
00:36:01	0,00	8,49		142	1,51	1,373
00:36:07	0,00	8,52		142	1,52	1,355
00:36:14	0,00	8,55		143	1,53	1,338
00:36:21	0,00	8,58		143	1,53	1,321
00:36:28	0,00	8,61		144	1,54	1,304
00:36:34	0,00	8,64		144	1,54	1,286
00:36:41	0,00	8,66		144	1,55	1,269
00:36:48	0,00	8,69		145	1,56	1,253

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:36:54	0,00	8,72		145	1,56	1,236
00:37:01	0,00	8,75		145	1,57	1,219
00:37:08	0,00	8,78		146	1,57	1,202
00:37:18	0,00	8,82		146	1,58	1,177
00:37:25	0,00	8,85		147	1,59	1,161
00:37:34	0,00	8,89		147	1,60	1,136
00:37:44	0,00	8,93		148	1,61	1,112
00:37:54	0,00	8,97		149	1,61	1,088
00:38:04	0,00	9,01		149	1,62	1,063
00:38:14	0,00	9,05		150	1,63	1,040
00:38:24	0,00	9,09		150	1,64	1,016
00:38:34	0,00	9,14		151	1,65	0,992
00:38:44	0,00	9,18		151	1,66	0,969
00:38:54	0,00	9,22		152	1,67	0,945
00:39:03	0,00	9,26		153	1,68	0,922
00:39:13	0,00	9,30		153	1,68	0,899
00:39:23	0,00	9,34		154	1,69	0,877
00:39:33	0,00	9,38		154	1,70	0,854
00:39:43	0,00	9,42		155	1,71	0,831
00:39:52	0,00	9,46		155	1,72	0,809
00:40:00	0,00	9,49		156	1,73	0,787
00:40:00	Fire brigade is alarmed					
00:40:09	0,00	9,53		156	1,74	0,770
00:40:19	0,00	9,57		157	1,75	0,749
00:40:29	0,00	9,61		157	1,75	0,727
00:40:38	0,00	9,65		158	1,76	0,705
00:40:48	0,00	9,69		159	1,77	0,683
00:40:57	0,00	9,73		159	1,78	0,662
00:41:07	0,00	9,77		160	1,79	0,641
00:41:17	0,00	9,81		160	1,80	0,620
00:41:26	0,00	9,84		161	1,81	0,599
00:41:36	0,00	9,88		161	1,82	0,578
00:41:45	0,00	9,92		162	1,83	0,557
00:41:55	0,00	9,96		162	1,84	0,537
00:42:04	0,00	10,00		163	1,84	0,516
00:42:14	0,00	10,04		163	1,85	0,496
00:42:23	0,00	10,08		164	1,86	0,476
00:42:33	0,00	10,12		164	1,87	0,456
00:42:42	0,00	10,15		165	1,88	0,436
00:42:52	0,00	10,19		166	1,89	0,416
00:43:01	0,00	10,23		166	1,90	0,396
00:43:11	0,00	10,27		167	1,91	0,377
00:43:20	0,00	10,31		167	1,92	0,357
00:43:29	0,00	10,34		168	1,93	0,338
00:43:39	0,00	10,38		168	1,94	0,319
00:43:48	0,00	10,42		169	1,94	0,300
00:43:57	0,00	10,46		169	1,95	0,281
00:44:07	0,00	10,50		170	1,96	0,262
00:44:16	0,00	10,53		170	1,97	0,239
00:44:25	0,00	10,57		171	1,98	0,221
00:44:35	0,00	10,61		171	1,99	0,202
00:44:44	0,00	10,64		172	2,00	0,184
00:44:53	0,00	10,68		172	2,01	0,166
00:45:02	0,00	10,72		173	2,02	0,148
00:45:12	0,00	10,76		173	2,03	0,134
00:45:21	0,00	10,79		174	2,04	0,112

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:45:30	0,00	10,83		174	2,05	0,095
00:45:39	0,00	10,87		175	2,06	0,077
00:45:48	0,00	10,90		175	2,06	0,060
00:45:58	0,00	10,94		176	2,07	0,047
00:46:07	0,00	10,98		176	2,08	0,026
00:46:16	0,00	11,01		177	2,09	0,009
00:46:25	0,00	11,05		177	2,10	-0,007
00:46:34	0,00	11,09		178	2,11	-0,019
00:46:43	0,00	11,12		178	2,12	-0,039
00:46:52	0,00	11,16		179	2,13	-0,055
00:47:01	0,00	11,19		179	2,14	-0,071
00:47:11	0,00	11,23		180	2,15	-0,086
00:47:20	0,00	11,27		180	2,16	-0,102
00:47:29	0,00	11,30		181	2,17	-0,117
00:47:38	0,00	11,34		181	2,18	-0,132
00:47:47	0,00	11,37		182	2,19	-0,147
00:47:56	0,00	11,41		182	2,20	-0,162
00:48:05	0,00	11,44		183	2,21	-0,177
00:48:14	0,00	11,48		183	2,21	-0,192
00:48:23	0,00	11,51		184	2,22	-0,202
00:48:32	0,00	11,55		184	2,23	-0,221
00:48:40	0,00	11,58		185	2,24	-0,236
00:48:49	0,00	11,62		185	2,25	-0,250
00:48:58	0,00	11,65		186	2,26	-0,264
00:49:07	0,00	11,69		186	2,27	-0,274
00:49:16	0,00	11,72		187	2,28	-0,293
00:49:25	0,00	11,76		187	2,29	-0,307
00:49:34	0,00	11,79		188	2,30	-0,321
00:49:43	0,00	11,83		188	2,31	-0,335
00:49:49	0,00	11,85		188	2,32	-0,340
00:49:49	Critical condition in room 'Part I': Heat radiation from smoke layer greater than 2,5 kW/m²					
00:49:57	0,00	11,89		189	2,32	-0,358
00:50:06	0,00	11,92		189	2,33	-0,372
00:50:15	0,00	11,95		190	2,34	-0,386
00:50:24	0,00	11,99		190	2,35	-0,399
00:50:33	0,00	12,02		191	2,36	-0,413
00:50:41	0,00	12,06		191	2,37	-0,426
00:50:50	0,00	12,09		192	2,38	-0,440
00:50:59	0,00	12,12		192	2,39	-0,453
00:51:08	0,00	12,16		193	2,40	-0,467
00:51:16	0,00	12,19		193	2,41	-0,480
00:51:25	0,00	12,23		193	2,42	-0,493
00:51:34	0,00	12,26		194	2,43	-0,506
00:51:43	0,00	12,29		194	2,44	-0,519
00:51:51	0,00	12,33		195	2,45	-0,532
00:52:00	0,00	12,36		195	2,46	-0,545
00:52:08	0,00	12,39		196	2,47	-0,558
00:52:17	0,00	12,43		196	2,48	-0,571
00:52:26	0,00	12,46		197	2,49	-0,583
00:52:35	0,00	12,49		197	2,50	-0,596
00:52:40	0,00	12,52		197	2,50	-0,605
00:52:40	Critical condition in room 'Part II': Heat radiation from smoke layer greater than 2,5 kW/m²					
00:52:49	0,00	12,55		198	2,51	-0,617
00:52:57	0,00	12,58		198	2,52	-0,630

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:53:06	0,00	12,61		199	2,53	-0,642
00:53:15	0,00	12,65		199	2,54	-0,650
00:53:23	0,00	12,68		200	2,55	-0,667
00:53:32	0,00	12,71		200	2,56	-0,679
00:53:40	0,00	12,75		201	2,57	-0,692
00:53:49	0,00	12,78		201	2,58	-0,704
00:53:57	0,00	12,81		201	2,59	-0,716
00:54:06	0,00	12,84		202	2,60	-0,728
00:54:14	0,00	12,88		202	2,61	-0,736
00:54:23	0,00	12,91		203	2,62	-0,752
00:54:31	0,00	12,94		203	2,63	-0,764
00:54:40	0,00	12,97		204	2,64	-0,776
00:54:48	0,00	13,00		204	2,65	-0,788
00:54:57	0,00	13,04		204	2,66	-0,800
00:55:00	0,00	13,05		205	2,66	-0,804
00:55:00	Fire brigade arrived, preparing extinguishing					
00:55:08	0,00	13,08		205	2,67	-0,811
00:55:16	0,00	13,11		205	2,68	-0,827
00:55:25	0,00	13,14		206	2,69	-0,839
00:55:33	0,00	13,17		206	2,70	-0,845
00:55:42	0,00	13,21		207	2,71	-0,862
00:55:50	0,00	13,24		207	2,72	-0,873
00:56:00	0,00	13,27		208	2,73	-0,884
00:56:00	Fire brigade ready, extinguishing started					
00:56:08	0,00	13,30		208	2,74	-0,897
00:56:16	0,00	13,34		209	2,75	-0,904
00:56:25	0,00	13,37		209	2,76	-0,920
00:56:32	0,00	13,40		209	2,77	-1,023
00:56:32	Fire is declining					
00:56:42	0,00	13,43		210	2,78	-1,328
00:56:51	0,00	13,47		210	2,79	-1,608
00:57:01	0,00	13,50		211	2,80	-1,877
00:57:11	0,00	13,53		211	2,81	-2,125
00:57:20	0,00	13,57		211	2,81	-2,353
00:57:30	0,00	13,60		212	2,82	-2,577
00:57:39	0,00	13,63		212	2,83	-2,785
00:57:49	0,00	13,66		212	2,83	-2,978
00:57:58	0,00	13,69		212	2,84	-3,172
00:58:08	0,00	13,71		213	2,84	-3,353
00:58:17	0,00	13,74		213	2,84	-3,528
00:58:27	0,00	13,77		213	2,85	-3,693
00:58:37	0,00	13,79		213	2,85	-3,862
00:58:46	0,00	13,81		213	2,85	-4,022
00:58:56	0,00	13,84		213	2,85	-4,179
00:59:05	0,00	13,86		213	2,85	-4,332
00:59:15	0,00	13,87		213	2,85	-4,483
00:59:24	0,00	13,89		213	2,85	-4,631
00:59:34	0,00	13,91		213	2,84	-4,777
00:59:43	0,00	13,93		213	2,84	-4,921
00:59:53	0,00	13,94		213	2,84	-5,063
01:00:00	0,00	13,95		212	2,84	-5,161
01:00:00	MAX. CALCULATION TIME - CALCULATION ABORTED!					

Calculation

Basic information

Client:	BWSC
Scenario name:	Part I
Consultant:	Rambøll
Reference no.:	
Company type:	Industry, chemical
Basic bldg. construction:	Brick-wall/concrete-roof
Last revision:	12-12-2018 14:27:23
Revision No.:	40

Calculation options

Post flash-over model enabled:	x
Time limit [min]:	60
Plumemodel:	Heskestad

Fire brigade

Fire brigade active:	-
City area:	-
24 hour:	-
Distance/fire station [km]:	10,0
Calculated response time [min]:	15
Time before manual alarm [min]:	40

Fire start

Fire start room:	Part II
Fire start, type:	Energy formula fire
Fire start, name:	11 MW Fast
Fire start, code:	-
Optical smoke potential [dB/m]:	100,0
Maximum Q(t) [MW]:	11,00
Parabolic growth [MW/min²]:	0,1692
Parabolic growth [kW/s²]:	0,0470
Linear growth [MW/min]:	0,0000
Constant fire [MW]:	0,0000
Initial fire [kW]:	0,00
Doubling time [min]:	0,00

Fire installations

	[---------- In operation ----------]						
Room name	AFV Heat	AFV Smoke	AFV Timer	Sprinkler	AFA Heat	AFA Smoke	Windload [m/s]
Part I	-	-	-	-	-	-	0,00
Part II	-	-	-	-	-	-	0,00

Events

Fire progression:
Energy formula fire > 11 MW Fast
Plumemodel > Heskestad
00:07:40 : Critical condition in room 'Part I': Smoke free height less than 5,20 m
00:09:11 : Critical condition in room 'Part II': Smoke free height less than 4,00 m
00:12:34 : Room 'Part I' is now filled with smoke
00:16:10 : Room 'Part II' is now filled with smoke
00:40:00 : Fire brigade is alarmed
00:48:13 : Critical condition in room 'Part II': Heat radiation from smoke layer greater than 2,5 kW/m²
00:52:36 : Critical condition in room 'Part I': Heat radiation from smoke layer greater than 2,5 kW/m²
00:55:00 : Fire brigade arrived, preparing extinguishing
00:56:00 : Fire brigade ready, extinguishing started
00:56:32 : Fire is declining
01:00:00 : MAX. CALCULATION TIME - CALCULATION ABORTED!

RHR and smoke layer temperature in all rooms

Time	Rate of heat release [kW]	Smoke layer temp. [ºC] Part I	Smoke layer temp. [ºC] Part II
00:00:00	0	20	20
00:00:09	4	20	20
00:00:18	17	20	20
00:00:28	39	20	20
00:00:38	68	20	20
00:00:47	108	20	20
00:00:57	157	20	20
00:01:06	209	20	20
00:01:15	269	20	20
00:01:25	340	20	22
00:01:34	423	20	22
00:01:44	513	20	23
00:01:53	610	20	23
00:02:03	718	20	23
00:02:13	838	20	24
00:02:23	965	20	24
00:02:32	1.096	21	25
00:02:42	1.244	21	25
00:02:52	1.399	22	26
00:03:02	1.561	22	26
00:03:11	1.731	22	27
00:03:21	1.909	22	28
00:03:31	2.096	23	28
00:03:40	2.291	23	29
00:03:50	2.496	23	29
00:04:00	2.709	24	30
00:04:09	2.927	24	31
00:04:18	3.149	24	31
00:04:28	3.391	25	32
00:04:38	3.647	25	33
00:04:47	3.892	25	33
00:04:57	4.154	25	34
00:05:06	4.423	26	34
00:05:16	4.698	26	35
00:05:25	4.978	27	35
00:05:35	5.285	27	36
00:05:45	5.597	27	36
00:05:54	5.914	28	37
00:06:04	6.234	28	37
00:06:13	6.560	29	38
00:06:23	6.914	29	38
00:06:33	7.273	30	39
00:06:43	7.637	30	39
00:06:52	8.005	31	40
00:07:02	8.378	31	40
00:07:11	8.754	32	41
00:07:21	9.162	32	42

00:07:31	9.575	33	42
00:07:40	9.964	33	43
00:07:40		Critical condition in room 'Part I': Smoke free height less than 5,20 m	
00:07:50	10.385	34	44
00:07:59	10.810	35	44
00:08:08	11.000	35	45
00:08:17	11.000	36	46
00:08:25	11.000	36	46
00:08:34	11.000	37	47
00:08:43	11.000	38	47
00:08:53	11.000	38	48
00:09:02	11.000	39	48
00:09:11	11.000	40	49
00:09:11		Critical condition in room 'Part II': Smoke free height less than 4,00 m	
00:09:20	11.000	40	49
00:09:29	11.000	41	50
00:09:39	11.000	41	51
00:09:48	11.000	42	51
00:09:58	11.000	43	52
00:10:07	11.000	43	53
00:10:15	11.000	44	53
00:10:24	11.000	44	54
00:10:34	11.000	45	55
00:10:42	11.000	46	55
00:10:50	11.000	46	56
00:10:59	11.000	47	56
00:11:09	11.000	48	57
00:11:17	11.000	48	58
00:11:25	11.000	49	58
00:11:34	11.000	49	59
00:11:43	11.000	50	60
00:11:50	11.000	50	60
00:11:58	11.000	51	61
00:12:05	11.000	52	61
00:12:14	11.000	52	62
00:12:23	11.000	53	63
00:12:28	11.000	53	63
00:12:34	11.000	54	64
00:12:34		Room 'Part I' is now filled with smoke	
00:12:39	11.000	54	64
00:12:49	11.000	55	65
00:12:54	11.000	55	65
00:13:00	11.000	55	66
00:13:05	11.000	56	66
00:13:10	11.000	56	66
00:13:16	11.000	56	67
00:13:23	11.000	57	67
00:13:29	11.000	57	68
00:13:38	11.000	58	68
00:13:46	11.000	59	69
00:13:55	11.000	59	69
00:14:00	11.000	60	70
00:14:09	11.000	60	70
00:14:17	11.000	61	71
00:14:26	11.000	61	72
00:14:35	11.000	62	72
00:14:43	11.000	63	73
00:14:52	11.000	63	74
00:15:01	11.000	64	74

00:15:10	11.000	64	75
00:15:18	11.000	65	75
00:15:27	11.000	65	76
00:15:36	11.000	66	77
00:15:44	11.000	67	77
00:15:53	11.000	67	78
00:16:01	11.000	68	78
00:16:10	11.000	68	79
00:16:10		Room 'Part II' is now filled with smoke	
00:16:18	11.000	69	80
00:16:27	11.000	69	80
00:16:35	11.000	70	81
00:16:44	11.000	71	81
00:16:52	11.000	71	82
00:17:00	11.000	72	82
00:17:09	11.000	72	83
00:17:17	11.000	73	84
00:17:26	11.000	73	84
00:17:34	11.000	74	85
00:17:43	11.000	74	85
00:17:51	11.000	75	86
00:17:59	11.000	76	86
00:18:07	11.000	76	87
00:18:16	11.000	77	87
00:18:24	11.000	77	88
00:18:32	11.000	78	89
00:18:40	11.000	78	89
00:18:49	11.000	79	90
00:18:57	11.000	79	90
00:19:05	11.000	80	91
00:19:13	11.000	80	91
00:19:21	11.000	81	92
00:19:29	11.000	81	92
00:19:37	11.000	82	93
00:19:46	11.000	82	94
00:19:54	11.000	83	94
00:20:02	11.000	84	95
00:20:10	11.000	84	95
00:20:18	11.000	85	96
00:20:26	11.000	85	96
00:20:34	11.000	86	97
00:20:42	11.000	86	97
00:20:50	11.000	87	98
00:20:58	11.000	87	98
00:21:06	11.000	88	99
00:21:14	11.000	88	99
00:21:22	11.000	89	100
00:21:30	11.000	89	100
00:21:38	11.000	90	101
00:21:46	11.000	90	101
00:21:54	11.000	91	102
00:22:01	11.000	91	102
00:22:09	11.000	92	103
00:22:17	11.000	92	103
00:22:25	11.000	93	104
00:22:33	11.000	93	104
00:22:41	11.000	94	105
00:22:48	11.000	94	106
00:22:56	11.000	95	106

00:23:04	11.000	95	107
00:23:12	11.000	96	107
00:23:19	11.000	96	108
00:23:27	11.000	97	108
00:23:35	11.000	97	109
00:23:43	11.000	98	109
00:23:50	11.000	98	110
00:23:58	11.000	99	110
00:24:06	11.000	99	111
00:24:13	11.000	99	111
00:24:21	11.000	100	112
00:24:29	11.000	100	112
00:24:36	11.000	101	112
00:24:44	11.000	101	113
00:24:52	11.000	102	113
00:24:59	11.000	102	114
00:25:07	11.000	103	114
00:25:14	11.000	103	115
00:25:22	11.000	104	115
00:25:30	11.000	104	116
00:25:37	11.000	105	116
00:25:45	11.000	105	117
00:25:52	11.000	106	117
00:26:00	11.000	106	118
00:26:07	11.000	107	118
00:26:15	11.000	107	119
00:26:22	11.000	107	119
00:26:30	11.000	108	120
00:26:37	11.000	108	120
00:26:44	11.000	109	121
00:26:52	11.000	109	121
00:26:59	11.000	110	122
00:27:07	11.000	110	122
00:27:14	11.000	111	123
00:27:22	11.000	111	123
00:27:29	11.000	112	123
00:27:36	11.000	112	124
00:27:44	11.000	113	124
00:27:51	11.000	113	125
00:27:58	11.000	113	125
00:28:06	11.000	114	126
00:28:13	11.000	114	126
00:28:20	11.000	115	127
00:28:28	11.000	115	127
00:28:35	11.000	116	128
00:28:42	11.000	116	128
00:28:49	11.000	117	129
00:28:57	11.000	117	129
00:29:04	11.000	117	129
00:29:11	11.000	118	130
00:29:18	11.000	118	130
00:29:26	11.000	119	131
00:29:33	11.000	119	131
00:29:40	11.000	120	132
00:29:47	11.000	120	132
00:29:54	11.000	120	133
00:30:01	11.000	121	133
00:30:09	11.000	121	134
00:30:16	11.000	122	134

00:30:23	11.000	122	134
00:30:30	11.000	123	135
00:30:37	11.000	123	135
00:30:44	11.000	123	136
00:30:51	11.000	124	136
00:30:58	11.000	124	137
00:31:05	11.000	125	137
00:31:12	11.000	125	138
00:31:19	11.000	126	138
00:31:26	11.000	126	138
00:31:33	11.000	126	139
00:31:41	11.000	127	139
00:31:47	11.000	127	140
00:31:54	11.000	128	140
00:32:01	11.000	128	141
00:32:08	11.000	129	141
00:32:15	11.000	129	141
00:32:22	11.000	129	142
00:32:29	11.000	130	142
00:32:36	11.000	130	143
00:32:43	11.000	131	143
00:32:50	11.000	131	144
00:32:57	11.000	131	144
00:33:04	11.000	132	144
00:33:11	11.000	132	145
00:33:18	11.000	133	145
00:33:25	11.000	133	146
00:33:31	11.000	134	146
00:33:38	11.000	134	146
00:33:45	11.000	134	147
00:33:52	11.000	135	147
00:33:59	11.000	135	148
00:34:06	11.000	136	148
00:34:12	11.000	136	149
00:34:19	11.000	136	149
00:34:26	11.000	137	149
00:34:33	11.000	137	150
00:34:40	11.000	138	150
00:34:46	11.000	138	151
00:34:53	11.000	138	151
00:35:00	11.000	139	151
00:35:07	11.000	139	152
00:35:17	11.000	140	152
00:35:23	11.000	140	153
00:35:33	11.000	141	153
00:35:40	11.000	141	154
00:35:47	11.000	142	154
00:35:57	11.000	142	155
00:36:04	11.000	142	155
00:36:13	11.000	143	156
00:36:20	11.000	143	156
00:36:30	11.000	144	157
00:36:40	11.000	145	157
00:36:50	11.000	145	158
00:37:00	11.000	146	159
00:37:10	11.000	146	159
00:37:20	11.000	147	160
00:37:29	11.000	147	160
00:37:39	11.000	148	161

00:37:49	11.000	149	162
00:37:59	11.000	149	162
00:38:09	11.000	150	163
00:38:18	11.000	150	163
00:38:28	11.000	151	164
00:38:38	11.000	151	164
00:38:48	11.000	152	165
00:38:57	11.000	153	166
00:39:07	11.000	153	166
00:39:17	11.000	154	167
00:39:26	11.000	154	167
00:39:36	11.000	155	168
00:39:46	11.000	155	168
00:39:55	11.000	156	169
00:40:00	11.000	156	169
00:40:00		Fire brigade is alarmed	
00:40:09	11.000	157	170
00:40:19	11.000	157	170
00:40:28	11.000	158	171
00:40:38	11.000	158	171
00:40:47	11.000	159	172
00:40:57	11.000	159	173
00:41:06	11.000	160	173
00:41:16	11.000	160	174
00:41:25	11.000	161	174
00:41:35	11.000	161	175
00:41:44	11.000	162	175
00:41:53	11.000	163	176
00:42:03	11.000	163	176
00:42:12	11.000	164	177
00:42:22	11.000	164	178
00:42:31	11.000	165	178
00:42:40	11.000	165	179
00:42:50	11.000	166	179
00:42:59	11.000	166	180
00:43:08	11.000	167	180
00:43:17	11.000	167	181
00:43:27	11.000	168	181
00:43:36	11.000	168	182
00:43:45	11.000	169	182
00:43:54	11.000	169	183
00:44:04	11.000	170	183
00:44:13	11.000	170	184
00:44:22	11.000	171	184
00:44:31	11.000	171	185
00:44:40	11.000	172	185
00:44:49	11.000	172	186
00:44:59	11.000	173	186
00:45:08	11.000	173	187
00:45:17	11.000	174	187
00:45:26	11.000	174	188
00:45:35	11.000	175	189
00:45:44	11.000	175	189
00:45:53	11.000	176	190
00:46:02	11.000	176	190
00:46:11	11.000	177	191
00:46:20	11.000	177	191
00:46:29	11.000	178	192
00:46:38	11.000	178	192

00:46:47	11.000	179	193
00:46:56	11.000	179	193
00:47:05	11.000	180	194
00:47:14	11.000	180	194
00:47:23	11.000	181	195
00:47:32	11.000	181	195
00:47:41	11.000	182	196
00:47:50	11.000	182	196
00:47:58	11.000	183	197
00:48:07	11.000	183	197
00:48:13	11.000	183	197
00:48:13		Critical condition in room 'Part II': Heat radiation from smoke layer greater than 2,5 kW/m²	
00:48:22	11.000	184	198
00:48:31	11.000	184	198
00:48:40	11.000	185	199
00:48:48	11.000	185	199
00:48:57	11.000	186	200
00:49:06	11.000	186	200
00:49:15	11.000	187	201
00:49:24	11.000	187	201
00:49:32	11.000	188	202
00:49:41	11.000	188	202
00:49:50	11.000	189	203
00:49:58	11.000	189	203
00:50:07	11.000	190	204
00:50:16	11.000	190	204
00:50:25	11.000	190	205
00:50:33	11.000	191	205
00:50:42	11.000	191	205
00:50:51	11.000	192	206
00:50:59	11.000	192	206
00:51:08	11.000	193	207
00:51:16	11.000	193	207
00:51:25	11.000	194	208
00:51:34	11.000	194	208
00:51:42	11.000	195	209
00:51:51	11.000	195	209
00:51:59	11.000	195	210
00:52:08	11.000	196	210
00:52:16	11.000	196	211
00:52:25	11.000	197	211
00:52:33	11.000	197	211
00:52:36	11.000	197	212
00:52:36		Critical condition in room 'Part I': Heat radiation from smoke layer greater than 2,5 kW/m²	
00:52:45	11.000	198	212
00:52:53	11.000	198	213
00:53:02	11.000	199	213
00:53:10	11.000	199	213
00:53:19	11.000	200	214
00:53:27	11.000	200	214
00:53:36	11.000	200	215
00:53:44	11.000	201	215
00:53:53	11.000	201	216
00:54:01	11.000	202	216
00:54:09	11.000	202	217
00:54:18	11.000	203	217
00:54:26	11.000	203	217

00:54:34	11.000	204	218
00:54:43	11.000	204	218
00:54:51	11.000	204	219
00:55:00	11.000	205	219
00:55:00		Fire brigade arrived, preparing extinguishing	
00:55:08	11.000	205	220
00:55:16	11.000	206	220
00:55:25	11.000	206	221
00:55:33	11.000	206	221
00:55:41	11.000	207	221
00:55:49	11.000	207	222
00:55:58	11.000	208	222
00:56:00	11.000	208	222
00:56:00		Fire brigade ready, extinguishing started	
00:56:08	11.000	208	223
00:56:16	11.000	209	223
00:56:24	11.000	209	224
00:56:32	10.908	210	224
00:56:32		Fire is declining	
00:56:42	10.590	210	224
00:56:51	10.271	210	225
00:57:01	9.953	211	225
00:57:10	9.634	211	225
00:57:20	9.315	212	225
00:57:30	8.997	212	225
00:57:39	8.678	212	225
00:57:49	8.360	212	225
00:57:58	8.041	213	225
00:58:08	7.723	213	225
00:58:17	7.404	213	225
00:58:27	7.086	213	224
00:58:36	6.767	213	224
00:58:46	6.448	213	224
00:58:56	6.130	213	224
00:59:05	5.811	213	223
00:59:15	5.493	213	223
00:59:24	5.174	213	223
00:59:34	4.856	213	222
00:59:43	4.537	213	222
00:59:53	4.219	213	221
01:00:00	4.000	213	221
01:00:00		MAX. CALCULATION TIME - CALCULATION ABORTED!	

Simulation results for each room

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:00:00	0,00		36,00	20		-0,010
00:00:09	0,00		36,00	20		0,000
00:00:18	0,00		36,00	20		0,000
00:00:28	0,00		36,00	20		0,000
00:00:38	0,00		36,00	20		0,000
00:00:47	0,00		36,00	20		0,000
00:00:57	0,00		36,00	20		0,000
00:01:06	0,00		36,00	20		0,000
00:01:15	0,00		36,00	20		0,000
00:01:25	0,00		36,00	20		0,022
00:01:34	0,00		36,00	20		0,029
00:01:44	0,00		36,00	20		0,035
00:01:53	0,00		36,00	20		0,040
00:02:03	0,00		36,00	20		0,044
00:02:13	0,01		36,00	20		0,048
00:02:23	0,01		36,00	20		0,051
00:02:32	0,01	0,08	35,65	21		0,236
00:02:42	0,01	0,10	33,55	21	0,09	0,301
00:02:52	0,01	0,11	31,61	22	0,10	0,377
00:03:02	0,01	0,12	29,84	22	0,11	0,464
00:03:11	0,01	0,14	28,21	22	0,12	0,565
00:03:21	0,01	0,15	26,72	22	0,13	0,681
00:03:31	0,01	0,17	25,35	23	0,14	0,813
00:03:40	0,01	0,19	24,11	23	0,15	0,962
00:03:50	0,01	0,21	22,94	23	0,15	1,133
00:04:00	0,01	0,23	21,86	24	0,16	1,324
00:04:09	0,01	0,25	20,85	24	0,17	1,534
00:04:18	0,01	0,27	19,91	24	0,18	1,764
00:04:28	0,01	0,30	18,94	25	0,19	2,033
00:04:38	0,01	0,32	18,03	25	0,21	2,342
00:04:47	0,01	0,34	17,24	25	0,22	2,664
00:04:57	0,01	0,36	16,46	25	0,23	3,033
00:05:06	0,01	0,38	15,70	26	0,24	3,440
00:05:16	0,01	0,40	14,96	26	0,25	3,880
00:05:25	0,01	0,42	14,25	27	0,26	4,354
00:05:35	0,01	0,45	13,50	27	0,27	4,905
00:05:45	0,01	0,47	12,77	27	0,28	5,495
00:05:54	0,01	0,50	12,07	28	0,29	6,124
00:06:04	0,01	0,52	11,38	28	0,30	6,793
00:06:13	0,01	0,55	10,72	29	0,31	7,503
00:06:23	0,01	0,58	10,03	29	0,33	8,313
00:06:33	0,01	0,61	9,37	30	0,34	9,171
00:06:43	0,01	0,64	8,72	30	0,35	10,077
00:06:52	0,01	0,67	8,10	31	0,36	11,031
00:07:02	0,01	0,70	7,49	31	0,37	12,035
00:07:11	0,01	0,73	6,91	32	0,38	13,089
00:07:21	0,01	0,77	6,30	32	0,40	14,274
00:07:31	0,01	0,81	5,72	33	0,41	15,517
00:07:40	0,01	0,84	5,19	33	0,42	16,730
00:07:40	Critical condition in room 'Part I': Smoke free height less than 5,20 m					
00:07:50	0,01	0,88	4,65	34	0,43	18,088
00:07:59	0,01	0,92	4,13	35	0,44	19,507
00:08:08	0,01	0,95	3,64	35	0,44	19,905

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:08:17	0,01	0,99	3,21	36	0,45	19,511
00:08:25	0,01	1,02	2,81	36	0,46	19,145
00:08:34	0,01	1,06	2,44	37	0,46	18,801
00:08:43	0,01	1,10	2,09	38	0,47	18,480
00:08:53	0,00	1,14	1,72	38	0,48	18,052
00:09:02	0,00	1,18	1,40	39	0,48	17,641
00:09:11	0,00	1,21	1,16	40	0,49	17,286
00:09:11	Critical condition in room 'Part II': Smoke free height less than 4,00 m					
00:09:20	0,00	1,25	0,92	40	0,49	16,928
00:09:29	0,00	1,29	0,72	41	0,49	16,590
00:09:39	0,00	1,33	0,56	41	0,50	16,276
00:09:48	0,00	1,37	0,42	42	0,50	15,986
00:09:58	0,00	1,41	0,31	43	0,51	15,720
00:10:07	0,00	1,45	0,23	43	0,51	15,415
00:10:15	0,00	1,49	0,16	44	0,52	15,096
00:10:24	0,00	1,53	0,12	44	0,52	14,770
00:10:34	0,00	1,57	0,08	45	0,52	14,440
00:10:42	0,00	1,60	0,06	46	0,53	14,171
00:10:50	0,00	1,64	0,04	46	0,53	13,897
00:10:59	0,00	1,68	0,03	47	0,54	13,618
00:11:09	0,00	1,73	0,02	48	0,54	13,331
00:11:17	0,00	1,76	0,01	48	0,54	13,109
00:11:25	0,00	1,80	0,01	49	0,55	12,880
00:11:34	0,00	1,85	0,01	49	0,55	12,644
00:11:43	0,00	1,89		50	0,56	12,397
00:11:50	0,00	1,92		50	0,56	12,227
00:11:58	0,00	1,96		51	0,56	12,052
00:12:05	0,00	2,00		52	0,57	11,870
00:12:14	0,00	2,04		52	0,57	11,683
00:12:23	0,00	2,08		53	0,58	11,487
00:12:28	0,00	2,11		53	0,58	11,374
00:12:34	0,00	2,13		54	0,58	11,261
00:12:34	Room 'Part I' is now filled with smoke					
00:12:39	0,00	2,16		54	0,58	11,147
00:12:49	0,00	2,20		55	0,59	10,964
00:12:54	0,00	2,23		55	0,59	10,868
00:13:00	0,00	2,26		55	0,59	10,760
00:13:05	0,00	2,28		56	0,60	10,664
00:13:10	0,00	2,31		56	0,60	10,567
00:13:16	0,00	2,34		56	0,60	10,467
00:13:23	0,00	2,37		57	0,61	10,355
00:13:29	0,00	2,40		57	0,61	10,256
00:13:38	0,00	2,44		58	0,61	10,097
00:13:46	0,00	2,48		59	0,62	9,981
00:13:55	0,00	2,52		59	0,62	9,840
00:14:00	0,00	2,55		60	0,63	9,761
00:14:09	0,00	2,59		60	0,63	9,632
00:14:17	0,00	2,63		61	0,63	9,521
00:14:26	0,00	2,68		61	0,64	9,390
00:14:35	0,00	2,72		62	0,64	9,266
00:14:43	0,00	2,76		63	0,65	9,161
00:14:52	0,00	2,80		63	0,65	9,047
00:15:01	0,00	2,84		64	0,66	8,932
00:15:10	0,00	2,88		64	0,66	8,833
00:15:18	0,00	2,92		65	0,67	8,731
00:15:27	0,00	2,97		65	0,67	8,622

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:15:36	0,00	3,01		66	0,68	8,529
00:15:44	0,00	3,05		67	0,68	8,436
00:15:53	0,00	3,09		67	0,68	8,337
00:16:01	0,00	3,13		68	0,69	8,246
00:16:10	0,00	3,17		68	0,69	8,160
00:16:10	Room 'Part II' is now filled with smoke					
00:16:18	0,00	3,21		69	0,70	8,069
00:16:27	0,00	3,25		69	0,70	7,981
00:16:35	0,00	3,29		70	0,71	7,903
00:16:44	0,00	3,33		71	0,71	7,818
00:16:52	0,00	3,37		71	0,72	7,736
00:17:00	0,00	3,41		72	0,72	7,658
00:17:09	0,00	3,45		72	0,73	7,581
00:17:17	0,00	3,49		73	0,73	7,504
00:17:26	0,00	3,53		73	0,74	7,432
00:17:34	0,00	3,57		74	0,74	7,356
00:17:43	0,00	3,61		74	0,75	7,281
00:17:51	0,00	3,65		75	0,75	7,214
00:17:59	0,00	3,69		76	0,75	7,143
00:18:07	0,00	3,73		76	0,76	7,073
00:18:16	0,00	3,76		77	0,76	7,007
00:18:24	0,00	3,80		77	0,77	6,940
00:18:32	0,00	3,84		78	0,77	6,873
00:18:40	0,00	3,88		78	0,78	6,810
00:18:49	0,00	3,92		79	0,78	6,745
00:18:57	0,00	3,96		79	0,79	6,679
00:19:05	0,00	3,99		80	0,79	6,621
00:19:13	0,00	4,03		80	0,80	6,559
00:19:21	0,00	4,07		81	0,80	6,498
00:19:29	0,00	4,11		81	0,81	6,439
00:19:37	0,00	4,15		82	0,81	6,380
00:19:46	0,00	4,18		82	0,82	6,321
00:19:54	0,00	4,22		83	0,82	6,265
00:20:02	0,00	4,26		84	0,83	6,208
00:20:10	0,00	4,30		84	0,83	6,152
00:20:18	0,00	4,33		85	0,84	6,097
00:20:26	0,00	4,37		85	0,84	6,042
00:20:34	0,00	4,41		86	0,85	5,988
00:20:42	0,00	4,44		86	0,85	5,935
00:20:50	0,00	4,48		87	0,85	5,882
00:20:58	0,00	4,52		87	0,86	5,830
00:21:06	0,00	4,55		88	0,86	5,778
00:21:14	0,00	4,59		88	0,87	5,728
00:21:22	0,00	4,63		89	0,87	5,677
00:21:30	0,00	4,66		89	0,88	5,627
00:21:38	0,00	4,70		90	0,88	5,578
00:21:46	0,00	4,73		90	0,89	5,529
00:21:54	0,00	4,77		91	0,89	5,481
00:22:01	0,00	4,80		91	0,90	5,433
00:22:09	0,00	4,84		92	0,90	5,385
00:22:17	0,00	4,88		92	0,91	5,339
00:22:25	0,00	4,91		93	0,91	5,292
00:22:33	0,00	4,95		93	0,92	5,246
00:22:41	0,00	4,98		94	0,92	5,201
00:22:48	0,00	5,02		94	0,93	5,156
00:22:56	0,00	5,05		95	0,93	5,111

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:23:04	0,00	5,09		95	0,94	5,067
00:23:12	0,00	5,12		96	0,94	5,024
00:23:19	0,00	5,16		96	0,95	4,980
00:23:27	0,00	5,19		97	0,95	4,937
00:23:35	0,00	5,23		97	0,96	4,895
00:23:43	0,00	5,26		98	0,96	4,850
00:23:50	0,00	5,30		98	0,97	4,808
00:23:58	0,00	5,33		99	0,97	4,767
00:24:06	0,00	5,37		99	0,98	4,725
00:24:13	0,00	5,40		99	0,98	4,685
00:24:21	0,00	5,43		100	0,99	4,645
00:24:29	0,00	5,47		100	0,99	4,605
00:24:36	0,00	5,50		101	1,00	4,565
00:24:44	0,00	5,54		101	1,00	4,526
00:24:52	0,00	5,57		102	1,01	4,487
00:24:59	0,00	5,60		102	1,01	4,448
00:25:07	0,00	5,64		103	1,02	4,411
00:25:14	0,00	5,67		103	1,02	4,376
00:25:22	0,00	5,71		104	1,03	4,335
00:25:30	0,00	5,74		104	1,03	4,298
00:25:37	0,00	5,77		105	1,04	4,261
00:25:45	0,00	5,81		105	1,05	4,225
00:25:52	0,00	5,84		106	1,05	4,189
00:26:00	0,00	5,87		106	1,06	4,153
00:26:07	0,00	5,91		107	1,06	4,117
00:26:15	0,00	5,94		107	1,07	4,082
00:26:22	0,00	5,97		107	1,07	4,047
00:26:30	0,00	6,00		108	1,08	4,012
00:26:37	0,00	6,04		108	1,08	3,978
00:26:44	0,00	6,07		109	1,09	3,944
00:26:52	0,00	6,10		109	1,09	3,910
00:26:59	0,00	6,13		110	1,10	3,877
00:27:07	0,00	6,17		110	1,10	3,844
00:27:14	0,00	6,20		111	1,11	3,814
00:27:22	0,00	6,23		111	1,11	3,778
00:27:29	0,00	6,26		112	1,12	3,746
00:27:36	0,00	6,30		112	1,12	3,717
00:27:44	0,00	6,33		113	1,13	3,682
00:27:51	0,00	6,36		113	1,13	3,651
00:27:58	0,00	6,39		113	1,14	3,622
00:28:06	0,00	6,43		114	1,14	3,588
00:28:13	0,00	6,46		114	1,15	3,558
00:28:20	0,00	6,49		115	1,16	3,530
00:28:28	0,00	6,52		115	1,16	3,497
00:28:35	0,00	6,55		116	1,17	3,467
00:28:42	0,00	6,58		116	1,17	3,441
00:28:49	0,00	6,62		117	1,18	3,408
00:28:57	0,00	6,65		117	1,18	3,380
00:29:04	0,00	6,68		117	1,19	3,350
00:29:11	0,00	6,71		118	1,19	3,322
00:29:18	0,00	6,74		118	1,20	3,298
00:29:26	0,00	6,77		119	1,20	3,266
00:29:33	0,00	6,80		119	1,21	3,239
00:29:40	0,00	6,83		120	1,21	3,212
00:29:47	0,00	6,87		120	1,22	3,185
00:29:54	0,00	6,90		120	1,23	3,162

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:30:01	0,00	6,93		121	1,23	3,133
00:30:09	0,00	6,96		121	1,24	3,111
00:30:16	0,00	6,99		122	1,24	3,084
00:30:23	0,00	7,02		122	1,25	3,060
00:30:30	0,00	7,05		123	1,25	3,036
00:30:37	0,00	7,08		123	1,26	3,012
00:30:44	0,00	7,11		123	1,26	2,989
00:30:51	0,00	7,14		124	1,27	2,966
00:30:58	0,00	7,17		124	1,27	2,942
00:31:05	0,00	7,20		125	1,28	2,920
00:31:12	0,00	7,23		125	1,29	2,897
00:31:19	0,00	7,26		126	1,29	2,874
00:31:26	0,00	7,29		126	1,30	2,852
00:31:33	0,00	7,32		126	1,30	2,830
00:31:41	0,00	7,35		127	1,31	2,807
00:31:47	0,00	7,38		127	1,31	2,786
00:31:54	0,00	7,41		128	1,32	2,764
00:32:01	0,00	7,44		128	1,32	2,742
00:32:08	0,00	7,47		129	1,33	2,720
00:32:15	0,00	7,50		129	1,33	2,699
00:32:22	0,00	7,53		129	1,34	2,677
00:32:29	0,00	7,56		130	1,35	2,660
00:32:36	0,00	7,59		130	1,35	2,635
00:32:43	0,00	7,62		131	1,36	2,617
00:32:50	0,00	7,65		131	1,36	2,593
00:32:57	0,00	7,68		131	1,37	2,576
00:33:04	0,00	7,71		132	1,37	2,551
00:33:11	0,00	7,74		132	1,38	2,531
00:33:18	0,00	7,77		133	1,38	2,510
00:33:25	0,00	7,79		133	1,39	2,490
00:33:31	0,00	7,82		134	1,40	2,473
00:33:38	0,00	7,85		134	1,40	2,449
00:33:45	0,00	7,88		134	1,41	2,429
00:33:52	0,00	7,91		135	1,41	2,409
00:33:59	0,00	7,94		135	1,42	2,389
00:34:06	0,00	7,97		136	1,42	2,373
00:34:12	0,00	8,00		136	1,43	2,350
00:34:19	0,00	8,03		136	1,44	2,330
00:34:26	0,00	8,05		137	1,44	2,314
00:34:33	0,00	8,08		137	1,45	2,291
00:34:40	0,00	8,11		138	1,45	2,272
00:34:46	0,00	8,14		138	1,46	2,256
00:34:53	0,00	8,17		138	1,46	2,234
00:35:00	0,00	8,20		139	1,47	2,214
00:35:07	0,00	8,22		139	1,47	2,199
00:35:17	0,00	8,27		140	1,48	2,171
00:35:23	0,00	8,29		140	1,49	2,148
00:35:33	0,00	8,34		141	1,50	2,120
00:35:40	0,00	8,36		141	1,50	2,102
00:35:47	0,00	8,39		142	1,51	2,087
00:35:57	0,00	8,43		142	1,52	2,060
00:36:04	0,00	8,46		142	1,52	2,037
00:36:13	0,00	8,50		143	1,53	2,010
00:36:20	0,00	8,53		143	1,54	1,992
00:36:30	0,00	8,57		144	1,55	1,965
00:36:40	0,00	8,61		145	1,55	1,938

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:36:50	0,00	8,65		145	1,56	1,912
00:37:00	0,00	8,70		146	1,57	1,885
00:37:10	0,00	8,74		146	1,58	1,863
00:37:20	0,00	8,78		147	1,59	1,837
00:37:29	0,00	8,82		147	1,60	1,811
00:37:39	0,00	8,86		148	1,61	1,781
00:37:49	0,00	8,90		149	1,61	1,756
00:37:59	0,00	8,94		149	1,62	1,730
00:38:09	0,00	8,98		150	1,63	1,705
00:38:18	0,00	9,02		150	1,64	1,684
00:38:28	0,00	9,06		151	1,65	1,659
00:38:38	0,00	9,10		151	1,66	1,630
00:38:48	0,00	9,14		152	1,67	1,605
00:38:57	0,00	9,18		153	1,68	1,581
00:39:07	0,00	9,22		153	1,68	1,560
00:39:17	0,00	9,26		154	1,69	1,536
00:39:26	0,00	9,30		154	1,70	1,508
00:39:36	0,00	9,34		155	1,71	1,484
00:39:46	0,00	9,38		155	1,72	1,464
00:39:55	0,00	9,41		156	1,73	1,437
00:40:00	0,00	9,43		156	1,73	1,425
00:40:00	Fire brigade is alarmed					
00:40:09	0,00	9,47		157	1,74	1,407
00:40:19	0,00	9,51		157	1,75	1,384
00:40:28	0,00	9,55		158	1,76	1,356
00:40:38	0,00	9,59		158	1,77	1,333
00:40:47	0,00	9,63		159	1,78	1,314
00:40:57	0,00	9,66		159	1,79	1,288
00:41:06	0,00	9,70		160	1,79	1,265
00:41:16	0,00	9,74		160	1,80	1,247
00:41:25	0,00	9,78		161	1,81	1,220
00:41:35	0,00	9,82		161	1,82	1,202
00:41:44	0,00	9,86		162	1,83	1,176
00:41:53	0,00	9,89		163	1,84	1,154
00:42:03	0,00	9,93		163	1,85	1,136
00:42:12	0,00	9,97		164	1,86	1,110
00:42:22	0,00	10,01		164	1,87	1,093
00:42:31	0,00	10,04		165	1,87	1,067
00:42:40	0,00	10,08		165	1,88	1,050
00:42:50	0,00	10,12		166	1,89	1,024
00:42:59	0,00	10,16		166	1,90	1,007
00:43:08	0,00	10,19		167	1,91	0,982
00:43:17	0,00	10,23		167	1,92	0,966
00:43:27	0,00	10,27		168	1,93	0,941
00:43:36	0,00	10,30		168	1,94	0,924
00:43:45	0,00	10,34		169	1,95	0,900
00:43:54	0,00	10,38		169	1,96	0,883
00:44:04	0,00	10,41		170	1,96	0,859
00:44:13	0,00	10,45		170	1,97	0,843
00:44:22	0,00	10,49		171	1,98	0,819
00:44:31	0,00	10,52		171	1,99	0,803
00:44:40	0,00	10,56		172	2,00	0,779
00:44:49	0,00	10,60		172	2,01	0,763
00:44:59	0,00	10,63		173	2,02	0,740
00:45:08	0,00	10,67		173	2,03	0,724
00:45:17	0,00	10,70		174	2,04	0,701

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:45:26	0,00	10,74		174	2,05	0,681
00:45:35	0,00	10,77		175	2,06	0,667
00:45:44	0,00	10,81		175	2,06	0,643
00:45:53	0,00	10,85		176	2,07	0,629
00:46:02	0,00	10,88		176	2,08	0,605
00:46:11	0,00	10,92		177	2,09	0,587
00:46:20	0,00	10,95		177	2,10	0,572
00:46:29	0,00	10,99		178	2,11	0,549
00:46:38	0,00	11,02		178	2,12	0,531
00:46:47	0,00	11,06		179	2,13	0,517
00:46:56	0,00	11,09		179	2,14	0,494
00:47:05	0,00	11,13		180	2,15	0,476
00:47:14	0,00	11,16		180	2,16	0,463
00:47:23	0,00	11,20		181	2,17	0,445
00:47:32	0,00	11,23		181	2,17	0,423
00:47:41	0,00	11,27		182	2,18	0,409
00:47:50	0,00	11,30		182	2,19	0,392
00:47:58	0,00	11,34		183	2,20	0,370
00:48:07	0,00	11,37		183	2,21	0,352
00:48:13	0,00	11,39		183	2,22	0,341
00:48:13	Critical condition in room 'Part II': Heat radiation from smoke layer greater than 2,5 kW/m²					
00:48:22	0,00	11,43		184	2,23	0,324
00:48:31	0,00	11,46		184	2,24	0,311
00:48:40	0,00	11,50		185	2,25	0,294
00:48:48	0,00	11,53		185	2,26	0,277
00:48:57	0,00	11,56		186	2,26	0,256
00:49:06	0,00	11,60		186	2,27	0,239
00:49:15	0,00	11,63		187	2,28	0,227
00:49:24	0,00	11,67		187	2,29	0,210
00:49:32	0,00	11,70		188	2,30	0,194
00:49:41	0,00	11,73		188	2,31	0,173
00:49:50	0,00	11,77		189	2,32	0,157
00:49:58	0,00	11,80		189	2,33	0,141
00:50:07	0,00	11,83		190	2,34	0,129
00:50:16	0,00	11,87		190	2,35	0,114
00:50:25	0,00	11,90		190	2,36	0,098
00:50:33	0,00	11,93		191	2,37	0,082
00:50:42	0,00	11,97		191	2,38	0,066
00:50:51	0,00	12,00		192	2,39	0,051
00:50:59	0,00	12,03		192	2,40	0,031
00:51:08	0,00	12,07		193	2,40	0,016
00:51:16	0,00	12,10		193	2,41	0,001
00:51:25	0,00	12,13		194	2,42	-0,013
00:51:34	0,00	12,17		194	2,43	-0,028
00:51:42	0,00	12,20		195	2,44	-0,042
00:51:51	0,00	12,23		195	2,45	-0,056
00:51:59	0,00	12,26		195	2,46	-0,070
00:52:08	0,00	12,30		196	2,47	-0,084
00:52:16	0,00	12,33		196	2,48	-0,098
00:52:25	0,00	12,36		197	2,49	-0,112
00:52:33	0,00	12,39		197	2,50	-0,126
00:52:36	0,00	12,40		197	2,50	-0,125
00:52:36	Critical condition in room 'Part I': Heat radiation from smoke layer greater than 2,5 kW/m²					
00:52:45	0,00	12,44		198	2,51	-0,139

Part I

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:52:53	0,00	12,47		198	2,52	-0,157
00:53:02	0,00	12,50		199	2,53	-0,171
00:53:10	0,00	12,53		199	2,54	-0,184
00:53:19	0,00	12,56		200	2,55	-0,193
00:53:27	0,00	12,60		200	2,56	-0,206
00:53:36	0,00	12,63		200	2,57	-0,219
00:53:44	0,00	12,66		201	2,58	-0,232
00:53:53	0,00	12,69		201	2,59	-0,245
00:54:01	0,00	12,72		202	2,60	-0,258
00:54:09	0,00	12,76		202	2,61	-0,276
00:54:18	0,00	12,79		203	2,62	-0,288
00:54:26	0,00	12,82		203	2,62	-0,296
00:54:34	0,00	12,85		204	2,63	-0,309
00:54:43	0,00	12,88		204	2,64	-0,322
00:54:51	0,00	12,91		204	2,65	-0,334
00:55:00	0,00	12,94		205	2,66	-0,351
00:55:00	Fire brigade arrived, preparing extinguishing					
00:55:08	0,00	12,98		205	2,67	-0,364
00:55:16	0,00	13,01		206	2,68	-0,372
00:55:25	0,00	13,04		206	2,69	-0,384
00:55:33	0,00	13,07		206	2,70	-0,396
00:55:41	0,00	13,10		207	2,71	-0,413
00:55:49	0,00	13,13		207	2,72	-0,421
00:55:58	0,00	13,16		208	2,73	-0,433
00:56:00	0,00	13,17		208	2,73	-0,437
00:56:00	Fire brigade ready, extinguishing started					
00:56:08	0,00	13,20		208	2,74	-0,448
00:56:16	0,00	13,23		209	2,75	-0,460
00:56:24	0,00	13,26		209	2,76	-0,476
00:56:32	0,00	13,29		210	2,77	-0,575
00:56:32	Fire is declining					
00:56:42	0,00	13,33		210	2,78	-0,886
00:56:51	0,00	13,36		210	2,79	-1,177
00:57:01	0,00	13,39		211	2,80	-1,448
00:57:10	0,00	13,43		211	2,81	-1,702
00:57:20	0,00	13,46		212	2,82	-1,942
00:57:30	0,00	13,49		212	2,82	-2,169
00:57:39	0,00	13,52		212	2,83	-2,385
00:57:49	0,00	13,55		212	2,84	-2,596
00:57:58	0,00	13,58		213	2,84	-2,790
00:58:08	0,00	13,61		213	2,84	-2,981
00:58:17	0,00	13,64		213	2,85	-3,166
00:58:27	0,00	13,66		213	2,85	-3,346
00:58:36	0,00	13,69		213	2,85	-3,521
00:58:46	0,00	13,71		213	2,85	-3,692
00:58:56	0,00	13,73		213	2,85	-3,860
00:59:05	0,00	13,76		213	2,85	-4,025
00:59:15	0,00	13,78		213	2,85	-4,187
00:59:24	0,00	13,79		213	2,85	-4,346
00:59:34	0,00	13,81		213	2,85	-4,504
00:59:43	0,00	13,83		213	2,85	-4,661
00:59:53	0,00	13,85		213	2,84	-4,816
01:00:00	0,00	13,86		213	2,84	-4,922
01:00:00	MAX. CALCULATION TIME - CALCULATION ABORTED!					

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:00:00	0,00		24,00	20		-0,005
00:00:09	0,00		24,00	20		0,000
00:00:18	0,00		24,00	20		0,000
00:00:28	0,00		24,00	20		0,000
00:00:38	0,00		24,00	20		0,000
00:00:47	0,00		24,00	20		0,000
00:00:57	0,00		24,00	20		0,000
00:01:06	0,01		24,00	20		0,000
00:01:15	0,01		24,00	20		0,000
00:01:25	0,01	0,14	23,53	22		0,022
00:01:34	0,01	0,15	22,63	22	0,12	0,029
00:01:44	0,01	0,17	21,86	23	0,13	0,034
00:01:53	0,01	0,19	21,21	23	0,13	0,037
00:02:03	0,01	0,21	20,67	23	0,14	0,039
00:02:13	0,01	0,23	20,23	24	0,14	0,039
00:02:23	0,01	0,26	19,91	24	0,14	0,039
00:02:32	0,01	0,28	19,68	25	0,15	0,220
00:02:42	0,01	0,31	19,50	25	0,15	0,281
00:02:52	0,01	0,34	19,39	26	0,15	0,353
00:03:02	0,01	0,37	19,31	26	0,15	0,436
00:03:11	0,01	0,40	19,27	27	0,16	0,533
00:03:21	0,01	0,43	19,24	28	0,16	0,646
00:03:31	0,01	0,47	19,23	28	0,16	0,775
00:03:40	0,01	0,50	19,22	29	0,16	0,921
00:03:50	0,01	0,54	19,21	29	0,16	1,089
00:04:00	0,01	0,57	19,19	30	0,16	1,278
00:04:09	0,01	0,60	19,14	31	0,17	1,488
00:04:18	0,01	0,64	19,05	31	0,17	1,718
00:04:28	0,01	0,67	18,90	32	0,17	1,990
00:04:38	0,01	0,71	18,63	33	0,18	2,302
00:04:47	0,01	0,74	18,27	33	0,18	2,626
00:04:57	0,01	0,76	17,84	34	0,19	2,994
00:05:06	0,01	0,79	17,38	34	0,19	3,399
00:05:16	0,01	0,81	16,90	35	0,20	3,837
00:05:25	0,01	0,83	16,40	35	0,21	4,308
00:05:35	0,01	0,86	15,86	36	0,22	4,856
00:05:45	0,01	0,88	15,32	36	0,23	5,442
00:05:54	0,01	0,91	14,78	37	0,24	6,068
00:06:04	0,01	0,93	14,24	37	0,25	6,733
00:06:13	0,01	0,96	13,70	38	0,26	7,438
00:06:23	0,01	0,99	13,12	38	0,27	8,242
00:06:33	0,01	1,02	12,55	39	0,28	9,093
00:06:43	0,01	1,05	11,99	39	0,30	9,992
00:06:52	0,01	1,08	11,43	40	0,31	10,939
00:07:02	0,01	1,11	10,89	40	0,32	11,933
00:07:11	0,01	1,15	10,35	41	0,33	12,975
00:07:21	0,01	1,18	9,78	42	0,35	14,145
00:07:31	0,01	1,22	9,22	42	0,36	15,371
00:07:40	0,01	1,26	8,71	43	0,38	16,565
00:07:40	Critical condition in room 'Part I': Smoke free height less than 5,20 m					
00:07:50	0,01	1,30	8,17	44	0,39	17,896
00:07:59	0,01	1,34	7,63	44	0,41	19,282
00:08:08	0,01	1,38	7,12	45	0,43	19,644
00:08:17	0,01	1,41	6,66	46	0,44	19,222
00:08:25	0,01	1,44	6,20	46	0,45	18,824
00:08:34	0,01	1,47	5,74	47	0,46	18,439

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:08:43	0,01	1,50	5,29	47	0,48	18,066
00:08:53	0,01	1,54	4,79	48	0,49	17,557
00:09:02	0,01	1,57	4,32	48	0,50	17,045
00:09:11	0,01	1,61	3,93	49	0,51	16,582
00:09:11	Critical condition in room 'Part II': Smoke free height less than 4,00 m					
00:09:20	0,01	1,64	3,52	49	0,52	16,088
00:09:29	0,01	1,68	3,14	50	0,53	15,591
00:09:39	0,01	1,72	2,77	51	0,54	15,095
00:09:48	0,01	1,76	2,42	51	0,55	14,603
00:09:58	0,01	1,80	2,09	52	0,56	14,118
00:10:07	0,01	1,84	1,81	53	0,57	13,601
00:10:15	0,01	1,88	1,57	53	0,57	13,084
00:10:24	0,01	1,92	1,35	54	0,58	12,560
00:10:34	0,00	1,97	1,14	55	0,58	12,034
00:10:42	0,00	2,00	0,99	55	0,59	11,613
00:10:50	0,00	2,05	0,85	56	0,60	11,193
00:10:59	0,00	2,09	0,73	56	0,60	10,772
00:11:09	0,00	2,14	0,61	57	0,61	10,352
00:11:17	0,00	2,17	0,53	58	0,61	10,035
00:11:25	0,00	2,21	0,46	58	0,62	9,717
00:11:34	0,00	2,26	0,39	59	0,62	9,397
00:11:43	0,00	2,30	0,33	60	0,63	9,074
00:11:50	0,00	2,33	0,29	60	0,63	8,855
00:11:58	0,00	2,37	0,26	61	0,64	8,635
00:12:05	0,00	2,41	0,23	61	0,64	8,412
00:12:14	0,00	2,45	0,19	62	0,64	8,185
00:12:23	0,00	2,49	0,17	63	0,65	7,955
00:12:28	0,00	2,52	0,15	63	0,65	7,824
00:12:34	0,00	2,54	0,14	64	0,66	7,695
00:12:34	Room 'Part I' is now filled with smoke					
00:12:39	0,00	2,57	0,13	64	0,66	7,563
00:12:49	0,00	2,61	0,11	65	0,66	7,358
00:12:54	0,00	2,64	0,10	65	0,67	7,254
00:13:00	0,00	2,67	0,09	66	0,67	7,134
00:13:05	0,00	2,69	0,08	66	0,67	7,030
00:13:10	0,00	2,72	0,07	66	0,68	6,926
00:13:16	0,00	2,74	0,07	67	0,68	6,821
00:13:23	0,00	2,78	0,06	67	0,68	6,700
00:13:29	0,00	2,80	0,05	68	0,69	6,597
00:13:38	0,00	2,85	0,05	68	0,69	6,431
00:13:46	0,00	2,88	0,04	69	0,70	6,312
00:13:55	0,00	2,93	0,03	69	0,70	6,169
00:14:00	0,00	2,95	0,03	70	0,71	6,087
00:14:09	0,00	2,99	0,03	70	0,71	5,958
00:14:17	0,00	3,03	0,02	71	0,72	5,846
00:14:26	0,00	3,08	0,02	72	0,72	5,715
00:14:35	0,00	3,12	0,02	72	0,73	5,595
00:14:43	0,00	3,16	0,01	73	0,73	5,490
00:14:52	0,00	3,20	0,01	74	0,74	5,378
00:15:01	0,00	3,24	0,01	74	0,74	5,266
00:15:10	0,00	3,28	0,01	75	0,75	5,170
00:15:18	0,00	3,32	0,01	75	0,75	5,071
00:15:27	0,00	3,36	0,01	76	0,76	4,968
00:15:36	0,00	3,40		77	0,76	4,877
00:15:44	0,00	3,44		77	0,77	4,789
00:15:53	0,00	3,48		78	0,77	4,694

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:16:01	0,00	3,52		78	0,78	4,607
00:16:10	0,00	3,56		79	0,78	4,525
00:16:10	Room 'Part II' is now filled with smoke					
00:16:18	0,00	3,60		80	0,79	4,440
00:16:27	0,00	3,64		80	0,79	4,359
00:16:35	0,00	3,67		81	0,80	4,286
00:16:44	0,00	3,71		81	0,81	4,207
00:16:52	0,00	3,75		82	0,81	4,132
00:17:00	0,00	3,79		82	0,82	4,061
00:17:09	0,00	3,83		83	0,82	3,988
00:17:17	0,00	3,87		84	0,83	3,917
00:17:26	0,00	3,90		84	0,83	3,850
00:17:34	0,00	3,94		85	0,84	3,781
00:17:43	0,00	3,98		85	0,84	3,713
00:17:51	0,00	4,02		86	0,85	3,650
00:17:59	0,00	4,06		86	0,85	3,585
00:18:07	0,00	4,10		87	0,86	3,521
00:18:16	0,00	4,13		87	0,86	3,460
00:18:24	0,00	4,17		88	0,87	3,398
00:18:32	0,00	4,21		89	0,87	3,337
00:18:40	0,00	4,24		89	0,88	3,279
00:18:49	0,00	4,28		90	0,88	3,220
00:18:57	0,00	4,32		90	0,89	3,162
00:19:05	0,00	4,36		91	0,90	3,106
00:19:13	0,00	4,39		91	0,90	3,050
00:19:21	0,00	4,43		92	0,91	2,995
00:19:29	0,00	4,47		92	0,91	2,941
00:19:37	0,00	4,50		93	0,92	2,888
00:19:46	0,00	4,54		94	0,92	2,834
00:19:54	0,00	4,57		94	0,93	2,782
00:20:02	0,00	4,61		95	0,93	2,731
00:20:10	0,00	4,65		95	0,94	2,680
00:20:18	0,00	4,68		96	0,94	2,630
00:20:26	0,00	4,72		96	0,95	2,581
00:20:34	0,00	4,76		97	0,95	2,531
00:20:42	0,00	4,79		97	0,96	2,483
00:20:50	0,00	4,83		98	0,97	2,436
00:20:58	0,00	4,86		98	0,97	2,388
00:21:06	0,00	4,90		99	0,98	2,342
00:21:14	0,00	4,93		99	0,98	2,296
00:21:22	0,00	4,97		100	0,99	2,250
00:21:30	0,00	5,00		100	0,99	2,205
00:21:38	0,00	5,04		101	1,00	2,161
00:21:46	0,00	5,07		101	1,00	2,117
00:21:54	0,00	5,11		102	1,01	2,074
00:22:01	0,00	5,14		102	1,02	2,031
00:22:09	0,00	5,18		103	1,02	1,988
00:22:17	0,00	5,21		103	1,03	1,946
00:22:25	0,00	5,25		104	1,03	1,904
00:22:33	0,00	5,28		104	1,04	1,863
00:22:41	0,00	5,31		105	1,04	1,822
00:22:48	0,00	5,35		106	1,05	1,782
00:22:56	0,00	5,38		106	1,05	1,742
00:23:04	0,00	5,42		107	1,06	1,703
00:23:12	0,00	5,45		107	1,07	1,664
00:23:19	0,00	5,48		108	1,07	1,625

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:23:27	0,00	5,52		108	1,08	1,586
00:23:35	0,00	5,55		109	1,08	1,549
00:23:43	0,00	5,59		109	1,09	1,511
00:23:50	0,00	5,62		110	1,09	1,473
00:23:58	0,00	5,65		110	1,10	1,437
00:24:06	0,00	5,69		111	1,11	1,400
00:24:13	0,00	5,72		111	1,11	1,364
00:24:21	0,00	5,75		112	1,12	1,328
00:24:29	0,00	5,79		112	1,12	1,292
00:24:36	0,00	5,82		112	1,13	1,257
00:24:44	0,00	5,85		113	1,13	1,223
00:24:52	0,00	5,88		113	1,14	1,188
00:24:59	0,00	5,92		114	1,15	1,154
00:25:07	0,00	5,95		114	1,15	1,120
00:25:14	0,00	5,98		115	1,16	1,087
00:25:22	0,00	6,02		115	1,16	1,053
00:25:30	0,00	6,05		116	1,17	1,021
00:25:37	0,00	6,08		116	1,17	0,988
00:25:45	0,00	6,11		117	1,18	0,955
00:25:52	0,00	6,15		117	1,19	0,924
00:26:00	0,00	6,18		118	1,19	0,892
00:26:07	0,00	6,21		118	1,20	0,860
00:26:15	0,00	6,24		119	1,20	0,829
00:26:22	0,00	6,27		119	1,21	0,799
00:26:30	0,00	6,31		120	1,22	0,768
00:26:37	0,00	6,34		120	1,22	0,738
00:26:44	0,00	6,37		121	1,23	0,708
00:26:52	0,00	6,40		121	1,23	0,678
00:26:59	0,00	6,43		122	1,24	0,649
00:27:07	0,00	6,46		122	1,25	0,619
00:27:14	0,00	6,50		123	1,25	0,590
00:27:22	0,00	6,53		123	1,26	0,562
00:27:29	0,00	6,56		123	1,26	0,533
00:27:36	0,00	6,59		124	1,27	0,505
00:27:44	0,00	6,62		124	1,28	0,477
00:27:51	0,00	6,65		125	1,28	0,450
00:27:58	0,00	6,68		125	1,29	0,422
00:28:06	0,00	6,71		126	1,29	0,395
00:28:13	0,00	6,75		126	1,30	0,368
00:28:20	0,00	6,78		127	1,31	0,342
00:28:28	0,00	6,81		127	1,31	0,315
00:28:35	0,00	6,84		128	1,32	0,290
00:28:42	0,00	6,87		128	1,32	0,264
00:28:49	0,00	6,90		129	1,33	0,238
00:28:57	0,00	6,93		129	1,34	0,213
00:29:04	0,00	6,96		129	1,34	0,188
00:29:11	0,00	6,99		130	1,35	0,163
00:29:18	0,00	7,02		130	1,35	0,140
00:29:26	0,00	7,05		131	1,36	0,115
00:29:33	0,00	7,08		131	1,37	0,091
00:29:40	0,00	7,11		132	1,37	0,068
00:29:47	0,00	7,14		132	1,38	0,044
00:29:54	0,00	7,17		133	1,38	0,022
00:30:01	0,00	7,20		133	1,39	0,000
00:30:09	0,00	7,23		134	1,40	-0,022
00:30:16	0,00	7,26		134	1,40	-0,043

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:30:23	0,00	7,29		134	1,41	-0,063
00:30:30	0,00	7,32		135	1,41	-0,083
00:30:37	0,00	7,35		135	1,42	-0,103
00:30:44	0,00	7,38		136	1,43	-0,123
00:30:51	0,00	7,41		136	1,43	-0,143
00:30:58	0,00	7,44		137	1,44	-0,162
00:31:05	0,00	7,47		137	1,44	-0,181
00:31:12	0,00	7,50		138	1,45	-0,201
00:31:19	0,00	7,53		138	1,46	-0,220
00:31:26	0,00	7,56		138	1,46	-0,238
00:31:33	0,00	7,59		139	1,47	-0,257
00:31:41	0,00	7,61		139	1,48	-0,276
00:31:47	0,00	7,64		140	1,48	-0,294
00:31:54	0,00	7,67		140	1,49	-0,313
00:32:01	0,00	7,70		141	1,49	-0,331
00:32:08	0,00	7,73		141	1,50	-0,349
00:32:15	0,00	7,76		141	1,51	-0,368
00:32:22	0,00	7,79		142	1,51	-0,386
00:32:29	0,00	7,82		142	1,52	-0,403
00:32:36	0,00	7,84		143	1,53	-0,421
00:32:43	0,00	7,87		143	1,53	-0,439
00:32:50	0,00	7,90		144	1,54	-0,456
00:32:57	0,00	7,93		144	1,54	-0,474
00:33:04	0,00	7,96		144	1,55	-0,491
00:33:11	0,00	7,99		145	1,56	-0,508
00:33:18	0,00	8,02		145	1,56	-0,526
00:33:25	0,00	8,04		146	1,57	-0,543
00:33:31	0,00	8,07		146	1,58	-0,559
00:33:38	0,00	8,10		146	1,58	-0,577
00:33:45	0,00	8,13		147	1,59	-0,594
00:33:52	0,00	8,16		147	1,59	-0,610
00:33:59	0,00	8,18		148	1,60	-0,627
00:34:06	0,00	8,21		148	1,61	-0,643
00:34:12	0,00	8,24		149	1,61	-0,660
00:34:19	0,00	8,27		149	1,62	-0,676
00:34:26	0,00	8,29		149	1,63	-0,692
00:34:33	0,00	8,32		150	1,63	-0,709
00:34:40	0,00	8,35		150	1,64	-0,725
00:34:46	0,00	8,38		151	1,65	-0,741
00:34:53	0,00	8,40		151	1,65	-0,757
00:35:00	0,00	8,43		151	1,66	-0,773
00:35:07	0,00	8,46		152	1,66	-0,789
00:35:17	0,00	8,50		152	1,67	-0,812
00:35:23	0,00	8,53		153	1,68	-0,828
00:35:33	0,00	8,57		153	1,69	-0,851
00:35:40	0,00	8,60		154	1,70	-0,867
00:35:47	0,00	8,62		154	1,70	-0,882
00:35:57	0,00	8,66		155	1,71	-0,905
00:36:04	0,00	8,69		155	1,72	-0,920
00:36:13	0,00	8,73		156	1,73	-0,943
00:36:20	0,00	8,76		156	1,74	-0,958
00:36:30	0,00	8,80		157	1,74	-0,980
00:36:40	0,00	8,84		157	1,75	-1,003
00:36:50	0,00	8,88		158	1,76	-1,025
00:37:00	0,00	8,92		159	1,77	-1,047
00:37:10	0,00	8,96		159	1,78	-1,068

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:37:20	0,00	9,00		160	1,79	-1,090
00:37:29	0,00	9,03		160	1,80	-1,112
00:37:39	0,00	9,07		161	1,81	-1,133
00:37:49	0,00	9,11		162	1,82	-1,155
00:37:59	0,00	9,15		162	1,83	-1,176
00:38:09	0,00	9,19		163	1,84	-1,197
00:38:18	0,00	9,23		163	1,85	-1,217
00:38:28	0,00	9,27		164	1,86	-1,238
00:38:38	0,00	9,31		164	1,87	-1,259
00:38:48	0,00	9,35		165	1,88	-1,279
00:38:57	0,00	9,38		166	1,89	-1,300
00:39:07	0,00	9,42		166	1,90	-1,320
00:39:17	0,00	9,46		167	1,91	-1,340
00:39:26	0,00	9,50		167	1,92	-1,360
00:39:36	0,00	9,54		168	1,93	-1,380
00:39:46	0,00	9,58		168	1,94	-1,399
00:39:55	0,00	9,61		169	1,95	-1,419
00:40:00	0,00	9,63		169	1,95	-1,432
00:40:00	Fire brigade is alarmed					
00:40:09	0,00	9,67		170	1,96	-1,447
00:40:19	0,00	9,71		170	1,97	-1,466
00:40:28	0,00	9,74		171	1,98	-1,486
00:40:38	0,00	9,78		171	1,99	-1,505
00:40:47	0,00	9,82		172	2,00	-1,523
00:40:57	0,00	9,85		173	2,01	-1,542
00:41:06	0,00	9,89		173	2,02	-1,561
00:41:16	0,00	9,93		174	2,03	-1,579
00:41:25	0,00	9,97		174	2,04	-1,598
00:41:35	0,00	10,00		175	2,05	-1,616
00:41:44	0,00	10,04		175	2,06	-1,635
00:41:53	0,00	10,08		176	2,07	-1,653
00:42:03	0,00	10,11		176	2,08	-1,671
00:42:12	0,00	10,15		177	2,09	-1,689
00:42:22	0,00	10,19		178	2,10	-1,707
00:42:31	0,00	10,22		178	2,11	-1,724
00:42:40	0,00	10,26		179	2,12	-1,742
00:42:50	0,00	10,29		179	2,14	-1,760
00:42:59	0,00	10,33		180	2,15	-1,777
00:43:08	0,00	10,37		180	2,16	-1,794
00:43:17	0,00	10,40		181	2,17	-1,811
00:43:27	0,00	10,44		181	2,18	-1,829
00:43:36	0,00	10,47		182	2,19	-1,846
00:43:45	0,00	10,51		182	2,20	-1,863
00:43:54	0,00	10,54		183	2,21	-1,879
00:44:04	0,00	10,58		183	2,22	-1,896
00:44:13	0,00	10,62		184	2,23	-1,913
00:44:22	0,00	10,65		184	2,24	-1,929
00:44:31	0,00	10,69		185	2,25	-1,946
00:44:40	0,00	10,72		185	2,26	-1,962
00:44:49	0,00	10,76		186	2,27	-1,978
00:44:59	0,00	10,79		186	2,28	-1,994
00:45:08	0,00	10,83		187	2,29	-2,010
00:45:17	0,00	10,86		187	2,30	-2,026
00:45:26	0,00	10,90		188	2,31	-2,042
00:45:35	0,00	10,93		189	2,32	-2,058
00:45:44	0,00	10,96		189	2,33	-2,074

Part II

Time	Smoke room [dB/m]	Smoke layer [dB/m]	Floor layer [m]	Layer temp. [ºC]	Heat radiation [kW/m²]	Floor pressure [N/m²]
00:45:53	0,00	11,00		190	2,34	-2,089
00:46:02	0,00	11,03		190	2,35	-2,105
00:46:11	0,00	11,07		191	2,36	-2,120
00:46:20	0,00	11,10		191	2,37	-2,135
00:46:29	0,00	11,14		192	2,38	-2,150
00:46:38	0,00	11,17		192	2,39	-2,166
00:46:47	0,00	11,20		193	2,40	-2,180
00:46:56	0,00	11,24		193	2,41	-2,196
00:47:05	0,00	11,27		194	2,42	-2,210
00:47:14	0,00	11,31		194	2,43	-2,225
00:47:23	0,00	11,34		195	2,44	-2,240
00:47:32	0,00	11,37		195	2,45	-2,254
00:47:41	0,00	11,41		196	2,46	-2,269
00:47:50	0,00	11,44		196	2,47	-2,283
00:47:58	0,00	11,47		197	2,48	-2,298
00:48:07	0,00	11,51		197	2,49	-2,312
00:48:13	0,00	11,53		197	2,50	-2,321
00:48:13	Critical condition in room 'Part II': Heat radiation from smoke layer greater than 2,5 kW/m²					
00:48:22	0,00	11,56		198	2,51	-2,335
00:48:31	0,00	11,60		198	2,52	-2,349
00:48:40	0,00	11,63		199	2,53	-2,363
00:48:48	0,00	11,66		199	2,54	-2,377
00:48:57	0,00	11,69		200	2,55	-2,391
00:49:06	0,00	11,73		200	2,56	-2,404
00:49:15	0,00	11,76		201	2,57	-2,418
00:49:24	0,00	11,79		201	2,58	-2,431
00:49:32	0,00	11,83		202	2,59	-2,445
00:49:41	0,00	11,86		202	2,60	-2,458
00:49:50	0,00	11,89		203	2,62	-2,471
00:49:58	0,00	11,92		203	2,63	-2,484
00:50:07	0,00	11,96		204	2,64	-2,497
00:50:16	0,00	11,99		204	2,65	-2,510
00:50:25	0,00	12,02		205	2,66	-2,523
00:50:33	0,00	12,05		205	2,67	-2,536
00:50:42	0,00	12,08		205	2,68	-2,548
00:50:51	0,00	12,12		206	2,69	-2,561
00:50:59	0,00	12,15		206	2,70	-2,573
00:51:08	0,00	12,18		207	2,71	-2,585
00:51:16	0,00	12,21		207	2,72	-2,598
00:51:25	0,00	12,24		208	2,73	-2,609
00:51:34	0,00	12,28		208	2,74	-2,621
00:51:42	0,00	12,31		209	2,75	-2,632
00:51:51	0,00	12,34		209	2,76	-2,644
00:51:59	0,00	12,37		210	2,77	-2,655
00:52:08	0,00	12,40		210	2,78	-2,666
00:52:16	0,00	12,43		211	2,79	-2,677
00:52:25	0,00	12,47		211	2,80	-2,688
00:52:33	0,00	12,50		211	2,82	-2,699
00:52:36	0,00	12,51		212	2,82	-2,703
00:52:36	Critical condition in room 'Part I': Heat radiation from smoke layer greater than 2,5 kW/m²					
00:52:45	0,00	12,54		212	2,83	-2,714
00:52:53	0,00	12,57		213	2,84	-2,724
00:53:02	0,00	12,60		213	2,85	-2,735
00:53:10	0,00	12,63		213	2,86	-2,746

Part II

Time	*Smoke room [dB/m]*	*Smoke layer [dB/m]*	*Floor layer [m]*	*Layer temp. [ºC]*	*Heat radiation [kW/m²]*	*Floor pressure [N/m²]*
00:53:19	0,00	12,66		214	2,87	-2,756
00:53:27	0,00	12,69		214	2,88	-2,767
00:53:36	0,00	12,72		215	2,89	-2,777
00:53:44	0,00	12,76		215	2,90	-2,788
00:53:53	0,00	12,79		216	2,91	-2,798
00:54:01	0,00	12,82		216	2,92	-2,809
00:54:09	0,00	12,85		217	2,94	-2,819
00:54:18	0,00	12,88		217	2,95	-2,829
00:54:26	0,00	12,91		217	2,96	-2,839
00:54:34	0,00	12,94		218	2,97	-2,849
00:54:43	0,00	12,97		218	2,98	-2,859
00:54:51	0,00	13,00		219	2,99	-2,869
00:55:00	0,00	13,03		219	3,00	-2,879
00:55:00	Fire brigade arrived, preparing extinguishing					
00:55:08	0,00	13,06		220	3,01	-2,889
00:55:16	0,00	13,09		220	3,02	-2,899
00:55:25	0,00	13,12		221	3,03	-2,909
00:55:33	0,00	13,15		221	3,04	-2,919
00:55:41	0,00	13,18		221	3,05	-2,929
00:55:49	0,00	13,21		222	3,06	-2,938
00:55:58	0,00	13,24		222	3,07	-2,948
00:56:00	0,00	13,25		222	3,08	-2,951
00:56:00	Fire brigade ready, extinguishing started					
00:56:08	0,00	13,28		223	3,09	-2,960
00:56:16	0,00	13,31		223	3,10	-2,969
00:56:24	0,00	13,34		224	3,11	-2,979
00:56:32	0,00	13,36		224	3,12	-3,080
00:56:32	Fire is declining					
00:56:42	0,00	13,40		224	3,13	-3,370
00:56:51	0,00	13,43		225	3,14	-3,627
00:57:01	0,00	13,46		225	3,14	-3,857
00:57:10	0,00	13,49		225	3,14	-4,066
00:57:20	0,00	13,52		225	3,15	-4,259
00:57:30	0,00	13,55		225	3,15	-4,438
00:57:39	0,00	13,57		225	3,15	-4,606
00:57:49	0,00	13,60		225	3,14	-4,763
00:57:58	0,00	13,62		225	3,14	-4,911
00:58:08	0,00	13,65		225	3,14	-5,052
00:58:17	0,00	13,67		225	3,13	-5,187
00:58:27	0,00	13,69		224	3,13	-5,315
00:58:36	0,00	13,71		224	3,12	-5,438
00:58:46	0,00	13,73		224	3,12	-5,557
00:58:56	0,00	13,75		224	3,11	-5,672
00:59:05	0,00	13,77		223	3,10	-5,782
00:59:15	0,00	13,78		223	3,09	-5,890
00:59:24	0,00	13,80		223	3,08	-5,995
00:59:34	0,00	13,81		222	3,07	-6,097
00:59:43	0,00	13,82		222	3,06	-6,196
00:59:53	0,00	13,83		221	3,05	-6,293
01:00:00	0,00	13,84		221	3,04	-6,359
01:00:00	MAX. CALCULATION TIME - CALCULATION ABORTED!					

Hooton Bio Power Project

Appendix 1 – Fire Prevention Plan

XXXXXX.XX.XXXX.XXX.XXXX

Issue Date
27.9.2019

REASON FOR ISSUE

☐ FOR ENQUIRY	☐ FOR REVIEW	☐ FOR APPROVAL
☐ FOR PURCHASE	☒ FOR INFORMATION	☐ FOR CONSTRUCTION

Rev	Date	Revision Description/Status	No. Pages	Prepared by	Checked by	Approved by
0	17.12.2018	Copy of Ince FPP		XXX	XX	XX
1	15.03.2019	BWSC update for Hooton		CNH	MRCH	MRC
	25.9.2019	CoGen update for Hooton		DM		

Table of Contents

1.0 Site Description 3
1.1 Site Activities 3
1.2 Location Plan 3
1.2.1 Physical Location 3
1.2.2 Local Community/Infrastructure 3
1.3 Site Plan 4
2.0 Preventing Fires 6
2.1 Material Storage 6
2.2 Personnel Safety 7
2.3 Access 8
2.4 Can any of the following affect access to and routes around site 9
2.5 Environmental Considerations 10
2.6 Maintenance Considerations 10
3.0 Reducing the impact of a fire 11
4.0 Sensitive Human Receptors 13
5.0 Sensitive Ecological Receptors 15

APPENDICES

- Fire Safety Strategy Report 2031.M0.J01.001.R2
- Site layout drawing 2031.D2.001.001
- Layout drawing – Fire main / Hydrant location 2031.M0.J01.001
- Firefighting Containment Volume Design 2031.CS.751.010 (Fairhurst)
- Drainage specification – 2031.CS.701.000 (Ramboll)
- Drainage specification – 2031.CS.751.000 (Fairhurst)
- 2031.C0.701.001 Enabling Works - Proposed Drainage Layout - Sheet 1
- 2031.C0.701.002 Enabling Works - Proposed Drainage Layout - Sheet 2
- 2031.C0.706.001 Proposed Drainage Outfall - Surface water - Sheet 1
- 2031.C0.730.001 Fire Main Enabling Works - Sheet 1
- 2031.C0.750.000 Site Drainage. Overall Layout
- 2031.C0.750.001 Site Drainage. Surface Water. Sheet 1
- 2031.C0.750.002 Site Drainage. Surface Water. Sheet 2
- 2031.C0.750.003 Site Drainage. Surface Water. Sheet 3
- 2031.C0.750.004 Site Drainage. Surface Water. Sheet 4
- 2031.C0.750.005 Site Drainage. Surface Water. Sheet 5
- 2031.C0.750.006 Site Drainage. Surface Water. Sheet 6
- 2031.C0.750.011 Site Drainage. Foul & Trade Effluent. Sheet 1
- 2031.C0.750.012 Site Drainage. Foul & Trade Effluent. Sheet 2
- 2031.C0.750.013 Site Drainage. Foul & Trade Effluent. Sheet 3
- 2031.C0.750.015 Site Drainage. Foul & Trade Effluent. Sheet 5
- 2031.C0.750.025 Site Drainage. Foul Outfall. Sheet 1
- 2031.C0.750.026 Site Drainage. Foul Outfall. Sheet 2
- 2031.C0.780.000 Site Utilities. Fire Main. Overall Layout
- 2031.C0.780.001 Site Utilities. Fire Main. Sheet 1
- 2031.C0.780.002 Site Utilities. Fire Main. Sheet 2
- 2031.C0.780.003 Site Utilities. Fire Main. Sheet 3
- 2031.C0.780.004 Site Utilities. Fire Main. Sheet 4
- 2031.C0.780.005.Site Utilities. Fire Main. Sheet 5

1.0 Site Description

1.1 SITE ACTIVITIES

The Hooton Bio Power Project is a dual line waste to energy Power Plant, which at full load, generate approximately 24 MW electrical power to the grid. The fuel for the Power Plant will be a mix of e.g. municipal waste and industrial waste. The Power Plant infeed fuel requirement at full load is some 30 tonnes per hour (15 tonnes per hour per line).

The Power Plant is designed to provide an enclosed process, from delivery, processing and storage of the feedstock, steam production in the boiler to the steam turbine generator set and finally electrical distribution.

Fuel is delivered to the plant waste fuel unloading area (feedstock receiving area) and unloaded into the reception bunker by truck. From here it will be transferred by crane into one of two shredders which reduce any received fuel to a homogeneous size. From the shredders the fuel is screened for non-combustible materials followed by conveying it to the Waste Fuel Storage Area (Feedstock storage area). In the waste fuel bunker the fuel is mixed and finally transferred to the receiving hoppers for the boilers for combustion.

The site houses three steel framed metal clad steel structures for the waste reception / storage building, boiler/gasification building and the turbine building, a concrete building for the electrical annex and a separate concrete/brick admin building. There is also a separate concrete/brick built SPEN 33kV sub-station.

1.2 LOCATION PLAN

1.2.1 Physical Location

The Works are located at: Hooton Bio Power Project, North Road, Eastham, Wirral, CH65 1AJ.

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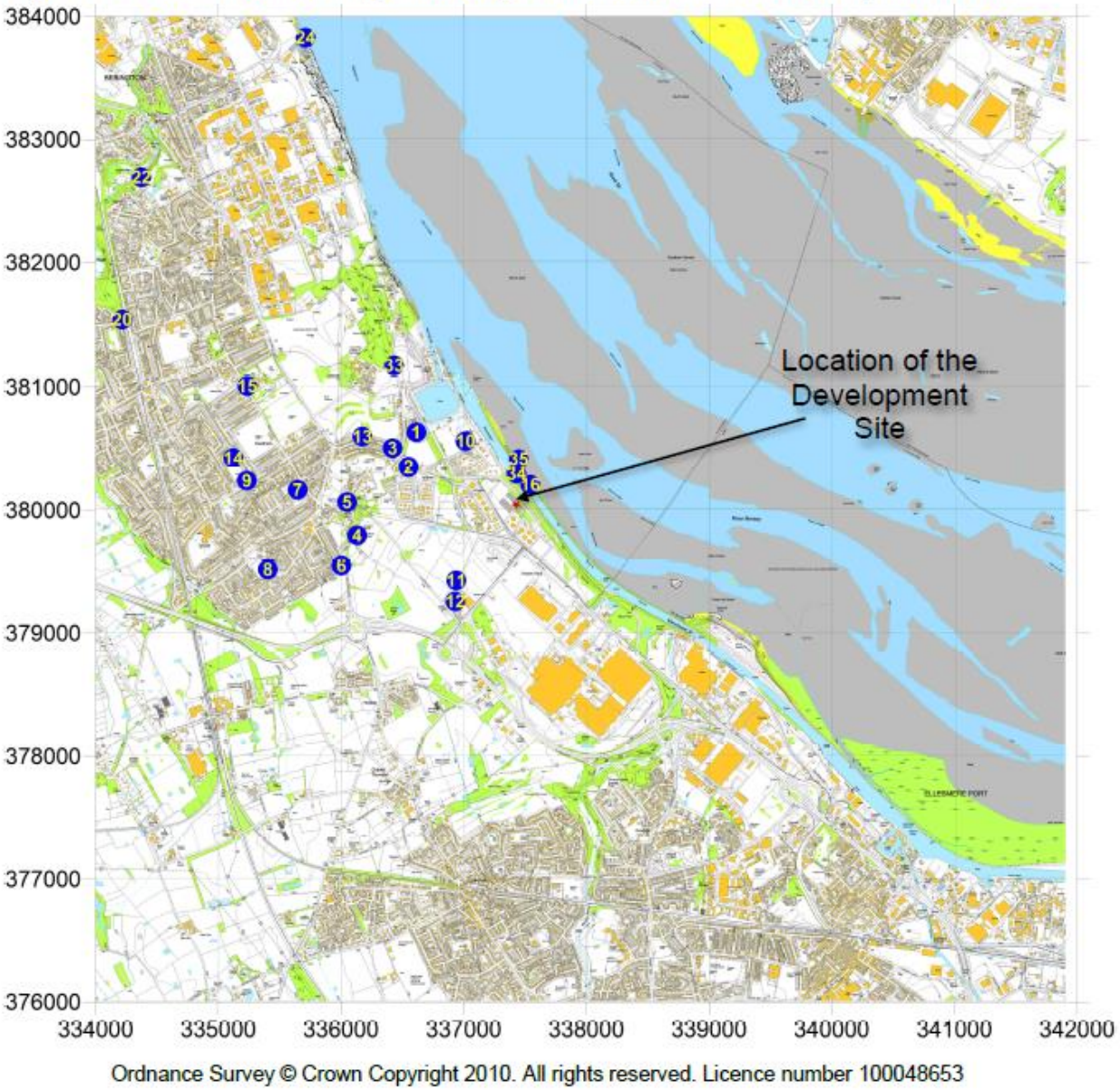
Figure 2-1 The Local Setting Showing the Location of the Development Site



1.2.2 Local Community/Infrastructure

As detailed on the FPP Location Plan,. Other receptors are included in the map appended to this document, reproduced from the Air Quality Assessment produced GFE environmental consultants .

Local Receptors

Name	Receptor Number
Seaview Avenue	1
Bankfields Drive	2
St David Road	3
Eastham Village Road	4
Stanley Lane School	5
Bramhall Drive	6
Lydale Ave School	7
Willington Avenue School	8
Newgarth Road School	9
MSC Eastham Football Club	10
Greenacres	11
Merton Road	12
St David Allotments	13
Wingate Road Allotments	14
Brindle Road Allotments	15
Hooton	16
Park Farm	17
Childer Thornton	18
Overpool	19

Table 2-5 Ecological Receptors Included in Detailed Modelling

Receptor No.	Receptor Name	X Coordinate	Y Coordinate	Distance from the Chimney (metres)
1	Mersey Estuary SPA	337542	380205	197
2	Dee Estuary SAC	324660	382164	12,943
3	Dee Estuary SPA	328959	376235	9,286
4	River Dee and Bala Lake SAC	339646	366613	13,613
5	Mersey Estuary SSSI	334215	381535	3,542
6	Dee Estuary SSSI	333758	380986	3,789
7	Dibbensdale SSSI	334373	382693	4,044
8	Hallwood Farm Marl Pit SSSI	334415	375864	5,153
9	New Ferry SSSI	335711	383828	4,155
10	Inner Marsh Farm SSSI	330970	373672	9,072
11	Heswell Dales SSSI	326398	381871	11,180
12	Mersey Narrows SSSI	332666	390353	11,356
13	The Dungeon SSSI	325244	383051	12,550
14	Dee Cliffs SSSI	324660	382164	12,943
15	Dunsdale Hollow SSSI	351106	376235	14,198
16	Frodsham Railway and Road Cuttings SSSI	351829	377993	14,546
17	Thurstanston Common SSSI	324967	384400	13,200

None of the above workplaces would be impacted by an incidents occurring on the site. Close relationships has already been established with Eastham refinery which is a COMAH site and has an emergency action plan for the surrounding area. The induction procedures will contain the special requirements associated with the neighbouring Eastham refinery COMAH site.

The only infrastructure on the edge of the 1km zone is the Manchester Ship Canal and the M53 motorway . This is should not be impacted by any incident occurring on the site.

To the North of the 1km zone there is the Manchester Ship Canal. It is proposed the treated waste water will discharge to local sewerage with surface water discharged to the Manachester ship canal via SUDS fitter with oil interceptor and penstock valve. It is proposed that this valve is closed immediately of any

fire incident such that the SUDS can retain fire water for reuse and ultimate removal for remote treatment . On failure of the treatment plant, the untreated waste will be stored in a retention tank and disposed of by road tanker.
The closest residential area of Elton is over 1km from the site. This residential area should not be impacted by any incident occurring on the site.

1.3 SITE PLAN

The Site Plan is shown on 2031.D2.001.001 – FPP Site Plan.

The walls between the fuel storage building/boiler building/turbine building are designed for a 2hr fire rating. The electrical annex is sectioned into several fire compartments designed for a 2hr fire rating. The SPEN sub-station has a 2hr fire rated structure.

The Site Plan shows locations of hazardous materials. These include the following external facilities:

- Diesel storage tank in bunded area;
- Diesel emergency generator tank;
- Containerized fire pump diesel tank;
- 33kV transformer oil;
- UREA storage tank;
- Active carbon storage tank;
- Lime storage tank;
- Two ash silos;
- Vacuum cleaning unit;
- CEMS compressed gas cylinders including hydrogen;

Within the boiler building there are the following hazardous materials:
NaOH (concentration < 25%);
NH_4OH (concentration < 25%);
Hydraulic oil (fire retardant FM approved/UL listed);

Within electrical annex WTP room there are the following hazardous materials:
Water Treatment Chemicals including Anti scalant, Active carbon, Ion exchange resin;

The site has been designed for one main site entrance to the South East sufficiently sized to allow emergency vehicles to access at all time.

A combined sprinkler and hydrant fire water storage tank holding 680 m^3 of fire water is installed on the plant for 2 hour operation of the containerized fire pump unit. Both the fire water storage tank and the containerized fire pump unit is designed according to NFPA. The tank is shown on the site plan.

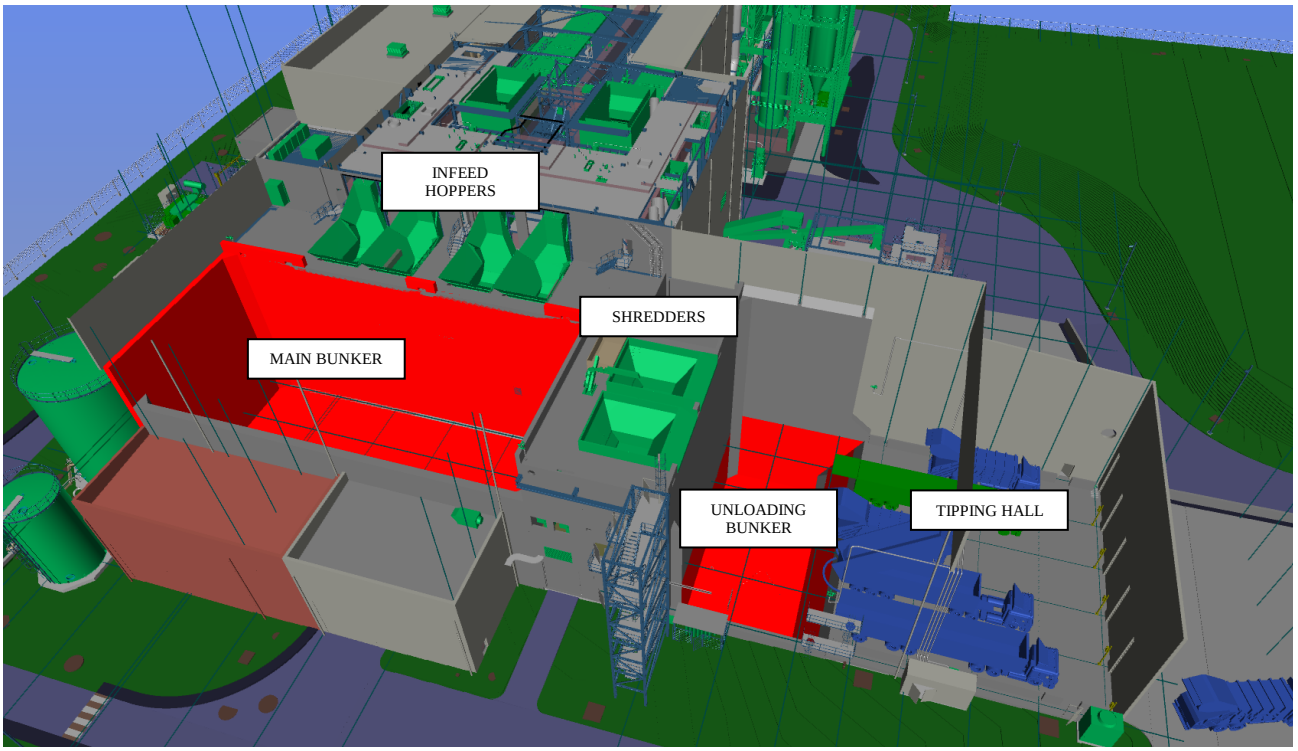
There are 5 drainage systems on site:

- Surface water which is collected through the road drainage system via an oil separator lead to the attenuation pond and finally discharged to Manchester Ship Canal.
- Surface water which is collected from process building roofs and lead to an rain water harvesting collection tank (SUDS) with overflow to attenuation pond fitted with oil interceptor and penstock valve.
- Foul water drainage from electrical annex building, administration building and local tea kitchen and toilet blocks lead to a central pump station discharging to public sewer off site.
- Process water for re-use which will be returned to the process with excess overflow to process water system.
- Process water, where unable to reuse (hot or excessive quantities) collected at equipment and pumped to the Sedimentation basin for treatment. Finally discharged to the foul drainage system.

The drainage plans, are included.

2.0 Preventing Fires

Preparation and screening of the feedstock to safeguard compliance with the fuel specification will be undertaken externally at a waste transfer station and supplied/delivered to the reception tipping hall/unloading bunker of capacity up to 938 tons representing a maximum of 1.3 days' operation of the plant. The feedstock will continuously be conveyed from the unloading bunker to the main bunker of a capacity up to 2,976 tons representing 4.1 days' operation of the plant.



The attached checklist summarized from the Environment Agency Fire Prevention Plan Guidance document detailed below describes how the project addresses each of the issues identified.

2.1 MATERIAL STORAGE

Item	Yes/No	Comments Actions
Do you have combustible, flammable and other flammable materials including cylinders on your site?	Yes	Municipal waste and industrial waste, Compressed gas for CEMS instrument, Diesel Oil. A detailed DSEAR reports will be issued.
Does your management system describe how you manage the quantity and type of material you intend to stockpile including seasonal and market variations	Yes	The feedstock storage is limited to the unloading bunker and the main bunker capacity. The feedstock will prior to delivery to the plant have been undergoing screening for oversized and of spec materials.
Is the location and duration of the stockpile appropriate	Yes	Limited quantity at site in enclosed storage area adjacent to end use

Do separation distances between stacks and/or other risk reduction measures on site meet the requirements of your local FRS	Yes	The feedstock storage area is either spatial separated from adjacent buildings or separated by 120 minutes fire walls. The area will be monitored by CO detection system for early warning and additionally installed with thermal cameras. Both the unloading bunker and the main bunker are installed with water monitors for fire extinguishing. Firewall separation and Please refer to the Fire Safety Strategy Report appended for further detail (2031.M0.J01.001.R2, section 8)
Have you contacted your local FRS about stack layout design and fire-fighting strategy	Yes	Through building control, the local FRS has reviewed and commented the Fire Safety Strategy Report.
Have you considered fitting an automatic fire detection and suppression system	Yes	Please refer to the Fire Safety Strategy Report appended for further detail. (2031.M0.J01.001.R2, section 5)
Are stock piles stored in excess of 3 months	No	There is a maximum 4 days turnover of the main bunker during normal operations. Cranes installed to feed the boilers will be programmed to collect fuel in a certain pattern and thereby not leaving areas inside the main bunker unattended for long periods. During planned outage for overhaul and maintenance fuel bunkers will be leveled to a minimum. Fire detection and water monitors will at all time normally be in place and operational.

2.2 PERSONNEL SAFETY

Item	Yes/No	Comments/Actions
Does your site have suitable first aid, fire-fighting equipment and training for staff	Yes	The operation and maintenance contractor will have procedures in place prior to commercial operation of the plant.
Are all means of escape for your staff adequate	Yes	Comprehensive review undertaken at design stage to meet Building Regulation requirement and BS 9999
Do you have a plan in place to raise the alarm and evacuate workers	Yes	Automatic Fire alarm system installed and fire evacuation plan and training will be developed prior to start up.

2.3 ACCESS

Item	Yes/No	Comments Actions
Have you provided suitable access for fire fighting vehicles	Yes	Yes – good access to all buildings with loop road. A swept path analysis will be carried out for FSR and other heavy vehicles on site.
Have you assessed potential fire spread on and around the site	Yes	Fire spread between buildings, internally inside buildings and external towards site boundary has been addressed and the plant has been designed accordingly. Preventing the risk fire spread is achieved either by compartmentation, fire walls, spatial separation or installed fire suppression systems. Please refer to the Fire Safety Strategy Report appended for further detail (2031.M0.J01.001.R2, section 8)
Have you considered where best to park up machinery at night to allow access for fire plan procedures or to minimize risk of loss in the event of fire	Yes	The site allows for various locations outdoor for parking machinery. Staff vehicles will be parked in the parking spaces shown on the appended site layout.
Have you considered what site security is required to prevent arson or vandalism	Yes	Site boundary will be fenced (2.4 m high). The entrance to site is through the gate. During day shift any visitor will be registered at the guardhouse. At night shift the gate will be kept closed. The site entrance will be monitored by CCTV as well as the main process areas.

2.4 CAN ANY OF THE FOLLOWING AFFECT ACCESS TO AND ROUTES AROUND SITE

Item	Yes/No	Comments Actions
Prevailing Wind causing smoke and fumes around access areas and routes to your	No	
Rough terrain	No	None
Buildings Debris	No	None
Security/Fencing	Yes	Security gate will be closed by end of business. Control room will be manned 24/7 and can be reached from gate via intercom.

2.5 ENVIRONMENTAL CONSIDERATIONS

Item	Yes/No	Comments Actions
Do you have a drainage plan for your site	Yes	Appended
Do you know which local surface waters, groundwater and/or sewage treatment works firewater run-off will flow to and how they may be affected by firewater run off	Yes	See appended "Firefighting Containment Volume Design". Any fire water collected would be tankered off site.
Are firefighting water supplies adequate on your site and are suitable open water supplies available and accessible,	Yes	A combined sprinkler and hydrant fire water storage tank holding 680 m3 of fire water is installed on the plant for 2 hour operation of the containerized fire pump unit.
Are the location of hydrants and their flow rates marked on your site plan even if outside the site boundaries	N/A	Fire main layout with location of hydrants appended. Design flow rate for hydrants is 500 gpm (1,890 l/min). Please refer to the Fire Safety Strategy Report appended for further detail (2031.M0.J01.001.R2, section 16.19)
Do you have adequate plans, equipment and facilities to contain firewater	Yes	See appended "Firefighting Containment Volume Design".
If firewater cannot be contained is a controlled burn a safe option	N/A	
Is a controlled burn also the best option for air quality and fire fighter safety?	N/A	
Do you know which properties and residential areas surrounding your site may be affected by smoke?	Yes	Yes please refer to receptor list above including adjacent Eastham refinery
If the answer to the above is yes then is there a plan to tell people living there what to do e.g. keep doors and windows shut.	Yes	Yes but Under development as site will only commence operation in 2021

2.6 MAINTENANCE CONSIDERATIONS

Item	Yes/No	Comments Actions
Does the equipment get regularly maintained	Yes	The operation and maintenance contractor will maintain detailed maintenance plans for all plant on site as per regulation.
Are certificates in place for all electrical equipment	Yes	Equipment required to be certified according to e.g. IEC, PED, CE etc. will comply.

3.0 Reducing the impact of a fire

As detailed in section 2.0, the timber preparation will be undertaken externally on another parts of the landowners site and supplied delivered to a reception tipping hall with a maximum of 4 days' supply to allow for bank holidays. Under normal operation 1 to 2 days' supply will be kept on in the reception hall.

Item	Yes/No	Comments Actions
Does the site have a waste acceptance procedure for non-permitted, incompatible waste or hot loads	Yes	Non-permitted, incompatible Feedstock or hot loads is visually inspected and monitored by thermal cameras during unloading into the bunker. Off-spec feedstock will be back-loaded into containers and removed from site. The installed fire water monitors is available for handling hot loads.
Is there a permitted Waste Acceptance		Yes EWC codes from permit will be agreed
Is there waste treatment on site	Yes	Feedstock is delivered to the Unloading bunker and from here it will be transferred by crane into one of two shredders which reduce any received fuel to a homogeneous size. From the shredders the fuel is screened for ferrous metals followed by conveying it to the main bunker.
Has the site defined the waste storage separation distances	No	Not applicable as building is fitted with automatic fire detection and suppression, is manned 24/7 and has an enclosed building with appropriate fire walls to sensitive areas.
Are Fire Walls used to separate waste	No	The feedstock is stored in the main bunker. Fire walls are installed for separation of key plant areas.
Is there a Quarantine Area for the waste	No	Off-spec feedstock will be back-loaded into containers and removed from site.
Is there a fire suppression system for the storage area	Yes	Fire water monitors are installed for firefighting in the bunkers. The unloading bunker and the main bunker are both covered with two monitors installed to assure any surface area in each bunker can be reached by two water streams.
Is there an active fire-fighting procedure for the site	Yes	The operation and maintenance contractor will have procedures in place prior to commercial operation of the plant.

Is there any contingency plans during an incident	Yes	The operation and maintenance contractor will have procedures in place prior to commercial operation of the plant. Please refer to the Fire Safety Strategy Report appended for further detail (2031.M0.J01.001.R2, section 17)

4.0 Sensitive Human Receptors

The adjacent Eastham refinery

Plus

Name	Receptor Number
Seaview Avenue	1
Bankfields Drive	2
St David Road	3
Eastham Village Road	4
Stanley Lane School	5
Bramhall Drive	6
Lydale Ave School	7
Willington Avenue School	8
Newgarth Road School	9
MSC Eastham Football Club	10
Greenacres	11
Merton Road	12
St David Allotments	13
Wingate Road Allotments	14
Brindle Road Allotments	15
Hooton	16
Park Farm	17
Childer Thornton	18
Overpool	19

5.0 Sensitive Ecological Receptors

Table 2-5 Ecological Receptors Included in Detailed Modelling

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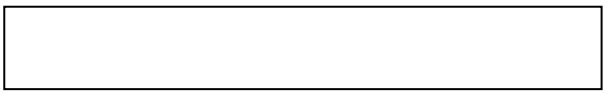

BWSC Generation Services UK Ltd
Hooton Bio Power Limited

BWSC Generation Services UK Ltd

Hooton EFW Plant

Odour Management Plan

Prepared by:	Reviewed by:	Approved by:
 24/09/2019 **Name: Andy Sampson** **Title: Plant Manager**	**Name:** **Title:**	**Name:** **Title:**

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Uncontrolled when printed. Controlled version is viewed via the Intranet.

Contents

1. PURPOSE....3
2. SCOPE....3
3. REFERENCES....3
4. ROLES AND RESPONSIBILITIES....3
4.1. PLANT MANAGER....3
4.2. QEHS LEAD....4
4.3. SHIFT TEAM LEADERS....4
4.4. ALL SITE PERSONNEL....5
5. PROCEDURE....5
5.1. MEASURING PROCEDURE....5
5.2. ODOUR MANAGEMENT PLAN (OMP)....8
6. DOCUMENT HISTORY & REVISION LOG....10
7. APPENDIX 1 - PRIMARY ODOUR CONTROL MEASURES....11
8. APPENDIX 2 – SOURCE MATERIALS....12
9. APPENDIX 3 – RELEASE POINTS....13
10. APPENDIX 4 – CONTINGENCY CONTROL MEASURES....14
11. APPENDIX 5 – ODOUR MONITORING PLAN....15
12. APPENDIX 6 – ODOUR CONTROL REPORTING SHEET....16

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1. Purpose

Odour is a sensory response to the chemicals in the inhaled air. The usual effect of bad odours is nuisance. It is outlined in Environmental Protection Act (EPA) 1990 and potentially this can also result in issues with the environment and with human health.

For this reason, in the Hooton EFW Plant (HEP) emissions from activities at site shall be free from odour at levels likely to cause pollution outside of the site boundary.

The purpose of this document is to describe an Odour Management Plan (OMP) for HEP and to ensure that suitable odour monitoring is carried out periodically to prevent or where that is not practicable to minimise odours on site.

2. Scope

The scope of this document covers all odour control and monitoring at HEP to avoid or reduce the presence of and the annoyance caused due to exposure to odours and will form part of the site Environmental Management System

3. References

- Environmental Protection Act, 1990.
- H4 Odour Management. Environment Agency, 2011.
- BS EN 13725:2004 on "Air Quality. Determination of odour concentration by dynamic olfactometry".
- Odour production, evaluation and control. Project MLMMI 02-HERS-03. Manitoba Livestock Manure Management Initiative Inc., 2002.

4. Roles and responsibilities

4.1. Plant Manager

The Plant Manager shall be responsible for:

- Preparing and issuing a site SMI covering the implementation of a OMP.

- Ensuring that sufficient resources are employed at HEP to enable the completion of the requirements specified within the OMP

4.2. QEHS Lead

The QEHS Lead shall be responsible for:

- Notifying to the site management if any abnormal and/or stronger odour generated from the site's activities which may produce pollution outside is detected.
- Keeping a record of all these abnormal and/or stronger hazardous odours on site, completing the odour control sheet as per Appendix 6.
- Managing, coordinating and completing the periodically odour inspections on and off site.
- Investigating issues, reports and / or complaints associated with odours
- Training site staff to ensure awareness of the requirements of the OMP and auditing to ensure compliance

4.3. Shift Team Leaders

Shift Team Leader shall be responsible for:

- Controlling the Operational activities on HEP site to avoid the presence of abnormal and/or stronger odours which may create a risk to the environment.
- Ensuring that all personnel on site carry out all measures required for controlling or removing (if possible) hazardous odours.
- Management and control of work planning to ensure the potential for the release of Odours is risk assessed and managed as part of the work planning progress.
- Receiving and acting upon any complaints received associated with odour emissions.

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4.4. All Site Personnel

All site staff shall be responsible for:

- Detecting and identifying abnormal and/or stronger odours at HEP which may produce pollution outside the site boundary area.
- Informing the QEHS Lead (or Shift Team Leader) if any abnormal and/or stronger odour is being generated at site.

5. Procedure

5.1. Measuring Procedure WHAT/HOW

➢ **Odour Intensity**

Odour intensity is a measure of the human response to an undiluted odour. There are some measuring odour intensity techniques based in comparing the intensity of an odour to the intensities of different but known concentrations of a reference odourant (commonly n-butanol), being measured in European Odour Units per cubic meter (UOE/m^3). However to measuring odours in HEP will not require such precision and odour intensity identification using human smell is considered a suitable and sufficient technique.

<u>Category Estimation Technique</u>

On site, an assessor shall estimate the odour intensity by ranking it according to their perception of its strength. An example of the category intensity scale could be the following:

- No Odour
- Very Faint Odour
- Faint Odour
- Distinct Odour
- Strong Odour
- Very Strong Odour
- Extremely Strong Odour

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Odour intensity is determined from the geometric mean of the different levels (intervals) of the category scales as perceived by each person.

- **Odour Offensiveness**

Offensiveness is a subjective, qualitative and comparative human classification of the nature of odour. Parameters used to define odour offensiveness are:

Hedonic tone

This is a measure of the pleasantness/unpleasantness of an odour, which is often evaluated and ranked using an 11 or 21- point scale ranging from +5 to 0 to -5 or +10 to 0 to -10, respectively. At +5 or +10 an odour is classified as very pleasant, very unpleasant at -5 or -10, and neutral at 0.

Odour description

An odour may be qualified by relating its perceived character or smell to that of a known substance. Descriptors of various characteristics and known smells are listed on a "descriptor wheel" or in a table.

Annoyance Level

Odour annoyance level or index is a measure of how humans "feel" about odours. The following scale is an example of annoyance measurement:

- Not Annoying
- Slightly Annoying
- Annoying
- Very Annoying
- Extremely Annoying

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It is important that this measure do not be influence by non-sensory factors such as environment or past experience.

- **Odour Frequency**

Odour frequency is influenced by several variables interacting collectively. These variables include the wind direction and speed, atmospheric stability, location of a distance between receptor and source odour, and of course the odour emission rate. The prevalent climatic conditions in an area determine the nature of odour dispersion in the locale of livestock operations.

WHERE

In most situations, an inverse relationship exists between distance from the source and odour intensity as the odour disperses from its source. With the odour measures is important to know the wind speed and direction for choosing a suitable place. When the speed is high, the distance between the odour source and the assessor shall be further and always following the wind direction.

WHEN

For measuring odour, the Plant should be in operation, ideally at full steady baseload and during the day, when odours can be stronger due to the temperature is higher.

Weather Conditions

- **The effect of wind direction and speed**

The frequency of any odour event at a given location downwind from a source of odour is dependent on how often the wind blows in that direction. Furthermore, the wind speed determines the magnitude and dispersion of the odour event. At low wind speeds, odour is diluted less and travels further than at high speeds.

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- **The effect of atmospheric stability**

The atmospheric stability relates to the level of air movement (turbulence) in the atmosphere, and it is commonly categorized by the stability classes (A-G) as follows:

A: Highly Unstable
B: Moderately Unstable
C: Slightly Unstable
D: Neutral
E: Slightly Stable
F: Moderately Stable
G: Highly Stable

A majority of odour events occur under stability classes E and F, with the most events occurring at lower wind speeds. In contrast, the least odour events occur at stability class A, then B, then C, even at low wind speeds.

5.2. Odour Management Plan (OMP)

The OMP should clearly demonstrate that HEP is competent and committed to controlling odour pollution and capable of managing the risk effectively.

The odour control measures integrated within the OMP shall be reviewed at least once a year.

The OMP will consider sources, releases and impacts, and use these to identify cost-effective opportunities for odour management. It should be designed to:

- Employ appropriate methods, including monitoring and contingencies, to control and minimise odour pollution.
- Prevent unacceptable odour pollution at all times.
- Reduce the risk of odour releasing incidents or accidents by anticipating them and planning accordingly.

The OMP appendixes shall include:

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- **Appendix 1 - Primary odour control measures**
  - Summary of odour control equipment and techniques utilised at site
- **Appendix 2 – Source materials**
  - inventory with descriptions and quantities of all potentially odorous solid, liquid and gaseous materials held on site across the full range of operating conditions
- **Appendix 3 – Release points**
  - Listing and description of odour release points installed
- **Appendix 4 – Contingency control measures**
  - Clarification on actions to be taken in case of failure or non-availability of the Primary control equipment or during an emergency situation
- **Appendix 5 – Odour monitoring plan**
  - Schedule for completion of odour monitoring activities including identification of key receptor points within a local area map
- **Appendix 6 – Odour control reporting sheet**
  - Common format for the reporting of periodic odour control inspections to ensure consistency and repeatability

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6. Document History & Revision Log

Document History and Revision Log				
Rev	**Status and short description of Change**	**Prepared/ Revised by**	**Reviewed by**	**Effective date**
0	DRAFT	Andy Sampson		24/09/2019
Signed controlled hard copies of all original and revised versions of this guideline are retained by the O&M Manager. The latest approved electronic revisions are maintained at:- Hooton common drive - SMI Policy & Procedure - SMI – Hooton-HSE-Env docs				

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7. Appendix 1 - Primary odour control measures

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8. Appendix 2 – Source materials

DRAFT

9. Appendix 3 – Release points

DRAFT

10. Appendix 4 – Contingency control measures

DRAFT

11. Appendix 5 – Odour monitoring plan

DRAFT

12. Appendix 6 – Odour control reporting sheet

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Project	2031 Hooton Bio Power Project	**Document no.**	**Rev.**
Date	18 September 2019	2031.S0.Z02.001	00
Document owner	HSW		
Verifier/approver	RBBD/LSE		Page 1/1
Revised/date	RBBD/18 September 2019		
Subject	**Energy Efficiency Formula**		

R1 Energy Efficiency Formula

Ref.: http://www.ciwm.co.uk/ciwm/knowledge/the-r1-energy-efficiency-formula.aspx

The Revised Waste Framework Directive (WFD Directive 2008/98/EC) specifies that incineration facilities dedicated to the processing of municipal solid waste can be classified as R1 only where their energy efficiency is equal to or above 0.65 for installations permitted after 31st December 2008.

The formula used is:

$$\text{Energy Efficiency} = \frac{(E_p - (E_f + E_i))}{(0.97 * (E_w + E_i))}$$

In which:

E_p	The annual energy produced as heat or electricity. It is calculated with energy in the form of electricity being multiplied by 2.6 and heat produced for commercial use multiplied by 1.1 (GJ/year)
E_f	The annual energy input to the system from fuel contributing to the production of steam (GJ/year)
E_i	The annual energy imported excluding ,E-w and E-f (GJ/year)
E_w	The annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/year)
0.97	The factor accounting for energy losses due to bottom ash and radiation

Assumptions

Plant operating hours: 7,800 h/y
Average waste feedstock LCV: 10.5 MJ/kg (not used in calculation)
Expected auxiliary fuel input: 1% (assumption)
Auxiliary electric consumption: 15% of generator output (assumed)
Thermal input: 88.7 MW
Nominal generator output: 28 MW

$E_w = 88.7 \cdot 7{,}800 \cdot 3.6 = 2{,}490{,}696$ GJ
$E_f = 0.01 \cdot E_w = 249{,}070$ GJ
$E_p = 28 \cdot 7{,}800 \cdot 3.6 \cdot \mathbf{2.6} = 2{,}044{,}224$ GJ (2.6 factor ref. guidance)
$E_i = 0.15 \cdot 28 \cdot 7{,}800 \cdot 3.6 = 117{,}936$ GJ

$$Energy\ Efficiency = \frac{2{,}044{,}224 - (249{,}070 + 117{,}936)}{0.97(2{,}490{,}696 + 249{,}070)}$$

$$Energy\ Efficiency = 0.779$$

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Hooton Bio Power Energy Efficiency

Name	Amount per year	Unit
Energy Inputs (annual basis)		
Residual Waste:	200,000	tes
Net Calorific Value:	10.50	MJ kg^{-1}
Gross Calorific Value:	11.74	MJ kg^{-1}
Energy input:		
(200,000 × 10^3 x 11.74 x 10^-3)/3.6	652,167	MWh
Support Fuel	210	t
Gross Calorific Value	43	MJ kg^{-1}
Energy input		
(210 x 10^3 x 43 x 10^-3)/3.6	2,508	MWh
Electrical power import	200	kW
Electrical power import period	760	hours
Electrical Energy Import	152	MWh
Total thermal input	**654,827**	**MWh**
Energy Outputs		
Nominal thermal input:	99.2	MW
Net electricl output:	23.7	MW
Full load operational hours:	8,000	hour
Electrical Power provided to external users:	156,446	MWhe
Power Efficiency (ηpower):	**23.9**	**%**
Heat Energy provided to External Users	0	MWhe
Heat Efficiency (η_{Heat})	-	
Overall Indicative Efficiency $\eta_{overall}$	**23.9**	**%**

Calculation

Comments
NCV (10,5MJ/Kg) the tonnage utilised varies with the NCV in accordance with tthe firing diagram.
Expected waste calorific value condition
Ratio between NCV and GCV depends on waste moisture content and detailed composition for expected waste condition
Calculated
Diesel support fuel for preheat and compliance purposes. Assumed 3 stops per year per line and fuel with 12,77MJ/kg at all times
Guidance shows 43MJ/m³, which must be wrong and MJ/kg
Calculated
This is limited as this is only a Standby consumptionfor electricity consumption during outages. Under normal operation the station produces and uses its own power and exports the excess.
Calculated
GCV Basis
GCV
Guarantee conditions
Expected operation range is 7500-8000h
Guarantee conditions
Calculated
Calculated
Calculated

PROJECT : **Hooton Bio Power Plant** 2031 M0 C50 001 4
DATE : 2019.06.19 / 2019.09.10 PROJ. DOC.NO SHEET REV.
ISSUED BY : SJ APPROVED BY: LATO
SUBJECT : **Continuous Emission Monitoring System (CEMS)** PAGE 1 OF 25

TECHNICAL SPECIFICATION

1. General Specification Page 2
2. General Requirements & Conditions Page 8
3. Scope of Supply Page 15
4. Data Sheets Page 17

Attachments:

/1/	Part 21; sect.15, rev.0	Continuous Emission Monitoring System (CEMS)
/2/	Parts 22, sect. 5.8, rev.P2	SNCR DeNOx system
/3/	Annex 1, App.2, sect.3, rev.0	Permit with introductory note (draft)
/4/	TGN M1, version 8	Sampling req. for stack emission monitoring
/5/	Appendix 5, GFE408, rev.0	Atmospheric Dispersion Modelling Report
/6/	2031.M0.002.001, rev.0	General Conditions
/7/	2031.S0.Z01.001, rev.1	Site Data
/8/	2031.S1.004.002, rev.1	Project Design Criteria, Civil and Seismic Design
/9/	2031.M0.013.001, rev 2	Surface Treatment for Mechanical Equipment
/10/	2031.M0.023.001, rev 0	Labeling and pipe marking KKS
/11/	2031.KG.300.011, rev.3	Guideline for KKS use in BWSC
/12/	2031.E1.B01.001, rev.1	General Specification for Instrumentation and Control
/13/	2031.E1.X01.001, rev.1	General Specification for OEM Panels
/14/	2031.E1.X02.001, rev.3	Spec. for 3-Phase Low Voltage Induction Motors
/15/	2031.E1.X05.001, rev.1	General Electrical Design Conditions
/16/	2031.E4.R01.001, rev.3	Electrical Installation Principles
/17/	2031.M0.600.010, rev.0	Mapress stainless steel pipes (A2 350)
/18/	2031.MD.C52.001, rev.0	Technical Documentation
/19/	2031.MQ.C50.001, rev.0	Quality Assurance Requirements
/20/	2031.MU.C50.001, rev.0	Demands to Sub-suppliers CE-marking
/21/	2031.S2.R01.001, rev.1	Capacity diagram: Flue gas and abatement system
/22/	2031.M2.C02.001, rev.1	Stack and Emission Monitoring P&ID (draft)
/23/	2031.M2.C02.002, rev.2	Emission Monitoring P&ID (draft)
/24/	2031.D2.434.001, rev.0	Flue gas treatment area layout, top view
/25/	2031.D2.423.001, rev.0	Flue gas treatment area layout, sect. G-G look west
/26/	533159-102-1030, rev.A	Steel Stack GA
/27/	6000.GI.310.0077	Comos Instruction
/28/	Sketch	Raw gas measurement platform
/32/	2031.E1.K20.001, rev.1	Cable Specification
/33/	2031.E1.X04.002, rev.2	Requirements for EI Installation, General Specifications
/34)	2031.S0.X01.001, rev.1	Explosive Atmosphere Area Classification
/35/	2031.D2.041.801, rev.0	Layout – Hazardous Area Classification

All references to any attachment in this specification shall be of the latest version

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TECHNICAL SPECIFICATION

1 General Specification

The work covered by this specification comprises the design, manufacture, supply, complete workshop test, complete documentation, performance and quality assurance of the stack Continuous Emission Monitoring System (CEMS) and the raw gas measurement as specified in the data sheets.

The specification of the Continuous Emission Monitoring System (CEMS) and the raw gas measurement is covered by this actual specification:

- 2031.M0.C50.001: Continuous Emission Monitoring System (CEMS) and 2 additional sub-specifications:
- 2031.M0.C51.001: CEMS - Analyzer House
- 2031.M0.C52.001: CEMS - Emission Reporting System

This specification with all attachments gives the minimum technical requirements for the design, manufacture, supply, performance and quality assurance.

The CEMS system is monitoring the exhaust gas components from a Renewable Energy Plant consisting of two (2) Kobelco boilers, each approx. 57.5 tons/hr steam production. Each boiler is burning waste and consists of a gasifier furnace and a melting furnace. The exhaust gas pipe from each boiler is connected to its dedicated flue gas pipe in the common stack through a FGT reactor and a fabric filter installation with lime injection.

The CEMS gas analysis shall consist of 1 CEMS analysis system per stack pipe (2 off) and in addition 1 CEMS analysis system acting as a redundant system to either of these 2 CEMS analysis systems. Thus, there will be three CEMS systems in total (automatic switchover system to common (redundant) CEMS analyser). Switching over time to be within 10 minutes.
Each of these three CEMS must measure continuously the gaseous components: NO, NO_2, NO_x (calculated)[1], SO_2[2], HCl[3], CO[4], CO_2[5], NH_3[6], H_2O, O_2[7], N_2O[8], TOC[10] / VOC[11] and H_2O[12].

[1] Nitrogen oxides NO_X as NO_2,
[2] Sulphur dioxide
[3] Hydrogen chloride
[4] Carbon monoxide
[5] Carbon dioxide
[6] Ammonia
[7] Oxygen
[8] Nitrous oxide
[10] Total organic carbon
[11] Volative organic compound
[12] Moisture

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Measurement of HF[9], Hg[13] and dioxin / furans shall be separately quoted as options.

Dedicated dust analysing with purge air fans shall be included, i.e. 1 dust analyser in each flue gas pipe, - and 1 purge air fan for each flue gas pipe. 1 piece of essential spare part for the dust sensor shall be included. Reference is made to section 3 of this specification.

The stack monitoring system shall also include pressure (BWSC supply), stack temperature (BWSC supply), volume flow and dust measurement in each flue gas pipe.

Further a raw gas analysis shall include and be complete for continuous simultaneous monitoring of HCl and SO_2 in raw exhaust gas upstream of each of the two (2) FGTs. Reference is made to attached capacity diagram /21/ 2031.S2.R0.001 and sketch /28/ “Raw gas measurement platform” with approximate dimensions added. The raw gas duct is vertical leading to a flue gas cooler. Raw gas analyser cabinets may be situated on the “Raw gas measurement platforms”, and / or may be placed on the opposite side of the flue gas coolers.
Optional prices to be quoted for O_2, H_20, NO_x in situ laser type analyser and NH_3 in situ laser type analyser for each flue gas pipe.

Basically, the CEMS system (stack) will be located at the bottom of the plant stack in a shelter/house unit (Technical Specification 2031.M0.C51.001). The shelter/house will contain the monitoring system for the exhaust gas stack and the auxiliary equipment for the CEMS system.
However, an option shall be provided for alternative location of the CEMS system in the FGT area electrical room.

Gaseous components shall be monitored continuously by an extractive system analyser for each flue gas pipe in the exhaust gas stack.

The system shall consider the characteristics of mainly householding waste exhaust gas with gas conditioning and materials ensuring trouble free operation with the rather corrosive nature and high concentrations of pollutants found in such waste exhaust (see subsequent sections for details).

The flue gas probes will be mounted outdoors on the stack at a platform with the instruments on the stack and in each flue gas pipe. The installations will be protected against direct snow, rain and sun exposure by roof covers (by others).

[9] Hydrogen fluoride [13]Mercury

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Weather conditions are according to /7/ 2031.S0.Z01.001, rev.1 Site Data". The CEMS shelter/house shall be installed with ventilation fan(s) and dual Air-Conditioners or heat pumps.

Finally, the system (especially the analyzing equipment, and sensors located in the plant stack and flue gas pipes mentioned above) shall be designed to cope with the rather wet and hot environment that may exist on the stack during the change of seasons.

The CEMS system and the raw gas analysis shall be designed and constructed in accordance with DIN / EN standards. Further all CEMS analyzer equipment such as gas analyzers, dust and flow must be approved and certified with a valid certification according to MCERTS Certified Products: Continuous Emission Monitoring System and Transportable-CEMs.

The equipment shall be CE marked according to 2031.MU.C50.001: "Demands to Sub-suppliers CE-marking".

Gas Emission Analyzing System, Dust Emission Analyzing System and Volume flow Emission Analyzing System shall include control and display equipment.

The CEMS system shall include an emission calculator system (Technical Specification 2031.M0.C52.001), if such equipment is required for British waste incineration plants. The calculator shall be located in the plant central control room. The emission calculator shall record all measurement values at actual condition and normalized ((T,P), ref. O2, dry and confidence intervals and with QAL2 values inserted in DCS) as well as system status from the monitoring systems. The system must allow for automatic mail sending of emission reports the British environmental agency.

A full access to the reporting system must be available in the CEMS container and partly in the plant manager's office, operation manager's office via the DCS.

The CEMS system shall be certified, calibrated and validated to meet the equivalent certification scheme: Certification according to QAL1, calibration according to QAL 2, CEMS system functional tested according to the QAL3, and Annual Surveillance Test (AST) by accredited test organization.

All values and status signals shall be transferred to the plant control system (DCS).

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TECHNICAL SPECIFICATION

1.1 Requirements

All equipment, fittings etc. must be fabricated fully in accordance with attachment to this specification as well as common description for all units.

All piping for compressed air must be stainless steel 1.4401 accordance with the enclosed document:

/17/ 2031.M0.600.010, rev.0 Mapress stainless steel pipes (A2 350)

Sampling lines must be in PTFE or high-alloy steel and be heat traced. Alternatively, sampling lines of a material recommend by supplier may be quoted optionally.

Calibration gas / flue gas pipes may be supplier's standard.

Gas sampling system must be with heated sample lines.

1.2 Codes and Standards

EN:	European Standard
DIN:	Deutsche Industrie Norm
ISO:	International Organization for Standardization
BS:	British Standard
EA:	Environment Agency (UK)

In particular, - the following directives and standards shall be observed and complied with:

- 98/37/EC Machinery Directive
- EN 15267–3 Air quality - Certification of automated measuring systems
- EN 13284 Stationary source emissions. Determination of low range mass concentration of dust. Manual gravimetric method
- EN 14181 Stationary source emissions - Quality assurance of automated measuring systems
- EN 14956 Air quality. Evaluation of the suitability of a measurement procedure by comparison with a required measurement uncertainty
- ISO 15713 Stationary Source Emissions – Sampling and determination of gaseous fluoride content
- ISO 17025 General requirements for the competence of testing and calibration laboratories
- 2008/1/EC IPPC Directive (Integrated Pollution Prevention and Control)

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- 2010/75/EU Industrial Emission Directive
- 2003/87/EC Emissions Trading Directive
- M1/EA M1 – Sampling requirements for stack emissions monitoring
- M2/EA M2 – Monitoring of stack emissions to air
- MCERT Environment Agency's Monitoring Certification Scheme

1.3 Erection of Unit

Technical drawings shall be submitted to BWSC for approval before start of fabrication.

The components/pipe connections shall be aligned without any stress.

The units/panels shall be provided with pipe and cable way supports.

1.4 Drawings

Final drawings of the container and panels shall be submitted for approval to BWSC.

The CEMS supplier shall:

- give inputs to nozzle sizes and positions.
- review and approve the final stack drawing with nozzle positions (BWSC Scope).

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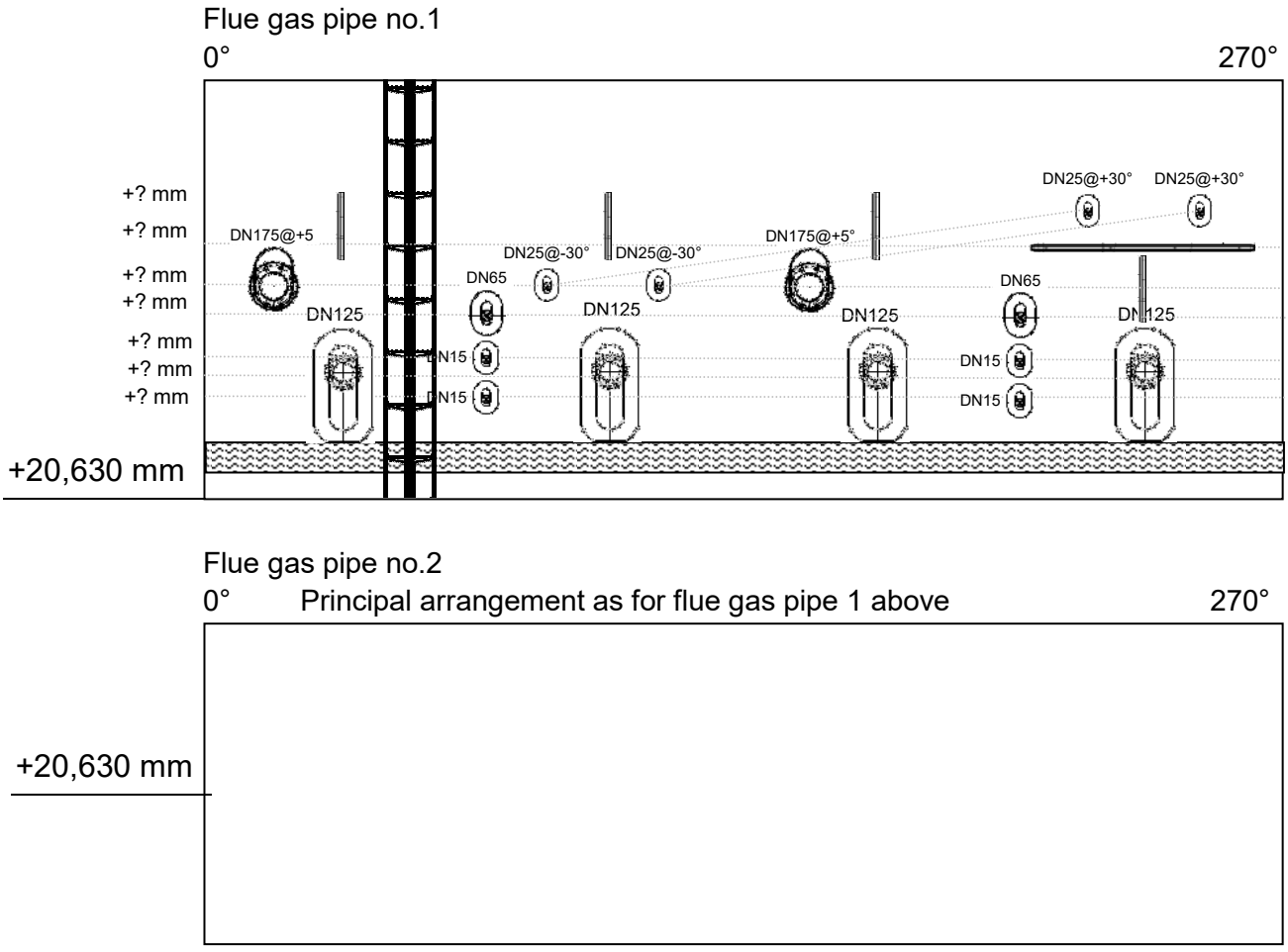
Emission Platform Layout (Preliminary example sketch only)



1.5 Excluded in Scope

- All DN15 and DN125 nozzles (supplied by stack supplier).

1.6 Transportation and Storage

All connections on the container unit shall be sealed and blanked of with a wooden plate or similar for transportation and storage on site.

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1.7 Explosive area classification

As the creation of an explosive gas atmosphere is prevented by the ventilation system, the CEMS container is unclassified.
The gas bottle cage will be classified EX zone 2 and signed off.

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2 General Requirements & Conditions

2.1 Warranty

The guarantee period is 24 months from the date of hand over to final user (TOC).

The targeted handover date at site is: Medio 2021

2.2 Measuring Principles

According to contract specification the analyzers/sensors employed must be of following types:

- O_2 sensor	:	Supplier to suggest accurate principle
- NO	:	Supplier to suggest accurate principle
- NO_2	:	Supplier to suggest accurate principle
- CO	:	Supplier to suggest accurate principle
- CO^2	:	Supplier to suggest accurate principle
- SO_2	:	Supplier to suggest accurate principle
- H_2O	:	Supplier to suggest accurate principle
- NH^3	:	Supplier to suggest accurate principle
- HCl	:	Supplier to suggest accurate principle
- HF (option)	:	Supplier to suggest accurate principle
- N_2O	:	Supplier to suggest accurate principle
- VOC / TOC	:	FIT / FID sensor or as suggested by supplier
- Substitute PM	:	Scattered light principle
- Temperature	:	Thermocouple/resistance thermometer
- Pressure	:	Transmitter
- Volume flow	:	Averaging pitot flow measurement preferred. MCERTS compatibility is not required

2.3 Measuring Ranges

Measuring ranges shall be as follows:(to be verified)

O_2	:	0 – 21 vol.%, dry
NO	:	0 – 400 mg/Nm^3, dry at ref. 11% O_2
NO_2	:	0 – 400 mg/Nm^3, dry at ref. 11% O_2
NO_x [8]	:	0 – 600 mg/Nm^3, dry at ref. 11% O_2

[8] NO_x to be calculated from NO and NO_2

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NH_3	:	0 – 60 mg/Nm^3, dry at ref. 11% O_2
HCl	:	0 – 300 mg/Nm^3, dry at ref. 11% O_2
CO	:	0 – 400 mg/Nm^3, dry at ref. 11% O_2
SO_2	:	0 – 500 mg/Nm^3, dry at ref. 11% O_2
VOC	:	0 – 70 mg/Nm^3, dry at ref. 11% O_2
HF (option)	:	0 – 20 mg/Nm^3, dry at ref. 11% O_2
H_2O	:	0 – 20 vol.%
N_2O	:	0 – 50 mg/Nm^3, dry at ref. 11% O_2

Scattered light refl. : 0 – 200 mg/Nm^3, dry at ref. 11% O_2

Exhaust gas data:

Temperature	:	0 – 180°C
Design temperature	:	200°C
Pressure	:	0.7 – 1.3 bar(a)
Nominal wet flow, @145°C, each pipe	:	0 – 78,302Nm^3/hr
Max. wet flow, @145°C, each pipe	:	0 – 101,800 Nm^3/hr

All measurements will be measured at actual conditions and will be rectify by the emission reporting system to standard reference conditions: Dry exhaust gas at 273 K, 101.3 kPa(a) with 11%vol O_2.

The system shall include automatic calibration routines.

2.4 Exhaust Gas Conditions

The exhaust gas will be supplied by household waste gasification boilers through an exhaust gas system with a flue gas desulphurisation (FGD), fabric filter (FF) and finally an ID fan.

Sampling / measurement point will be in the stack pipe downstream of the boiler, the FGD and ID fan.

2.4.1 Flue Gas Temperature

Normal temperature at the point of sampling is expected to be between 130°C and 180°C (normal ~145°C).

Measuring system shall be designed for an exhaust gas temperature up to minimum of 200°C.

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2.4.2 Exhaust Gas Components

For guidance following composition/characteristics are expected, operating on household waste after NO_X reduction in SNCR and particle as well as acid gas removal in a bag house filter:

Expected exhaust gas inlet data to each flue gas pipe of the stack:

	Flowsheet reference	G1 FGC exit					
	Load case	Case A *3	Case G *4	Case I *5	Case Min *6	Case Acid ratio*7	Case BREF*8
Mass flow-Solids	kg/h	407	386	1383	224	1383	1383
Mass flow-Liquids	kg/h	0	0	0	0	0	0
Mass flow-Gas	kg/h	100,227	95,496	110,042	55,125	110,042	110,042
Mass flow-Total	kg/h	100,634	95,882	111,425	55,349	111,425	111,425
Flue gas flow	Nm^3/h, dry	66,246	63,539	72,067	36,436	72,067	72,067
Flue gas flow	Nm^3/h, wet	78,302	74,261	86,443	43,066	86,443	86,443
Flue gas flow	Nm^3/h, dry, 11% O_2	101,443	98,460	109,825	55,793	109,825	109,825
Actual flow	Am^3/h, wet	126,667	119,805	140,665	68,382	140,665	140,665
Temperature	°C	155	155	155	155	155	155
Pressure*2	Pa	-3,145	-2,879	-3,724	-1,300	-3,724	-3,724
Density gas	kg/Nm^3, wet	1.280	1.286	1.273	1.280	1.273	1.273
Density gas	kg/m^3	0.791	0.797	0.782	0.806	0.782	0.782
Dust load	mg/Nm3, dry	6,146	6,077	19,192	6,146	19,192	19,192
Dust load	mg/Nm3, dry, 11% O2	4,014	3,922	12,594	4,014	12,594	12,594
Dust load	mg/Nm^3, wet	5,200	5,200	16,000	5,200	16,000	16,000
Dust load	mg/m^3, wet	3,215	3,223	9,833	3,275	9,833	9,833
CO_2	Vol%, dry	13.47	13.63	13.41	13.47	13.41	13.41
CO_2	Vol%, wet	12.71	12.88	12.63	12.71	12.63	12.63
O_2	Vol%, dry	5.69	5.50	5.76	5.69	5.76	5.76
O_2	Vol%, wet	4.8	4.71	4.8	4.8	4.8	4.8
H_2O	Vol%	15.40	14.44	16.63	15.40	16.63	16.63
N_2 + Ar	Vol%, wet	68.39	69.19	67.39	68.39	67.39	67.39
SO_2	mg/Nm^3, dry, 11% O_2	486	854	854	486	854	854
HCl	mg/Nm^3, dry, 11% O_2	1,101	1,930	1,930	1,101	427	1,930
HF	mg/Nm^3, dry, 11% O_2	27.5	50	50	27.5	50	50
NO_x (as NO_2)*1	mg/Nm^3, dry, 11% O_2	200	200	200	200	200	200
CO*1	mg/Nm^3, dry, 11% O_2	50	50	50	50	50	50
NH_3*1	mg/Nm^3, dry, 11% O_2	30	30	30	30	30	30
TOC	mg/Nm^3, dry, 11% O_2	No proces data available and FGT SUPPLIER are to provide system with PAC capacities per prior design to waste incineration.					
Cd + Tl	mg/Nm^3, dry, 11% O_2						
Hg	mg/Nm^3, dry, 11% O_2						
Metals	mg/Nm^3, dry, 11% O_2						
Dioxin/Furans	$ngTEQ/Nm^3$dry, 11% O_2						
Solid flow	kg/h						
Density solids	kg/m3						
Req. volume	net m3/X days						
Duct velocity @ diameter *9	m/s	18.6	17.6	20.7	10.1	20.7	20.7
Duct diameter (Design)	mm	1550	1550	1550	1550	1550	1550
Temp max (Mech. design)	°C	200					
Pressure max (design)	Pa	-4,970					
Days of storage @ Case A							

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Emission requirements (daily average values only) are expected to be as listed in below table. Values may then be considered as being input data as well.

		G10 Stack exit					
		Case A *3	Case G *4	Case I *5	Case Min *6	Case Acid ratio	Case BREF
Dust load	mg/Nm3, dry, 11% O2	<10	<10	<10	<10	<10	<5
SO_2	mg/Nm³, dry, 11% O_2	< 50	< 50	< 50	< 50	< 50	< 30
HCl	mg/Nm³, dry, 11% O_2	< 10	< 10	< 10	< 10	< 10	< 6
HF	mg/Nm³, dry, 11% O_2	< 1	< 1	< 1	< 1	< 1	< 1
NO_x (as NO_2)*1	mg/Nm³, dry, 11% O_2	< 200	< 200	< 200	< 200	< 200	< 120
CO*1	mg/Nm³, dry, 11% O_2	< 50	< 50	< 50	< 50	< 50	< 50
NH_3*1	mg/Nm³, dry, 11% O_2	< 30	< 30	< 30	< 30	< 30	< 10
TOC	mg/Nm³, dry, 11% O_2	< 10	< 10	< 10	< 10	< 10	< 10
Cd + Tl	mg/Nm³, dry, 11% O_2	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,02
Hg	mg/Nm³, dry, 11% O_2	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,025
Metals	mg/Nm³, dry, 11% O_2	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,3
Dioxin/Furans	ngTEQ/Nm³dry, 11% O_2	0.1	0.1	0.1	0.1	0.1	0.06

Above PM emission to be measured indirectly and correlated with sampling according to EN 13284-1.

2.5 Other Conditions

Note that measuring range may be slightly redefined after order.

2.6 Ambient Conditions

The analyzer unit will be ventilated, but equipment/cabinets should be designed for surrounding temperatures > site max. temperature +20°C and include margin for internal heat dissipation in cabinets.

Stack mounted equipment (probes, dust transmitter etc.) shall also be designed for ambient air temperature > site max. temperature + 30°C.

2.7 Electrical Requirements

The system emission analyser and dust monitor must be provided with interface signals i.e. alarms, operation/status, on/off signals etc. for the remote DCS. BWSC must approve the signal exchange.

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TECHNICAL SPECIFICATION

Each of the measurements shall be transmitted to the emission reporting system (2031.M0.C52.001) as 4–20 mA signals or by an Ethernet interface protected i.e. Modbus TCP.

Electrical drawings for cable/wiring shall be part of the delivery. The drawings shall be submitted to BWSC for approval.

BWSC will provide the builder with a cable/wiring list. The builder shall use the cable and terminal identification numbers according to this list. These identification numbers shall also be included in the documentation.

Power supply : 400V–230V / 50Hz

The emission monitoring system shall be supplied by uninterruptible power supply (UPS) during blackout with minimum of 30 minutes.

UPS Power supply : 400V–230 V / 50 Hz

The supplier shall provide a list of electrical consumers in which level of voltage needs to be included.

The manufacturer shall do all the cabling, wiring on the purge air fan system and in the container unit. All cable glands to be of metal type. All cable penetrations to/from the container must be established with a cable frame, according to /16/ Electrical Installation Principles.

The main distribution board (A00HNE11 GA002) shall include motor starter for each purge air fan according to BWSC standard and will be controlled by the DCS with the following signals to the DCS system; Start order (RO), Fault (DI), In operation (DI).

The following signals must be hardwired direct to the DCS system and must be available in the signal interface Junction Box (A00HNE11 GA001):

- CEMS Container - Gas Detector (A00HNE11 CQ101)
- Flow switches – Purge air dust transmitter (A10HNE31 CF101 and A20HNE31 CF101)
- Purge air backup flow valve – Close order (A10HNE21 AA021 and A20HNE21 AA021)
- Common Alarms – CEMS equipment divided in to logical systems
- Fuel gas cut off valves – Close order

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2.8 Spare Parts

The following spare parts shall be quoted separately for inclusion in the scope of supply or ordered separately:

Commissioning Spare Parts:

- 1 set Commissioning spare parts consisting of wearing parts etc.

Recommended Spare Parts:

- 1 set Spare parts for 2 years operation, including list with itemized prices
- 1 set Spare parts for 5 years operation, including list with itemized prices
- 1 set Strategic spares, including list with itemized prices

Preservation of spare parts:
All spare parts shall be preserved and packed for 5 years indoor storage at applicable location at the power plant.

Itemized price lists:
Itemized lists with unit-prices shall be supplied, one for the 2 years spare parts and one for the strategic spare parts.

2.9 Installation

The supplier shall include as an option: Complete installation work for all items included in the scope of supply as for example cables, piping and probes on the Stack.

2.10 Commissioning and Training According to QAL3

The supplier shall include as an option support and supervisory on commission and start-up at site. Further a training course for the operators and maintenance section must be included to maintain and demonstrate the required quality of measured result during the normal operation of the AMS according to the Quality Assurance Level 3 (QAL3) of EN 14181.

Further shall the supplier include an option of the QAL3 third part test, this shall be performed by an accredited test organization to this type of measurements.

2.11 Quality Assurance Documentation Requirements

Requirements for QA documents, certificates, performance tests and type test certificates, inspections and tests, production planning and reporting, etc. is specified in the enclosed document – Factory Inspection / Test Plan, Doc. No. 2031.MQ.C50.001.

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BWSC shall be invited to participate in the inspections and tests taking place in the manufacturer as well as the sub-supplier's workshops. BWSC shall also have the right to inspect the manufacturer as well as the sub-supplier's workshops at any time as found necessary.

2.12 Technical Documentation Requirements

The drawings and documents are required as a minimum, but not limited to:
attachment /18/ 2031.MD.C52.001.

All drawings shall be furnished with title blocks provided by BWSC. Drawings shall be handed over in PDF and DWG format.

The supplier shall fill in technical data on excel data list which has been explained in attachment /27/ 6000.GI.310.0077.
Excel lists which have been mentioned in the attachment will be sent to the supplier after P&ID creation and each P&ID modification.

2.13 Labelling

All equipment, valves and instruments shall be labelled with BWSC tag numbers and in accordance with the enclosed document no. 2031.M0.023.001 – Labelling..

Identification must also be included in the drawings.

2.14 Service and maintenance

The supplier shall be prepared to offer instant service and maintenance on site in case of possible malfunction of the systems supplied by him. Verification of the supplier's service organisation in UK may be requested.

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3 Scope of Supply

The scope of supply for **CEMS System** consists of the following equipment for one (1) 80 m exhaust gas steel stack with two (2) flue gas pipes:

3.1 Gas Emission Analysing System

3 off	Emission analyser of NO, NO_2, HCl, CO, SO_2, O_2, H_2O and VOC as TOC
4 off	Sampling probes and heated sample line (approx. 30 meters) from stack gas Pipes
4 off	Connection/Communication box
1 lot	Special cable etc. (if needed)
1 lot	Counter flanges for above incl. pipe section for welding to stack
2 off	Fuel Gas pressure regulators and shut-off valves
1 lot	Calibration gases pressure regulators, shut-off valves and automatic calibration unit and including internal QAL3 adjustment filters
1 off	Automatic verification/calibration unit

3.2 Gas Emission Analysing System for raw gas HCl, SO_2 and O_2

2 off	Gas analyser of HCl, SO2 and O2
2 off	Sampling probes and heated sample line (approx. 30 meters) from duct to analyser
2 off	Connection/Communication box
2 lot	Special cable etc. (if needed)
2 lot	Counter flanges for above incl. pipe section for welding to stack
1 off	Automatic verification/calibration unit
2 off	Sampling probes and heated sample line (approx. 30 meters) for HCL-, SO2- and O_2 monitoring upstream of FGT.

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3.3 Dust Emission Analysing System

2 pc Dust sensor (scattered light principle)

1 pc Essential spare part for the dust sensor

2 off Purge air system, including two (1) purge air fan per system

1 lot Counter flange for above incl. pipe sections for welding to flue gas pipes

1 lot Special cable etc. (if needed) (Cable lengths to be informed by BWSC)

2 pc Flow switch to purge air system

2 pc Purge air backup supply valve (on/off)

1 pc Purge air backup supply regulation valve system

3.4 Flue Gas Flow Measurement System

2 off Flow sensor

2 off Connection / Communication box

2 set Counter flanges for above incl. pipe section for welding to flue gas pipe

1 lot Special cable etc. (if needed) (Cable lengths to be informed by BWSC)

3.5 CEMS Equipment

2 pc Temperature sensors incl. pockets (BWSC supply)

2 pc Pressure transmitters (BWSC supply)

1 lot Calibration gas

2 pc Data Communication Switch

2 pc Fiber Optic Connection Boxes (BWSC supply)

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4 Data Sheets

4.1 Gasifier Boiler

Make	:	**Kobelco**	
Nominal exhaust gas flow, wet @ 145°C, each flue gas pipe	:	**78,302**	Nm^3/h
Related normal exh. gas velocity in stack pipe	:	14-15	m/s
Maximum exhaust. gas flow, each flue gas pipe (ID fan max, not operation point)	:	**101,800**	Nm3/h
Related maximum exh. gas velocity in stack pipe	:	18-19	m/s
Exhaust gas temp.at 100% load	:	**145**	°C +/- 20°C
Maximum exhaust gas temp.at 110% load	:	**180**	°C +/- 20°C

4.2 Stack

Common stack height	:	**80**	**m**
Each flue gas pipe inner diameter	:	ø1,400	mm
Stack shell diameter	:	ø3,300	mm
Flue gas pipe thickness	:	5	mm
Flue gas pipe material	:	S355J2W	
Thickness of stack shell	:	_____	mm
Surface temperature at stack shell	:	max 60	°C

4.3 Control Instrument air (Supplied by BWSC)

Pressure	:	max. 8	bar(g)
Oil contents	:	max. 1	mg/m^3
Dew point	:	–40°	C
ISO 8573 Class	:	3.3.3	

(To be used for gas emission analyser and dust emission monitor and flow measurement for purge air back-up)

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4.4 Continuous Emission Monitoring System (CEMS) - Gas

4.4.1 Emission Transmitter of gas - Analyser

Equipment No	:	A10 HNE61 GH001 A20 HNE61 GH001 A00 HNE62 GH001
Make	:	_____
Type	:	_____

Sensor measuring principle:

- NO	:	_____
- NO_2	:	_____
- NH_3	:	_____
- CO	:	_____
- $C0_2$	.	_____
- H_2O	:	_____
- SO_2	:	_____
- HCl	:	_____
- HF (option)	:	_____
- N_2O	:	_____
- O_2	:	_____
- VOC	:	_____

Power supply capacity	:	_____kVA (V / 50Hz)
Protection class	:	IP 54
Dimensions (L x W x H)	:	_x__x_ mm
Weight	:	_____kg

Reference is made to attachment /3/ “Permit with introductory note (draft)” table S13, reference IC7 regarding precision requirements of QAL1, QAI2 and QAL3.

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4.4.2 Emission Transmitter of gas - Probe

Equipment No	:	A10HNE81 CQ011 / CQ012 A20HNE81 CQ011 / CQ012
Make	:	_____
Type	:	
Probe length	:	_____ m
Dimensions (L x W x H)	:	__×___ ×__ mm
Weight	:	App.__ kg (Without flange)

4.4.3 Connection Pipe

Connection	:	Special flange pipe
Diameter	:	ø_____
Length	:	To be informed by BWSC
Flange	:	_____

4.4.4 Gas Emission Transmitter

Equipment No	:	A10HNE81 CQ011 / CQ012 A20HNE81 CQ011 / CQ012
Make	:	_____
Type	:	_____
Calibration on	:	NO, NO_2, HCl, NH3, CO, CO_2, N_2O, HF, TOC, H_2O, SO_2 and O_2
App % of NOx, CO & NH3 used for process reg.	:	_____
Intervals for calibration with light filter	:	1–2 hour
Intervals for calibration with span gas	:	12 months
Type of calibration gas (Not part of delivery)	:	80% of measured ranges
Protection class	:	IP_____

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4.4.5 Communication boxes for gas probes	:	A10HNE61 GH011 A10HNE62 GH011 A20HNE61 GH011 A20HNE62 GN011
Make	:	_____
Type	:	_____
Protection class, min.	:	IP55

4.5 Continuous Emission Monitoring System (CEMS) – Dust

4.5.1 Emission Transmitter of dust

Equipment No	:	A10HNE81 CQ001 A10HNE81 CQ002 A20HNE81 CQ001 A20HNE81 CQ002
Make	:	_____
Type	:	_____
Sensor measuring principle:		
- Dust	:	_____
Measuring range (4-20 mA):		
- Particulates	:	0 - 200 mg/m3, wet
Accuracy	:	< 1% of range
Power supply capacity	:	___ V - 50Hz

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	Protection class	:	Minimum IP 65
4.5.2	Measuring head		
	Dimensions (L x W x H)	:	__x__x__mm
	Weight	:	App.____kg (Without flange)
4.5.3	Connection Pipe		
	Connection	:	Special flange pipe[9]
	Diameter	:	ø_____
	Length	:	To be informed by BWSC
	Flange	:	_____
4.5.4	Control and Display unit		
	Equipment No	:	A10HNE81 GH001 A10HNE81 GH002 A20HNE81 GH001 A20HNE81 GH002
	Make	:	_____
	Type	:	_____
	Dimensions (L x W x H)	:	_x_ x mm
	Weight	:	App.____ kg
4.5.5	Purge Air Fan		
	Number of fans	:	2 pcs
	Equipment No	:	A10HNE31 AN001 A20HNE31 AN001
	Make	:	_____
	Power supply capacity	:	_____
	Protection class, motor	:	Minimum IP 55

[9] If necessary, otherwise forward instruction for nozzle installation.

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	Connection	:	DN_____
	Dimensions (L x W x H)	:	__x__ x__ mm
	Weight	:	App.____ kg

4.5.6 Purge Air flow switch

	Number of switches	:	2 pcs
	Equipment No	:	A10HNE31 CF101 A20HNE31 CF101
	Make	:	_____
	Power supply capacity	:	_____
	Protection class	:	Minimum IP 65
	Connection	:	DN_____
	Cable connection	:	
	Output	:	_____
	Dimensions (L x W x H)	:	x x mm
	Materials Housing	:	
	Wet-side	:	
	Weight	:	Approx. kg

4.6 Continuous Emission Monitoring System (CEMS) - Flow

4.6.1 Emission Transmitter of flow

	Equipment No	:	A10HNE81 CF001 A20HNE81 CF001
	Make	:	_____
	Type	:	_____
	Sensor measuring principle:		
-	flow	:	Averaging pitot flow measurement
	Measuring range (4-20 mA):		
-	Flow	:	0 –_____m^3/hr

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	Accuracy	:	< 1% of range
	Power supply capacity	:	__ V - 50Hz
	Protection class	:	Minimum IP 65

4.6.2 Measuring head

	Dimensions (L x W x H)	:	__x__x__ mm
	Weight	:	Appr.___ kg (without flange)

4.6.3 Connection Pipe

	Connection	:	Special flange pipe[10]
	Diameter	:	_____
	Length	:	To be informed by BWSC
	Flange	:	_____

4.6.4 Control and Display unit

	Equipment No	:	A10HNE81GH011 A20HNE81GH011
	Make	:	_____
	Type	:	_____
	Dimensions (L x W x H)	:	__x__x__ mm
	Weight	:	Appr.___ kg

4.7 CEMS Equipment (Common)

4.7.1 Temperature sensor (BWSC Supply)

	Equipment No	:	A10HNE81 CT001 A20HNE81 CT001
	BWSC Standard	:	2031.M0.312.001

[10] If necessary, otherwise forward instruction for nozzle installation.

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	Measuring principle	:	Resistance thermometer (RTD) PT100 element with 3-wire connection.

4.7.2 Pressure transmitter (BWSC Supply)

Equipment No	:	A10HNE81 CP001 A20HNE81 CP001
BWSC Standard	:	2031.M0.332.001
Measuring principle	:	Pressure measurement based on the capacitance principle.

4.7.3 Fiber Optic Connect box - Container (BWSC Supply)

Equipment No	:	A00HNE11 GA001
Make	:	_____
Type	:	_____

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PROJECT : **Hooton Bio Power Plant** 2031 M0 C52 001 1
DATE : 2019.06.20 / 2019.07.03 PROJ. DOC.NO SHEET REV.
ISSUED BY : SJ APPROVED BY: LATO
SUBJECT : **Continuous Emission Monitoring System (CEMS) – Emission Reporting System**

TECHNICAL SPECIFICATION

Index

1. General Specification

2. General Requirements & Conditions

3. Scope of Supply

4. Attachments:

Please see main specification – 2031.M0.C50.001.

/30/ 2031.MQ.C52.001, rev. 0 Quality Assurance Requirements
/18/ 2031.MD.C52.001, rev. 0 Technical Documentation

All references to any attachment in this specification shall be of the latest version.

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TECHNICAL SPECIFICATION

1 General Specification

The work covered by this specification comprises the design, manufacture, supply, complete workshop test, complete documentation, performance and quality assurance of the Continuous Emission Monitoring System (CEMS) specified in the data sheets.

The specification of the Continuous Emission Monitoring System (CEMS) is covered by 3 (three) sub specifications:

- 2031.M0.C50.001: Continuous Emission Monitoring System (CEMS)
- 2031.M0.C51.001: CEMS - Analyzer house
- 2031.M0.C52.001: CEMS – Emission reporting system (This specification)

This specification with all attachments gives the minimum technical requirements for the design, manufacture, supply, performance and quality assurance.

The CEMS - Emission reporting system is monitoring, logging and reporting the gas components measured by the CEMS equipment (Tech. Spec. 2031.M0.C50.001): NO, NO_2, NO_x(calculated)[1],SO_2[2], HCl[3], CO[4], H_2O, TOC / VOC[5], and O_2. Further pressure, temperature, volume flow, and dust concentration in the exhaust gas are to be measured and recorded.

The CEMS - Emission reporting system will be located in the central control room (CCR).

The CEMS system shall be designed and constructed in accordance with DIN / EN standards. The CEMS reporting system shall be in compliance with the Environment Agency Technical Guidance (UK) for “Continuous monitoring of industrial chimneys, stacks and flues (MCERT)”.

The CEMS system shall be designed according to Industrial Emissions Directive 2010.

---

[1] Nitrogen Oxides. NO_X as NO_2

[2] Sulphur dioxide

[3] Hydrogen chloride

[4] Carbon monoxide

[5] Volatile Organic Compounds

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The equipment shall be CE marked.

The emission reporting and calculator shall record all measurement values at actual condition and normalized as well as system status from the monitoring systems. Further shall the system be able to calculate the mass emission for each gas component.

The CEMS system shall be certified, calibrated and validated to meet the equivalent certification scheme. Further shall the CEMS system be functional tested according to the Quality Assurance Level 3 (QAL3) and Annual Surveillance Test (AST) by accredited test organization.

A full access to the reporting system must be available in the CEMS container and partly in the plant manager's office, operation manager's office via the DCS.

All values and status signals shall be transferred to the plant control system (DCS).

1.1 Codes and Standards

EN:	European Standard
DIN:	Deutsche Industrie Norm
ISO:	International Organization for Standardization
EA:	Environment Agency

In particular with:

- 98/37/EC Machinery Directive
- EA M1 Environment Agency Technical Guidance Note M1
- EA M2 Environment Agency Technical Guidance Note M2
- EN 15267 Air quality - Certification of automated measuring systems
- EN 14181 Stationary source emissions - Quality assurance of automated measuring systems
- EN 14956 Air quality. Evaluation of the suitability of a measurement procedure by comparison with a required measurement uncertainty
- 2010/75/EU Industrial Emission Directive
- 2001/80/EC The limitation of emission of certain pollutants into the air from large Combustion Plant
- MCERTS Monitoring Certification Scheme

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1.2 Erection of unit

Technical drawings shall be submitted to BWSC for approval before start of fabrication.

The panel shall be provided with pipe and cable way supports.

1.3 Drawings

Final drawings of the panel shall be submitted for approval to BWSC.

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2 General Requirements & Conditions

2.1 Warranty

The guarantee period is 24 months from the date of hand over to final user.

The estimated handover date at site is expected to be: 2021.07.25

2.2 Ambient conditions

The reporting system must be ventilated, but equipment/panels should be designed for surrounding temperatures > site max. temperature + 20°C and include margin for internal heat dissipation in cabinets.

2.3 Electrical Requirements

The CEMS reporting system must be provided with common alarm, watch dog and operation/status on/off signal for the remote DCS. BWSC must approve the signal exchange.

Each of the measurements shall be transmitted to the emission reporting system (2031.M0.C52.001) as 4–20 mA signals or by TCP/IP serial link according to 2031.E1.B01 General specification for I&C for package units with control.

The measurements shall be transmitted from the emission reporting system to the DCS system by redundant OPC and hardwired signals according to 2031.E1.B01.001 General specification for I&C for package units with control.

Power supply : 400 V or 230 V / 50 Hz

IT-Requirements

PC Servers shall be delivered as a virtual machine compliant with VMware 5.5. BWSC will then add these servers to the virtual environment of the overall DCS-system.

Hardware dongles should be avoided.

Clients and Servers should preferable be enrolled into the overall DCS windows domain (Windows 2012 AD)

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BWSC will push antivirus software to all CEMS windows clients in the domain. McAfee Endpoint protection will be used. Any antivirus exceptions needed by the CMES software must be agreed upon.

BWSC will patch all windows servers with approved Microsoft security patches several times a year. If the CEMS software does not accept that further steps needs to be taken.

2.4 Commissioning and Training according to QAL3

The supplier shall include commission and start-up on site. Further a training course for the operators and maintenance section must be included to maintain and demonstrate the required quality of measured result during the normal operation according to the Quality Assurance Level 3 (QAL3) with reference to EN 14181.

2.5 Quality Assurance Documentation Requirements

Requirements for QA documents, certificates, performance tests and type test certificates, inspections and tests, production planning and reporting, etc. is specified in the enclosed document – Factory Inspection / Test Plan, Doc. No. 2031.MQ.C52.001.

BWSC shall be invited to participate in the inspections and tests taking place in the manufacturer as well as the sub-supplier's workshops. BWSC shall also have the right to inspect the manufacturer as well as the sub-supplier's workshops at any time as found necessary.

2.6 Technical Documentation Requirements

The drawings and documents are required as a minimum, but not limited to:
Which are mentioned in attachment /16/ 2031.MD.C52.001.

All drawings shall be furnished with title blocks provided by BWSC. Drawings shall be handed over in PDF and DWG format.

The supplier shall fill in technical data on excel data list which has been explained in attachment /27/ 6000.GI.310.0077.
Excel lists which have been mentioned in the attachment will be sent to the supplier after P&ID creation and each P&ID modification.

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2.7 Labelling

All equipment, valves and instruments shall be labelled with BWSC TAG. Nos., and in accordance with the enclosed document /10/ – 2031.M0.023.001 – Labelling.

Identification must also be included in the drawings.

2.8 Interface Communication Test (at BWSC office)

An interface communication test must be held at BWSC office in Denmark at supplier expense. The Supplier is expected to bring PLC's, servers/workstations and other communication equipment used by the CEMS.

The purpose of this test is to assure all interfaces between CEMS system and the overall DCS is working and in compliant with the contract.

The following items will be tested:

1. Watchdog agreement.
2. Redundant fieldbus and OPC communication failover and recovery.
3. NTP Time synchronization.
4. Remote connection setup is working and in compliance with BWSC requirements.
5. OPC typical test.
6. Backup and restore procedures.

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3 Scope of Supply (regarding CEMS Reporting System)

3.1 Data Logging

The report system shall be designed to logging off emission values: NO, NO_2, NO_x (Calculated), N_2O (Option), VOC, SO_2, HCl, HF, CO, CO_2, NH_3, H_2O, O_2, pressure, temperature, volume flow (incl. Nm^3/h at actual % O_2 and at 11% O_2 (dry)) and dust concentration.

The reporting system shall provide logging and trending of raw data, and corrected data, including archiving, trends and mass emission calculations.

The reporting system shall store at least one-minute averages of the raw data as the basis for the 30-minute averages. All measured parameters and status signals shall be repeated via a TCP/IP serial link to the DCS system.

Evaluation of percentile, minima, maxima and mean averages of all measured valves.

The system shall allow the option for a second report when no fuel was being processed; the report shall be separately stamped and excluded from the analysis for reporting purposes.

The system shall be designed to evaluate and reporting according to Environment Agency (UK) MCERTS requirements.

The CEMS reporting system shall have the functionality to initiate an auto calibration for zero and span as well as self-diagnostic functions. Further carry out of QAL3 checks.

It shall be possible to extract data to accessible files in MS Excel-compatible format. The time interval of interest shall be defined by the operator. The Excel data, period and measurement interval selection, import and analysis functions shall be pre-programmed.

A full back-up data storage system shall be supplied capable to storing minimum one year's worth of data (both raw and normalized). The system shall have the ability to transfer defined data to a network shared folder and an external storage media.

The final calculations of the CEMS reporting system shall be submitted for approval to BWSC.

The CEMS reporting system must communicate with the DCS system, and all main values (raw, corrected, total mass and status) must be transferred by a TCP/IP serial link.

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3.2 Plant operation logging

The reporting system shall beside the emission monitoring also log operating / fault condition information on:

a) Boilers (2 off) on / off
b) Fault condition

Note that additional requirements might be added during the final engineering.

3.3 Reporting

The system shall be able to make reports for each day, one per week, one per month, one per quarter and a yearly summary on an automatic basis.

The reports shall as a minimum include the following evaluations:

- 30 minute moving average
- Daily moving average
- Monthly average
- Mass emissions per day and summarising period
- Evaluation of valid / void data
- Evaluation of minima, maxima and means
- Evaluation of operating hours of boiler, auxiliary burners, flue gas treatment, by-pass operation.
- Evaluation of the facility has complied the regulatory limits that will be defined in the operating license of values

All reports shall be printed and stored electronically in ".PDF" format.

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4 Data Sheet

4.1 CEMS Reporting PC/Primary data server (if not virtual)

Equipment No	:	_____
Make	:	_____
Type	:	_____
Power supply capacity	:	
Protection class	:	IP 54
Mounting type	:	19” type
Dimensions (L x W x H)	:	_x__ x__ mm
Weight	:	Appr.___ kg

4.2 CEMS Data logging PC/Secondary data server (If not virtual)

Equipment No	:	_____
Make	:	_____
Type	:	_____
Power supply capacity	:	
Mounting type	:	19” type
Protection class	:	IP 54
Dimensions (L x W x H)	:	_x__x__mm
Weight	:	Appr.____kg

4.3 Communication Switch - CCR

Equipment No	:	_____
Make	:	_____
Type	:	_____
Mounting type	:	19” type
Protection class	:	IP 54

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	Dimensions (L x W x H)	:	_x_ x_ mm
	Weight	:	Appr.___ kg

4.4 CEMS Reporting PC Monitor (if provided)

Equipment No	:	_____
Type	:	min 24” type
Make	:	Dell[6]
Protection class	:	IP 54

[6] Preferred supplier

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DATE : 2019.06.19 / 2019.07.25 PROJ. DOC.NO SHEET REV.
ISSUED BY : SJ APPROVED BY: LATO
SUBJECT : **Continuous Emission Monitoring System (CEMS)** PAGE 1 OF 25

TECHNICAL SPECIFICATION

1. General Specification Page 2
2. General Requirements & Conditions Page 8
3. Scope of Supply Page 15
4. Data Sheets Page 17

Attachments:

/1/	Part 21; sect.15, rev.0	Continuous Emission Monitoring System (CEMS)
/2/	Parts 22, sect. 5.8, rev.P2	SNCR DeNOx system
/3/	Annex 1, App.2, sect.3, rev.0	Permit with introductory note (draft)
/4/	TGN M1, version 8	Sampling req. for stack emission monitoring
/5/	Appendix 5, GFE408, rev.0	Atmospheric Dispersion Modelling Report
/6/	2031.M0.002.001, rev.0	General Conditions
/7/	2031.S0.Z01.001, rev.1	Site Data
/8/	2031.S1.004.002, rev.1	Project Design Criteria, Civil and Seismic Design
/9/	2031.M0.013.001, rev 2	Surface Treatment for Mechanical Equipment
/10/	2031.M0.023.001, rev 0	Labeling and pipe marking KKS
/11/	2031.KG.300.011, rev.3	Guideline for KKS use in BWSC
/12/	2031.E1.B01.001, rev.1	General Specification for Instrumentation and Control
/13/	2031.E1.X01.001, rev.0	General Specification for OEM Panels
/14/	2031.E1.X02.001, rev.3	Spec. for 3-Phase Low Voltage Induction Motors
/15/	2031.E1.X05.001, rev.1	General Electrical Design Conditions
/16/	2031.E4.R01.001, rev.3	Electrical Installation Principles
/17/	2031.M0.600.010, rev.0	Mapress stainless steel pipes (A2 350)
/18/	2031.MD.C52.001, rev.0	Technical Documentation
/19/	2031.MQ.C50.001, rev.0	Quality Assurance Requirements
/20/	2031.MU.C50.001, rev 0	Demands to Sub-suppliers CE-marking
/21/	2031.S2.R01.001, rev.1	Capacity diagram: Flue gas and abatement system
/22/	2031.M2.C02.001, rev.1	Stack and Emission Monitoring P&ID (draft)
/23/	2031.M2.C02.002, rev.2	Emission Monitoring P&ID (draft)
/24/	2031.D2.434.001, rev.0	Flue gas treatment area layout, top view
/25/	2031.D2.423.001, rev.0	Flue gas treatment area layout, sect. G-G look west
/26/	533159-102-1030, rev.0	Steel Stack GA
/27/	6000.GI.310.0077	Comos Instruction
/28/	Sketch	Raw gas measurement platform

All references to any attachment in this specification shall be of the latest version

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TECHNICAL SPECIFICATION

1 General Specification

The work covered by this specification comprises the design, manufacture, supply, complete workshop test, complete documentation, performance and quality assurance of the stack Continuous Emission Monitoring System (CEMS) and the raw gas measurement as specified in the data sheets.

The specification of the Continuous Emission Monitoring System (CEMS) and the raw gas measurement is covered by this actual specification:

- 2031.M0.C50.001: Continuous Emission Monitoring System (CEMS) and 2 additional sub-specifications:
- 2031.M0.C51.001: CEMS - Analyzer House
- 2031.M0.C52.001: CEMS - Emission Reporting System

This specification with all attachments gives the minimum technical requirements for the design, manufacture, supply, performance and quality assurance.

The CEMS system is monitoring the exhaust gas components from a Renewable Energy Plant consisting of two (2) Kobelco boilers, each approx. 57.5 tons/hr steam production. Each boiler is burning waste and consists of a gasifier furnace and a melting furnace. The exhaust gas pipe from each boiler is connected to its dedicated flue gas pipe in the common stack through a FGT reactor and a fabric filter installation with lime injection.

The CEMS gas analysis shall consist of 1 CEMS analysis system per stack pipe (2 off) and in addition 1 CEMS analysis system acting as a redundant system to either of these 2 CEMS analysis systems. Thus, there will be three CEMS systems in total (automatic switchover system to common (redundant) CEMS analyser). Switching over time to be within 10 minutes.
Each of these three CEMS must measure continuously the gaseous components: NO, NO_2, NO_x (calculated)[1], SO_2[2], HCl[3], CO[4], CO_2[5], NH_3[6], H_2O, O_2[7], N_2O[8], TOC[10] / VOC[11] and H_2O[12].

[1] Nitrogen oxides NO_X as NO_2,
[2] Sulphur dioxide
[3] Hydrogen chloride
[4] Carbon monoxide
[5] Carbon dioxide
[6] Ammonia
[7] Oxygen
8 Nitrous oxine
[10] Total organic carbon
[11] Volative organic compound
[12] Moisture

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Measurement of HF[9], Hg[13] and dioxin / furans shall be separately quoted as options.

Redundant dust analysing with purge air fans shall be included, i.e. 2 dust analyzers in each flue gas pipe, - and 2 purge air fans for each flue gas pipe. Reference is made to section 3 of this specification.

The stack monitoring system shall also include pressure (BWSC supply), stack temperature (BWSC supply), volume flow and a redundant dust measurement in each flue gas pipe.

Further a raw gas analysis shall include and be complete for continuous simultaneous monitoring of HCl and SO_2 in raw exhaust gas upstream of each of the two (2) FGTs. Reference is made to attached capacity diagram /21/ 2031.S2.R0.001 and sketch /28/ "Raw gas measurement platform" with approximate dimensions added. The raw gas duct is vertical leading to a flue gas cooler. Raw gas analyser cabinets may be situated on the "Raw gas measurement platforms", and / or may be placed on the opposite side of the flue gas coolers.
Optional prices to be quoted for O_2, H_20, NO_x in situ laser type analyser and NH_3 in situ laser type analyser for each flue gas pipe.

Basically, the CEMS system (stack) will be located at the bottom of the plant stack in a shelter/house unit (Technical Specification 2031.M0.C51.001). The shelter/house will contain the monitoring system for the exhaust gas stack and the auxiliary equipment for the CEMS system.
However, an option shall be provided for alternative location of the CEMS system in the FGT area electrical room.

Gaseous components shall be monitored continuously by an extractive system analyser for each flue gas pipe in the exhaust gas stack.

The system shall consider the characteristics of mainly householding waste exhaust gas with gas conditioning and materials ensuring trouble free operation with the rather corrosive nature and high concentrations of pollutants found in such waste exhaust (see subsequent sections for details).

The flue gas probes will be mounted outdoors on the stack at a platform with the instruments on the stack and in each flue gas pipe. The installations will be protected against direct snow, rain and sun exposure by roof covers (by others).

[9] Hydrogen fluoride [13]Mercury

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Weather conditions are according to /7/ 2031.S0.Z01.001, rev.1 Site Data". The CEMS shelter/house shall be installed with ventilation fan(s) and dual Air-Conditioners or heat pumps.

Finally, the system (especially the analyzing equipment, and sensors located in the plant stack and flue gas pipes mentioned above) shall be designed to cope with the rather wet and hot environment that may exist on the stack during the change of seasons.

The CEMS system and the raw gas analysis shall be designed and constructed in accordance with DIN / EN standards. Further all CEMS analyzer equipment such as gas analyzers, dust and flow must be approved and certified with a valid certification according to MCERTS Certified Products: Continuous Emission Monitoring System and Transportable-CEMs.

The equipment shall be CE marked according to 2031.MU.C50.001: "Demands to Sub-suppliers CE-marking".

Gas Emission Analyzing System, Dust Emission Analyzing System and Volume flow Emission Analyzing System shall include control and display equipment.

The CEMS system shall include an emission calculator system (Technical Specification 2031.M0.C52.001), if such equipment is required for British waste incineration plants. The calculator shall be located in the plant central control room. The emission calculator shall record all measurement values at actual condition and normalized ((T,P), ref. O2, dry and confidence intervals and with QAL2 values inserted in DCS) as well as system status from the monitoring systems. The system must allow for automatic mail sending of emission reports the British environmental agency.

A full access to the reporting system must be available in the CEMS container and partly in the plant manager's office, operation manager's office via the DCS.

The CEMS system shall be certified, calibrated and validated to meet the equivalent certification scheme: Certification according to QAL1, calibration according to QAL 2, CEMS system functional tested according to the QAL3, and Annual Surveillance Test (AST) by accredited test organization.

All values and status signals shall be transferred to the plant control system (DCS).

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TECHNICAL SPECIFICATION

1.1 Requirements

All equipment, fittings etc. must be fabricated fully in accordance with attachment to this specification as well as common description for all units.

All piping for compressed air must be stainless steel 1.4401 accordance with the enclosed document:

/17/ 2031.M0.600.010, rev.0 Mapress stainless steel pipes (A2 350)

Sampling lines must be in PTFE or high-alloy steel and be heat traced. Alternatively, sampling lines of a material recommend by supplier may be quoted optionally.

Calibration gas / flue gas pipes may be supplier's standard.

Gas sampling system must be with heated sample lines.

1.2 Codes and Standards

EN:	European Standard
DIN:	Deutsche Industrie Norm
ISO:	International Organization for Standardization
BS:	British Standard
EA:	Environment Agency (UK)

In particular, - the following directives and standards shall be observed and complied with:

- 98/37/EC Machinery Directive
- EN 15267–3 Air quality - Certification of automated measuring systems
- EN 13284 Stationary source emissions. Determination of low range mass concentration of dust. Manual gravimetric method
- EN 14181 Stationary source emissions - Quality assurance of automated measuring systems
- EN 14956 Air quality. Evaluation of the suitability of a measurement procedure by comparison with a required measurement uncertainty
- ISO 15713 Stationary Source Emissions – Sampling and determination of gaseous fluoride content
- ISO 17025 General requirements for the competence of testing and calibration laboratories
- 2008/1/EC IPPC Directive (Integrated Pollution Prevention and Control)
- 2010/75/EU Industrial Emission Directive

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- 2003/87/EC Emissions Trading Directive
- M1/EA M1 – Sampling requirements for stack emissions monitoring
- M2/EA M2 – Monitoring of stack emissions to air
- MCERT Environment Agency's Monitoring Certification Scheme

1.3 Erection of Unit

Technical drawings shall be submitted to BWSC for approval before start of fabrication.

The components/pipe connections shall be aligned without any stress.

The units/panels shall be provided with pipe and cable way supports.

1.4 Drawings

Final drawings of the container and panels shall be submitted for approval to BWSC.

The CEMS supplier shall:

- give inputs to nozzle sizes and positions.
- review and approve the final stack drawing with nozzle positions (BWSC Scope).

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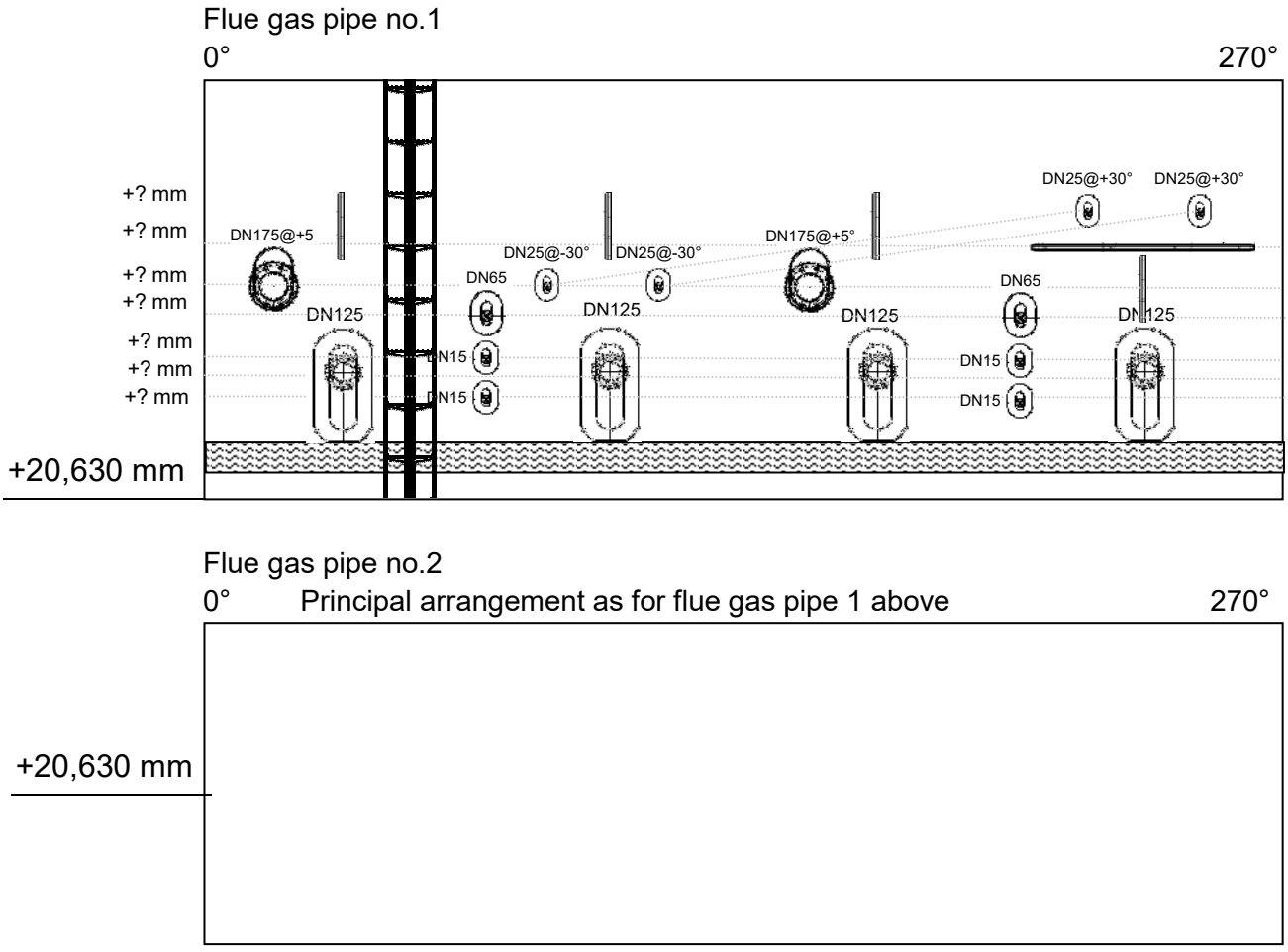
Emission Platform Layout (Preliminary example sketch only)



1.5 Excluded in Scope

- All DN15 and DN125 nozzles (supplied by stack supplier).

1.6 Transportation and Storage

All connections on the container unit shall be sealed and blanked of with a wooden plate or similar for transportation and storage on site.

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1.7 Explosive area classification

As the creation of an explosive gas atmosphere is prevented by the ventilation system, the CEMS container is unclassified.
The gas bottle cage will be classified EX zone 2 and signed off.

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2 General Requirements & Conditions

2.1 Warranty

The guarantee period is 24 months from the date of hand over to final user (TOC).

The targeted handover date at site is: Medio 2021

2.2 Measuring Principles

According to contract specification the analyzers/sensors employed must be of following types:

- O_2 sensor	:	Supplier to suggest accurate principle
- NO	:	Supplier to suggest accurate principle
- NO_2	:	Supplier to suggest accurate principle
- CO	:	Supplier to suggest accurate principle
- CO^2	:	Supplier to suggest accurate principle
- SO_2	:	Supplier to suggest accurate principle
- H_2O	:	Supplier to suggest accurate principle
- NH^3	:	Supplier to suggest accurate principle
- HCl	:	Supplier to suggest accurate principle
- HF (option)	:	Supplier to suggest accurate principle
- N_2O	:	Supplier to suggest accurate principle
- VOC / TOC	:	FIT / FID sensor or as suggested by supplier
- Substitute PM	:	Scattered light principle
- Temperature	:	Thermocouple/resistance thermometer
- Pressure	:	Transmitter
- Volume flow	:	Averaging pitot flow measurement preferred. MCERTS compatibility is not required

2.3 Measuring Ranges

Measuring ranges shall be as follows:(to be verified)

O_2	:	0 – 21 vol.%, dry
NO	:	0 – 400 mg/Nm^3, dry at ref. 11% O_2
NO_2	:	0 – 400 mg/Nm^3, dry at ref. 11% O_2
NO_x [8]	:	0 – 600 mg/Nm^3, dry at ref. 11% O_2

[8] NO_x to be calculated from NO and NO_2

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NH_3	:	0 – 60 mg/Nm^3, dry at ref. 11% O_2
HCl	:	0 – 300 mg/Nm^3, dry at ref. 11% O_2
CO	:	0 – 400 mg/Nm^3, dry at ref. 11% O_2
SO_2	:	0 – 500 mg/Nm³, dry at ref. 11% O_2
VOC	:	0 – 70 mg/Nm³, dry at ref. 11% O_2
HF (option)	:	0 – 20 mg/Nm³, dry at ref. 11% O_2
H_2O	:	0 – 20 vol.%
N_2O	:	0 – 50 mg/Nm^3, dry at ref. 11% O_2

Scattered light refl. : 0 – 200 mg/Nm^3, dry at ref. 11% O_2

Exhaust gas data:

Temperature	:	0 – 180°C
Design temperature	:	200°C
Pressure	:	0.7 – 1.3 bar(a)
Nominal wet flow, @145°C, each pipe	:	0 – 78,302Nm³/hr
Max. wet flow, @145°C, each pipe	:	0 – 101,800 Nm³/hr

All measurements will be measured at actual conditions and will be rectify by the emission reporting system to standard reference conditions: Dry exhaust gas at 273 K, 101.3 kPa(a) with 11%vol O_2.

The system shall include automatic calibration routines.

2.4 Exhaust Gas Conditions

The exhaust gas will be supplied by household waste gasification boilers through an exhaust gas system with a flue gas desulphurisation (FGD), fabric filter (FF) and finally an ID fan.

Sampling / measurement point will be in the stack pipe downstream of the boiler, the FGD and ID fan.

2.4.1 Flue Gas Temperature

Normal temperature at the point of sampling is expected to be between 130°C and 180°C (normal ~145°C).

Measuring system shall be designed for an exhaust gas temperature up to minimum of 200°C.

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2.4.2 Exhaust Gas Components

For guidance following composition/characteristics are expected, operating on household waste after NO_X reduction in SNCR and particle as well as acid gas removal in a bag house filter:

Expected exhaust gas inlet data to each flue gas pipe of the stack:

	Flowsheet reference	G1 FGC exit					
	Load case	Case A *3	Case G *4	Case I *5	Case Min *6	Case Acid ratio*7	Case BREF*8
Mass flow-Solids	kg/h	407	386	1383	224	1383	1383
Mass flow-Liquids	kg/h	0	0	0	0	0	0
Mass flow-Gas	kg/h	100,227	95,496	110,042	55,125	110,042	110,042
Mass flow-Total	kg/h	100,634	95,882	111,425	55,349	111,425	111,425
Flue gas flow	Nm^3/h, dry	66,246	63,539	72,067	36,436	72,067	72,067
Flue gas flow	Nm^3/h, wet	78,302	74,261	86,443	43,066	86,443	86,443
Flue gas flow	Nm^3/h, dry, 11% O_2	101,443	98,460	109,825	55,793	109,825	109,825
Actual flow	Am^3/h, wet	126,667	119,805	140,665	68,382	140,665	140,665
Temperature	°C	155	155	155	155	155	155
Pressure*2	Pa	-3,145	-2,879	-3,724	-1,300	-3,724	-3,724
Density gas	kg/Nm^3, wet	1.280	1.286	1.273	1.280	1.273	1.273
Density gas	kg/m^3	0.791	0.797	0.782	0.806	0.782	0.782
Dust load	mg/Nm3, dry	6,146	6,077	19,192	6,146	19,192	19,192
Dust load	mg/Nm3, dry, 11% O2	4,014	3,922	12,594	4,014	12,594	12,594
Dust load	mg/Nm^3, wet	5,200	5,200	16,000	5,200	16,000	16,000
Dust load	mg/m^3, wet	3,215	3,223	9,833	3,275	9,833	9,833
CO_2	Vol%, dry	13.47	13.63	13.41	13.47	13.41	13.41
CO_2	Vol%, wet	12.71	12.88	12.63	12.71	12.63	12.63
O_2	Vol%, dry	5.69	5.50	5.76	5.69	5.76	5.76
O_2	Vol%, wet	4.8	4.71	4.8	4.8	4.8	4.8
H_2O	Vol%	15.40	14.44	16.63	15.40	16.63	16.63
N_2 + Ar	Vol%, wet	68.39	69.19	67.39	68.39	67.39	67.39
SO_2	mg/Nm^3, dry, 11% O_2	486	854	854	486	854	854
HCl	mg/Nm^3, dry, 11% O_2	1,101	1,930	1,930	1,101	427	1,930
HF	mg/Nm^3, dry, 11% O_2	27.5	50	50	27.5	50	50
NO_x (as NO_2)*1	mg/Nm^3, dry, 11% O_2	200	200	200	200	200	200
CO*1	mg/Nm^3, dry, 11% O_2	50	50	50	50	50	50
NH_3*1	mg/Nm^3, dry, 11% O_2	30	30	30	30	30	30
TOC	mg/Nm^3, dry, 11% O_2	No proces data available and FGT SUPPLIER are to provide system with PAC capacities per prior design to waste incineration.					
Cd + Tl	mg/Nm^3, dry, 11% O_2						
Hg	mg/Nm^3, dry, 11% O_2						
Metals	mg/Nm^3, dry, 11% O_2						
Dioxin/Furans	$ngTEQ/Nm^3$dry, 11% O_2						
Solid flow	kg/h						
Density solids	kg/m3						
Req. volume	net m3/X days						
Duct velocity @ diameter *9	m/s	18.6	17.6	20.7	10.1	20.7	20.7
Duct diameter (Design)	mm	1550	1550	1550	1550	1550	1550
Temp max (Mech. design)	°C	200					
Pressure max (design)	Pa	-4,970					
Days of storage @ Case A							

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Emission requirements (daily average values only) are expected to be as listed in below table. Values may then be considered as being input data as well.

		G10 **Stack exit**					
		Case A *3	Case G *4	Case I *5	Case Min *6	Case Acid ratio	Case BREF
Dust load	mg/Nm3, dry, 11% O2	<10	<10	<10	<10	<10	<5
SO_2	mg/Nm³, dry, 11% O_2	< 50	< 50	< 50	< 50	< 50	< 30
HCl	mg/Nm³, dry, 11% O_2	< 10	< 10	< 10	< 10	< 10	< 6
HF	mg/Nm³, dry, 11% O_2	< 1	< 1	< 1	< 1	< 1	< 1
NO_x (as NO_2)*1	mg/Nm³, dry, 11% O_2	< 200	< 200	< 200	< 200	< 200	< 120
CO*1	mg/Nm³, dry, 11% O_2	< 50	< 50	< 50	< 50	< 50	< 50
NH_3*1	mg/Nm³, dry, 11% O_2	< 30	< 30	< 30	< 30	< 30	< 10
TOC	mg/Nm³, dry, 11% O_2	< 10	< 10	< 10	< 10	< 10	< 10
Cd + Tl	mg/Nm³, dry, 11% O_2	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,02
Hg	mg/Nm³, dry, 11% O_2	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,025
Metals	mg/Nm³, dry, 11% O_2	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,3
Dioxin/Furans	ngTEQ/Nm³dry, 11% O_2	0.1	0.1	0.1	0.1	0.1	0.06

Above PM emission to be measured indirectly and correlated with sampling according to EN 13284-1.

2.5 Other Conditions

Note that measuring range may be slightly redefined after order.

2.6 Ambient Conditions

The analyzer unit will be ventilated, but equipment/cabinets should be designed for surrounding temperatures > site max. temperature +20°C and include margin for internal heat dissipation in cabinets.

Stack mounted equipment (probes, dust transmitter etc.) shall also be designed for ambient air temperature > site max. temperature + 30°C.

2.7 Electrical Requirements

The system emission analyser and dust monitor must be provided with interface signals i.e. alarms, operation/status, on/off signals etc. for the remote DCS. BWSC must approve the signal exchange.

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Each of the measurements shall be transmitted to the emission reporting system (2031.M0.C52.001) as 4–20 mA signals or by an Ethernet interface protected i.e. Modbus TCP.

Electrical drawings for cable/wiring shall be part of the delivery. The drawings shall be submitted to BWSC for approval.

BWSC will provide the builder with a cable/wiring list. The builder shall use the cable and terminal identification numbers according to this list. These identification numbers shall also be included in the documentation.

Power supply : 400V–230V / 50Hz

The emission monitoring system shall be supplied by uninterruptible power supply (UPS) during blackout with minimum of 30 minutes.

UPS Power supply : 400V–230 V / 50 Hz

The supplier shall provide a list of electrical consumers in which level of voltage needs to be included.

The manufacturer shall do all the cabling, wiring on the purge air fan system and in the container unit. All cable glands to be of metal type. All cable penetrations to/from the container must be established with a cable frame, according to /16/ Electrical Installation Principles.

The main distribution board (A00HNE11 GA002) shall include motor starter for each purge air fan according to BWSC standard and will be controlled by the DCS with the following signals to the DCS system; Start order (RO), Fault (DI), In operation (DI).

The following signals must be hardwired direct to the DCS system and must be available in the signal interface Junction Box (A00HNE11 GA001):

- CEMS Container - Gas Detector (A00HNE11 CQ101)
- Flow switches – Purge air dust transmitter (A10HNE31 CF101 and A20HNE31 CF101)
- Purge air backup flow valve – Close order (A10HNE21 AA021 and A20HNE21 AA021)
- Common Alarms – CEMS equipment divided in to logical systems
- Fuel gas cut off valves – Close order

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2.8 Spare Parts

The following spare parts shall be quoted separately for inclusion in the scope of supply or ordered separately:

Commissioning Spare Parts:

- 1 set Commissioning spare parts consisting of wearing parts etc.

Recommended Spare Parts:

- 1 set Spare parts for 2 years operation, including list with itemized prices
- 1 set Spare parts for 5 years operation, including list with itemized prices
- 1 set Strategic spares, including list with itemized prices

Preservation of spare parts:
All spare parts shall be preserved and packed for 5 years indoor storage at applicable location at the power plant.

Itemized price lists:
Itemized lists with unit-prices shall be supplied, one for the 2 years spare parts and one for the strategic spare parts.

2.9 Installation

The supplier shall include as an option: Complete installation work for all items included in the scope of supply as for example cables, piping and probes on the Stack.

2.10 Commissioning and Training According to QAL3

The supplier shall include as an option support and supervisory on commission and start-up at site. Further a training course for the operators and maintenance section must be included to maintain and demonstrate the required quality of measured result during the normal operation of the AMS according to the Quality Assurance Level 3 (QAL3) of EN 14181.

Further shall the supplier include an option of the QAL3 third part test, this shall be performed by an accredited test organization to this type of measurements.

2.11 Quality Assurance Documentation Requirements

Requirements for QA documents, certificates, performance tests and type test certificates, inspections and tests, production planning and reporting, etc. is specified in the enclosed document – Factory Inspection / Test Plan, Doc. No. 2031.MQ.C50.001.

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BWSC shall be invited to participate in the inspections and tests taking place in the manufacturer as well as the sub-supplier's workshops. BWSC shall also have the right to inspect the manufacturer as well as the sub-supplier's workshops at any time as found necessary.

2.12 Technical Documentation Requirements

The drawings and documents are required as a minimum, but not limited to:
attachment /18/ 2031.MD.C52.001.

All drawings shall be furnished with title blocks provided by BWSC. Drawings shall be handed over in PDF and DWG format.

The supplier shall fill in technical data on excel data list which has been explained in attachment /27/ 6000.GI.310.0077.
Excel lists which have been mentioned in the attachment will be sent to the supplier after P&ID creation and each P&ID modification.

2.13 Labelling

All equipment, valves and instruments shall be labelled with BWSC tag numbers and in accordance with the enclosed document no. 2031.M0.023.001 – Labelling..

Identification must also be included in the drawings.

2.14 Service and maintenance

The supplier shall be prepared to offer instant service and maintenance on site in case of possible malfunction of the systems supplied by him. Verification of the supplier's service organisation in UK may be requested.

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3 Scope of Supply

The scope of supply for **CEMS System** consists of the following equipment for one (1) 80 m exhaust gas steel stack with two (2) flue gas pipes:

3.1 Gas Emission Analysing System

3 off	Emission analyser of NO, NO_2, HCl, CO, SO_2, O_2, H_2O and VOC as TOC
4 off	Sampling probes and heated sample line (approx. 30 meters) from stack gas Pipes
4 off	Connection/Communication box
1 lot	Special cable etc. (if needed)
1 lot	Counter flanges for above incl. pipe section for welding to stack
2 off	Fuel Gas pressure regulators and shut-off valves
1 lot	Calibration gases pressure regulators, shut-off valves and automatic calibration unit and including internal QAL3 adjustment filters
1 off	Automatic verification/calibration unit

3.2 Gas Emission Analysing System for raw gas HCl, SO_2 and O_2

2 off	Gas analyser of HCl, SO2 and O2
2 off	Sampling probes and heated sample line (approx. 30 meters) from duct to analyser
2 off	Connection/Communication box
2 lot	Special cable etc. (if needed)
2 lot	Counter flanges for above incl. pipe section for welding to stack
1 off	Automatic verification/calibration unit
2 off	Sampling probes and heated sample line (approx. 30 meters) for HCL-, SO2- and O_2 monitoring upstream of FGT.

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3.3 Dust Emission Analysing System

4 pc	Dust sensor (scattered light principle)
2 off	Purge air system, including two (2) purge air fans per system
1 lot	Counter flange for above incl. pipe sections for welding to flue gas pipes
1 lot	Special cable etc. (if needed) (Cable lengths to be informed by BWSC)
2 pc	Flow switch to purge air system
4 pc	Purge air backup supply valve (on/off)
1 pc	Purge air backup supply regulation valve system

3.4 Flue Gas Flow Measurement System

2 off	Flow sensor
2 off	Connection / Communication box
2 set	Counter flanges for above incl. pipe section for welding to flue gas pipe
1 lot	Special cable etc. (if needed) (Cable lengths to be informed by BWSC)

3.5 CEMS Equipment

2 pc	Temperature sensors incl. pockets (BWSC supply)
2 pc	Pressure transmitters (BWSC supply)
1 lot	Calibration gas
2 pc	Data Communication Switch
2 pc	Fiber Optic Connection Boxes (BWSC supply)

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4 Data Sheets

4.1 Gasifier Boiler

Make	:	**Kobelco**	
Nominal exhaust gas flow, wet @ 145°C, each flue gas pipe	:	**78,302**	Nm^3/h
Related normal exh. gas velocity in stack pipe	:	14-15	m/s
Maximum exhaust. gas flow, each flue gas pipe (ID fan max, not operation point)	:	**101,800**	Nm3/h
Related maximum exh. gas velocity in stack pipe	:	18-19	m/s
Exhaust gas temp.at 100% load	:	**145**	°C +/- 20°C
Maximum exhaust gas temp.at 110% load	:	**180**	°C +/- 20°C

4.2 Stack

Common stack height	:	**80**	**m**
Each flue gas pipe inner diameter	:	ø1,400	mm
Stack shell diameter	:	ø3,300	mm
Flue gas pipe thickness	:	5	mm
Flue gas pipe material	:	S355J2W	
Thickness of stack shell	:	_____	mm
Surface temperature at stack shell	:	max 60	°C

4.3 Control Instrument air (Supplied by BWSC)

Pressure	:	max. 8	bar(g)
Oil contents	:	max. 1	mg/m^3
Dew point	:	–40°	C
ISO 8573 Class	:	3.3.3	

(To be used for gas emission analyser and dust emission monitor and flow measurement for purge air back-up)

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4.4 Continuous Emission Monitoring System (CEMS) - Gas

4.4.1 Emission Transmitter of gas - Analyser

Equipment No	:	A10 HNE61 GH001 A20 HNE61 GH001 A00 HNE62 GH001
Make	:	_____
Type	:	_____

Sensor measuring principle:

- NO	:	_____
- NO_2	:	_____
- NH_3	:	_____
- CO	:	_____
- $C0_2$	.	_____
- H_2O	:	_____
- SO_2	:	_____
- HCl	:	_____
- HF (option)	:	_____
- N_2O	:	_____
- O_2	:	_____
- VOC	:	_____

Power supply capacity	:	_____kVA (V / 50Hz)
Protection class	:	IP 54
Dimensions (L x W x H)	:	_x__x_ mm
Weight	:	_____kg

Reference is made to attachment /3/ “Permit with introductory note (draft)” table S13, reference IC7 regarding precision requirements of QAL1, QAI2 and QAL3.

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4.4.2 Emission Transmitter of gas - Probe

Equipment No	:	A10HNE81 CQ011 / CQ012 A20HNE81 CQ011 / CQ012
Make	:	_____
Type	:	
Probe length	:	_____ m
Dimensions (L x W x H)	:	__×___ ×__ mm
Weight	:	App.__ kg (Without flange)

4.4.3 Connection Pipe

Connection	:	Special flange pipe
Diameter	:	ø_____
Length	:	To be informed by BWSC
Flange	:	_____

4.4.4 Gas Emission Transmitter

Equipment No	:	A10HNE81 CQ011 / CQ012 A20HNE81 CQ011 / CQ012
Make	:	_____
Type	:	_____
Calibration on	:	NO, NO_2, HCl, NH3, CO, CO_2, N_2O, HF, TOC, H_2O, SO_2 and O_2
App % of NOx, CO & NH3 used for process reg.	:	_____
Intervals for calibration with light filter	:	1–2 hour
Intervals for calibration with span gas	:	12 months
Type of calibration gas (Not part of delivery)	:	80% of measured ranges
Protection class	:	IP_____

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4.4.5 Communication boxes for gas probes	:	A10HNE61 GH011 A10HNE62 GH011 A20HNE61 GH011 A20HNE62 GN011
Make	:	_____
Type	:	_____
Protection class, min.	:	IP55

4.5 Continuous Emission Monitoring System (CEMS) – Dust

4.5.1 Emission Transmitter of dust

Equipment No	:	A10HNE81 CQ001 A10HNE81 CQ002 A20HNE81 CQ001 A20HNE81 CQ002
Make	:	_____
Type	:	_____
Sensor measuring principle:		
- Dust	:	_____
Measuring range (4-20 mA):		
- Particulates	:	0 - 200 mg/m3, wet
Accuracy	:	< 1% of range
Power supply capacity	:	___ V - 50Hz

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	Protection class	:	Minimum IP 65
4.5.2	Measuring head		
	Dimensions (L x W x H)	:	__x__x__mm
	Weight	:	App.____kg (Without flange)
4.5.3	Connection Pipe		
	Connection	:	Special flange pipe[9]
	Diameter	:	ø_____
	Length	:	To be informed by BWSC
	Flange	:	_____
4.5.4	Control and Display unit		
	Equipment No	:	A10HNE81 GH001 A10HNE81 GH002 A20HNE81 GH001 A20HNE81 GH002
	Make	:	_____
	Type	:	_____
	Dimensions (L x W x H)	:	_x_ x mm
	Weight	:	App.____ kg
4.5.5	Purge Air Fan		
	Number of fans	:	4 pcs
	Equipment No	:	A10HNE31 AN001 A10HNE31 AN001 A20HNE31 AN001 A20HNE31 AN002
	Make	:	_____
	Power supply capacity	:	_____

[9] If necessary, otherwise forward instruction for nozzle installation.

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Protection class, motor		:	Minimum IP 55
Connection		:	DN_____
Dimensions (L x W x H)		:	__x__ x__ mm
Weight		:	App.____ kg

4.5.6 Purge Air flow switch

Number of switches		:	2 pcs
Equipment No		:	A10HNE31 CF101 A20HNE31 CF101
Make		:	_____
Power supply capacity		:	_____
Protection class		:	Minimum IP 65
Connection		:	DN_____
Cable connection		:	
Output		:	_____
Dimensions (L x W x H)		:	x x mm
Materials	Housing Wet-side	: :	
Weight		:	Approx. kg

4.6 Continuous Emission Monitoring System (CEMS) - Flow

4.6.1 Emission Transmitter of flow

Equipment No	:	A10HNE81 CF001 A20HNE81 CF001
Make	:	_____
Type	:	_____

Sensor measuring principle:

- flow	:	Averaging pitot flow measurement (MCERTS not required)

Measuring range (4-20 mA):

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- Flow	:	0 –_____m^3/hr
Accuracy	:	< 1% of range
Power supply capacity	:	__ V - 50Hz
Protection class	:	Minimum IP 65

4.6.2 Measuring head

Dimensions (L x W x H)	:	__x__x__ mm
Weight	:	Appr.___ kg (without flange)

4.6.3 Connection Pipe

Connection	:	Special flange pipe[10]
Diameter	:	_____
Length	:	To be informed by BWSC
Flange	:	_____

4.6.4 Control and Display unit

Equipment No	:	A10HNE81GH011 A20HNE81GH011
Make	:	_____
Type	:	_____
Dimensions (L x W x H)	:	__x__x__ mm
Weight	:	Appr.___ kg

4.7 CEMS Equipment (Common)

4.7.1 Temperature sensor (BWSC Supply)

Equipment No	:	A10HNE81 CT001 A20HNE81 CT001
BWSC Standard	:	2031.M0.312.001

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	Measuring principle	:	Resistance thermometer (RTD) PT100 element with 3-wire connection.

4.7.2 Pressure transmitter (BWSC Supply)

Equipment No	:	A10HNE81 CP001 A20HNE81 CP001
BWSC Standard	:	2031.M0.332.001
Measuring principle	:	Pressure measurement based on the capacitance principle.

4.7.3 Fiber Optic Connect box - Container (BWSC Supply)

Equipment No	:	A00HNE11 GA001
Make	:	_____
Type	:	_____

[10] If necessary, otherwise forward instruction for nozzle installation.

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TECHNICAL SPECIFICATION

Index

1. General Specification

2. Scope of Supply

3. CEMS Station and Equipment is coved by 3 specifications:

2031.M0.C50.001	Continuous Emission Monitoring System (CEMS)
2031.M0.C51.001	CEMS – Analyzer House (This specification)
2031.M0.C52.001	CEMS Emission Calculator

4. Attachments

Please see main specification - 2031.M0.C50.001.

/29/	2031.MQ.C51.001, rev. 0	CEMS Station Containerized Unit, Quality Schedule
/31/	2031.S0.X01.001, rev.0	Explosive Atmosphere Area Classification

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TECHNICAL SPECIFICATION

1 CEMS Analyzer house

1 of Unit No.	:	+A00HNE11
Type of container	:	
Number of rooms	:	1 (Analyzer Room)
Number of cages	:	1 or 2 (Fuel Gas and Calibration gas cages[1])

The CEMS house shall be well ventilated with redundant and monitored ventilators, and a system to shut off gas supply in the event of failing ventilation.

1.1 Nozzles dimensions

Location of connections flanges is subject to BWSC approval.

2 off Gas Sample line inlet	:	TBD
1 off compressed air line inlet	:	DN 32, PN 16, Mapress SS 316
2 off purge air line outlet	:	DN 15, PN 16
1 off gas analyzer drain	:	House floor
1 off vent	:	House roof

1.2 Doors Location

Doors	:	Lockable access door(s) [2]

1.3 Inert Gas Protection

Inert Gas Bottles	:	BWSC Supply (1 off cylinder) – **possible storage in CEMS cylinder cage?**
Overpressure Damper	:	BWSC Supply (1 off) approx. ø300.

[1] Calibration gas and fuel gas cages must be classified according to ATEX zone 2.
[2] Access to analyzer room on the container wall, and access to calibration gas bottle room to be defined during layout review of the container.

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2 Scope of Supply

2.1 Main Components

1 off Container	:	+A00HNE11

2.2 Main Instruments (In analyzer room)

3 of Gas Emission Analyzers Units	:	+A10HNE61, +A20HNE61, +A00HNE62
3 off Gas Emission Analyzers (in Gas Emission Analyzers Units)	:	A10HNE61GH001 A20HNE61GH001 A00HNE62GH001
4 off Dust Emission - Display Units	:	A10HNE81 GH001 A10HNE81 GH002 A20HNE81 GH001 A20HNE81 GH002
2 off Flow meter - Display Units	:	A10HNE81 GH001 A20HNE81 GH001
1 off Fiber Optic Connect box (BWSC Supply)		A00HNE11 GA001
1 off compressed air on/off valve[3]	:	A10HNE21 AA011 A20HNE21 AA011
1 off Compressed air bypass valve[4]	:	A10HNE21 AA022 A20HNE21 AA022
1 off Purge air reduction valve	:	A10HNE21 AA031 A20HNE21 AA031
2 off Purge air on/off solenoid valve[5]	:	A10HNE21 AA021

[3] Compressed air for purging of dust and flow transmitter (in SS 316)
[4] Compressed air for purging of dust and flow transmitter (in SS 316)
[5] The actuator to valves must be normal open

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		A20HNE21 AA021
3 off Air dryer & oil filter (with alarm for malfunctioning)	:	A10HNE60 AT801 A20HNE60 AT801 A00HNE60 AT801
3 off Purge air manual drain valve	:	A10HNE21 AA020 A20HNE21 AA020 A00HNE21 AA020
6 off Compressed air on/off ball valves for gas analyzers	:	A10HNE60AA801AA811/ A812 A20HNE60AA801AA811/ A812 A00HNE60AA801AA811/ A812
3 off Compressed air filter / reduction valves (Part of gas emission analyzers)	:	A10HNE61 AA821 A20HNE61 AA821 A00HNE62 AA821
1 off Common Junction Box	:	A00HNE61 GA001
1 off Switchboard Box	:	A00HNE61 GA002
3 off Condensate vessels	:	A10HNE11 AT301 A20HNE11 AT301 A00HNE11 AT301
1 off room gas detector	:	____
1 off room dew point transmitter	:	____

Above mention components are described in the reference specifications listed on page 1.

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3.1 Cage for Calibration gas and Fuel gas cylinders

The calibration gas cylinders and the fuel gas cylinders will be located outside the house in separate open vented weather sheltered cage. The cage must have a capacity to contain 8 gas bottles. The calibration gas cage must be lockable

2.3.1 Calibration gas supply

1 off calibration gas cylinder (N_2)	:	A10HNE71 BB401
1 off calibration gas cylinder (CH_4O_2)	:	A10HNE71 BB402
2 off Cal. gas reduction valve	:	A10HNE71 AA401 / AA402
6 off Cal. gas supply valves	:	A10HNE71 AA411 / AA412 A20HNE71 AA401 / AA402 A00HNE71 AA401 / AA402

2.3.2 Fuel gas supply (for VOC measuring)

The supply valve for each fuel gas bottle must be provided with automatic changeover manifold

2 off Fuel gas cylinders	:	A10HNE72 BB401 / BB402
2 off Fuel gas reduction valves	:	A10HNE72 AA401 / AA402
3 off Fuel gas solenoid valves	:	A10HNE72 AA410 A20HNE72 AA411 A00HNE72 AA411
3 off Fuel gas supply valves	:	A10HNE72 AA409 A20HNE72 AA401 A00HNE72 AA401

3.2 Air Condition Systems

Number	:	Min 2 pcs
Tag. no.	:	A00HNE12 AN001 / AN002
Type	:	_____

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3.3 Ventilation fan

Number	:	Min 1 pcs
Tag. no.	:	A00HNE11 AN001
Type	:	_____

3.4 Dimensions

Minimum length	:	15 ft (~4.57 m)
Total Unit weight	:	_____ kg

3.5 Surface Treatment

Surface treatment	:	spec. no. 2031.M0.013.001
Color (Inside)	:	RAL 9010 – white or similar.
Color (Outside)	:	00A05 Goose grey (BS4800)
Protective paint system	:	C4 - High

3.6 Electric lighting fixtures

Inside Container/ Analyzer room :

No off	:	Min 2 pcs
Type	:	LED or traditional 72 W
Luminance	:	E_{avg} = 300 lux, RA = 80
		E_{min} / E_{max} = 0.7
Emergency Lighting (acc. to CIBSE) :		10% of illum. on the reference plane or min. 15 lux

3.7 Gas detector

No. off	:	1
TAG no.	:	_____
Make	:	_____

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	Type	:	_____

3.8 Dew point transmitter

No. off	:	1
TAG no.	:	_____
Make	:	_____
Type	:	_____

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Steam total	114.104 ton/h
Steam one boiler	57.100 ton/h

	bar	kJ/kg
	kg/s	° C

	P	h
	m	t

60 | 3229
31.70 | 420

114.1 ton/h

0.00

Fuel load 88,678 kW

Low Heat 12.77 MJ/kg

Fuel load 25.0 Ton/h

8,000 h

199,994 Ton/Year

59 | 3229
31.70 | 419.3

59.0 | 3230
0.03 | 420

Design Point **A**

Project	2031 Hooton Bio Power Project	**Doc. No. Rev.**
Date	10-12-2018	2031.S3.S01 001.R03
Document Owner	HXN	
Verifier / Approver	HSW / LSE	Page 1 / 9
Revised / Date	25-09-2019	
Subject	HBD Design Point (A) 420 C 60 bar 12,77GJ/t Ambient 12 C	

BWSC

Generator

Gear

28,805 kW

0.060 bar

0.060 | 2302
22.1

6.2 | 2850
2.33 | 200

3.36 | 2258
1.60 | 137

1.7 | 2209
2.14 | 114

15.8 | 2936
0.16 | 258

15.8 | 2936
0.16 | 258

0.46 | 1770
2.25 | 79

12 ° C

35 °C

25 °C

25 °C

9.2 | 566
28.8 | 134

15.8 | 713.5
0.6 | 168.6

FVT

10.2 | 467.7
28.8 | 111.4

11.2 | 321.0
28.8 | 76.5

12.2 | 174.6
22.8 | 41.4

0.160 | 151
22.5 | 36

0.160 | 151
0.3 | 36

0 kw

3,229 kw

1,744 kw

6.4 | 676
48.2 | 160

72.3 | 408.5
13.2 | 96.2

15.8 | 2936
0.6 | 257

1.7 | 341
3.7 | 81

3.4 | 488
1.6 | 116

0.6 | 200
6.0 | 48

347 kW

74.8 | 687.0
31.7 | 161.7

7.7 | 445.8
8.2 | 106.2

72.3 | 408.5
13.2 | 96.2

73.3 | 785
13.2 | 184

74.3 | 780
13.2 | 183

5.0 | 676.3
8.2 | 162.6

1989 kW

64 kW

57.6 | 854.1
0.03 | 200.0

1232 kW

15.8 | 707
0.6 | 167

35 °C

160 °C

160 °C

71.8 | 559.0
13.2 | 131.9

1450 kW

1.01 | 196.2
55.14 | 179

70.8 | 687.0
18.5 | 161.7

1.01 | 196.2
55.14 | 179.0

1.01 | 169.873
55.14 | 155.47

70.8 | 679.4
31.7 | 160.0

70.8 | 669
13.2 | 158

PROJECT : **Hooton Bio Power Project**
DATE : 2019.02.05 REVISED: 2019.03.19
ISSUED BY : SJ APPROVED BY: LATO
SUBJECT : **Steel Stack**

2031 M0 C20 001 3
PROJ. DOC.NO SHEET REV.

1 OF 17

TECHNICAL SPECIFICATION

INDEX

1. Attachments 2

2. Scope of Supply 3

2.1 Structures and Accessories 4
2.2 Nozzle Layouts 7
2.3 Excluded in Scope 7

3. Specifications 7

3.1 General Specification 7
3.2 Design 8
3.3 Steel Structures 9
3.4 Foundation 9
3.5 Surface Treatment 10
3.6 Spare Parts 10

4. Documentation & Testing 10

4.1 Drawings and Documents 10
4.2 Inspection and Tests 11
4.3 General Requirements for Lifting Lugs 11
4.4 CDM Regulations 12

5. Erection and Transportation 12

5.1 Special Tools 12
5.2 Erection Weights 12
5.3 Transportation 12

6. Design Data 13

6.1 Rating 13
6.2 Design 15

7. Miscellaneous 16

7.1 Aviation Lights 16

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1. Attachments

ID	Document no.	Subject
/1/	Part 21, sect. 17, rev.4	Stack (Kobelco's Requirements)
/2/	2031.M0,002.001, rev.0	General Conditions
/3/	2031.S0.Z01.001, rev.0	Site Data
/4/	2031.S1.004.002, rev.1	Project Design Criteria, Civil and Seismic Design
/5/	2031.S2.R01.001, rev.1	Capacity Diagram: Flue gas & abatem. system
/6/	2031.M2.C02.001, rev.0	P&ID: Stack and emission monitoring
/7/	2031.M0.009.001, rev.0	Lifting Lugs
/8/	2031.M0.013.001, rev.2	Surface Treatment for Mechanical Equipment
/9/	2031.M0.013.054, rev.0	Surface Treatment, System no.6, C4-high
/10/	2031.M0.013.055, rev.0	Surface Treatment, System no. 8
/11/	2031.M0.024.001, rev.1	Insulation BS-Standard
/12/	2031.M0.025.001, rev.1	General Documentation Requirements
/13/	2031.E1.K20.001, rev.0	Cable specification
/14/	2031.E4.R01.063, rev.1	Electrical Installation – Stack
/15/	2031.E4.R01.064, rev.1	Electrical Installation – Stack – Details
/16/	2031.E5.E12.001, rev.0	Grounding Grid System
/17/	2031.D2.001.601, rev.0	Site Plan, Logistic Layout, General
/18/	2031.D2.005.001, rev.0	Site Plan Layout, section A-A & B-B
/19/	2031.D2.007.001, rev.0	Site Plan Layout, section C-C & D-D
/20/	2031.D2.031.001, rev.0	Site Plan Layout, FGT Area
/21/	2024.D2.900.001, rev.0	Typical Handrail and Stairs *)
/22/	2024.M5.901.001, rev.1	Typical Fixed Ladder *)
/23/	2031.CS.010.000, rev.1	Civil Work Design Conditions
/24/	2031.CS.010.001, rev.1	Civil Work Design Conditions, Appendix

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/25/	2031.CS.030.000, rev.0	Requirements for Structural Steel
/26/	2031.CS.030.001, rev.1	Steel Specification, Appendix
/27/	2031.CS.031.000, rev.0	Welding of galvanized Steel
/28/	2031.CS.032.000, rev.0	Repair procedure for galvanized steel structures
/29/	2031.TG.301.003, rev.0	General Site Requirements for M&E Contractors
/30/	EPR/AP3832WS, rev.0	Environmental Permit 23.08.2017 (draft)
/31/	2031.MD.C20.001, rev.0	Document and Drawing submittal Schedule
/32/	2031.MQ.C20.001, rev.0	QA / QC Requirements to Supplier
/33/	2031.MU.C20.001, rev.0	Demands to Suppliers CE- marking
/34/	TGN M1, version 8	Sampling req. for stack emission monitoring
/35/	Navisworks	Screen dump, stack area

*) To be replaced by 2031 project specific documents when being available.

2. Scope of Supply

This Technical Specification with all its attachments gives the minimum technical requirements for the work comprising Design, Manufacture, Supply, Surface Treatment, Delivery, Performance Testing and Quality Assurance of one (1) Stack for Hooton Bio Power Project.

Design of foundation loads are critical for the project and shall be completed as soon as possible and **no later than 2 weeks** from order.

The guarantee period is two (2) years from the estimated handing over date to final user. Reference is made to commercial documents regarding handing over (TOC) date.

Stack template, cast-in items and anchor foundation bolts incl. spacer rings, nuts and distance holders to be delivered separately on site on beforehand.

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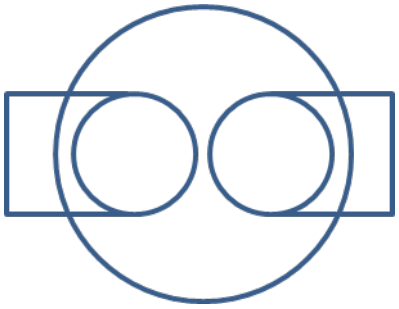
2.1 Structures and Accessories

One (1) common stack, 80 m high complete in all respects, including but not limited to:

- Structural outer steel shell ø3300 according to manufactures design.
- Circular baseplate with enough stiffeners.
- Two (2) x ø1,400 mm inner diameter flue gas ducts made of corrosion resistant material.



- Anchor bolts / cast-in items complete with all necessary nuts, bolts, spacers, template and red bolt to indicate correct orientation.
- 2-layer insulation of the two flue gas ducts. Reference is made to attach specification 2031.M0.024.001 “Insulation BS-Standard”.
- Two (2) flue gas inlet flanges DN1400, PN2.5, EN/DIN 86044. Centre of each flange at elevation +10,000 mm, positioned 180° from each other and positioned 150 – 200 mm outside the outer common shell. All flue gas inlet flanges shall be delivered with counter flange, nuts & bolts, and packings. Flange joints in outer shell are to be sealed to prevent ingress of water
- One (1) ø600 cleaning door in each flue gas duct. Replacement by one (1) ø200 access/cleaning door in each flue gas duct to be quoted optionally.
- Certified lifting points / eyes.

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TECHNICAL SPECIFICATION

- One (1) safety access ladder from ground level to top of stack including safety harness, e.g. FABA system AL2 including rest platforms at max. distances of 8 m.
- One (1) ladder guard (intruder protection) at ground level
- (1) additional safety line system (Milan Kit) for erection of 80 m stack according to CDM regulations.
- 360° platform for emission control approx. elevation +17,700 mm (top of inlet flange + 5 × inner diameter minimum elevation). Width: In general, 1,600 mm constructed with 4 wings with a total width of 1,600 mm + 1,000 mm = 2,600 mm **or** (outer stack diameter / 2) + 1,500 mm, whichever is greatest. Wing-width: 1,000 mm. To be confirmed.
- An approx. 360° wide 1,000 mm deep extra platform approx. 2.5 m above the main emission platform.
- In general, ballproof gratings to be supplied.
- Compliance with EN 14122-4 to prevent fall risks from ladder(s) starting on the emission platform.
- 360° aviation light platform at top of stack (manufacturer's standard).
- Platforms must be provided with two (2) off 230 V power outlets on the emission platform.
- Each flue gas pipe: Nozzles for emission control (ref. as required by the Industrial Emissions Directive (IED)) supplied by CEMS supplier to Stack supplier except for four (4) off DN125 and four (4) off DN15 flanges all with blinds. Accordance with the Environment Agency M1 guidelines.

  CEMS for each exhaust gas flow to consist of:

		QTY			
	Emission analysing equipment, comprising	1			
	- Gas analyser for NO, NO2, N2O, CO, CO2, SO2, NH3, HCl, TOC, H2O	3			Stack
	- Gas analyser for HCl, SO2	2			Upstream FGT
	- Oxygen analyser	1			
	- Dust measurement	1			

- Option for relevant numbers off Unistrut P1000 monorails on the centerline above each sample points.

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TECHNICAL SPECIFICATION

- One (1) electrical crane hoists for the CEMS measurement platform (approx. 3,000 mm above platform) mounted on stack. Lifting capacity: Min. SWL 250 kg. Hot dip galvanized.
- Cable ladder, Øgland LOE-75-600-HDG, installed from base to main platform.
- Two (2) off 50 mm pipes as cable conduits from ground level to top of stack with Junction boxes which should be stainless steel 316 at each stack section breaks. PVC protection ring to be installed.
- Three (3) lightning rods in AISI 316 for protection of stack 120° apart on top of stack. Cable conduits from lightning rods routed to earthing connections on top platform.
- Four (4) off earthing connection welds connected to the internal load bearing steel stack for external connection of earth conductors. Two at base of stack and two at top platform. Hole size M12.
- Required brackets for aviation light junction boxes in top or/and bottom of stack.
- Aviation lights, ref. section 7.1 of this specification.
- Electrical bonding over each flange connection should be installed. During installation electrical conductivity from top to bottom of stack will be measured.
- Electrical conductivity test on-site, which will be as erection verification.
- 1” drain line from each flue gas pipe in stack with outer thread in AISI 316L and terminating outside structural shell at approx. 1.5 m height.
- Ventilation openings at common stack shell base and top.
- Vibration damper, ref. section 3.2 of this specification.
- Brackets for erection platforms.
- Template and anchor foundation bolts incl. spacer rings, nuts and distance holders (to be delivered early due to on-site activities). Anchor bolt rings to be manufactured to standard container transport.
- Transportation supports for stack sections.
- Drawing(s), erection manual and any other document should be in English.

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- For delivery the stack shall be divided into sections according to further agreement with BWSC.
- Chimney windshield and top cover

2.2 Nozzle Layouts

Reference is made to attachment /6/ 2031.M2.C02.001, rev.0: P&ID: "Stack and emission monitoring" regarding number of and dimensions of nozzles, - and which nozzles shall be blinded off. Nozzle positions shall be proposed by the supplier, and shall be subject to BWSC approval and detailed design
Nozzles for continuous emission monitoring is installed at an appropriate location, as required by the Industrial Emissions Directive (IED).

Option prices to be given on possible additional nozzles for CEMS analyzing.

2.3 Excluded in Scope

- Delivery and erection as options.
- All DN50, DN65, and DN125 nozzles (supplied by BWSC / CEMS supplier).

3. Specifications

3.1 General Specification

The stack consists of a painted external structural steel shell and two (2) insulated interior flue gas pipes.

Flue gas pipe insulation is retained by means of wire nails welded to the pipe. Joints between insulation layers shall be mounted staggered.

All requirements in attachment /1/ – Part 21, sect. 17, rev.4: Stack (Kobelco's Requirements) shall be fulfilled.

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3.2 Design

The structural shell shall be designed, inspected, constructed and tested in accordance with the latest Euro Codes (EC) including the British Standard National Annexes (BS–NA). E.g. BS EN 1993-3-2: Eurocode 3 Design of Steel Structures – Chimneys.
Further the stack should meet the technical design requirements of HMIP 1993 'Guidelines on Discharge Stack Heights for Polluting Emission and Technical Guidance Note D1 (Dispersion)' ISBN 0 11 752794 7.

All nozzles, platform for emission control and platform for flow measuring shall be designed and constructed according to EN 15259.

The structural shell shall be delivered with hydraulic vibration damper placed at the top of the stack if deemed necessary (ref. detailed design).

The design life of the stack and foundations including the baseplate connections supplied under the Contract shall not be less than 25 years or 200,000 hours operation. Among others that means, that the materials and protective coating of windshield, outer steel shell and flue gas ducts shall be chosen to ensure a design life minimum of 25 years in a costal corrosive environment. Materiel specification required for approval.

The stack designer is expected to recommend the absolute necessary flue steel plate thickness (including possible corrosion allowance) to fulfill the requirement of a design life time of 25 years based on the aggressiveness of the flue gas and the data listed in section 5.1 in this specification according to relevant Euro Codes.

General design conditions are according to attachments /3/ and /4/.

Any junction boxes must have metal gland and cable inlet in bottom of it. JB with holes in top will not be accepted.
Electrical bonding must be made with 3 wires over flange connections to ensure electric conductivity from top to bottom.

In addition to the general design conditions the following design conditions are valid:
Characteristic live load on platforms: 3.0 kN/m² / 1.5 kN

Load on each inlet flange :

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Vertical downwards	:	500 kg (to be confirmed).
Horizontal axial	:	500 kg (to be confirmed).

3.3 Steel Structures

Flange joints in structural shell will be external bolted and sealed to prevent ingress of moisture.

Structural shell shall be equipped with circular base-plate with necessary stiffeners and flue gas inlets.

Each flue gas inlet shall be delivered with flange, complying with supplied drawings of flanges, counter-flange, nuts, packing and one access door incl. accessories.

Structural shells shall be equipped with earthing boss connections, lifting eyes and fixtures for aircraft-warning lights.

Steel plates and profiles shall be steel grade S235JRG2, S275JR or S355JO according to EN 10025. Steel plates (5 mm) for flue gas shall be CORTEN grade S355J2W according to EN 10025. However, the upper approx. 3 m shall at least be 3 mm stainless steel (duplex) RF 1.4462.

1" drain line with outer thread from flue shall be made of stainless steel AISI 316L. Ref. section 2.1.

3.4 Foundation

The Structural shell shall be erected by bolting the base plate onto the underlying structure / template.

The supplier shall inform if there is any part of the stack structure e.g. drain pipes located below the top surface of the concrete foundation in order to provide necessary box-outs. Not expected and should be avoided if possible.

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Top of concrete foundation is located in relative project level +0.000 m. Grouting level will be calculated by supplier.

3.5 Surface Treatment

The structural shell shall be given an external surface treatment complying with corrosion category C4 - High durability according to ISO EN 12944-5. Reference is made to attached surface treatment documents /8/, /9/ and /10/.

Final color:
The stack shall be painted uniformly in color Goose Wing Grey: BS 10A05 **– to be confirmed.**
Further a black band shall be applied to the top section of the 80m tall stack in order to hide brown discoloration that accumulates over time.

Concerning galvanization of stack accessories reference is given to document:
/8/ 2031.M0.013.001, rev.2: “Surface Treatment for Mechanical Equipment”.

3.6 Spare Parts

List of recommended spare parts for 2 years operation. With KKS number, make, model, and itemized prices, if any. Reference is made to commercial documents.

4. Documentation & Testing

4.1 Drawings and Documents

The drawings and documents are required as a minimum, but not limited to:
Which are mentioned in attachment /31/ 2031.MD.C20.001 and in below list:

- Design calculations for entire stack structure including anchor bolts
- Lay-out drawings
- Construction drawings
- Erection drawings
- Erection manual including calculation of critical wind speeds during erection
- Material certificates

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- Quality Plan/Test and Inspection Program
- WPS
- Welders Certificates
- Production and Manufacturing Program
- Design calculations for any such damper arrangements
- Measuring sheet for electrical conductivity

All drawings shall be furnished with title blocks provided by BWSC. Drawings shall be submitted in pdf and stp format (step-file).

Calculations and drawings are subject to BWSC, Client and local authorities' approval. The supplier shall inform about any deviation or non-compliance with the specifications being part of this contract.

The supplier shall fill in relevant information in the "inform" boxes in the Factory Inspection / Test Plans of attachment 2031.CQ.C20.001.

4.2 Inspection and Tests

Factory inspections and tests shall comprise, but are not limited to:

- Visual examination of progress in work
- Visual check of workmanship and finish
- Check of dimensions against suppliers certified outline drawings
- Review of material certificates
- Check of surface treatment before painting
- Check of painting according to specification
- Check of welding

4.3 General Requirements for Lifting Lugs

Reference is made to attachment /7/ 2031.M0.009.001, rev.0: "Lifting Lugs" regarding requirements for materials and welding of Lifting Lugs.

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4.4 CDM Regulations

In general, the supplier is to ensure that all CDM regulations related issues are included in the offer. Also, it is important that the supplier is to:

- Ensure that a Rescue Strategy has been worked out
- Ensure (if the supplier is to erect the stack) that the stack erectors have participated in courses such as
  - Rescue at Height Training
  - Confined Space Awareness Training
  - Confined Space Rescue Training

5. Erection and Transportation

5.1 Special Tools

A list containing any special tools required for the proper erection shall be forwarded to BWSC. If any, special tools shall be part of delivery. Reference is made to commercial documents.

5.2 Erection Weights

The weight of all major parts to be erected on site shall be informed, including requirement for lifting capacity on site for erection of the complete stack sections.

All major parts shall be equipped with eye bolts or similar for lifting during transport and erection.

5.3 Transportation

All materials shall be delivered FCA (incoterms 2010) and packed according to BPRI.
Total transport weight, size, and volume for the supply shall be reported to BWSC.
All major parts shall be equipped with necessary stiffeners to ensure geometry during transport.
All temporary supports necessary during transportation is a part of scope of supply according to paragraph 1.

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Reference is further made to commercial documents.

6. Design Data

6.1 Rating

Exhaust gas temperature, 100% load	: 130°C – 180°C
Exhaust gas temperature, normal operation	: approx. 135°C
Exhaust gas temperature, design	: min. 200°C
Exhaust gas quantity	: nominal: 69,870 Nm^3/h
	: max.: 79,100 Nm^3/h
	(approx. 0 Pa(g) stack inlet)

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TECHNICAL SPECIFICATION

Exhaust gas inlet data to funnel:

	Flowsheet reference	G1 FGC exit					
	Load case	Case A *3	Case G *4	Case I *5	Case Min *6	Case Acid ratio*7	Case BREF*8
Mass flow-Solids	kg/h	407	386	1383	224	1383	1383
Mass flow-Liquids	kg/h	0	0	0	0	0	0
Mass flow-Gas	kg/h	100,227	95,496	110,042	55,125	110,042	110,042
Mass flow-Total	kg/h	100,634	95,882	111,425	55,349	111,425	111,425
Flue gas flow	Nm^3/h, dry	66,246	63,539	72,067	36,436	72,067	72,067
Flue gas flow	Nm^3/h, wet	78,302	74,261	86,443	43,066	86,443	86,443
Flue gas flow	Nm^3/h, dry, 11% O_2	101,443	98,460	109,825	55,793	109,825	109,825
Actual flow	Am^3/h, wet	126,667	119,805	140,665	68,382	140,665	140,665
Temperature	°C	155	155	155	155	155	155
Pressure*2	Pa	-3,145	-2,879	-3,724	-1,300	-3,724	-3,724
Density gas	kg/Nm^3, wet	1.280	1.286	1.273	1.280	1.273	1.273
Density gas	kg/m^3	0.791	0.797	0.782	0.806	0.782	0.782
Dust load	mg/Nm3, dry	6,146	6,077	19,192	6,146	19,192	19,192
Dust load	mg/Nm3, dry, 11% O2	4,014	3,922	12,594	4,014	12,594	12,594
Dust load	mg/Nm^3, wet	5,200	5,200	16,000	5,200	16,000	16,000
Dust load	mg/m^3, wet	3,215	3,223	9,833	3,275	9,833	9,833
CO_2	Vol%, dry	13.47	13.63	13.41	13.47	13.41	13.41
CO_2	Vol%, wet	12.71	12.88	12.63	12.71	12.63	12.63
O_2	Vol%, dry	5.69	5.50	5.76	5.69	5.76	5.76
O_2	Vol%, wet	4.8	4.71	4.8	4.8	4.8	4.8
H_2O	Vol%	15.40	14.44	16.63	15.40	16.63	16.63
N_2 + Ar	Vol%, wet	68.39	69.19	67.39	68.39	67.39	67.39
SO_2	mg/Nm^3, dry, 11% O_2	486	854	854	486	854	854
HCl	mg/Nm^3, dry, 11% O_2	1,101	1,930	1,930	1,101	427	1,930
HF	mg/Nm^3, dry, 11% O_2	27.5	50	50	27.5	50	50
NO_x (as NO_2)*1	mg/Nm^3, dry, 11% O_2	200	200	200	200	200	200
CO*1	mg/Nm^3, dry, 11% O_2	50	50	50	50	50	50
NH_3*1	mg/Nm^3, dry, 11% O_2	30	30	30	30	30	30
TOC	mg/Nm^3, dry, 11% O_2	No proces data available and FGT SUPPLIER are to provide system with PAC capacities per prior design to waste incineration.					
Cd + Tl	mg/Nm^3, dry, 11% O_2						
Hg	mg/Nm^3, dry, 11% O_2						
Metals	mg/Nm^3, dry, 11% O_2						
Dioxin/Furans	ngTEQ/Nm^3dry, 11% O_2						
Solid flow	kg/h						
Density solids	kg/m3						
Req. volume	net m3/X days						
Duct velocity @ diameter *9	m/s	18.6	17.6	20.7	10.1	20.7	20.7
Duct diameter (Design)	mm	1550	1550	1550	1550	1550	1550
Temp max (Mech. design)	°C	200					
Pressure max (design)	Pa	-4,970					
Days of storage @ Case A							

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Emission requirements (daily average values only) are expected to be as listed in below table. Values may then be considered as being input data as well.

		G10 Stack exit					
		Case A *3	Case G *4	Case I *5	Case Min *6	Case Acid ratio	Case BREF
Dust load	mg/Nm3, dry, 11% O2	<10	<10	<10	<10	<10	<5
SO_2	mg/Nm³, dry, 11% O_2	< 50	< 50	< 50	< 50	< 50	< 30
HCl	mg/Nm³, dry, 11% O_2	< 10	< 10	< 10	< 10	< 10	< 6
HF	mg/Nm³, dry, 11% O_2	< 1	< 1	< 1	< 1	< 1	< 1
NO_x (as NO_2)*1	mg/Nm³, dry, 11% O_2	< 200	< 200	< 200	< 200	< 200	< 120
CO*1	mg/Nm³, dry, 11% O_2	< 50	< 50	< 50	< 50	< 50	< 50
NH_3*1	mg/Nm³, dry, 11% O_2	< 30	< 30	< 30	< 30	< 30	< 10
TOC	mg/Nm³, dry, 11% O_2	< 10	< 10	< 10	< 10	< 10	< 10
Cd + Tl	mg/Nm³, dry, 11% O_2	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,02
Hg	mg/Nm³, dry, 11% O_2	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,025
Metals	mg/Nm³, dry, 11% O_2	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,3
Dioxin/Furans	ngTEQ/Nm³dry, 11% O_2	0.1	0.1	0.1	0.1	0.1	0.06

In general, the plant design is based on the principle that it is either running close to normal operation or it is not running at all.

6.2 Design

Height : 80 meters
Diameter of outer
Common shell : approx. 3,300 mm (to be verified by stack supplier)
Diameter of flue pipe : 1,400 mm (to be verified by stack supplier based on minimum flue gas exit velocity: 15 m/s @ nominal flow as required under the IED.)
Connection flange : DN1400, PN2.5 according EN/DIN 86044.

In the following the level details are according to relative project levels where top of the foundation to be considered in relative project level +0.000 m.

All dimensions, angles and levels are to be confirmed before fabrication commences.

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Elevation of top of stack : +80,000 mm
Elevation of top platform for aviation lights : Level to be designed by designer

Placement of platform wings:
Center of platform wings shall be located opposite of the corresponding manual sample nozzles as described in EN 15259.

Various Supports for Electrical Equipment:
Reference is made to attachment /1/, /14/ and /15/ for further principle details and requirements.

7. Miscellaneous

7.1 Aviation Lights

Aircraft warning lights shall be provided and shall be in accordance with “International Standards and Recommended Practices - Aerodromes” issued by the International Civil Aviation Organization.

The warning lights shall be placed at the highest and most practicable point and be visible from any angle.

Four (4) aircraft warning lights at top of common stack incl. cables to terminal box equally spaced which should be LED type with long durability and low energy consumption, in compliance with the CAA regulations.

Warning lights shall give a steady light of a setting of 200 candelas (Cd). 230 V cable and switch for the aviation light shall be available at the top platform. A common alarm indicating a failed light shall be provided.

Lightning protection system shall be provided in accordance with BS EN 62305.

One stainless steel AISI 316 junction box should be installed on bottom of stack which will be used for aviation light.

- Elevation of aviation lights: Level to be designed by designer

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- Required junction boxes for aviation light in top or /and bottom of stack which shall be stainless steel AISI 316 and shall be installed on dedicated brackets.

End of Specification.

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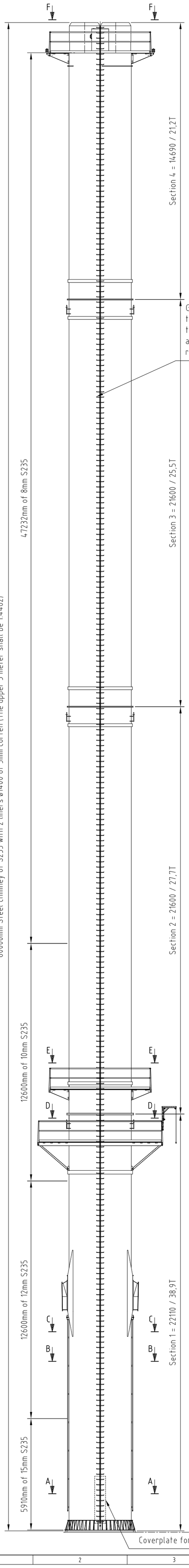
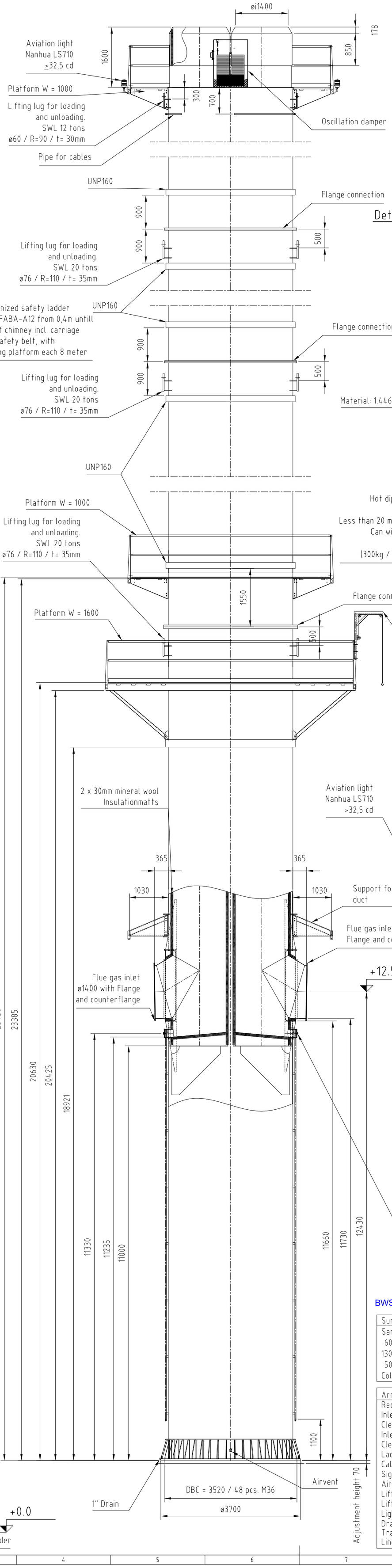
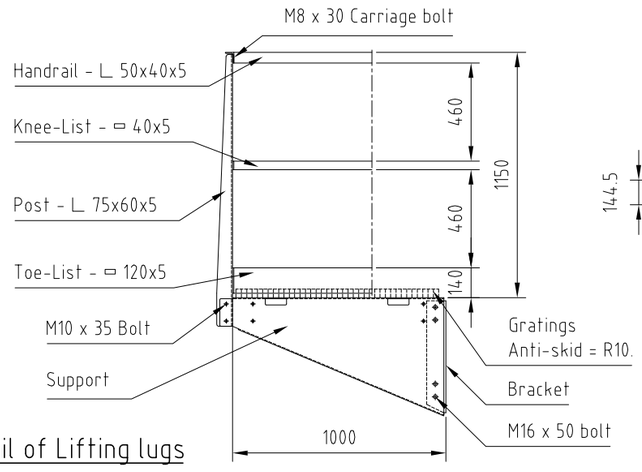
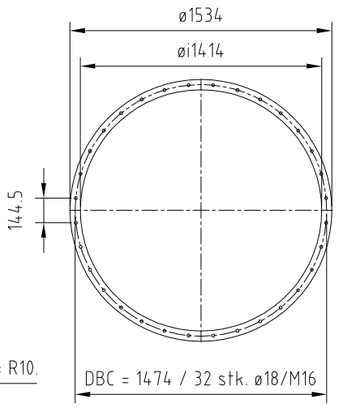




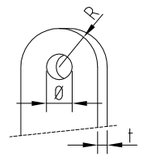
Detail: Platform



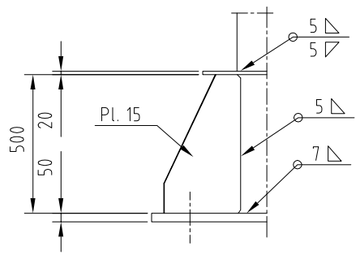
Detail of flue gas inlet flange



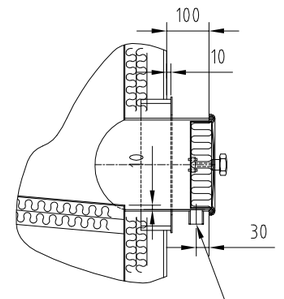
Detail of Lifting lugs



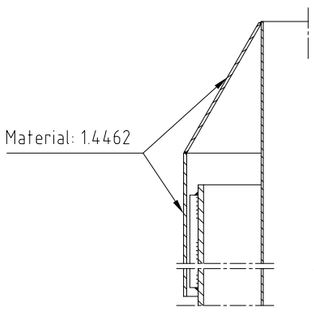
Detail of base gussets



Detail of the cleaning door

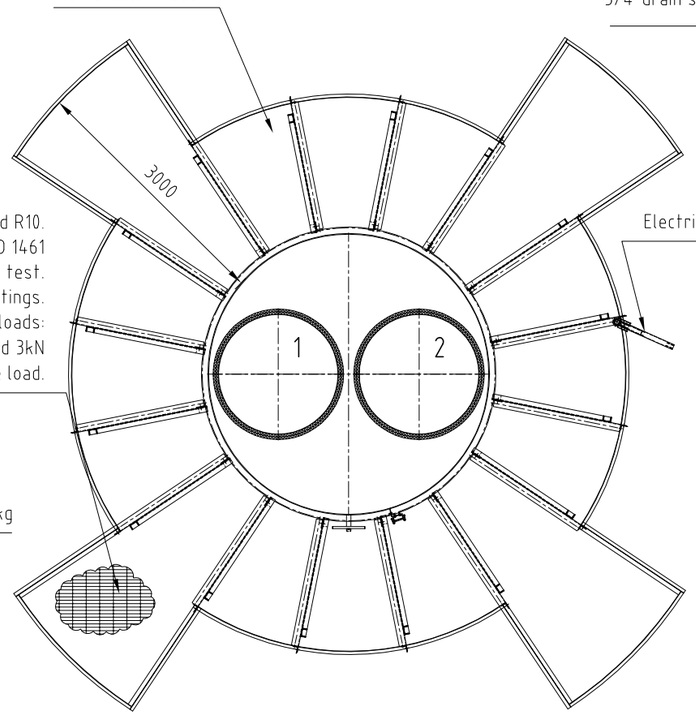


Detail of top

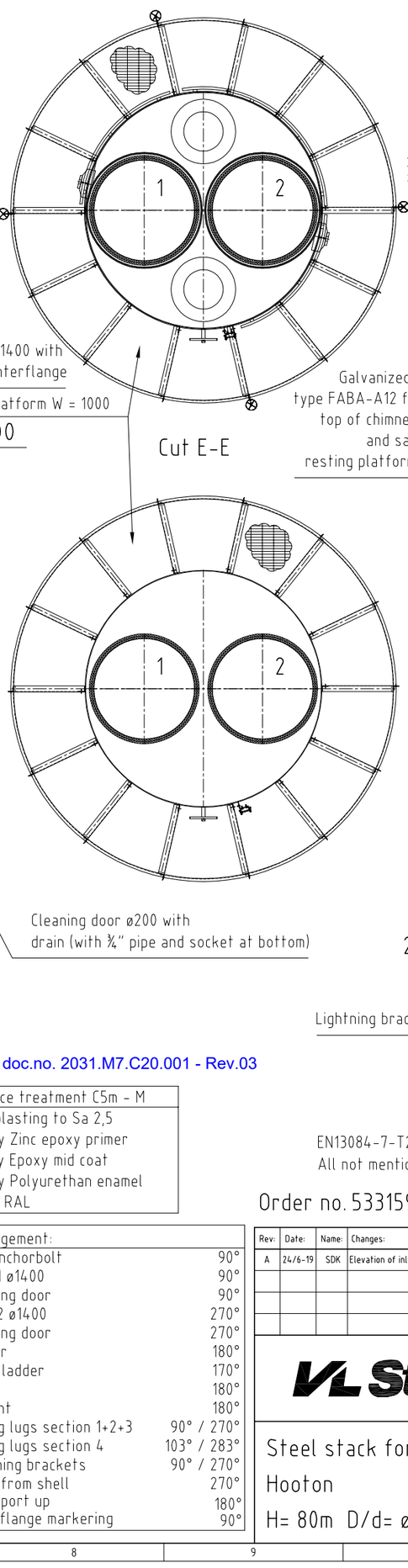


Gratings with Anti-skid R10.
Hot dip galvanized acc. EN ISO 1461
Can pass a 20 mm ball test.
Less than 20 mm spacing between gratings.
Can withstand the following loads:
2kN/m2 (200kg). and 3kN
(300kg / 200 x 200mm) as single load.

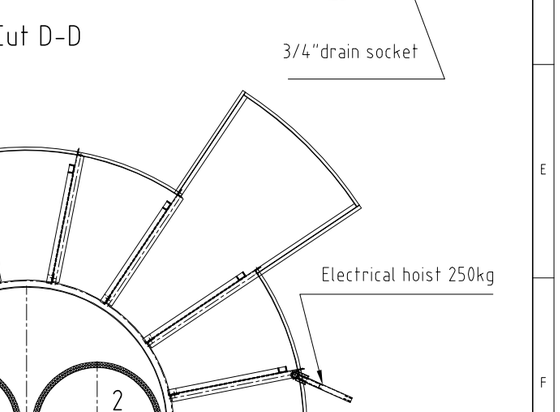
Cut D-D



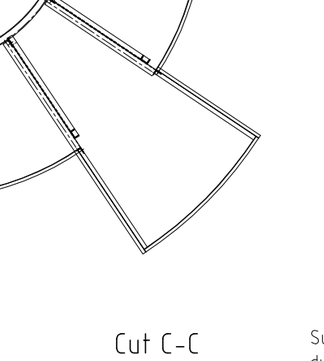
Cut F-F



Cut C-C



Cut B-B

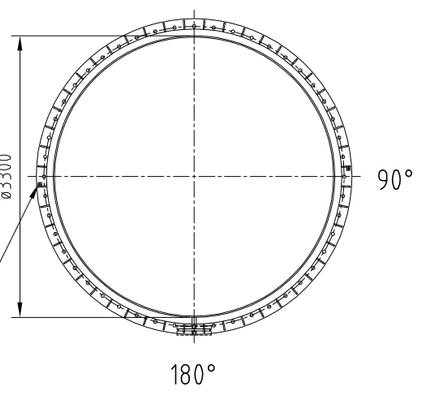


Cut E-E

Galvanized safety ladder
type FABA-A12 from 0,4m untill
top of chimney incl. carriage
and safety belt, with
resting platform each 8 meter

Cut A-A

0°



BWSC doc.no. 2031.M7.C20.001 - Rev.03

Surface treatment C5m - M
Sandblasting to Sa 2,5
60 my Zinc epoxy primer
130 my Epoxy mid coat
50 my Polyurethan enamel
Color: RAL

Arrangement:	
Red anchorbolt	90°
Inlet 1 ø1400	90°
Cleaning door	90°
Inlet 2 ø1400	270°
Cleaning door	270°
Ladder	180°
Cable ladder	170°
Sign	180°
Airvent	180°
Lifting lugs section 1+2+3	90° / 270°
Lifting lugs section 4	103° / 283°
Lightning brackets	90° / 270°
Drain from shell	270°
Transport up	180°
Liner flange markering	90°

EN13084-7-T200-H0-D-L20-Corten-0
All not mentioned weldings a=3

Order no. 533159 Weight= 113 t

Rev:	Date:	Name:	Changes:	Rev:	Date:	Name:	Changes:
A	24/6-19	SDK	Elevation of inlet and platforms changed				

VL Staal a/s

Scale:		Date:	Name:
1:50	Drawn by:	16/5-19	SDK
1:	Controlled by:	-	-
	Papersize:		A1

Steel stack for
Hooton
H= 80m D/d= ø3300 / 2 x ø1400mm

533159-102-1030A