

**STERLING CHEMICAL MALTA LTD, HAL FAR**

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**APPLICATION FOR VARIATION OF IPPC PERMIT  
VOLUME 2: IPPC APPLICATION DOCUMENT**



**Version 3: June 2021**



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## Quality Assurance

**Sterling Chemical Malta Ltd, Hal Far**  
**Application for Variation of IPPC Permit: Volume 2**  
 June 2021

**Report for: Sterling Chemical Malta Ltd**

### Revision Schedule

| Rev | Date      | Details              | Prepared by                                              | Reviewed by                      | Approved by                               |
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| 00  | Feb. 2021 | Submission to client | <b>Rachel Decelis</b><br>Senior Environmental Consultant | <b>Rachel Xuereb</b><br>Director | <b>Adrian Mallia</b><br>Managing Director |
| 01  | May 2021  | Submission to ERA    | <b>Rachel Decelis</b><br>Senior Environmental Consultant | <b>Rachel Xuereb</b><br>Director | <b>Adrian Mallia</b><br>Managing Director |
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## 1. INTRODUCTION

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- 1.1. This application for variation of the Integrated Pollution Prevention and Control (IPPC) permit was commissioned by Sterling Chemical Malta Ltd, herein referred to as 'the Operator'.
- 1.2. Sterling Chemical Malta Ltd operates a factory for the development, optimisation and manufacture of Active Pharmaceutical Ingredients (APIs) at HF 50, HF 51 and HF53, Hal Far Industrial Estate.
- 1.3. The operation of the facility is regulated by IPPC permit number IP 0001/19 issued by the Environment and Resources Authority (ERA). The area authorised by the IPPC permit is shown in **Figure 1.1**.
- 1.4. This application covers the following variations:
  - The operation of a warehouse in the HF53 block, to be used for waste storage;
  - The inclusion of additional emission points to air from production areas and laboratory fume hoods / cabinets, located in the HF51 block, as well as the ventilation system for the new waste warehouse in the HF53 block; and
  - Updating of the air emissions monitoring programme to remove ammonia, since this is not used or produced in any of the production activities on site.

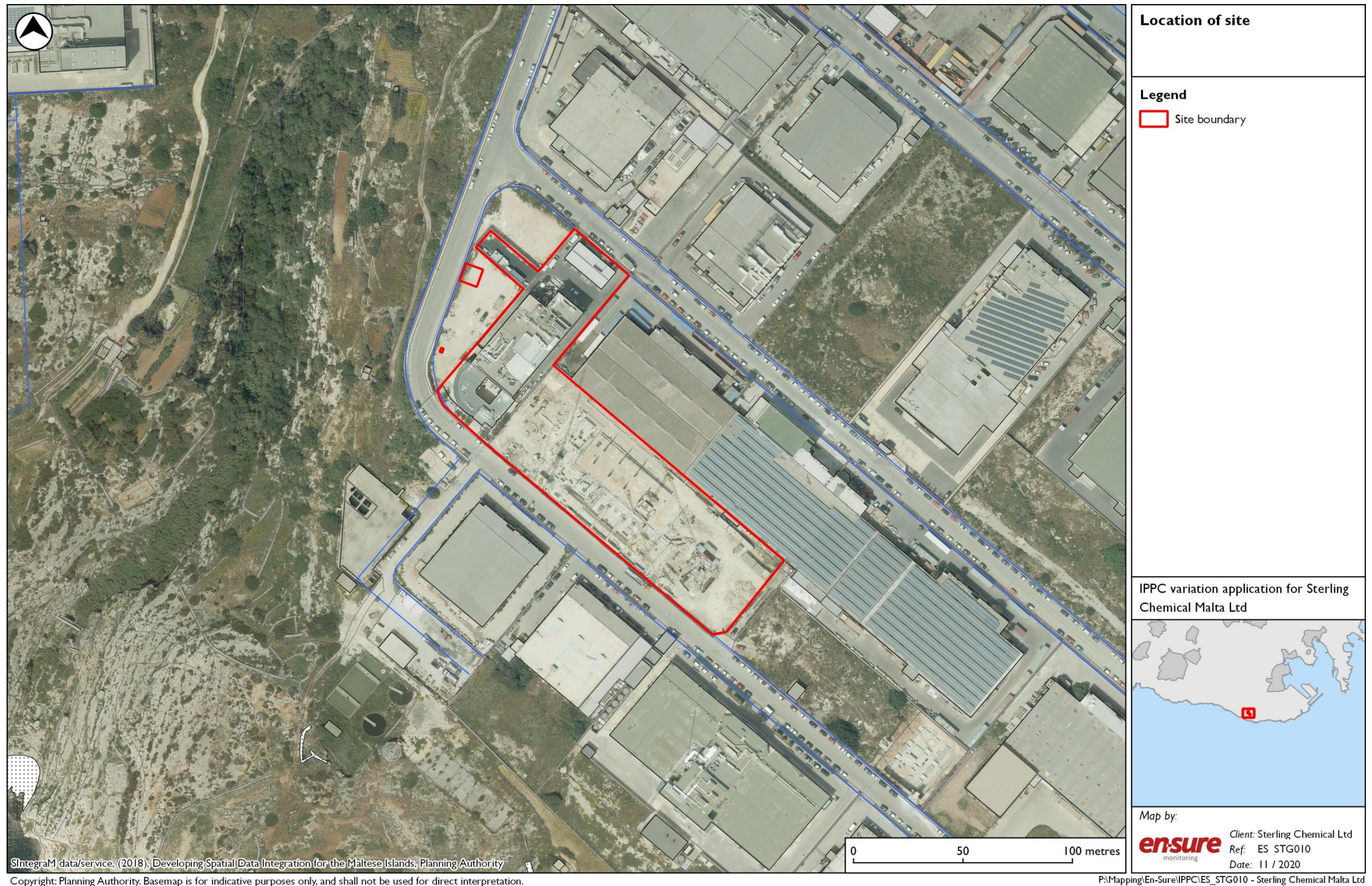
### Structure of the IPPC Application

- 1.5. The IPPC Application consists of three volumes:
  - **Volume 1** comprises the IPPC application forms A and C;
  - **Volume 2** (the current volume) consists of the IPPC application document; and
  - **Volume 3** consists of an Addendum to the earlier Land and Groundwater Risk Assessment prepared for the already permitted facility; this Addendum covers the risks to land and groundwater from the proposed variations.





Figure 1.1: Location of the site







## 2. THE PROPOSED VARIATIONS

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### C1.2 Non-Technical Description

- 2.1. Sterling Chemical Malta Ltd operates a factory for the development, optimisation and manufacture of Active Pharmaceutical Ingredients (APIs).
- 2.2. This application covers the following variations:
  - The operation of a warehouse in the HF53 block, to be used for waste storage;
  - The inclusion of existing additional emission points to air from the clean rooms in the production areas, and from laboratory fume hoods / cabinets, located in the HF51 block, as well as the ventilation system for the new waste warehouse; and
  - Updating of the air emissions monitoring programme to remove ammonia, since this is not used or produced in any of the production activities on site.
- 2.3. The warehouse will be used for storage of non-flammable waste, which will be stored in appropriate containers on shelving. The warehouse is concreted and has gutters leading to an impermeable underground reservoir to contain any spills and wash water. Waste will continue to be sent to licensed facilities.
- 2.4. Emissions to air will be treated with methods that depend on the nature of the emissions; these include high efficiency particulate air (HEPA) filters to collect fine particles, and carbon filters to absorb volatile compounds. Monitoring will also be carried out from these emission points, as relevant.
- 2.5. A land and groundwater risk assessment prepared for the proposed variations (**Volume 3**) has concluded that as a result of the mitigation measures envisaged to be implemented, notably containment and abatement systems, risks to land and groundwater from the proposed variations range from none to low.

### C1.3 The Proposed Variations

- 2.6. As mentioned, the proposed variations comprise:
  - The operation of a warehouse in the HF53 block, to be used for waste storage;
  - The inclusion of existing additional emission points to air from production areas and laboratory fume hoods / cabinets, located in the HF51 block, as well as the ventilation system for the new waste warehouse; and
  - Updating of the air emissions monitoring programme to remove ammonia.



- 2.7. In respect of the warehouse operation, it is envisaged that the existing conditions on waste management in permit IP 0001/19 can continue to apply.
- 2.8. In respect of air emissions, it is proposed that Table 2.2.1 in the IPPC permit, which lists the authorised emission points to air would be updated to include the new emission points from production areas and laboratory fume hoods / cabinets. As advised by ERA, the ventilation system for the waste warehouse is also to be included as an emission point.
- 2.9. Additionally, it is proposed that in Table 2.2.2 in the IPPC permit, which lists the monitoring requirements, the requirement to monitor ammonia from EM1 and EM 13 (scrubbers) is removed, since ammonia is not used or produced in the production activities on site.

### 3. TECHNIQUES

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#### C2.1 Environmental Management System

- 3.1. The Operator already has an Environmental Management System (EMS) in place, which is certified to the ISO 14001:2015 standard. A copy of the ISO 14001 certificate, as well as key relevant documentation has previously been submitted to ERA.
- 3.2. The activities covered by this variation application will be included in the EMS, as relevant, once they are fully commissioned. A copy of the final updated EMS documents can also be submitted to ERA if required.

#### C2.2 Proposed Activities

- 3.3. As noted, the proposed variations comprise:
- The operation of a warehouse in the HF53 block, to be used for storage of non-flammable waste;
  - The inclusion of existing additional emission points from production areas and laboratory fume hoods / cabinets, located in the HF51 block, as well as the ventilation system for the new waste warehouse in the HF53 block; and
  - Updating of the air emissions monitoring programme to remove ammonia.
- 3.4. The following sub-sections give further details on the above variations.

#### Waste Warehouse

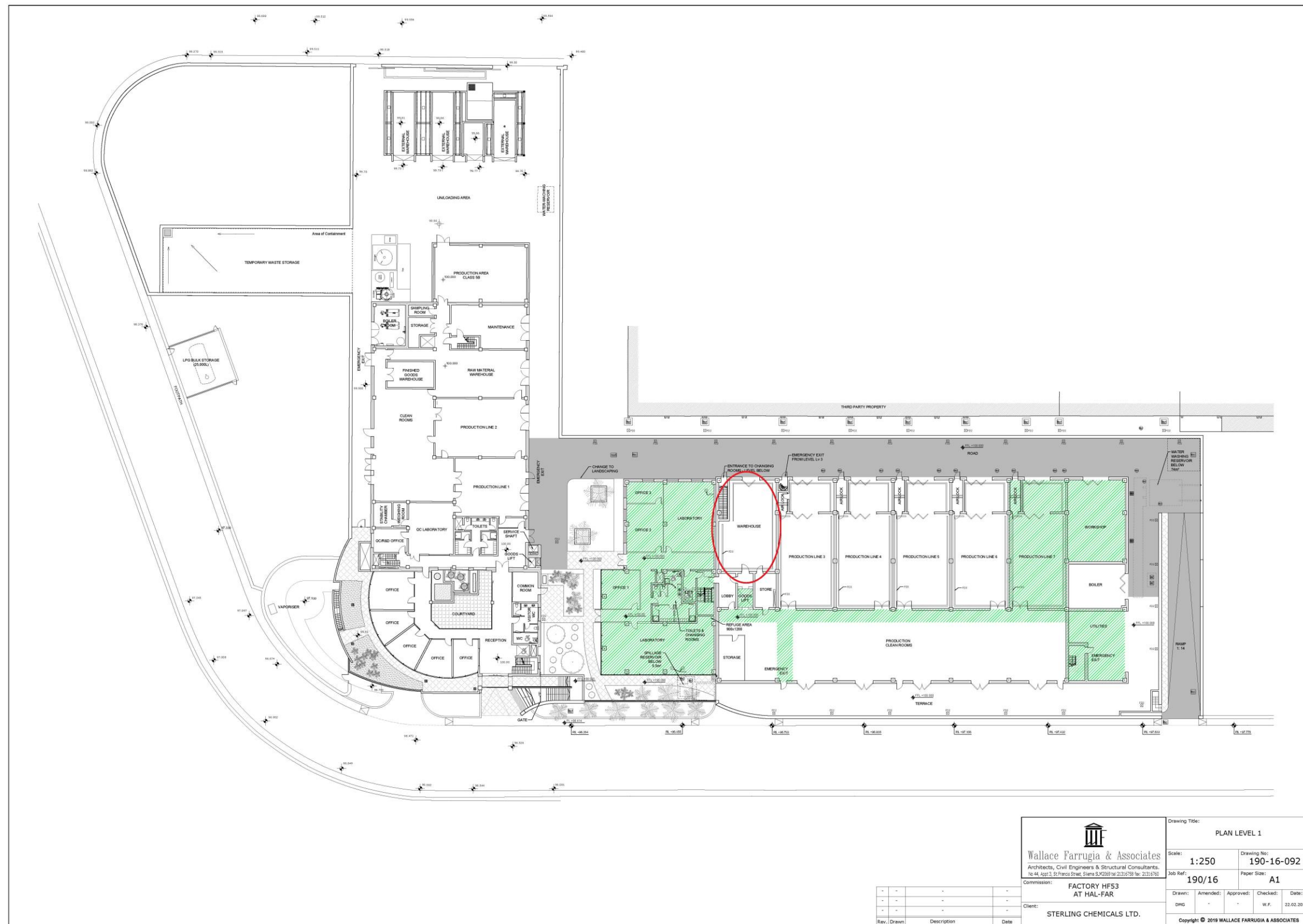
- 3.5. The need for additional waste storage space has arisen due to the lack of sufficient storage space in the existing facility. Waste is currently stored in the external waste storage area, with hazardous waste being stored in bundled shipping containers. The addition of a new waste warehouse will therefore increase the facility's capacity for waste storage as well as improve the logistics related to waste management.
- 3.6. It is noted that the external waste storage area will continue to be used once the waste warehouse is commissioned. However, eventually both the proposed waste warehouse and the existing external waste storage area will no longer be needed, since additional waste storage capacity is planned elsewhere on site.<sup>1</sup>
- 3.7. The location of the warehouse is marked in red in **Figure 3.1** and **Figure 3.2**. The warehouse is a double-height warehouse.

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<sup>1</sup> The Operator has plans to extend the external flammable warehouse, and to add ISO tanks for waste storage in the HF50 block. These plans would be the subject of a separate IPPC variation application to be submitted in the future.



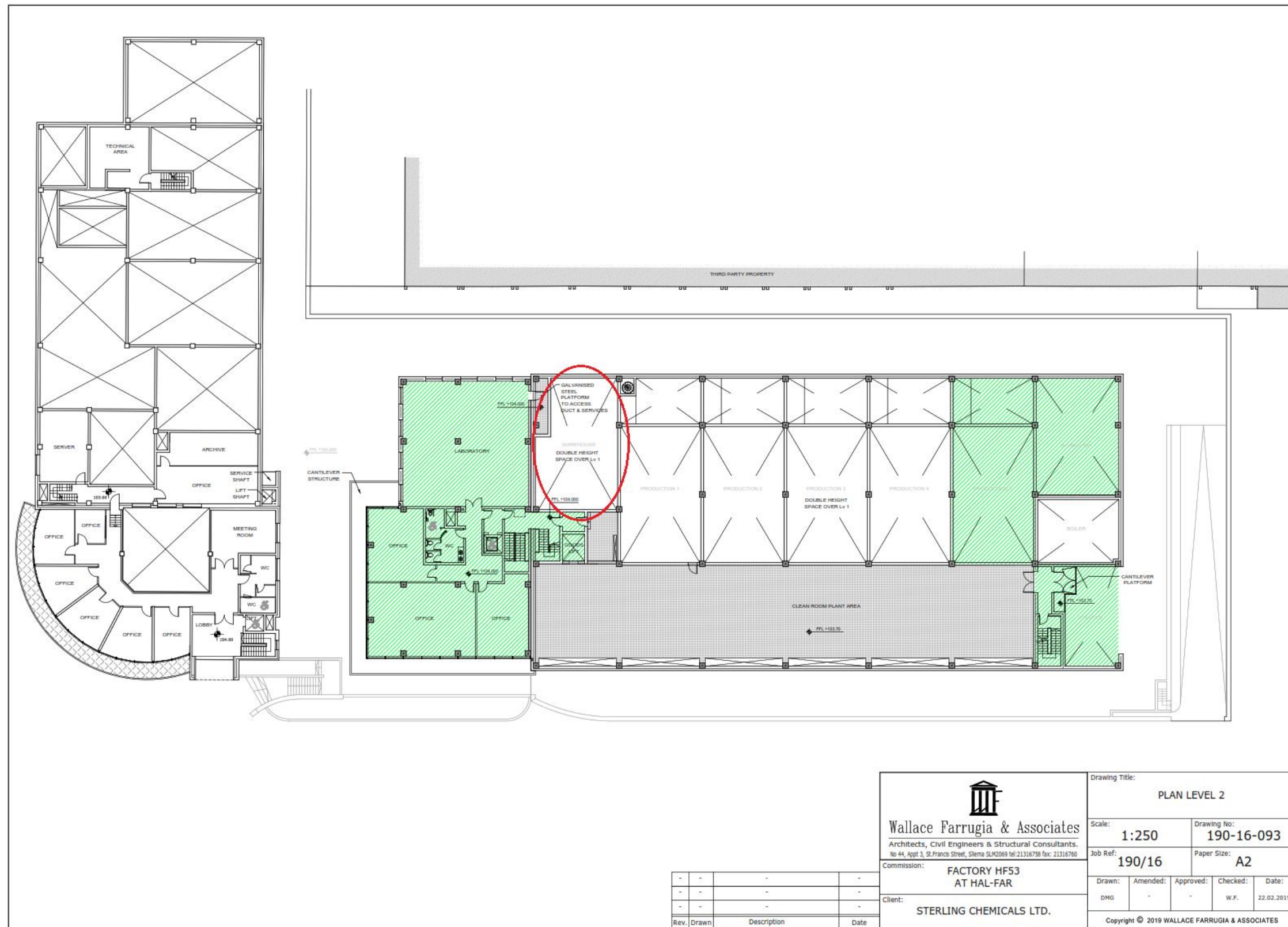
Figure 3.1: Layout of the facility (Level 1)



The location of the waste warehouse is circled in red.



Figure 3.2: Layout of the facility (Level 2)



The location of the waste warehouse is circled in red.

- 3.8. Waste will be stored in appropriate labelled containers (such as drums and intermediate bulk containers, IBCs) and stacked on shelves. Further information on the waste streams to be stored is provided in section C3.1.
- 3.9. In the event of a spill, this would be collected by stainless steel gutters around the internal perimeter, draining to the 57 m<sup>3</sup> 'water washing reservoir' at the north eastern corner of the HF 53 block. A drainage plan is presented as **Figure 3.3**.

### New Emission Points to Air

- 3.10. The proposed variations include the addition of new emission points to air from:
- the existing production areas and micronisation plant in the HF 51 block (emission points EM2 and EM3A-C);
  - the laboratories in the HF51 block (emission points EM4C-E, EM8A-D, EM10B-D); and
  - the ventilation system from the new waste warehouse (emission point EM22).
- 3.11. The new emission points to air are summarised in **Table 3.1**, which also summarises the abatement applicable to each emission point.

**Table 3.1: New emission points to air**

| Ref.               | Source                                                        | Abatement                       |
|--------------------|---------------------------------------------------------------|---------------------------------|
| EM2                | HVAC (General ventilation and air-conditioning) – HF 51 block | Fabric filter                   |
| EM3A               | HVAC Production Line 2 clean rooms                            | HEPA filter (HF1)               |
| EM3B               | HVAC Production Line 1 clean rooms                            | HEPA filter (HF2)               |
| EM3C               | Micronisation plant clean rooms                               | HEPA filter (HF3)               |
| EM4C               | Microniser lab fume hoods                                     | Carbon filter                   |
| EM4D               | Microniser lab fume hoods                                     | Carbon filter                   |
| EM4E               | Microniser lab fume hoods                                     | Carbon filter                   |
| EM8A               | AMS (Quality Control) lab fume hoods                          | Carbon filter                   |
| EM8B               | AMS (Quality Control) lab fume hoods                          | Carbon filter                   |
| EM8C               | AMS (Quality Control) lab fume hoods                          | Carbon filter                   |
| EM8D               | AMS (Quality Control) lab cabinet and localised hoods         | Carbon filter                   |
| EM10B <sup>2</sup> | R&D lab fume hoods                                            | Carbon filter                   |
| EM10C              | R&D lab fume hoods                                            | Carbon filter                   |
| EM10D              | R&D lab fume hoods                                            | Carbon filter                   |
| EM22               | Waste warehouse                                               | None – no significant emissions |

- 3.12. Further information on these emission points, including their location and further details on the abatement techniques, is provided in section C3.6.

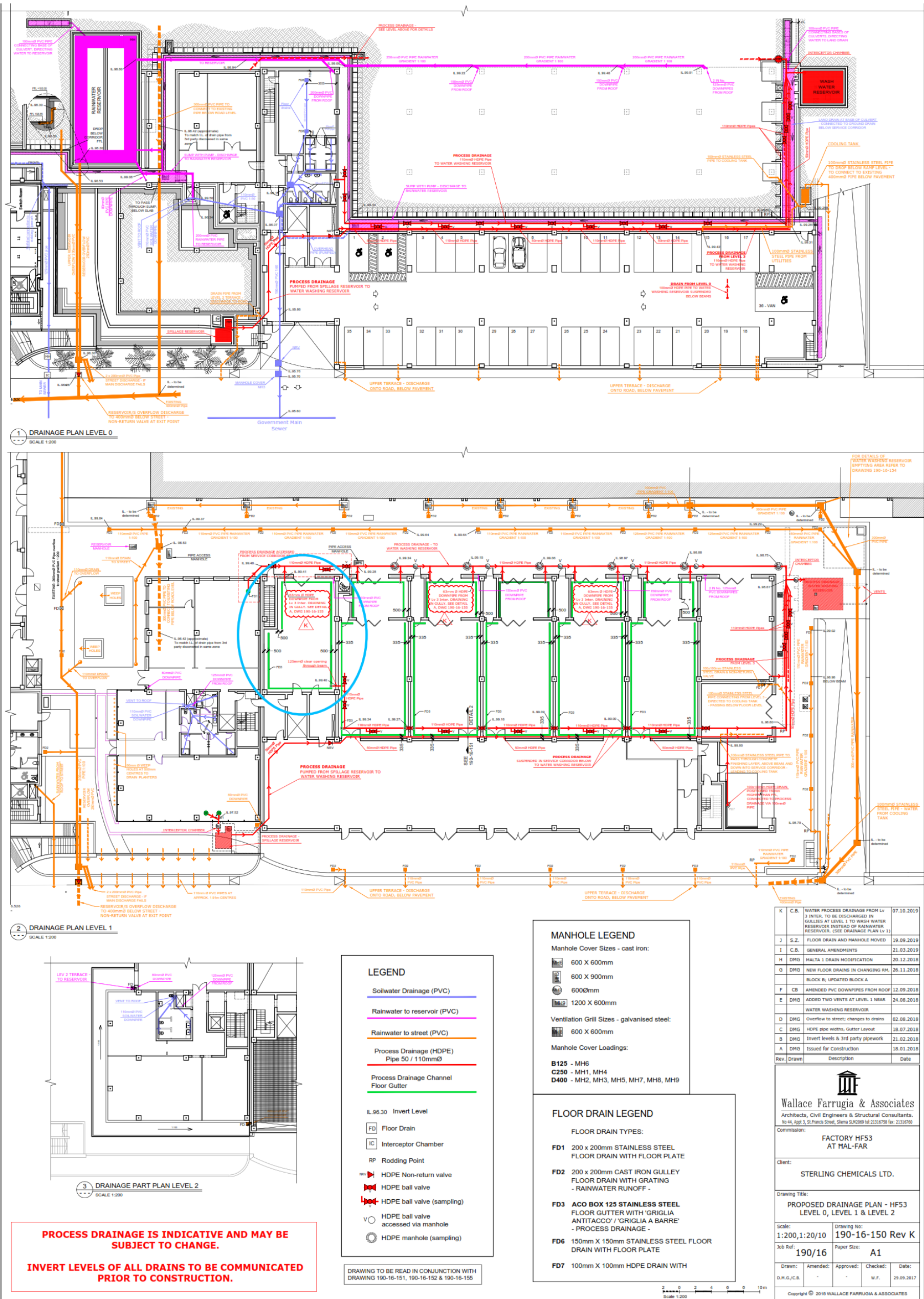
<sup>2</sup> The existing emission point EM10 (Micronisation laboratory from hood extraction vent) is being relabelled as EM10A.

### **Updating of Air Emissions Monitoring Programme**

- 3.13. Since ammonia is not generated or used in any of the production activities on site, and is only generated as a by-product in one of the processes occurring in the pilot plant (Line 7), i.e. on a very small scale, a request is being made for removal of this parameter from the air emissions monitoring programme.



Figure 3.3: Drainage plan







#### **C2.2.4 Best Available Technique Assessment**

- 3.14. Updated Best Available Technique (BAT) assessments, to take into account minor recent updates to the facility (not necessarily related to the proposed variations) are included as **Annex 1** and **Annex 2**.
- 3.15. Assessment has been made against the:
- BAT Conclusions in the BREF document for the Manufacture of Organic Fine Chemicals (August 2006); and
  - BAT Conclusions for common waste water and waste gas treatment/management systems in the chemical sector (Commission Implementing Decision (EU) 2016/902).

#### **C2.2.5 Alternatives**

- 3.16. In selecting the warehouse for waste storage, the zero option of retaining only the existing external waste storage area was considered; however, this represents a higher cost to the Operator since the shipping containers in which hazardous waste is currently being stored are rented.
- 3.17. The option of exporting waste from the site more frequently would also represent a higher cost to the Operator.
- 3.18. The selection of an area that has already been built was preferable as it would enable operations to commence faster, and since other suitable areas on site (such as the external flammable warehouse) were already being used for other purposes, the identified warehouse represented the most appropriate option.

### **C2.5 Maintenance**

- 3.19. The facility's maintenance plan includes maintenance of the air emissions abatement equipment that is included as part of this variation application.
- 3.20. Maintenance requirements are in accordance with manufacturer specifications and with any applicable legal requirements.

### **C2.6 Energy**

- 3.21. The main users of electrical energy resulting from the proposed variations will be lighting for the waste warehouse and pumps for the air extraction systems pertaining to the new emission points; the increase in electricity consumption will be minimal.
- 3.22. Indoor lighting will be based on energy efficient systems (LED or similar) to minimise consumption.

## **C2.7 Water**

- 3.23. The only additional water consumption arising from the proposed variations will be from washing of the waste warehouse floor. Therefore the increase in water consumption will be minimal.
- 3.24. No changes to the current water sources are proposed.

## **C2.8 Risk Assessment**

- 3.25. An environmental risk assessment for a proposed extension to the facility (both phase 1 and phase 2) was previously prepared as part of an EIA update submitted for development planning application PA 8089/19. That EIA update was already submitted to ERA as part of a previous IPPC variation application.
- 3.26. That environmental risk assessment considered, amongst others, the risk of spills from the waste warehouse (which was then envisaged as a raw materials warehouse), and concluded that with the proposed mitigation measures the pollutant linkage would be removed. This conclusion is also reached in the land and groundwater risk assessment prepared as part of the current IPPC application (**Volume 3**).
- 3.27. Although the emission points to air included as part of the proposed variations were not specifically considered in that environmental risk assessment, the environmental risk from similar emission points (also fitted with abatement) was classed as low.
- 3.28. With mitigation, the risk of fire was judged to be low, while the risk from the generation of used extinguishant was classed as low to moderate, depending on the size of the fire. It is noted that the scope of the EIA was wider and covered more areas / activities than in the current IPPC variation application; additionally, the waste warehouse will only store non-flammable waste, which reduces the risk of fire arising from the proposed variations. In the land and groundwater risk assessment prepared as part of the current IPPC application (**Volume 3**), no pollutant linkage was identified from the release of used contaminated extinguishant from the waste warehouse, due to the presence of containment.

## **Emergency Procedures**

- 3.29. The facility's Emergency and Evacuation Plan has been updated to take into account the operation of the waste warehouse. A copy is included as **Annex 3**.
- 3.30. Other emergency procedures currently in place will continue to apply:
- MIOS\_ 4.4.7-A Procedure to follow in case of fire;
  - MIOS\_ 4.4.7-B Operating instruction for fire extinguishers, fire hydrants and mobile foam groups;

- MIOS\_ 4.4.7-C Procedure to follow in case of spill or release or contact with hazardous substances;
- MIOS\_ 4.4.7-D Procedure to follow in case of malfunction or breakdown of equipment;
- MIOS\_ 4.4.7-E Procedure to follow in case of injury or illness;
- MIOS\_ 4.4.7-F Procedure to follow for the safety of the plant and the employees;
- MIOS\_ 4.4.7-G Procedure to follow in case of earthquake, flood/flood, power emergency;
- MIOS\_ 4.4.7-H Procedure to follow in case of emergency;
- MIOS\_ 4.4.7-L Procedure to adopt in the event of oxygen-deficient atmosphere; and
- MIOS\_4.4.7-M-Procedure for testing emergency pump.

### **Fire Safety**

- 3.31. The existing 600 m<sup>3</sup> reservoir on the HF 51 block will continue to be reserved exclusively for firefighting of the entire site. This is kept full at all times, and a level meter with alarm is installed for this purpose. This volume is able to provide up to 150 minutes of firefighting water.
- 3.32. A fire safety and ventilation report has been drawn up for the HF53 block, which houses the waste warehouse; a copy is included as **Annex 4**.
- 3.33. The waste warehouse will include a break glass manual call point, an internal fire sounder and a flashing beacon as alarm systems. A Class ABC dry chemical fire extinguisher will also be installed; there will be no sprinklers or water-based firefighting systems in this area.
- 3.34. Drawings of the fire detection and firefighting systems in the HF53 block are included in **Annex 4**.

### **Spill Management**

- 3.35. The waste warehouse is underlain by an impermeable concrete layer. The floor has stainless steel gutters around the internal perimeter, draining to the 57 m<sup>3</sup> 'water washing reservoir' at the northeastern corner of the HF 53 block. The gutters will collect any spilt waste and wash water from floor washing.
- 3.36. A spill kit will also be included in the waste warehouse.
- 3.37. As mentioned, procedure MIOS\_ 4.4.7-C *Procedure to follow in case of spill or release or contact with hazardous substances*, will continue to apply.

## **C2.9 Training**

- 3.38. The procedure governing the identification of training needs and implementation of a training programme is MPA\_4.4.2 (copy submitted to ERA previously). This procedure was already identified as part of the original IPPC application, and will continue to apply.
- 3.39. This procedure aims to ensure that any persons working for or on behalf of the facility involved in activities that could have an impact on the environment are properly trained to carry out their assigned duties in a manner that will not cause deviation from the company environmental policy (whereas the policy includes a commitment to comply with applicable legal requirements and other environmental requirements to which the Company subscribes, i.e. including its IPPC permit).
- 3.40. The procedure also requires the implementation of an annual training plan, and maintenance of training records. Therefore the activities covered by these proposed variations will be included in a forthcoming training plan that includes the proposed variations, and corresponding records kept.

## 4. EMISSIONS

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### C3.1 Waste

#### Waste Identification

- 4.1. The principal waste types to be stored in the waste warehouse are indicated in **Table 4.1**. These waste types are already generated by the existing operations of the facility, and no new waste types are envisaged.

**Table 4.1: Waste stored in the warehouse**

| EWC code  | Description                                                       |
|-----------|-------------------------------------------------------------------|
| 06 01 06* | Other acids                                                       |
| 07 07 01* | Aqueous washing liquids and mother liquors                        |
| 07 07 03* | Organic halogenated solvents, washing liquids, and mother liquors |
| 16 10 01* | Aqueous liquid wastes containing hazardous substances             |

- 4.2. It is noted that no flammable wastes will be stored in the waste warehouse. With respect to waste having the EWC code 07 07 03\*, this refers to dichloromethane which is not flammable.
- 4.3. There will also be some additional spent filters (EWC code 07 07 10\*) generated as a result of the new emission points to air; the quantities will be minor, and such waste will continue to be managed as per current practices.
- 4.4. The quantities of waste generated from the facility will not change significantly as a result of the proposed variations.

#### Waste Management

- 4.5. In the waste warehouse, waste will be stored in appropriate containers such as drums and intermediate bulk containers (IBCs). The containers will be stacked onto shelves, similar to those shown in **Figure 4.1**. It is noted that the warehouse is a double-height warehouse.
- 4.6. The maximum quantity of waste stored in the warehouse will be 100 m<sup>3</sup>.
- 4.7. Any spills of waste from the warehouse will drain through gutters located around the internal perimeter, to the existing 57 m<sup>3</sup> 'water washing reservoir' at the northeastern corner of the HF 53 block. A drainage plan is included as part of section C2.2.



**Figure 4.1: Example shelving**



### Waste Transfers

- 4.8. All waste on site will continue to be transferred to licensed facilities using authorised waste carriers, and records will continue to be maintained and reported to ERA as per current practice.
- 4.9. Movements of hazardous waste will also be covered by consignment permits / notes, as is the current practice.

### C3.6 Emissions to Air

- 4.10. As mentioned, the proposed variations include the addition of emission points to air, as shown in **Table 4.2**.

**Table 4.2: New emission points to air**

| Ref.               | Source                                                        | Abatement         |
|--------------------|---------------------------------------------------------------|-------------------|
| EM2                | HVAC (General ventilation and air-conditioning) – HF 51 block | Fabric filter     |
| EM3A               | HVAC Production Line 2 clean rooms                            | HEPA filter (HF1) |
| EM3B               | HVAC Production Line 1 clean rooms                            | HEPA filter (HF2) |
| EM3C               | Micronisation plant clean rooms                               | HEPA filter (HF3) |
| EM4C               | Microniser lab fume hoods                                     | Carbon filter     |
| EM4D               | Microniser lab fume hoods                                     | Carbon filter     |
| EM4E               | Microniser lab fume hoods                                     | Carbon filter     |
| EM8A               | AMS (Quality Control) Lab fume hoods                          | Carbon filter     |
| EM8B               | AMS (Quality Control) Lab fume hoods                          | Carbon filter     |
| EM8C               | AMS (Quality Control) Lab fume hoods                          | Carbon filter     |
| EM8D               | AMS (Quality Control) Lab cabinet and localised hoods         | Carbon filter     |
| EM10B <sup>3</sup> | R&D Lab fume hoods                                            | Carbon filter     |
| EM10C              | R&D Lab fume hoods                                            | Carbon filter     |
| EM10D              | R&D Lab fume hoods                                            | Carbon filter     |
| EM22               | Waste warehouse                                               | None              |

<sup>3</sup> The existing emission point EM10 (Micronisation laboratory from hood extraction vent) is being relabelled as EM10A.

- 4.11. One new emission point covering the general ventilation and air-conditioning of the HF51 block, notably the production areas, warehouses and maintenance rooms, is being introduced (labelled as EM 2 in **Figure 4.2**). Exhaust air from this point is released through air grilles having a basic fabric filter; information on this system is included in **Annex 5**. It is noted that no handling of powder is carried out in the areas covered by this emission point, and if any containers are opened (e.g. reactors or IBCs), local extraction is used which is directed to the existing scrubber (EM 1).
- 4.12. Emissions from the clean rooms in production Lines 1 and 2, and the micronisation plant (also located in the HF51 block) are treated using a HEPA H13 filter (emission points EM3A-3C). It is noted that the production lines include filters, dryers, and centrifuges, whereas the micronisation plant mills fine powders; these activities may release powder emissions. Specification sheets for the HEPA filters are included in **Annex 6**; these show that the filtration efficiency is greater than 99.95%. It is noted that a differential pressure device is installed before and after each HEPA filter in order to monitor the operation of the filter; the filters are already included in the facility's maintenance programme and replaced as per the maintenance schedule. Additionally, in the production lines, if any containers are opened (e.g. reactors or IBCs), local extraction is also used which is directed to the existing scrubber (EM 1). In the micronisation plant, containers are opened inside an enclosed glove box, whereas emissions are directed first to a HEPA filter (H13) and then to the existing scrubber (EM 1), as described in an earlier IPPC application.<sup>4</sup>
- 4.13. Several new emission points from laboratory fume hoods and a lab cabinet are also being introduced (EM4C-E, EM8A-C, and EM10B-D). Such emissions are treated through a carbon filter prior to release at roof level. Specification sheets for typical carbon filters to be used are included in **Annex 7**.<sup>5</sup> Additionally a HEPA H13 filter is installed on the suction hoods (balance enclosure) where weighing of powders is carried out; the treated air is released inside the same laboratory. Specification sheets for HEPA filters are included in **Annex 6**. It is noted that the laboratories are existing laboratories, however, the fume hoods and cabinets are new.
- 4.14. The waste warehouse will have a dedicated ventilation system for air circulation; this is required for health and safety reasons, to ensure sufficient air exchange in the workplace. The door of the warehouse will always be kept open, and the vent will exhaust at roof level (EM22). It is noted that there are no filters, because the new warehouse will only be used to store the non-flammable waste currently being stored in the external warehouse. Additionally, no operations will be carried out inside the warehouse; there will be closed containers and no transfers or other operations will be carried out. Therefore there are no significant emissions.

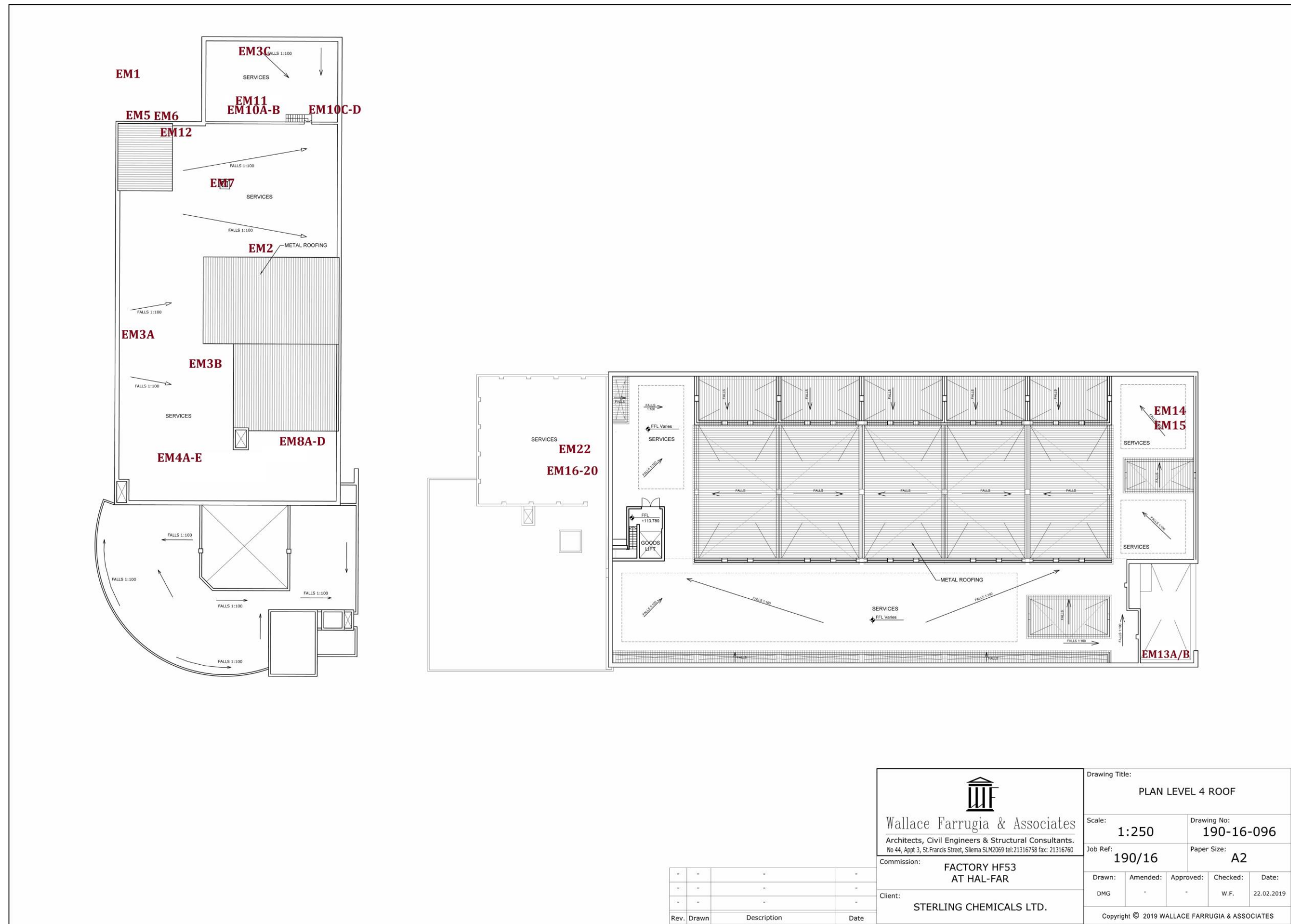
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<sup>4</sup> En-Sure Ltd, 2017. *Sterling Chemical Malta Ltd, Hal Far. Application for Variation of IPPC Permit: Volume 2: IPPC Application Document* (Version: 1). San Gwann, October 2017; vi + 51 pp. + 5 Annexes.

<sup>5</sup> It is envisaged that the filter type will be ProjectCarbo PCPRN0606 filters or similar.



Figure 4.2: Emission points to air







- 4.15. No new boilers, emergency electricity generators, or cooling towers are proposed as part of the proposed variations.

### C3.10 Monitoring

- 4.3.1. The relevant emissions associated with the proposed variations are emissions to air. A monitoring proposal for emissions to air is included in **Table 4.3**.

**Table 4.3: Proposed monitoring programme: emissions to air**

| Emission point reference | Source                                | Parameters                 | Monitoring method               | Frequency                                                                                                                                                                        |
|--------------------------|---------------------------------------|----------------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EM3A-C                   | Clean rooms                           | Total particulate matter   | EN 13284-1:2017 (or equivalent) | Annually                                                                                                                                                                         |
| EM4C-E, EM8A-D, EM10B-D  | Laboratory fume hoods and lab cabinet | Total particulate matter   | EN 13284-1:2017 (or equivalent) | One-time monitoring (provided the applicable limit value is met); <sup>8</sup> if not, the monitoring would be repeated annually until compliance is achieved two years in a row |
|                          |                                       | Total organic carbon (TOC) | EN 12619:2013 (or equivalent)   | Every four years (provided the applicable limit value is met); <sup>9</sup> if not, the monitoring would be repeated annually until compliance is achieved two years in a row    |

- 4.3.2. The monitoring proposal for the clean rooms (EM3A-C) is based on the nature of substances that could be emitted from the areas associated with these emission points (primarily dust, because some dry powder may be emitted from the clean rooms, whereas as mentioned VOC emissions are directed to the scrubber).

- 4.3.3. The monitoring proposal for emissions from the laboratories takes into account:

- the nature of the emissions that could be released to air from these sources, i.e. primarily volatile organic compounds, and to a lesser extent, dust;
- the 2019 monitoring results on the existing EM4 (a similar laboratory emission point);<sup>10</sup> the results were:
  - TOC: 12.6 mg/Nm<sup>3</sup>;
  - Dust: 0.1 mg/Nm<sup>3</sup>; and

<sup>8</sup> The Organic Fine Chemicals BREF (section 5.2.3.6) sets a BAT-AEL for particulate matter of 0.05 – 5 mg/m<sup>3</sup> or 0.001 – 0.1 kg/h.

<sup>9</sup> The Organic Fine Chemicals BREF (section 5.2.3.1.2) sets a BAT-AEL for TOC of 20 mgC/Nm<sup>3</sup> (dry gas) or 0.1 kg C/h.

<sup>10</sup> Sunlab Group Ltd (2019) *Test Report no 2019 09016A-002*.

- the requirements of the Industrial Emissions (Limitation of Emissions of Volatile Organic Compounds) Regulations, S.L.549.79, whereas monitoring of individual VOCs having specific risk phrases (e.g. dichloromethane) is only required if these VOCs are used as solvents and if mass flow thresholds of 10 or 100 g/h are exceeded (the threshold applicable depends on the compound).
- 4.3.4. It is noted that monitoring in conjunction with EM2 (the general ventilation and air-conditioning system for the HF 51 block) is not considered necessary. This is since no handling of powder is carried out in the areas covered by this emission point, and if any containers are opened, local extraction is used which is directed to the scrubber. This recommendation is also consistent with ERA's requirements in the IPPC permit regarding a similar emission point (EM14, which is the ventilation system for line 7).
- 4.3.5. With regard to EM22 (the ventilation system for the waste warehouse), monitoring is also not considered necessary, since there are no significant emissions. As mentioned, the waste warehouse will only be used to store the non-flammable waste currently being stored in the external warehouse. Additionally, there will be closed containers and no transfers or other operations will be carried out inside the new waste warehouse.
- 4.3.6. The monitoring stipulated in **Table 4.3** would be carried out when activities associated with the respective emission point are underway.
- 4.3.7. If accepted by ERA, it is proposed that the laboratory emissions monitoring strategy in **Table 4.3** would also be applicable to the already permitted emission points EM4A-B, EM10A and EM11, going forward.
- 4.3.8. The methodology used and the results obtained will be reported to ERA as part of the Annual Environmental Report, and compared against the emission limits set in the IPPC permit.
- 4.3.9. As mentioned, since ammonia is not generated or used in any of the production activities on site, and is only generated as a by-product in one of the processes occurring in the pilot plant (Line 7), i.e. on a very small scale, a request is being made for removal of this parameter from the air emissions monitoring programme.

## 5. IMPACT ON THE ENVIRONMENT

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### C4.1 Environmental Effects

- 5.1. As described in this Application, the potential emissions arising from the proposed variations are:
- Emissions to air; and
  - Risk of land / groundwater contamination.
- 5.2. The surrounding land uses are mapped in **Figure 5.1**. The predominant land uses in the surrounding area are industrial, predominantly manufacturing activities (including pharmaceutical production, detergent manufacture, production of climate control systems, and printing presses) and storage / warehousing.
- 5.3. The facility is also located around 12 m from the valley sides of Wied Žnuber, which forms part of a Special Protected Area (SPA), a Natura2000 Special Area of Conservation (SAC) – Site of International Importance, and an Area of Ecological Importance (AEI). Some cultivated agricultural land is also found along both sides of the Wied Žnuber valley.
- 5.4. There are no residential properties within 250 m of the site.
- 5.5. Emissions to air from the proposed variations are described in section C3.6 of this application. As mentioned, air emissions will be mitigated, including through the use of HEPA filters for the clean rooms, and a carbon filter for the laboratories. Therefore the environmental impacts of air emissions from the proposed variations are expected to be low.
- 5.6. As noted in the IPPC application form (**Volume 1**), no emissions to land and groundwater are proposed. The Addendum to the Land and Groundwater Risk Assessment (**Volume 3**) identifies the risks to land and groundwater as ranging from none (where there is no pollutant linkage) to low.

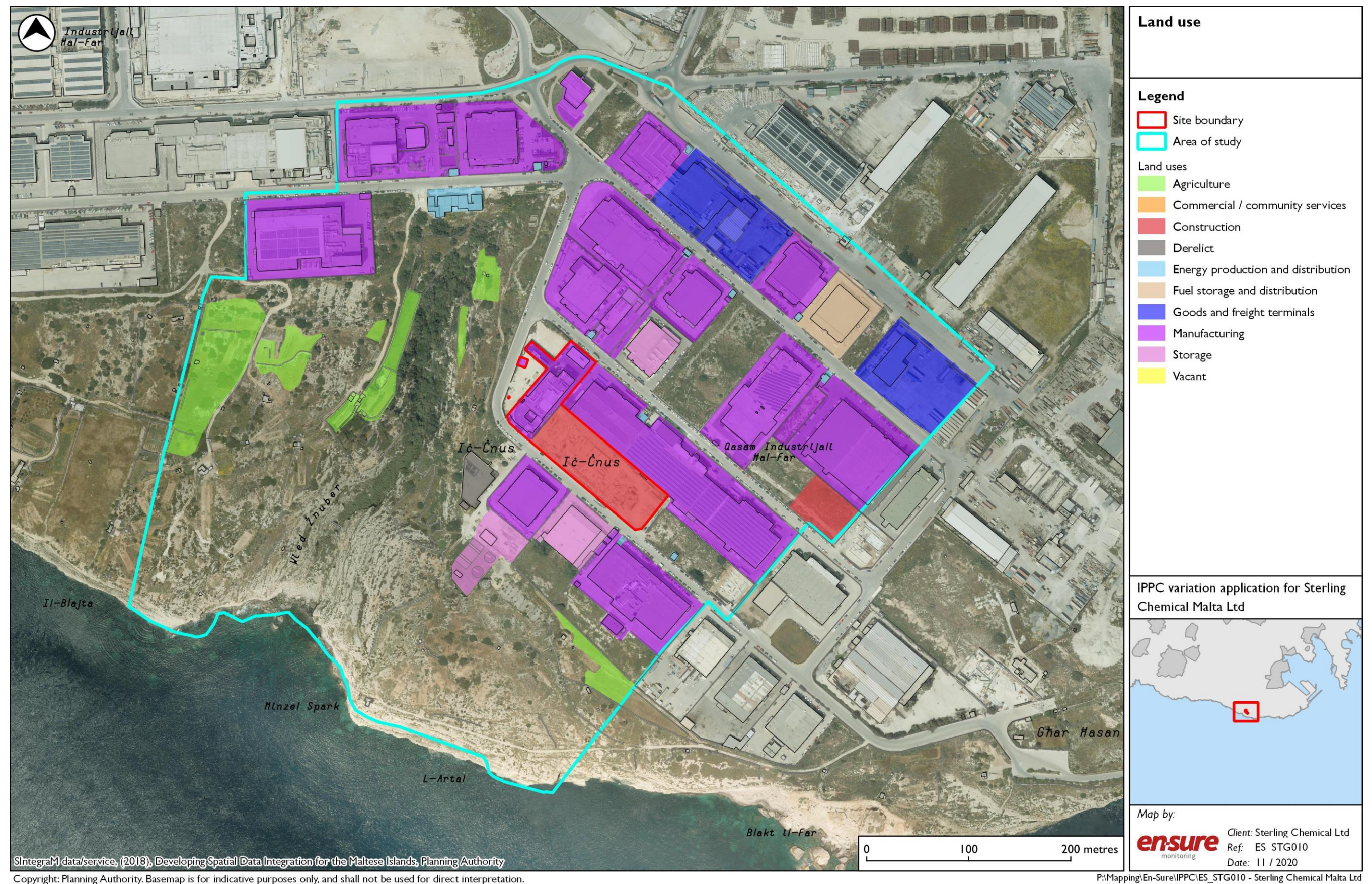
### C4.2 Effects on Other Sites

- 5.7. Considering that the mitigation measures that will be in place, as well as the nature of the other industrial sites in the vicinity, it is considered that the proposed variations are unlikely to have a significant effect on other sites.





Figure 5.1: Surrounding land uses







## **Annex 1: BAT Assessment - Organic Fine Chemicals**



## IPPC BAT Conclusions

Best Available techniques (BAT) conclusions, for the Manufacture of Organic Fine Chemicals. (August 2006)

## General Considerations:

### D. Comparison Exercise with BAT

| BAT CONCLUSION                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | STATUS AT INSTALLATION: Sterling Chemical Malta Ltd<br>DATE: 28 <sup>th</sup> January 2021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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| 1. Prevention and minimisation of environmental impact                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 1.1 Prevention of environmental impact                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| BAT 1<br><br>Integration of environmental, health and safety considerations into process development | BAT is to provide an auditable trail for the integration of environmental, health and safety considerations into process development (see BREF Section 4.1.2).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Production processes and technologies are evaluated at the design phase, and optimised to improve performance and reduce environmental impacts, for instance by increasing production yields, lowering energy and water consumption, minimising the use of solvents where possible, and reducing production time and space required, while also respecting product quality requirements. Optimisation of the process is documented in the internal Process Validation documentation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| BAT 2<br><br>Integration of environmental, health and safety considerations into process development | <p>BAT is to develop new processes as follows (see BREF Section 4.1.1):</p> <ul style="list-style-type: none"> <li>a) To improve process design to maximise the incorporation of all the input materials used into the final product (see, e.g. BREF Sections 4.1.4.3 and 4.1.4.8)</li> <li>b) To use substances that possess little or no toxicity to human health and the environment. Substances should be chosen in order to minimise the potential for accidents, releases, explosions and fires (e.g for solvent selection, see BREF Section 4.1.3).</li> <li>c) To avoid the use of auxiliary substances (e.g. solvents, separation agents, etc. see e.g. BREF Section 4.1.4.2</li> <li>d) To minimise energy requirements in recognition of the associated environmental and economic impacts. Reactions at ambient temperatures and pressures should be preferred</li> <li>e) To use renewable feedstock rather than depleting, wherever technically and economically practicable</li> <li>f) To avoid unnecessary derivatisation (e.g. blocking or protection groups)</li> <li>g) To apply catalytic reagents, which are typically superior to stoichiometric reagents (see, e.g. BREF Sections 4.1.4.4 and 4.1.4.5).</li> </ul> | <p>a) b) c) All raw materials used are chosen by carefully studying the impact that they could have in terms of environment, health and safety. All raw materials, including those that form part of the chemical synthesis, need internal authorisation. Carcinogenic, mutagenic, or reprotoxic substances are avoided as much as possible. Reduction in solvent use is optimised as part of the process development.</p> <p>d) Equipment used in ATEX areas is ATEX certified. Reactors are made of AISI stainless steel and all materials are CE certified. Each new piece of equipment or machinery is checked by the HSE office in order to ensure the best solution (for example ATEX or CE certifications, closed systems whose security is guaranteed by the producer, emergency and warning levels for the environment, and guarantees of the maximum energy efficiency). Energy efficiency is also considered, as described in the '<i>Minimisation of energy consumption</i>' section below. Where it is not possible to lower the temperature (because of production reasons), energy savings are made using thermally insulated pipes and equipment.</p> <p>e) Due to product quality constraints, it is not possible to recover solvent for reuse / cleaning. However, solvent use is minimised by:</p> |



|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>- Using the same solvent used to clean the reactor in order to clean the filter / centrifuge used in the same process; and</p> <p>- If the reactor is going to be reused for the same product type, doing only one round of cleaning with fresh solvent (as opposed to three rounds when a multipurpose clean is carried out).</p> <p>Additionally, the Research and Development Department constantly works with the Production Department to improve yields and find better solutions to minimise costs and reduce the consumption of energy, hazardous substances, and waste produced.</p> <p>f) In process development, unnecessary derivatisation is avoided; this is also done to improve process reliability.</p> <p>g) Catalytic reagents are used when possible; these can also improve yields, reduce energy consumption, and reduce substance consumption.</p>                                                                                                                                                                                                                                                                                                                                                                                           |
| 1.2 Process safety and prevention of runaway reactions |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <p><b>BAT 2</b></p> <p><b>Safety assessment</b></p>    | <p><b>BAT is to carry out a structured safety assessment for normal operation and to take into account effects due to deviations of the chemical process and deviations in the operation of the plant</b> (see BREF Section 4.1.6).</p> <p>In order to ensure that a process can be controlled adequately, <b>BAT is to apply one or a combination of the following techniques</b> (without ranking, see BREF Section 4.1.6.1):</p> <ul style="list-style-type: none"> <li>• organisational measures</li> <li>• concepts involving control engineering techniques</li> <li>• reaction stoppers (e.g. neutralisation, quenching)</li> <li>• emergency cooling</li> <li>• pressure resistant construction</li> <li>• pressure relief</li> </ul> | <p>During the development of the Master Production Document, the chemical safety of the reaction is assessed and steps are undertaken to limit the consequences of unusual events.</p> <p>In order to ensure safe conditions during operation, the following measures have been taken:</p> <ul style="list-style-type: none"> <li>• All operations to be carried out are listed in detail in a Production Record that shows all the sensitive parameters (temperature, pressure, vapour, time), all machinery, and all fixed or mobile mechanical equipment that can be used. The Production Record is endorsed by Health Safety and Environment office. In addition, the Quality and Safety management system establishes all procedures and gives useful suggestions on the workers' safety. Every morning an operator is charged with checking that all utilities (cooling tower, nitrogen inerting system, LPG tanks' connections, scrubber, etc.) are working correctly. Additionally, software is in place to monitor the utilities, relevant parameters (e.g. pressure and temperature of fluids and the reaction mass), and the inerting capacity of the system before and after use.</li> <li>• The production sequence is documented and inputted</li> </ul> |

|                                                                         |                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
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|                                                                         |                                                                                                                                                                                                                                                                                             | <p>into the reactor control system, then the sequence is executed by the reactor. Inertisation, pressurisation and venting processes are automated. The micronisation process is also automated. There is an automatic system in place in case of overheating (as described in the next bullet point).</p> <ul style="list-style-type: none"> <li>• An automatic system is in place in case of overheating, in which the processes (e.g. heating, mixing) are stopped automatically and cooling is applied automatically. In case of overpressure, a pressure disc ruptures and the vapour is collected in a blowdown tank. A reaction neutraliser is on hand for specific reactions (e.g. when bromine is used); this is listed in the Batch Production Record. In case of fire, extinguishing media appropriate to the substance being used are applied.</li> <li>• In case of over temperature, an automatic system will cool the reactor to reach the necessary set point; this is done via the heating / cooling pipes in the reactor jacket.</li> <li>• Equipment is built and certified in compliance with the Pressure Equipment Directive.</li> <li>• In case of an uncontrolled pressure rise inside the reactors, a security system for pressure release starts functioning, wherein a disc is ruptured and the gas is collected in a blowdown tank. Emissions from the blowdown tank are then routed to the scrubber. If the pressure rises within the jacket (the internal coil that encloses the reactor to ensure the temperatures needed are reached) there is a safety valve for discharging the cooling / heating media.</li> </ul> |
| <b>BAT 3</b><br><br><b>Handling and storage of hazardous substances</b> | Handling and storage of hazardous substances require precautions to limit the risks. On sites where toxic substances are handled, operators need sufficient and adequate knowledge to work safely in normal operation and to react adequately when deviations from normal operations occur. | Incompatible chemicals are stored in different places so as to avoid any contact, as required in the management system procedures. Flammable substances are stored in the external covered flammable warehouse to ensure appropriate ventilation, whereas temperature-sensitive materials are stored in cold rooms. Operators are provided with appropriate personal protective equipment, which changes depending on the toxicity or danger of the substance being handled. Handling operations in the plant (for example, loading solvents inside the reactors or weighing them) are performed in a closed circuit, or using a local extraction system which leads to the scrubber.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                                                         | <b>BAT is to establish and implement procedures and technical measures to limit risks from the handling and storage of hazardous substances</b> (for an example, see BREF Section 4.2.30).                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                                         | <b>BAT is to provide sufficient and adequate training for operators who handle hazardous substances</b> (for an example, see BREF Section 4.2.29).                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

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|                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | A training programme is in place for operators, which includes handling of hazardous substances for operators who carry out such duties.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>1.3 Minimisation of environmental impact</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>BAT 5</b><br><br><b>Plant design</b>         | <p><b>BAT is to design new plants in such a way that emissions are minimised by applying techniques including the following (see BREF Sections 4.2.1, 4.2.3, 4.2.14, 4.2.15, 4.2.21):</b></p> <ul style="list-style-type: none"> <li><b>a) using closed and sealed equipment</b></li> <li><b>b) closing the production building and ventilating it mechanically</b></li> <li><b>c) using inert gas blanketing for process equipment where VOCs are handled</b></li> <li><b>d) connecting reactors to one or more condensers for solvent recovery</b></li> <li><b>e) connecting condensers to the recovery/abatement system</b></li> <li><b>f) using gravity flow instead of pumps (pumps can be an important source of fugitive emissions)</b></li> <li><b>g) enabling the segregation and selective treatment of waste water streams</b></li> <li><b>h) enabling a high degree of automation by application of a modern process control system in order to ensure a stable and efficient operation.</b></li> </ul> | <p>a) The plant has been designed to minimise the possible emissions of hazardous substances, such as VOCs and dust, to the environment. For example, reactors, centrifuges and mobile filters are connected through fixed or mobile pipes in order to ensure a closed pathway for the reaction mass or the product / raw material.</p> <p>Pumps are used when loading liquid raw materials into reactors; and a local extraction system (which leads to the scrubber), or a closed-circuit system is used. Loading / unloading operations are carried out when the machinery is off.</p> <p>b) The production building is enclosed and ventilated mechanically.</p> <p>c) All operations, including the drying phase, are preceded and followed by inertisation, typically performed through nitrogen.</p> <p>d) e) Each reactor is equipped with a shell-and-tube heat exchanger to condense organic vapours. The entire reaction line is then connected to a second larger heat exchanger. Following this step, vapours are then treated in a carbon filter and the scrubber.</p> <p>f) Gravity is used whenever feasible.</p> <p>g) All industrial waste water types are collected separately and exported to licensed waste management facilities.</p> <p>h) The production sequence is documented and inputted into the reactor control system; then the sequence is executed by the reactor. Inertisation, pressurisation and venting processes are automated. The micronisation process is also automated. There is also an automatic system in place in case of overheating.</p> |

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| <b>BAT 6</b><br><br><b>Ground protection and water retention options</b> | <b>BAT is to design, build, operate and maintain facilities, where substances (usually liquids) which represent a potential risk of contamination of ground and groundwater are handled, in such a way that spill potential is minimised. Facilities have to be sealed, stable and sufficiently resistant against possible mechanical, thermal or chemical stress</b> (see BREF Section 4.2.27).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Measures for protection of land and groundwater are described in the Land and Groundwater Risk assessment prepared for Sterling Chemical Malta Ltd (including subsequent Addenda). These include: <ul style="list-style-type: none"><li>• Containment for spillages of hazardous liquid waste and used firefighting water;</li><li>• Impermeable surfacing where hazardous substances / wastes are stored;</li><li>• Ensuring that hazardous substances / wastes are only loaded / unloaded / stored in designated areas;</li><li>• High-level alarms for wash water reservoirs;</li><li>• Periodic testing of wash water reservoirs / sumps / bunds for impermeability; and</li><li>• Spill kits at key points throughout the site.</li></ul> |
|                                                                          | <b>BAT is to enable leakages to be quickly and reliably recognised</b> (see BREF Section 4.2.27).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                                          | <b>BAT is to provide sufficient retention volumes to safely retain spills and leaking substances in order to enable treatment or disposal</b> (see BREF Section 4.2.27).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                                          | <b>BAT is to provide sufficient retention volume to safely retain fire fighting water and contaminated surface water</b> (see BREF Section 4.2.28).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                                          | <b>BAT is to apply all the following techniques</b> (see also BREF Section 4.2.27): <ul style="list-style-type: none"><li>• carrying out loading and unloading only in designated areas protected against leakage run-off</li><li>• storing and collecting materials awaiting disposal in designated areas protected against leakage run-off</li><li>• fitting all pump sumps or other treatment plant chambers from which spillage might occur with high liquid level alarms or regularly supervising pump sumps by personnel instead</li><li>• establishing programmes for testing and inspecting tanks and pipelines including flanges and valves</li><li>• providing spill control equipment, such as containment booms and suitable absorbent material</li><li>• testing and demonstrating the integrity of bunds</li><li>• equipping tanks with overfill prevention.</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>1.4 Minimisation of VOC emissions</b>                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Enclosure of sources</b>                                              | <b>BAT is to contain and enclose sources and to close any openings in order to minimise uncontrolled emissions</b> (see BREF Section 4.2.14).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Reactors and other equipment are kept closed during operation, with emissions being diverted to the air abatement system (which consists of two sets of condensers, an activated carbon filter, and a scrubber). Additionally, enclosed pipes are used during transfer of substances (including solvents) between reactors, or between a reactor and centrifuge, whereas materials are transferred by suction (using pumps) or gravity. All liquid transfers are either handled via a closed circuit system, where any excess vapours (creating an overpressure) are diverted to the air abatement system; or else a local extraction system (which leads to the scrubber) is used.                                                            |
| <b>Drying in closed circuits</b>                                         | <b>BAT is to carry out drying by using closed circuits, including condensers for solvent recovery</b> (see BREF Section 4.2.14).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Drying operations are performed in aseptic areas (clean rooms), so once the product has been filtered / centrifuged, it is placed on trays within a static dryer until it is completely dry. Here the liquid solvent or water that evaporates is channelled from the vacuum unit and / or directly from the vent system to the abatement system, which consists of condensers, an activated carbon filter, and a scrubber. Additionally, the clean rooms are fitted with HEPA filters to collect any powder emissions.                                                                                                                                                                                                                         |

|                                                               |                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| Equipment cleaning using solvents                             | BAT is to keep equipment closed for rinsing and cleaning with solvents (see BREF Section 4.2.14).                                                                                                                                                                                                                                                          | Reactors are kept closed during rinsing and cleaning with solvents. Residual solvents are removed by vacuum pumping, and the vapours collected are directed to the abatement system. Once cleaning has been completed, the container is inerted using nitrogen.                                                                                                                                                                                                                        |
| Recirculation of process vents                                | BAT is to use recirculation of process vapours where purity requirements allow this (see BREF Section 4.2.14).                                                                                                                                                                                                                                             | Process vapours cannot be recirculated due to product quality requirements. The collected vapours are exported to licensed waste management facilities.                                                                                                                                                                                                                                                                                                                                |
| <b>1.5 Minimisation of exhaust gas volume flows and loads</b> |                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Closure of openings                                           | <p>BAT is to close any unnecessary openings in order to prevent air being sucked to the gas collection system via the process equipment (see BREF Sections 4.2.14 and 4.3.5.17).</p> <p>At a given temperature (e.g. set by a condenser), the decisive parameter to control the mass flow of an exhaust gas is the volume flow.</p>                        | Process equipment is kept closed during operation (and vapour collection).                                                                                                                                                                                                                                                                                                                                                                                                             |
| Testing the airtightness of process equipment                 | BAT is to ensure the airtightness of process equipment, especially of vessels (see BREF Section 4.2.16).                                                                                                                                                                                                                                                   | <p>Airtightness and the ability to generate vacuum inside the equipment and, in particular, inside the reactors is ensured as follows:</p> <ol style="list-style-type: none"> <li>1. The equipment is certified for airtightness by the manufacturers;</li> <li>2. A pressure test is carried out regularly; and</li> <li>3. Correct sealing and airtightness is visually verifiable through barometric indicators which measure and show the pressure inside the reactors.</li> </ol> |
| Inertisation                                                  | BAT is to apply shock inertisation instead of continuous inertisation (see BREF Section 4.2.17).                                                                                                                                                                                                                                                           | Shock inertisation is applied; inertisation is performed before and after loading / unloading the reaction mass.                                                                                                                                                                                                                                                                                                                                                                       |
|                                                               | Testing airtightness of the equipment is carried out regularly and enables the application of shock inertisation instead of continuous inertisation. Still, continuous inertisation has to be accepted due to safety requirements, e.g. where processes generate O <sub>2</sub> or where processes require further loading of material after inertisation. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Minimisation of exhaust gas volume flows from distillations   | <p>BAT is to minimise the exhaust gas volume flows from distillations by optimising the layout of the condenser (see BREF Section 4.2.20).</p> <p>Exhaust gas volume flows from distillations can be minimised to almost zero if the layout of the condenser allows sufficient heat removal.</p>                                                           | Each reactor is equipped with a shell-and-tube heat exchanger that enables reduction of the exhaust gas by condensing vapours and collecting them in receiving flasks. Then the flow passes through an activated carbon filter and reaches the scrubber, to remove the residual VOCs. Therefore any solvent in the process distillation exhaust gas is abated using this system.                                                                                                       |
| Liquid additions into vessels                                 | BAT is to carry out liquid addition to vessels as bottom feed or with dip-leg, unless reaction chemistry and/or safety considerations make it impractical (see BREF Sections 4.2.15, 4.2.18). In such cases, the addition of liquid as top feed with a pipe directed to the wall reduces splashing and hence, the organic load in the displaced gas.       | Liquid raw materials are loaded through a dip-leg.                                                                                                                                                                                                                                                                                                                                                                                                                                     |



|                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                        |
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|                                                                   | <p>Liquid addition to a vessel is possible as top feed or as bottom feed or with dip-leg. In the case of an organic liquid, the organic load in the displaced gas is about 10 to 100 times higher if added via top feed. If both solids and an organic liquid are added to the vessel, the solids can be used as a dynamic lid in the case of bottom feeding the liquid</p> <p>If both solids and an organic liquid are added to a vessel, BAT is to use solids as a blanket in circumstances where the density difference promotes the reduction of the organic load in the displaced gas, unless reaction chemistry and/or safety considerations make it impractical (see BREF Section 4.2.18).</p> |                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Minimisation of peak emission concentrations</b>               | <b>BAT is to minimise the accumulation of peak loads and flows and related emission concentration peaks by, e.g.</b><br><br>a) <b>optimisation of the production matrix</b> (see BREF Section 4.3.5.17)<br>b) <b>Application of smoothing filters</b> (see BREF Section 4.3.5.16 and also Section 4.3.5.13).                                                                                                                                                                                                                                                                                                                                                                                          | A three-stage gas treatment setup is in place for emissions from the reactors, consisting of cryogenic condensation followed by adsorption on activated carbon, then wet scrubbing. The abatement system efficiency is ensured by replacing the carbon in the carbon filters regularly (approximately monthly, depending on production activities), and replacing the scrubber water regularly (approximately weekly). |
|                                                                   | A characteristic aspect of batch processes is the variation of pollutant load and volume flow in exhaust gases. Such variations represent a challenge for the operation of recovery or abatement techniques and result frequently in undesirable emission concentration peaks potentially representing a higher environmental impact.                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>1.6 Minimisation of volume and load of waste water streams</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Mother liquors with high salt content</b>                      | <p>The separation of products or intermediates from aqueous solutions frequently creates highly loaded aqueous mother liquors.</p> <p><b>BAT is to avoid mother liquors with high salt content or to enable the work-up of mother liquors by the application of alternative separation techniques</b> (see BREF Section 4.2.24), e.g.</p> <p>a) <b>membrane processes</b><br/>a) <b>solvent-based processes</b><br/>b) <b>reactive extraction</b><br/>c) <b>or to omit intermediate isolation.</b></p>                                                                                                                                                                                                | The separation technique for the separation of mother liquors from the dissolved solid is a solvent-based process. Cooling is applied to the mother liquor (at a temperature between 0 and 5 °C). After a few hours of settling, further filtration under vacuum is applied to separate the solid from the mother liquor.                                                                                              |
| <b>Counter-current product washing</b>                            | <b>BAT is to apply counter-current product washing where the production scale justifies the introduction of the technique</b> (see BREF Section 4.2.22).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Not applicable. Production takes place in batches, so there is typically only one reactor undertaking that specific type of reaction at any time (i.e. a second reactor would not typically be carrying out the same process at the same time, and so counter-current product washing would not be possible).                                                                                                          |
|                                                                   | As a polishing step, organic products are often washed with an aqueous phase in order to remove impurities. High efficiencies in combination with low water consumption (and low waste water generation) can be achieved with counter-current washing. However, the degree of optimisation of the washing process depends on the production level and regularity. With small amounts, experimental production runs and rare production campaigns, counter-current product washing is not applicable.                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Water-free vacuum generation</b>                               | <p><b>BAT is to apply water-free vacuum generation</b> (see BREF Sections 4.2.5, 4.2.6 and 4.2.7).</p> <p>Water-free vacuum generation is realised by using, e.g. dry running pumps, liquid ring pumps using solvents as the ring medium or closed cycle liquid ring pumps. However, where the applicability of these techniques is restricted, the use of steam injectors or water ring pumps is justified.</p>                                                                                                                                                                                                                                                                                      | Sterling Chemical Malta Ltd only uses dry-type pumps or liquid ring pumps to generate a vacuum; in the case of the latter a water and sodium-based salts solution is used as the ring medium, to trap acid vapours.                                                                                                                                                                                                    |

|                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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| <b>Determination of the completion of reactions</b> | <p>For batch processes, <b>BAT is to establish clear procedures for the determination of the desired end point of the reaction</b> (for an example, see BREF Section 4.2.23).</p> <p>The precise determination of a chemical process completion minimises the potential load in waste water streams caused by a batch process.</p>                                                                                                                                                                                                                                                                                           | <p>A documented production process is in place for each synthesis, which indicates all the parameters to be followed to perform the synthesis optimally, and the execution time of each operation step by step. The process is developed and optimised at R&amp;D stage. Following the production process, the completion of the process (and product quality) is confirmed by Sterling Chemical Malta Ltd's laboratories.</p>                                                                                                                                                                                             |
| <b>Indirect cooling</b>                             | <p><b>BAT is to apply indirect cooling</b> (see BREF Section 4.2.9).</p> <p>Indirect cooling is not applicable for processes which require the addition of water or ice to enable safe temperature control, temperature jumps or temperature shock. Direct cooling can also be required to control "run away" situations (see BREF Section 4.1.6.2) or where there are concerns about blocking heat-exchangers.</p>                                                                                                                                                                                                          | <p>Indirect cooling is the default cooling method; this is carried out using the jacket around the reactors.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Cleaning</b>                                     | <p><b>BAT is to apply a pre-rinsing step prior to rinsing/cleaning of equipment to minimise organic loads in wash-waters</b> (see BREF Section 4.2.12).</p> <p>Production plant cleaning procedures can be optimised to reduce the resulting waste water loads. In particular, the introduction of an additional cleaning step (pre-rinsing) enables the separation of large portions of solvents from wash-waters. Where different materials are frequently transported in pipes, the use of pigging technology represents another option to reduce product losses within cleaning procedures (see BREF Section 4.2.8).</p> | <p>In nearly every cleaning operation of the reactors and centrifuges a pre-washing step is carried out using a solvent. If the reactor is going to be reused for the same product type, only one round of cleaning is carried out with solvent (as opposed to three rounds for a multipurpose clean).</p> <p>Once solvent cleaning has been performed, the container is filled up to about 1/3 capacity with water and washed. This washwater contains a far lower concentration of active ingredients compared to a scenario where a solvent washing step is not carried out.</p> <p>Pigging technology is not used.</p> |
| <b>Minimisation of energy consumption</b>           | <p><b>BAT is to assess the options and to optimise the energy consumption</b> (for examples, see BREF Sections 4.2.11 and 4.2.20).</p> <p>On an OFC site, a wide variety of processes/operations involve cooling and heating, heat-exchange or the use of temperature profiles. An obvious example to optimise heat consumption is the use of residual heat as energy input to another process, for example in the case of energetically coupled distillations.</p>                                                                                                                                                          | <p>Sterling Chemical Malta Ltd's steam generators have condensate recovery, whose heat is reused for the laboratory ovens.</p> <p>Energy consumption is considered when installing new equipment, and also assessed in the corresponding IPPC application as applicable. Energy consumption is also considered when developing new reactions.</p> <p>Thermally insulated pipes and equipment are used for processes requiring heat.</p> <p>Indoor lighting is based on energy efficient systems (LED or similar) to minimise consumption.</p>                                                                              |

| Part 2. Management and treatment of waste streams   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                  |          |                  |                |                 |            |      |    |                   |                                               |                                                                                                                                                                                       |
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| 2.1 Mass balances and process waste stream analysis |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                  |          |                  |                |                 |            |      |    |                   |                                               |                                                                                                                                                                                       |
| Mass balances                                       | BAT is to establish mass balances for VOCs (including CHCs), TOC or COD, AOX or EOX and heavy metals on a yearly basis (see BREF Sections 4.3.1.4, 4.3.1.5 and 4.3.1.6).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p>Mass balances are prepared annually for VOC solvents, and reported as part of the Annual Environmental Report (AER).</p> <p>Additionally, as required by the IPPC permit, a waste gas stream inventory has been prepared in line with the requirements of BAT 2 and BAT 16 of Commission Implementing Decision 2016/902 establishing best available techniques (BAT) conclusions under Directive 2010/75/EU for common waste water and waste gas treatment /management systems in the chemical sector.</p> <p>With regard to contaminants in wastewater, Sterling Chemical Malta Ltd does not treat its wastewater on site but exports it to licensed facilities; therefore mass balances are not relevant to improving the treatment process.</p> |  |                  |          |                  |                |                 |            |      |    |                   |                                               |                                                                                                                                                                                       |
| Waste stream analysis                               | BAT is to carry out a detailed waste stream analysis in order to identify the origin of the waste stream and a basic data set to enable management and suitable treatment of exhaust gases, waste water streams and solid residues (see BREF Section 4.3.1.1).                                                                                                                                                                                                                                                                                                                                                                                                                  | <p>Exhaust gases are treated as described in the IPPC application, and air emissions monitoring is carried out as required by the IPPC permit.</p> <p>Industrial waste and wastewater are sent to licensed waste management facilities.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |                  |          |                  |                |                 |            |      |    |                   |                                               |                                                                                                                                                                                       |
| Assessment of waste water streams                   | <p>BAT is to assess at least the parameters given in Table 1 for waste water streams, unless the parameter can be seen as irrelevant from a scientific point of view (see BREF Section 4.3.1.2).</p> <p><i>Table 1: Parameters for the assessment of waste water streams</i></p> <table><tr><td>Parameter</td><td></td></tr><tr><td>Volume per batch</td><td rowspan="10">Standard</td></tr><tr><td>Batches per year</td></tr><tr><td>Volume per day</td></tr><tr><td>Volume per year</td></tr><tr><td>COD or TOC</td></tr><tr><td>BOD5</td></tr><tr><td>pH</td></tr><tr><td>Bio eliminability</td></tr><tr><td>Biological inhibition, including infiltration</td></tr></table> | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  | Volume per batch | Standard | Batches per year | Volume per day | Volume per year | COD or TOC | BOD5 | pH | Bio eliminability | Biological inhibition, including infiltration | <p>Sterling Chemical Malta Ltd does not treat its industrial wastewater on site but exports it to licensed facilities; therefore detailed compositional analysis is not relevant.</p> |
| Parameter                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                  |          |                  |                |                 |            |      |    |                   |                                               |                                                                                                                                                                                       |
| Volume per batch                                    | Standard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                  |          |                  |                |                 |            |      |    |                   |                                               |                                                                                                                                                                                       |
| Batches per year                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                  |          |                  |                |                 |            |      |    |                   |                                               |                                                                                                                                                                                       |
| Volume per day                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                  |          |                  |                |                 |            |      |    |                   |                                               |                                                                                                                                                                                       |
| Volume per year                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                  |          |                  |                |                 |            |      |    |                   |                                               |                                                                                                                                                                                       |
| COD or TOC                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                  |          |                  |                |                 |            |      |    |                   |                                               |                                                                                                                                                                                       |
| BOD5                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                  |          |                  |                |                 |            |      |    |                   |                                               |                                                                                                                                                                                       |
| pH                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                  |          |                  |                |                 |            |      |    |                   |                                               |                                                                                                                                                                                       |
| Bio eliminability                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                  |          |                  |                |                 |            |      |    |                   |                                               |                                                                                                                                                                                       |
| Biological inhibition, including infiltration       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                  |          |                  |                |                 |            |      |    |                   |                                               |                                                                                                                                                                                       |

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|                                       | AOX                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Where it is expected |                                                                                                                                                                                                                                                                                                                                 |  |
|                                       | CHCs                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      |                                                                                                                                                                                                                                                                                                                                 |  |
|                                       | Solvents                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |                                                                                                                                                                                                                                                                                                                                 |  |
|                                       | Heavy metals                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |                                                                                                                                                                                                                                                                                                                                 |  |
|                                       | Total N                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |                                                                                                                                                                                                                                                                                                                                 |  |
|                                       | Total P                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |                                                                                                                                                                                                                                                                                                                                 |  |
|                                       | Chloride                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |                                                                                                                                                                                                                                                                                                                                 |  |
|                                       | Bromide                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |                                                                                                                                                                                                                                                                                                                                 |  |
|                                       | SO <sub>4</sub> <sup>2-</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      |                                                                                                                                                                                                                                                                                                                                 |  |
|                                       | Residual toxicity                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |                                                                                                                                                                                                                                                                                                                                 |  |
|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |                                                                                                                                                                                                                                                                                                                                 |  |
| Monitoring of emissions to air        | Monitoring of waste gas emissions should reflect the operational mode of the production processes (batch, semi-continuous or continuous) and should also take into account the emission of individual substances, especially if substances with eco-toxicological potential are released. Therefore, emission profiles should be recorded instead of levels derived from short sampling periods. Emission data should be related to the operations responsible. |                      | Air emissions monitoring is carried out as required by the IPPC permit.                                                                                                                                                                                                                                                         |  |
|                                       | For emissions to air, BAT is to monitor the emission profile which reflects the operational mode of the production process (see BREF Section 4.3.1.8).                                                                                                                                                                                                                                                                                                          |                      | Air emissions monitoring is carried out as required by the IPPC permit. A waste gas stream inventory has been prepared in line with the requirements of BAT 2 and BAT 16 of Commission Implementing Decision 2016/902. A monitoring proposal is also being prepared on the basis of the pollutants identified in the inventory. |  |
|                                       | In the case of a non-oxidative abatement/recovery system, BAT is to apply a continuous monitoring system (e.g. FID), where exhaust gases from various processes are treated in a central recovery/abatement system (see BREF Section 4.3.1.8).                                                                                                                                                                                                                  |                      | Air emissions monitoring is carried out as stipulated in the IPPC permit.                                                                                                                                                                                                                                                       |  |
|                                       | BAT is to individually monitor substances with eco-toxicological potential if such substances are released (see BREF Section 4.3.1.8).                                                                                                                                                                                                                                                                                                                          |                      | As mentioned a waste gas stream inventory has been prepared in line with the requirements of BAT 2 and BAT 16 of Commission Implementing Decision 2016/902. A monitoring proposal is also being prepared on the basis of the pollutants identified in the inventory.                                                            |  |
| Assessment of individual volume flows | BAT is to assess individual exhaust gas volume flows from process equipment to recovery/abatement systems (see BREF Section 4.3.1.7).                                                                                                                                                                                                                                                                                                                           |                      | Gas volume flows from process equipment to the scrubber are known and documented, to ensure that the scrubber capacity is not exceeded.                                                                                                                                                                                         |  |
|                                       | The key to the understanding of the waste gas emission situation and the basis of improvement strategies is the knowledge of the individual contribution of processes and operations to the volume flow to recovery and abatement systems.                                                                                                                                                                                                                      |                      |                                                                                                                                                                                                                                                                                                                                 |  |
| 2.2 Re-use of solvents                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |                                                                                                                                                                                                                                                                                                                                 |  |

|                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
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| <b>Solvents re-use</b>                                                                     | <p><b>BAT is to re-use solvents as far as purity requirements (e.g. requirements according to cGMP) allow, by:</b></p> <ul style="list-style-type: none"> <li>a) <b>using the solvent from previous batches of a production campaign for future batches as far as purity requirements allow</b> (see Section 4.3.4)</li> <li>b) <b>collecting spent solvents for on-site or off-site purification and re-use</b> (for an example, see Section 4.3.3)</li> <li>c) <b>collecting spent solvents for on-site or off-site utilisation of the calorific value</b> (see Section 4.3.5.7).</li> </ul> | <p>Reuse of solvents in production / cleaning is prohibited by GMP rules, due to the potential for cross-contamination. Spent solvents are exported to licensed waste management facilities. Sterling Chemical Malta Ltd's contract with its waste management contractor states that waste is so be sent for reuse or recycling where possible.</p>                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>2.3 Treatment of exhaust gases</b>                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>2.3.1 Selection of VOC recovery/abatement techniques and achievable emission levels</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Selection of VOC and recovery abatement techniques</b>                                  | <p><b>BAT is to select VOC recovery and abatement techniques according to the flow scheme in Figure 1.</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>Each reactor is connected to a heat exchanger to condense organic vapours. The entire reactor line is also connected to a second, larger heat exchanger, following which vapours are treated in an activated carbon filter and a wet scrubber. The criteria for thermal or catalytic oxidation are not fulfilled, as the existing abatement system removes hazardous substances (and VOCs to the required levels), Sterling Chemical Malta Ltd does not have autothermal operations, and there is no possibility of reduction of primary energy consumption through the use of incineration.</p> <p>A VOC emission level of 20 mg C/m<sup>3</sup> (as per Table 5.2 of the BREF) is achievable at the scrubber outlets under normal operation.</p> |



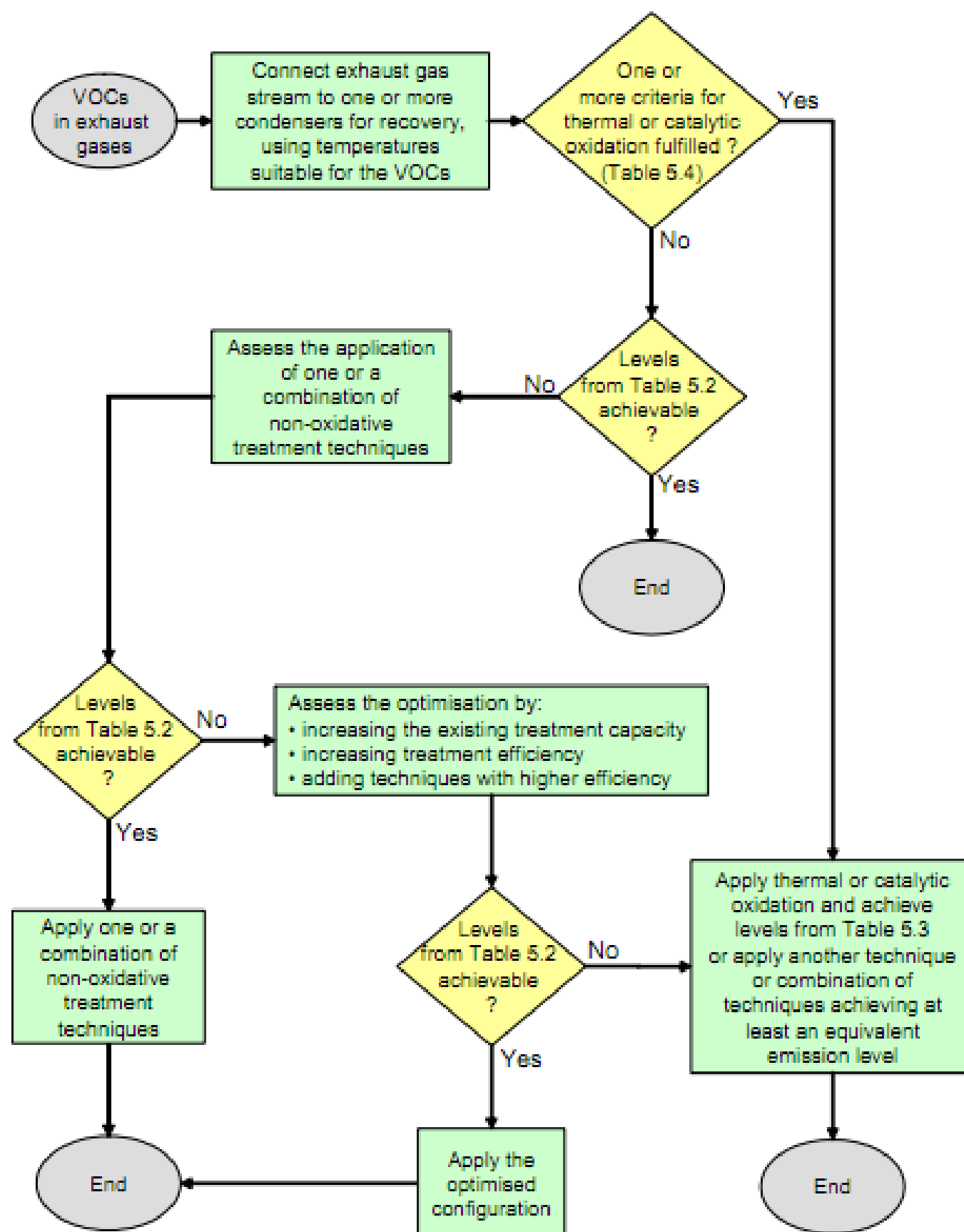


Figure 1: BAT for the selection of VOC recovery/abatement techniques

|                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                       |                                             |  |                       |                 |                                            |  |         |                                                                                                                                               |       |    |    |                                                                                                                                                                                              |
|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|---------------------------------------------|--|-----------------------|-----------------|--------------------------------------------|--|---------|-----------------------------------------------------------------------------------------------------------------------------------------------|-------|----|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                | <p>The selection of VOC treatment techniques is a crucial task on a multipurpose site. Since the volume flows show a wide variation on a multipurpose site, the key parameter for the selection of techniques are average mass flows from emission point sources in kg/hour. One or a combination of techniques can be applied as a recovery/abatement system for a whole site, an individual production building, or an individual process. This depends on the particular situation and affects the number of point sources.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                       |                                             |  |                       |                 |                                            |  |         |                                                                                                                                               |       |    |    |                                                                                                                                                                                              |
| <b>Non-oxidative VOC recovery and abatement techniques</b>                     | <p><b>BAT is to reduce emissions to the levels given in Table 2 where non-oxidative VOC recovery or abatement techniques are applied</b> (see BREF Sections 4.3.5.6, 4.3.5.11, 4.3.5.14, 4.3.5.17, 4.3.5.18).</p> <p><i>Table 2: BAT associated VOC emission levels for non-oxidation recovery/abatement techniques</i></p> <table><tr><td>Parameter</td><td colspan="3">Average emission level from point sources *</td></tr><tr><td>Total Organic C</td><td colspan="3">0.1 kg C/hour or 20 mg C/m<sup>3</sup> **</td></tr></table> <p>*The averaging time relates to the emission profile (see Sections 5.2.1.1.4 and 4.3.1.8), the levels relate to dry gas and Nm3</p> <p>** The concentration levels relates to volume flows without dilution by, e.x. volume flows from room or building ventilation.</p> <p>Non-oxidative recovery/abatement techniques are operated efficiently after minimisation of volume flows (see BREF Section 5.1.2.4) and the achieved concentration levels should be related to the corresponding volume flow without dilution by, e.g. volume flows from building or room ventilation.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Parameter                                             | Average emission level from point sources * |  |                       | Total Organic C | 0.1 kg C/hour or 20 mg C/m <sup>3</sup> ** |  |         | VOC emissions from the scrubbers are typically below 20 mg C/m <sup>3</sup> ; this is without any dilution from building or room ventilation. |       |    |    |                                                                                                                                                                                              |
| Parameter                                                                      | Average emission level from point sources *                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                       |                                             |  |                       |                 |                                            |  |         |                                                                                                                                               |       |    |    |                                                                                                                                                                                              |
| Total Organic C                                                                | 0.1 kg C/hour or 20 mg C/m <sup>3</sup> **                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                       |                                             |  |                       |                 |                                            |  |         |                                                                                                                                               |       |    |    |                                                                                                                                                                                              |
| <b>VOC abatement by thermal oxidation/incineration and catalytic oxidation</b> | <p><b>BAT is to reduce VOC emissions to the levels given in Table 3 where thermal oxidation/incineration or catalytic oxidation are applied</b> (see BREF Sections 4.3.5.7, 4.3.5.8, 4.3.5.18).</p> <p><i>Table 3: BAT associated emission levels for total organic C for thermal oxidation/incineration or catalytic oxidation.</i></p> <table><tr><td>Thermal oxidation/incineration or catalytic oxidation</td><td>Average mass flow</td><td></td><td>Average concentration</td></tr><tr><td></td><td>Kg C/hour</td><td></td><td>mg C/m3</td></tr><tr><td>Total organic C</td><td>&lt;0.05</td><td>or</td><td>&lt;5</td></tr></table> <p>The averaging time relates to the emission profile ( see Section 5.2.1.1.4), levels relate to dry gas and Nm<sup>3</sup></p> <p>BAT associated emission levels for total organic C for thermal oxidation/incineration or catalytic oxidation.</p> <p>Thermal oxidation/incineration and catalytic oxidation are proven techniques for destroying VOCs with highest efficiency but show considerable cross-media effects. In direct comparison, catalytic oxidation consumes less energy and creates less NO<sub>x</sub> and hence is preferred where technically possible. Thermal oxidation is advantageous where support fuel can be replaced by organic liquid waste (e.g. waste solvents which are technically/economically available on-site and non-recoverable) or where autothermal operation can be enabled by stripping of organic compounds from waste water streams (see BREF Section 4.3.5.9 and BAT in Part 4, Section “Removal of solvents from waste water streams”). Where exhaust gases also contain high loads of other pollutants besides VOCs, thermal oxidation can enable, e.g. the recovery of marketable HCl (see BREF Section 4.3.5.2) or, if the thermal oxidiser is equipped with a DeNO<sub>x</sub> unit or is designed as two stage combustion, the efficient abatement of NO<sub>x</sub> (see BREF Section 4.3.5.7). Thermal oxidation/incineration and catalytic oxidation can also be a suitable technique to reduce odour emissions</p> | Thermal oxidation/incineration or catalytic oxidation | Average mass flow                           |  | Average concentration |                 | Kg C/hour                                  |  | mg C/m3 | Total organic C                                                                                                                               | <0.05 | or | <5 | Not applicable. Thermal oxidation / catalytic oxidation are not used at the Sterling Chemical Malta Ltd plant, as described in the ‘Selection of VOC and recovery abatement techniques’ row. |
| Thermal oxidation/incineration or catalytic oxidation                          | Average mass flow                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                       | Average concentration                       |  |                       |                 |                                            |  |         |                                                                                                                                               |       |    |    |                                                                                                                                                                                              |
|                                                                                | Kg C/hour                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                       | mg C/m3                                     |  |                       |                 |                                            |  |         |                                                                                                                                               |       |    |    |                                                                                                                                                                                              |
| Total organic C                                                                | <0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | or                                                    | <5                                          |  |                       |                 |                                            |  |         |                                                                                                                                               |       |    |    |                                                                                                                                                                                              |

## 2.3.2 Recovery/ abatement of NO<sub>x</sub>

**NO<sub>x</sub> from thermal oxidation/ incineration or catalytic oxidation**

For thermal oxidation/incineration or catalytic oxidation, **BAT is to achieve the NO<sub>x</sub> emission levels given in Table 4 and, where necessary, to apply a DeNO<sub>x</sub> system (e.g. SCR or SNCR) or two stage combustion to achieve such levels** (see BREF Sections 4.3.5.7 and 4.3.5.19).

Not applicable. Thermal oxidation / catalytic oxidation are not used at the Sterling Chemical Malta Ltd plant, as described in Section 2.3.1 above.

*Table 4 BAT associated NO<sub>x</sub> emission levels*

| Source                                                                                      | Average mass flow<br>kg/hour * | or | Average concentration<br>mg/m3 * | comment                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------|--------------------------------|----|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chemical production processes, e.g. nitration, recovery of spent acids                      | 0.03-1.7                       |    | 7-220**                          | The lower end of the range relates to low inputs to the scrubbing system and scrubbing with H2O. With high inputs levels, the lower end of the range is not achievable even with H2O2 as the scrubbing medium. |
| Thermal oxidation/incineration, catalytic oxidation                                         | 0.1-0.3                        |    | 13-50***                         |                                                                                                                                                                                                                |
| Thermal oxidation/incineration, catalytic oxidation, input of nitrogenous organic compounds |                                |    | 25-150***                        | Lower range with SCR, upper range with SNCR                                                                                                                                                                    |

- NOx expressed as NO2, the averaging time relates to the emission profile (see 5.2.1.1.4)
- Levels relate to dry gas and Nm3
- Levels relate to dry gas and Nm3

|                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                   |
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| <b>NO<sub>x</sub> from chemical processes</b>                                 | <p><b>For exhaust gases from chemical production processes, BAT is to achieve the NO<sub>x</sub> emission levels given in Table 4 and, where necessary to apply treatment techniques such as scrubbing or scrubber cascades with scrubber media such as H<sub>2</sub>O and/or H<sub>2</sub>O<sub>2</sub> to achieve such levels</b> (see BREF Section 4.3.5.1).</p> <p>Where NO<sub>x</sub> is absorbed from strong NO<sub>x</sub> streams (about 1000 ppm and higher) a 55 % HNO<sub>3</sub> can be obtained for on-site or off-site re-use. Often, exhaust gases containing NO<sub>x</sub> from chemical processes also contain VOCs and can be treated in a thermal oxidiser/incinerator, e.g. equipped with a DeNO<sub>x</sub> unit or built as a two stage combustion (where already available on-site).</p>                        | NO <sub>x</sub> is abated using the scrubbers; emissions of NO <sub>x</sub> from the scrubber are typically below the upper level for chemical production processes quoted in Table 4.                                                                                            |
| <b>2.3.3 Recovery/abatement of HCl, Cl<sub>2</sub> and HBr/Br<sub>2</sub></b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                   |
| <b>Halogen/Hydrogen halide removal</b>                                        | <b>BAT is to achieve HCl emission levels of 0.2 – 7.5 mg/m<sup>3</sup> or 0.001 – 0.08 kg/hour and, where necessary, to apply of one or more scrubbers using scrubbing media such as H<sub>2</sub>O or NaOH in order to achieve such levels</b> (see BREF Section 4.3.5.3).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | HCl and HBr emissions are abated using the scrubbers; in such instances an alkali is added to the scrubber medium (water) to neutralise these emissions. As a result, the emission levels quoted in the BREF are achievable.                                                      |
|                                                                               | <b>BAT is to achieve Cl<sub>2</sub> emission levels of 0.1 – 1 mg/m<sup>3</sup> and, where necessary, to apply techniques such as absorption of the excess chlorine</b> (see BREF Section 4.3.5.5) <b>and/or scrubbing with scrubbing media such as NaHSO<sub>3</sub> in order to achieve such levels</b> (see BREF Section 4.3.5.2).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Chlorine gas is not used or produced as a by-product.                                                                                                                                                                                                                             |
|                                                                               | <b>BAT is to achieve HBr emission levels &lt;1 mg/m<sup>3</sup> and, where necessary, to apply scrubbing with scrubbing media such as H<sub>2</sub>O or NaOH in order to achieve such levels</b> (see BREF Sections 1.1.1, 4.3.5.4).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                   |
|                                                                               | HCl is removed from exhaust gases with one or more scrubbers using scrubbing media such as H <sub>2</sub> O or NaOH (see BREF Section 4.3.5.3). HCl can be efficiently recovered from exhaust gases with high HCl concentrations, if the production volume justifies the investment costs for the required equipment. This can be expected where production lines are dedicated to a larger volume product or to a range of similar products. For an example, see BREF Section 4.3.5.2. Where HCl recovery is not preceded by VOC removal, potential organic contaminants (AOX) have to be considered in the recovered HCl. Similarly, Cl <sub>2</sub> requires additional measures if present in the exhaust gas. HBr and Br <sub>2</sub> are recovered/removed under similar conditions from exhaust gases (see BREF Section 4.3.5.4). |                                                                                                                                                                                                                                                                                   |
| <b>2.3.4 NH<sub>3</sub> emission levels</b>                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                   |
| <b>Removal of NH<sub>3</sub> from exhaust gases</b>                           | <b>BAT is to achieve NH<sub>3</sub> emission levels of 0.1 – 10 mg/m<sup>3</sup> or 0.001 – 0.1 kg/hour and, where necessary, to apply scrubbing with scrubbing media such as H<sub>2</sub>O or acid in order to achieve such levels</b> (see BREF Section 4.3.5.20).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Wet scrubbing is in place for the production process. Ammonia is not currently used / generated by the production activities, but if this occurs in the future, then an acid will be added to the scrubber medium to neutralise these emissions.                                  |
| <b>NH<sub>3</sub> slip from DeNO<sub>x</sub></b>                              | <b>BAT is to achieve NH<sub>3</sub> slip levels from SCR or SNCR of &lt;2 mg/m<sup>3</sup> or &lt;0.02 kg/hour</b> (see BREF Section 4.3.5.7).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Not applicable. SCR / SNCR are deNO <sub>x</sub> units for thermal oxidation, which is not used at the Sterling Chemical Malta Ltd plant, as described in Section 2.3.1 above.                                                                                                    |
| <b>2.3.5 SO<sub>x</sub> removal</b>                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                   |
| <b>Removal of SO<sub>x</sub> from exhaust gases</b>                           | <b>BAT is to achieve SO<sub>x</sub> emission levels of 1 – 15 mg/m<sup>3</sup> or 0.001 – 0.1 kg/hour and, where necessary, to apply scrubbing with scrubbing media such as H<sub>2</sub>O or NaOH in order to achieve such levels</b> (see BREF Section 4.3.5.21).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Wet scrubbing is in place for the production process. SO <sub>x</sub> is generated as a by-product in some reactions, and emissions are abated using the scrubbers. Monitoring is also planned; it is anticipated that the emission levels will not exceed 15 mg/m <sup>3</sup> . |

|                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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| <b>2.3.6 Particulate removal</b>                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Removal of particulates from exhaust gases</b>                    | <p><b>BAT is to achieve particulate emission levels of 0.05 – 5 mg/m<sup>3</sup> or 0.001 – 0.1 kg/hour and, where necessary, to apply techniques such as bag filters, fabric filters, cyclones, scrubbing, or wet electrostatic precipitation (WESP) in order to achieve such levels (see BREF Section 4.3.5.22).</b></p>                                                                                                                                                                                                                                                                                                                                      | <p>Particulate emissions from the reactors are abated using the scrubbers; emissions of particulate matter from the scrubber are typically well below 5 mg/m<sup>3</sup>.</p> <p>HEPA filters are also installed in other areas where particulate emissions may be generated, such as in:</p> <ul style="list-style-type: none"> <li>• Weighing chambers;</li> <li>• Clean rooms (finishing areas);</li> <li>• Micronisation plant; and</li> <li>• Suction hoods (balance enclosures) in the labs where weighing of powders is carried out.</li> </ul> <p>Where necessary a pre-filter is used before the HEPA filter, as described in the IPPC application.</p> |
| <b>2.3.7 Cyanide removal</b>                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Removal of free cyanides from exhaust gases</b>                   | <p><b>BAT is to remove free cyanides from exhaust gases, and to achieve a waste gas emission level of 1 mg/m<sup>3</sup> or 3 g/hour as HCN (see BREF Section 4.3.6.2).</b></p> <p>Due to their toxicity, cyanides are removed from rich and lean exhaust gases by scrubbing.</p>                                                                                                                                                                                                                                                                                                                                                                               | <p>HCN is not used or produced at Sterling Chemical Malta Ltd; if such emissions occur in the future these will be abated using the scrubbers.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>2.4 Management and treatment of waste water streams</b>           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Mother liquors from halogenation and sulphochlorination</b>       | <p>Some types of waste water streams are typical candidates for segregation and selective pre-treatment or disposal due to their characteristic properties.</p> <p><b>BAT is to segregate and pretreat or dispose of mother liquors from halogenations and sulphochlorinations (see BREF Sections 4.3.2.5, 4.3.2.10).</b></p>                                                                                                                                                                                                                                                                                                                                   | <p>Not applicable. Sterling Chemical Malta Ltd does not produce mother liquors from sulphochlorinations or halogenations.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Waste water streams containing biologically active substances</b> | <p><b>BAT is to pre-treat waste water streams containing biologically active substances at levels which could pose a risk either to a subsequent waste water treatment or to the receiving environment after discharge (see BREF Sections 4.3.2.6, 4.3.7.5, 4.3.7.9, 4.3.8.13 and 4.3.8.18).</b></p> <p>Examples are, e.g. waste water streams from the production of biocides/plant health products or wash-waters from product washing after the nitration of aromates, typically containing (nitro-) phenols.</p>                                                                                                                                            | <p>All industrial wastewater streams are exported to licensed waste management facilities.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Spent acids from sulphonations or nitrations</b>                  | <p><b>BAT is to segregate and collect separately spent acids, e.g. from sulphonations or nitrations for on-site or off-site recovery or to apply BAT given in Part 2 next section 5.2.4.2 (see BREF Sections 4.3.2.6, 4.3.2.8).</b></p> <p>Spent acids from sulphonations or nitrations can usually be recovered. Where recovery is not possible, e.g. due to a high salt content (see also BAT in Part 1 Section “Mother liquors with high salt content” of the BREF document), pre-treatment can be necessary according to the BAT given in Part 2 Section “Treatment of waste water streams with relevant refractory organic load” of the BREF document.</p> | <p>Not applicable. No sulphonations or nitrations are carried out at Sterling Chemical Malta Ltd.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>2.5 Treatment of waste water streams</b>                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |



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| <b>Background information</b>                                             | <p>The refractory organic load of a waste water stream passes through the biological WWTP more or less unchanged and requires pre-treatment prior to biological treatment (see BREF Section 4.3.7.10).</p> <p>Pre-treatment techniques include oxidative techniques (e.g. see BREF Section 4.3.7.2) and non-destructive techniques (e.g. see BREF Section 4.3.7.1) and alternatively the disposal option (incineration). Two main strategies are available for pre-treatment: elimination of refractory loadings or enhancing the biodegradability of such loadings (compare BREF Sections 4.3.7.6 and 4.3.7.12). However, as an alternative to the investment of pre-treatment techniques a modernisation of the process should always be assessed as an option in order to prevent or minimise the refractory load of a waste water stream. The main criterion for this is the bioeliminability. If the actual production spectrum causes poorly bioeliminable organic loadings in most of the waste water streams (e.g. manufacture of dyes, optical brighteners, aromatic intermediates), the refractory load is introduced as selection criterion in order to set priorities.</p> <p>Bioeliminabilities and, hence, the refractory organic load are related to the assessment of the inherent bioeliminability, e.g. by Zahn-Wellens test (see BREF Section 4.3.1.3). Instead of the 80 % from inherent bioeliminability testing, for screening purposes, a BOD5/COD ratio of 0.6 can be used. The development of pre-treatment strategies for refractory loads is not viable in cases of experimental production runs and rare batch production.</p> | Not applicable. There is no on-site biological WWTP, and therefore no pre-treatment is required. All hazardous liquid waste is exported to licensed waste management facilities, and none is discharged to sewer. The volumes of wastewater generated by Sterling Chemical Malta Ltd are too small to justify the large investment (and land take-up) required to build and operate an on-site WWTP; it is more cost-effective to export such waste.                                                                                                   |
| <b>Relevant refractory organic loading</b>                                | <p>For the purposes of pre-treatment, BAT is to classify organic loading as follows:</p> <p><b>Refractory organic loading is not relevant if the waste water stream shows a bioeliminability of greater than about 80 – 90 % (see BREF Sections 4.3.7.6, 4.3.7.7, 4.3.7.8). In cases with lower bioeliminability, the refractory organic loading is not relevant if it is lower than the range of about 7.5 – 40 kg TOC per batch or per day (see BREF Sections 4.3.7.10, 4.3.7.12 and 4.3.7.13).</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Pre-treatment is not applicable, as described in the ‘ <i>Background information</i> ’ row.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Relevant refractory organic loading; Segregation and pre-treatment</b> | <b>BAT is to segregate and pre-treat waste water streams containing relevant refractory organic loadings according to the criteria given in previous Section “Relevant refractory organic loading” ( 5.2.4.2.1.).</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Pre-treatment is not applicable, as described in the ‘ <i>Background information</i> ’ row.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Relevant refractory organic loading; Overall COD elimination</b>       | For the segregated waste water streams carrying a relevant refractory organic load according to Section “Relevant refractory organic loading”. <b>BAT is to achieve overall COD elimination rates for the combination of pre-treatment and biological treatment of &gt;95 % (see BREF Section 4.3.8.9).</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Not applicable, as described in the ‘ <i>Background information</i> ’ row.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Removal of solvents from waste water streams</b>                       | <b>BAT is to recover solvents from waste water streams for on-site or off-site re-use, using techniques such as stripping, distillation/rectification, extraction or combinations of such techniques, where the costs for biological treatment and purchase of fresh solvents are higher than the costs for recovery and purification (see BREF Section 4.3.7.18).</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Due to cGMP requirements, Sterling Chemical Malta Ltd can only purchase fresh solvents for use at on site from approved suppliers. Additionally, it is outside the company’s core business to operate an on-site waste management facility for solvent recovery or a waste incineration plant with energy recovery. However, all waste solvent is exported to licensed waste management facilities. Sterling Chemical Malta Ltd’s contract with its waste management contractor states that waste is so be sent for reuse or recycling where possible. |
|                                                                           | <b>BAT is to recover solvents from waste water streams in order to use the calorific value if the energy balance shows that overall natural fuel can be substituted (see BREF Section 4.3.5.7).</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Removal of halogenated compounds from waste</b>                        | <b>BAT is to remove purgeable CHCs from waste water streams, e.g. by stripping, rectification or extraction and to achieve sum concentrations &lt;1 mg/l in the outlet from pre-treatment or to achieve sum concentrations of &lt;0.1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Pre-treatment is not applicable, as described in the ‘ <i>Background information</i> ’ row.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                       |       |                                                                                                                                                                                                        |                                                                                    |
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| water streams;<br>Removal of purgeable chlorinated hydrocarbons                                                   | mg/l in the inlet to the on-site biological WWTP or in the inlet to the municipal sewerage system (see BREF Sections 4.3.7.18, 4.3.7.19, 4.3.7.20).<br><br>Purgeable chlorinated hydrocarbons (CHCs) show eco-toxicological potential and are being substituted as solvents where technically possible. Where CHCs are still in use, all efforts are undertaken to remove such compounds from waste water streams.                                         |                       |       |                                                                                                                                                                                                        |                                                                                    |
| Removal of halogenated compounds from waste water streams;<br>Pre-treatment of waste water streams containing AOX | iiBAT is to pre-treat waste water streams with significant AOX loads and to achieve the AOX levels given in Table 5 in the inlet to the on-site biological WWTP or in the inlet to the municipal sewerage system (see BREF Section 4.3.7.14).                                                                                                                                                                                                              |                       |       |                                                                                                                                                                                                        | Pre-treatment is not applicable, as described in the ‘Background information’ row. |
|                                                                                                                   | Table 5 BAT associated AOX levels in the inlet to the on-site biological WWTP or in the inlet to the municipal sewerage system                                                                                                                                                                                                                                                                                                                             |                       |       |                                                                                                                                                                                                        |                                                                                    |
|                                                                                                                   | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Yearly average levels | Unit  | Comment                                                                                                                                                                                                |                                                                                    |
|                                                                                                                   | AOX                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.5- 8.5              | mg/L  | The upper range relates to cases where halogenated compounds are processed in numerous processes and the corresponding waste water streams are pre-treated and/or where the AOX is very bioeliminable. |                                                                                    |
| Pre-treatment of waste water streams containing heavy metals                                                      | BAT is to pre-treat waste water streams containing significant levels of heavy metals or heavy metal compounds from processes where they are used deliberately and to achieve the heavy metal concentrations given in Figure 8 in the inlet to the on-site biological WWTP or in the inlet to the municipal sewerage system (see BREF Section 4.3.7.22).<br><br>Table 6 BAT associated levels for heavy metals in the inlet to the on-site biological WWTP |                       |       |                                                                                                                                                                                                        | Pre-treatment is not applicable, as described in the ‘Background information’ row. |
|                                                                                                                   | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Yearly average levels | Units | Comment                                                                                                                                                                                                |                                                                                    |
|                                                                                                                   | Cu                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.03-0.4              | mg/l  | The upper ranges result from the deliberate use of heavy metals or heavy metals compounds in numerous processes and the pre-treatment of such water streams from such use.                             |                                                                                    |
|                                                                                                                   | Cr                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.04-0.3              |       |                                                                                                                                                                                                        |                                                                                    |
|                                                                                                                   | Ni                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.03-0.3              |       |                                                                                                                                                                                                        |                                                                                    |
|                                                                                                                   | Zn                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.1-0.5               |       |                                                                                                                                                                                                        |                                                                                    |

|                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                              |
|-----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
|                                                                       | <p>The main factor to actively influence the emission level of heavy metals is the segregation and selective pre-treatment of waste water streams from processes where heavy metals are used deliberately. For examples and applied pre-treatment techniques, see BREF Sections 4.2.25, 4.3.2.4, 4.3.7.3, 4.3.7.21. If equivalent removal levels can be demonstrated in comparison with the combination of pre-treatment and biological waste water treatment, heavy metals can be eliminated from the total effluent using only the biological waste water treatment process, provided that the biological treatment is carried out on-site and the treatment sludge is incinerated.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                              |
| <p><b>Destruction of free cyanides</b></p>                            | <p><b>BAT is to recondition waste water streams containing free cyanides in order to substitute raw materials where technically possible</b> (see BREF Section 4.3.6.2).</p> <p><b>BAT is to:</b></p> <ul style="list-style-type: none"> <li>a) <b>pretreat waste water streams containing significant loads of cyanides and to achieve a cyanide level of 1 mg/l or lower in the treated waste water stream</b> (see BREF Section 4.3.6.2) or to</li> <li>b) <b>enable safe degradation in a biological WWTP</b> (see BREF Section 4.3.6.2 under Applicability).</li> </ul> <p>Due to their toxicity, cyanides are removed from rich and lean waste water streams, e.g. by pH adjustment and oxidative destruction with H<sub>2</sub>O<sub>2</sub> (for other techniques, see BREF Section 4.3.6.2 under Applicability). Depending on the individual case, it may be also possible to enable safe degradation of cyanides in a biological WWTP (see BREF Section 4.3.6.2 under Applicability). The use of NaOCl for pre-treatment is not considered as BAT due to the potential for formation of AOX. Reconditioning of different cyanide loaded streams can enable re-use and substitution of raw materials. Cyanides occurring in waste water streams together with high COD loads can be pre-treated oxidatively by techniques such as wet oxidation with O<sub>2</sub> under alkaline conditions. In such cases, cyanide levels &lt;1 mg/l are achievable in the treated waste water stream (see BREF Section 4.3.7.4).</p> | <p>Not applicable. Sterling Chemical Malta Ltd does not use cyanides, or release cyanides in wastewater.</p> |
| <p><b>Biological waste water treatment</b></p>                        | <p>After the application of BAT given in previous Sections “Typical waste water streams for segregation, pretreatment or disposal”, “Treatment of waste water streams with relevant refractory organic load”, “Removal of solvents from waste water streams”, “Removal of halogenated compounds from waste water streams” and “Pre-treatment of waste water streams containing heavy metals” of the BREF document (management and treatment of waste water streams), <b>BAT is to treat effluents containing a relevant organic load, such as waste water streams from production processes, rinsing and cleaning water, in a biological WWTP</b> (see BREF Sections 4.3.8.6 and 4.3.8.10).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p>Not applicable, as described in the ‘<i>Background information</i>’ row.</p>                              |
| <p><b>Biological waste water treatment;<br/>On-site and joint</b></p> | <p><b>BAT is to ensure that the elimination in a joint waste water treatment is overall not poorer than in the case of on-site treatment. This is realised by regular degradability/ bioeliminability testing</b> (see BREF Section 4.3.8.5).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>Not applicable. There is no joint wastewater treatment.</p>                                               |

|                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |                                                                                                                                                                                                                    |                     |  |           |       |      |         |     |        |      |                      |         |         |                                                                                                                                   |             |        |                                                                                                                                                                   |     |         |                                                                                                                                                                       |    |           |                                                                                                                                                                                                                    |    |            |    |           |    |      |                  |         |                     |                                                                   |
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| treatment                                                                   | Biological waste water treatment is carried out on-site or as joint treatment with other industrial waste waters or together with municipal waste water. Joint treatment can have advantages and disadvantages (see BREF Section 4.3.8.4) and the biological treatment of a complex effluent from an OFC site requires a high level of communication between production and WWTP. An important aspect is the protection of the biological treatment from variations of the input properties, e.g. load or toxicity (see BREF Sections 4.3.7.5, 4.3.8.4, 4.3.8.6, 4.3.8.7). Where stable operation cannot be ensured, retrofitting to a more reliable setup is required (see BREF Sections 4.3.8.3, 4.3.8.8). This retrofitting may include the change-over from joint treatment with municipal waste water to on-site treatment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |                                                                                                                                                                                                                    |                     |  |           |       |      |         |     |        |      |                      |         |         |                                                                                                                                   |             |        |                                                                                                                                                                   |     |         |                                                                                                                                                                       |    |           |                                                                                                                                                                                                                    |    |            |    |           |    |      |                  |         |                     |                                                                   |
| Biological waste water treatment ;<br>Elimination rates and emission levels | <p><b>BAT is to take full advantage of the biological degradation potential of the total effluent and to achieve BOD elimination rates above 99 % and yearly average BOD emission levels of 1 – 18 mg/l. The levels relate to the effluent after biological treatment without dilution, e.g. by mixing with cooling water</b> (see BREF Section 4.3.8.11).</p> <p><b>BAT is to achieve the emission levels given in Table 7.</b></p> <p><i>Table 7:BAT for emissions from the biological WWTP</i></p> <table><tr><td></td><td colspan="2">Yearly averages*</td><td></td></tr><tr><td>Parameter</td><td>Level</td><td>Unit</td><td>Comment</td></tr><tr><td>COD</td><td>12-250</td><td rowspan="10">mg/l</td><td>See Section 4.3.8.10</td></tr><tr><td>Total P</td><td>0.2-1.5</td><td>The upper range results from the production of mainly compounds containing phosphorus (see Sections 4.3.7.24, 4.3.8.16, 4.3.8.17)</td></tr><tr><td>Inorganic N</td><td>2 – 20</td><td>The upper range results from production of mainly organic compounds containing nitrogen or from, e.g. fermentation processes (see Sections 4.3.2.11 and 4.3.8.14)</td></tr><tr><td>AOX</td><td>0.1-1.7</td><td>The upper range results from numerous AOX relevant productions and pretreatment of waste water streams with significant AOX loads (see Sections 4.3.8.12, 5.2.4.4.2).</td></tr><tr><td>Cu</td><td>0.007-0.1</td><td rowspan="5">The upper ranges result from the deliberate use of heavy metals or heavy metal compounds in numerous processes and the pretreatment of waste water streams from such use (see Sections 4.3.7.22, 4.3.8.1, 5.2.4.5)</td></tr><tr><td>Cr</td><td>0.004-0.05</td></tr><tr><td>Ni</td><td>0.01-0.05</td></tr><tr><td>Zn</td><td>-0.1</td></tr><tr><td>Suspended solids</td><td>10 – 20</td><td>See section 4.3.8.7</td></tr></table> |      | Yearly averages*                                                                                                                                                                                                   |                     |  | Parameter | Level | Unit | Comment | COD | 12-250 | mg/l | See Section 4.3.8.10 | Total P | 0.2-1.5 | The upper range results from the production of mainly compounds containing phosphorus (see Sections 4.3.7.24, 4.3.8.16, 4.3.8.17) | Inorganic N | 2 – 20 | The upper range results from production of mainly organic compounds containing nitrogen or from, e.g. fermentation processes (see Sections 4.3.2.11 and 4.3.8.14) | AOX | 0.1-1.7 | The upper range results from numerous AOX relevant productions and pretreatment of waste water streams with significant AOX loads (see Sections 4.3.8.12, 5.2.4.4.2). | Cu | 0.007-0.1 | The upper ranges result from the deliberate use of heavy metals or heavy metal compounds in numerous processes and the pretreatment of waste water streams from such use (see Sections 4.3.7.22, 4.3.8.1, 5.2.4.5) | Cr | 0.004-0.05 | Ni | 0.01-0.05 | Zn | -0.1 | Suspended solids | 10 – 20 | See section 4.3.8.7 | Not applicable, as described in the ‘Background information’ row. |
|                                                                             | Yearly averages*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |                                                                                                                                                                                                                    |                     |  |           |       |      |         |     |        |      |                      |         |         |                                                                                                                                   |             |        |                                                                                                                                                                   |     |         |                                                                                                                                                                       |    |           |                                                                                                                                                                                                                    |    |            |    |           |    |      |                  |         |                     |                                                                   |
| Parameter                                                                   | Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Unit | Comment                                                                                                                                                                                                            |                     |  |           |       |      |         |     |        |      |                      |         |         |                                                                                                                                   |             |        |                                                                                                                                                                   |     |         |                                                                                                                                                                       |    |           |                                                                                                                                                                                                                    |    |            |    |           |    |      |                  |         |                     |                                                                   |
| COD                                                                         | 12-250                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | mg/l | See Section 4.3.8.10                                                                                                                                                                                               |                     |  |           |       |      |         |     |        |      |                      |         |         |                                                                                                                                   |             |        |                                                                                                                                                                   |     |         |                                                                                                                                                                       |    |           |                                                                                                                                                                                                                    |    |            |    |           |    |      |                  |         |                     |                                                                   |
| Total P                                                                     | 0.2-1.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      | The upper range results from the production of mainly compounds containing phosphorus (see Sections 4.3.7.24, 4.3.8.16, 4.3.8.17)                                                                                  |                     |  |           |       |      |         |     |        |      |                      |         |         |                                                                                                                                   |             |        |                                                                                                                                                                   |     |         |                                                                                                                                                                       |    |           |                                                                                                                                                                                                                    |    |            |    |           |    |      |                  |         |                     |                                                                   |
| Inorganic N                                                                 | 2 – 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      | The upper range results from production of mainly organic compounds containing nitrogen or from, e.g. fermentation processes (see Sections 4.3.2.11 and 4.3.8.14)                                                  |                     |  |           |       |      |         |     |        |      |                      |         |         |                                                                                                                                   |             |        |                                                                                                                                                                   |     |         |                                                                                                                                                                       |    |           |                                                                                                                                                                                                                    |    |            |    |           |    |      |                  |         |                     |                                                                   |
| AOX                                                                         | 0.1-1.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      | The upper range results from numerous AOX relevant productions and pretreatment of waste water streams with significant AOX loads (see Sections 4.3.8.12, 5.2.4.4.2).                                              |                     |  |           |       |      |         |     |        |      |                      |         |         |                                                                                                                                   |             |        |                                                                                                                                                                   |     |         |                                                                                                                                                                       |    |           |                                                                                                                                                                                                                    |    |            |    |           |    |      |                  |         |                     |                                                                   |
| Cu                                                                          | 0.007-0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      | The upper ranges result from the deliberate use of heavy metals or heavy metal compounds in numerous processes and the pretreatment of waste water streams from such use (see Sections 4.3.7.22, 4.3.8.1, 5.2.4.5) |                     |  |           |       |      |         |     |        |      |                      |         |         |                                                                                                                                   |             |        |                                                                                                                                                                   |     |         |                                                                                                                                                                       |    |           |                                                                                                                                                                                                                    |    |            |    |           |    |      |                  |         |                     |                                                                   |
| Cr                                                                          | 0.004-0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |                                                                                                                                                                                                                    |                     |  |           |       |      |         |     |        |      |                      |         |         |                                                                                                                                   |             |        |                                                                                                                                                                   |     |         |                                                                                                                                                                       |    |           |                                                                                                                                                                                                                    |    |            |    |           |    |      |                  |         |                     |                                                                   |
| Ni                                                                          | 0.01-0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                                                                                                                                                                                                                    |                     |  |           |       |      |         |     |        |      |                      |         |         |                                                                                                                                   |             |        |                                                                                                                                                                   |     |         |                                                                                                                                                                       |    |           |                                                                                                                                                                                                                    |    |            |    |           |    |      |                  |         |                     |                                                                   |
| Zn                                                                          | -0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |                                                                                                                                                                                                                    |                     |  |           |       |      |         |     |        |      |                      |         |         |                                                                                                                                   |             |        |                                                                                                                                                                   |     |         |                                                                                                                                                                       |    |           |                                                                                                                                                                                                                    |    |            |    |           |    |      |                  |         |                     |                                                                   |
| Suspended solids                                                            | 10 – 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                                                                                                                                                                                                                    | See section 4.3.8.7 |  |           |       |      |         |     |        |      |                      |         |         |                                                                                                                                   |             |        |                                                                                                                                                                   |     |         |                                                                                                                                                                       |    |           |                                                                                                                                                                                                                    |    |            |    |           |    |      |                  |         |                     |                                                                   |

|                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                   |                                                                                                             |  |  |                  |       |                 |                                                                                                             |                  |       |                  |       |                  |        |                   |     |                                                                                                                    |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|--|--|------------------|-------|-----------------|-------------------------------------------------------------------------------------------------------------|------------------|-------|------------------|-------|------------------|--------|-------------------|-----|--------------------------------------------------------------------------------------------------------------------|--|--|--|--|
|                                                                                                                    | <table><tr><td></td><td></td><td></td><td></td></tr><tr><td>LID<sub>F</sub></td><td>1 – 2</td><td rowspan="5">Dilution factor</td><td rowspan="5">Toxicity is also expressed as aquatic toxicity (EC50 levels), see also Sections 4.3.8.7, 4.3.8.13, 4.3.8.18</td></tr><tr><td>LID<sub>D</sub></td><td>2 – 4</td></tr><tr><td>LID<sub>A</sub></td><td>1 – 8</td></tr><tr><td>LID<sub>L</sub></td><td>3 – 16</td></tr><tr><td>LID<sub>EU</sub></td><td>1.5</td></tr><tr><td colspan="4">* The levels relate to the effluent after biological treatment without dilution, e.g. by mixing with cooling water</td></tr></table> <p>For biological waste water treatment, COD elimination rates of 93 – 97 % are typically achievable as a yearly average. It is important that a COD elimination rate cannot be understood as a standalone parameter, but is influenced by the production spectrum (e.g. production of dyes/pigments, optical brighteners, aromatic intermediates which create refractory loadings in most of the waste water streams on a site), the degree of solvent removal (see BREF Section 4.3.7.18) and the degree of pre-treatment of refractory organic loadings (see BREF Sections 4.3.8.7 and 4.3.8.10).</p> <p>Depending on the individual situation, retrofitting of the biological WWTP is required in order to adjust, e.g. treatment capacity or buffer volume or the application of a nitrification/denitrification or a chemical/mechanical stage (e.g. see BREF Section 4.3.8.8).<sup>iii</sup></p> |                                                                   |                                                                                                             |  |  | LID <sub>F</sub> | 1 – 2 | Dilution factor | Toxicity is also expressed as aquatic toxicity (EC50 levels), see also Sections 4.3.8.7, 4.3.8.13, 4.3.8.18 | LID <sub>D</sub> | 2 – 4 | LID <sub>A</sub> | 1 – 8 | LID <sub>L</sub> | 3 – 16 | LID <sub>EU</sub> | 1.5 | * The levels relate to the effluent after biological treatment without dilution, e.g. by mixing with cooling water |  |  |  |  |
|                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                   |                                                                                                             |  |  |                  |       |                 |                                                                                                             |                  |       |                  |       |                  |        |                   |     |                                                                                                                    |  |  |  |  |
| LID <sub>F</sub>                                                                                                   | 1 – 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Dilution factor                                                   | Toxicity is also expressed as aquatic toxicity (EC50 levels), see also Sections 4.3.8.7, 4.3.8.13, 4.3.8.18 |  |  |                  |       |                 |                                                                                                             |                  |       |                  |       |                  |        |                   |     |                                                                                                                    |  |  |  |  |
| LID <sub>D</sub>                                                                                                   | 2 – 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                   |                                                                                                             |  |  |                  |       |                 |                                                                                                             |                  |       |                  |       |                  |        |                   |     |                                                                                                                    |  |  |  |  |
| LID <sub>A</sub>                                                                                                   | 1 – 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                   |                                                                                                             |  |  |                  |       |                 |                                                                                                             |                  |       |                  |       |                  |        |                   |     |                                                                                                                    |  |  |  |  |
| LID <sub>L</sub>                                                                                                   | 3 – 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                   |                                                                                                             |  |  |                  |       |                 |                                                                                                             |                  |       |                  |       |                  |        |                   |     |                                                                                                                    |  |  |  |  |
| LID <sub>EU</sub>                                                                                                  | 1.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                   |                                                                                                             |  |  |                  |       |                 |                                                                                                             |                  |       |                  |       |                  |        |                   |     |                                                                                                                    |  |  |  |  |
| * The levels relate to the effluent after biological treatment without dilution, e.g. by mixing with cooling water |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                   |                                                                                                             |  |  |                  |       |                 |                                                                                                             |                  |       |                  |       |                  |        |                   |     |                                                                                                                    |  |  |  |  |
| Monitoring of the total effluent                                                                                   | <p><b>BAT is to regularly monitor the total effluent to and from the biological WWTP measuring at least the parameters given in Table 1</b> (see BREF Section 4.3.8.21).</p> <p>Regular monitoring of the total effluent, including performance of the biological WWTP enables the operator of a multipurpose plant to identify problems arising from product changes, individual production campaigns or even individual production batches and to indicate that measures to solve such problems lead to results (for an example, see BREF Section 4.3.8.8).</p> <p>Monitoring of refractory loads, AOX, and heavy metals show if pre-treatment strategies were successful (for an example, see BREF Sections 4.3.7.14 and 4.3.7.22). The monitoring frequencies should reflect the operational mode of the production and the frequency of product changes as well as the ratio of buffer volume and residence time in the biological WWTP.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Not applicable, as described in the ‘Background information’ row. |                                                                                                             |  |  |                  |       |                 |                                                                                                             |                  |       |                  |       |                  |        |                   |     |                                                                                                                    |  |  |  |  |
| Monitoring of the total effluent<br>Biomonitoring                                                                  | <p><b>BAT is to carry out regular biomonitoring of the total effluent after the biological WWTP where substances with ecotoxicological potential are handled or produced with or without intention</b> (for examples, see BREF Sections 4.3.8.18 and 4.3.8.19).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Not applicable, as described in the ‘Background information’ row. |                                                                                                             |  |  |                  |       |                 |                                                                                                             |                  |       |                  |       |                  |        |                   |     |                                                                                                                    |  |  |  |  |



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|                                                                        | Where substances with eco-toxicological potential are handled or produced with or without intention (e.g. production of active pharmaceutical ingredients, biocides, plant health products), biomonitoring is a tool to identify residual acute toxicity in the total effluent instead of tracking an uncertain and possibly wide range of individual substances. Biomonitoring also represents an option to identify inherent problems on a production site which are possibly not as visible as fluctuations in other monitoring data. The biomonitoring frequencies should reflect them operational mode of the production and the frequency of product changes. Where biomonitoring shows that residual toxicity is a concern, the causes of such toxicity should be identified in order to develop and implement measures.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                         |
| <b>Monitoring of the total effluent<br/>Online toxicity monitoring</b> | <p><b>BAT is to apply online toxicity monitoring in combination with online TOC measurement if residual acute toxicity is identified as a concern</b>, for examples see BREF Sections 4.3.8.7 and 4.3.8.20.</p> <p>Where residual toxicity is identified as a concern (e.g. where fluctuations of the performance of the biological WWTP can be related to critical production campaigns), online biomonitoring in combination with online TOC measurement is a tool to identify critical situations early and to enable the operator to react</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Not applicable, as described in the ' <i>Background information</i> ' row.                                                                                                                                                                                                              |
| <b>3. Environmental management</b>                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                         |
| <b>Environmental management techniques</b>                             | <p>A number of environmental management techniques are determined as BAT. The scope (e.g. level of detail) and nature of the EMS (e.g. standardised or non-standardised) will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.</p> <p><b>BAT is to implement and adhere to an Environmental Management System (EMS) that incorporates, as appropriate to individual circumstances, the following features:</b> (see BREF Chapter 4)</p> <ul style="list-style-type: none"> <li>• definition of an environmental policy for the installation by top management (commitment of the top management is regarded as a precondition for a successful application of other features of the EMS)</li> <li>• planning and establishing the necessary procedures</li> <li>• implementation of the procedures, paying particular attention to <ul style="list-style-type: none"> <li>- structure and responsibility</li> <li>- training, awareness and competence</li> <li>- communication</li> <li>- employee involvement</li> <li>- documentation</li> <li>- efficient process control</li> <li>- maintenance programme</li> <li>- emergency preparedness and response</li> <li>- safeguarding compliance with environmental legislation</li> </ul> </li> <li>• checking performance and taking corrective action, paying particular attention to <ul style="list-style-type: none"> <li>- monitoring and measurement (see also the Reference document on Monitoring of Emissions)</li> <li>- corrective and preventive action</li> <li>- maintenance of records</li> <li>- independent (where practicable) internal auditing in order to determine whether or not the</li> </ul> </li> </ul> | <p>Sterling Chemical Malta Ltd is certified to the ISO 14001:2015 standard, and therefore has the required Environmental Management System (EMS) procedures and documents in place; a copy of the relevant documentation has been submitted to ERA as part of the IPPC application.</p> |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | <p>environmental management system conforms to planned arrangements and has been properly implemented and maintained.</p> <ul style="list-style-type: none"> <li>• Review by top management.</li> </ul> <p>Three further features, which can complement the above stepwise, are considered as supporting measures. However, their absence is generally not inconsistent with BAT. These three additional steps are:</p> <ul style="list-style-type: none"> <li>• having the management system and audit procedure examined and validated by an accredited certification body or an external EMS verifier</li> <li>• preparation and publication (and possibly external validation) of a regular environmental statement describing all the significant environmental aspects of the installation, allowing for year-by-year comparison against environmental objectives and targets as well as with sector benchmarks as appropriate</li> <li>• Implementation and adherence to an internationally accepted voluntary system such as EMAS and EN ISO 14001:1996. This voluntary step could give higher credibility to the EMS. In particular EMAS, which embodies all the above-mentioned features, gives higher credibility. However, non-standardised systems can in principle be equally effective provided that they are properly designed and implemented.</li> </ul> |  |
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<sup>i</sup> [https://eippcb.jrc.ec.europa.eu/reference/BREF/ofc\\_bref\\_0806.pdf](https://eippcb.jrc.ec.europa.eu/reference/BREF/ofc_bref_0806.pdf)

<sup>ii</sup> In some Member States, AOX is a well established screening parameter for the assessment of halogenated organic compounds in aqueous solutions. In other Member States, AOX as a parameter is just being established and step-by-step implementation will be necessary in many cases. The main factor to actively influence the emission level of AOX is the segregation and selective pretreatment of waste water streams from processes with AOX relevance. For examples and applied techniques, see BREF Sections 4.3.7.15, 4.3.7.16, 4.3.7.17, 4.3.7.23.

<sup>iii</sup> In some Member States, AOX is a well established screening parameter for the assessment of halogenated organic compounds in an aqueous solution. In other Member States, AOX as a parameter is just being established and step-by-step implementation will be necessary in many cases. The main factor to actively influence the heavy metal emission levels is the segregation and selective pre-treatment of waste water streams (see BREF Section 4.3.7.22).



**Annex 2: BAT Assessment - Common Waste Water and Waste Gas Treatment /  
Management Systems in the Chemical Sector**

## BAT Conclusions for common waste water and waste gas treatment/ management systems in the chemical sector (Commission Implementing Decision (EU) 2016/902)

| BAT conclusion                                             | Status at the Scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Environmental management systems</b>                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>BAT 1</b><br><br><b>Environmental Management System</b> | <p>In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features:</p> <ul style="list-style-type: none"> <li>i. commitment of the management, including senior management;</li> <li>ii. an environmental policy that includes the continuous improvement of the installation by the management;</li> <li>iii. planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment;</li> <li>iv. implementation of procedures paying particular attention to: <ul style="list-style-type: none"> <li>a) structure and responsibility;</li> <li>b) recruitment, training, awareness and competence;</li> <li>c) communication;</li> <li>d) employee involvement;</li> <li>e) documentation;</li> <li>f) effective process control;</li> <li>g) maintenance programmes;</li> <li>h) emergency preparedness and response;</li> <li>i) safeguarding compliance with environmental legislation;</li> </ul> </li> <li>v. checking performance and taking corrective action, paying particular attention to: <ul style="list-style-type: none"> <li>a) monitoring and measurement (see also the Reference Report on Monitoring of emissions to Air and Water from IED installations — ROM);</li> <li>b) corrective and preventive action;</li> <li>c) maintenance of records;</li> <li>d) independent (where practicable) internal or external auditing in order to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained;</li> </ul> </li> <li>vi. review of the EMS and its continuing suitability, adequacy and effectiveness by senior management;</li> <li>vii. following the development of cleaner technologies;</li> <li>viii. consideration for the environmental impacts from the eventual decommissioning of the plant at the design stage of a new plant, and throughout its operating life;</li> <li>ix. application of sectoral benchmarking on a regular basis;</li> </ul> <p>The facility has an EMS in place that is certified to the ISO 14001:2015 standard.</p> |

| BAT conclusion                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                       | Status at the Scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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|                                                                       | <div><div>x. waste management plan (see BAT 13).</div><div>Specifically for chemical sector activities, BAT is to incorporate the following features in the EMS:</div><div><div>xi. on multi-operator installations/sites, establishment of a convention that sets out the roles, responsibilities and coordination of operating procedures of each plant operator in order to enhance the cooperation between the various operators;</div><div>xii. establishment of inventories of waste water and waste gas streams (see BAT 2).</div></div><div>In some cases, the following features are part of the EMS</div><div><div>xiii. odour management plan (see BAT 20);</div><div>xiv. noise management plan (see BAT 22).</div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                                       | Applicability                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | The scope (e.g. level of detail) and nature of the EMS (e.g. standardised or non-standardised) will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>BAT 2</b><br><b>Inventory of waste water and waste gas streams</b> | <div>In order to facilitate the reduction of emissions to water and air and the reduction of water usage, BAT is to establish and to maintain an inventory of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the following features:</div> <div><div><div>i. information about the chemical production processes, including:</div><div><div>(a) chemical reaction equations, also showing side products;</div><div>(b) simplified process flow sheets that show the origin of the emissions;</div><div>(c) descriptions of process-integrated techniques and waste water/waste gas treatment at source including their performances;</div></div><div>ii. information, as comprehensive as is reasonably possible, about the characteristics of the waste water streams, such as:</div><div><div><div>(a) average values and variability of flow, pH, temperature, and conductivity;</div><div>(b) average concentration and load values of relevant pollutants/parameters and their variability (e.g. COD/TOC, nitrogen species, phosphorus, metals, salts, specific organic compounds);</div><div>(c) data on bioeliminability (e.g. BOD, BOD/COD ratio, Zahn-Wellens test, biological inhibition potential (e.g. nitrification));</div></div><div>iii. information, as comprehensive as is reasonably possible, about the characteristics of the waste gas streams, such as:</div><div><div><div>a. average values and variability of flow and temperature;</div><div>b. average concentration and load values of relevant pollutants/parameters and their variability (e.g. VOC, CO, NO<sub>x</sub>, SO<sub>x</sub>, chlorine, hydrogen chloride);</div><div>c. flammability, lower and higher explosive limits, reactivity;</div><div>d. presence of other substances that may affect the waste gas treatment system or plant safety (e.g. oxygen, nitrogen, water vapour, dust).</div></div></div></div></div></div> |                                                                                                                                                                                                                                       | <div>All hazardous wastewater streams are recorded, collected and discarded appropriately, and reported to ERA as part of the Annual Environmental Report (AER) for the Scheme. There is no on-site wastewater treatment at the Scheme.</div> <div>Air emissions monitoring is carried out as required by the IPPC permit, and reported to ERA as part of the Annual Environmental Report (AER) for the Scheme. Additionally, a waste gas stream inventory has been prepared as required by the IPPC permit.</div> |
| 2. Monitoring                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |



| BAT conclusion                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Status at the Scheme                                                                                                                                                                                                                                   |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-------------|-------------------------------------------------|-------------------------------------------|--|---------|-------|---------------------------------------------|--|--------------------------|------------------------------|--|--------|------------------------------------|--|----------|---------------------------------------------------------------|--|--------------------------------|-----------------------|--|--------------------------------|---------------------|--|-------------|-------------------------------------------------|---------------------------------------------|--|-------------|---------|--------|----|--------------------------------|----|----|----|----|-----------------------------|-------------------------|----------------------------------|--------------|-----------------------------------------------------------------------------|-----------------------------------------|-------------|-------------------------------------------------|-------------------------------------------------------|---------------------------------|--------------|-------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>BAT 3</b><br><br><b>Monitoring of key process parameters</b> | For relevant emissions to water as identified by the inventory of waste water streams (see BAT 2), BAT is to monitor key process parameters (including continuous monitoring of waste water flow, pH and temperature) at key locations (e.g. influent to pre-treatment and influent to final treatment).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | All hazardous wastewater streams are collected and discarded appropriately, and reported to ERA as part of the Annual Environmental Report (AER) for the Scheme. There is no on-site wastewater treatment at the Scheme or discharges to water bodies. |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
| <b>BAT 4</b><br><br><b>Monitoring of emissions to water</b>     | <div>BAT is to monitor emissions to water in accordance with EN standards with at least the minimum frequency given below. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.</div> <table><tr><th colspan="2">Substance/parameter</th><th>Standard(s)</th><th>Minimum monitoring frequency <sup>(1) (2)</sup></th></tr><tr><td colspan="2">Total organic carbon (TOC) <sup>(3)</sup></td><td>EN 1484</td><td rowspan="6">Daily</td></tr><tr><td colspan="2">Chemical oxygen demand (COD) <sup>(3)</sup></td><td>No EN standard available</td></tr><tr><td colspan="2">Total suspended solids (TSS)</td><td>EN 872</td></tr><tr><td colspan="2">Total nitrogen (TN) <sup>(4)</sup></td><td>EN 12260</td></tr><tr><td colspan="2">Total inorganic nitrogen (N<sub>inorg</sub>) <sup>(4)</sup></td><td>Various EN standards available</td></tr><tr><td colspan="2">Total phosphorus (TP)</td><td>Various EN standards available</td></tr></table><br><table><tr><th colspan="2">Substance/parameter</th><th>Standard(s)</th><th>Minimum monitoring frequency <sup>(1) (2)</sup></th></tr><tr><td colspan="2">Adsorbable organically bound halogens (AOX)</td><td>EN ISO 9562</td><td rowspan="6">Monthly</td></tr><tr><td rowspan="6">Metals</td><td>Cr</td><td rowspan="6">Various EN standards available</td></tr><tr><td>Cu</td></tr><tr><td>Ni</td></tr><tr><td>Pb</td></tr><tr><td>Zn</td></tr><tr><td>Other relevant, if relevant</td></tr><tr><td rowspan="5">Toxicity <sup>(5)</sup></td><td>Fish eggs (<i>Danio rerio</i>)</td><td>EN ISO 15088</td><td rowspan="5">To be decided based on a risk assessment, after an initial characterisation</td></tr><tr><td>Daphnia (<i>Daphnia magna Straus</i>)</td><td>EN ISO 6341</td></tr><tr><td>Luminescent bacteria (<i>Vibrio fischeri</i>)</td><td>EN ISO 11348-1<br/>EN ISO 11348-2 or<br/>EN ISO 11348-3</td></tr><tr><td>Duckweed (<i>Lemna minor</i>)</td><td>EN ISO 20079</td></tr><tr><td>Algae</td><td>EN ISO 8692<br/>EN ISO 10253<br/>EN ISO 10710</td></tr></table> <div><sup>(1)</sup> Monitoring frequencies may be adapted if the data series clearly demonstrate a sufficient stability.<br/><sup>(2)</sup> The sampling point is located where the emission leaves the installation.<br/><sup>(3)</sup> TOC monitoring and COD monitoring are alternatives. TOC monitoring is the preferred option because it does not rely on the use of very toxic compounds.<br/><sup>(4)</sup>TN and N<sub>inorg</sub> monitoring are alternatives.<br/><sup>(5)</sup> An appropriate combination of these methods can be used.</div> | Substance/parameter                                                                                                                                                                                                                                    |                                                                             | Standard(s) | Minimum monitoring frequency <sup>(1) (2)</sup> | Total organic carbon (TOC) <sup>(3)</sup> |  | EN 1484 | Daily | Chemical oxygen demand (COD) <sup>(3)</sup> |  | No EN standard available | Total suspended solids (TSS) |  | EN 872 | Total nitrogen (TN) <sup>(4)</sup> |  | EN 12260 | Total inorganic nitrogen (N <sub>inorg</sub> ) <sup>(4)</sup> |  | Various EN standards available | Total phosphorus (TP) |  | Various EN standards available | Substance/parameter |  | Standard(s) | Minimum monitoring frequency <sup>(1) (2)</sup> | Adsorbable organically bound halogens (AOX) |  | EN ISO 9562 | Monthly | Metals | Cr | Various EN standards available | Cu | Ni | Pb | Zn | Other relevant, if relevant | Toxicity <sup>(5)</sup> | Fish eggs ( <i>Danio rerio</i> ) | EN ISO 15088 | To be decided based on a risk assessment, after an initial characterisation | Daphnia ( <i>Daphnia magna Straus</i> ) | EN ISO 6341 | Luminescent bacteria ( <i>Vibrio fischeri</i> ) | EN ISO 11348-1<br>EN ISO 11348-2 or<br>EN ISO 11348-3 | Duckweed ( <i>Lemna minor</i> ) | EN ISO 20079 | Algae | EN ISO 8692<br>EN ISO 10253<br>EN ISO 10710 | Not applicable. There are no emissions to water bodies from the Scheme. All hazardous wastewater streams are collected and discarded off-site. |
| Substance/parameter                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Standard(s)                                                                                                                                                                                                                                            | Minimum monitoring frequency <sup>(1) (2)</sup>                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
| Total organic carbon (TOC) <sup>(3)</sup>                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | EN 1484                                                                                                                                                                                                                                                | Daily                                                                       |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
| Chemical oxygen demand (COD) <sup>(3)</sup>                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | No EN standard available                                                                                                                                                                                                                               |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
| Total suspended solids (TSS)                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | EN 872                                                                                                                                                                                                                                                 |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
| Total nitrogen (TN) <sup>(4)</sup>                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | EN 12260                                                                                                                                                                                                                                               |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
| Total inorganic nitrogen (N <sub>inorg</sub> ) <sup>(4)</sup>   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Various EN standards available                                                                                                                                                                                                                         |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
| Total phosphorus (TP)                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Various EN standards available                                                                                                                                                                                                                         |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
| Substance/parameter                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Standard(s)                                                                                                                                                                                                                                            | Minimum monitoring frequency <sup>(1) (2)</sup>                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
| Adsorbable organically bound halogens (AOX)                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | EN ISO 9562                                                                                                                                                                                                                                            | Monthly                                                                     |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
| Metals                                                          | Cr                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Various EN standards available                                                                                                                                                                                                                         |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
|                                                                 | Cu                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                        |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
|                                                                 | Ni                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                        |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
|                                                                 | Pb                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                        |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
|                                                                 | Zn                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                        |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
|                                                                 | Other relevant, if relevant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                        |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
| Toxicity <sup>(5)</sup>                                         | Fish eggs ( <i>Danio rerio</i> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | EN ISO 15088                                                                                                                                                                                                                                           | To be decided based on a risk assessment, after an initial characterisation |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
|                                                                 | Daphnia ( <i>Daphnia magna Straus</i> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | EN ISO 6341                                                                                                                                                                                                                                            |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
|                                                                 | Luminescent bacteria ( <i>Vibrio fischeri</i> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | EN ISO 11348-1<br>EN ISO 11348-2 or<br>EN ISO 11348-3                                                                                                                                                                                                  |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
|                                                                 | Duckweed ( <i>Lemna minor</i> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | EN ISO 20079                                                                                                                                                                                                                                           |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
|                                                                 | Algae                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | EN ISO 8692<br>EN ISO 10253<br>EN ISO 10710                                                                                                                                                                                                            |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |
| <b>BAT 5</b>                                                    | BAT is to periodically monitor diffuse VOC emissions to air from relevant sources by using an appropriate combination of the techniques I-III or,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | VOC measurements and calculations are carried out                                                                                                                                                                                                      |                                                                             |             |                                                 |                                           |  |         |       |                                             |  |                          |                              |  |        |                                    |  |          |                                                               |  |                                |                       |  |                                |                     |  |             |                                                 |                                             |  |             |         |        |    |                                |    |    |    |    |                             |                         |                                  |              |                                                                             |                                         |             |                                                 |                                                       |                                 |              |       |                                             |                                                                                                                                                |

| BAT conclusion                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                              | Status at the Scheme                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Monitoring of diffuse VOC emissions                                           | where large amounts of VOC are handled, all of the techniques I-III.<br><br>i. sniffing methods (e.g. with portable instruments according to EN 15446) associated with correlation curves for key equipment;<br><br>ii. optical gas imaging methods;<br><br>iii. calculation of emissions based on emissions factors, periodically validated (e.g. once every two years) by measurements.<br><br>Where large amounts of VOCs are handled, the screening and quantification of emissions from the installation by periodic campaigns with optical absorption-based techniques, such as Differential absorption light detection and ranging (DIAL) or Solar occultation flux (SOF), is a useful complementary technique to the techniques I to III.<br><br>(See also Section 6.2. ) |                                                                                                                                                                                              | as required by the IPPC permit, and reported to ERA as part of the AER.                                                                                                                                                                                                                                                                                                            |
|                                                                               | BAT is to periodically monitor odour emissions from relevant sources in accordance with EN standards.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                    |
| BAT 6<br><br>Odour emission monitoring                                        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Emissions can be monitored by dynamic olfactometry according to EN 13725. Emission monitoring may be complemented by measurement/estimation of odour exposure or estimation of odour impact. | The Scheme is not a significant source of odour emissions, and so odour monitoring is not required.                                                                                                                                                                                                                                                                                |
|                                                                               | Applicability                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The applicability is restricted to cases where odour nuisance can be expected or has been substantiated.                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                    |
| 3. Emissions to water                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                    |
| 3.1 Water usage and waste water generation                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                    |
| BAT 7<br><br>Reduction of volume and/or pollutant load of waste water streams | In order to reduce the usage of water and the generation of waste water, BAT is to reduce the volume and/or pollutant load of waste water streams, to enhance the reuse of waste water within the production process and to recover and reuse raw materials.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                              | It is not possible to change the production process as this is strictly dependent on the product.<br><br>Additionally, due to the nature of the Scheme and the need to avoid contamination of the API product, reuse / recovery of raw materials or waste water is not possible.<br><br>However, water usage at the Scheme is not high, and is reported to ERA as part of the AER. |
| 3.2. Waste water collection and segregation                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                    |
| BAT 8<br><br>Segregation of contaminated waste streams                        | In order to prevent the contamination of uncontaminated water and to reduce emissions to water, BAT is to segregate uncontaminated waste water streams from waste water streams that require treatment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                              | Contaminated wastewater streams are segregated from uncontaminated rainwater.                                                                                                                                                                                                                                                                                                      |
|                                                                               | Applicability                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The segregation of uncontaminated rainwater may not be applicable in the case of existing waste water collection systems.                                                                    |                                                                                                                                                                                                                                                                                                                                                                                    |
| BAT 9<br><br>Buffer storage capacity                                          | In order to prevent uncontrolled emissions to water, BAT is to provide an appropriate buffer storage capacity for waste water incurred during other than normal operating conditions based on a risk assessment (taking into account e.g. the nature of the pollutant, the effects on further treatment, and the receiving environment), and to take appropriate further measures (e.g. control, treat, reuse).                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                              | The Scheme includes mitigation measures for protection of land and groundwater in the event of a spill, as outlined in the Land and Groundwater Risk assessment prepared for the Scheme.                                                                                                                                                                                           |
|                                                                               | Applicability                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The interim storage of contaminated rainwater requires segregation, which may not be applicable in the case of existing waste water collection systems.                                      |                                                                                                                                                                                                                                                                                                                                                                                    |
| 3.3 Waste water treatment                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                    |
| BAT 10<br><br>Integrated waste water                                          | In order to reduce emissions to water, BAT is to use an integrated waste water management and treatment strategy that includes an appropriate combination of the techniques in the priority order given below.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                              | All hazardous wastewater streams are collected and discarded appropriately at licensed facilities.                                                                                                                                                                                                                                                                                 |

| BAT conclusion                             |                                                                                                                                                                                                                                                                                           |                                                 |                                                                                                                                                                                                                               |                       | Status at the Scheme                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| management                                 | Technique                                                                                                                                                                                                                                                                                 |                                                 | Description                                                                                                                                                                                                                   |                       | <div>It is not possible to change the production process or reduce water consumption as this is strictly dependent on the product; however, water consumption at the Scheme is not high and is reported to ERA as part of the AER.</div> <div>Additionally, due to the nature of the Scheme and the need to avoid contamination of the API product, reuse / recovery of raw materials or waste water is not possible.</div> |
|                                            | a)                                                                                                                                                                                                                                                                                        | Process-integrated techniques <sup>(1)</sup>    | Techniques to prevent or reduce the generation of water pollutants.                                                                                                                                                           |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | b)                                                                                                                                                                                                                                                                                        | Recovery of pollutants at source <sup>(1)</sup> | Techniques to recover pollutants prior to their discharge to the waste water collection system.                                                                                                                               |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | c)                                                                                                                                                                                                                                                                                        | Waste water pre-treatment <sup>(1) (2)</sup>    | Techniques to abate pollutants before the final waste water treatment.<br><br>Pre-treatment can be carried out at the source or in combined streams                                                                           |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | d)                                                                                                                                                                                                                                                                                        | Final waste water treatment <sup>(3)</sup>      | Final waste water treatment by, for example, preliminary and primary treatment, biological treatment, nitrogen removal, phosphorus removal and/or final solids removal techniques before discharge to a receiving water body. |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | <div><sup>(1)</sup> These techniques are further described and defined in other BAT conclusions for the chemical industry.</div> <div><sup>(2)</sup> See BAT 11.</div> <div><sup>(3)</sup> See BAT 12.</div>                                                                              |                                                 |                                                                                                                                                                                                                               |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | Description                                                                                                                                                                                                                                                                               |                                                 | The integrated waste water management and treatment strategy is based on the inventory of waste water streams (see BAT 2).                                                                                                    |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
| BAT-associated emission levels (BAT-AELs): |                                                                                                                                                                                                                                                                                           | see Section 3.4                                 |                                                                                                                                                                                                                               |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
| BAT 11                                     | In order to reduce emissions to water, BAT is to pre-treat waste water that contains pollutants that cannot be dealt with adequately during final waste water treatment by using appropriate techniques.                                                                                  |                                                 |                                                                                                                                                                                                                               |                       | Not applicable. Pre-treatment of the hazardous wastewater streams is not required by the receiving facility.                                                                                                                                                                                                                                                                                                                |
| Pre-treatment of waste water               | Description:                                                                                                                                                                                                                                                                              |                                                 |                                                                                                                                                                                                                               |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | Waste water pre-treatment is carried out as part of an integrated waste water management and treatment strategy (see BAT 10) and is generally necessary to:                                                                                                                               |                                                 |                                                                                                                                                                                                                               |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | — protect the final waste water treatment plant (e.g. protection of a biological treatment plant against inhibitory or toxic compounds);                                                                                                                                                  |                                                 |                                                                                                                                                                                                                               |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | — remove compounds that are insufficiently abated during final treatment (e.g. toxic compounds, poorly/non-biodegradable organic compounds, organic compounds that are present in high concentrations, or metals during biological treatment);                                            |                                                 |                                                                                                                                                                                                                               |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | — remove compounds that are otherwise stripped to air from the collection system or during final treatment (e.g. volatile halogenated organic compounds, benzene);                                                                                                                        |                                                 |                                                                                                                                                                                                                               |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | — remove compounds that have other negative effects (e.g. corrosion of equipment; unwanted reaction with other substances; contamination of waste water sludge).                                                                                                                          |                                                 |                                                                                                                                                                                                                               |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | In general, pre-treatment is carried out as close as possible to the source in order to avoid dilution, in particular for metals. Sometimes, waste water streams with appropriate characteristics can be segregated and collected in order to undergo a dedicated combined pre-treatment. |                                                 |                                                                                                                                                                                                                               |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
| BAT 12                                     | In order to reduce emissions to water, BAT is to use an appropriate combination of final waste water treatment techniques.                                                                                                                                                                |                                                 |                                                                                                                                                                                                                               |                       | Not applicable. The Scheme does not include an on-site wastewater treatment plant. All hazardous wastewater streams are collected and discarded off-site at licensed facilities, and there are no direct emissions to a receiving water body from the Scheme.                                                                                                                                                               |
| Final waste water treatment techniques     | Description: Final waste water treatment is carried out as part of an integrated waste water management and treatment strategy (see BAT 10).                                                                                                                                              |                                                 |                                                                                                                                                                                                                               |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | Appropriate final waste water treatment techniques, depending on the pollutant, include:                                                                                                                                                                                                  |                                                 |                                                                                                                                                                                                                               |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | Technique                                                                                                                                                                                                                                                                                 |                                                 | Typical pollutants abated                                                                                                                                                                                                     | Applicability         |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | Preliminary and primary treatment                                                                                                                                                                                                                                                         |                                                 |                                                                                                                                                                                                                               |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | a)                                                                                                                                                                                                                                                                                        | Equalisation                                    | All pollutants                                                                                                                                                                                                                | Generally applicable. |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | b)                                                                                                                                                                                                                                                                                        | Neutralisation                                  | Acids, alkalis                                                                                                                                                                                                                |                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |

| BAT conclusion |                                                                                                                                                                                                                                                   |                                                                                                           |                                 |                                                                                                                                                                                                                                                                                                                              | Status at the Scheme |  |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--|
|                | c)                                                                                                                                                                                                                                                | Physical separation, e.g. screens, sieves, grit separators, grease separators or primary settlement tanks | Suspended solids, oil/grease    |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | Biological treatment (secondary treatment), e.g.                                                                                                                                                                                                  |                                                                                                           |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | d)                                                                                                                                                                                                                                                | Activated sludge process                                                                                  | Biodegradable organic compounds | Generally applicable.                                                                                                                                                                                                                                                                                                        |                      |  |
|                | e)                                                                                                                                                                                                                                                | Membrane bioreactor                                                                                       |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | Nitrogen removal                                                                                                                                                                                                                                  |                                                                                                           |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | f)                                                                                                                                                                                                                                                | Nitrification/denitrification                                                                             | Total nitrogen, ammonia         | Nitrification may not be applicable in case of high chloride concentrations (i.e. around 10 g/l) and provided that the reduction of the chloride concentration prior to nitrification would not be justified by the environmental benefits. Not applicable when the final treatment does not include a biological treatment. |                      |  |
|                | Phosphorus removal                                                                                                                                                                                                                                |                                                                                                           |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | g)                                                                                                                                                                                                                                                | Chemical precipitation                                                                                    | Phosphorus                      | Generally applicable                                                                                                                                                                                                                                                                                                         |                      |  |
|                | Final Solids removal                                                                                                                                                                                                                              |                                                                                                           |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | h)                                                                                                                                                                                                                                                | Coagulation and flocculation                                                                              | Suspended solids                | Generally applicable.                                                                                                                                                                                                                                                                                                        |                      |  |
|                | i)                                                                                                                                                                                                                                                | Sedimentation                                                                                             |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | j)                                                                                                                                                                                                                                                | Filtration (e.g. sand filtration, microfiltration, ultrafiltration)                                       |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | k)                                                                                                                                                                                                                                                | Flotation                                                                                                 |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | (1) The descriptions of the techniques are given in Section 6.1.                                                                                                                                                                                  |                                                                                                           |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | 3.4. BAT-associated emission levels for emissions to water                                                                                                                                                                                        |                                                                                                           |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | The BAT-associated emission levels (BAT-AELs), for emissions to water given in Table 1, Table 2 and Table 3 apply to direct emissions to a receiving water body from:                                                                             |                                                                                                           |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | (i) the activities specified in Section 4 of Annex I to Directive 2010/75/EU;                                                                                                                                                                     |                                                                                                           |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | (ii) independently operated waste water treatment plants specified in Section 6.11 of Annex I to Directive 2010/75/EU provided that the main pollutant load originates from activities specified in Section 4 of Annex I to Directive 2010/75/EU; |                                                                                                           |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | (iii) The combined treatment of waste water from different origins provided that the main pollutant load originates from activities specified in Section 4 of Annex I to Directive 2010/75/EU.                                                    |                                                                                                           |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |
|                | The BAT-AELs apply at the point where the emission leaves the installation.                                                                                                                                                                       |                                                                                                           |                                 |                                                                                                                                                                                                                                                                                                                              |                      |  |

| BAT conclusion                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Status at the Scheme                                  |                           |            |                                               |                                       |                                                       |                                                 |                                        |                                                     |                              |                                |                                                       |           |                           |            |                                    |                                |                                                      |                                                               |                                |                                                       |  |
|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|---------------------------|------------|-----------------------------------------------|---------------------------------------|-------------------------------------------------------|-------------------------------------------------|----------------------------------------|-----------------------------------------------------|------------------------------|--------------------------------|-------------------------------------------------------|-----------|---------------------------|------------|------------------------------------|--------------------------------|------------------------------------------------------|---------------------------------------------------------------|--------------------------------|-------------------------------------------------------|--|
|                                                               | <p><b>Table 1: BAT-AELs for direct emissions of TOC, COD and TSS to a receiving water body</b></p> <table><tr><th>Parameter</th><th>BAT-AEL ( yearly average)</th><th>Conditions</th></tr><tr><td>Total organic carbon (TOC) <sup>(1) (2)</sup></td><td>10-33 mg/l <sup>(3) (4) (5) (6)</sup></td><td>The BAT-AEL applies if the emission exceeds 3,3 t/yr.</td></tr><tr><td>Chemical oxygen demand (COD) <sup>(1) (2)</sup></td><td>30-100 mg/l <sup>(3) (4) (5) (6)</sup></td><td>The BAT-AEL applies if the emission exceeds 10 t/yr</td></tr><tr><td>Total suspended solids (TSS)</td><td>5,0-35 mg/l <sup>(7) (8)</sup></td><td>The BAT-AEL applies if the emission exceeds 3,5 t/yr.</td></tr></table> <p><sup>(1)</sup> No BAT-AEL applies for Biochemical oxygen demand (BOD). As an indication, the yearly average BOD<sub>5</sub> level in the effluent from a biological waste water treatment plant will generally be ≤ 20 mg/l.</p> <p><sup>(2)</sup> Either the BAT-AEL for TOC or the BAT-AEL for COD applies. TOC is the preferred option because its monitoring does not rely on the use of very toxic compounds.</p> <p><sup>(3)</sup> The lower end of the range is typically achieved when few tributary waste water streams contain organic compounds and/or the waste water mostly contains easily biodegradable organic compounds.</p> <p><sup>(4)</sup> The upper end of the range may be up to 100 mg/l for TOC or up to 300 mg/l for COD, both as yearly averages, if both of the following conditions are fulfilled:</p> <ul style="list-style-type: none"><li>— Condition A: Abatement efficiency ≥ 90 % as a yearly average (including both pre-treatment and final treatment).</li><li>— Condition B: If a biological treatment is used, at least one of the following criteria is met:<ul style="list-style-type: none"><li>— A low-loaded biological treatment step is used (i.e. ≤ 0,25 kg COD/kg of organic dry matter of sludge). This implies that the BOD<sub>5</sub> level in the effluent is ≤ 20 mg/l.</li><li>— Nitrification is used.</li></ul></li></ul> <p><sup>(5)</sup> The upper end of the range may not apply if all of the following conditions are fulfilled:</p> <ul style="list-style-type: none"><li>— Condition A: Abatement efficiency ≥ 95 % as a yearly average (including both pretreatment and final treatment).</li><li>— Condition B: same as Condition B in footnote (4).</li><li>— Condition C: The influent to the final waste water treatment shows the following characteristics: TOC &gt; 2 g/l (or COD &gt; 6 g/l) as a yearly average and a high proportion of refractory organic compounds.</li></ul> <p><sup>(6)</sup> The upper end of the range may not apply when the main pollutant load originates from the production of methylcellulose.</p> <p><sup>(7)</sup> The lower end of the range is typically achieved when using filtration (e.g. sand filtration, microfiltration, ultrafiltration, membrane bioreactor), while the upper end of the range is typically achieved when using sedimentation only.</p> <p><sup>(8)</sup> This BAT-AEL may not apply when the main pollutant load originates from the production of soda ash via the Solvay process or from the production of titanium dioxide.</p> <p><b>Table 2: BAT-AELs for direct emissions of nutrients to a receiving water body</b></p> <table><tr><th>Parameter</th><th>BAT-AEL ( yearly average)</th><th>Conditions</th></tr><tr><td>Total nitrogen (TN) <sup>(1)</sup></td><td>5,0-25 mg/l <sup>(2) (3)</sup></td><td>The BAT-AEL applies if the emission exceeds 2,5 t/yr</td></tr><tr><td>Total inorganic nitrogen (N<sub>inorg</sub>) <sup>(1)</sup></td><td>5,0-20 mg/l <sup>(2) (3)</sup></td><td>The BAT-AEL applies if the emission exceeds 2,0 t/yr.</td></tr></table> | Parameter                                             | BAT-AEL ( yearly average) | Conditions | Total organic carbon (TOC) <sup>(1) (2)</sup> | 10-33 mg/l <sup>(3) (4) (5) (6)</sup> | The BAT-AEL applies if the emission exceeds 3,3 t/yr. | Chemical oxygen demand (COD) <sup>(1) (2)</sup> | 30-100 mg/l <sup>(3) (4) (5) (6)</sup> | The BAT-AEL applies if the emission exceeds 10 t/yr | Total suspended solids (TSS) | 5,0-35 mg/l <sup>(7) (8)</sup> | The BAT-AEL applies if the emission exceeds 3,5 t/yr. | Parameter | BAT-AEL ( yearly average) | Conditions | Total nitrogen (TN) <sup>(1)</sup> | 5,0-25 mg/l <sup>(2) (3)</sup> | The BAT-AEL applies if the emission exceeds 2,5 t/yr | Total inorganic nitrogen (N <sub>inorg</sub> ) <sup>(1)</sup> | 5,0-20 mg/l <sup>(2) (3)</sup> | The BAT-AEL applies if the emission exceeds 2,0 t/yr. |  |
| Parameter                                                     | BAT-AEL ( yearly average)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Conditions                                            |                           |            |                                               |                                       |                                                       |                                                 |                                        |                                                     |                              |                                |                                                       |           |                           |            |                                    |                                |                                                      |                                                               |                                |                                                       |  |
| Total organic carbon (TOC) <sup>(1) (2)</sup>                 | 10-33 mg/l <sup>(3) (4) (5) (6)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | The BAT-AEL applies if the emission exceeds 3,3 t/yr. |                           |            |                                               |                                       |                                                       |                                                 |                                        |                                                     |                              |                                |                                                       |           |                           |            |                                    |                                |                                                      |                                                               |                                |                                                       |  |
| Chemical oxygen demand (COD) <sup>(1) (2)</sup>               | 30-100 mg/l <sup>(3) (4) (5) (6)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | The BAT-AEL applies if the emission exceeds 10 t/yr   |                           |            |                                               |                                       |                                                       |                                                 |                                        |                                                     |                              |                                |                                                       |           |                           |            |                                    |                                |                                                      |                                                               |                                |                                                       |  |
| Total suspended solids (TSS)                                  | 5,0-35 mg/l <sup>(7) (8)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | The BAT-AEL applies if the emission exceeds 3,5 t/yr. |                           |            |                                               |                                       |                                                       |                                                 |                                        |                                                     |                              |                                |                                                       |           |                           |            |                                    |                                |                                                      |                                                               |                                |                                                       |  |
| Parameter                                                     | BAT-AEL ( yearly average)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Conditions                                            |                           |            |                                               |                                       |                                                       |                                                 |                                        |                                                     |                              |                                |                                                       |           |                           |            |                                    |                                |                                                      |                                                               |                                |                                                       |  |
| Total nitrogen (TN) <sup>(1)</sup>                            | 5,0-25 mg/l <sup>(2) (3)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | The BAT-AEL applies if the emission exceeds 2,5 t/yr  |                           |            |                                               |                                       |                                                       |                                                 |                                        |                                                     |                              |                                |                                                       |           |                           |            |                                    |                                |                                                      |                                                               |                                |                                                       |  |
| Total inorganic nitrogen (N <sub>inorg</sub> ) <sup>(1)</sup> | 5,0-20 mg/l <sup>(2) (3)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | The BAT-AEL applies if the emission exceeds 2,0 t/yr. |                           |            |                                               |                                       |                                                       |                                                 |                                        |                                                     |                              |                                |                                                       |           |                           |            |                                    |                                |                                                      |                                                               |                                |                                                       |  |

| BAT conclusion                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                        |                                                        | Status at the Scheme                                         |           |                          |            |                                             |                                             |                                                        |                            |                                                                         |                                                        |                          |                                                                         |                                                        |                          |                                                          |                                                        |                        |
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|                                             | Total phosphorus (TP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0,50-3,0 mg/l <sup>(4)</sup>                           | The BAT-AEL applies if the emission exceeds 300 kg/yr. |                                                              |           |                          |            |                                             |                                             |                                                        |                            |                                                                         |                                                        |                          |                                                                         |                                                        |                          |                                                          |                                                        |                        |
|                                             | <p><sup>(1)</sup> Either the BAT-AEL for total nitrogen or the BAT-AEL for total inorganic nitrogen applies.</p> <p><sup>(2)</sup> The BAT-AELs for TN and N<sub>inorg</sub> do not apply to installations without biological waste water treatment. The lower end of the range is typically achieved when the influent to the biological waste water treatment plant contains low levels of nitrogen and/or when nitrification/denitrification can be operated under optimum conditions.</p> <p><sup>(3)</sup>The upper end of the range may be higher and up to 40 mg/l for TN or 35 mg/l for N<sub>inorg</sub>, both as yearly averages, if the abatement efficiency is ≥ 70 % as a yearly average (including both pre-treatment and final treatment).</p> <p><sup>(4)</sup> The lower end of the range is typically achieved when phosphorus is added for the proper operation of the biological waste water treatment plant or when phosphorus mainly originates from heating or cooling systems. The upper end of the range is typically achieved when phosphorus-containing compounds are produced by the installation.</p> <p><b>Table 3: BAT-AELs for direct emission of AOX and metals to a receiving water body</b></p> <table><tr><th>Parameter</th><th>BAT-AEL (yearly average)</th><th>Conditions</th></tr><tr><td>Adsorbable organically bound halogens (AOX)</td><td>0,20-1,0 mg/l <sup>(1)</sup> <sup>(2)</sup></td><td>The BAT-AEL applies if the emission exceeds 100 kg/yr.</td></tr><tr><td>Chromium (expressed as Cr)</td><td>5,0-25 µg/l <sup>(3)</sup> <sup>(4)</sup> <sup>(5)</sup> <sup>(6)</sup></td><td>The BAT-AEL applies if the emission exceeds 2,5 kg/yr.</td></tr><tr><td>Copper (expressed as Cu)</td><td>5,0-50 µg/l <sup>(3)</sup> <sup>(4)</sup> <sup>(5)</sup> <sup>(7)</sup></td><td>The BAT-AEL applies if the emission exceeds 5,0 kg/yr.</td></tr><tr><td>Nickel (expressed as Ni)</td><td>5,0-50 µg/l <sup>(3)</sup> <sup>(4)</sup> <sup>(5)</sup></td><td>The BAT-AEL applies if the emission exceeds 5,0 kg/yr.</td></tr><tr><td>Zinc (expressed as Zn)</td><td>20-300 µg/l <sup>(3)</sup> <sup>(4)</sup> <sup>(5)</sup> <sup>(8)</sup></td><td>The BAT-AEL applies if the emission exceeds 30 kg/yr</td></tr></table> <p><sup>(1)</sup> The lower end of the range is typically achieved when few halogenated organic compounds are used or produced by the installation.</p> <p><sup>(2)</sup> This BAT-AEL may not apply when the main pollutant load originates from the production of iodinated X-ray contrast agents due to the high refractory loads. This BAT-AEL may also not apply when the main pollutant load originates from the production of propylene oxide or epichlorohydrin via the chlorohydrin process due to the high loads.</p> <p><sup>(3)</sup> The lower end of the range is typically achieved when few of the corresponding metal (compounds) are used or produced by the installation.</p> <p><sup>(4)</sup> This BAT-AEL may not apply to inorganic effluents when the main pollutant load originates from the production of inorganic heavy metal compounds.</p> <p><sup>(5)</sup> This BAT-AEL may not apply when the main pollutant load originates from the processing of large volumes of solid inorganic raw materials that are contaminated with metals (e.g. soda ash from the Solvay process, titanium dioxide).</p> <p><sup>(6)</sup> This BAT-AEL may not apply when the main pollutant load originates from the production of chromium-organic compounds.</p> <p><sup>(7)</sup> This BAT-AEL may not apply when the main pollutant load originates from the production of copper-organic compounds or the production of vinyl chloride monomer/ethylene dichloride via the ox chlorination process.</p> <p><sup>(8)</sup> This BAT-AEL may not apply when the main pollutant load originates from the production of viscose fibres.</p> <p>The associated monitoring is in BAT 4.</p> |                                                        |                                                        |                                                              | Parameter | BAT-AEL (yearly average) | Conditions | Adsorbable organically bound halogens (AOX) | 0,20-1,0 mg/l <sup>(1)</sup> <sup>(2)</sup> | The BAT-AEL applies if the emission exceeds 100 kg/yr. | Chromium (expressed as Cr) | 5,0-25 µg/l <sup>(3)</sup> <sup>(4)</sup> <sup>(5)</sup> <sup>(6)</sup> | The BAT-AEL applies if the emission exceeds 2,5 kg/yr. | Copper (expressed as Cu) | 5,0-50 µg/l <sup>(3)</sup> <sup>(4)</sup> <sup>(5)</sup> <sup>(7)</sup> | The BAT-AEL applies if the emission exceeds 5,0 kg/yr. | Nickel (expressed as Ni) | 5,0-50 µg/l <sup>(3)</sup> <sup>(4)</sup> <sup>(5)</sup> | The BAT-AEL applies if the emission exceeds 5,0 kg/yr. | Zinc (expressed as Zn) |
| Parameter                                   | BAT-AEL (yearly average)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Conditions                                             |                                                        |                                                              |           |                          |            |                                             |                                             |                                                        |                            |                                                                         |                                                        |                          |                                                                         |                                                        |                          |                                                          |                                                        |                        |
| Adsorbable organically bound halogens (AOX) | 0,20-1,0 mg/l <sup>(1)</sup> <sup>(2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The BAT-AEL applies if the emission exceeds 100 kg/yr. |                                                        |                                                              |           |                          |            |                                             |                                             |                                                        |                            |                                                                         |                                                        |                          |                                                                         |                                                        |                          |                                                          |                                                        |                        |
| Chromium (expressed as Cr)                  | 5,0-25 µg/l <sup>(3)</sup> <sup>(4)</sup> <sup>(5)</sup> <sup>(6)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | The BAT-AEL applies if the emission exceeds 2,5 kg/yr. |                                                        |                                                              |           |                          |            |                                             |                                             |                                                        |                            |                                                                         |                                                        |                          |                                                                         |                                                        |                          |                                                          |                                                        |                        |
| Copper (expressed as Cu)                    | 5,0-50 µg/l <sup>(3)</sup> <sup>(4)</sup> <sup>(5)</sup> <sup>(7)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | The BAT-AEL applies if the emission exceeds 5,0 kg/yr. |                                                        |                                                              |           |                          |            |                                             |                                             |                                                        |                            |                                                                         |                                                        |                          |                                                                         |                                                        |                          |                                                          |                                                        |                        |
| Nickel (expressed as Ni)                    | 5,0-50 µg/l <sup>(3)</sup> <sup>(4)</sup> <sup>(5)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | The BAT-AEL applies if the emission exceeds 5,0 kg/yr. |                                                        |                                                              |           |                          |            |                                             |                                             |                                                        |                            |                                                                         |                                                        |                          |                                                                         |                                                        |                          |                                                          |                                                        |                        |
| Zinc (expressed as Zn)                      | 20-300 µg/l <sup>(3)</sup> <sup>(4)</sup> <sup>(5)</sup> <sup>(8)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | The BAT-AEL applies if the emission exceeds 30 kg/yr   |                                                        |                                                              |           |                          |            |                                             |                                             |                                                        |                            |                                                                         |                                                        |                          |                                                                         |                                                        |                          |                                                          |                                                        |                        |
| 4. Waste                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                        |                                                        |                                                              |           |                          |            |                                             |                                             |                                                        |                            |                                                                         |                                                        |                          |                                                                         |                                                        |                          |                                                          |                                                        |                        |
| BAT 13<br>Waste Management Plan             | In order to prevent or, where this is not practicable, to reduce the quantity of waste being sent for disposal, BAT is to set up and implement a waste management plan as part of the environmental management system (see BAT 1) that, in order of priority, ensures that waste is prevented, prepared for                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                        |                                                        | A waste management plan is included in the IPPC application. |           |                          |            |                                             |                                             |                                                        |                            |                                                                         |                                                        |                          |                                                                         |                                                        |                          |                                                          |                                                        |                        |



| BAT conclusion                                                        |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                | Status at the Scheme                                                                                                                                                                                       |                                                                                                                                                       |
|-----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                       | reuse, recycled or otherwise recovered.                                                                                                                                                                          |                                                                                                                                                                                                                                |                                                                                                                                                                                                            |                                                                                                                                                       |
| <b>BAT 14</b><br><br><b>Reduction of volume of waste water sludge</b> | In order to reduce the volume of waste water sludge requiring further treatment or disposal, and to reduce its potential environmental impact, BAT is to use one or a combination of the techniques given below. |                                                                                                                                                                                                                                | Not applicable. The Scheme does not include an on-site wastewater treatment plant.                                                                                                                         |                                                                                                                                                       |
|                                                                       | <b>Technique</b>                                                                                                                                                                                                 | <b>Description</b>                                                                                                                                                                                                             |                                                                                                                                                                                                            | <b>Applicability</b>                                                                                                                                  |
|                                                                       | a) Conditioning                                                                                                                                                                                                  | Chemical conditioning (i.e. adding coagulants and/or flocculants) or thermal conditioning (i.e. heating) to improve the conditions during sludge thickening/dewatering.                                                        |                                                                                                                                                                                                            | Not applicable to inorganic sludges. The necessity for conditioning depends on the sludge properties and on the thickening/dewatering equipment used. |
|                                                                       | b) Thickening/dewatering                                                                                                                                                                                         | Thickening can be carried out by sedimentation, centrifugation, flotation, gravity belts, or rotary drums. Dewatering can be carried out by belt filter presses or plate filter presses.                                       |                                                                                                                                                                                                            | Generally applicable.                                                                                                                                 |
|                                                                       | c)Stabilisation                                                                                                                                                                                                  | Sludge stabilisation includes chemical treatment, thermal treatment, aerobic digestion, or anaerobic digestion.                                                                                                                |                                                                                                                                                                                                            | Not applicable to inorganic sludges. Not applicable for short-term handling before final treatment.                                                   |
|                                                                       | d) Drying                                                                                                                                                                                                        | Sludge is dried by direct or indirect contact with a heat source.                                                                                                                                                              |                                                                                                                                                                                                            | Not applicable to cases where waste heat is not available or cannot be used.                                                                          |
| 5. Emissions to air                                                   |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                |                                                                                                                                                                                                            |                                                                                                                                                       |
| 5.1. Waste gas collection                                             |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                |                                                                                                                                                                                                            |                                                                                                                                                       |
| <b>BAT 15</b><br><br><b>Treatment of air emissions</b>                | In order to facilitate the recovery of compounds and the reduction of emissions to air, BAT is to enclose the emission sources and to treat the emissions, where possible.                                       |                                                                                                                                                                                                                                | Emissions to air are treated as described in the IPPC application.                                                                                                                                         |                                                                                                                                                       |
|                                                                       | Applicability                                                                                                                                                                                                    | The applicability may be restricted by concerns on operability (access to equipment), safety (avoiding concentrations close to the lower explosive limit) and health (where operator access is required inside the enclosure). |                                                                                                                                                                                                            |                                                                                                                                                       |
| 5.2. Waste gas treatment                                              |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                |                                                                                                                                                                                                            |                                                                                                                                                       |
| <b>BAT 16</b><br><br><b>Integrated waste gas management plan</b>      | In order to reduce emissions to air, BAT is to use an integrated waste gas management and treatment strategy that includes process-integrated and waste gas treatment techniques.                                |                                                                                                                                                                                                                                | Emissions to air are treated as described in the IPPC application, and monitored in accordance with the IPPC permit. A monitoring proposal based on the waste gas stream inventory is also being prepared. |                                                                                                                                                       |
|                                                                       | Description: The integrated waste gas management and treatment strategy is based on the inventory of waste gas streams (see BAT 2) giving priority to process-integrated techniques.                             |                                                                                                                                                                                                                                |                                                                                                                                                                                                            |                                                                                                                                                       |
| 5.3. Flaring                                                          |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                |                                                                                                                                                                                                            |                                                                                                                                                       |

| BAT conclusion                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Status at the Scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                               |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
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| BAT 17<br><br>Usage of flaring solely for safety reasons                | In order to prevent emissions to air from flares, BAT is to use flaring only for safety reasons or non-routine operational conditions (e.g. start-ups, shutdowns) by using one or both of the techniques given below.                                                                                                                                                                                                                                                                                                                                             |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Not applicable. Flaring is not used at the Scheme.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                               |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
|                                                                         | <table><tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>a)</td><td>Correct plant design</td><td>This includes the provision of a gas recovery system with sufficient capacity and the use of high-integrity relief valves.</td><td>Generally applicable to new plants. Gas recovery systems may be retro- fitted in existing plants.</td></tr><tr><td>b)</td><td>Plant management</td><td>This includes balancing the fuel gas system and using advanced process control.</td><td>Generally applicable.</td></tr></table> |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Technique                                                                                                                                                     |  | Description | Applicability | a) | Correct plant design | This includes the provision of a gas recovery system with sufficient capacity and the use of high-integrity relief valves. | Generally applicable to new plants. Gas recovery systems may be retro- fitted in existing plants. | b) | Plant management | This includes balancing the fuel gas system and using advanced process control. | Generally applicable. |
|                                                                         | Technique                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                     | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Applicability                                                                                                                                                 |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
|                                                                         | a)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Correct plant design                                                                | This includes the provision of a gas recovery system with sufficient capacity and the use of high-integrity relief valves.                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Generally applicable to new plants. Gas recovery systems may be retro- fitted in existing plants.                                                             |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
| b)                                                                      | Plant management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | This includes balancing the fuel gas system and using advanced process control.     | Generally applicable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                               |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
|                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                               |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
|                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                               |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
| BAT 18<br><br>Flare management                                          | In order to reduce emissions to air from flares when flaring is unavoidable, BAT is to use one or both of the techniques given below.                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Not applicable. Flaring is not used at the Scheme.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                               |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
|                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Technique                                                                           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Applicability                                                                                                                                                 |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
|                                                                         | a)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Correct design of flaring devices                                                   | Optimisation of height, pressure, assistance by steam, air or gas, type of flare tips (either enclosed or shielded), etc., aimed to enable smokeless and reliable operation and to ensure the efficient combustion of ex- cess gases.                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Applicable to new flares. In existing plants, applicability may be restricted due to e.g. maintenance time avail- ability during the turnaround of the plant. |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
|                                                                         | b)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Monitoring and recording as part of flare management                                | Continuous monitoring of the gas sent to flaring, measurements of gas flow and estimations of other parameters (e.g. composition, heat con- tent, ratio of assistance, velocity, purge gas flow rate, pollutant emissions (e.g. NOX, CO, hydrocarbons, noise)). The recording of flaring events usually includes the estimated/ measured flare gas composition, the estimated/measured flare gas quantity and the duration of operation. The recording allows for the quantification of emissions and the potential prevention of future flaring events. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Generally applicable.                                                                                                                                         |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
| 5.4 Diffuse VOC emissions                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                               |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
| BAT 19<br><br>Mitigation measures to reduce diffuse VOC emission to air | In order to prevent or, where that is not practicable, to reduce diffuse VOC emissions to air, BAT is to use a combination of the techniques given below.                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Emissions of VOCs are directed towards treatment systems, which are also monitored as required by the IPPC permit.<br><br>Equipment is selected according to its intended use. In relation to high-integrity equipment, corrosion-resistant equipment is in place, and also some agitators have mechanical seals.<br><br>Equipment is tested upon commissioning and certified as having been installed correctly in line with manufacturer guidance.<br><br>A maintenance programme is also in place, as described in the IPPC application. Reactors use a vacuum / suction system, so in case of damage air would go into the reactor rather than leaking out. Maintenance of reactors includes vacuum testing to |                                                                                                                                                               |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
|                                                                         | Technique                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                     | Applicability                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                               |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
|                                                                         | Techniques related to plant design                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                               |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
|                                                                         | a)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Limit the number of potential emissions sources                                     | Applicability may be restricted in the case of existing plants due to operability requirements.                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                               |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
|                                                                         | b)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Maximise process-inherent containment features                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                               |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
|                                                                         | c)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Select high-integrity equipment (see the description in Section 6.2)                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                               |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |
|                                                                         | d)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Facilitate maintenance activities by ensuring access to potentially leaky equipment |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                               |  |             |               |    |                      |                                                                                                                            |                                                                                                   |    |                  |                                                                                 |                       |

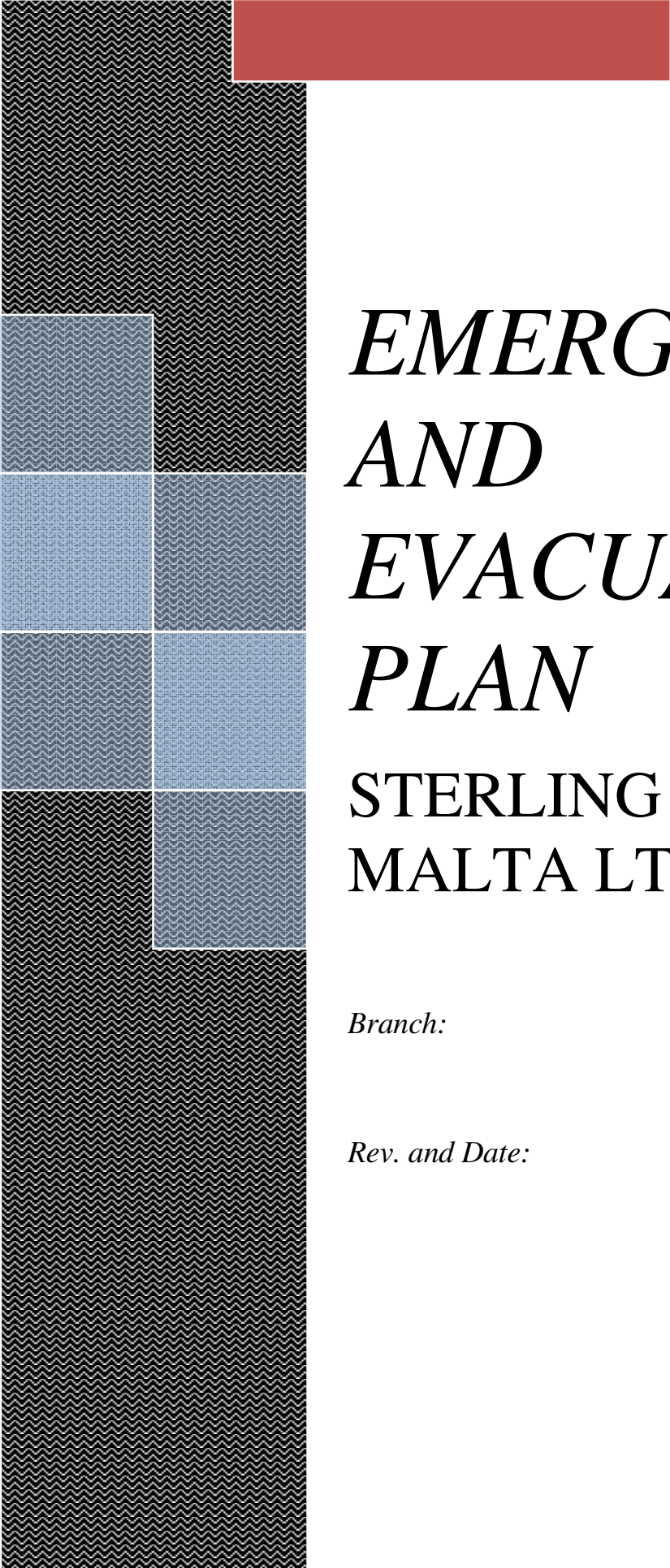
| BAT conclusion                                                                                                                              |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                |                                                                                                                                                                              | Status at the Scheme                                                                                                                         |                                                                                         |
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|                                                                                                                                             |  | <i>Techniques related to plant/equipment constructions, assembly and commissioning</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                |                                                                                                                                                                              | ensure the integrity of the equipment. If the test fails then all the equipment is checked until the source is identified.                   |                                                                                         |
|                                                                                                                                             |  | e)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Ensure well-defined and comprehensive procedures for plant/equipment construction and assembly. This includes using the designed gasket stress for flanged joint assembly (see the description in Section 6.2) | Generally applicable.                                                                                                                                                        |                                                                                                                                              |                                                                                         |
|                                                                                                                                             |  | f)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Ensure robust plant/equipment commissioning and handover procedures in line with the design requirements                                                                                                       |                                                                                                                                                                              |                                                                                                                                              |                                                                                         |
|                                                                                                                                             |  | <i>Techniques related to plant operation</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                |                                                                                                                                                                              |                                                                                                                                              |                                                                                         |
|                                                                                                                                             |  | g)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Ensure good maintenance and timely replacement of equipment                                                                                                                                                    | Generally applicable.                                                                                                                                                        |                                                                                                                                              |                                                                                         |
|                                                                                                                                             |  | h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Use a risk-based leak detection and repair (LDAR) programme (see the description in Section 6.2)                                                                                                               |                                                                                                                                                                              |                                                                                                                                              |                                                                                         |
|                                                                                                                                             |  | i)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | As far as it is reasonable, prevent diffuse VOC emissions, collect them at source, and treat them                                                                                                              |                                                                                                                                                                              |                                                                                                                                              |                                                                                         |
|                                                                                                                                             |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                |                                                                                                                                                                              |                                                                                                                                              |                                                                                         |
|                                                                                                                                             |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                |                                                                                                                                                                              |                                                                                                                                              |                                                                                         |
|                                                                                                                                             |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                |                                                                                                                                                                              |                                                                                                                                              |                                                                                         |
| The associated monitoring is in BAT 5.                                                                                                      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                |                                                                                                                                                                              |                                                                                                                                              |                                                                                         |
| 5.5. Odour emissions                                                                                                                        |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                |                                                                                                                                                                              |                                                                                                                                              |                                                                                         |
| <b>BAT 20</b><br><br><b>Odour Management Plan</b>                                                                                           |  | In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to set up, implement and regularly review an odour management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements:<br><br>i. a protocol containing appropriate actions and timelines;<br><br>ii. a protocol for conducting odour monitoring;<br><br>iii. a protocol for response to identified odour incidents;<br><br>iv. an odour prevention and reduction programme designed to identify the source(s); to measure/estimate odour exposure; to characterise the contributions of the sources; and to implement prevention and/or reduction measures.<br><br>The associated monitoring is in BAT 6. |                                                                                                                                                                                                                |                                                                                                                                                                              | Not applicable. The Scheme is not a significant source of odour emissions.                                                                   |                                                                                         |
|                                                                                                                                             |  | Applicability                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | The applicability is restricted to cases where odour nuisance can be expected or has been substantiated                                                                                                        |                                                                                                                                                                              |                                                                                                                                              |                                                                                         |
| <b>BAT 21</b><br><br><b>Mitigation measures for the reduction of odours from waste water collection/treatment and from sludge treatment</b> |  | In order to prevent or, where that is not practicable, to reduce odour emissions from waste water collection and treatment and from sludge treatment, BAT is to use one or a combination of the techniques given below.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                |                                                                                                                                                                              | Not applicable. The Scheme is not a significant source of odour emissions. Additionally, there is no on-site wastewater or sludge treatment. |                                                                                         |
|                                                                                                                                             |  | <b>Technique</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                | <b>Description</b>                                                                                                                                                           |                                                                                                                                              | <b>Applicability</b>                                                                    |
|                                                                                                                                             |  | a)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Minimise residence times                                                                                                                                                                                       | Minimise the residence time of waste water and sludge in collection and storage systems, in particular under anaerobic conditions.                                           |                                                                                                                                              | Applicability may be restricted in the case of existing collection and storage systems. |
|                                                                                                                                             |  | b)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Chemical treatment                                                                                                                                                                                             | Use chemicals to destroy or to reduce the formation of odorous compounds (e.g. oxidation or precipitation of hydrogen sulphide).                                             |                                                                                                                                              | Generally applicable.                                                                   |
|                                                                                                                                             |  | c)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Optimise aerobic treatment                                                                                                                                                                                     | This can include:<br>(i) controlling the oxygen content;<br>(ii) frequent maintenance of the aeration system;<br>(iii) use of pure oxygen;<br>(iv) Removal of scum in tanks. |                                                                                                                                              | Generally applicable.                                                                   |

| BAT conclusion                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                 |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                  | Status at the Scheme                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                              |  | d)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Enclosure                                       | Cover or enclose facilities for collecting and treating waste water and sludge to collect the odorous waste gas for further treatment.                                                                                                                                                                                     | Generally applicable.                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                            |
|                                              |  | e)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | End-of-pipe treatment                           | This can include:<br>(i) biological treatment;<br>(ii) Thermal oxidation.                                                                                                                                                                                                                                                  | Biological treatment is only applicable to compounds that are easily soluble in water and readily bioeliminable.                                                                                 |                                                                                                                                                                                                                                                                                                                                            |
| 5.6. Noise emissions                         |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                 |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                            |
| BAT 22<br><br>Noise Management Plan          |  | In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to set up and implement a noise management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements:<br><br>(i) a protocol containing appropriate actions and timelines;<br><br>(ii) a protocol for conducting noise monitoring;<br><br>(iii) a protocol for response to identified noise incidents;<br><br>(iv) a noise prevention and reduction programme designed to identify the source(s), to measure/estimate noise exposure, to characterise the contributions of the sources and to implement prevention and/or reduction measures. |                                                 |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                  | Noise monitoring is carried out as required by the IPPC permit; should any noise impacts be identified the appropriate abatement action will be taken.                                                                                                                                                                                     |
|                                              |  | Applicability                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                 | The applicability is restricted to cases where noise nuisance can be expected or has been substantiated.                                                                                                                                                                                                                   |                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                            |
| BAT 23<br><br>Mitigations of Noise Emissions |  | In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques given below.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                 |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                  | The Scheme includes noise mitigation measures including:<br>- Siting of the Scheme in an industrial area;<br>- Use of low-noise pumps;<br>- Enclosing the micronisation plant and technical area in a concreted room.<br><br>Should noise impacts be identified in future noise monitoring surveys, further mitigation will be considered. |
|                                              |  | Techniques                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                 | Description                                                                                                                                                                                                                                                                                                                | Applicability                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                            |
|                                              |  | a)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Appropriate location of equipment and buildings | Increasing the distance between the emitter and the receiver and using buildings as noise screens.                                                                                                                                                                                                                         | For existing plants, the relocation of equipment may be restricted by a lack of space or excessive costs.                                                                                        |                                                                                                                                                                                                                                                                                                                                            |
|                                              |  | b)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Operational measures                            | This includes:<br>i. improved inspection and maintenance of equipment;<br>ii. closing of doors and windows of enclosed areas, if possible;<br>iii. equipment operation by experienced staff;<br>iv. avoidance of noisy activities at night, if possible;<br>v. provisions for noise control during maintenance activities. | Generally applicable.                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                            |
|                                              |  | c)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Low-noise equipment                             | This includes low-noise compressors, pumps and flares.                                                                                                                                                                                                                                                                     | Applicable only when the equipment is new or replaced.                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                            |
|                                              |  | d)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Noise-control equipment                         | This includes:<br>(i) noise-reducers;<br>(ii) equipment insulation;<br>(iii) enclosure of noisy equipment;<br>(iv) soundproofing of buildings.                                                                                                                                                                             | Applicability may be restricted due to space requirements (for existing plants), health, and safety issues.                                                                                      |                                                                                                                                                                                                                                                                                                                                            |
|                                              |  | e)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Noise abatement                                 | Inserting obstacles between emitters and receivers (e.g. protection walls, embankments and buildings).                                                                                                                                                                                                                     | Applicable only to existing plants; since the design of new plants should make this technique unnecessary. For existing plants, the insertion of obstacles may be restricted by a lack of space. |                                                                                                                                                                                                                                                                                                                                            |



## **Annex 3: Emergency and Evacuation Plan**





# *EMERGENCY AND EVACUATION PLAN*

STERLING CHEMICAL  
MALTA LTD

*Branch:*

**Industrial Estate  
Hal Far HF 51  
Malta**

*Rev. and Date:*

**rev. 03 of 30/11/2020**



|            |                                                             |           |
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# 1 GENERAL PART

## 1.1 INTRODUCTION

This document is prepared in accordance with the Legal Notice 44 of 2002 as amended by Legal Notice 437 of 2012 "Work place (minimum health and safety requirements) regulation" concerning measures of prevention and protection to be taken within the workplace to reduce the risk of fire or to limit the consequences if it does occur.

## 1.2 STATE OF REVISIONS AND AMENDMENTS

| Rev. | Date       | Modified section                       | Amendment Description                                                                                                                                                        |
|------|------------|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 01   | 07/01/2019 | All                                    | New production department, new laboratory                                                                                                                                    |
| 02   | 16/06/2020 | All                                    | New Office, Micronization, Prod., Distillation Room,<br>Update Company logo,<br>Updating of the names of the coordinators of the<br>emergency and Vice Emergency Coordinator |
| 03   | 30/11/2020 | Description of the<br>building, Layout | Warehouse 22MR, REI archive, Locker room                                                                                                                                     |

## 1.3 AIMS OF EMERGENCY PLAN

The purpose of this document is to make available to all relevant personnel a clear source of information in order to understand and adopt the procedures to be followed in the event of an emergency. The Emergency Plan is an operational tool for planning operations during accidents, fires, accidents, gas leaks, spills of dangerous substances or any other calamitous event that determines the need to leave the structure (e.g. earthquakes, floods, etc. ), in order to allow an orderly and safe exodus to all occupants of a building.

This emergency plan has the following goals:

- Identify all emergencies that may involve the activity and functionality of the system
- Provide an emergency organization compliant with the Company's organizational scheme
- Provide staff and visitors with the necessary information on behavioural rules to follow in the event of fire or serious danger
- Coordinate staff interventions at all levels, so that all the behaviours and actions that each person in the company must implement to safeguard their own and others' safety and, if possible, to limit damage to property and building structure
- Assign tasks and tasks to specifically identified and trained personnel to avoid confusion of roles

- Deal with the incurred emergency in order to control and mitigate its effects
- Coordinate the internal Emergency service staff.

## 1.4 APPLICABILITY

The contents of this document apply to all emergency situations as later defined.

## 1.5 LEGISLATIVE REFERENCES

Legal Notice 44 of 2002 as amended by Legal Notice 437

Legal Notice 11 of 2002

## 1.6 DEFINITION AND CLASSIFICATION OF EMERGENCY

Emergency consists on any deviation from the normal operating conditions, often resulting in the occurrence of unexpected and difficult to predict events, giving rise to damage situations for men, equipment and environment.

The following list, details the various types of events (dangers) potentially able to originate emergency situations:

| INTERNAL EMERGENCY                                                               | EXTERNAL EMERGENCY |
|----------------------------------------------------------------------------------|--------------------|
| Fires of various origin and nature                                               | Flood              |
| Spill or accidental release of hazardous substances (flammable, toxic, irritant) | Earthquake         |
| Failure or sudden break of an equipment                                          | Wind Storm         |
| Emergency power                                                                  |                    |
| Injury/illness                                                                   |                    |
| Oxygen-deficient atmosphere                                                      |                    |

In order for the company's emergency plan to be effectively applied in cases of real need, it is essential the everyone's cooperation, collaboration beginning with an in-house training concerning the general safety regulations applied to the workplace, that the person receives when starts working in the company, continues with a careful reading of this handbook, with learning and familiarizing the use of the available equipment (fire extinguishers, sprinklers, smoke detectors, light boxes and first aid given in the attached maps), and ending with emergency simulations designed to train the

staff to deal calmly and efficiently, an emergency situation.

## 1.7 REGISTER COMPANY

|                                    |                                                               |
|------------------------------------|---------------------------------------------------------------|
| <b>Company Name</b>                | STERLING CHEMICAL MALTA LTD                                   |
| <b>Production Plant</b>            | HF51, Hal Far Industrial Estate – BIRZEBUGGIA BBG3000 - Malta |
| <b>VAT ID</b>                      | MT16941304                                                    |
| <b>Company Registration Number</b> | C.35208                                                       |
| <b>Employer</b>                    | ROBERTO TUMBIOLO                                              |
| <b>Activity Sector</b>             | Production of basic pharmaceuticals                           |

## 1.8 DESCRIPTION OF PLANT AND ACTIVITIES

### A. DESCRIPTION OF THE BUILDING

The industrial area is developed in an area with a number of other companies manufacturing active pharmaceuticals ingredients and finished pharmaceuticals already present in close proximity to the site. The figures below show the exact location on the map.



The factory is built in accordance with the KNPD 2006 guidelines with the accessibility for disabled restricted to the offices building. Access to the building will be via a main entrance doorway at road level or internally via the car park. The various levels are accessed by means of a passenger lift satisfying the KNPD criteria.

The premises are constructed as a single building covering a total of 3295 square metres. Two areas can be identified in the building, an administrative one and an operative one.

| <i>Administrative area</i>                                                                                                                                                                | <i>Operative area</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Underground floor</i>                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <ul style="list-style-type: none"> <li>• 20 parking spaces (+ 1 disabled)</li> <li>• 1 substation room</li> <li>• 1 control room</li> <li>• REI archive</li> <li>• Locker room</li> </ul> | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>Ground floor</i>                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <ul style="list-style-type: none"> <li>• 4 offices</li> <li>• 1 conference room</li> <li>• 1 canteen</li> <li>• 3 restrooms (gents, ladies, disabled)</li> <li>• 1 courtyard</li> </ul>   | <ul style="list-style-type: none"> <li>• R&amp;D/QC office</li> <li>• R&amp;D/QC lab</li> <li>• Micronization</li> <li>• Stability chamber room</li> <li>• Weighing room</li> <li>• Lockers for labs (gents and ladies)</li> <li>• Restrooms for labs (gents and ladies)</li> <li>• Lockers room for production</li> <li>• Toilets for production</li> <li>• Production Rooms</li> <li>• Clean rooms</li> <li>• Boiler room</li> <li>• Sampling room</li> <li>• Workshop</li> <li>• Warehouse area</li> <li>• Finished goods warehouse</li> <li>• Cold rooms</li> <li>• Warehouse 22MR</li> </ul> |
| <i>First floor</i>                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <ul style="list-style-type: none"> <li>• 7 office</li> </ul>                                                                                                                              | <ul style="list-style-type: none"> <li>• Archive</li> <li>• Server room</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>Second floor</i>                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>• R&amp;D office/Engineering/HSE office</li> <li>• R&amp;D laboratory</li> <li>• Distillation Room</li> <li>• QC/R&amp;D Lab.</li> <li>• QC/R&amp;D Office</li> <li>• Analytical Research Lab.</li> <li>• Utilities area</li> </ul>                                                                                                                                                                                                                                                                                                                        |

## B. ACTIVITY DESCRIPTION

Depending on the departments, following activities are carried out:

- **Quality control laboratory:**
  - Sampling of raw materials, intermediates and finished products.
  - Preparation and analysis of reagents.
  - Preparation of documentation relating to quality control operations.

- **RD laboratory:**
  - Bibliographic research
  - Development of the synthesis and purification of new molecules
  - Optimization of existing summaries
  - Study of analytical controls
  - Validation of synthetic processes and drafting of the related processing sheets
- **AR Laboratory:**
  - Sampling of incoming and outgoing products.
  - Preparation and analysis of various reagents.
  - Analysis of incoming, outgoing, intermediate, finished products, products from the Research and Development laboratory and external samples.
  - Preparation of documentation relating to quality control operations.
- **Warehouse:**
  - The warehouse is intended for the storage of raw materials and finished products.  
The products are placed on the pallet racking by using a forklift and moved by means of manual pallet trucks
- **Warehouse 22 MR:**
  - The 22 MR warehouse is intended for the storage of non-flammable waste in metal and/or plastic containers. The containers are placed on the shelves by forklift and moved by manual and / or electric pallet trucks. Into the 22MR Room no transfer of liquids between containers is carried out.
- **Production:**
  - Chemical synthesis: Reactions of transformation of raw materials and intermediates into other intermediates or finished products by chemical synthesis conducted inside chemical reactors.
  - Insulation and Drying: following chemical synthesis, the product is isolated, subsequently dried and packaged using centrifuges and dryers.
- **Office:**
  - Document processing
  - Design and planning of equipment, maintenance management
  - Management of orders, customers and shipments
  - Economic - financial and administrative management
  - Accounting and fiscal management.



- **REI archive:**

- The REI archive is intended for the storage, in dedicated cabinets, of the GMP documentation. The room is protected with a Argonite-gas firefighting system.

- **Locker room**

- This is the changing room with toilets and showers for Sterling staff.

## C. INTERNAL AID (NUMBERS)

|                                                                                 |                                                                                   |
|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Coordinatore dell'emergenza<br>Emergency Coordinator                            | <b>Alessandro Bianchi</b><br><b>Mob. +356 99963496</b>                            |
| Vicecoordinatore dell'emergenza<br>Vice Emergency Coordinator                   | <b>Andrea Farinacci</b><br><b>Mob. +356 99245064</b>                              |
| Coordinatore dell'emergenza turno di notte<br>Night Shift Emergency Coordinator | <b>Supervisore di produzione di turno</b><br><b>Mob. 79332969 - Mob. 99480945</b> |
| Front Desk                                                                      | <b>Tel. 400</b>                                                                   |

## D. EXTERNAL AID (NUMBERS)

The external telephone numbers for emergency response and communications are contained in the module **MMS\_4.4.7-C Emergency Number**

|                                           |                       |
|-------------------------------------------|-----------------------|
| Vigili del Fuoco - Fire fighters          | (0) <b>112</b>        |
| Emergenza Sanitaria – Ambulance           | (0) <b>112</b>        |
| Polizia - Police                          | (0) <b>112</b>        |
| Protezione Civile Malta- Civil Protection | (0) <b>23930000</b>   |
| ARMS- Energia Elettrica/Idrica Malta      | (0) <b>80072222</b>   |
| Ospedale Mater dei Malta                  | (0) <b>25 45 0000</b> |
| Ospedale St. James Zejtun                 | (0) <b>23 29 1000</b> |

## E. FIRE DEVICES AND FIRST AID

In all the company areas there are fire and first aid devices; refer to the "General Emergency and Evacuation Plans". The device control is performed by outside companies as required by law, and also by internal staff as required by Fire logbook e by the Firs aid logbook.

In the plant there also are universal anti-spill kit for chemicals, usable in case of small spills, in particular, they are stored in all laboratories, in all production departments and in all the warehouses.

In the "General Emergency and Evacuation Plans" the kit exact location

## F. DETECTION SYSTEMS AND FIRE ALARM

The entire building is equipped with a fire detection system and with the related alarm systems. The alarm system control is located in the Front Desk office. The location of the heat and smoke detector is shown in the attached Fire detection plan view.

## G. ASSEMBLY POINT

For the exact location of the assembly point, see the attached "General Emergency and Evacuation Floor Plan". The escape routes to reach the assembly point s are marked with arrows.

**Never get away from the plant without have first been to the assembly point and having responded to the call by the Emergency Coordinator or his appointee.**

The failure to achieve the same, it may in fact cause difficulties in the census of the staff and cause therefore risks to other students.

## H. PEOPLE TO EVACUATE

It is essential, for safety purposes, that the crowding is identified, which is the maximum number of hypothetical workers and other people in the workplace or in a specific area of the same in the event that an emergency occurs.

Currently the number of workers is around 80 people, but the working time is different in function of the department and the job so the number of people within the plant is variable during the day. During the day time the situation is about the following

| Occupant          | Whole plant                                                                        | No. of persons    |
|-------------------|------------------------------------------------------------------------------------|-------------------|
| <b>Constant</b>   | Employees                                                                          | <b>Around 80</b>  |
| <b>Fortuitous</b> | The staff of goods and services companies that can occasionally enter in the plant | <b>20 About</b>   |
| <b>Tot.</b>       |                                                                                    | <b>Around 100</b> |

During the hours 6:00 pm to 8:00 am there are 4 employees in production departments; from 5:00 pm to 9.00 pm, if required by the work, there may be one employee in the laboratory.

Invalid workers have no disability such as to prevent him to reach safety in event of emergency or evacuation. The determination of the exact number of people inside of the company can be carried out considering:

- **WORKERS:** In the company we have a computer system for recording the attendance from which we have the real-time access by stations located both inside the plant. Every worker has to sign in and clock out both their presence for work shift both their break and exit for work reasons. In case

of emergency the Front Desk employee has to verify the presence and report them to the Emergency Coordinator.

- VISITORS: any person who is not within the groups above identified (contractors, consultants, outside contractors ...) must go to the Front Desk to register in the Visitors Register. In case of evacuation is the responsibility of the Front Desk employee to take the registry for subsequent verification.

## 2. SPECIAL SECTION

### 2.1 EMERGENCY AND EVACUATION TEAM

The names of the firefighter and first aid operators and the emergency and evacuation team composition are contained in the MMS\_4.4.7-D S\_4.4.7-D Emergency and evacuation team.

The appointed staff is trained with specific courses as required by law.

| ROLE/RUOLO                                                              | NAMES/NOMINATIVI                                                                                                |                                       |                                                                   |
|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------------------------|-------------------------------------------------------------------|
| Co-ordinatore dell'emergenza                                            | Alessandro Bianchi Mob. +356 99963496                                                                           |                                       |                                                                   |
| Vice co-ordinatore dell'emergenza                                       | Andrea Farinacci Mob. +356 99245064                                                                             |                                       |                                                                   |
| Co-ordinatore dell'emergenza turno di notte                             | Supervisore di produzione di turno<br>Mob. +356 79332969                                                        |                                       |                                                                   |
| Addetto messa in sicurezza impianti e apparecchiature                   | Addetti antincendio in base alle indicazioni del Supervisor /Vice Coordinatore delle emergenze                  |                                       |                                                                   |
| Addetto sezionamento quadro elettrico generale                          | Addetti antincendio in base alle indicazioni del Coordinatore delle emergenze (Manutenzione) Mob. +356 99142139 |                                       |                                                                   |
| Addetto sezionamento valvola generale intercettazione gas /Lpg          | Addetti antincendio Produzione/in base alle indicazioni del Vice Coordinatore delle emergenze                   |                                       |                                                                   |
| Responsabile controllo evacuazione <u>Produzione 1 e Magazzino</u>      | Supervisore di produzione di turno<br>Mob. +356 79332969 Mob. +356 99380036                                     |                                       |                                                                   |
| Responsabile controllo evacuazione <u>Produzione 2 -</u>                | Supervisore di produzione di turno<br>Mob. +356 79332969 Mob. +356 99480945                                     |                                       |                                                                   |
| Responsabile controllo evacuazione <u>Micronizzazione</u>               | Supervisor/Preposto<br>Mob. +356 99113633                                                                       |                                       |                                                                   |
| Responsabile controllo evacuazione <u>Laboratorio QC1/Locali Comuni</u> | Supervisor/Preposto<br>Mob. +356 99768039 Int. 426 – 428                                                        |                                       |                                                                   |
| Responsabile controllo evacuazione <u>Laboratorio R&amp;D/Scale-up</u>  | Supervisor/Preposto<br>Mob. +356 99022772 - Int.. 455                                                           |                                       |                                                                   |
| Responsabile controllo evacuazione <u>Laboratorio QC2</u>               | Supervisor/Preposto<br>Mob.+356 99604356 - Int. 437                                                             |                                       |                                                                   |
| Responsabile controllo evacuazione <u>Uffici edificio</u>               | Responsabile di ogni ufficio                                                                                    |                                       |                                                                   |
| Responsabile registri visitatori                                        | Front desk<br>Int. 400                                                                                          | Sterling Chemical<br>Tel.<br>20908700 | Manutenzione<br>Caneponi Mob. 99054582<br>Nicolella Mob. 99311763 |
| Responsabile verifica presenze                                          | Antonella Bianconi<br>Int. 400                                                                                  | Angele Sammut<br>Int. 401             | FRONT DESK                                                        |

## **2.2 DUTIES OF THE EMERGENCY TEAM**

### **A. FIRE PREVENTION OPERATOR**

Fire fighters' employees are workers required to implement the necessary measures in the field of fire prevention. In case of alarm, those have not specific tasks, follow the Emergency Coordinator's directions.

#### **Behaviour outside of the emergency:**

Recalling that the fire prevention employee is not a professional, the main tasks to be carried out during the normal working activities outside of the emergency prevention activities are related and can be summarized as follows:

- Ensure the maintenance of order and cleanliness in the various workplaces
- Enforcing the ban on smoking and open flames where such actions may cause fire or in the presence of flammable materials
- Make sure flammable materials are kept away from heat sources and electrical installations
- Make sure there are no obstructions and/or dimensions in the vicinity of the various firefighting
- Check for proper placement of fire extinguishers and their state of charge
- Check for proper operation of hydrants
- Check the appropriate functioning of the electrical system
- Check the correct operation of boilers and gas shut-off valve
- Check the correct operation of electrical panels of the area and the main electrical panel
- Check the correct operation of the various machines and electrical equipment, as well as the integrity of the power cords and plug sockets
- Check for proper operation of emergency lighting
- Make sure there are no obstructions and/or dimensions along exit routes and near the emergency exits
- Check for proper operation of the door opening of emergency exits
- Make sure that at the end of the working time all the machines are turned off (except the ones that, due to the production, process cannot be turned off

## **B. FIRST AID OPERATORS**

First aid employees are workers required to implement the necessary measures in the field of first aid and medical assistance. The Employer make provisions to have, as stated in article 5 of Legal Notice 11 of 2002, a suitable number of workers (at least one every 50 workers).

These people are trained through courses in First Aid in the manner specified by LN 11 of 2002. The First Aid consists in carrying out simple steps performed by unqualified personnel, designed to keep alive the injured and prevent complications, waiting for a specialized intervention.

Designated workers must follow, first of all, the general rules to be followed in an emergency, then remove the curious, stay calm, do not take personal initiatives, primarily be interested in the vital conditions of the injured and call 112, using, in the meantime, the content of first aid kits, which are always available in the company and kept in good condition.

### **Behaviour outside of the emergency:**

Recalling that the guy on first aid is not a professional, his duties of prevention can be summarized as follows:

- Check, at least every 6 months, the contents of the medication packages of the structures which are responsible, checking the material inside and their expiration time.
- Check periodically the signages (white cross on a green) indicating the location of the medical devices.

## **C. FIRST AID OPERATIONS AND CONDUCT IN CASE OF EMERGENCY**

All the operations to be performed when the emergency occurs are explained in detail in the specific operating instructions for each task and / or type of attached emergency

## **2.3 FIRE DETECTION AND ALARM SYSTEMS**

The function of a fire detection system is to detect a fire in the shortest possible time and to provide optical / acoustic signals to the occupants of a building. The fire can be "discovered" and reported by man manually (alarm buttons) or automatically by a fire detection system. The detection system consists of:

### **Alarm buttons**

Each company building has several buttons to be pressed for immediate activation of the alarm status.

| Type                                                                              | Symbols                                                                           |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
|  |  |

### **Fire detection system**

Each company building is equipped with a fire detection system capable of detecting the presence of a fire inside a building by means of optical and thermal detectors capable of signalling any fire principles in the presence of smoke and an increase in temperature.



### **Fire alarm plates**

The flashing red plates are luminous signaling devices, connected to the alarm control unit, which in the event of a fire principle emit an intermittent red light, with the writing "Fire alarm" to warn everyone present of a possible emergency in progress



## **2.4 FIRE EXTINGUISHING EQUIPMENT**

### **Fire extinguishers**

Fire extinguishers are the most frequently used means of first intervention to extinguish fires.

**They are not effective if the fire is in a more advanced stage**

| Type            |                                                                                     | Symbols                                                                               |
|-----------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Powder          |    |    |
| Foam            |    |    |
| CO <sub>2</sub> |   |   |
| Powder 50 kg    |  |  |

For a correct location, refer to the plans

**Hose reel**

Fire-fighting equipment consisting essentially of a box, pipe support, manual shut-off valve, flexible pipe complete with fittings and dispensing nozzle which, through the supply of water, is essential for the fight against fires.



| Type      |                                                                                   | Symbols                                                                             |
|-----------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| hose reel |  |  |

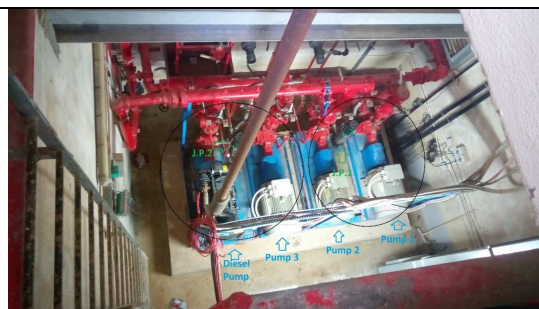
### Sprinkler system

The sprinkler is an automatic rain extinguisher system; has the purpose of detecting the presence of a fire and extinguishing it in the initial stage.

| Type             |                                                                                    |
|------------------|------------------------------------------------------------------------------------|
| Sprinkler system |  |

### Fire-Fighting Tank

In the plant there is a fire-fighting tank of about 600 cubic meters. The fire-fighting tank serves, through electric pumps, the hose reel line and the sprinkler line.



## 2.5 FIRST AID MEASURES

For first aid systems we mean all those systems and devices (listed and pictured below) that can be used for first aid on the farm.

| Type                                  |                                                                                     | Symbols                                                                               |
|---------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| First aid kit                         |    |    |
| Eye wash kit                          |    |    |
| Wash eyes on the floor                |   |   |
| Emergency floor showers with eye wash |  |  |

## 2.6 ANTI-SPILL KIT

By spill kit we mean all those systems and devices to be used in case of spillage of chemical substances

| Type                                                            | Raffigurazione                                                                      |
|-----------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Container containing: sheets, pillows, sleeves, bags for waste; |  |

### 3. ATTACHMENTS

#### **Operating instructions:**

MIOS\_ 4.4.7-A Procedure to follow in case of fire

MIOS\_ 4.4.7-B Operating instruction for fire extinguishers, fire hydrants and mobile foam groups

MIOS\_ 4.4.7-C Procedure to follow in case of spill or release or contact with hazardous substances

MIOS\_ 4.4.7-D Procedure to follow in case of malfunction or breakdown of equipment

MIOS\_ 4.4.7-E Procedure to follow in case of injury or illness

MIOS\_ 4.4.7-F Procedure to follow for the safety of the plant and the employees

MIOS\_ 4.4.7-G Procedure to follow in case of earthquake, flood/flood, power emergency

MIOS\_ 4.4.7-H Procedure to follow in case of emergency

MIOS\_ 4.4.7-I Emergency and evacuation procedure

MIOS\_ 4.4.7-L Procedure to adopt in the event of oxygen-deficient atmosphere

MIOS\_4.4.7-M-Procedure for testing emergency pump

MIOS\_4.5.1-A Registro antincendio

MIOS\_4.5.1-B- Registro primo soccorso

#### **Forms:**

MMS\_4.4.7-C Emergency numbers

MMS\_4.4.7-D Emergency and evacuation team

MM\_4.4.7-E Verbale prova emergenza

#### **Layout:**

Emergency and Evacuation Floor plan

Fire sprinkler floorplans

Fire detection system floorplans

**Birzebuggia, 30/11/2020**



STERLING CHEMICAL MALTA LTD  
1351, HAL-FAR INDUSTRIAL ESTATE  
BIRZEBBUGIA - 9603000 MALTA  
MT VAT 16941304

The employer

Roberto Tumbiolo



# EMERGENCY LAYOUT

STERLING CHEMICAL MALTA Ltd.  
HF51, Hal-Far Industrial Estate Birzebbuga BBG3000 - Malta

LEVEL 0  
Underground floor Malta 2

## In case of emergency

Active Alarm



Call the internal telephone numbers  
+356 99101171  
+356 2090875  
+356 99963496  
+356 79332969  
or  
400

What is your name?  
What happened?  
Where are you?  
There are any injuries?

Follow the instructions provided by the fire team officer

## In case of fire

Active Alarm



Push the emergency button

or



Call the internal telephone numbers  
+356 99101171  
+356 2090875  
+356 99963496  
+356 79332969  
or  
400

What is your name?  
What happened?  
Where are you?  
There are any injuries?

Follow the instructions provided by the fire team officer

## In case of evacuation

Exit



Go outside using the nearest emergency exit.  
Do not run.  
Close the doors.  
Don't collect personal items.

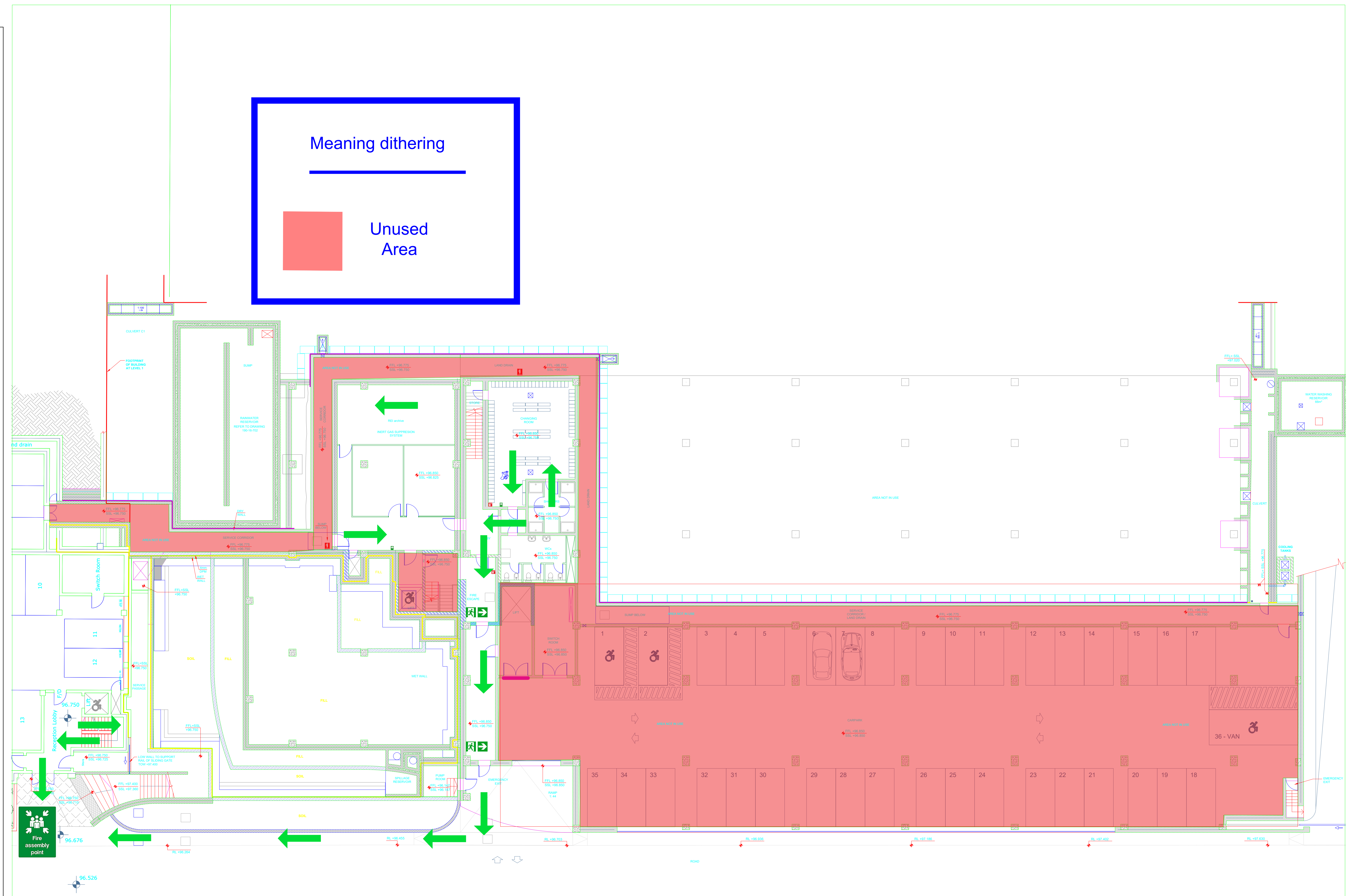
Assemble



Proceed to the designated assembly point

Meaning dithering

Unused Area



## EMERGENCY LAYOUT LEGEND:

YOU ARE HERE

ESCAPE WAY

EMERGENCY EXIT

ASSEMBLY POINT

FIRST AID KIT

EMERGENCY SHOWER

SPILL KIT

MOBILE FOAM GROUP



FIRE EXTINGUISHER



WHEELED FIRE EXTINGUISHER



FIRE HYDRANT & HOSE REEL



ALARM BUTTON



FIRE BLANKET



FIRE BRIGADE ATTACK



LPG VALVE



ELECTRICITY RELEASE BUTTON



FIRE CABINET



SMOKE DETECTION SYSTEM CONTROL





# EMERGENCY LAYOUT

STERLING CHEMICAL MALTA Ltd.  
HF51, Hal-Far Industrial Estate Birzebbuga BBG3000 - Malta

LEVEL 1  
Reception Lobby

## In case of emergency

Active Alarm



Call the internal telephone numbers  
+356 99101171  
+356 2090875  
+356 99963496  
+356 79332969  
or  
400

What is your name?  
What happened?  
Where are you?  
There are any injuries?

Follow the instructions provided by the fire team officer

## In case of fire

Active Alarm



Push the emergency button

or



Call the internal telephone numbers  
+356 99101171  
+356 2090875  
+356 99963496  
+356 79332969  
or  
400

What is your name?  
What happened?  
Where are you?  
There are any injuries?

Follow the instructions provided by the fire team officer

## In case of evacuation

Exit



Go outside using the nearest emergency exit.  
Do not run.  
Close the doors.  
Don't collect personal items.

Assemble



Proceed to the designated assembly point



## EMERGENCY LAYOUT LEGEND:

● YOU ARE HERE

→ ESCAPE WAY

→ EMERGENCY EXIT

ASSEMBLY POINT

FIRST AID KIT

EMERGENCY SHOWER

SPILL KIT

MOBILE FOAM GROUP

FIRE EXTINGUISHER

WHEELED FIRE EXTINGUISHER

FIRE HYDRANT & HOSE REEL

ALARM BUTTON

FIRE BLANKET

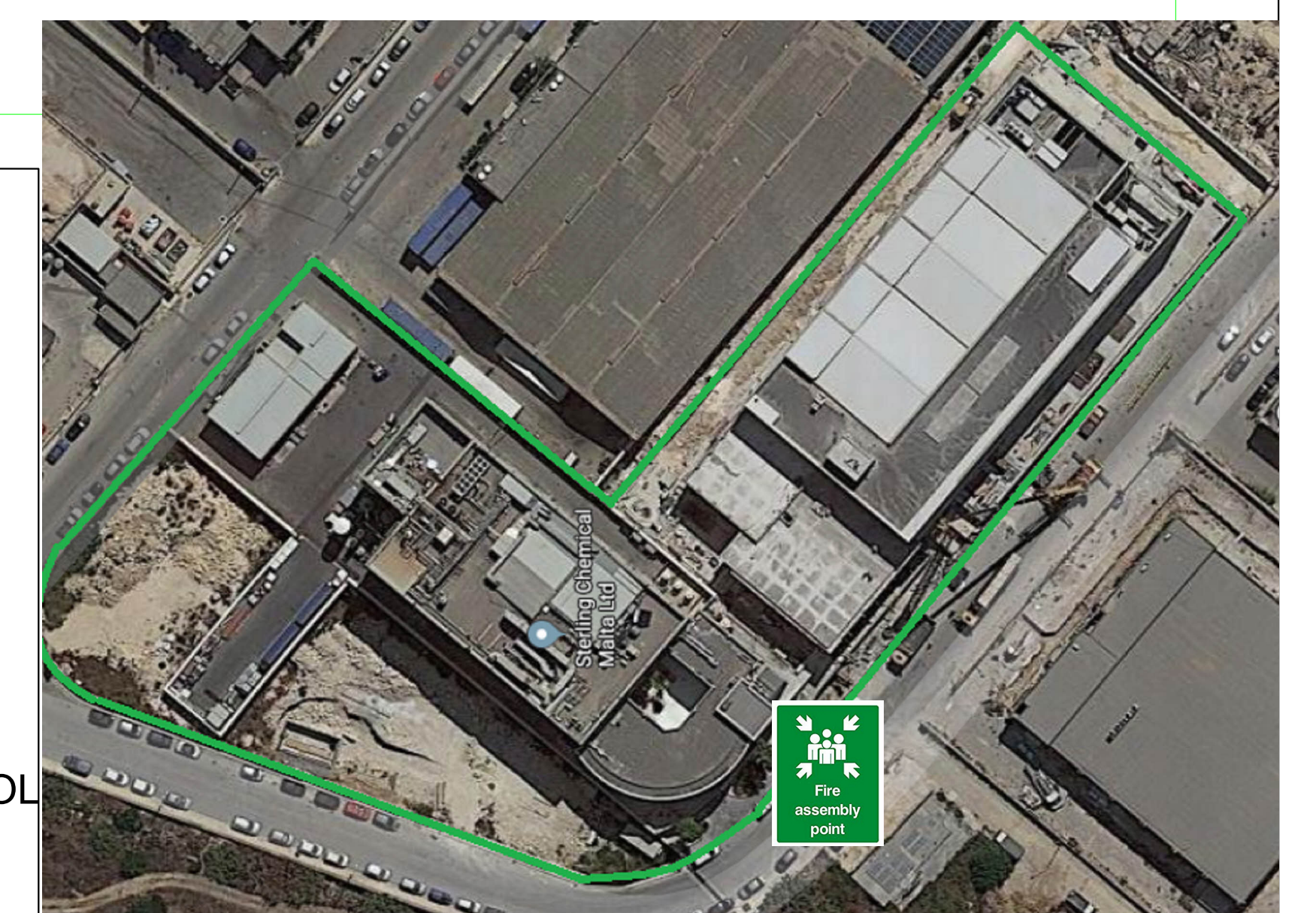
FIRE BRIGADE ATTACK

LPG VALVE

ELECTRICITY RELEASE BUTTON

FIRE CABINET

SMOKE DETECTION SYSTEM CONTROL







## **Annex 4: Fire Safety and Ventilation Report**





**CAMILLERI & CUSCHIERI**  
CONSULTING ENGINEERS

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website: www.camilleriandcuschieri.com

VAT Reg. No: MT10436416

**Mr Damian Whitehead**  
o.b.o. Malta Industrial Parks Ltd.

7<sup>th</sup> October 2019

## **Revised Fire Safety, and Ventilation Report for Factory HF53 in Hal Far**

With reference to the proposed project and the attached plans as received from the architects, please find the following fire safety and ventilation report for your perusal.

### **(A) Fire Safety**

BS9999:2008 classifies Offices and Industrial Premises under Occupancy Characteristic type A, where the purpose group is described as Occupants who are awake and familiar with the building. The Overall Risk Profile shall be A3, estimating a fast fire growth rate. All elements of the structure must have a fire resistance of at least 90minutes.

## **1 Fire Fighting Measures**

The fire fighting installation shall be comprised of a sprinkler system as indicated in the drawings. On the other hand, production areas shall be provided with Sodium bicarbonate type extinguishers.

The fire fighting installation shall also entail a wet mains system. Fire extinguishers shall also be installed in selected areas throughout the building.

Both the sprinkler system and the wet mains system draw water from a dedicated water reserve.

The system shall be designed and certified in accordance with international recommendations.

### **1.1 Fire cabinets**

The premises shall be furnished with fire cabinets which shall contain fire extinguishers and a fire blanket. The cabinets shall be red in colour and shall have FIRE POINT together with a pictogram clearly displayed on them.

### **1.2 Fire extinguishers.**

The fire extinguishers shall be of various types including:

- Dry powder type which are suitable for all types of fires including:
  - Type A (Paper, wood, textile, fabric)
  - Type B (Flammable liquids)
  - Type C (Flammable gases)
  - Electrical hazards
- AFFF type which are very effective on many classes of fires but is not recommended for use on electrical fires;
- CO2 type which are effective on electrical fires.

### **1.3 Fire blankets**

The fire blankets are particularly suited for the extinguishing of fires in their early stages by smothering the flames.

### **1.4 Wet Mains system**

The wet mains shall be comprised from a series of landing valves and hose reels at each level, a breech point inlet for tank refill connected together via a network of galvanised pipes.

These shall be connected to the existing fire pump.

### **1.5 Fire-Fighting Staircases**

The building shall be furnished with two fire-fighting staircases as per requirements satisfying BS9999 of 2008.

The fire-fighting stairwell shall be adjacent to the outside or situated in a fire protected corridor that is 1.5m wide and no longer than 18m in length from the outside. The corridor is deemed to be part of the fire-fighting shaft, and any access to it should be by way of a protected lobby. The fire-fighting staircase and fire-fighting lobby shall be separated by a fire door as can be seen in the drawings.

The fire-fighting lobby shall house the fire mains and landing valves.

Following the above provisions, it can be concluded that the fire-fighting lobbies shall be in line with BS9999.

### **1.6 Conclusion**

From the above, it may be observed that the building shall be furnished with adequate fire fighting measures.

## **2 Fire Detection System**

According to BS9999 of 2008, an Automatic Fire Detection System to cover areas as defined by category L2 within BS5839 shall be required. As a result, areas and levels of the building shall be furnished with a fire detection installation comprising of a fire alarm monitoring panel, rate of rise heat detectors, smoke detectors, manual call points and fire alarm sounders as may be required.

### **2.1 Fire alarm panel**

The fire alarm panel shall have clear zoning indications such that in the event of a fire, the location of the detector triggered can easily and accurately be located. In addition, besides being connected to the essential power supply, the panel shall have a battery backup with 72 hours autonomy such that the system would remain operative for three days despite a power failure. The panel is connected to the fire brigade by means of an auto dialler which shall be programmed to dial up selected numbers in the event of the fire alarm being triggered.

## **2.2 Rate of Rise Heat detectors.**

Locations where vapour could be present shall be furnished with rate of rise heat detectors installed as indicated in the drawings. These shall have dual sensing facilities in that they are triggered both by a sudden rise in temperature as well as a fixed temperature mechanism set at 60°C. This combination makes them suitable to be installed where reliable performance and early warning capabilities are essential.

## **2.3 Break glass manual call points**

These shall be located at strategic locations around the premises, essentially next to each exit such that in the event of someone noticing a fire in its conception stages prior to the heat detectors triggering, can sound the alarm by pressing the call point.

## **2.4 Fire alarm sounders**

These shall be of the electronic sounder type rated at a minimum of 90dB at 1m. These shall be positioned as indicated in the drawing to ensure a minimum sounder level of 70dB at any location within the area.

## **2.5 Smoke detectors**

Smoke detectors shall be used in most areas to detect a fire by the sensing of smoke. They shall be of the ionisation type or optical type as required in the particular area. The spacing and the sensitivity of the detectors shall be according to British Standard 5839.

## **2.6 Conclusion**

From the above, it may be concluded that the premises shall be furnished with adequate fire detection measures.

# **3 Emergency escape routes**

## **3.1 Maximum Travel Distances and Escape Widths**

The Maximum Travel Escape Distances to be respected in this category are 18m when travel is in a single direction and 45m when two-directions of escape are possible onto a safe zone.

### **3.2 Lighting Installation**

The premises shall also be furnished with Emergency lighting which will illuminate in the event of a utility failure and will hence enable the safe exit of personnel.

The emergency lights shall fall into three main categories namely:

- Non-maintained emergency lights which shall operate in the event of a utility failure. These are the most common type.
- Maintained emergency lights which shall remain illuminated at all times. These shall be installed primarily in the staircases.
- Illuminated exit signs. These shall of the maintained type and shall hence remain illuminated at all times. These shall be complete with a visual indication to clearly denote exit routes.

In certain areas photo luminescent exit signs shall also be installed as necessary in order identify the emergency escape routes.

Lighting shall be designed such that illuminance levels are in line CIBSE recommendations.

## **4 Ventilation Strategy**

### **4.1 Ventilation details**

Drawings indicate areas which are earmarked to be furnished according to International requirements with:

- A forced fresh air ventilation installation
- A forced extraction system within the bathrooms

### **4.2 Fresh air installation**

Fresh air shall be introduced into the spaces from fresh air ducts passing over the false ceilings. In general, the air shall be drawn from the outside of the building, passed through a filter, ducted though a system of phenolic ductwork and discharged into spaces via a supply grill. The grills shall be furnished with volume control dampers in order to be able to set the air flows in each zone during the commissioning stages of the project.

In places where the ducts shall pass through compartments, they shall be protected with the use of fire dampers that shall seal the separate compartments in case of fire.

#### **4.3 Extraction**

The forced extraction shall occur from the bathrooms, kitchens or other areas pertinent to foul air is. Air shall be drawn through the grills and extracted to the outside of the building by means of the negative pressure generated by an extractor fan. All extraction grills shall also be furnished with dampers which shall be set during the commissioning stages of the project.

The extraction system in the bathrooms shall also be designed in accordance with CIBSE recommendations of greater to 5 air changes per hour. The toilets shall be kept under negative pressure.

#### **4.4 Conclusion**

From the above it may be observed that the building shall be furnished with ventilation systems which shall conform to international standards.



## **(B) Car Park Fire Safety**

BS9999:2008 classifies Car Parks under Occupancy Characteristic type B, where the purpose group is described as Occupants who are awake and might be unfamiliar with the building. The Overall Risk Profile shall be B2, estimating a medium fire growth rate.

### **1 Fire Fighting Measures**

The fire fighting installation shall be comprised mainly of a sprinkler system as indicated in the drawings. The system shall be designed and certified in accordance with international recommendations.

The fire fighting installation shall also entail a wet mains system in this area.

Both the sprinkler system and the wet mains system draw water from a dedicated water reserve.

#### **1.1 Wet Mains system**

The wet mains system shall be comprised of landing valves and hose reels connected together via a network of galvanised pipes.

The hose reels shall be regularly spaced within the car park. The landing valve shall be located in close proximity to the fire escapes to enable fire-fighting personnel to connect their flat type hoses, making all areas immediately accessible.

#### **1.2 Conclusion**

From the above, it may be observed that the garage shall be furnished with adequate fire fighting measures.

### **2 Fire detection System**

The garage shall be furnished with a fire detection installation comprising of fire alarm monitoring panel, rate of rise heat detectors, smoke detectors, manual call points and fire alarm sounders.

## **2.1 Rate of Rise Heat detectors**

The garage driveway and other locations where vapour could be present, shall be furnished with rate of rise heat detectors. These have dual sensing facilities in that they are triggered both by a sudden rise in temperature as well as a fixed temperature mechanism set at 60°C. This combination makes them suitable to be installed where reliable performance and early warning capabilities are essential.

## **2.2 Break glass manual call points**

These shall be located at strategic locations around the premises, essentially next to each exit such that in the event of someone noticing a fire in its conception stages prior to the heat detectors triggering, can sound the alarm by pressing the call point.

## **2.3 Fire alarm sounders**

These are of the electronic sounder type rated and shall be positioned so as to ensure a minimum sounder level of 70dB at any location within the area.

## **2.4 Conclusion**

From the above, it may be concluded that the premises shall be furnished with adequate fire detection measures.

# **3 Emergency escape routes**

## **3.1 Maximum Travel Distances and Escape Widths**

The Maximum Travel Distances to be respected in this category is 50m.

## **3.2 Lighting Installation**

The light fittings installed in the car park are rated to IP 65 which makes them particularly suited for this type of environment in that they are resistant to the ingress of both dust and water.

The premises shall also be furnished with Emergency lighting which will illuminate in the event of a utility failure and will hence enable the safe exit of vehicles and pedestrians.

The emergency lights fall into three main categories namely

- Non-maintained emergency lights which shall operate in the event of a utility failure. These are the most common type
- Maintained emergency lights which shall remain illuminated at all times. These shall be installed primarily in the staircases.
- Illuminated exit signs. These shall of the maintained type and shall hence remain illuminated at all times. These shall be complete with a visual indication to clearly denote exit routes.

In certain areas photo luminescent exit signs shall also be installed as necessary in order identify the emergency escape routes.

Lighting shall be designed such that illuminance levels are in line CIBSE recommendations.

## 4 Ventilation

With reference to the ventilation requirements for the car park of the above captioned project, please find our considerations as follows:

### 4.1 Car Park Ventilation

The car park is located above ground. It shall be provided with natural ventilation. The ventilation opening in the outside wall shall be of at least 5% of the floor area.

### 4.2 Conclusion

From the above it may be concluded that the car park shall be provided with suitable ventilation measures.

It may also be observed that the garage shall conform to international standards as well as to local safety legislation.

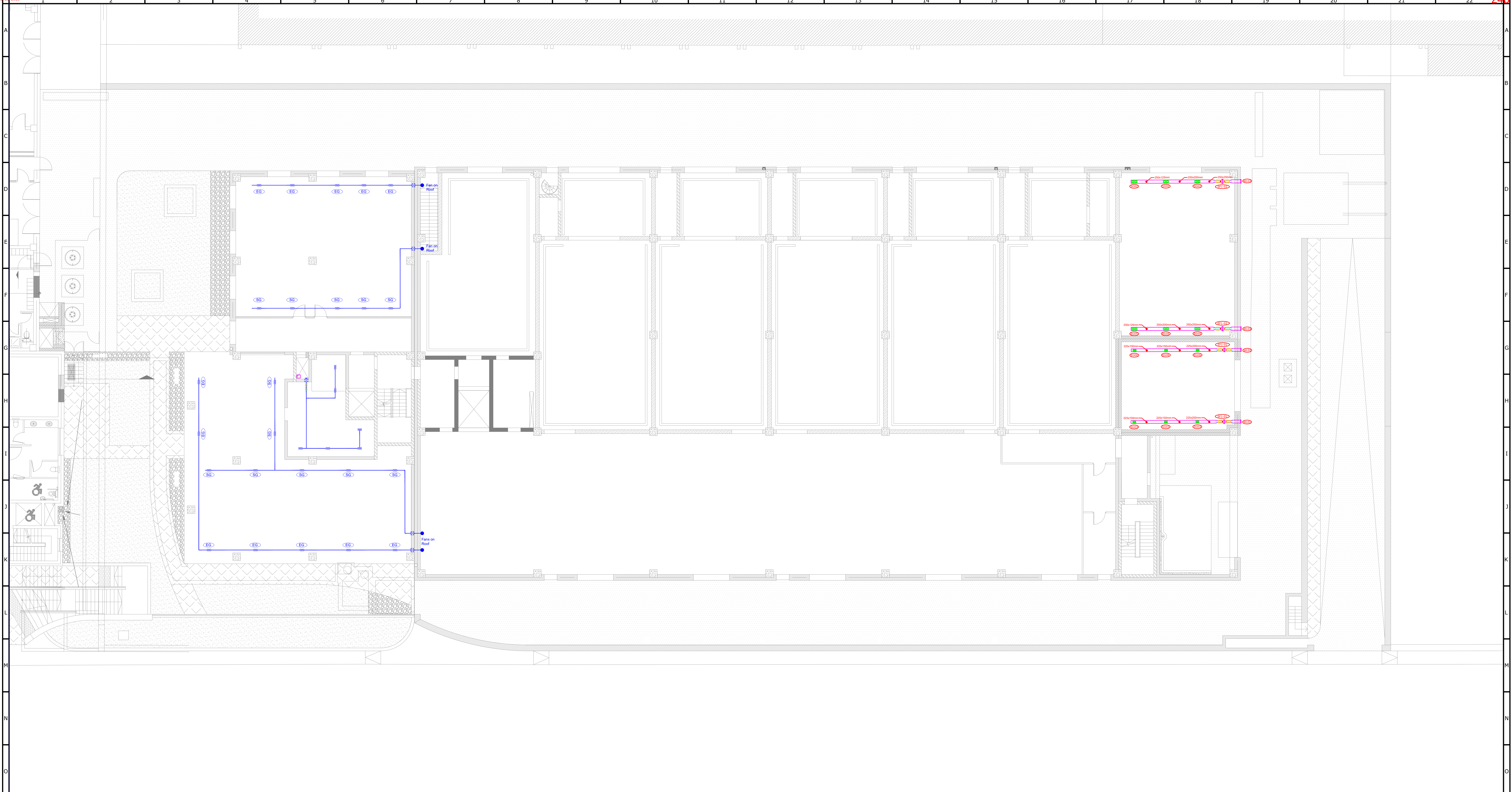
## 5 Structural and architectural considerations

It is deemed that the structural considerations for the building such as the building's fire integrity, fire resistance of structural elements, fire doors, fire compartments, escape routes and escape widths indicated in this report shall be reviewed and ensured by third parties.

We trust that the above meet your requirements.

Regards,  
Ing. Owen Vassallo



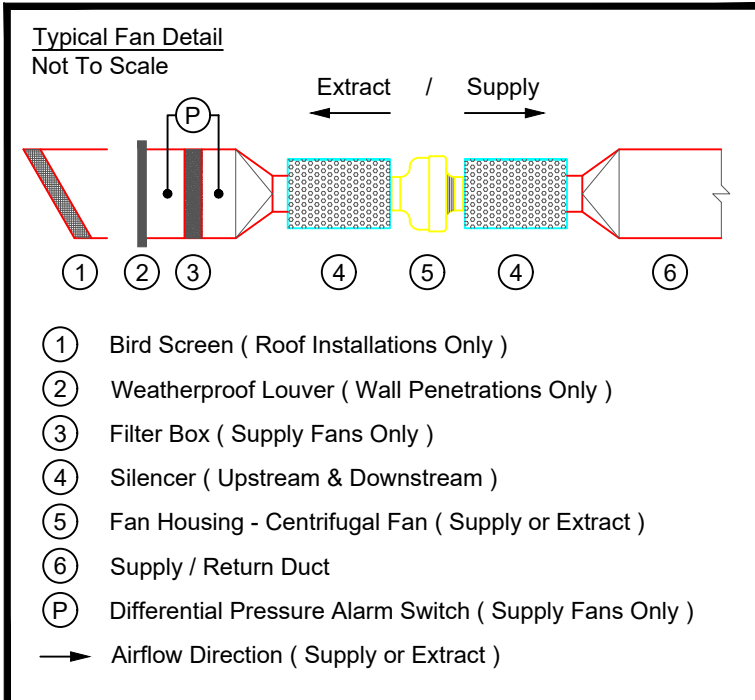


Legend:-

|  |                                              |
|--|----------------------------------------------|
|  | Centrifugal Supply / Extract Ventilation Fan |
|  | Silencer                                     |
|  | Grill                                        |
|  | Rectangular Duct Riser / Drop                |
|  | Weather Proof Louver                         |
|  | Chamfered Bird Screen                        |
|  | Non-Return Damper                            |
|  | Motorised Damper                             |
|  | Fire Damper                                  |

Ventilation Important Notes:

- All fans to have a variable speed controller and silencers upstream and downstream to the flow, unless otherwise indicated in the drawing.
- All supply fans/extract to be mounted using anti-vibration mountings.
- All dimensions indicated in the drawing are internal dimensions and refer to the width by the depth of the duct section.
- Fresh air fans to be complete with filter box and a differential pressure alarm switch.
- Diffuser grills shall be of the single curved blade type unless otherwise indicated.
- All diffuser grills to be complete with opposed blade damper.
- All Fans at roof level to be mounted on top of each other where possible.
- Duct configuration in shafts to be determined on site
- Ventilation Fans to be interfaced to the FAP



Louver Schedule:

| Louver Reference: | Louver Type:          | Louver Size:   |
|-------------------|-----------------------|----------------|
| Louwer - WL01     | Weather Proof Louver  | 225x200 (mm)   |
| Louwer - WL02     | Weather Proof Louver  | 225x175 (mm)   |
| Louwer - WL03     | Weather Proof Louver  | 250x250 (mm)   |
| Louwer - WL04     | Weather Proof Louver  | 800x400 (mm)   |
| Louwer - WL05     | Weather Proof Louver  | 1300x1300 (mm) |
| Louwer - WL06     | Weather Proof Louver  | 250x225 (mm)   |
| Louwer - WL07     | Weather Proof Louver  | 150x150 (mm)   |
| Louwer - WL08     | Weather Proof Louver  | 150x175 (mm)   |
| Louwer - WL09     | Weather Proof Louver  | 200x150 (mm)   |
| Louwer - BS01     | Chamfered Bird Screen | 275x250 (mm)   |

Grills Schedule:

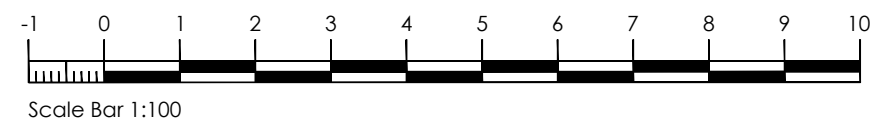
| Grill Reference:     | Grill Type:                           | Grill Size:   |
|----------------------|---------------------------------------|---------------|
| Supply Grill - SG01  | Single Curve c/w Opposed Blade Damper | 250x200 (mm)  |
| Supply Grill - SG02  | Single Curve c/w Opposed Blade Damper | 400x200 (mm)  |
| Supply Grill - SG03  | Single Curve c/w Opposed Blade Damper | 250x150 (mm)  |
| Supply Grill - SG04  | Single Curve c/w Opposed Blade Damper | 200x100 (mm)  |
| Supply Grill - SG05  | Single Curve c/w Opposed Blade Damper | 1000x200 (mm) |
| Supply Grill - SG06  | Single Curve c/w Opposed Blade Damper | 300x150 (mm)  |
| Extract Grill - EG01 | Single Curve c/w Opposed Blade Damper | 300x150 (mm)  |
| Extract Grill - EG02 | Single Curve c/w Opposed Blade Damper | 250x100 (mm)  |
| Extract Grill - EG03 | Single Curve c/w Opposed Blade Damper | 250x200 (mm)  |
| Extract Grill - EG04 | Single Curve c/w Opposed Blade Damper | 600x600 (mm)  |
| Extract Grill - EG05 | Single Curve c/w Opposed Blade Damper | 400x200 (mm)  |
| Extract Grill - EG06 | Single Curve c/w Opposed Blade Damper | 250x150 (mm)  |

Ventilation Fans Schedule:

| Fan Reference:       | Position: | Fan Type:       | Fan Rating:         | Filter Box: | Silencers: |
|----------------------|-----------|-----------------|---------------------|-------------|------------|
| Supply Fan - SF0-01  | Level 3   | Centrifugal Fan | 1150m³/hr @ 175Pa   | Yes         | 2 Qty      |
| Supply Fan - SF1-01  | Level 1   | Centrifugal Fan | 600m³/hr @ 150Pa    | Yes         | 2 Qty      |
| Supply Fan - SF1-02  | Level 1   | Centrifugal Fan | 1000m³/hr @ 150Pa   | Yes         | 2 Qty      |
| Supply Fan - SF3-01  | Level 3   | Centrifugal Fan | 1000m³/hr @ 150Pa   | Yes         | 2 Qty      |
| Supply Fan - SF3-02  | Level 3   | Centrifugal Fan | 360m³/hr @ 150Pa    | Yes         | 2 Qty      |
| Supply Fan - SF3-03  | Level 3   | Centrifugal Fan | 900m³/hr @ 150Pa    | Yes         | 2 Qty      |
| Extract Fan - EF0-01 | Level 0   | Centrifugal Fan | 630m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF0-02 | Level 0   | Centrifugal Fan | 480m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF0-03 | Level 0   | Centrifugal Fan | 1000m³/hr @ 100Pa   | No          | 2 Qty      |
| Extract Fan - EF0-04 | Level 0   | Centrifugal Fan | 10,000m³/hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-05 | Level 0   | Centrifugal Fan | 10,000m³/hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-06 | Level 0   | Centrifugal Fan | 10,000m³/hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-07 | Level 0   | Centrifugal Fan | 250m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF1-01 | Level 1   | Centrifugal Fan | 600m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF1-02 | Level 1   | Centrifugal Fan | 1000m³/hr @ 100Pa   | No          | 2 Qty      |
| Extract Fan - EF3-01 | Level 3   | Centrifugal Fan | 150m³/hr @ 100Pa    | No          | 2 Qty      |

Fire Dampers Schedule:

| Damper Reference: | Louver Type:          | Louver Size:  |
|-------------------|-----------------------|---------------|
| Damper - MD01     | Motorised Fire Damper | 250x250 (mm)  |
| Damper - MD02     | Motorised Fire Damper | 225x175 (mm)  |
| Damper - MD03     | Motorised Fire Damper | 225x150 (mm)  |
| Damper - MD04     | Motorised Fire Damper | 150x150 (mm)  |
| Damper - FD01     | Fire Damper           | 250x250 (mm)  |
| Damper - FD02     | Fire Damper           | 150x100 (mm)  |
| Damper - FD03     | Fire Damper           | 275x250 (mm)  |
| Damper - FD04     | Fire Damper           | 150x75 (mm)   |
| Damper - FD05     | Fire Damper           | 1000x200 (mm) |
| Damper - FD06     | Fire Damper           | 250x250 (mm)  |
| Damper - FD07     | Fire Damper           | 150x100 (mm)  |

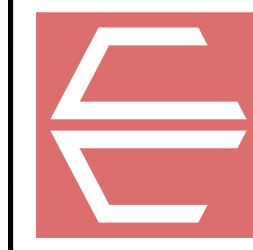


A0 PLEASE DO NOT SCALE FROM THE DRAWING

|    |          |                |                    |                           |                                          |                   |
|----|----------|----------------|--------------------|---------------------------|------------------------------------------|-------------------|
| -  | -        | -              | Scale: 1:100       | Revision No.: 03          | Date: 24.09.19                           | Position: Level 1 |
| 03 | 24.09.19 | Revised Layout | Job No.: 17.019    | Drawing No.: SFR.1.VNT.01 | Service: Ventilation Installation Layout |                   |
| 02 | 07.07.17 | Revised Layout | Drawn By: A. Z. A. | Checked By:               |                                          |                   |
| 01 | 30.05.17 | Revised Layout |                    |                           |                                          |                   |

Project Name & Address:

Factory HF53, Hal Far

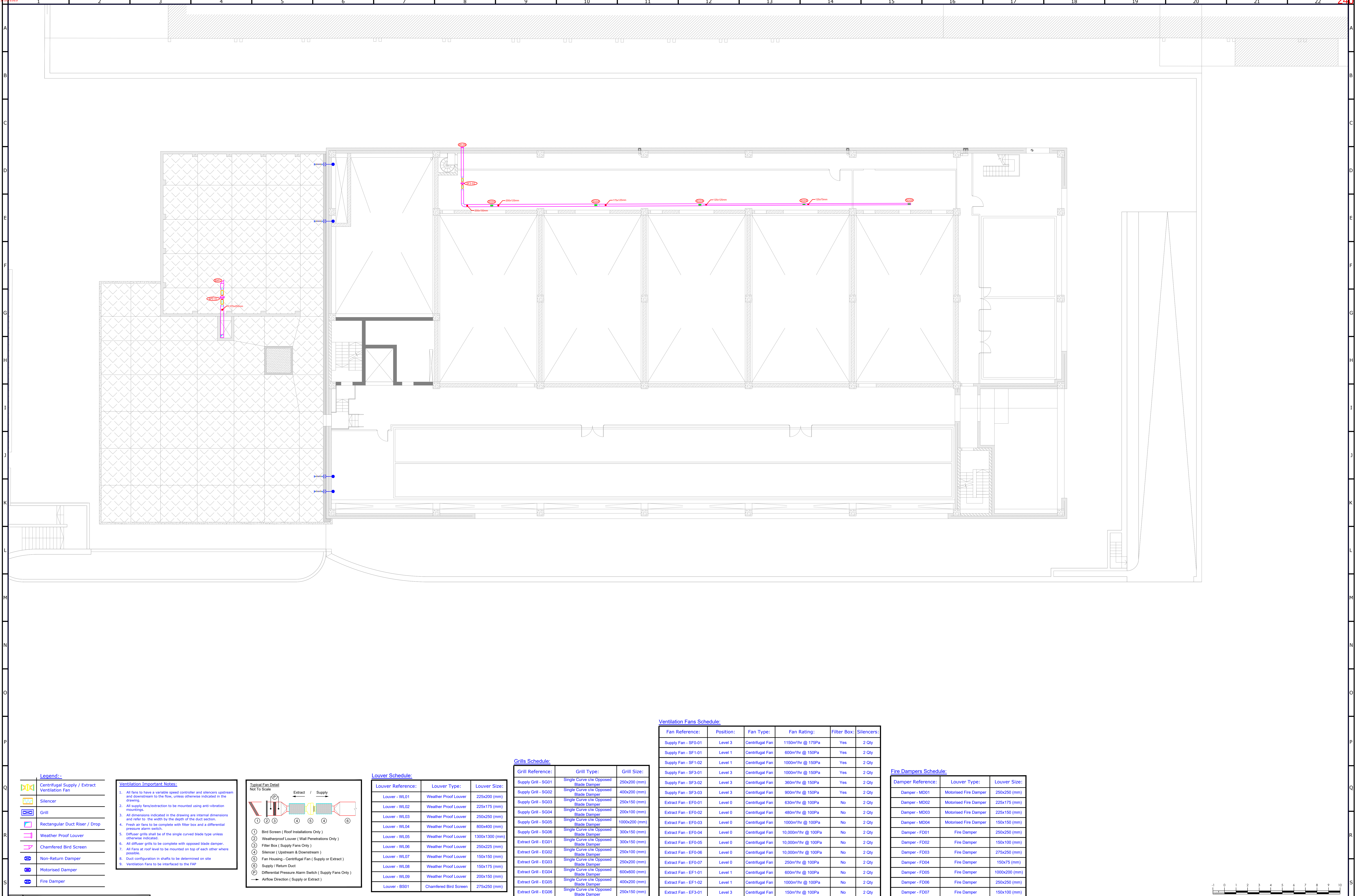


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10 Years

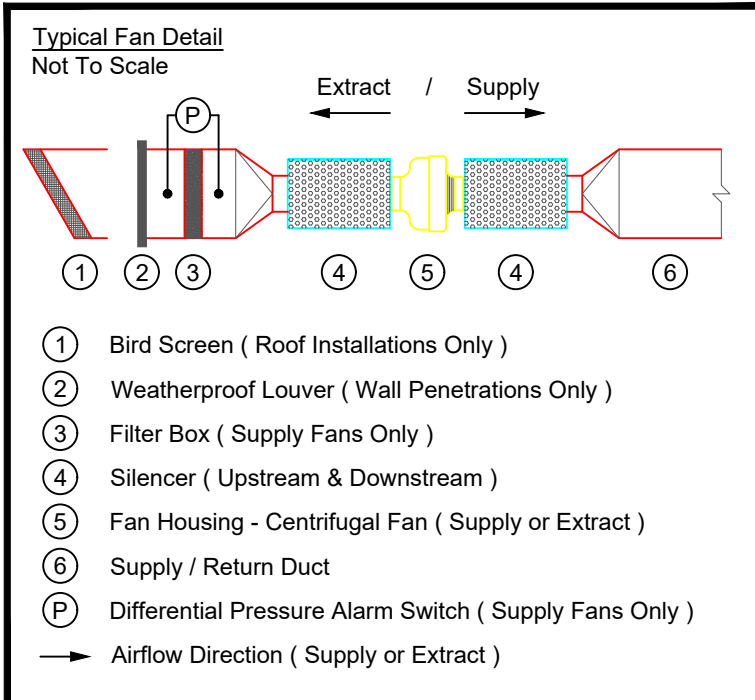




**Legend:-**

|  |                                              |
|--|----------------------------------------------|
|  | Centrifugal Supply / Extract Ventilation Fan |
|  | Silencer                                     |
|  | Grill                                        |
|  | Rectangular Duct Riser / Drop                |
|  | Weather Proof Louver                         |
|  | Chamfered Bird Screen                        |
|  | Non-Return Damper                            |
|  | Motorised Damper                             |
|  | Fire Damper                                  |

- Ventilation Important Notes:**
1. All fans to have a variable speed controller and silencers upstream and downstream to the flow, unless otherwise indicated in the drawing.
  2. All supply fans/extraction to be mounted using anti-vibration mountings.
  3. All dimensions indicated in the drawing are internal dimensions and refer to the width by the depth of the duct section.
  4. Fresh air fans to be complete with filter box and a differential pressure alarm switch.
  5. Diffuser grills shall be of the single curved blade type unless otherwise indicated.
  6. All diffuser grills to be complete with opposed blade damper.
  7. All Fans at roof level to be mounted on top of each other where possible.
  8. Duct configuration in shafts to be determined on site
  9. Ventilation Fans to be interfaced to the FAP



**Louver Schedule:**

| Louver Reference: | Louver Type:          | Louver Size:   |
|-------------------|-----------------------|----------------|
| Louwer - WL01     | Weather Proof Louver  | 225x200 (mm)   |
| Louwer - WL02     | Weather Proof Louver  | 225x175 (mm)   |
| Louwer - WL03     | Weather Proof Louver  | 250x250 (mm)   |
| Louwer - WL04     | Weather Proof Louver  | 800x400 (mm)   |
| Louwer - WL05     | Weather Proof Louver  | 1300x1300 (mm) |
| Louwer - WL06     | Weather Proof Louver  | 250x225 (mm)   |
| Louwer - WL07     | Weather Proof Louver  | 150x150 (mm)   |
| Louwer - WL08     | Weather Proof Louver  | 150x175 (mm)   |
| Louwer - WL09     | Weather Proof Louver  | 200x150 (mm)   |
| Louwer - BS01     | Chamfered Bird Screen | 275x250 (mm)   |

**Grills Schedule:**

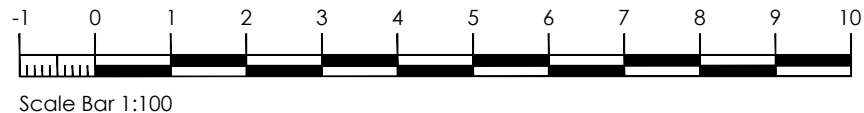
| Grill Reference:     | Grill Type:                           | Grill Size:   |
|----------------------|---------------------------------------|---------------|
| Supply Grill - SG01  | Single Curve o/w Opposed Blade Damper | 250x200 (mm)  |
| Supply Grill - SG02  | Single Curve o/w Opposed Blade Damper | 400x200 (mm)  |
| Supply Grill - SG03  | Single Curve o/w Opposed Blade Damper | 250x150 (mm)  |
| Supply Grill - SG04  | Single Curve o/w Opposed Blade Damper | 200x100 (mm)  |
| Supply Grill - SG05  | Single Curve o/w Opposed Blade Damper | 1000x200 (mm) |
| Supply Grill - SG06  | Single Curve o/w Opposed Blade Damper | 300x150 (mm)  |
| Extract Grill - EG01 | Single Curve o/w Opposed Blade Damper | 300x150 (mm)  |
| Extract Grill - EG02 | Single Curve o/w Opposed Blade Damper | 250x100 (mm)  |
| Extract Grill - EG03 | Single Curve o/w Opposed Blade Damper | 250x200 (mm)  |
| Extract Grill - EG04 | Single Curve o/w Opposed Blade Damper | 600x600 (mm)  |
| Extract Grill - EG05 | Single Curve o/w Opposed Blade Damper | 400x200 (mm)  |
| Extract Grill - EG06 | Single Curve o/w Opposed Blade Damper | 250x150 (mm)  |

**Ventilation Fans Schedule:**

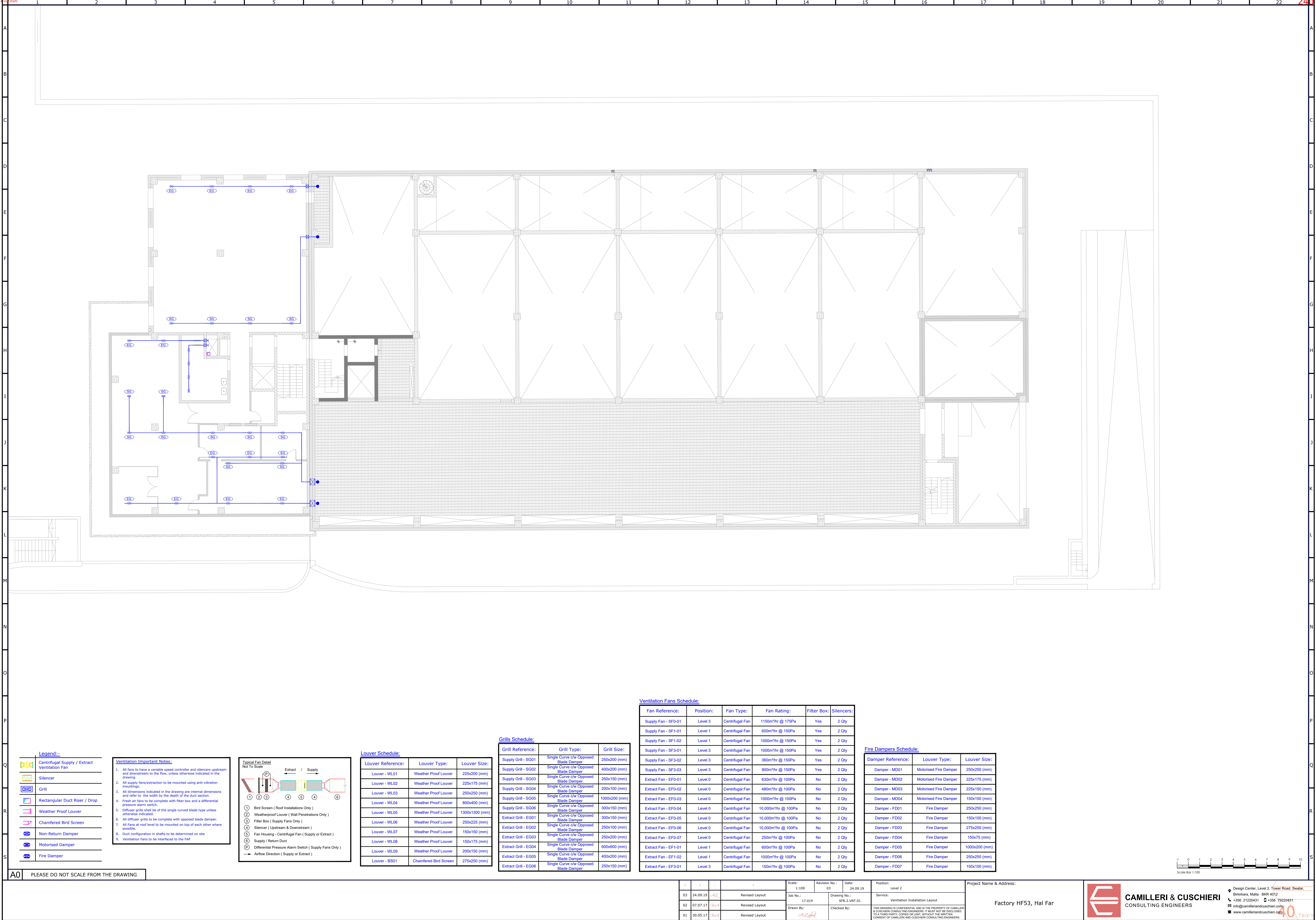
| Fan Reference:       | Position: | Fan Type:       | Fan Rating:         | Filter Box: | Silencers: |
|----------------------|-----------|-----------------|---------------------|-------------|------------|
| Supply Fan - SF0-01  | Level 3   | Centrifugal Fan | 1150m³/hr @ 175Pa   | Yes         | 2 Qty      |
| Supply Fan - SF1-01  | Level 1   | Centrifugal Fan | 600m³/hr @ 150Pa    | Yes         | 2 Qty      |
| Supply Fan - SF1-02  | Level 1   | Centrifugal Fan | 1000m³/hr @ 150Pa   | Yes         | 2 Qty      |
| Supply Fan - SF3-01  | Level 3   | Centrifugal Fan | 1000m³/hr @ 150Pa   | Yes         | 2 Qty      |
| Supply Fan - SF3-02  | Level 3   | Centrifugal Fan | 360m³/hr @ 150Pa    | Yes         | 2 Qty      |
| Supply Fan - SF3-03  | Level 3   | Centrifugal Fan | 900m³/hr @ 150Pa    | Yes         | 2 Qty      |
| Extract Fan - EF0-01 | Level 0   | Centrifugal Fan | 630m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF0-02 | Level 0   | Centrifugal Fan | 480m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF0-03 | Level 0   | Centrifugal Fan | 1000m³/hr @ 100Pa   | No          | 2 Qty      |
| Extract Fan - EF0-04 | Level 0   | Centrifugal Fan | 10,000m³/hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-05 | Level 0   | Centrifugal Fan | 10,000m³/hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-06 | Level 0   | Centrifugal Fan | 10,000m³/hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-07 | Level 0   | Centrifugal Fan | 250m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF1-01 | Level 1   | Centrifugal Fan | 600m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF1-02 | Level 1   | Centrifugal Fan | 1000m³/hr @ 100Pa   | No          | 2 Qty      |
| Extract Fan - EF3-01 | Level 3   | Centrifugal Fan | 150m³/hr @ 100Pa    | No          | 2 Qty      |

**Fire Dampers Schedule:**

| Damper Reference: | Louver Type:          | Louver Size:  |
|-------------------|-----------------------|---------------|
| Damper - MD01     | Motorised Fire Damper | 250x250 (mm)  |
| Damper - MD02     | Motorised Fire Damper | 225x175 (mm)  |
| Damper - MD03     | Motorised Fire Damper | 225x150 (mm)  |
| Damper - MD04     | Motorised Fire Damper | 150x150 (mm)  |
| Damper - FD01     | Fire Damper           | 250x250 (mm)  |
| Damper - FD02     | Fire Damper           | 150x100 (mm)  |
| Damper - FD03     | Fire Damper           | 275x250 (mm)  |
| Damper - FD04     | Fire Damper           | 150x75 (mm)   |
| Damper - FD05     | Fire Damper           | 1000x200 (mm) |
| Damper - FD06     | Fire Damper           | 250x250 (mm)  |
| Damper - FD07     | Fire Damper           | 150x100 (mm)  |





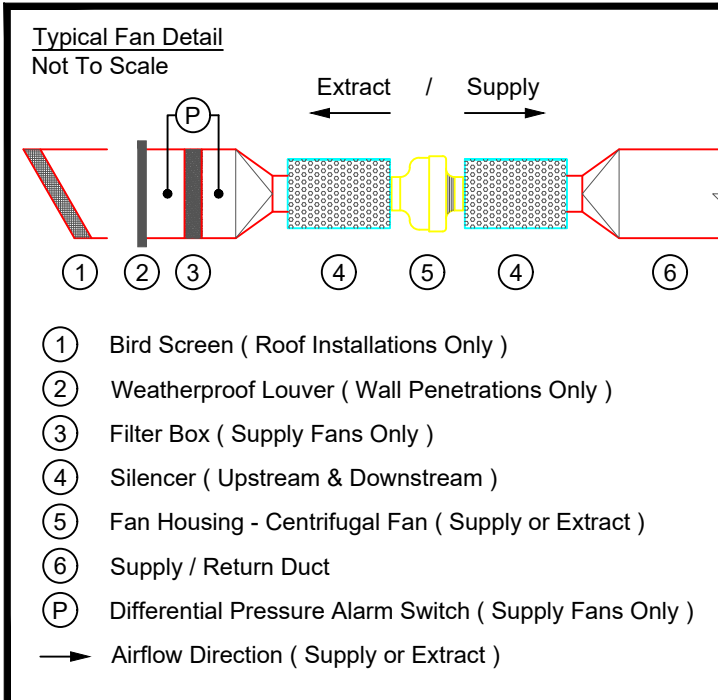


Legend:-

|  |                                              |
|--|----------------------------------------------|
|  | Centrifugal Supply / Extract Ventilation Fan |
|  | Silencer                                     |
|  | Grill                                        |
|  | Rectangular Duct Riser / Drop                |
|  | Weather Proof Louver                         |
|  | Chamfered Bird Screen                        |
|  | Non-Return Damper                            |
|  | Motorised Damper                             |
|  | Fire Damper                                  |

Ventilation Important Notes:

- All fans to have a variable speed controller and silencers upstream and downstream to the flow, unless otherwise indicated in the drawing.
- All supply fans/extraction to be mounted using anti-vibration mountings.
- All dimensions indicated in the drawing are internal dimensions and refer to the width by the depth of the duct section.
- Fresh air fans to be complete with filter box and a differential pressure alarm switch.
- Diffuser grills shall be of the single curved blade type unless otherwise indicated.
- All diffuser grills to be complete with opposed blade damper.
- All Fans at roof level to be mounted on top of each other where possible.
- Duct configuration in shafts to be determined on site
- Ventilation Fans to be interfaced to the FAP



Louver Schedule:

| Louver Reference: | Louver Type:          | Louver Size:   |
|-------------------|-----------------------|----------------|
| Louwer - WL01     | Weather Proof Louver  | 225x200 (mm)   |
| Louwer - WL02     | Weather Proof Louver  | 225x175 (mm)   |
| Louwer - WL03     | Weather Proof Louver  | 250x250 (mm)   |
| Louwer - WL04     | Weather Proof Louver  | 800x400 (mm)   |
| Louwer - WL05     | Weather Proof Louver  | 1300x1300 (mm) |
| Louwer - WL06     | Weather Proof Louver  | 250x225 (mm)   |
| Louwer - WL07     | Weather Proof Louver  | 150x150 (mm)   |
| Louwer - WL08     | Weather Proof Louver  | 150x175 (mm)   |
| Louwer - WL09     | Weather Proof Louver  | 200x150 (mm)   |
| Louwer - BS01     | Chamfered Bird Screen | 275x250 (mm)   |

Grills Schedule:

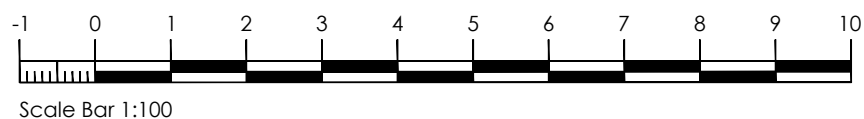
| Grill Reference:     | Grill Type:                           | Grill Size:   |
|----------------------|---------------------------------------|---------------|
| Supply Grill - SG01  | Single Curve o/w Opposed Blade Damper | 250x200 (mm)  |
| Supply Grill - SG02  | Single Curve o/w Opposed Blade Damper | 400x200 (mm)  |
| Supply Grill - SG03  | Single Curve o/w Opposed Blade Damper | 250x150 (mm)  |
| Supply Grill - SG04  | Single Curve o/w Opposed Blade Damper | 200x100 (mm)  |
| Supply Grill - SG05  | Single Curve o/w Opposed Blade Damper | 1000x200 (mm) |
| Supply Grill - SG06  | Single Curve o/w Opposed Blade Damper | 300x150 (mm)  |
| Extract Grill - EG01 | Single Curve o/w Opposed Blade Damper | 300x150 (mm)  |
| Extract Grill - EG02 | Single Curve o/w Opposed Blade Damper | 250x100 (mm)  |
| Extract Grill - EG03 | Single Curve o/w Opposed Blade Damper | 250x200 (mm)  |
| Extract Grill - EG04 | Single Curve o/w Opposed Blade Damper | 600x600 (mm)  |
| Extract Grill - EG05 | Single Curve o/w Opposed Blade Damper | 400x200 (mm)  |
| Extract Grill - EG06 | Single Curve o/w Opposed Blade Damper | 250x150 (mm)  |

Ventilation Fans Schedule:

| Fan Reference:       | Position: | Fan Type:       | Fan Rating:         | Filter Box: | Silencers: |
|----------------------|-----------|-----------------|---------------------|-------------|------------|
| Supply Fan - SF0-01  | Level 3   | Centrifugal Fan | 1150m³/hr @ 175Pa   | Yes         | 2 Qty      |
| Supply Fan - SF1-01  | Level 1   | Centrifugal Fan | 600m³/hr @ 150Pa    | Yes         | 2 Qty      |
| Supply Fan - SF1-02  | Level 1   | Centrifugal Fan | 1000m³/hr @ 150Pa   | Yes         | 2 Qty      |
| Supply Fan - SF3-01  | Level 3   | Centrifugal Fan | 1000m³/hr @ 150Pa   | Yes         | 2 Qty      |
| Supply Fan - SF3-02  | Level 3   | Centrifugal Fan | 360m³/hr @ 150Pa    | Yes         | 2 Qty      |
| Supply Fan - SF3-03  | Level 3   | Centrifugal Fan | 900m³/hr @ 150Pa    | Yes         | 2 Qty      |
| Extract Fan - EF0-01 | Level 0   | Centrifugal Fan | 630m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF0-02 | Level 0   | Centrifugal Fan | 480m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF0-03 | Level 0   | Centrifugal Fan | 1000m³/hr @ 100Pa   | No          | 2 Qty      |
| Extract Fan - EF0-04 | Level 0   | Centrifugal Fan | 10,000m³/hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-05 | Level 0   | Centrifugal Fan | 10,000m³/hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-06 | Level 0   | Centrifugal Fan | 10,000m³/hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-07 | Level 0   | Centrifugal Fan | 250m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF1-01 | Level 1   | Centrifugal Fan | 600m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF1-02 | Level 1   | Centrifugal Fan | 1000m³/hr @ 100Pa   | No          | 2 Qty      |
| Extract Fan - EF3-01 | Level 3   | Centrifugal Fan | 150m³/hr @ 100Pa    | No          | 2 Qty      |

Fire Dampers Schedule:

| Damper Reference: | Louver Type:          | Louver Size:  |
|-------------------|-----------------------|---------------|
| Damper - MD01     | Motorised Fire Damper | 250x250 (mm)  |
| Damper - MD02     | Motorised Fire Damper | 225x175 (mm)  |
| Damper - MD03     | Motorised Fire Damper | 225x150 (mm)  |
| Damper - MD04     | Motorised Fire Damper | 150x150 (mm)  |
| Damper - FD01     | Fire Damper           | 250x250 (mm)  |
| Damper - FD02     | Fire Damper           | 150x100 (mm)  |
| Damper - FD03     | Fire Damper           | 275x250 (mm)  |
| Damper - FD04     | Fire Damper           | 150x75 (mm)   |
| Damper - FD05     | Fire Damper           | 1000x200 (mm) |
| Damper - FD06     | Fire Damper           | 250x250 (mm)  |
| Damper - FD07     | Fire Damper           | 150x100 (mm)  |



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| No. | Date     | Description    |
|-----|----------|----------------|
| 03  | 24.09.19 | Revised Layout |
| 02  | 07.07.17 | Revised Layout |
| 01  | 30.05.17 | Revised Layout |

|                      |                           |                                          |
|----------------------|---------------------------|------------------------------------------|
| Scale: 1:100         | Revision No.: 03          | Date: 24.09.19                           |
| Job No.: 17.019      | Drawing No.: SFR.2.VNT.01 | Service: Ventilation Installation Layout |
| Drawn By: A. Zappala | Checked By:               |                                          |

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Project Name & Address:

Factory HF53, Hal Far

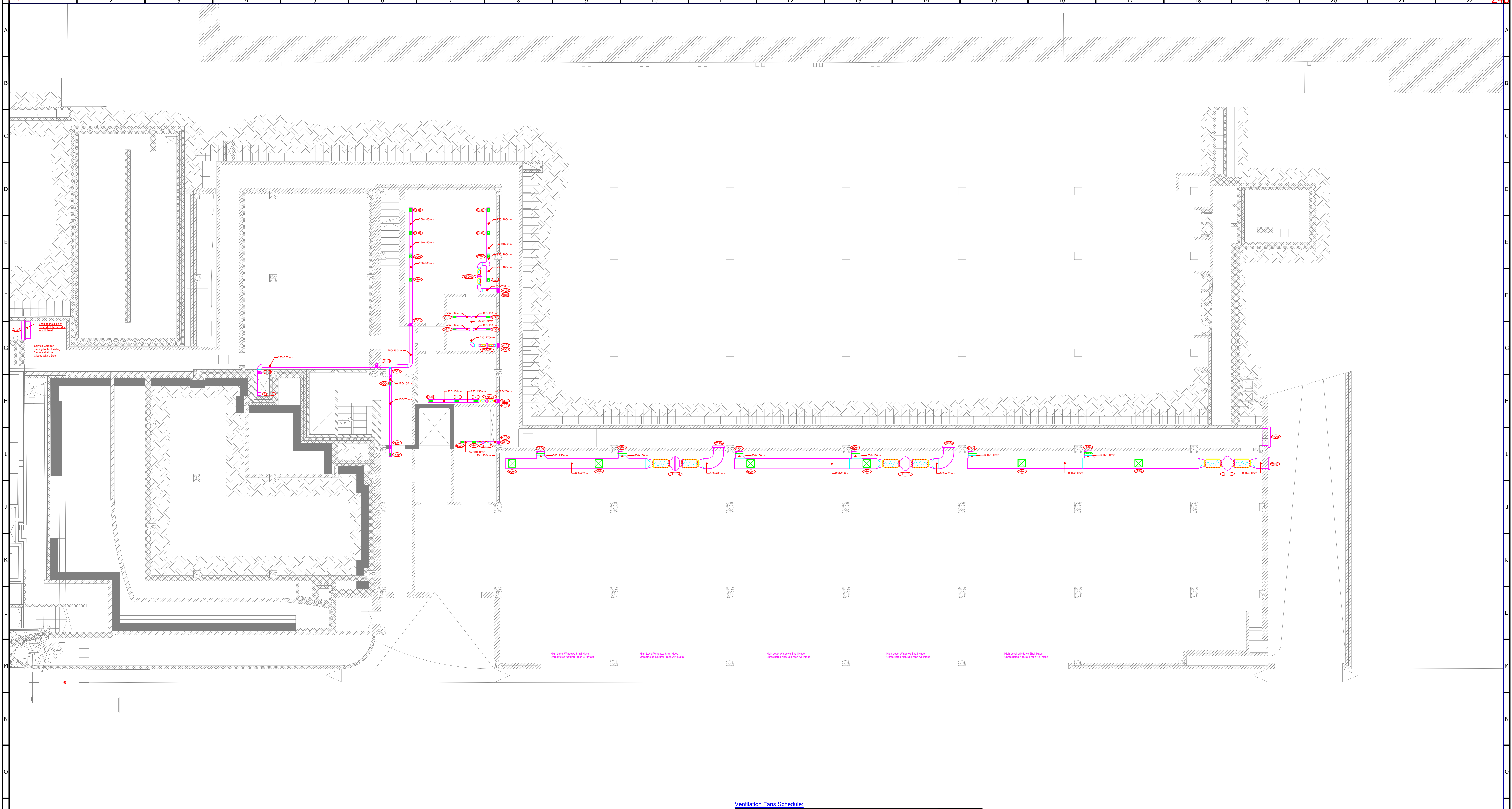


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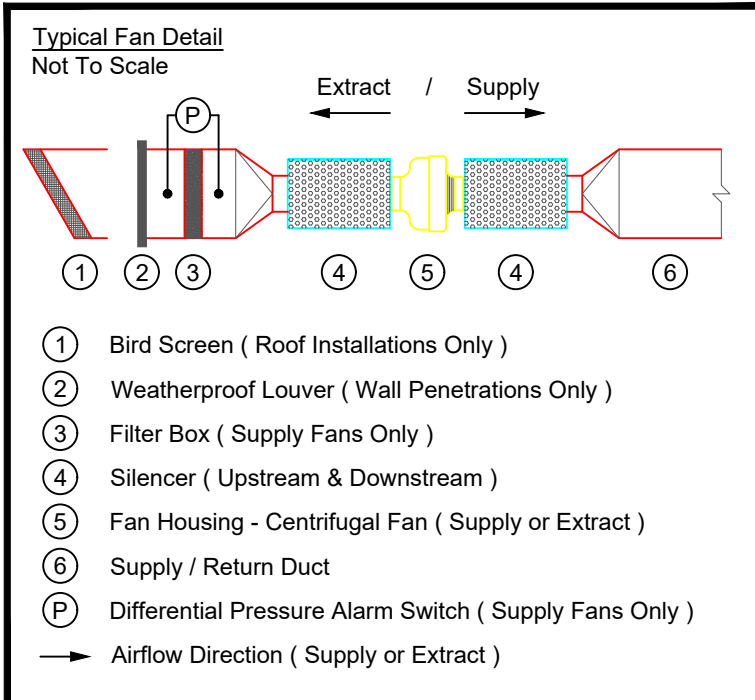
10 Years





| Legend:- |                                              |
|----------|----------------------------------------------|
|          | Centrifugal Supply / Extract Ventilation Fan |
|          | Silencer                                     |
|          | Grill                                        |
|          | Rectangular Duct Riser / Drop                |
|          | Weather Proof Louver                         |
|          | Chamfered Bird Screen                        |
|          | Non-Return Damper                            |
|          | Motorised Damper                             |
|          | Fire Damper                                  |

- Ventilation Important Notes:**
1. All fans to have a variable speed controller and silencers upstream and downstream to the flow, unless otherwise indicated in the drawing.
  2. All supply fans/extraction to be mounted using anti-vibration mountings.
  3. All dimensions indicated in the drawing are internal dimensions and refer to the width by the depth of the duct section.
  4. Fresh air fans to be complete with filter box and a differential pressure alarm switch.
  5. Diffuser grills shall be of the single curved blade type unless otherwise indicated.
  6. All diffuser grills to be complete with opposed blade damper.
  7. All Fans at roof level to be mounted on top of each other where possible.
  8. Duct configuration in shafts to be determined on site
  9. Ventilation Fans to be interfaced to the FAP



| Louver Schedule:  |                       |                |
|-------------------|-----------------------|----------------|
| Louver Reference: | Louver Type:          | Louver Size:   |
| Louver - WL01     | Weather Proof Louver  | 225x200 (mm)   |
| Louver - WL02     | Weather Proof Louver  | 225x175 (mm)   |
| Louver - WL03     | Weather Proof Louver  | 250x250 (mm)   |
| Louver - WL04     | Weather Proof Louver  | 800x400 (mm)   |
| Louver - WL05     | Weather Proof Louver  | 1300x1300 (mm) |
| Louver - WL06     | Weather Proof Louver  | 250x225 (mm)   |
| Louver - WL07     | Weather Proof Louver  | 150x150 (mm)   |
| Louver - WL08     | Weather Proof Louver  | 150x175 (mm)   |
| Louver - WL09     | Weather Proof Louver  | 200x150 (mm)   |
| Louver - BS01     | Chamfered Bird Screen | 275x250 (mm)   |

| Grills Schedule:     |                                       |               |
|----------------------|---------------------------------------|---------------|
| Grill Reference:     | Grill Type:                           | Grill Size:   |
| Supply Grill - SG01  | Single Curve c/w Opposed Blade Damper | 250x200 (mm)  |
| Supply Grill - SG02  | Single Curve c/w Opposed Blade Damper | 400x200 (mm)  |
| Supply Grill - SG03  | Single Curve c/w Opposed Blade Damper | 250x150 (mm)  |
| Supply Grill - SG04  | Single Curve c/w Opposed Blade Damper | 200x100 (mm)  |
| Supply Grill - SG05  | Single Curve c/w Opposed Blade Damper | 1000x200 (mm) |
| Supply Grill - SG06  | Single Curve c/w Opposed Blade Damper | 300x150 (mm)  |
| Extract Grill - EG01 | Single Curve c/w Opposed Blade Damper | 300x150 (mm)  |
| Extract Grill - EG02 | Single Curve c/w Opposed Blade Damper | 250x100 (mm)  |
| Extract Grill - EG03 | Single Curve c/w Opposed Blade Damper | 250x200 (mm)  |
| Extract Grill - EG04 | Single Curve c/w Opposed Blade Damper | 600x600 (mm)  |
| Extract Grill - EG05 | Single Curve c/w Opposed Blade Damper | 400x200 (mm)  |
| Extract Grill - EG06 | Single Curve c/w Opposed Blade Damper | 250x150 (mm)  |

**Ventilation Fans Schedule:**

| Fan Reference:       | Position: | Fan Type:       | Fan Rating:                      | Filter Box: | Silencers: |
|----------------------|-----------|-----------------|----------------------------------|-------------|------------|
| Supply Fan - SF0-01  | Level 3   | Centrifugal Fan | 1150m <sup>3</sup> /hr @ 175Pa   | Yes         | 2 Qty      |
| Supply Fan - SF1-01  | Level 1   | Centrifugal Fan | 600m <sup>3</sup> /hr @ 150Pa    | Yes         | 2 Qty      |
| Supply Fan - SF1-02  | Level 1   | Centrifugal Fan | 1000m <sup>3</sup> /hr @ 150Pa   | Yes         | 2 Qty      |
| Supply Fan - SF3-01  | Level 3   | Centrifugal Fan | 1000m <sup>3</sup> /hr @ 150Pa   | Yes         | 2 Qty      |
| Supply Fan - SF3-02  | Level 3   | Centrifugal Fan | 360m <sup>3</sup> /hr @ 150Pa    | Yes         | 2 Qty      |
| Supply Fan - SF3-03  | Level 3   | Centrifugal Fan | 900m <sup>3</sup> /hr @ 150Pa    | Yes         | 2 Qty      |
| Extract Fan - EF0-01 | Level 0   | Centrifugal Fan | 630m <sup>3</sup> /hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF0-02 | Level 0   | Centrifugal Fan | 480m <sup>3</sup> /hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF0-03 | Level 0   | Centrifugal Fan | 1000m <sup>3</sup> /hr @ 100Pa   | No          | 2 Qty      |
| Extract Fan - EF0-04 | Level 0   | Centrifugal Fan | 10,000m <sup>3</sup> /hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-05 | Level 0   | Centrifugal Fan | 10,000m <sup>3</sup> /hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-06 | Level 0   | Centrifugal Fan | 10,000m <sup>3</sup> /hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-07 | Level 0   | Centrifugal Fan | 250m <sup>3</sup> /hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF1-01 | Level 1   | Centrifugal Fan | 600m <sup>3</sup> /hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF1-02 | Level 1   | Centrifugal Fan | 1000m <sup>3</sup> /hr @ 100Pa   | No          | 2 Qty      |
| Extract Fan - EF3-01 | Level 3   | Centrifugal Fan | 150m <sup>3</sup> /hr @ 100Pa    | No          | 2 Qty      |

**Fire Dampers Schedule:**

| Damper Reference: | Louver Type:          | Louver Size:  |
|-------------------|-----------------------|---------------|
| Damper - MD01     | Motorised Fire Damper | 250x250 (mm)  |
| Damper - MD02     | Motorised Fire Damper | 225x175 (mm)  |
| Damper - MD03     | Motorised Fire Damper | 225x150 (mm)  |
| Damper - MD04     | Motorised Fire Damper | 150x150 (mm)  |
| Damper - FD01     | Fire Damper           | 250x250 (mm)  |
| Damper - FD02     | Fire Damper           | 150x100 (mm)  |
| Damper - FD03     | Fire Damper           | 275x250 (mm)  |
| Damper - FD04     | Fire Damper           | 150x75 (mm)   |
| Damper - FD05     | Fire Damper           | 1000x200 (mm) |
| Damper - FD06     | Fire Damper           | 250x250 (mm)  |
| Damper - FD07     | Fire Damper           | 150x100 (mm)  |

A0 PLEASE DO NOT SCALE FROM THE DRAWING

Scale Bar 1:100

| -  |          | -              | Scale: 1:100                 | Revision No.: 03          | Date: 24.09.19                           | Postion: Level 0 |
|----|----------|----------------|------------------------------|---------------------------|------------------------------------------|------------------|
| 03 | 24.09.19 | Revised Layout | Job No.: 17.019              | Drawing No.: SFL-0.VNT-01 | Service: Ventilation Installation Layout |                  |
| 02 | 07.07.17 | Revised Layout | Drawn By: <i>A. Z. G. G.</i> | Checked By:               |                                          |                  |
| 01 | 29.05.17 | Revised Layout |                              |                           |                                          |                  |

Project Name & Address:

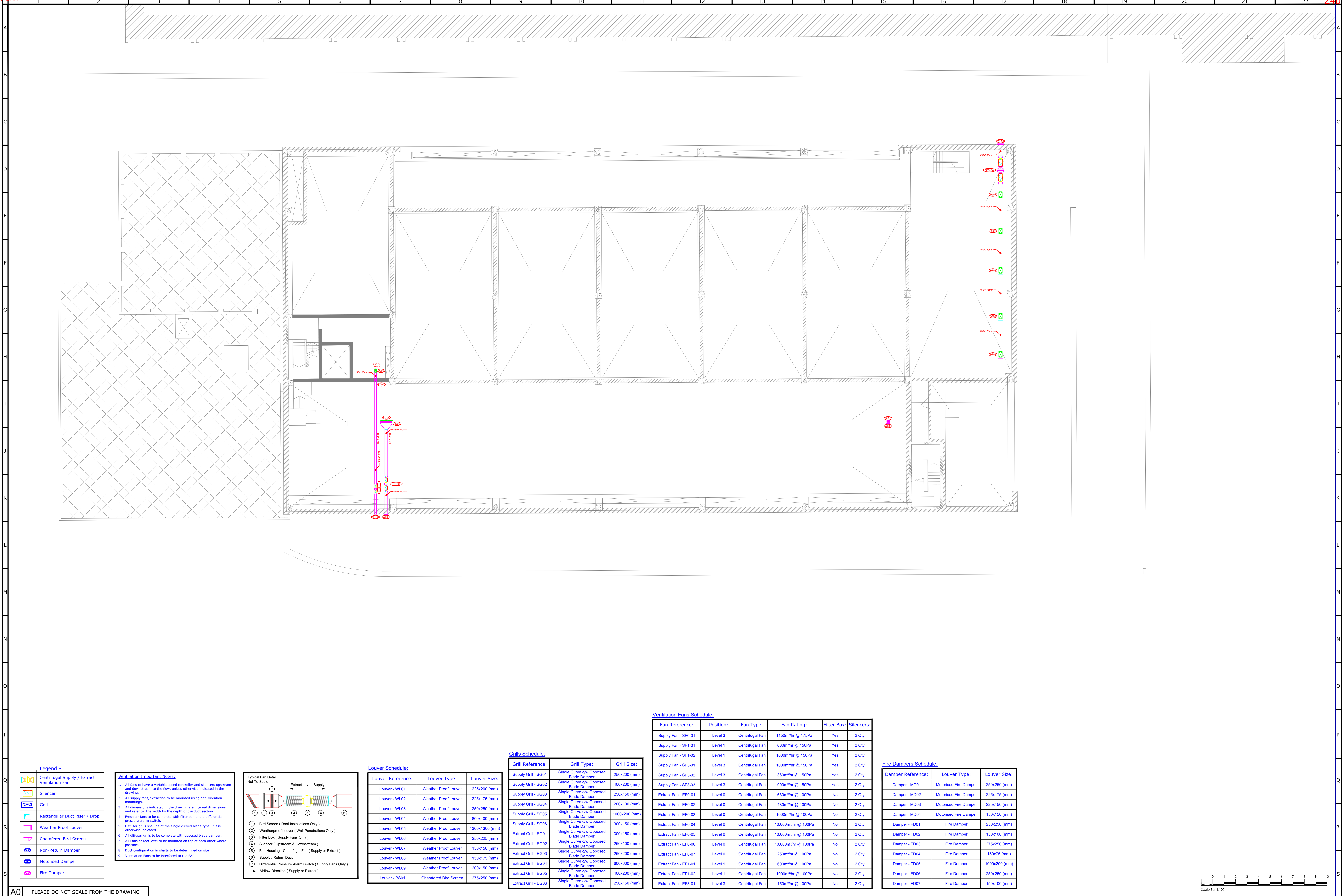
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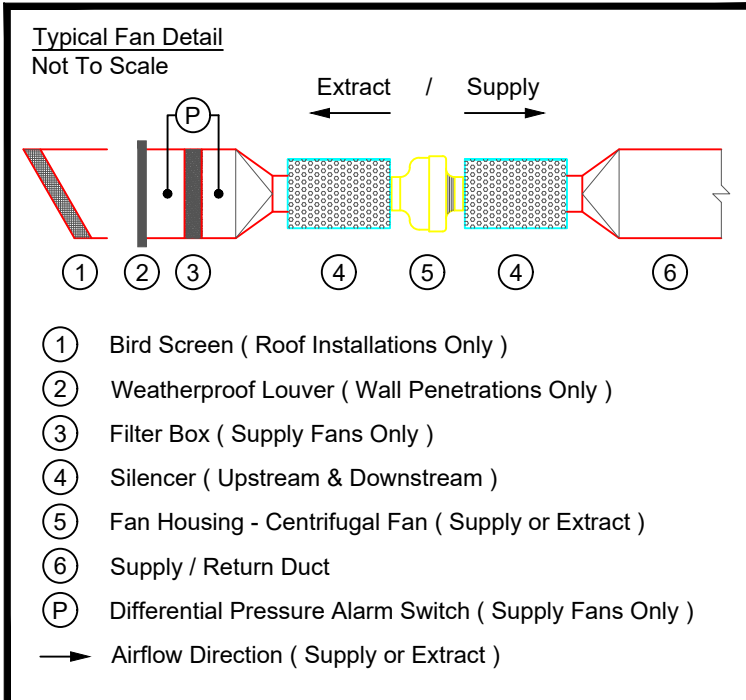




**Legend:-**

|  |                                              |
|--|----------------------------------------------|
|  | Centrifugal Supply / Extract Ventilation Fan |
|  | Silencer                                     |
|  | Grill                                        |
|  | Rectangular Duct Riser / Drop                |
|  | Weather Proof Louver                         |
|  | Chamfered Bird Screen                        |
|  | Non-Return Damper                            |
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| Louwer - WL05     | Weather Proof Louver  | 1300x1300 (mm) |
| Louwer - WL06     | Weather Proof Louver  | 250x225 (mm)   |
| Louwer - WL07     | Weather Proof Louver  | 150x150 (mm)   |
| Louwer - WL08     | Weather Proof Louver  | 150x175 (mm)   |
| Louwer - WL09     | Weather Proof Louver  | 200x150 (mm)   |
| Louwer - BS01     | Chamfered Bird Screen | 275x250 (mm)   |

**Grills Schedule:**

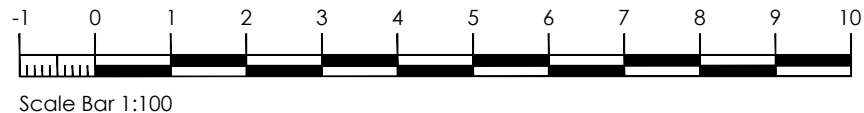
| Grill Reference:     | Grill Type:                           | Grill Size:   |
|----------------------|---------------------------------------|---------------|
| Supply Grill - SG01  | Single Curve c/w Opposed Blade Damper | 250x200 (mm)  |
| Supply Grill - SG02  | Single Curve c/w Opposed Blade Damper | 400x200 (mm)  |
| Supply Grill - SG03  | Single Curve c/w Opposed Blade Damper | 250x150 (mm)  |
| Supply Grill - SG04  | Single Curve c/w Opposed Blade Damper | 200x100 (mm)  |
| Supply Grill - SG05  | Single Curve c/w Opposed Blade Damper | 1000x200 (mm) |
| Supply Grill - SG06  | Single Curve c/w Opposed Blade Damper | 300x150 (mm)  |
| Extract Grill - EG01 | Single Curve c/w Opposed Blade Damper | 300x150 (mm)  |
| Extract Grill - EG02 | Single Curve c/w Opposed Blade Damper | 250x100 (mm)  |
| Extract Grill - EG03 | Single Curve c/w Opposed Blade Damper | 250x200 (mm)  |
| Extract Grill - EG04 | Single Curve c/w Opposed Blade Damper | 600x600 (mm)  |
| Extract Grill - EG05 | Single Curve c/w Opposed Blade Damper | 400x200 (mm)  |
| Extract Grill - EG06 | Single Curve c/w Opposed Blade Damper | 250x150 (mm)  |

**Ventilation Fans Schedule:**

| Fan Reference:       | Position: | Fan Type:       | Fan Rating:         | Filter Box: | Silencers: |
|----------------------|-----------|-----------------|---------------------|-------------|------------|
| Supply Fan - SF0-01  | Level 3   | Centrifugal Fan | 1150m³/hr @ 175Pa   | Yes         | 2 Qty      |
| Supply Fan - SF1-01  | Level 1   | Centrifugal Fan | 600m³/hr @ 150Pa    | Yes         | 2 Qty      |
| Supply Fan - SF1-02  | Level 1   | Centrifugal Fan | 1000m³/hr @ 150Pa   | Yes         | 2 Qty      |
| Supply Fan - SF3-01  | Level 3   | Centrifugal Fan | 1000m³/hr @ 150Pa   | Yes         | 2 Qty      |
| Supply Fan - SF3-02  | Level 3   | Centrifugal Fan | 360m³/hr @ 150Pa    | Yes         | 2 Qty      |
| Supply Fan - SF3-03  | Level 3   | Centrifugal Fan | 900m³/hr @ 150Pa    | Yes         | 2 Qty      |
| Extract Fan - EF0-01 | Level 0   | Centrifugal Fan | 630m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF0-02 | Level 0   | Centrifugal Fan | 480m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF0-03 | Level 0   | Centrifugal Fan | 1000m³/hr @ 100Pa   | No          | 2 Qty      |
| Extract Fan - EF0-04 | Level 0   | Centrifugal Fan | 10,000m³/hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-05 | Level 0   | Centrifugal Fan | 10,000m³/hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-06 | Level 0   | Centrifugal Fan | 10,000m³/hr @ 100Pa | No          | 2 Qty      |
| Extract Fan - EF0-07 | Level 0   | Centrifugal Fan | 250m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF1-01 | Level 1   | Centrifugal Fan | 600m³/hr @ 100Pa    | No          | 2 Qty      |
| Extract Fan - EF1-02 | Level 1   | Centrifugal Fan | 1000m³/hr @ 100Pa   | No          | 2 Qty      |
| Extract Fan - EF3-01 | Level 3   | Centrifugal Fan | 150m³/hr @ 100Pa    | No          | 2 Qty      |

**Fire Dampers Schedule:**

| Damper Reference: | Louver Type:          | Louver Size:  |
|-------------------|-----------------------|---------------|
| Damper - MD01     | Motorised Fire Damper | 250x250 (mm)  |
| Damper - MD02     | Motorised Fire Damper | 225x175 (mm)  |
| Damper - MD03     | Motorised Fire Damper | 225x150 (mm)  |
| Damper - MD04     | Motorised Fire Damper | 150x150 (mm)  |
| Damper - FD01     | Fire Damper           | 250x250 (mm)  |
| Damper - FD02     | Fire Damper           | 150x100 (mm)  |
| Damper - FD03     | Fire Damper           | 275x250 (mm)  |
| Damper - FD04     | Fire Damper           | 150x75 (mm)   |
| Damper - FD05     | Fire Damper           | 1000x200 (mm) |
| Damper - FD06     | Fire Damper           | 250x250 (mm)  |
| Damper - FD07     | Fire Damper           | 150x100 (mm)  |



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|   |   |   |                       |                            |                                                                                                                                                                                                                                       |                    |
|---|---|---|-----------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| - | - | - | Scale: 1:100          | Revision No.: 00           | Date: 24.09.19                                                                                                                                                                                                                        | Position: Level 3I |
| - | - | - | Job No.: 17.019       | Drawing No.: SFR.3I.VNT.01 | Service: Ventilation Installation Layout                                                                                                                                                                                              |                    |
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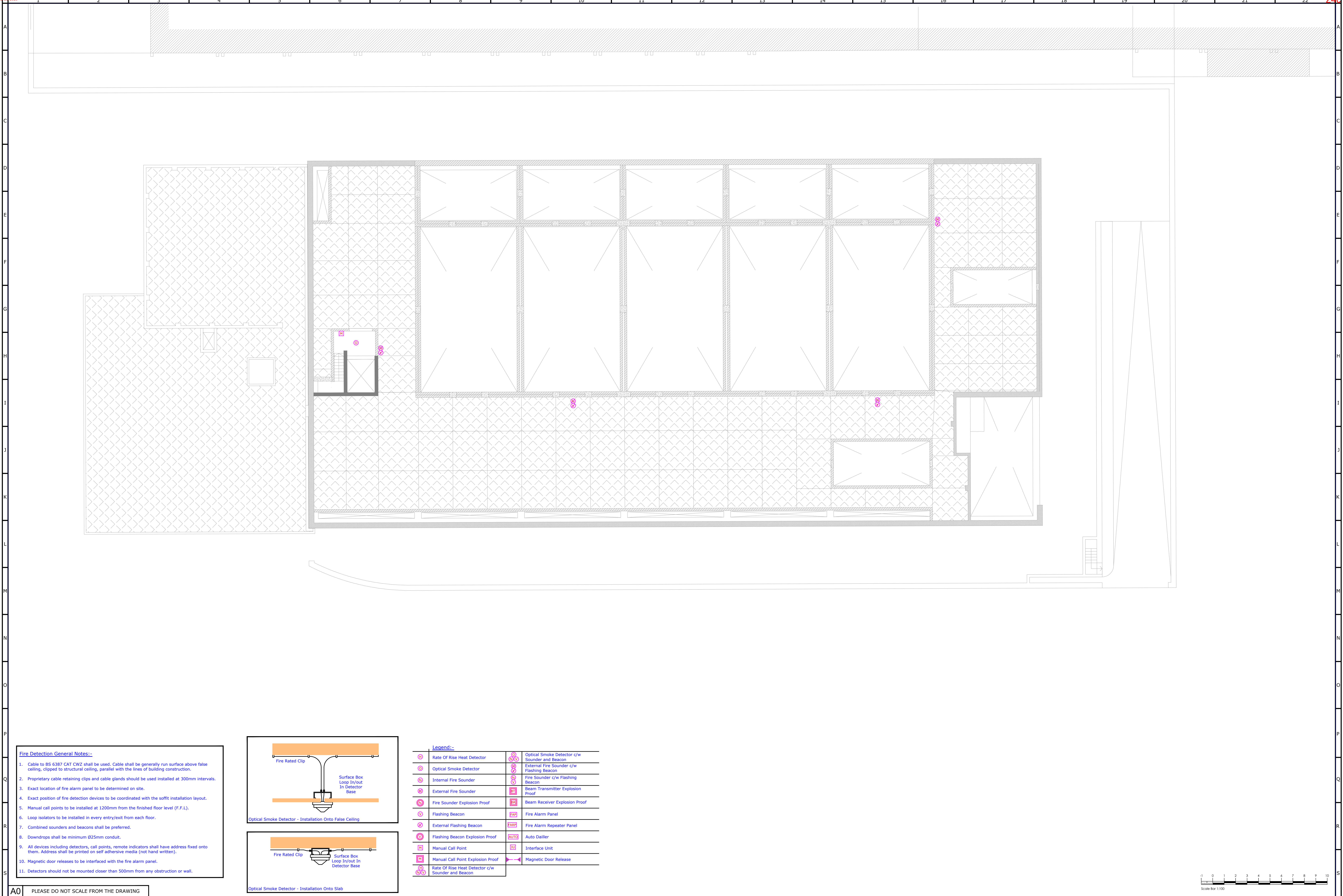


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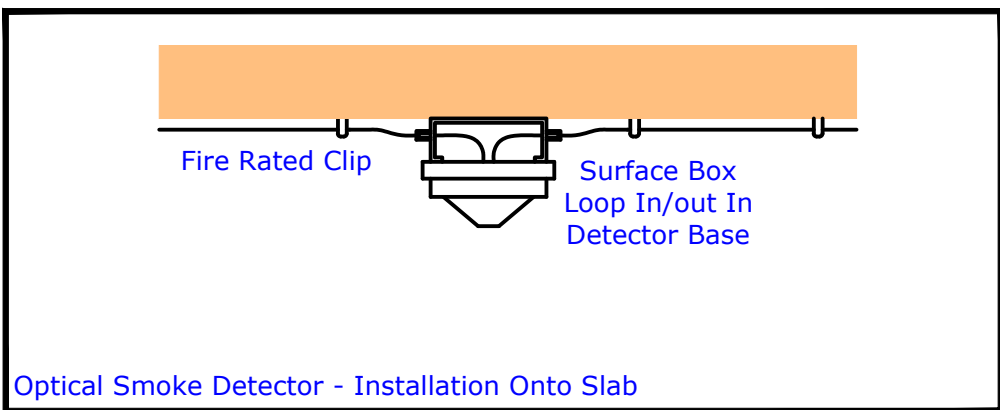
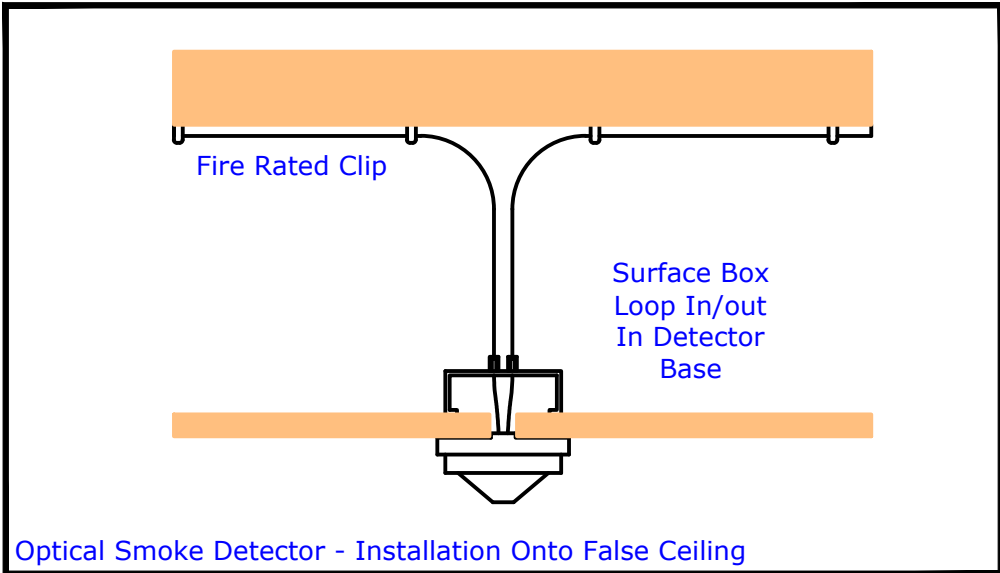
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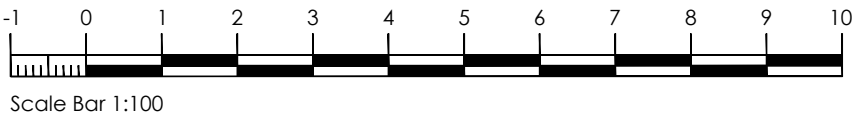




- Fire Detection General Notes:-**
1. Cable to BS 6387 CAT CWZ shall be used. Cable shall be generally run surface above false ceiling, clipped to structural ceiling, parallel with the lines of building construction.
  2. Proprietary cable retaining clips and cable glands should be used installed at 300mm intervals.
  3. Exact location of fire alarm panel to be determined on site.
  4. Exact position of fire detection devices to be coordinated with the soffit installation layout.
  5. Manual call points to be installed at 1200mm from the finished floor level (F.F.L).
  6. Loop isolators to be installed in every entry/exit from each floor.
  7. Combined sounders and beacons shall be preferred.
  8. Downdrops shall be minimum Ø25mm conduit.
  9. All devices including detectors, call points, remote indicators shall have address fixed onto them. Address shall be printed on self adhesive media (not hand written).
  10. Magnetic door releases to be interfaced with the fire alarm panel.
  11. Detectors should not be mounted closer than 500mm from any obstruction or wall.



| Legend:- |                                                   |        |                                               |
|----------|---------------------------------------------------|--------|-----------------------------------------------|
| (H)      | Rate Of Rise Heat Detector                        | (S)    | Optical Smoke Detector c/w Sounder and Beacon |
| (S)      | Optical Smoke Detector                            | (G)    | External Fire Sounder c/w Flashing Beacon     |
| (G)      | Internal Fire Sounder                             | (F)    | Fire Sounder c/w Flashing Beacon              |
| (E)      | External Fire Sounder                             | (BT)   | Beam Transmitter Explosion Proof              |
| (F)      | Fire Sounder Explosion Proof                      | (BR)   | Beam Receiver Explosion Proof                 |
| (V)      | Flashing Beacon                                   | (FAP)  | Fire Alarm Panel                              |
| (FAR)    | External Flashing Beacon                          | (FAR)  | Fire Alarm Repeater Panel                     |
| (FV)     | Flashing Beacon Explosion Proof                   | (AUTO) | Auto Dailer                                   |
| (M)      | Manual Call Point                                 | (IU)   | Interface Unit                                |
| (MCP)    | Manual Call Point Explosion Proof                 | (M)    | Magnetic Door Release                         |
| (H)      | Rate Of Rise Heat Detector c/w Sounder and Beacon |        |                                               |



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|                             |                           |                                                                                                                                                                                                                                         |                      |
|-----------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Scale: 1:100                | Revision No.: 00          | Date: 24.09.19                                                                                                                                                                                                                          | Position: Roof Level |
| Job No.: 17.019             | Drawing No.: SRL.RF.FD.01 | Service: Fire Detection Installation Layout                                                                                                                                                                                             |                      |
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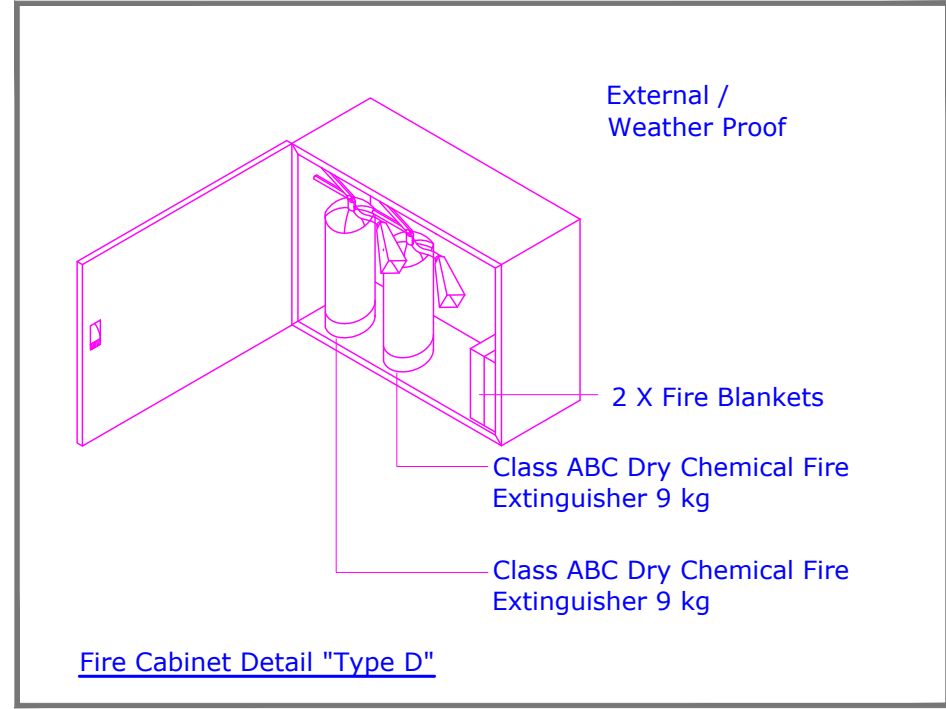
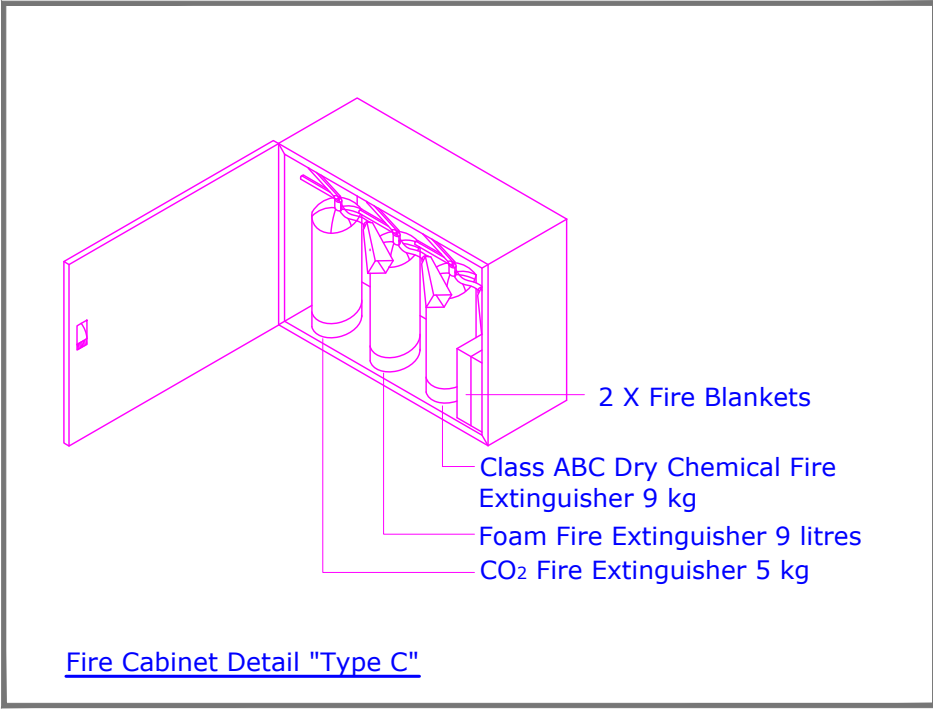
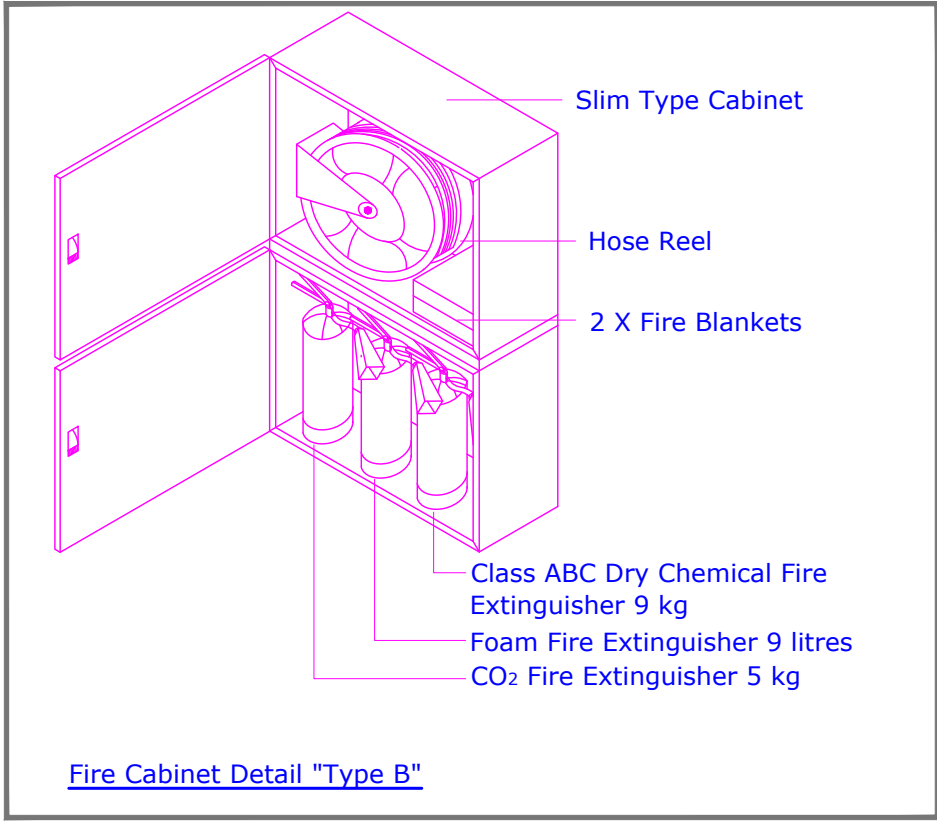
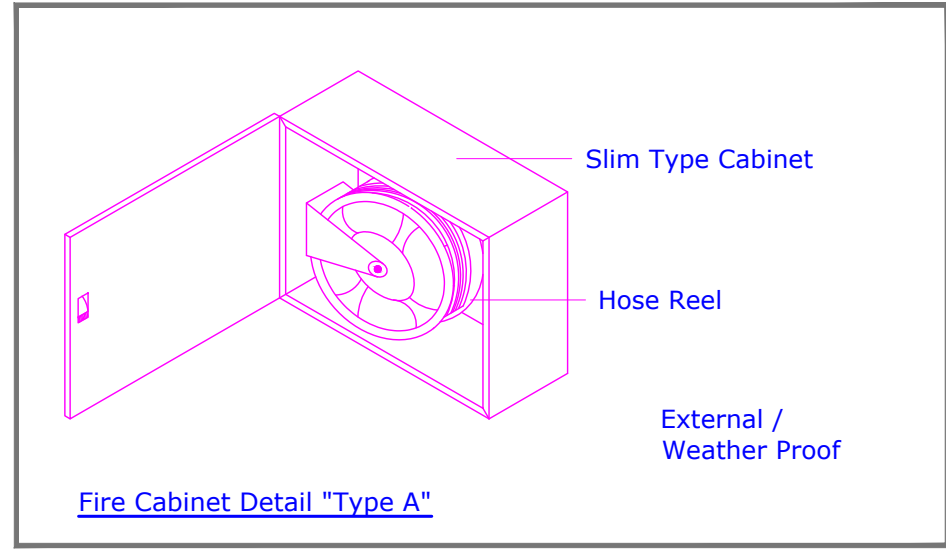
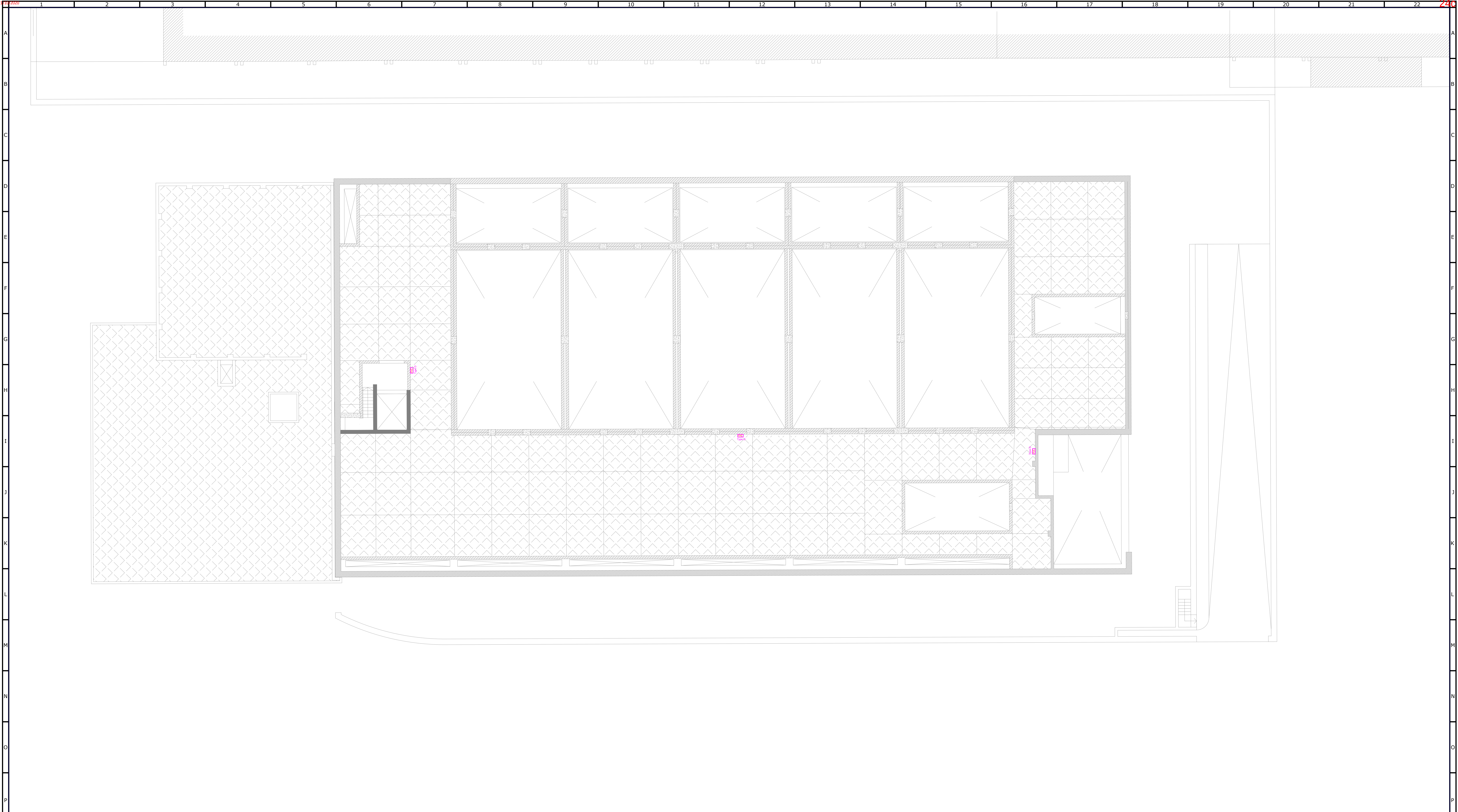
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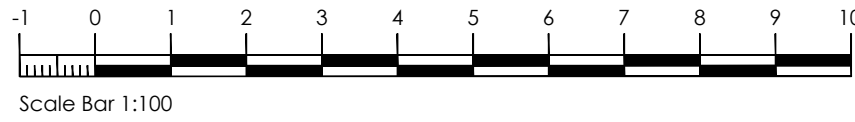


#### Fire Fighting General Notes:

1. All emergency escape doors from any area to open outwards.
2. Exact fire fighting pipework route to be coordinated with other services.
3. Exact position of fire cabinets to be coordinated with furniture layout once it is issued by the client.
4. Fire cabinets shall be installed surface or recessed mounted as instructed by client / interior designer team.
5. All pipework crossings are at high level.
6. All fire fighting pipework shall be as follows
  - Main Pipework shall be of 4"
  - Branch pipework feeding both hose reel and landing valve shall be of 2 1/2"
  - Branch pipework feeding landing valve only shall be of 2 1/2"
  - Branch pipework feeding hose reel only shall be of 1"

#### Legend:-

|  |                                                           |
|--|-----------------------------------------------------------|
|  | Fire Fighting Cabinet                                     |
|  | Breech Point                                              |
|  | Pressure Reducing Landing Valve                           |
|  | Fire Fighting Pipe                                        |
|  | Riser/Drop                                                |
|  | Fire Trolley c/w Class ABC Dry Chemical Fire Extinguisher |
|  | Class ABC Dry Chemical Fire Extinguisher 9kg              |
|  | Foam Fire Extinguisher 9 Liters                           |
|  | CO2 Fire Extinguisher 5 kg                                |



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| Scale: 1:100                | Revision No.: 00          | Date: 24.09.19                             |
| Job No.: 17.019             | Drawing No.: SFR.RF.FF.01 | Service: Fire Fighting Installation Layout |
| Drawn By: <i>A. Zappala</i> | Checked By:               |                                            |

|                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Position: Roof Level                                                                                                                                                                                                                  |
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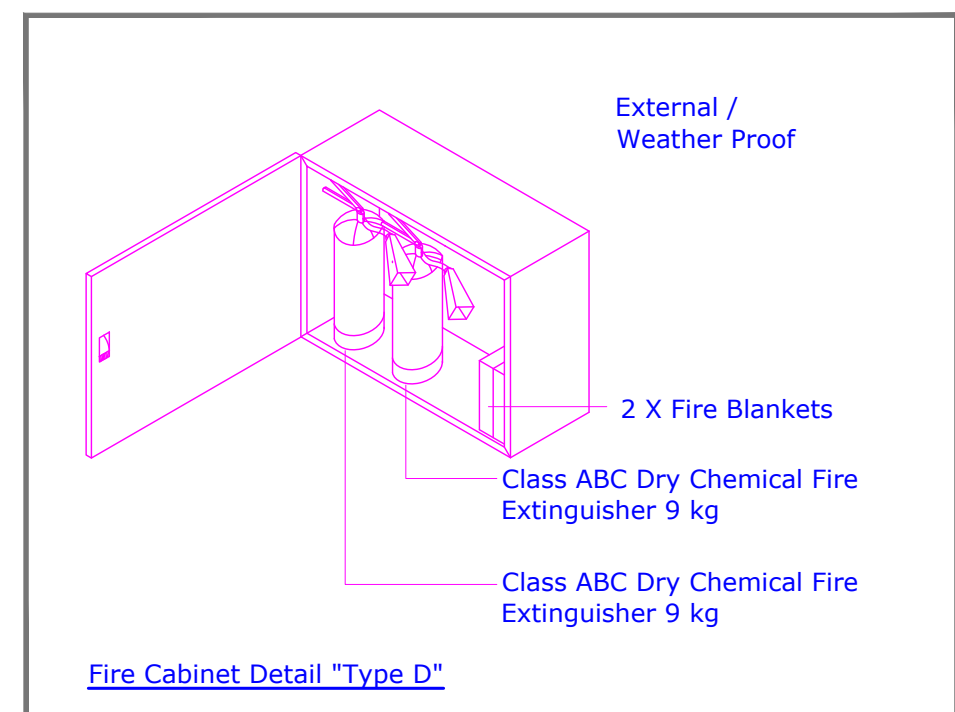
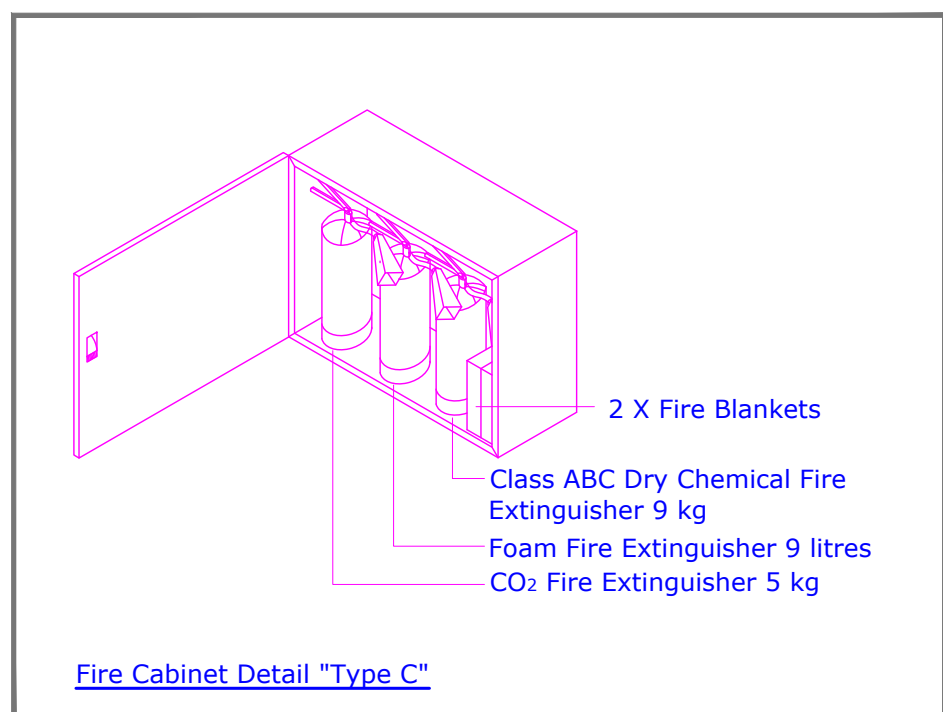
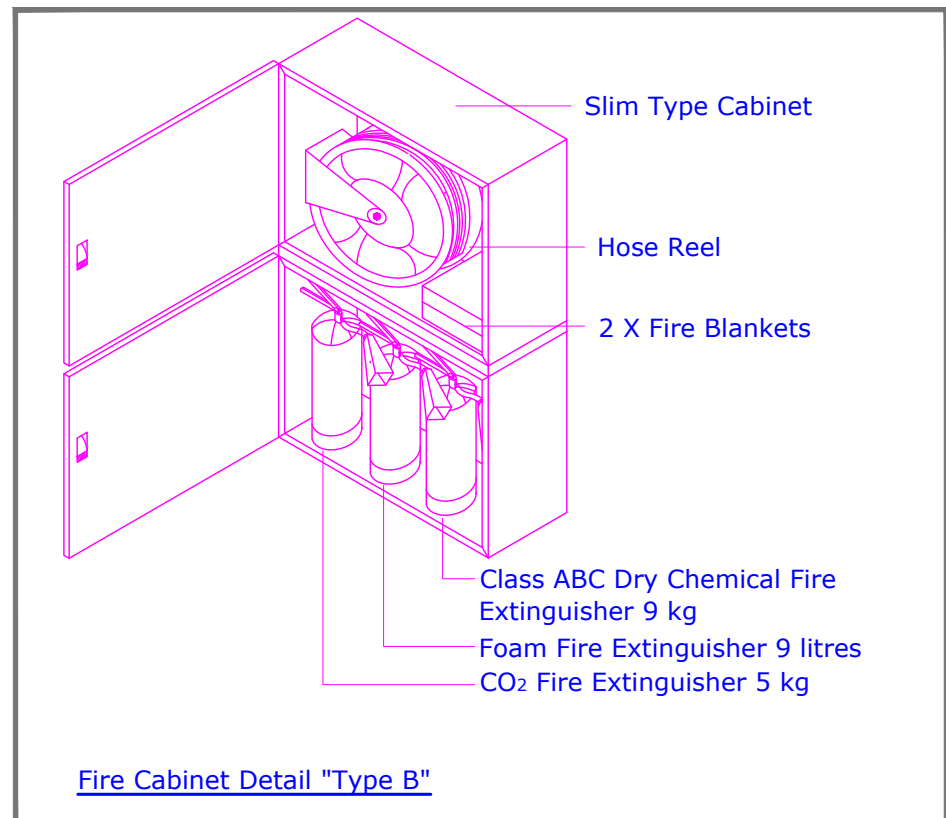
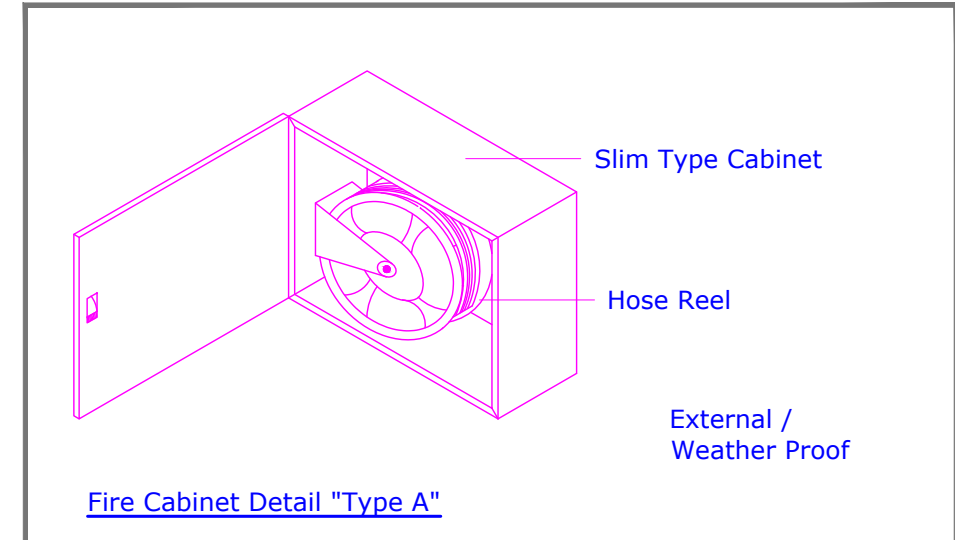
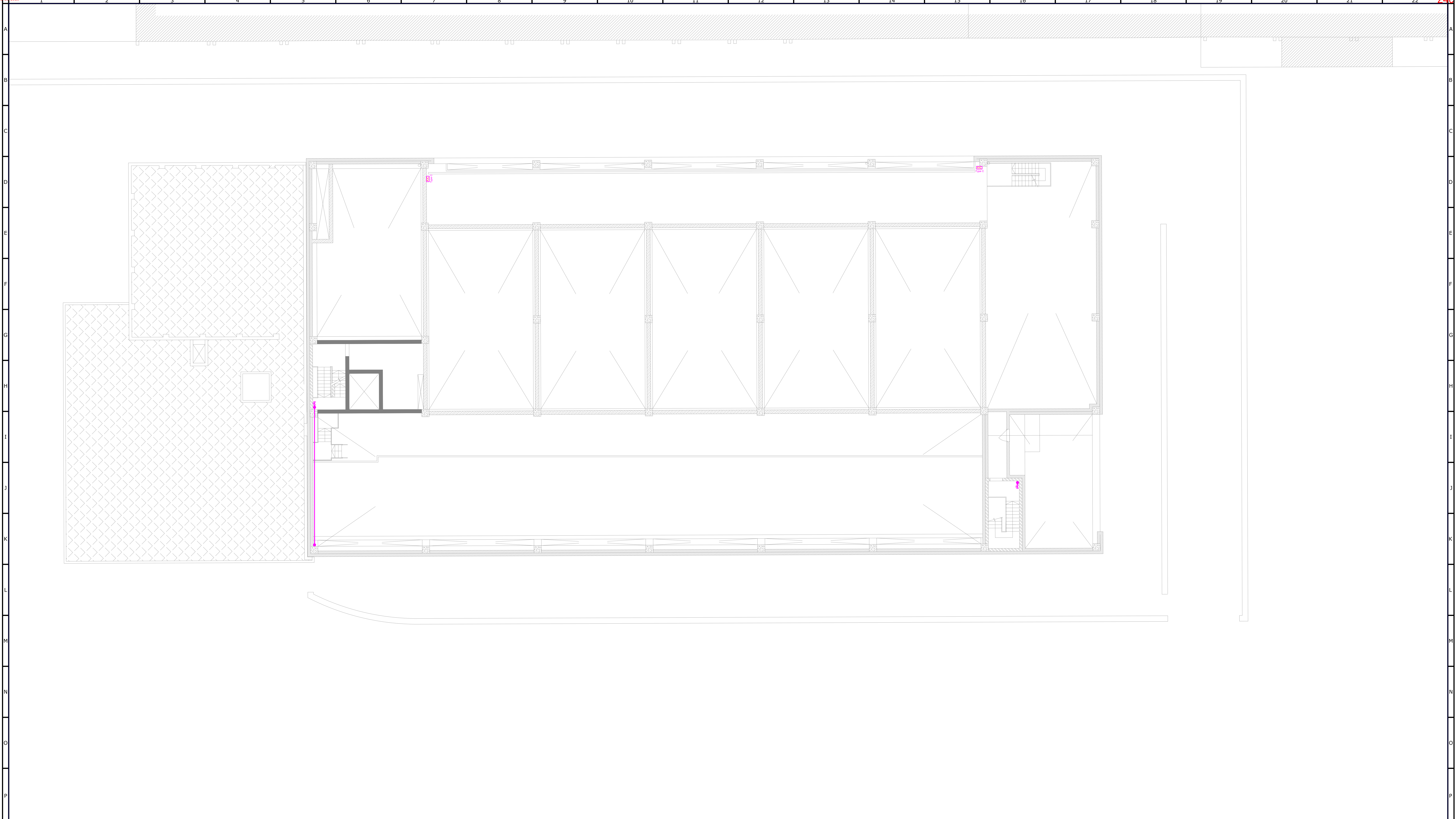


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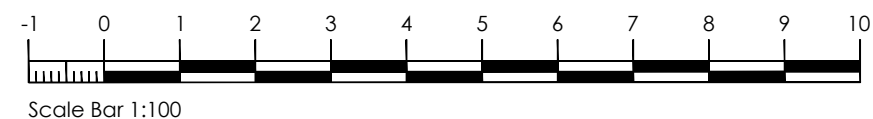
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    - Branch pipework feeding hose reel only shall be of 1"

| Legend:- |                                                           |
|----------|-----------------------------------------------------------|
| FFC      | Fire Fighting Cabinet                                     |
| ×        | Breach Point                                              |
| PRV      | Pressure Reducing Landing Valve                           |
| FFP      | Fire Fighting Pipe                                        |
| RD       | Riser/Drop                                                |
| FT       | Fire Trolley c/w Class ABC Dry Chemical Fire Extinguisher |
| DC       | Class ABC Dry Chemical Fire Extinguisher 9kg              |
| FF       | Foam Fire Extinguisher 9 Litres                           |
| CO       | CO2 Fire Extinguisher 5 kg                                |

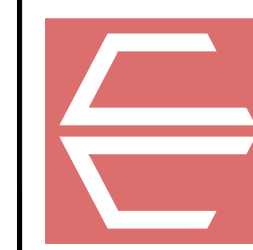


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| Scale: 1:100         | Revision No.: 00          | Date: 24.09.19                                                                                                                                                                                                                        | Position: Level 3J |
| Job No.: 17.019      | Drawing No.: SFR.3J.FF.01 | Service: Fire Fighting Installation Layout                                                                                                                                                                                            |                    |
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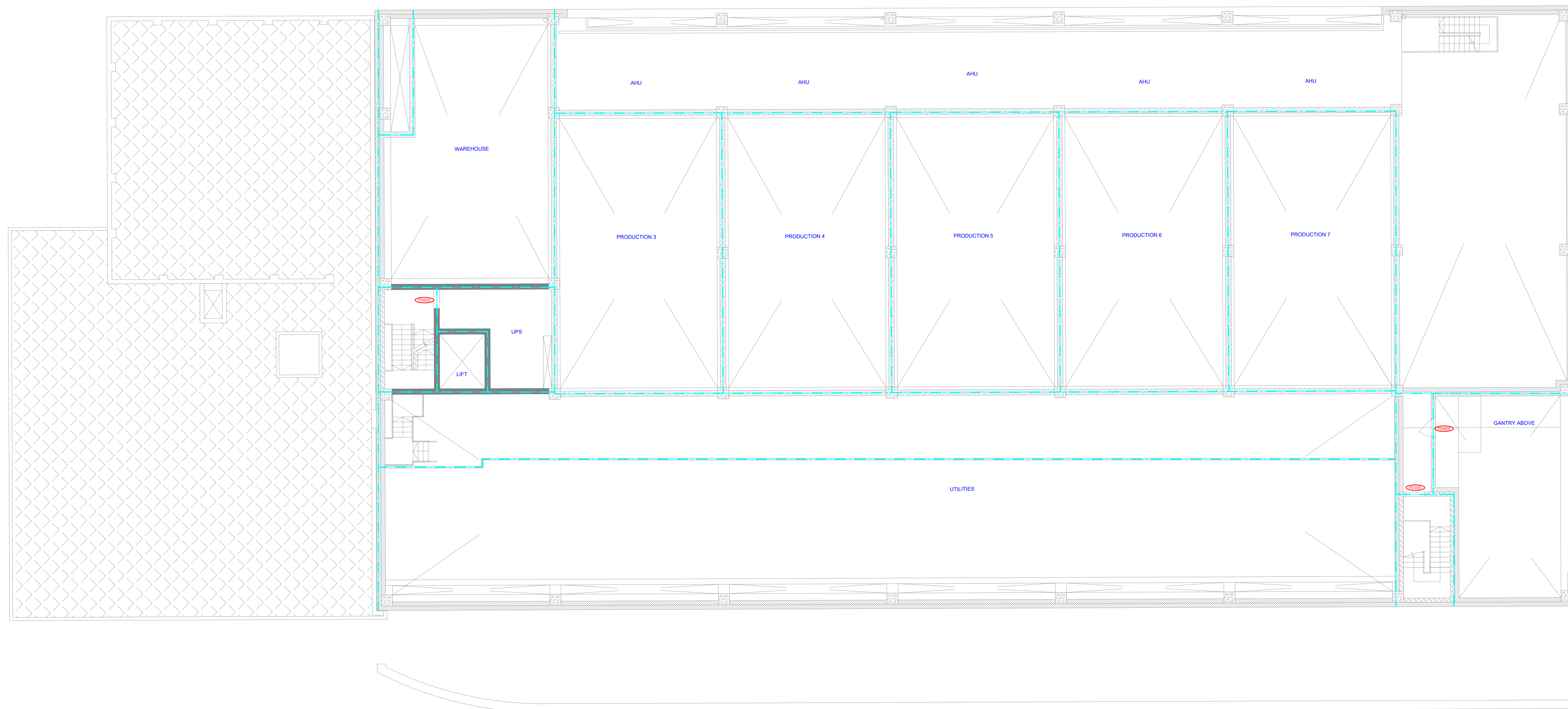


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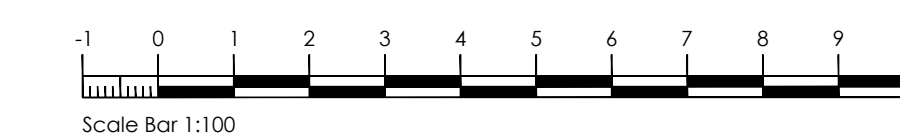


1 PROPOSED PLAN Lv 3 Intermediate  
SCALE 1:100

| Legend:-                                                                          |                                                  |
|-----------------------------------------------------------------------------------|--------------------------------------------------|
|  | Fire Door 60min Fire and Smoke Resistant         |
|  | Fire Door 60min Fire Resistant                   |
|  | Fire Door 30min Fire and Smoke Resistant         |
|  | Fire Door 20min Fire and Smoke Resistant         |
|  | Fire Curtain 60min Fire and Smoke Resistant      |
|  | Fire Compartment 60min Fire and Smoke Resistant  |
|  | Fire Compartment 90min Fire and Smoke Resistant  |
|  | Fire Compartment 120min Fire and Smoke Resistant |

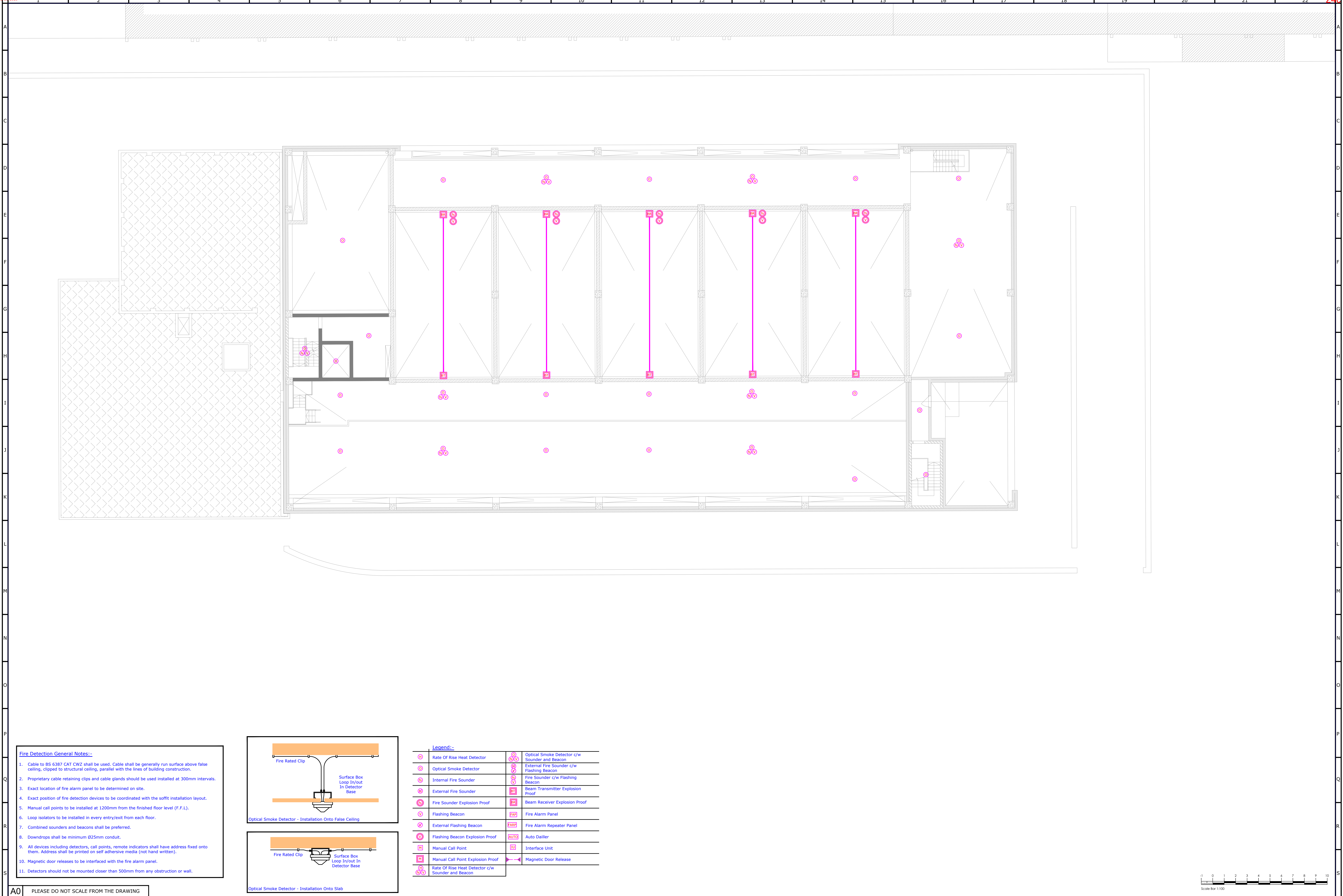
Important Note:  
All Structural Element Shall Have A  
Minimum Fire Resistance Of 120min

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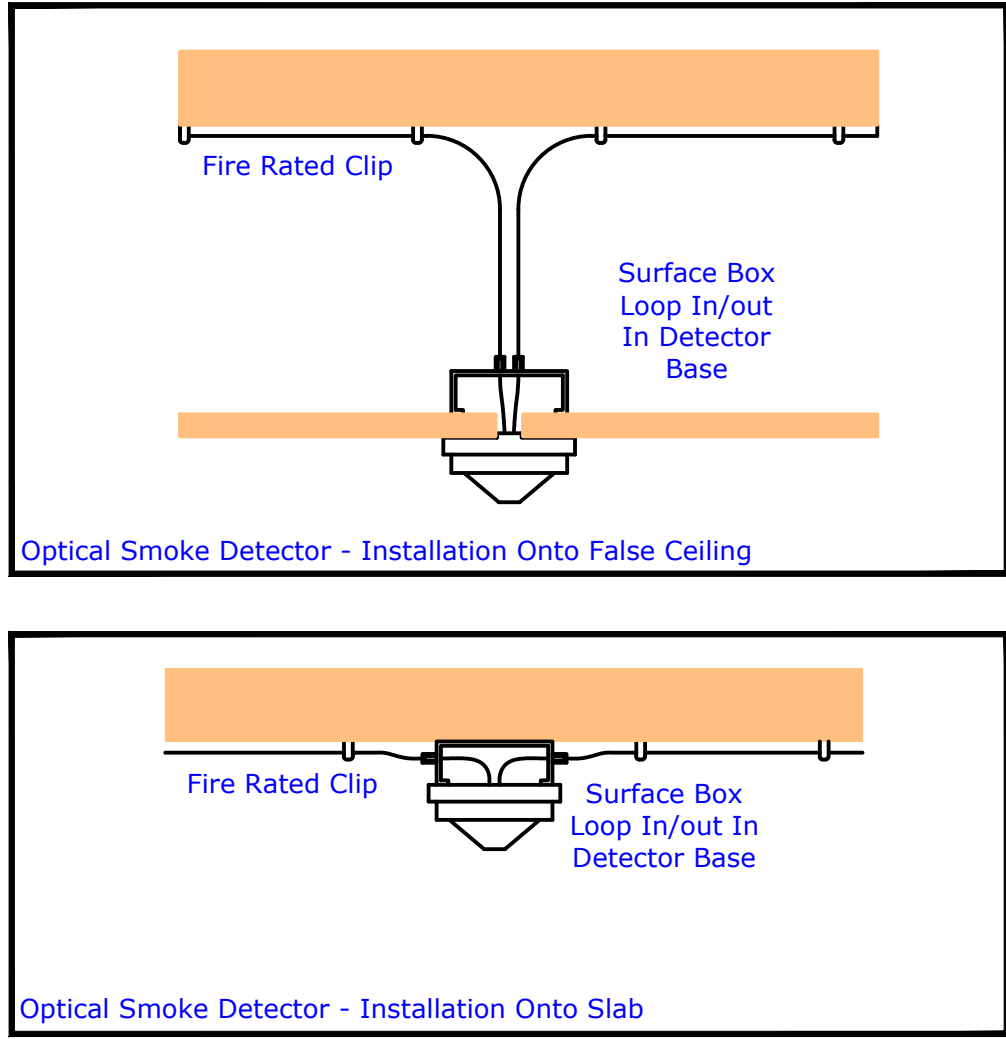


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|---|---|---|---|---|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| - | - | - | - | - | Scale:                                                                                | Revision No.:                                                                         | Date:                                                                                                                                                                                                                                 | Position: | Project Name & Address: | <br><b>CAMILLERI &amp; CUSCHIERI</b><br>CONSULTING ENGINEERS | Design Center, Level 2, Tower Road, Swatara,<br>Birkirkara, Malta BKR 4012<br>+356 21220431 +356 79220431<br>info@camilleriandcuschieri.com<br>www.camilleriandcuschieri.com |  |
| - | - | - | - | - | 1:100                                                                                 | 00                                                                                    | 24.09.19                                                                                                                                                                                                                              | Level 31  |                         |                                                                                                                                                   |                                                                                                                                                                              |                                                                                       |
| - | - | - | - | - | Job No.:                                                                              | Drawing No.:                                                                          | Service:                                                                                                                                                                                                                              |           |                         |                                                                                                                                                   |                                                                                                                                                                              |                                                                                       |
| - | - | - | - | - | 17.019                                                                                | SFR.31.FC.01                                                                          | Fire Compartmentation Layout                                                                                                                                                                                                          |           |                         |                                                                                                                                                   |                                                                                                                                                                              |                                                                                       |
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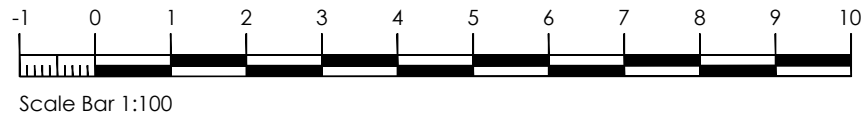




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  10. Magnetic door releases to be interfaced with the fire alarm panel.
  11. Detectors should not be mounted closer than 500mm from any obstruction or wall.



| Legend:- |                                                   |  |                                               |
|----------|---------------------------------------------------|--|-----------------------------------------------|
|          | Rate Of Rise Heat Detector                        |  | Optical Smoke Detector c/w Sounder and Beacon |
|          | Optical Smoke Detector                            |  | External Fire Sounder c/w Flashing Beacon     |
|          | Internal Fire Sounder                             |  | Fire Sounder c/w Flashing Beacon              |
|          | External Fire Sounder                             |  | Beam Transmitter Explosion Proof              |
|          | Fire Sounder Explosion Proof                      |  | Beam Receiver Explosion Proof                 |
|          | Flashing Beacon                                   |  | Fire Alarm Panel                              |
|          | External Flashing Beacon                          |  | Fire Alarm Repeater Panel                     |
|          | Flashing Beacon Explosion Proof                   |  | Auto Dailer                                   |
|          | Manual Call Point                                 |  | Interface Unit                                |
|          | Manual Call Point Explosion Proof                 |  | Magnetic Door Release                         |
|          | Rate Of Rise Heat Detector c/w Sounder and Beacon |  |                                               |



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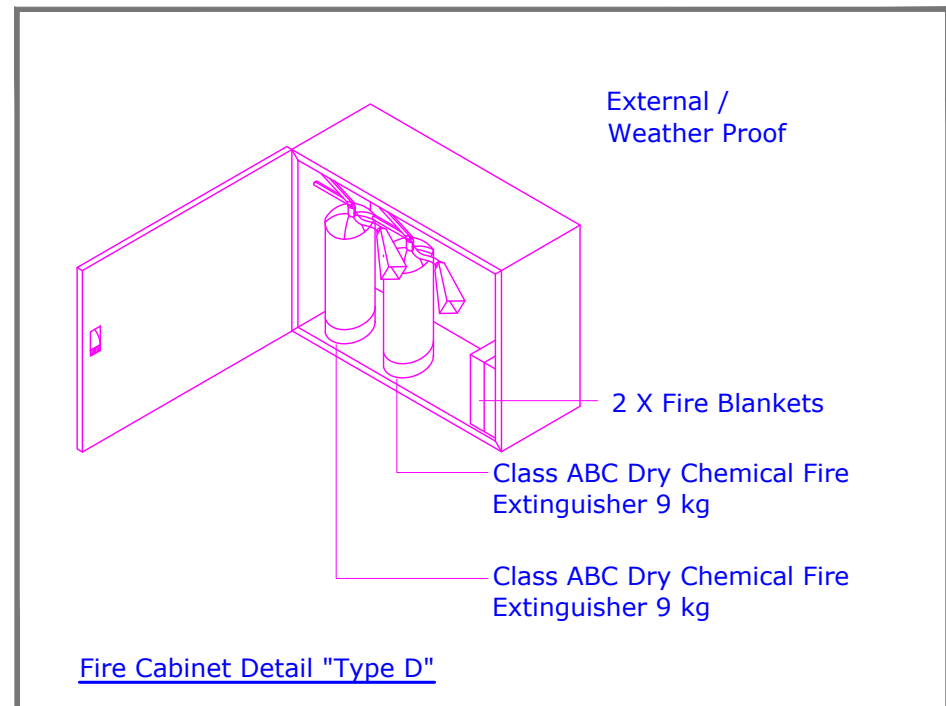
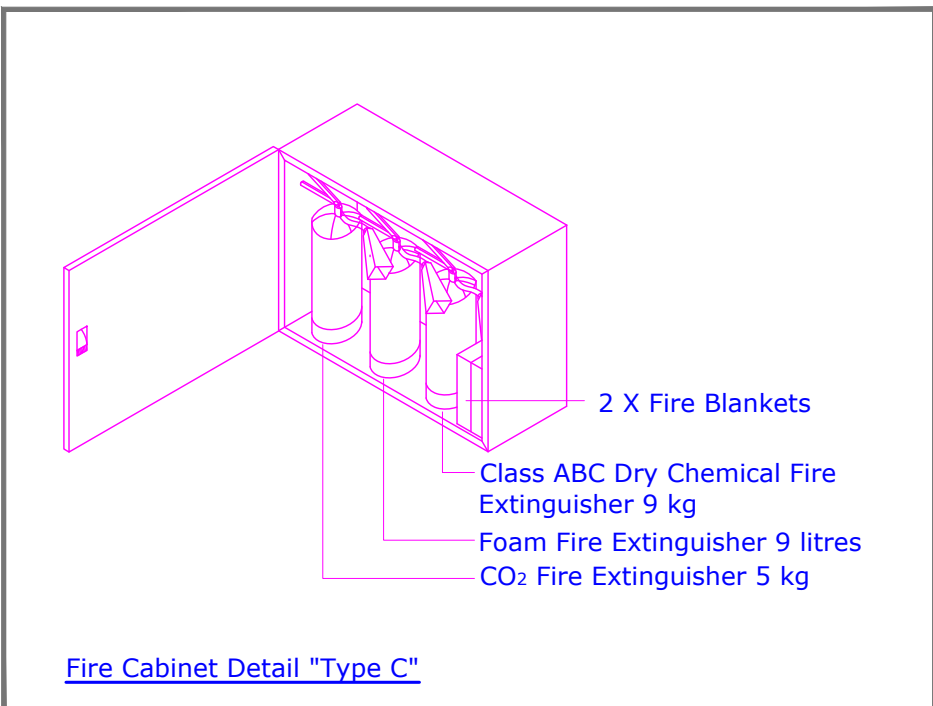
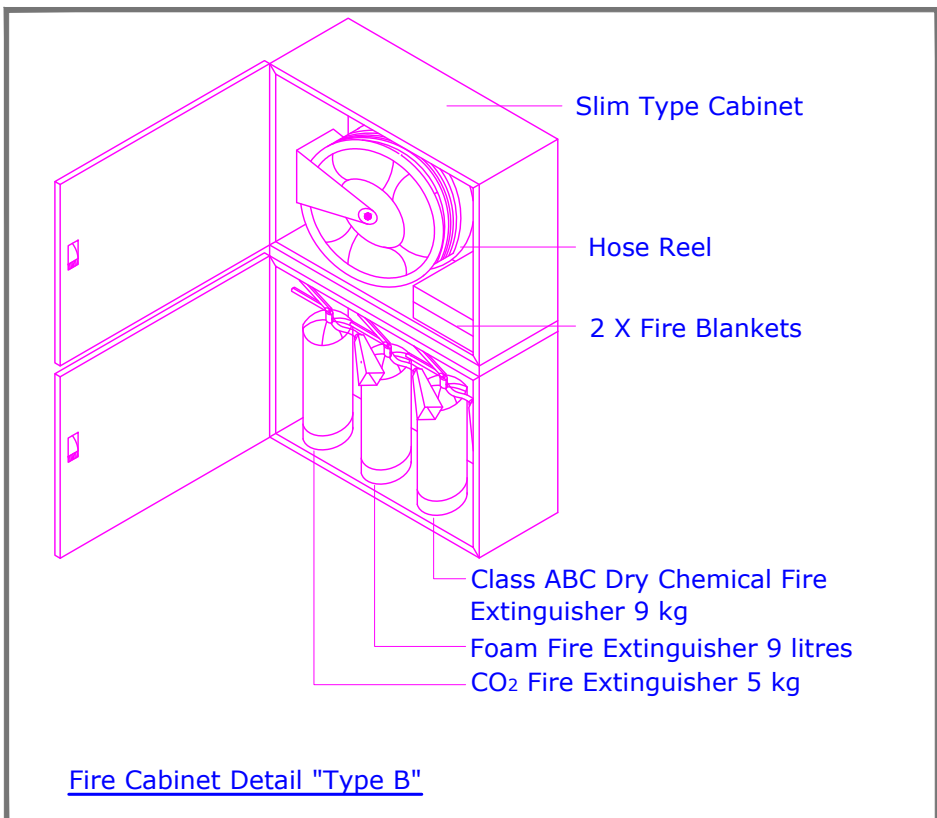
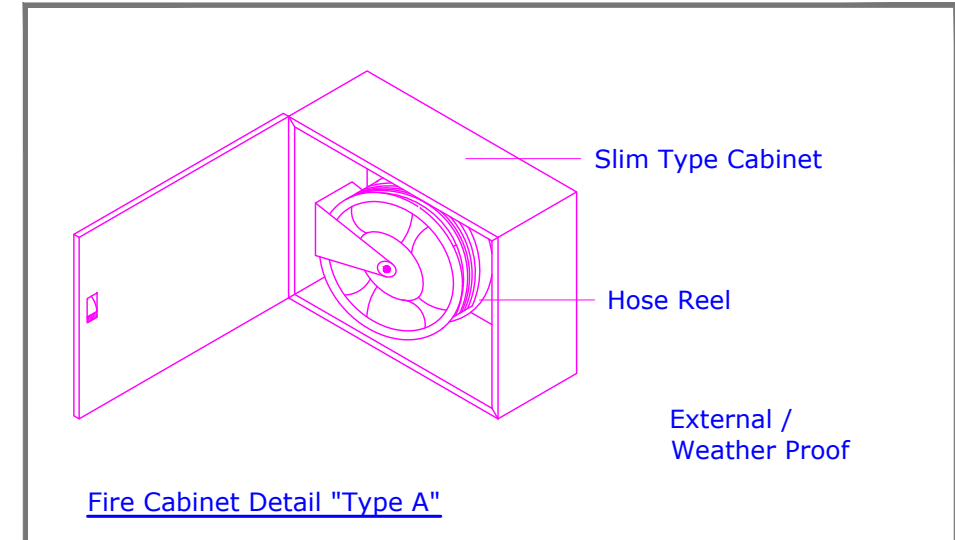
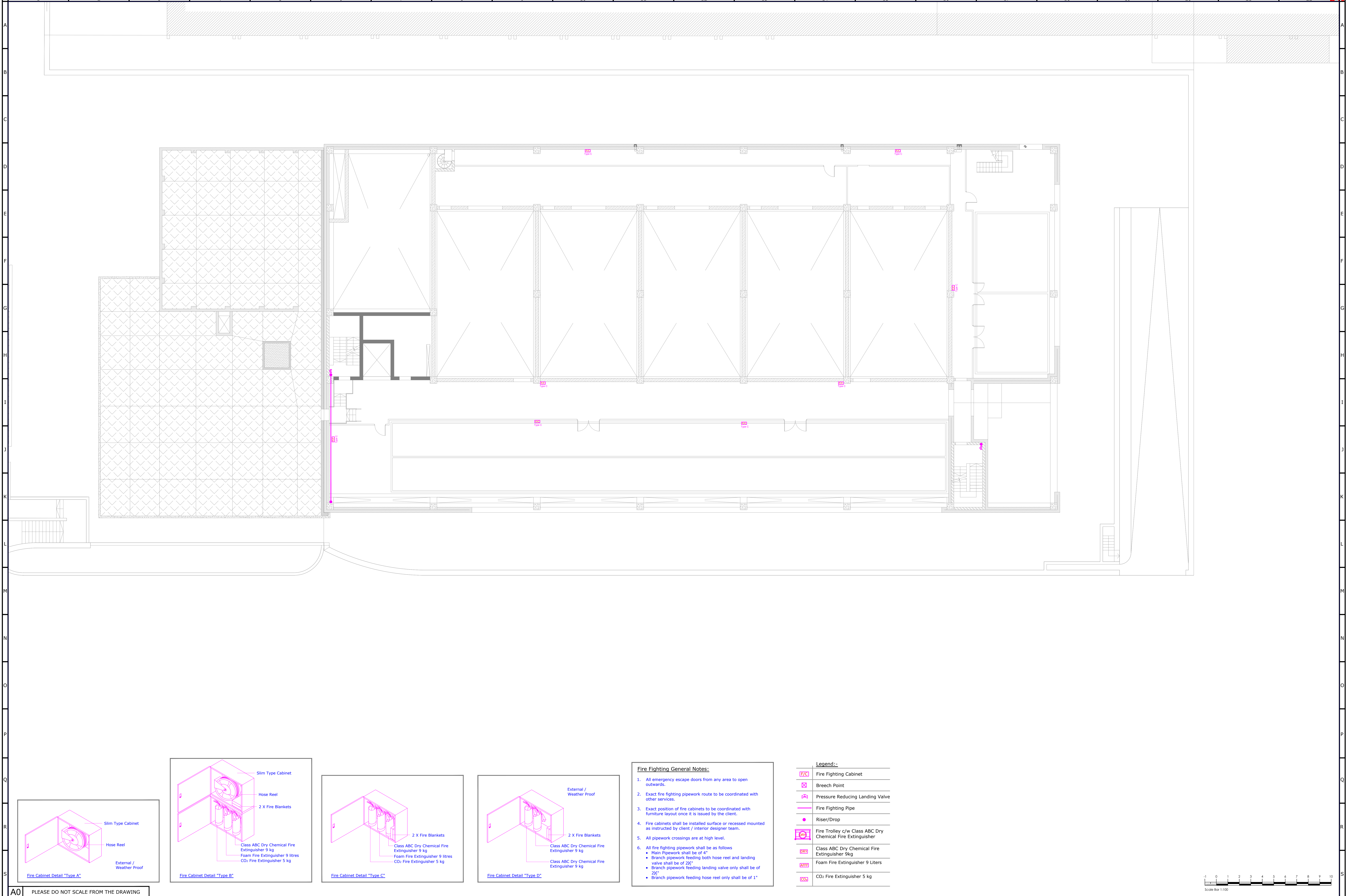
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|-----------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Scale: 1:100                | Revision No.: 00          | Date: 24.09.19                                                                                                                                                                                                                        | Position: Level 3I |
| Job No.: 17.019             | Drawing No.: SFR.3I.FD.01 | Service: Fire Detection Installation Layout                                                                                                                                                                                           |                    |
| Drawn By: <i>A. Zappala</i> | Checked By:               | THIS DRAWING IS CONFIDENTIAL AND IS THE PROPERTY OF CAMILLERI & CUSCHIERI CONSULTING ENGINEERS. IT MUST NOT BE DISCLOSED TO A THIRD PARTY, COPIED OR LENT, WITHOUT THE WRITTEN CONSENT OF CAMILLERI & CUSCHIERI CONSULTING ENGINEERS. |                    |

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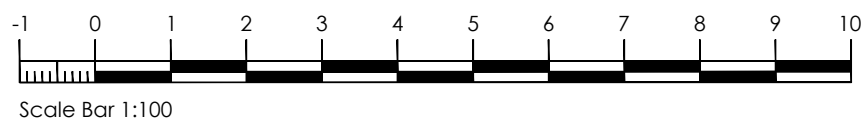
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- Fire Fighting General Notes:**
1. All emergency escape doors from any area to open outwards.
  2. Exact fire fighting pipework route to be coordinated with furniture layout once it is issued by the client.
  3. Exact position of fire cabinets to be coordinated with furniture layout once it is issued by the client.
  4. Fire cabinets shall be installed surface or recessed mounted as instructed by client / interior designer team.
  5. All pipework crossings are at high level.
  6. All fire fighting pipework shall be as follows
    - Main pipework shall be of 4"
    - Branch pipework feeding both hose reel and landing valve shall be of 2 1/2"
    - Branch pipework feeding landing valve only shall be of 2 1/2"
    - Branch pipework feeding hose reel only shall be of 1"

| Legend:- |                                                           |
|----------|-----------------------------------------------------------|
|          | Fire Fighting Cabinet                                     |
|          | Breach Point                                              |
|          | Pressure Reducing Landing Valve                           |
|          | Fire Fighting Pipe                                        |
|          | Riser/Drop                                                |
|          | Fire Trolley c/w Class ABC Dry Chemical Fire Extinguisher |
|          | Class ABC Dry Chemical Fire Extinguisher 9kg              |
|          | Foam Fire Extinguisher 9 Liters                           |
|          | CO2 Fire Extinguisher 5 kg                                |



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|    |          |                |                 |                          |                                                                                                                                                                                                                                       |                   |
|----|----------|----------------|-----------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| -  | -        | -              | Scale: 1:100    | Revision No.: 02         | Date: 24.09.19                                                                                                                                                                                                                        | Position: Level 3 |
| -  | -        | -              | Job No.: 17.019 | Drawing No.: SFR.3.FF.01 | Service: Fire Fighting Installation Layout                                                                                                                                                                                            |                   |
| 02 | 24.09.19 | Revised Layout | Drawn By:       | Checked By:              | THIS DRAWING IS CONFIDENTIAL AND IS THE PROPERTY OF CAMILLERI & CUSCHIERI CONSULTING ENGINEERS. IT MUST NOT BE DISCLOSED TO A THIRD PARTY, COPIED OR LENT, WITHOUT THE WRITTEN CONSENT OF CAMILLERI & CUSCHIERI CONSULTING ENGINEERS. |                   |
| 01 | 07.07.17 | Revised Layout |                 |                          |                                                                                                                                                                                                                                       |                   |

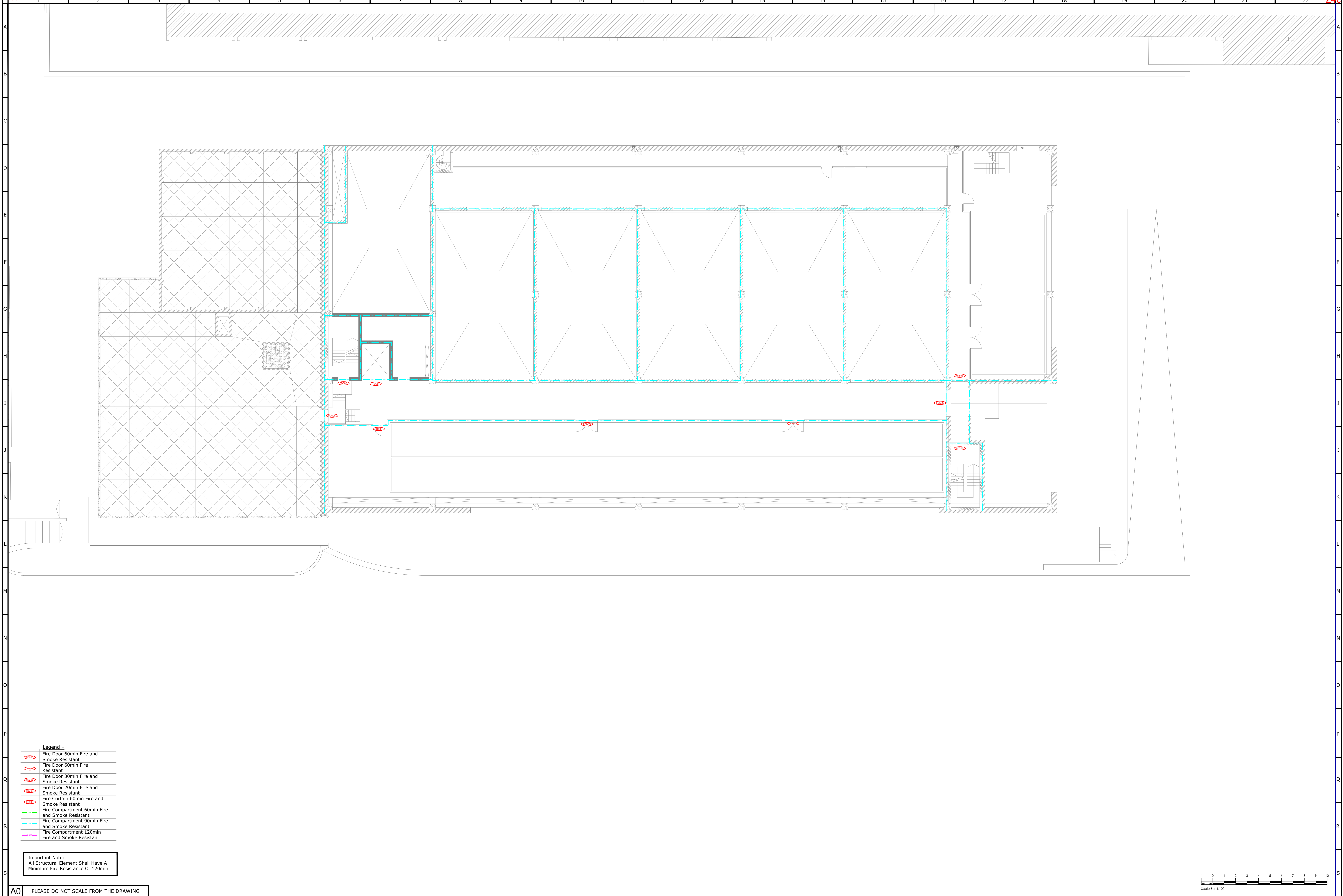
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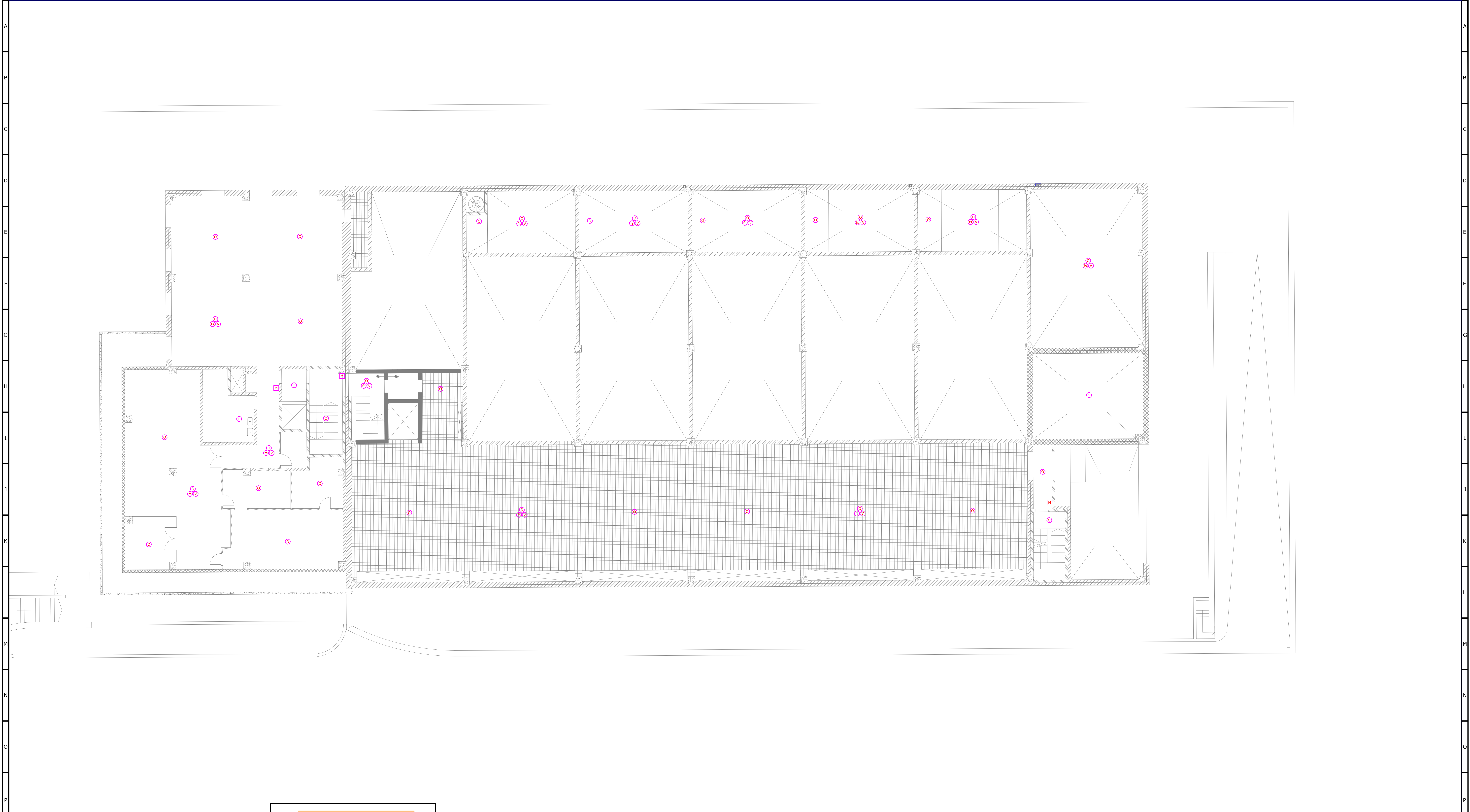
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10 Years

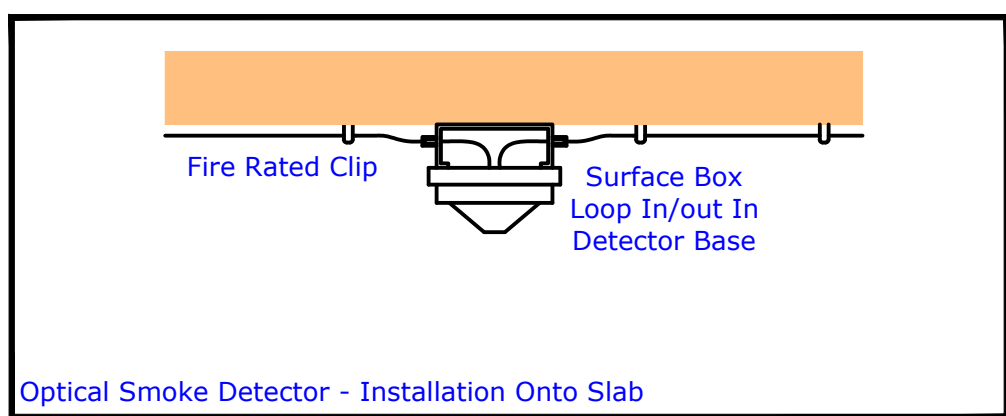
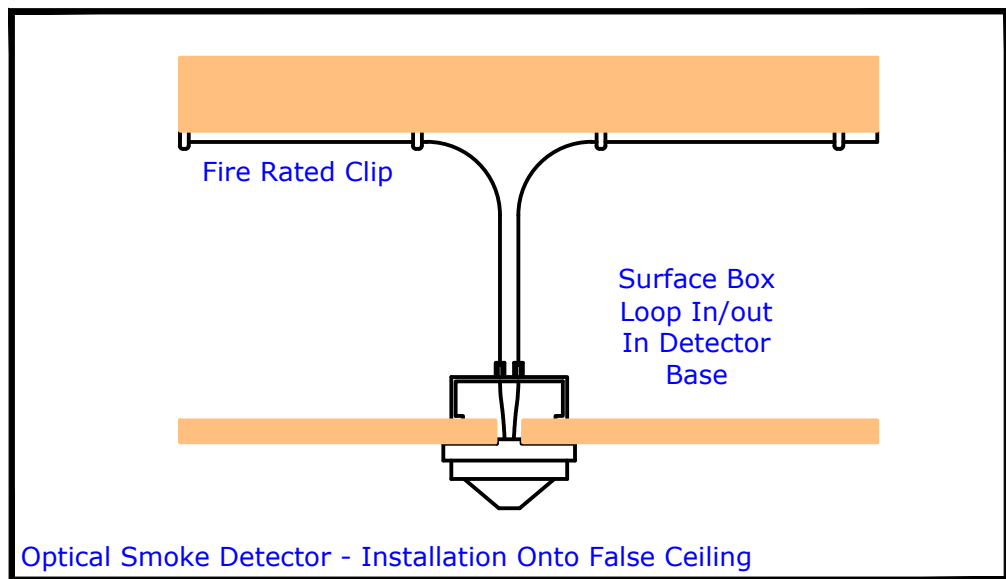




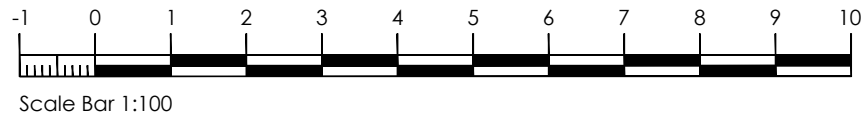




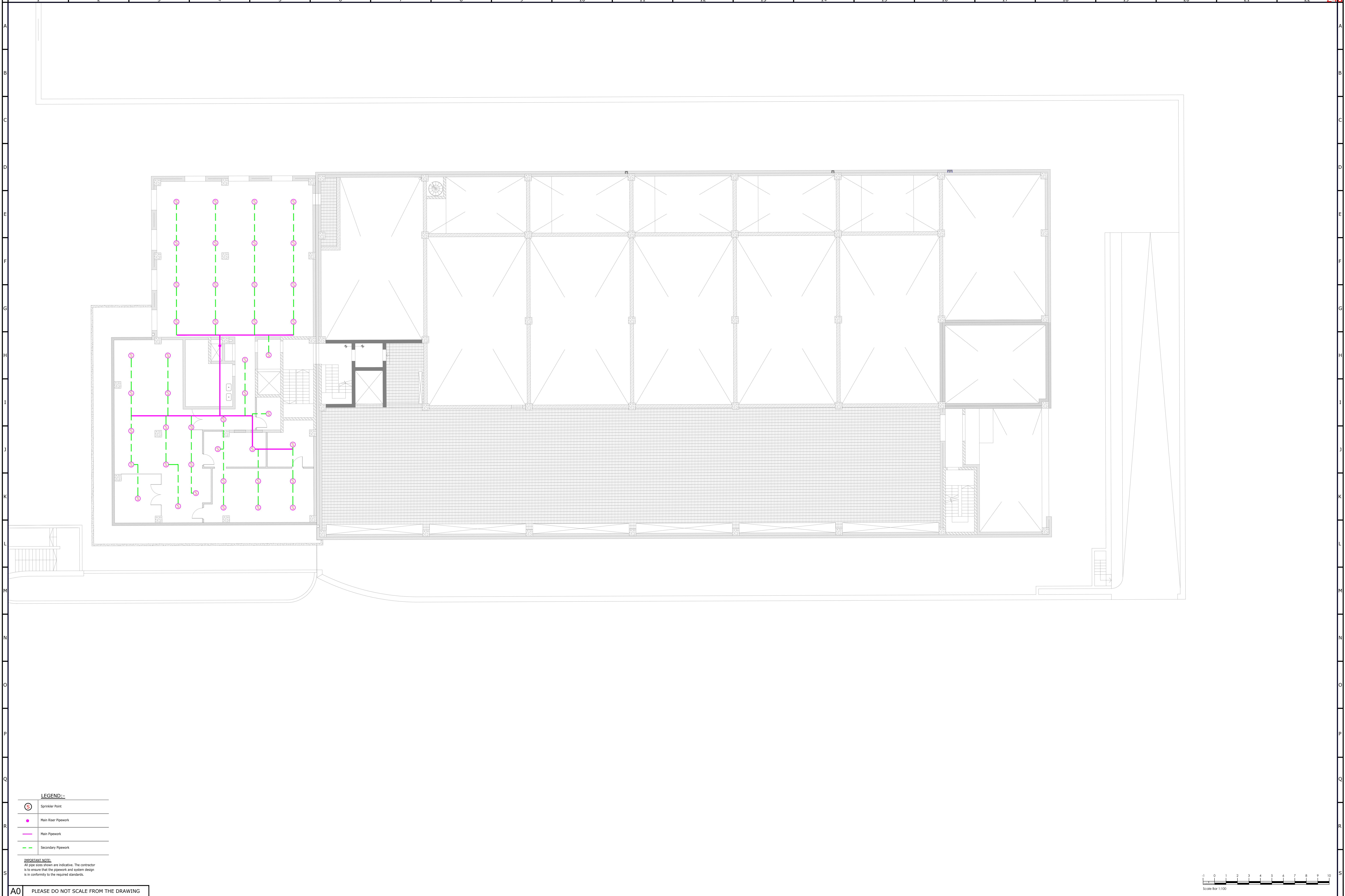
- Fire Detection General Notes:-**
1. Cable to BS 6387 CAT CWZ shall be used. Cable shall be generally run surface above false ceiling, clipped to structural ceiling, parallel with the lines of building construction.
  2. Proprietary cable retaining clips and cable glands should be used installed at 300mm intervals.
  3. Exact location of fire alarm panel to be determined on site.
  4. Exact position of fire detection devices to be coordinated with the soffit installation layout.
  5. Manual call points to be installed at 1200mm from the finished floor level (F.F.L).
  6. Loop isolators to be installed in every entry/exit from each floor.
  7. Combined sounders and beacons shall be preferred.
  8. Downdrops shall be minimum Ø25mm conduit.
  9. All devices including detectors, call points, remote indicators shall have address fixed onto them. Address shall be printed on self adhesive media (not hand written).
  10. Magnetic door releases to be interfaced with the fire alarm panel.
  11. Detectors should not be mounted closer than 500mm from any obstruction or wall.



| Legend:- |                                                   |   |                                               |
|----------|---------------------------------------------------|---|-----------------------------------------------|
| Ⓜ        | Rate Of Rise Heat Detector                        | Ⓢ | Optical Smoke Detector c/w Sounder and Beacon |
| Ⓢ        | Optical Smoke Detector                            | Ⓢ | External Fire Sounder c/w Flashing Beacon     |
| Ⓢ        | Internal Fire Sounder                             | Ⓢ | Fire Sounder c/w Flashing Beacon              |
| Ⓢ        | External Fire Sounder                             | Ⓢ | Beam Transmitter Explosion Proof              |
| Ⓢ        | Fire Sounder Explosion Proof                      | Ⓢ | Beam Receiver Explosion Proof                 |
| Ⓢ        | Flashing Beacon                                   | Ⓢ | Fire Alarm Panel                              |
| Ⓢ        | External Flashing Beacon                          | Ⓢ | Fire Alarm Repeater Panel                     |
| Ⓢ        | Flashing Beacon Explosion Proof                   | Ⓢ | Auto Dailer                                   |
| Ⓢ        | Manual Call Point                                 | Ⓢ | Interface Unit                                |
| Ⓢ        | Manual Call Point Explosion Proof                 | Ⓢ | Magnetic Door Release                         |
| Ⓢ        | Rate Of Rise Heat Detector c/w Sounder and Beacon |   |                                               |







LEGEND:-

Sprinkler Point

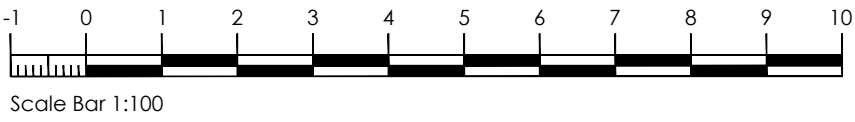
Main Riser Pipework

Main Pipework

Secondary Pipework

IMPORTANT NOTE:  
All pipe sizes shown are indicative. The contractor is to ensure that the pipework and system design is in conformity to the required standards.

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|    |          |                |                             |                           |                                                                                                                                                                                                                                       |                   |
|----|----------|----------------|-----------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| -  | -        | -              | Scale: 1:100                | Revision No.: 03          | Date: 24.09.19                                                                                                                                                                                                                        | Position: Level 2 |
| 03 | 24.09.19 | Revised Layout | Job No.: 17.019             | Drawing No.: SFR.2.SPR.01 | Service: Sprinkler Installation Layout                                                                                                                                                                                                |                   |
| 02 | 07.07.17 | Revised Layout | Drawn By: <i>A. Zappala</i> | Checked By:               | THIS DRAWING IS CONFIDENTIAL AND IS THE PROPERTY OF CAMILLERI & CUSCHIERI CONSULTING ENGINEERS. IT MUST NOT BE DISCLOSED TO A THIRD PARTY, COPIED OR LENT, WITHOUT THE WRITTEN CONSENT OF CAMILLERI & CUSCHIERI CONSULTING ENGINEERS. |                   |
| 01 | 30.05.17 | Revised Layout |                             |                           |                                                                                                                                                                                                                                       |                   |

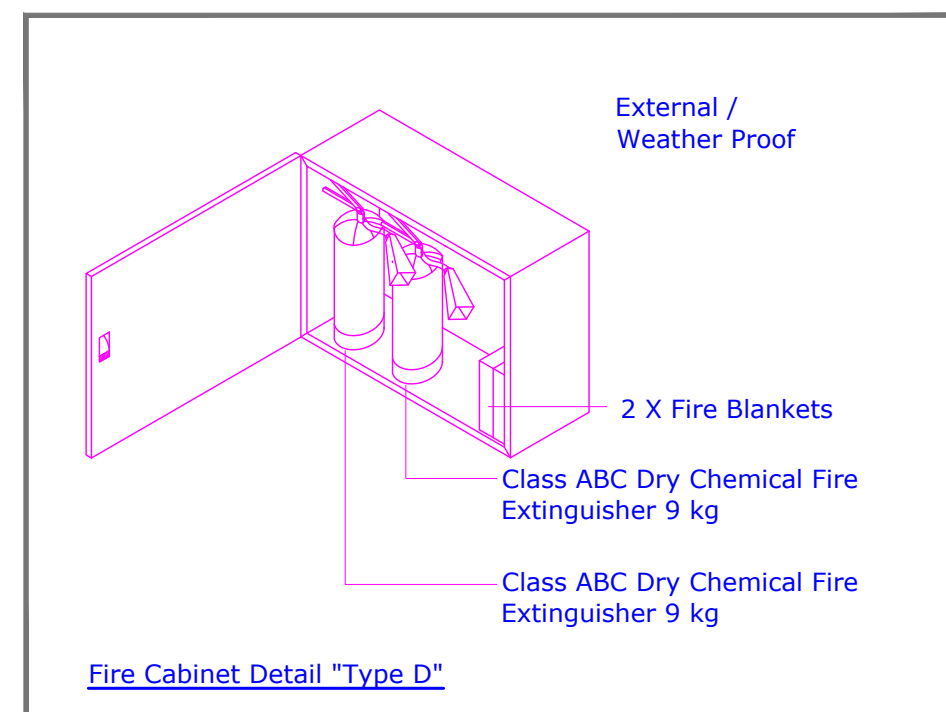
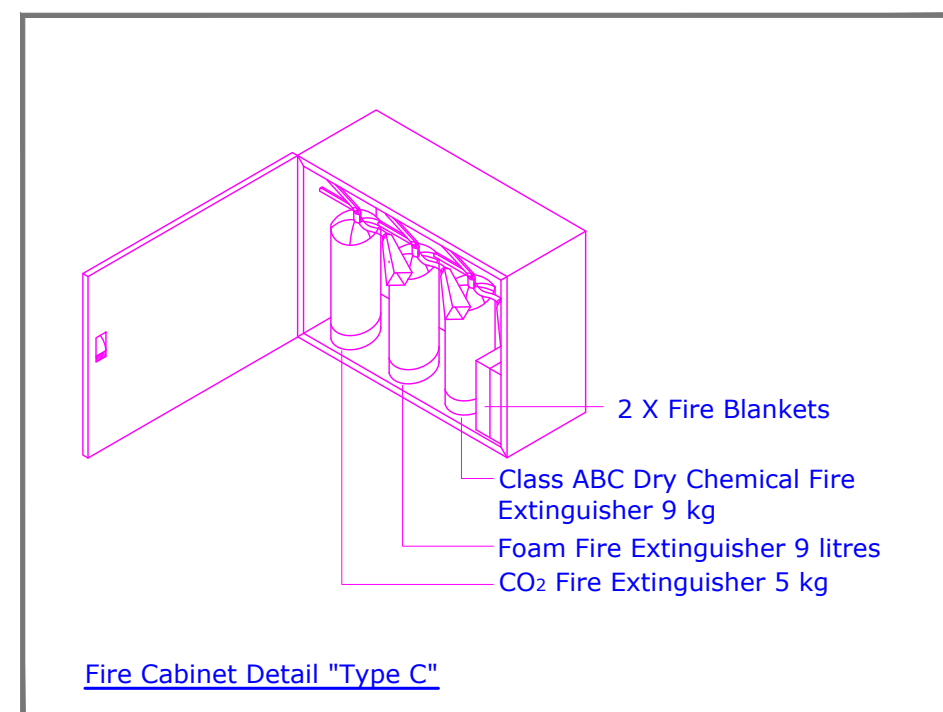
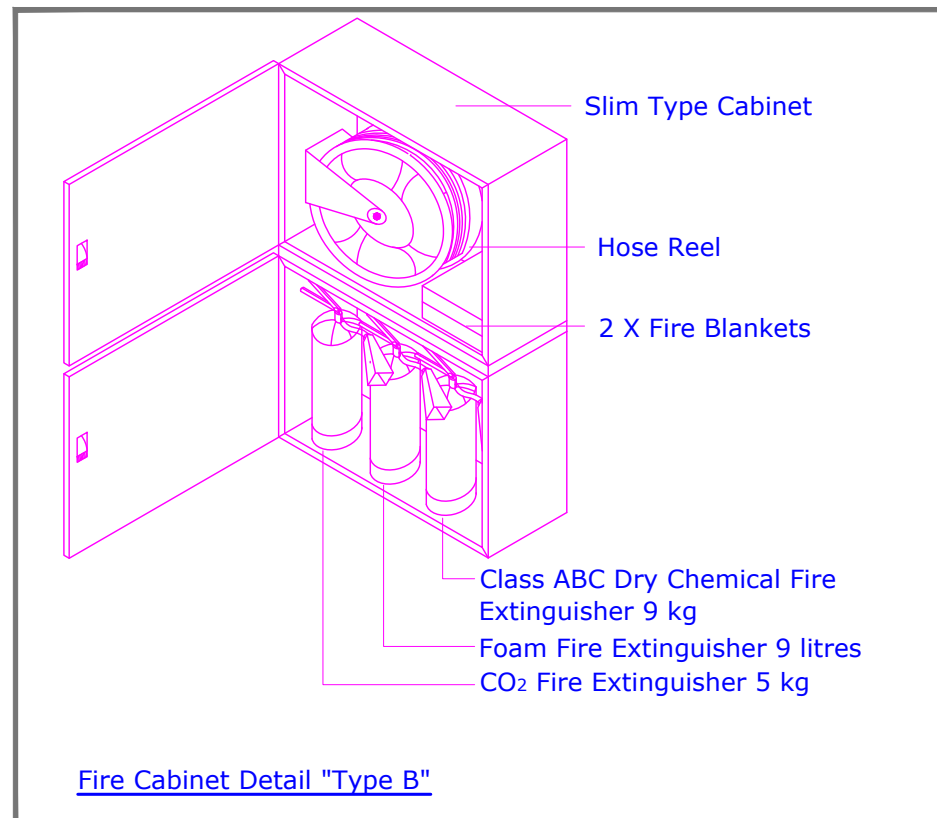
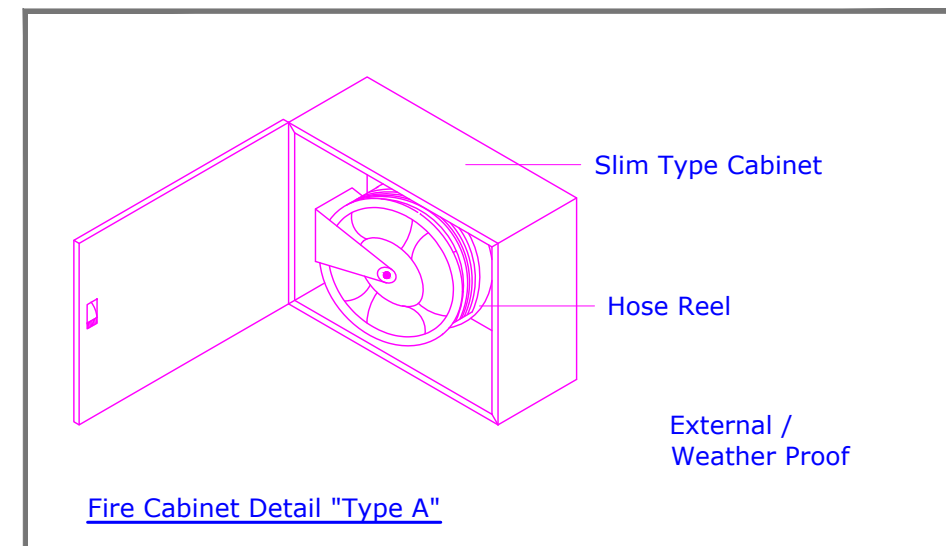
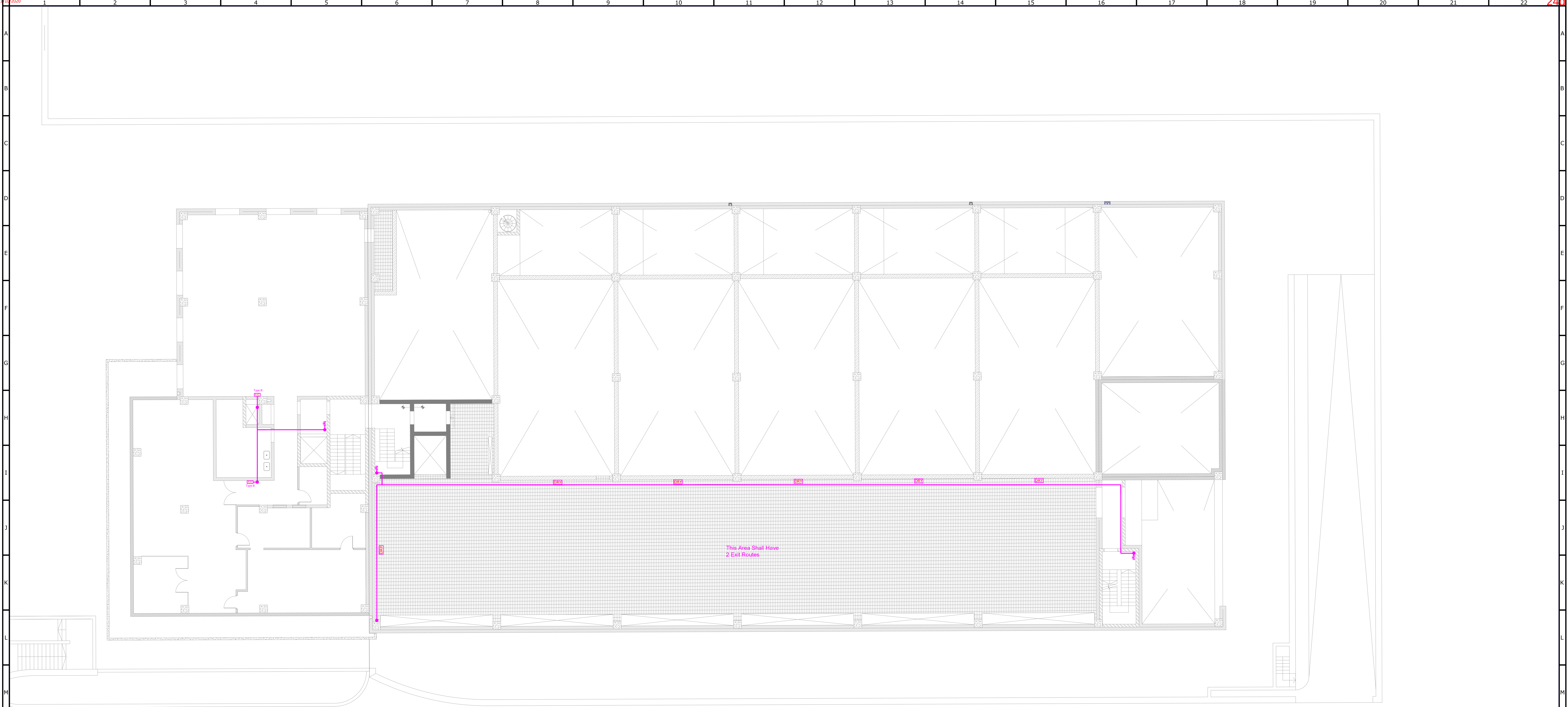
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40 Years





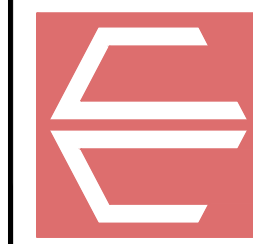
Fire Fighting General Notes:

1. All emergency escape door/s from any area to open outwards.
2. Exact fire fighting pipework route to be coordinated with other services.
3. Exact position of fire cabinets to be coordinated with furniture layout once it is issued by the client.
4. Fire cabinets shall be installed surface or recessed mounted as instructed by client / interior designer team.
5. All pipework crossings are at high level.
6. All fire fighting pipework shall be as follows
  - Main Pipework shall be of 4"
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  - Branch pipework feeding landing valve only shall be of 2"
  - Branch pipework feeding hose reel only shall be of 1"

Legend:-

|                                                                                       |                                                           |
|---------------------------------------------------------------------------------------|-----------------------------------------------------------|
|  | Fire Fighting Cabinet                                     |
|  | Breech Point                                              |
|  | Pressure Reducing Landing Valve                           |
|  | Fire Fighting Pipe                                        |
|  | Riser/Drop                                                |
|  | Fire Trolley c/w Class ABC Dry Chemical Fire Extinguisher |
|  | Class ABC Dry Chemical Fire Extinguisher 9kg              |
|  | Foam Fire Extinguisher 9 Liters                           |
|  | CO <sub>2</sub> Fire Extinguisher 5 kg                    |

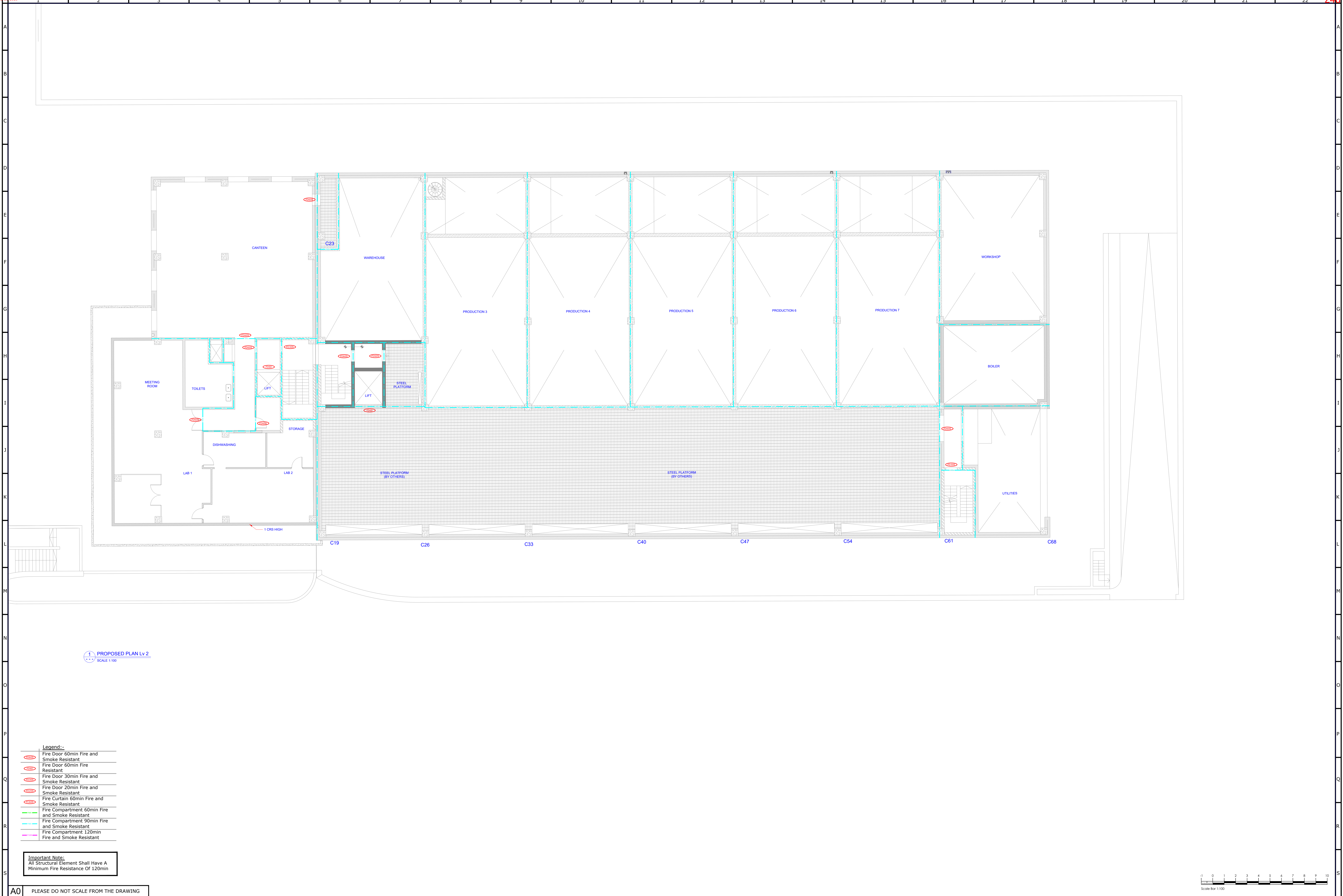
Scale Bar 1:100



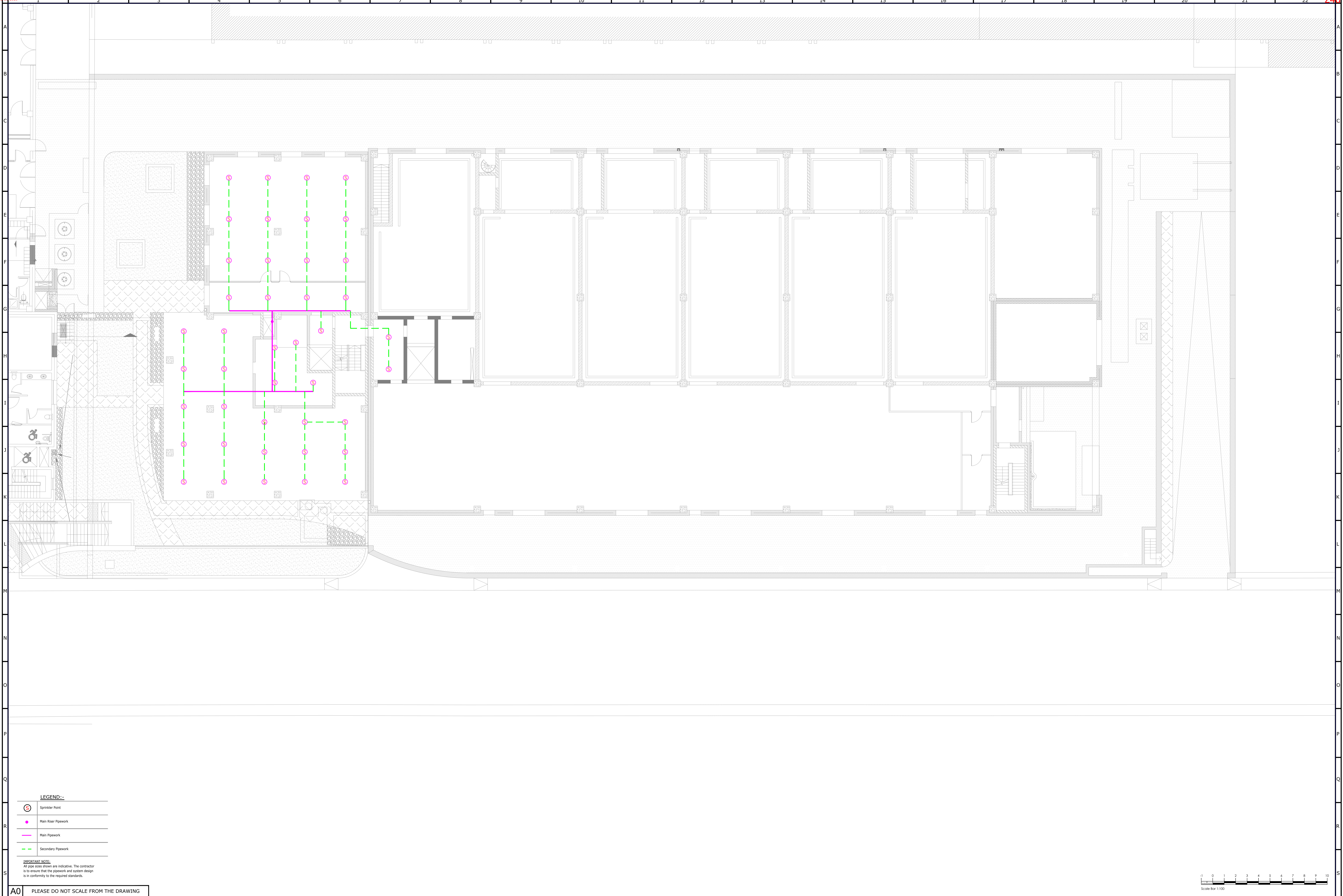
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| LEGEND:- |                     |
|----------|---------------------|
|          | Sprinkler Point     |
|          | Main Riser Pipework |
|          | Main Pipework       |
|          | Secondary Pipework  |

**IMPORTANT NOTE:**  
All pipe sizes shown are indicative. The contractor is to ensure that the pipework and system design is in conformity to the required standards.

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|    |          |                |                             |                           |                                                                                                                                                                                                                                       |                   |
|----|----------|----------------|-----------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| -  | -        | -              | Scale: 1:100                | Revision No.: 03          | Date: 24.09.19                                                                                                                                                                                                                        | Position: Level 1 |
| 03 | 24.09.19 | Revised Layout | Job No.: 17.019             | Drawing No.: SFR.1.SPR.01 | Service: Sprinkler Installation Layout                                                                                                                                                                                                |                   |
| 02 | 07.07.17 | Revised Layout | Drawn By: <i>A. Zappala</i> | Checked By:               | THIS DRAWING IS CONFIDENTIAL AND IS THE PROPERTY OF CAMILLERI & CUSCHIERI CONSULTING ENGINEERS. IT MUST NOT BE DISCLOSED TO A THIRD PARTY, COPIED OR LENT, WITHOUT THE WRITTEN CONSENT OF CAMILLERI & CUSCHIERI CONSULTING ENGINEERS. |                   |
| 01 | 30.05.17 | Revised Layout |                             |                           |                                                                                                                                                                                                                                       |                   |

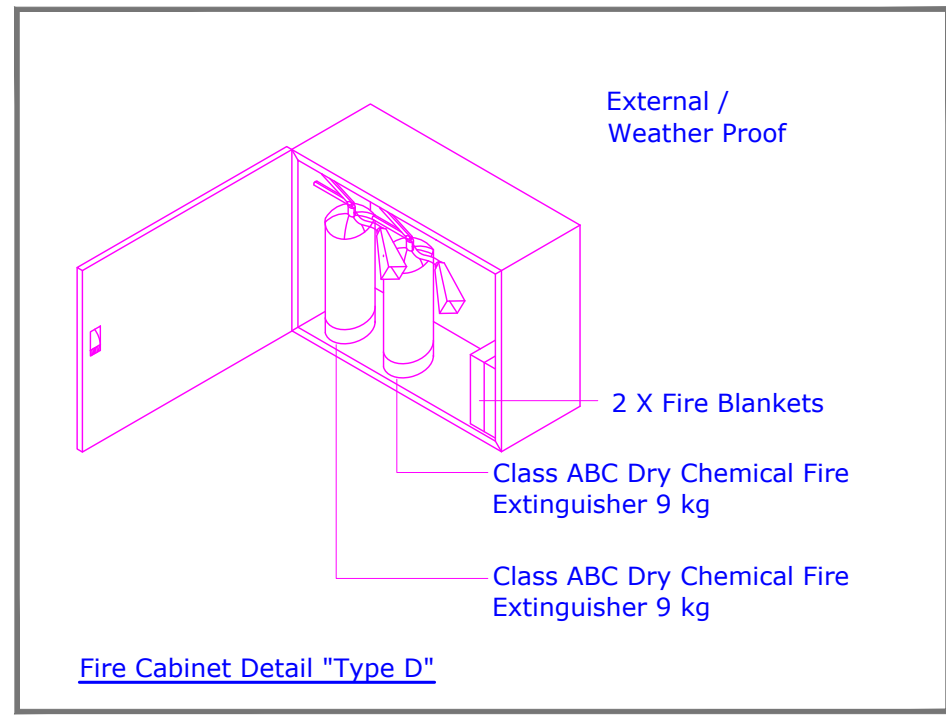
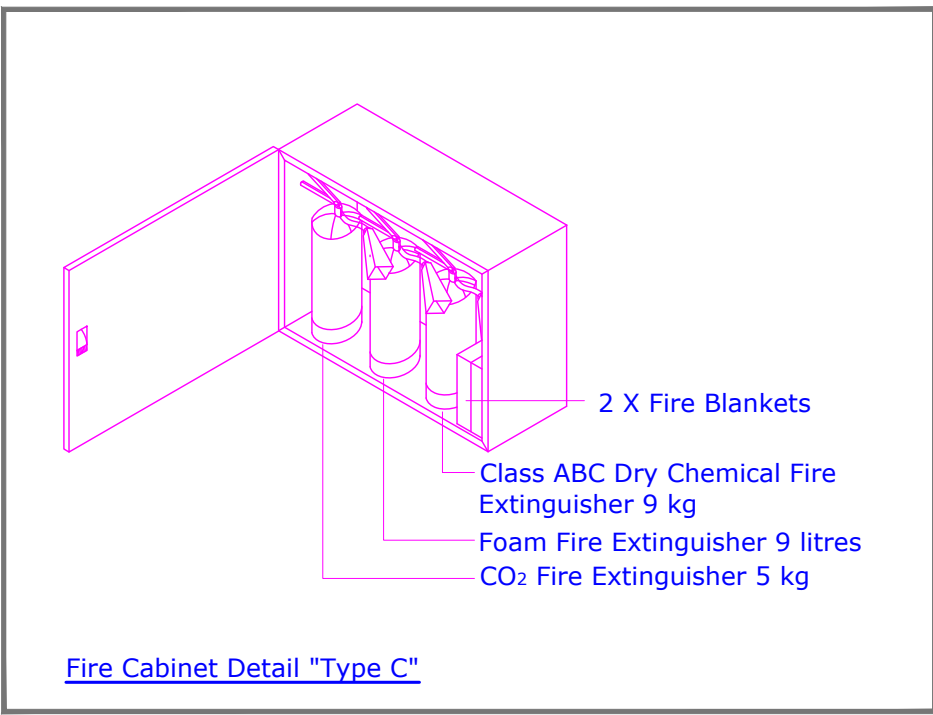
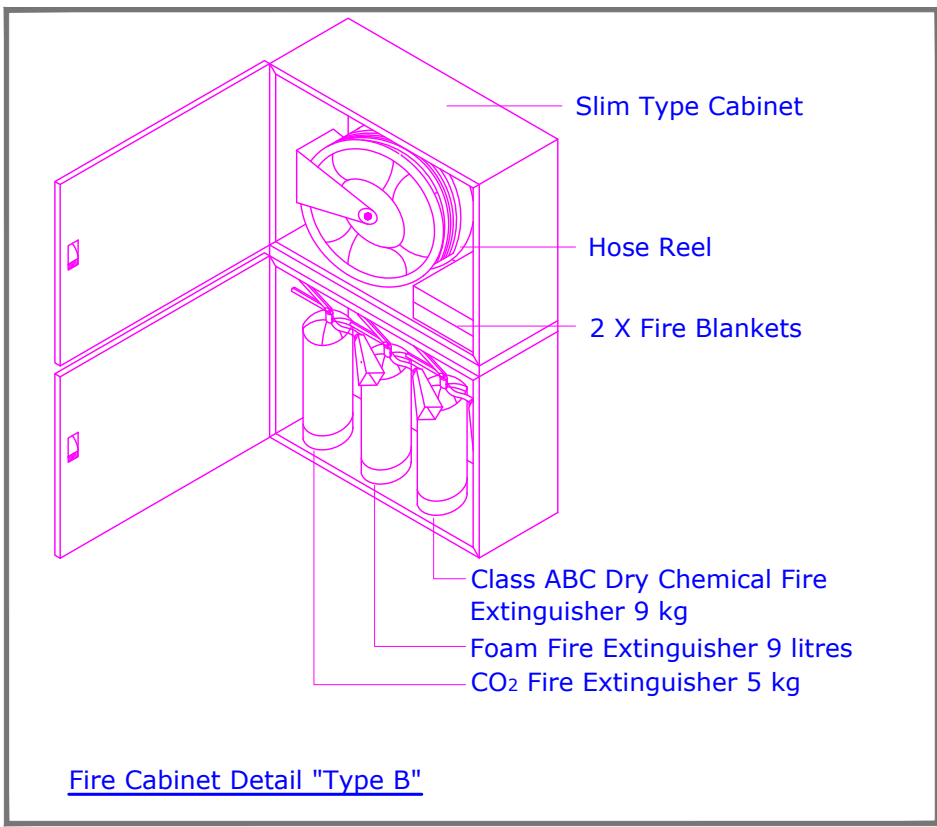
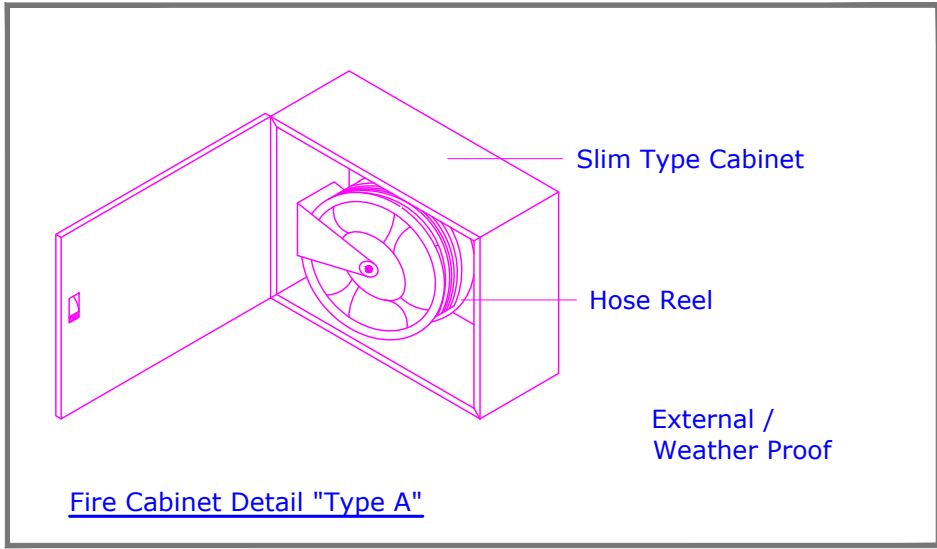
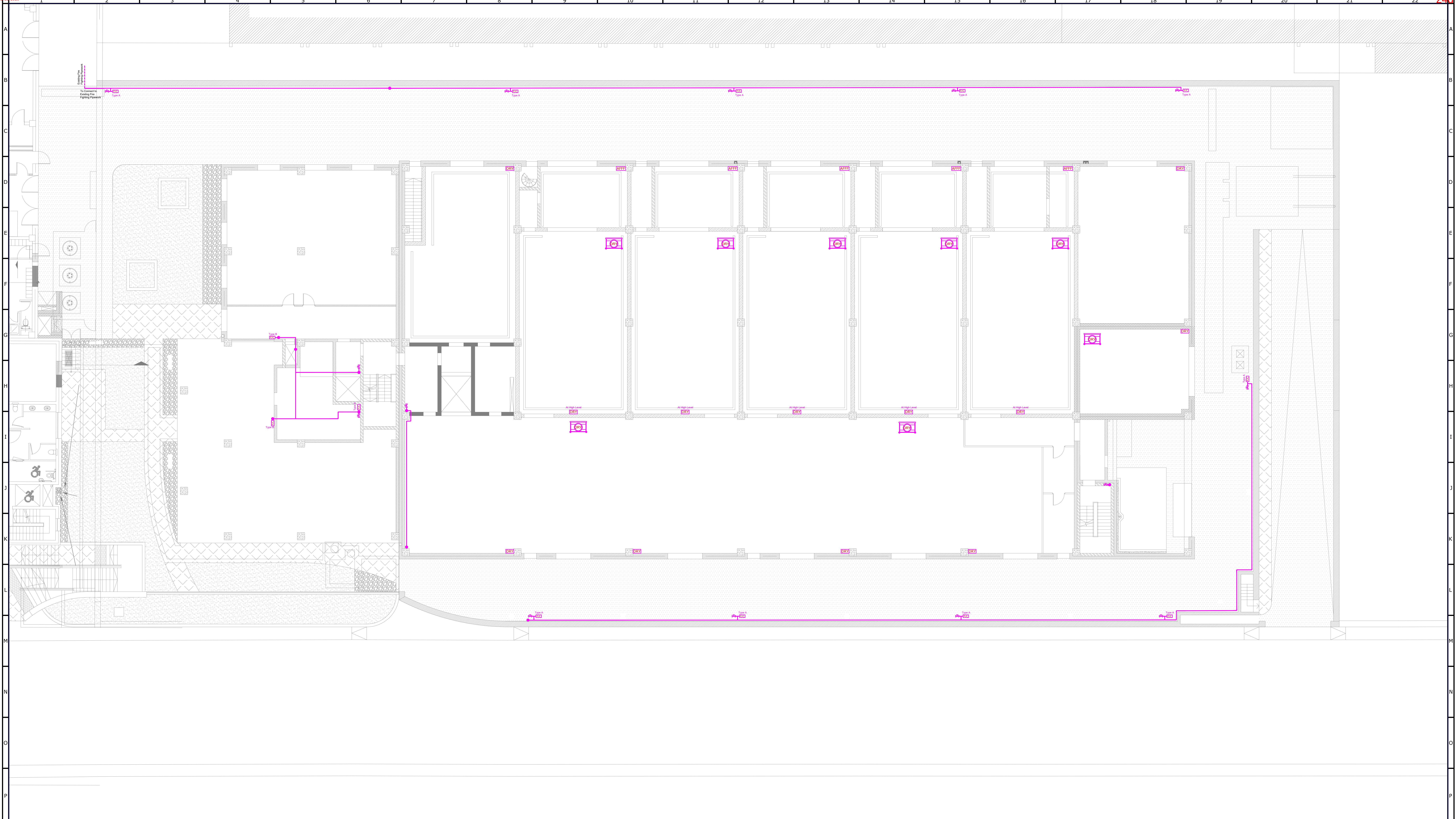
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40 Years



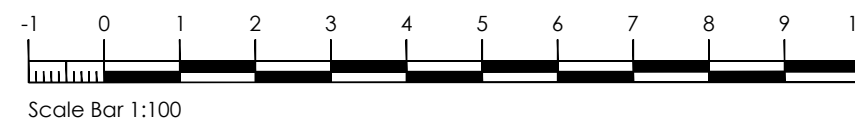


#### Fire Fighting General Notes:

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  - Branch pipework feeding landing valve only shall be of 2 1/2"
  - Branch pipework feeding hose reel only shall be of 1"

#### Legend:-

|  |                                                           |
|--|-----------------------------------------------------------|
|  | Fire Fighting Cabinet                                     |
|  | Breach Point                                              |
|  | Pressure Reducing Landing Valve                           |
|  | Fire Fighting Pipe                                        |
|  | Riser/Drop                                                |
|  | Fire Trolley c/w Class ABC Dry Chemical Fire Extinguisher |
|  | Class ABC Dry Chemical Fire Extinguisher 9kg              |
|  | Foam Fire Extinguisher 9 Liters                           |
|  | CO2 Fire Extinguisher 5 kg                                |



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|    |          |                |
|----|----------|----------------|
| -  | -        | -              |
| -  | -        | -              |
| 02 | 25.09.19 | Revised Layout |
| 01 | 07.07.17 | Revised Layout |

|                 |                          |                                            |
|-----------------|--------------------------|--------------------------------------------|
| Scale: 1:100    | Revision No.: 02         | Date: 24.09.19                             |
| Job No.: 17.019 | Drawing No.: SFR.1.FF.01 | Service: Fire Fighting Installation Layout |
| Drawn By:       | Checked By:              |                                            |

|                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Position: Level 1                                                                                                                                                                                                                     |
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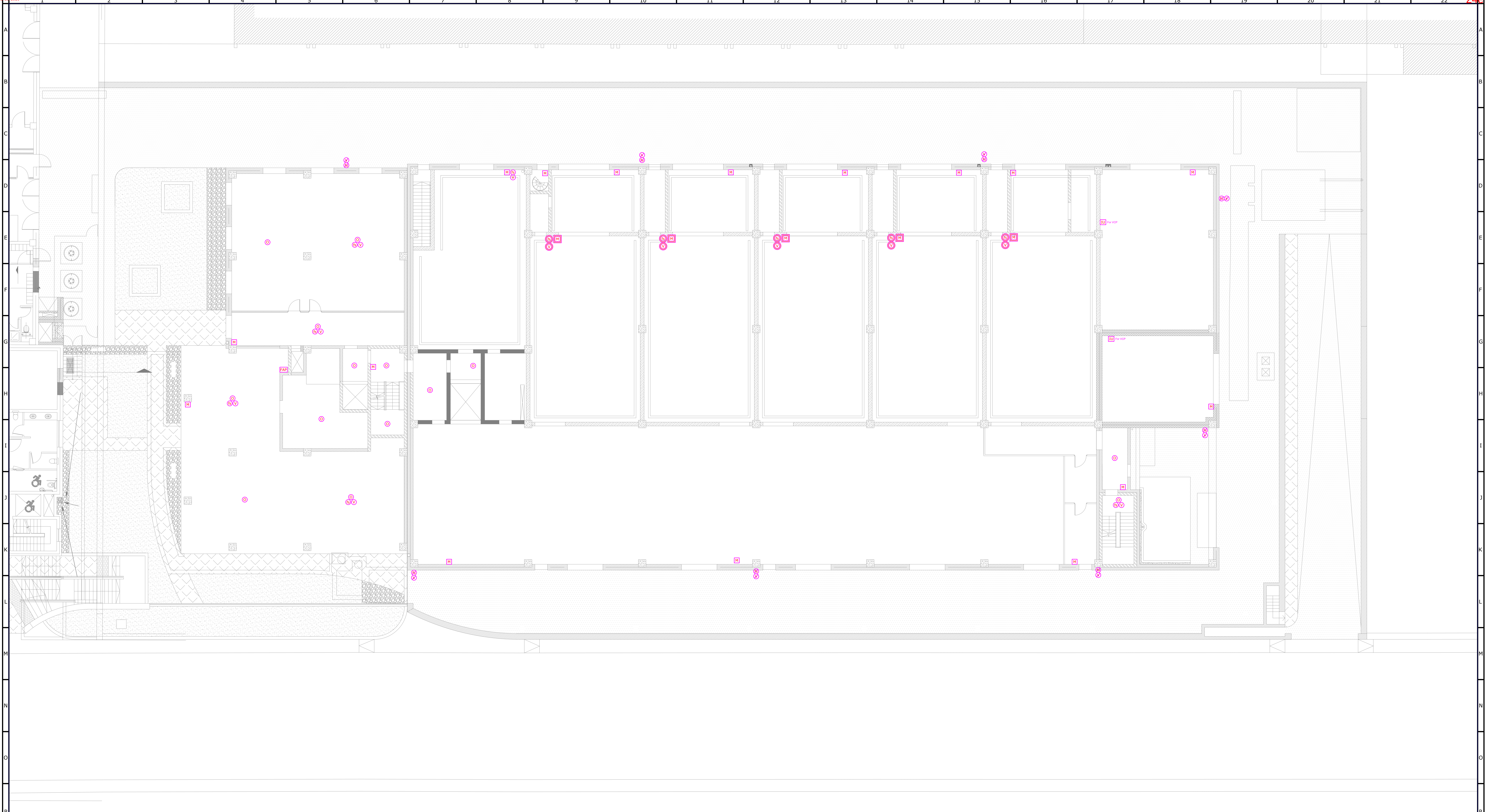
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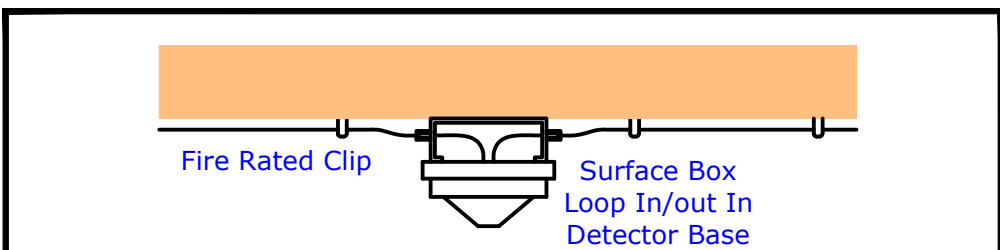
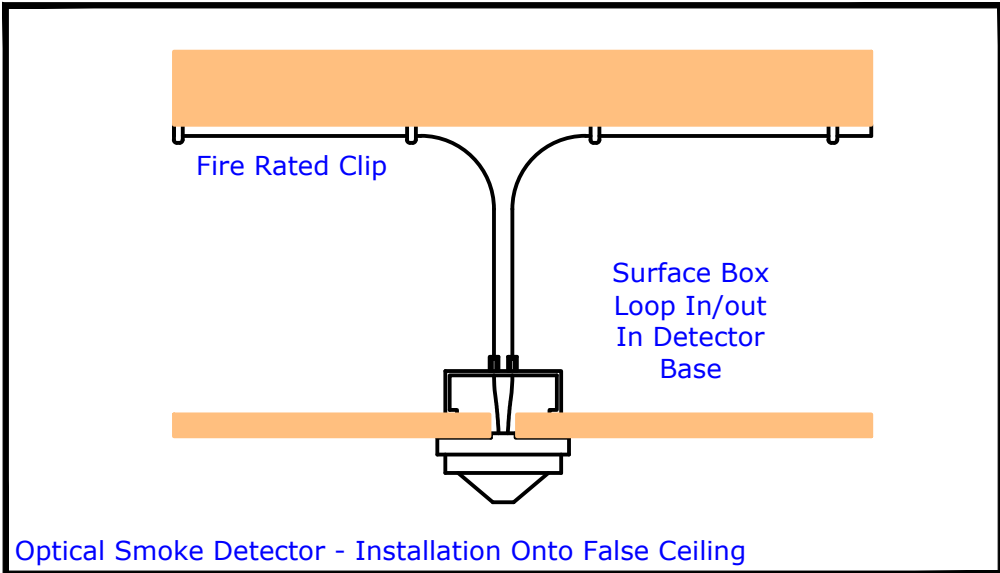
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10 Years

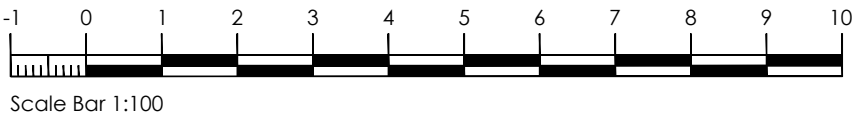




- Fire Detection General Notes:-**
1. Cable to BS 6387 CAT CWZ shall be used. Cable shall be generally run surface above false ceiling, clipped to structural ceiling, parallel with the lines of building construction.
  2. Proprietary cable retaining clips and cable glands should be used installed at 300mm intervals.
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  10. Magnetic door releases to be interfaced with the fire alarm panel.
  11. Detectors should not be mounted closer than 500mm from any obstruction or wall.



| Legend:- |                                                   |      |                                               |
|----------|---------------------------------------------------|------|-----------------------------------------------|
| RR       | Rate Of Rise Heat Detector                        | OSD  | Optical Smoke Detector c/w Sounder and Beacon |
| OSD      | Optical Smoke Detector                            | ES   | External Fire Sounder c/w Flashing Beacon     |
| IS       | Internal Fire Sounder                             | FS   | Fire Sounder c/w Flashing Beacon              |
| ES       | External Fire Sounder                             | BT   | Beam Transmitter Explosion Proof              |
| ES       | Fire Sounder Explosion Proof                      | BR   | Beam Receiver Explosion Proof                 |
| V        | Flashing Beacon                                   | FAP  | Fire Alarm Panel                              |
| ES       | External Flashing Beacon                          | FARP | Fire Alarm Repeater Panel                     |
| V        | Flashing Beacon Explosion Proof                   | AUTO | Auto Dailer                                   |
| M        | Manual Call Point                                 | IU   | Interface Unit                                |
| M        | Manual Call Point Explosion Proof                 | MDR  | Magnetic Door Release                         |
| RR       | Rate Of Rise Heat Detector c/w Sounder and Beacon |      |                                               |



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|----|----------|----------------|-----------------------|--------------------------|---------------------------------------------|-------------------|
| -  | -        | -              | Scale: 1:100          | Revision No.: 03         | Date: 24.09.19                              | Position: Level 1 |
| 03 | 24.09.19 | Revised Layout | Job No.: 17.019       | Drawing No.: SFR.1.FD.01 | Service: Fire Detection Installation Layout |                   |
| 02 | 07.07.17 | Revised Layout | Drawn By: A. Z. G. G. | Checked By:              |                                             |                   |
| 01 | 30.05.17 | Revised Layout |                       |                          |                                             |                   |

Project Name & Address:

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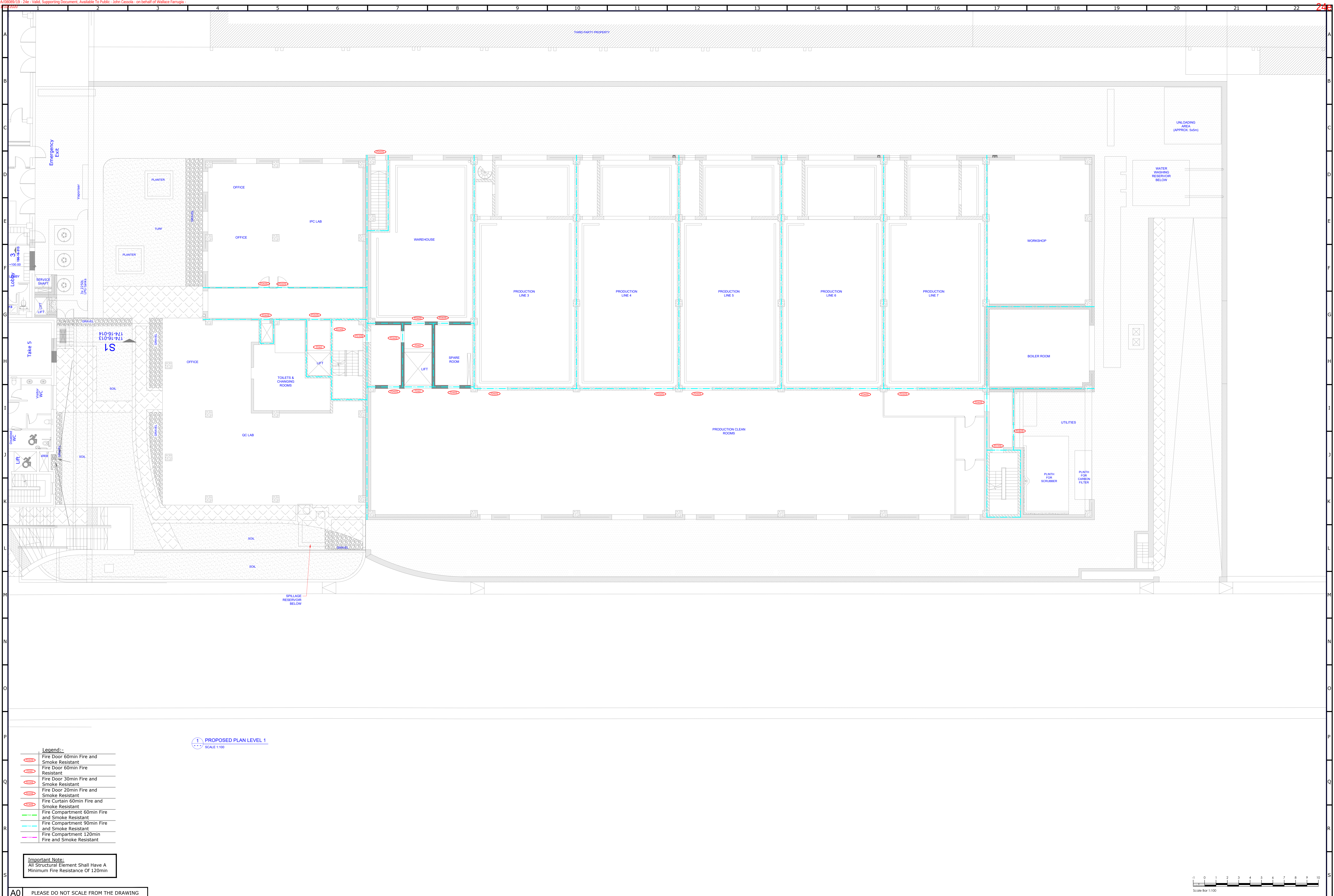


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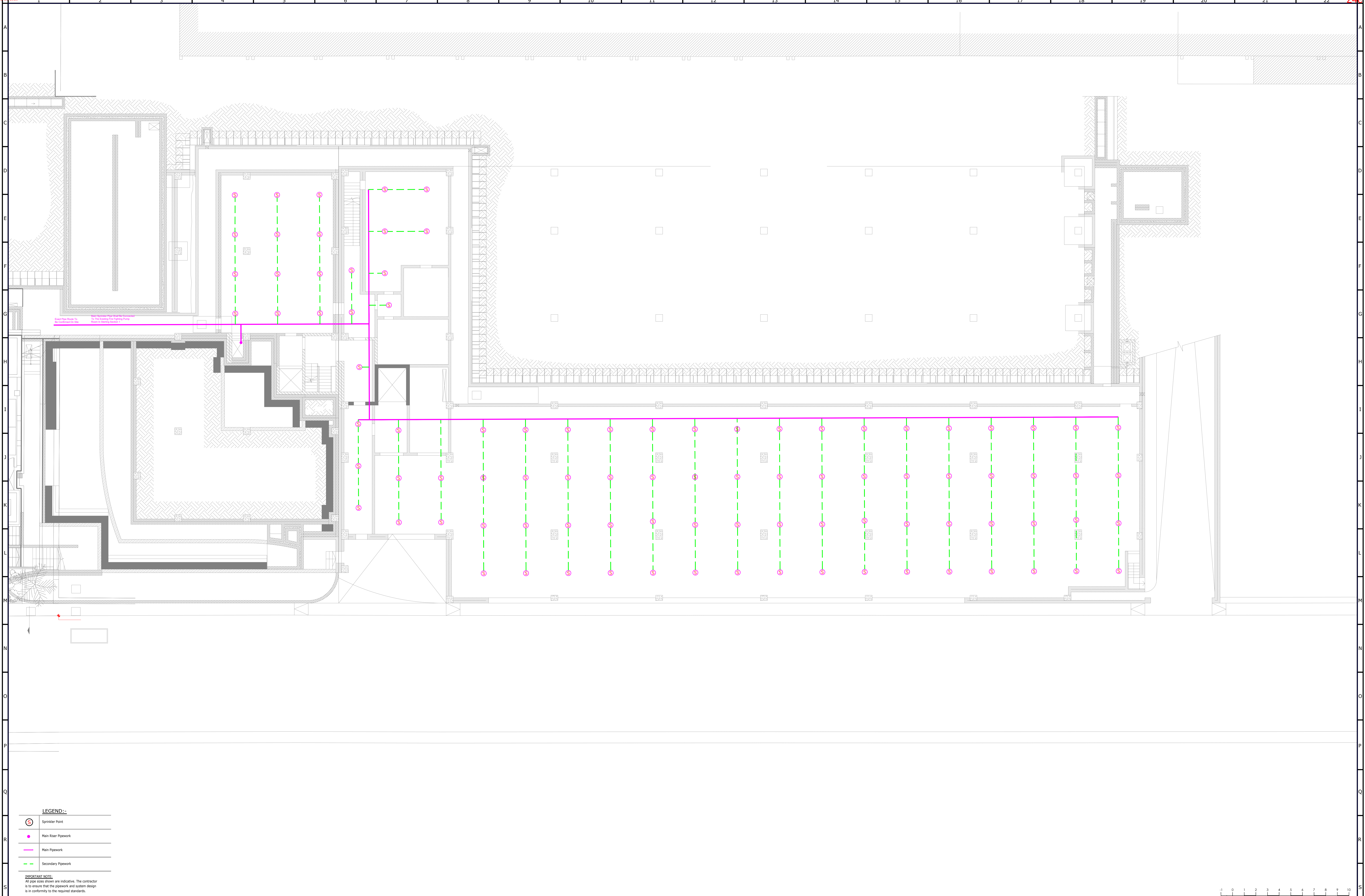
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10 Years









LEGEND:-

S

Sprinkler Point

●

Main Riser Pipework

—

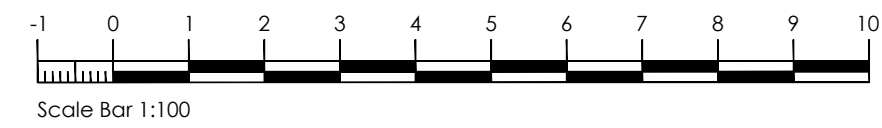
Main Pipework

- - -

Secondary Pipework

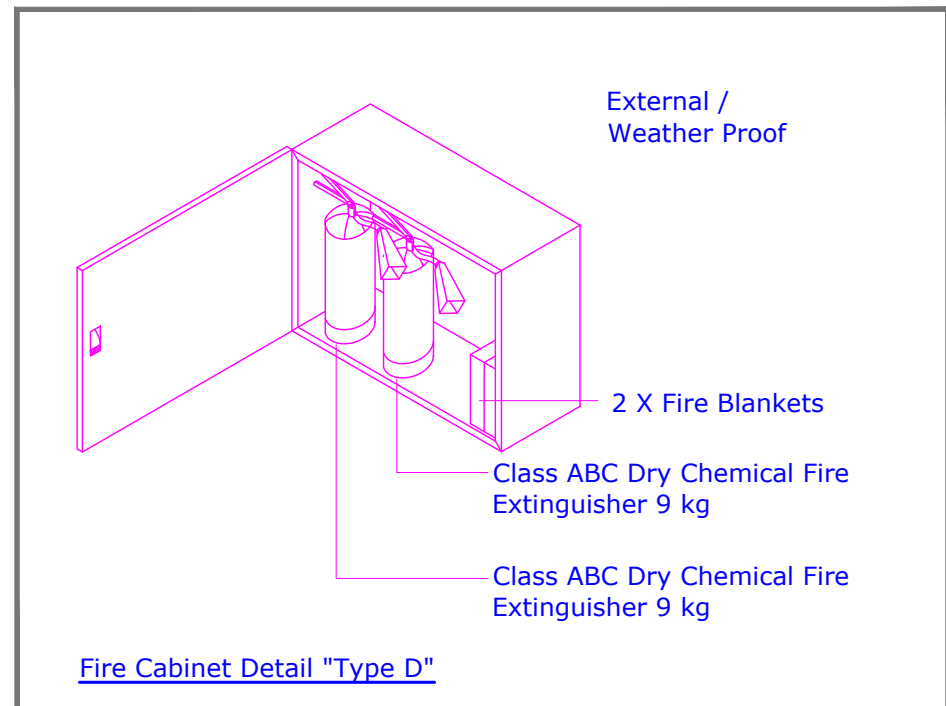
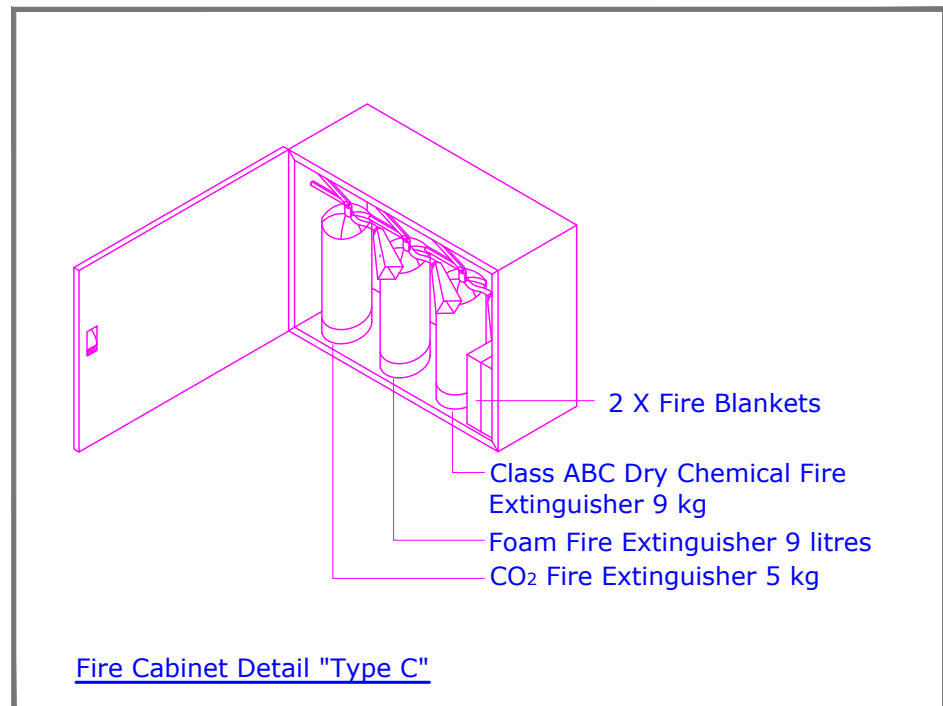
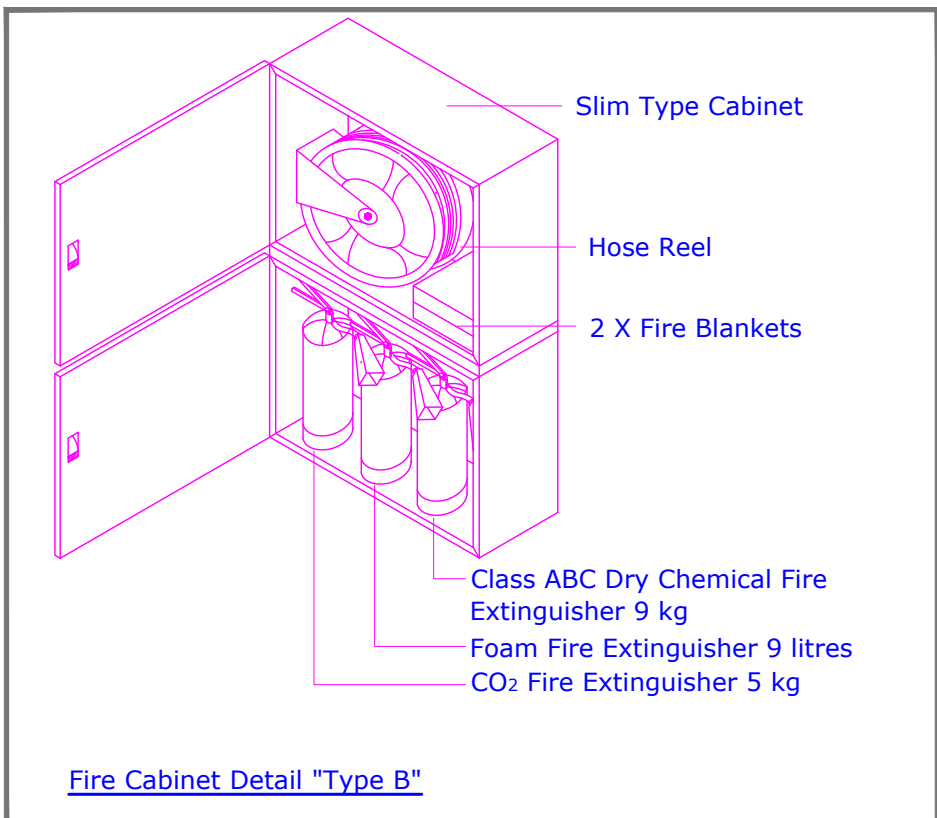
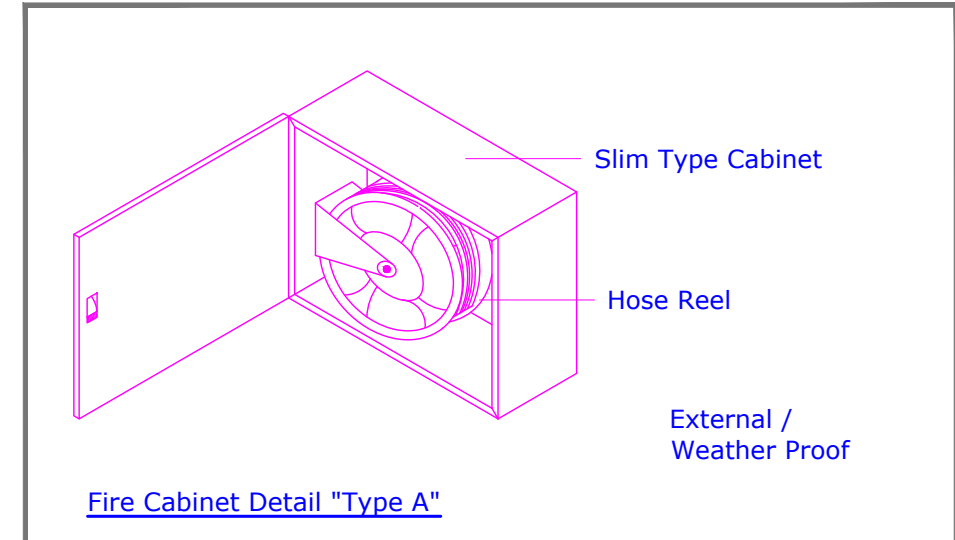
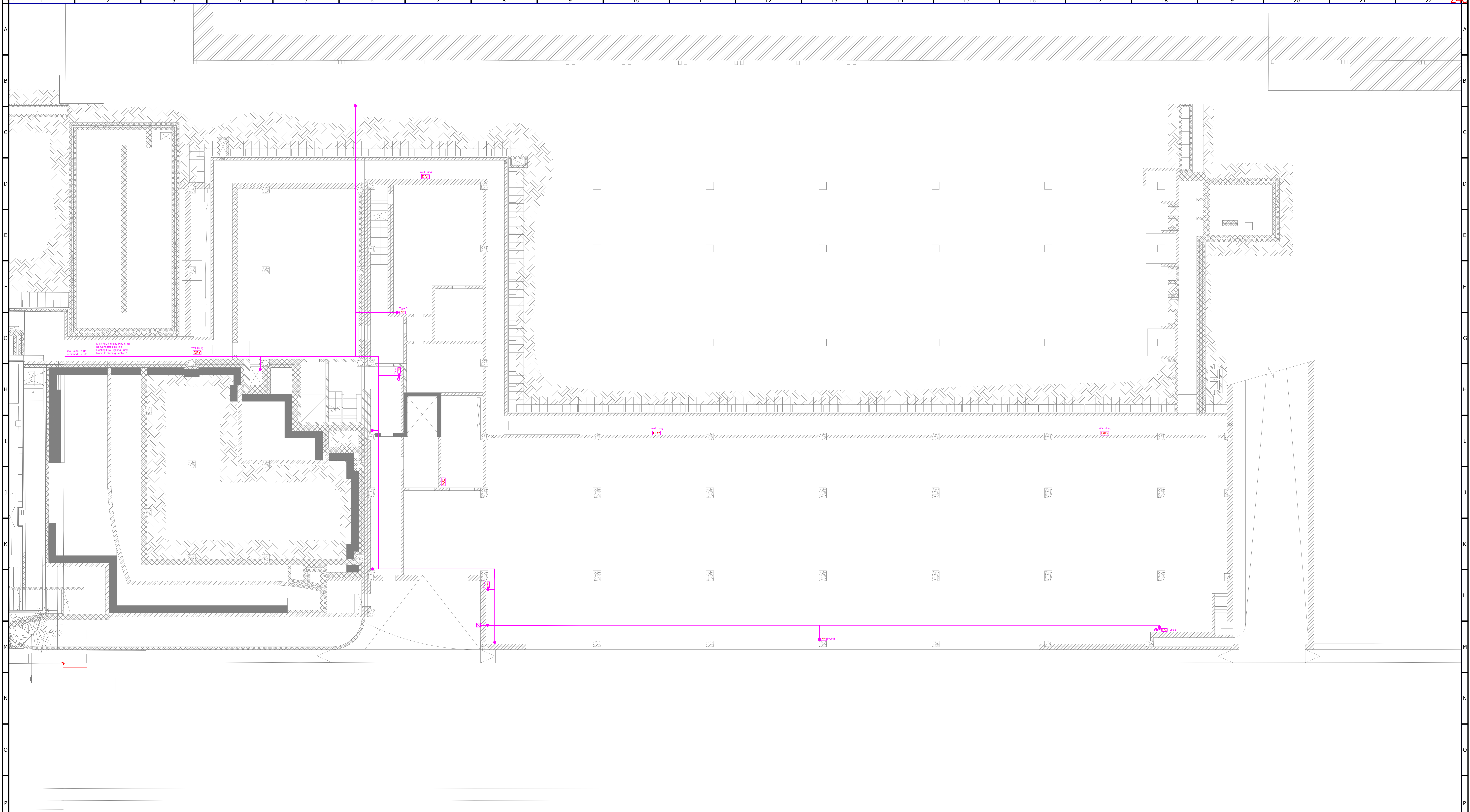
**IMPORTANT NOTE:**  
All pipe sizes shown are indicative. The contractor is to ensure that the pipework and system design is in conformity to the required standards.

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|    |          |                |                             |                           |                                                                                                                                                                                                                                       |                   |                                                      |                                                                                                                                                                                                                                                                                                                                                                                 |  |  |
|----|----------|----------------|-----------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| -  | -        | -              | Scale: 1:100                | Revision No.: 03          | Date: 24.09.19                                                                                                                                                                                                                        | Position: Level 0 | Project Name & Address:<br><br>Factory HF53, Hal Far | <div><div><b>CAMILLERI &amp; CUSCHIERI</b><br/>CONSULTING ENGINEERS</div></div> <div>Design Center, Level 2, Tower Road, Swatar, Birkirkara, Malta BKR 4012<br/>+356 21220431 +356 79220431<br/>info@camilleriandcuschieri.com<br/>www.camilleriandcuschieri.com</div> <div>40 Years</div> |  |  |
| 03 | 24.09.19 | Revised Layout | Job No.: 17.019             | Drawing No.: SPR.0.SPR.01 | Service: Sprinkler Installation Layout                                                                                                                                                                                                |                   |                                                      |                                                                                                                                                                                                                                                                                                                                                                                 |  |  |
| 02 | 07.07.17 | Revised Layout | Drawn By: <i>A. Zappala</i> | Checked By:               | THIS DRAWING IS CONFIDENTIAL AND IS THE PROPERTY OF CAMILLERI & CUSCHIERI CONSULTING ENGINEERS. IT MUST NOT BE DISCLOSED TO A THIRD PARTY, COPIED OR LENT, WITHOUT THE WRITTEN CONSENT OF CAMILLERI & CUSCHIERI CONSULTING ENGINEERS. |                   |                                                      |                                                                                                                                                                                                                                                                                                                                                                                 |  |  |
| 01 | 29.05.17 | Revised Layout |                             |                           |                                                                                                                                                                                                                                       |                   |                                                      |                                                                                                                                                                                                                                                                                                                                                                                 |  |  |
|    |          |                |                             |                           |                                                                                                                                                                                                                                       |                   |                                                      |                                                                                                                                                                                                                                                                                                                                                                                 |  |  |





#### Fire Fighting General Notes:

1. All emergency escape doors from any area to open outwards.
2. Exact fire fighting pipework route to be coordinated with other services.
3. Exact position of fire cabinets to be coordinated with furniture layout once it is issued by the client.
4. Fire cabinets shall be installed surface or recessed mounted as instructed by client / interior designer team.
5. All pipework crossings are at high level.
6. All fire fighting pipework shall be as follows
  - Main Pipework shall be of 4"
  - Branch pipework feeding both hose reel and landing valve shall be of 2 1/2"
  - Branch pipework feeding landing valve only shall be of 2 1/2"
  - Branch pipework feeding hose reel only shall be of 1"

#### Legend:-

|  |                                                           |
|--|-----------------------------------------------------------|
|  | Fire Fighting Cabinet                                     |
|  | Breach Point                                              |
|  | Pressure Reducing Landing Valve                           |
|  | Fire Fighting Pipe                                        |
|  | Riser/Drop                                                |
|  | Fire Trolley c/w Class ABC Dry Chemical Fire Extinguisher |
|  | Class ABC Dry Chemical Fire Extinguisher 9kg              |
|  | Foam Fire Extinguisher 9 Liters                           |
|  | CO2 Fire Extinguisher 5 kg                                |

Scale Bar 1:100

A0 PLEASE DO NOT SCALE FROM THE DRAWING

|                 |                          |                                                                                                                                                                                                                                         |                   |
|-----------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Scale: 1:100    | Revision No.: 02         | Date: 24.09.19                                                                                                                                                                                                                          | Position: Level 0 |
| Job No.: 17.019 | Drawing No.: SFR.0.FF.01 | Service: Fire Fighting Installation Layout                                                                                                                                                                                              |                   |
| Drawn By:       | Checked By:              | THIS DRAWING IS CONFIDENTIAL AND IS THE PROPERTY OF CAMILLERI & CUSCHIERI CONSULTING ENGINEERS. IT MUST NOT BE DISCLOSED TO A THIRD PARTY, COPIED OR LENT, WITHOUT THE WRITTEN CONSENT OF CAMILLERI AND CUSCHIERI CONSULTING ENGINEERS. |                   |

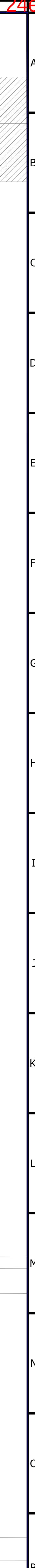
Project Name & Address:  
Factory HF53, Hal Far



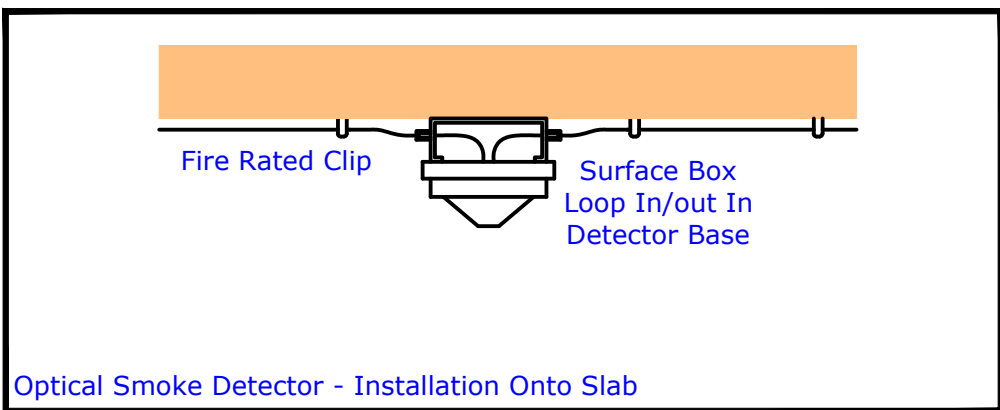
Design Center, Level 2, Tower Road, Swatar,  
Birkirkara, Malta BKR 4012  
+356 21220431 +356 79220431  
info@camillerianduscieri.com  
www.camillerianduscieri.com

10 Years





0 PLEASE DO NOT SCALE FROM THE DRAWING

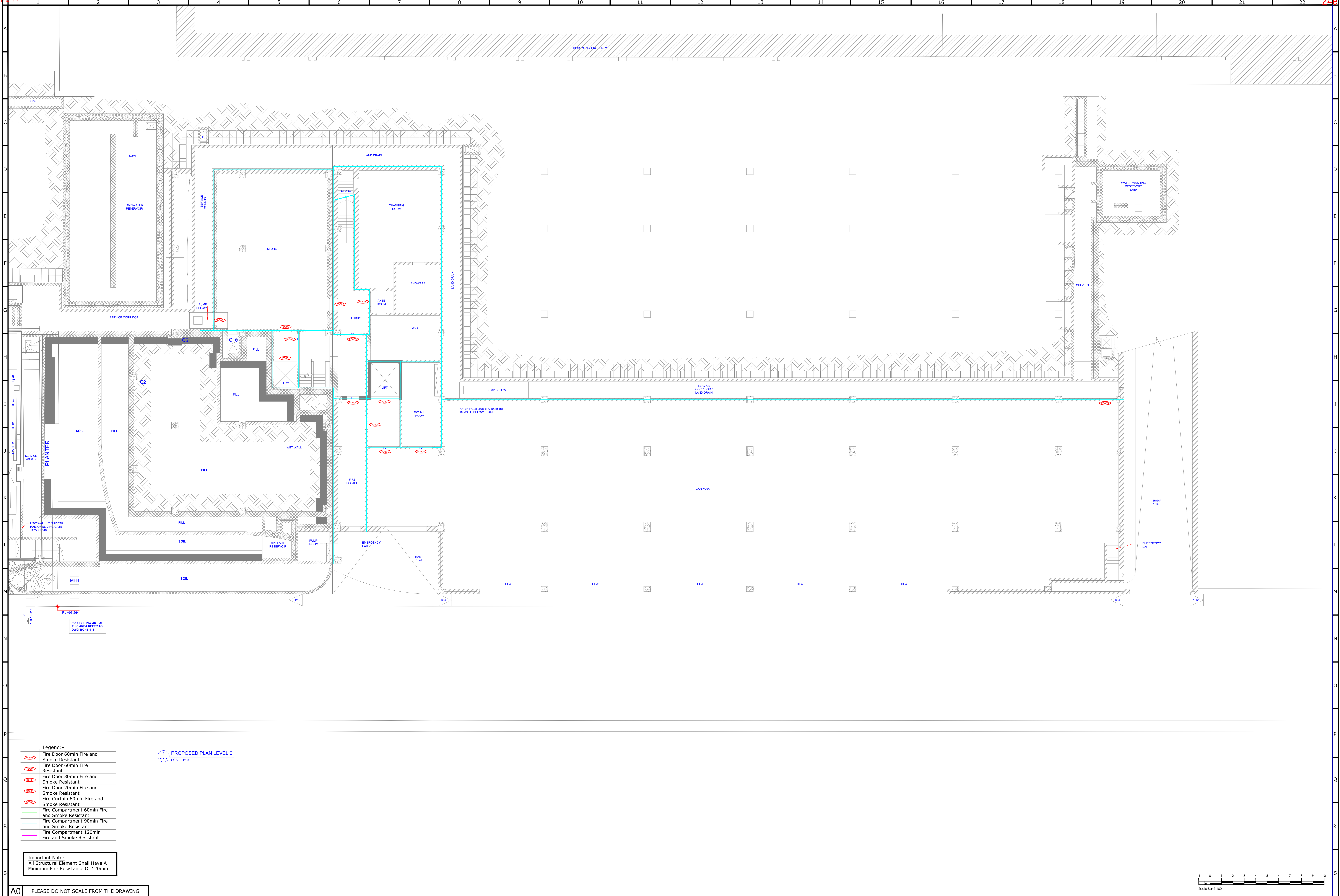


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## **Annex 5: Fabric Filter**



**AFA/M** - Return air grilles with inclined fins and filter

## AFA/M Return air grilles with inclined fins and filter

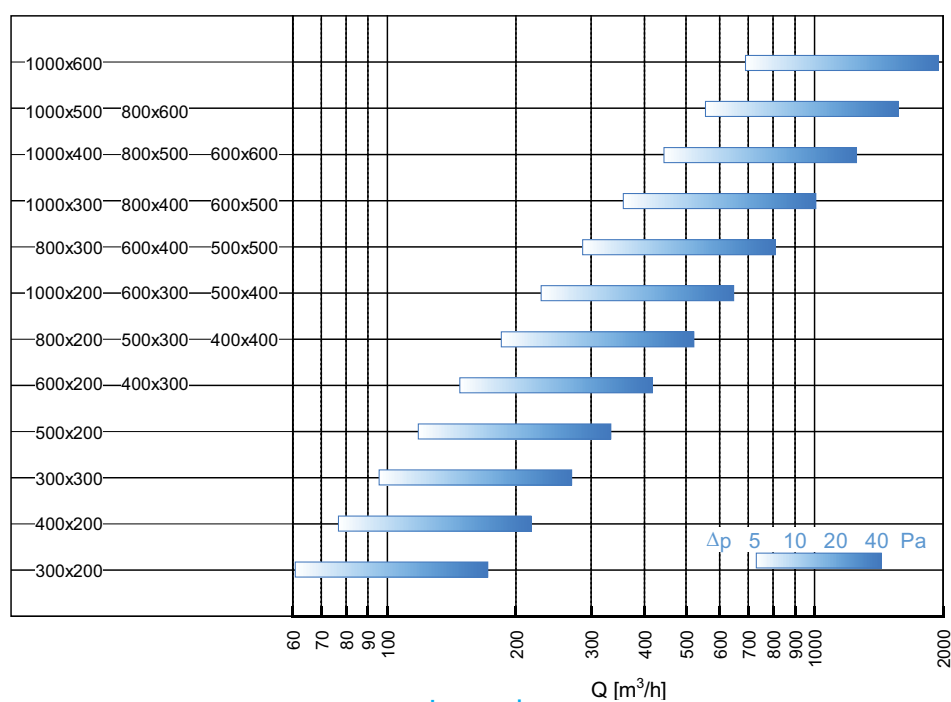


### Versions

- AFA/M (alluminio estruso)

The AFA/M series of return air grilles with fixed horizontally inclined fins with a pitch of 25 mm complete with filtering unit and “push-push” closing system have been designed to be installed in the interior of buildings for the return or the circulation of air, for small or medium airflow rates. The special shape of the fins also allows their use externally for the collection of fresh air, ventilation or the expulsion of stale air. The opening/closing click system is easy and compact to use by pushing the central part of the grille, which opens around the knuckle joints while the external counter frame hold steady. The AFA/M occurs without outstanding knobs and the strength of the system allows also a ceiling installation without risks of accidental release.

### Quick reference selection table



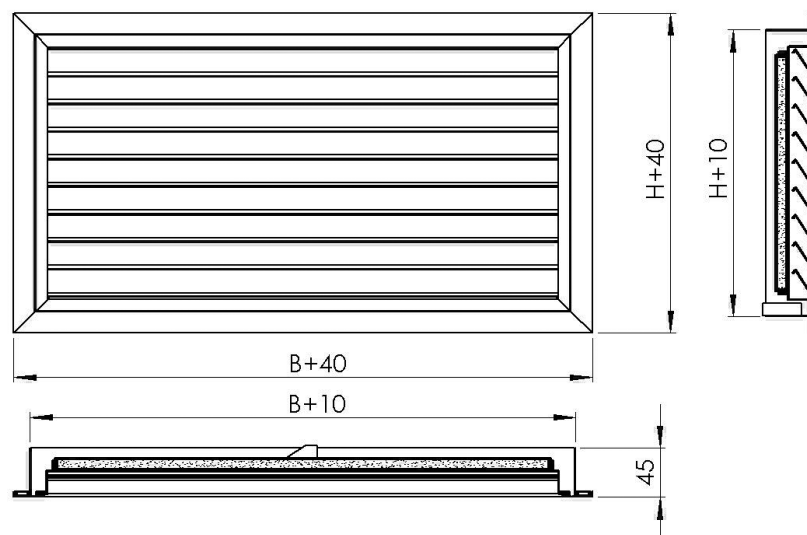
### Legend

Q [m³/h] o [l/s]      return air flow rate  
 BxH [mm]              nominal dimensions of the grille  
 Δp [Pa]                  pressure loss

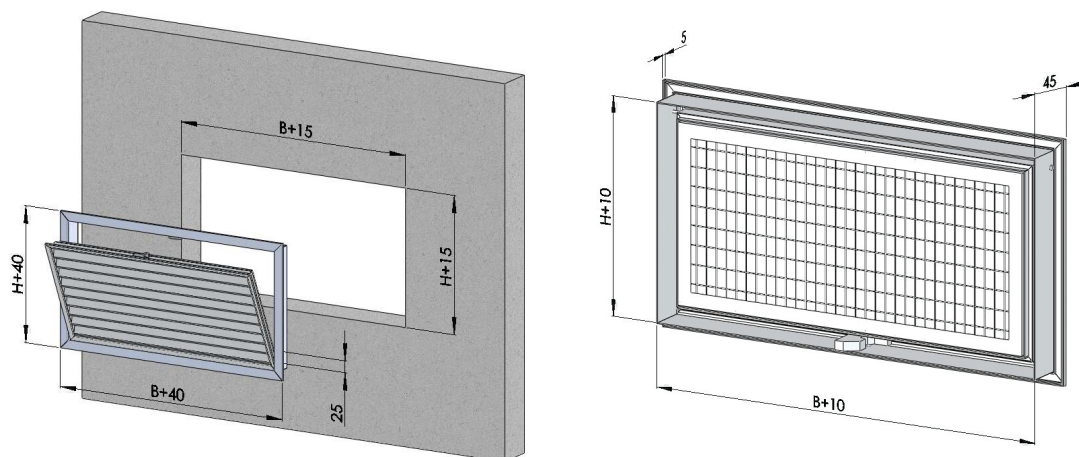


## Dimensions

### Section Dimensions



### 3D Dimensions



### Construction

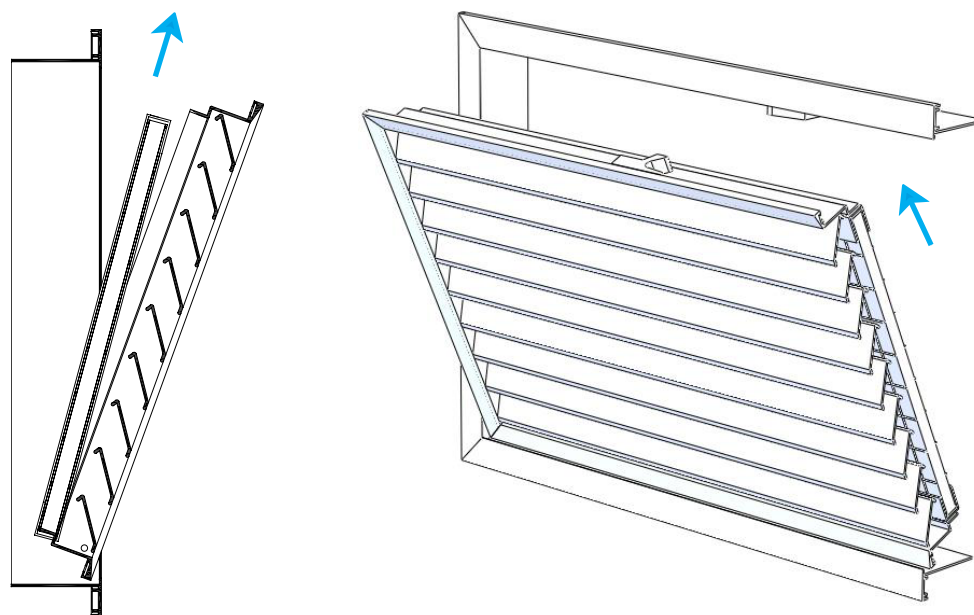
Standard construction of, the AFA/M series of grilles involves the use of natural anodised extruded aluminium.

#### Standard dimensions:

- For B from a minimum of 300 mm to a maximum of 1000 mm in increments of 50 mm
- For H from a minimum of 200 mm to a maximum of 600 mm in increments of 50 mm

For non-standard sizes please contact our technical office

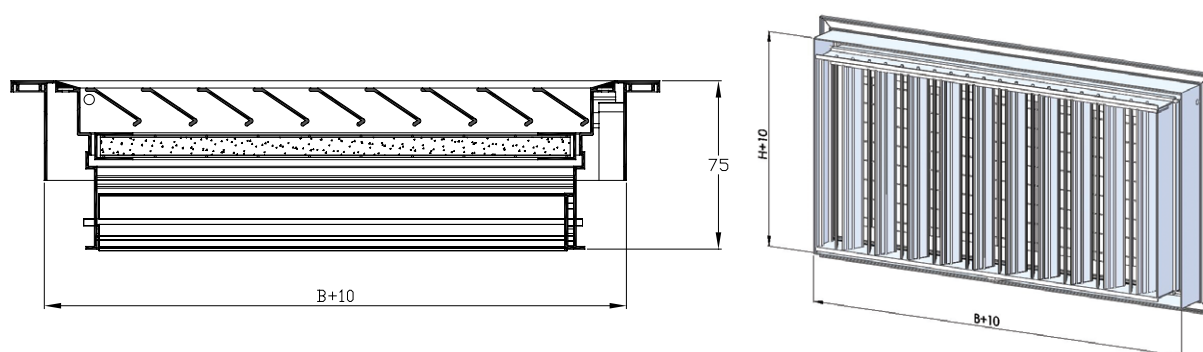
## Extraction of filter and opening



The opening/closing click system push-push type lets to open easily and quickly the central part of the grille, which rotates around the knuckle joints while the external counter frame hold steady, allowing an easier and compact extraction of the filter for the maintenance, the lot without knobs or other outstanding or visible parts.

## Accessories

### SC - opposed blade regulating damper



AFA/M with a counter-moving damper and fins parallel to the short side, made entirely of aluminium, operable by means of a screw-driver from the front part of the grille; on request it is possible to install either a proportional or an on/off servomotor.

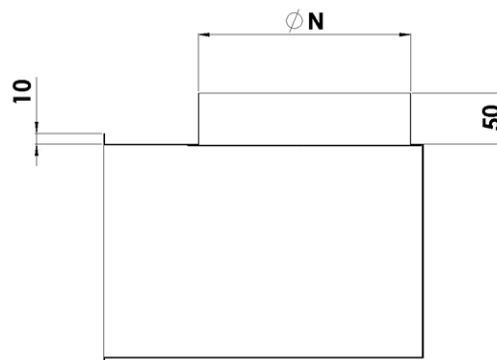
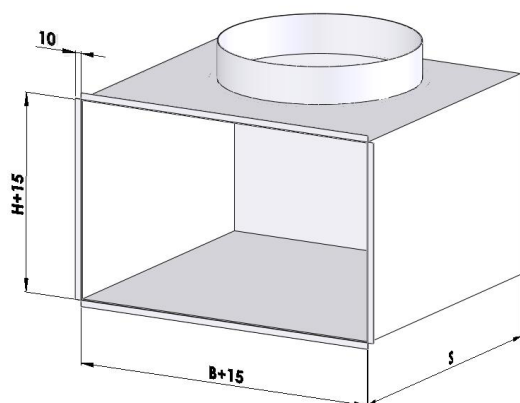
### Counterframes

CTC: counterframe for fitting onto ducts, made of Sendzimir zinc plated steel, (for the dimensions please see the "Fixing systems" section).

CTM: counterframe for fitting onto walls, made of Sendzimir zinc plated steel, (for the dimensions please see the "Fixing systems" section).

N.B. The sizes of the standard counterframes (CTC and CTM) must be  $(B+15) \times (H+15)$

## PS1-PSI1 plenum boxes

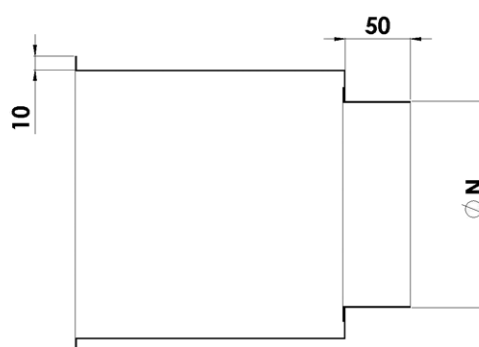
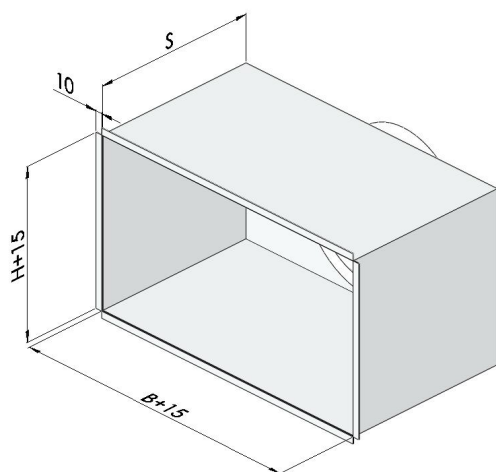


PS1-Standard plenum box made of Sendzimir zinc plated steel with side connection.

PSI1-Plenum box insulated with class 1 certified material (Ministerial Decree 26-6-1984 Article 8) made of Sendzimir zinc plated steel with side connection.

N.B. The sizes of the standard plenum boxes PS1 and PSI1 for the grilles with filter holders (AFA/M, BMQA/M, ...) must be  $(B+15) \times (H+15)$

## PS2-PSI2 plenum boxes



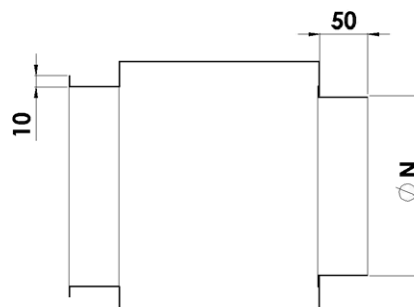
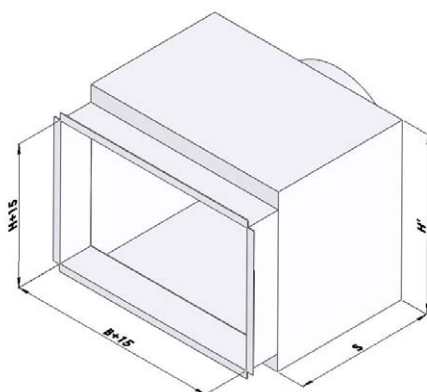
PS2-Standard plenum box made of Sendzimir zinc plated steel with rear connection.

PSI2-Plenum box insulated with class 1 certified material (Ministerial Decree 26-6-1984 Article 8) made of Sendzimir zinc plated steel with rear connection.

N.B. The sizes of the standard plenum boxes PS2 and PSI2 for the grilles with filter holders (AFA/M, BMQA/M, ...) must be  $(B+15) \times (H+15)$



## PS2M-PSI2M plenum boxes



PS2M-Standard plenum box made of Sendzimir zinc plated steel with rear connection.

PSI2M-Plenum box insulated with class 1 certified material (Ministerial Decree 26-6-1984 Article 8) made of Sendzimir zinc plated steel with rear connection.

N.B. The sizes of the standard plenum boxes PS2M and PSI2M for the grilles with filter holders (AFA/M, BMQA/M, ...) must be  $(B+15) \times (H+15)$

## Plenum box dimensions

PS1 - PS2M

| ØN  | 100     | 160     | 200     | 250      | 315      | 350      | 400      |
|-----|---------|---------|---------|----------|----------|----------|----------|
| S   | 200     | 260     | 300     | 350      | 415      | 450      | 500      |
| H'  | 150     | 210     | 250     | 300      | 365      | 400      | 450      |
| BxH | 200x100 | 300x100 | 500x100 | 800x100  | 800x150  | 900x200  | 900x300  |
|     | 250x100 | 350x100 | 600x100 | 900x100  | 900x150  | 1000x200 | 1000x300 |
|     |         | 400x100 | 300x150 | 1000x100 | 1000x150 | 500x300  | 800x400  |
|     |         | 200x150 | 350x150 | 500x150  | 600x200  | 600x300  |          |
|     |         | 250x150 | 400x150 | 600x150  | 700x200  | 700x300  |          |
|     |         | 200x200 | 250x200 | 700x150  | 800x200  | 800x300  |          |
|     |         |         | 300x200 | 400x200  | 400x300  | 500x400  |          |
|     |         |         |         | 500x200  |          | 600x400  |          |

PS2

| ØN  | 100      | 125      | 160     | 250     | No. connections |
|-----|----------|----------|---------|---------|-----------------|
| S   | 200      | 200      | 200     | 200     |                 |
| BXH | 200x100  | 300x150  | 250x200 | 400x300 | 1               |
|     | 250x100  | 350x150  | 300x200 | 500x300 |                 |
|     |          | 400x150  | 400x200 |         |                 |
|     | 300x100  | 500x150  | 500x200 |         | 2               |
|     | 350x100  | 600x150  | 600x200 |         |                 |
|     | 400x100  |          | 700x200 |         |                 |
|     | 500x100  |          | 800x200 |         |                 |
|     | 600x100  |          |         |         |                 |
|     | 700x100  | 700x150  |         |         | 3               |
|     | 800x100  | 800x150  |         |         |                 |
|     | 900x100  |          |         |         |                 |
|     | 1000x100 |          |         |         |                 |
|     |          | 900x150  |         |         | 4               |
|     |          | 1000x150 |         |         |                 |

## Technical data

### Effective outlet area

The effective outlet area is a notional area that, once the velocity of the air is known, makes it possible to arrive at the rate of flow that is actually passing through the grille. The measurement is carried out with an instrument that measures the velocity of the air at various points between the fins. The formula that links the various parameters is as follows:

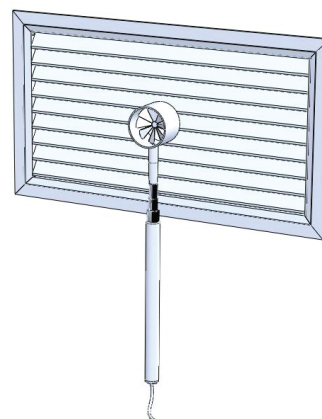
$$Q = v_k \times S \times 3600$$

where

Q = supply air flow rate [m<sup>3</sup>/h]

V<sub>k</sub> = velocity relating to S [m/s]

S = effective outlet area [m<sup>2</sup>]



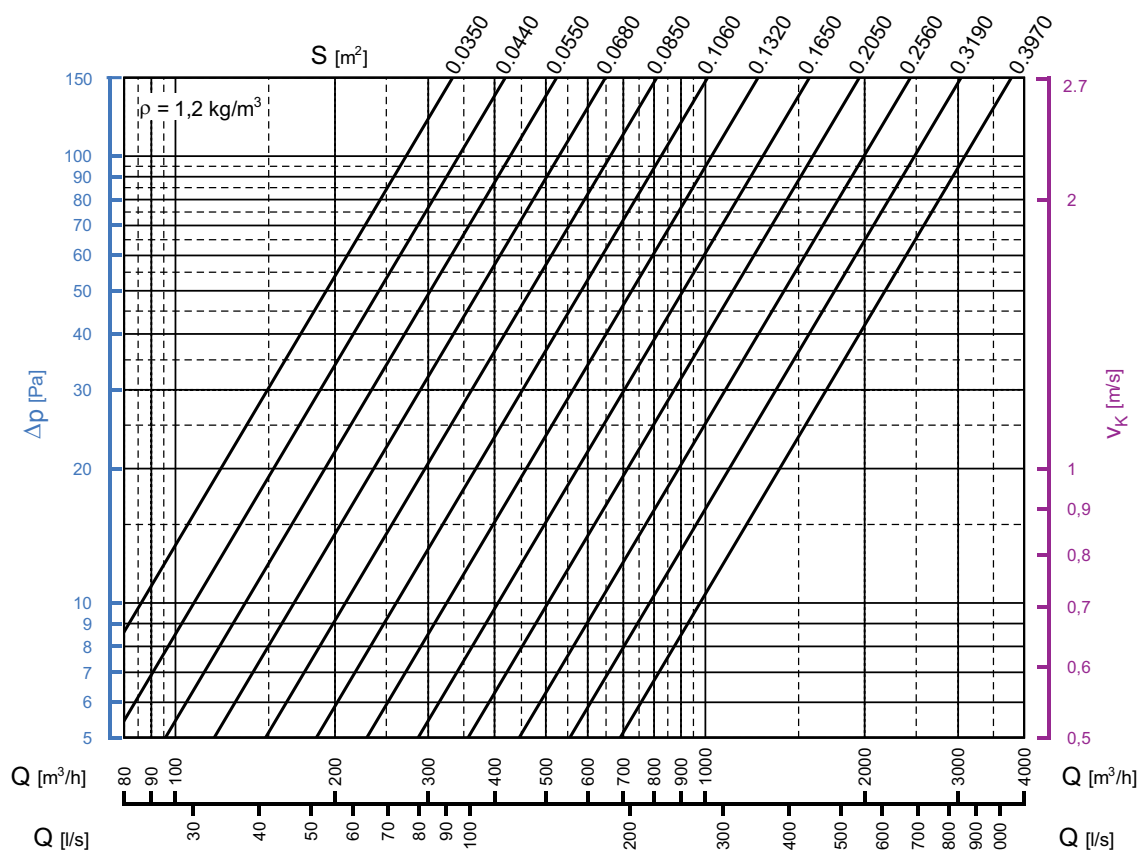
| H/B | 300     | 400     | 500     | 600     | 800     | 1000    |
|-----|---------|---------|---------|---------|---------|---------|
| 200 | • 0,035 | • 0,048 | • 0,06  | • 0,073 | 0,098   | 0,123   |
| 300 | 0,055   | • 0,074 | • 0,094 | • 0,114 | • 0,153 | • 0,192 |
| 400 | 0,074   | 0,101   | • 0,128 | • 0,154 | 0,207   | 0,260   |
| 500 | 0,094   | 0,128   | • 0,161 | • 0,195 | 0,262   | 0,329   |
| 600 | 0,114   | 0,154   | 0,195   | 0,235   | 0,316   | 0,397   |

- Standard sizes available from stock

### Weights (kg)

| H/B | 300 | 400 | 500 | 600 | 800 | 1000 |
|-----|-----|-----|-----|-----|-----|------|
| 200 | 0,8 | 1,0 | 1,2 | 1,3 | 1,7 | 2,0  |
| 300 | 1,0 | 1,3 | 1,5 | 1,7 | 2,1 | 2,6  |
| 400 | 1,3 | 1,5 | 1,8 | 2   | 2,6 | 3,1  |
| 500 | 1,5 | 1,8 | 2,1 | 2,4 | 3,0 | 3,6  |
| 600 | 1,7 | 2,0 | 2,4 | 2,7 | 3,4 | 4,1  |

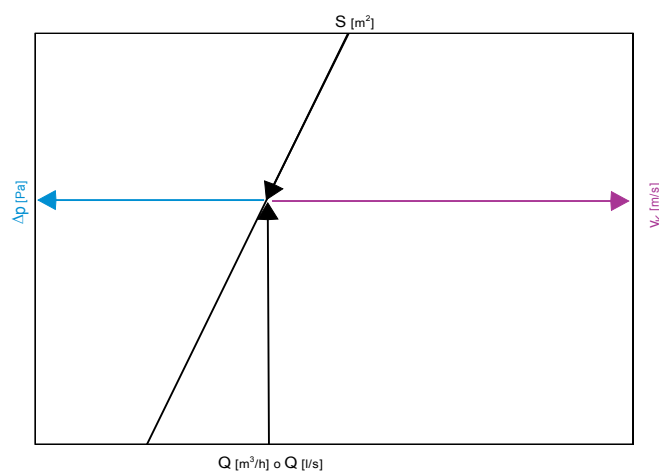
## Pressure loss



### Legend

|                         |                                                    |
|-------------------------|----------------------------------------------------|
| $Q$ [m <sup>3</sup> /h] | supply air flow rate                               |
| $S$ [m <sup>2</sup> ]   | effective outlet area                              |
| $v_k$ [m/s]             | velocity relating to the effective outlet area $S$ |
| $\Delta p$ [Pa]         | total pressure loss                                |

### Graphical operating chart



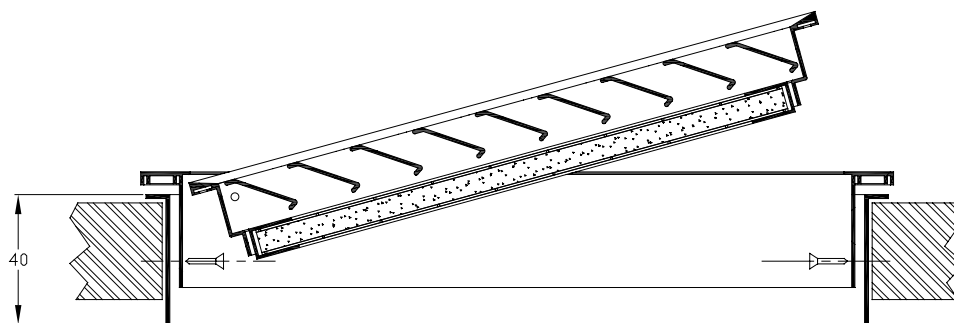


## Fixing systems

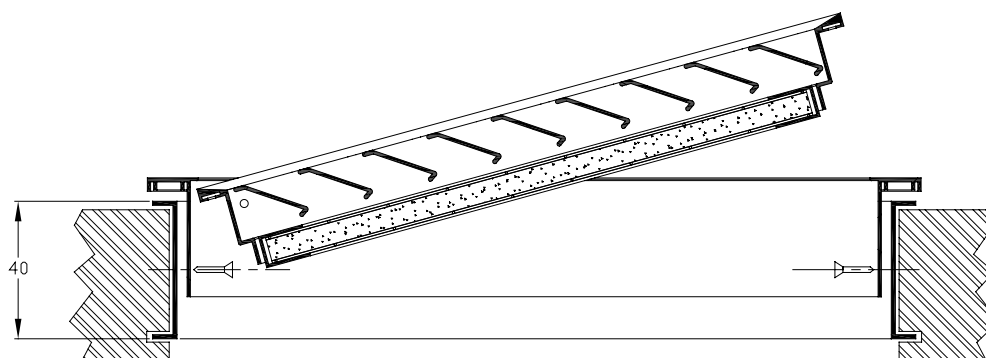
### Type of fixing

Fixing of AFA/M grilles is carried out by means of screws into the intern counterframe.

#### CTC- Fixing with screws



#### CTM- Fixing with screws



### Installazione

#### Installation on rectangular ducting:

- 1-Make a hole in the ducting size (B+15) (H+15)
- 2-Insert into the hole in the ducting a counterframe of the same size as the hole and secure it with screws or rivets
- 3-Secure the grille with screws

#### Wall installation with a plenum box:

- 1-Make a hole in the wall size (B+15) (H+15)
- 2-Embed the plenum box flush with the wall
- 3-Secure the grille with screws



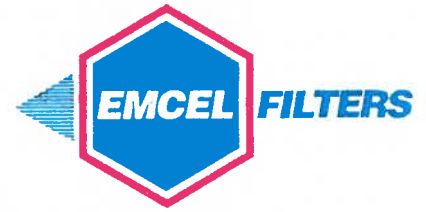
**tecno-ventil**  
componenti per impianti di climatizzazione

tecno-ventil s.p.a.  
Via Parma, 2  
26016 Spino d'Adda (CR)  
Tel. +39 0373.980456  
Fax +39 0373.980681  
[www.tecnoventil.com](http://www.tecnoventil.com)  
[info@tecnoventil.com](mailto:info@tecnoventil.com)





## **Annex 6: HEPA Filter Specification Sheets**



## CERTIFICATE OF CONFORMITY

**Batch No. 47235.01**

**Customer:** Nuova Guseo s.r.l.

**Order No:** 1372

**Drawing No:** E2234-40 Gr135 Issue 1

**Description:** Cylindrical Leaf Seal HEPA Filter

**Customer Ref:** CFE-H14-197D0300L-/RIF.CO.L59/CE (2 off)   
CFE-H14-197D0300L-/RIF.CO.L70/CE (3 off)

**Serial No:** 47235-01-01 to 47235-01-05

**Quantity:** 5 off

have been tested and/or inspected in accordance with the conditions and requirements of the contract or Purchase Order and unless otherwise noted conform in all respects to the specification(s) and drawing(s) relevant thereto.

**Signed:**

A blue ink signature of Mr J D Robson.

**Print Name:** Mr J D Robson

**Authorised by:**

A blue ink signature of Mr R Clark.

**Print Name:** Mr R Clark

**Date:** 09 February 2018

EMCEL Filters Limited is proud to be affiliated with:





## CERTIFICATE OF CONFORMITY

Batch No. 47235.03

**Customer:** Nuova Guseo s.r.l.

**Order No:** 1372

**Drawing No:** E2234-40 Gr134 Issue 1

**Description:** Cylindrical Leaf Seal HEPA Filter

**Customer Ref:** CFE-H14-236D0375L-/RIF.CO.L59/CE (1 off)   
CFE-H14-236D0375L-/RIF.CO.L70/CE (1 off)

**Serial No:** 47235-03-01 to 47235-03-02

**Quantity:** 2 off

have been tested and/or inspected in accordance with the conditions and requirements of the contract or Purchase Order and unless otherwise noted conform in all respects to the specification(s) and drawing(s) relevant thereto.

Signed:

A blue ink signature of Mr J D Robson.

Print Name: Mr J D Robson

Authorised by:

A blue ink signature of Mr R Clark.

Print Name: Mr R Clark

Date: 09 February 2018

EMCEL Filters Limited is proud to be affiliated with:







## CERTIFICATE OF TEST

**Customer:** Nuova Guseo s.r.l.

This is to certify that the item manufactured to your

**Order No:** 1372

**Drawing No:** E2234-40 Gr135 Issue 1

**Product Description:** Cylindrical Leaf Seal HEPA Filter

**EMCEL Batch No:** 47235.01

**Serial No:** 47235-01-02

Has been volumetrically tested to BS EN ISO 14644 Part 3 using an aerosol of Ondina oil

|                           |                                                  |
|---------------------------|--------------------------------------------------|
| Aerosol Airflow Test Rate | 74 cfm                                           |
| Type Of Aerosol           | Thermally generated poly dispersed ondina el oil |
| Challenge                 | 32 µg/l                                          |
| Penetration               | 0.0031 %                                         |
| Efficiency                | 99.9969 %                                        |
| Tested By                 | A. Macias                                        |
| Date of Test              | 08/02/18                                         |
| Instrument No             | Smoke Generator P636, Photometer P685            |
| Required Efficiency       | 99.995 %                                         |
| Pass/Fail                 | <b>PASS</b>                                      |

Signed

Mr J D Robson  
Quality Assurance Manager

Original to customer, copy to be retained by EMCEL Filters Limited. Details of results will be filed by batch number and held for 3 years.

EMCEL Filters Limited is proud to be affiliated with:

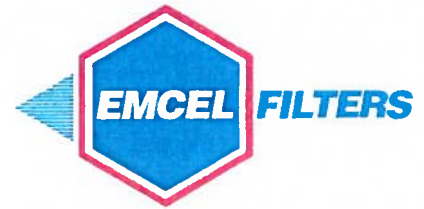


# EMCEL Filters Limited

Blatchford Road | Horsham | West Sussex | United Kingdom | RH13 5RA

Tel: (01403) 253215 | Fax: (01403) 259881

Email: [info@emcelfilters.co.uk](mailto:info@emcelfilters.co.uk) | Web: [www.emcelfilters.co.uk](http://www.emcelfilters.co.uk)



## CERTIFICATE OF TEST

**Customer:** Nuova Guseo s.r.l.

This is to certify that the item manufactured to your

**Order No:** 1372

**Drawing No:** E2234-40 Gr135 Issue 1

**Product Description:** Cylindrical Leaf Seal HEPA Filter

**EMCEL Batch No:** 47235.01

**Serial No:** 47235-01-01

Has been volumetrically tested to BS EN ISO 14644 Part 3 using an aerosol of Ondina oil

|                           |                                                  |
|---------------------------|--------------------------------------------------|
| Aerosol Airflow Test Rate | 74 cfm                                           |
| Type Of Aerosol           | Thermally generated poly dispersed ondina el oil |
| Challenge                 | 34 µg/l                                          |
| Penetration               | 0.0022 %                                         |
| Efficiency                | 99.9978 %                                        |
| Tested By                 | A. Macias                                        |
| Date of Test              | 08/02/18                                         |
| Instrument No             | Smoke Generator P636, Photometer P685            |
| Required Efficiency       | 99.995 %                                         |
| Pass/Fail                 | <b>PASS</b>                                      |

Signed

Mr J D Robson  
Quality Assurance Manager

Original to customer, copy to be retained by EMCEL Filters Limited. Details of results will be filed by batch number and held for 3 years.

EMCEL Filters Limited is proud to be affiliated with:



EMCEL FILTERS LIMITED IS A REGISTERED ISO9001 COMPANY – CERTIFICATE No FM24138

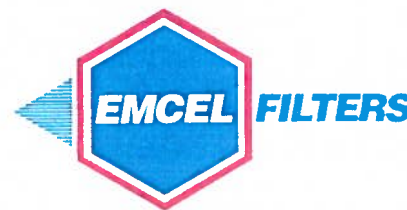
QAD103 REV003

# EMCEL Filters Limited

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Email: [info@emcelfilters.co.uk](mailto:info@emcelfilters.co.uk) | Web: [www.emcelfilters.co.uk](http://www.emcelfilters.co.uk)



## CERTIFICATE OF TEST

**Customer:** Nuova Guseo s.r.l.

This is to certify that the item manufactured to your

**Order No:** 1372

**Drawing No:** E2234-40 Gr134 Issue 1

**Product Description:** Cylindrical Leaf Seal HEPA Filter

**EMCEL Batch No:** 47235.03

**Serial No:** 47235-03-01

Has been volumetrically tested to BS EN ISO 14644 Part 3 using an aerosol of Ondina oil

|                           |                                                  |
|---------------------------|--------------------------------------------------|
| Aerosol Airflow Test Rate | 160 cfm                                          |
| Type Of Aerosol           | Thermally generated poly dispersed ondina el oil |
| Challenge                 | 46 µg/l                                          |
| Penetration               | 0.0037 %                                         |
| Efficiency                | 99.9963 %                                        |
| Tested By                 | A. Macias                                        |
| Date of Test              | 08/02/18                                         |
| Instrument No             | Smoke Generator P636, Photometer P685            |
| Required Efficiency       | 99.995 %                                         |
| Pass/Fail                 | PASS                                             |

Signed

Mr J D Robson  
Quality Assurance Manager

Original to customer, copy to be retained by EMCEL Filters Limited. Details of results will be filed by batch number and held for 3 years.

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QAD103 REV003





## **Annex 7: Carbon Filter Specification Sheet**

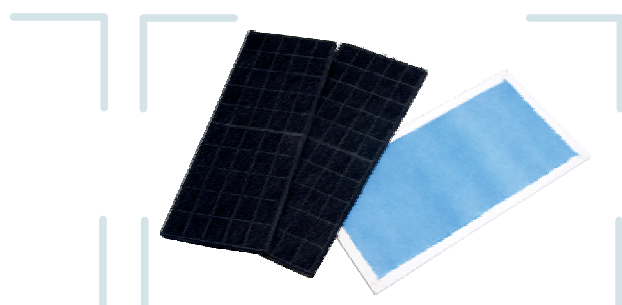
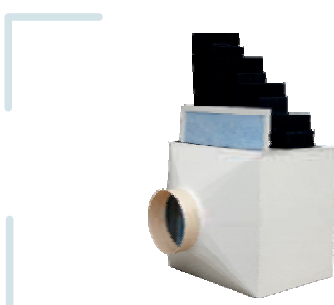
# PROJECTCARBO







# Indice



|                               |         |
|-------------------------------|---------|
| ProjectCARBO                  | pag. 2  |
| Carboni attivi                | pag. 4  |
| Cassonetti per filtri         | pag. 8  |
| Cassonetti doppia azione      | pag. 14 |
| Sistemi aspiranti e filtranti | pag. 20 |
| Prefiltri e carboni attivi    | pag. 21 |
| Filtri assoluti               | pag. 22 |

# PROJECTCARBO



La manipolazione di sostanze tossico-nocive implica la necessità di assicurare il contenimento di eventuali emissioni in ambiente, sia nel laboratorio che in atmosfera. Le normative GLP (Good Laboratory Practice) ed in generale quelle di tutela del personale nei luoghi di lavoro, pongono dei precisi limiti all'emissione di sostanze inquinanti.

I cassonetti PROJECTCARBO, grazie all'impiego di filtri a carbone attivo, consentono di purificare gli ambienti di lavoro da acidi, solventi ed altre sostanze nocive alla salute ed alla sicurezza dell'uomo.

Il loro utilizzo permette di proteggere sia il personale nei luoghi di lavoro che gli ambienti, ottenendo emissioni fumi pulite, con riferimento alle varie normative di sicurezza ambientale.

I cassonetti PROJECTCARBO, realizzati interamente in PVC, sono completi di un pre-filtro che trattiene la polvere ed allunga la vita delle lastre. Questa precauzione garantisce un notevole risparmio economico in quanto evita il precoce intasamento dei pori del carbone attivo. I cassonetti possono essere installati sia in posizione orizzontale che in posizione verticale, all'interno o all'esterno degli ambienti di lavoro.

La particolare disposizione delle lastre di carbone migliora l'efficienza dei filtri e riduce le perdite di carico totali. La possibilità di sovrapporre o affiancare più cassonetti permette di aumentare le portate migliorando il rendimento e quindi la quantità di sostanze tossiche assorbite.

La sostituzione delle lastre di carbone è semplice e non richiede particolari D.P.I. (Dispositivi di Protezione Individuale), la semplicità è dovuta anche al particolare rivestimento delle lastre che trattiene la micropolvere rilasciata dai granuli di carbone.



Esempio di installazione di un cassonetto PROJECTCARBO con elettroaspiratore





The manipulation of toxic and harmful substances implies the need to ensure containment of any emissions into the environment, both in the laboratory and in the atmosphere. GPL regulations (Good Laboratory Practice) and general rules of workers' protection give precise limits to the polluting emissions.

PROJECTCARBO filter boxes, through the use of activated carbon filters, help purify the workplace from: acids, solvents and other substances harmful to health and human safety. Their use allows to protect both the workers and the environment, getting clean smoke emissions, with reference to various standards of environmental safety.

PROJECTCARBO filter boxes are made entirely of PVC and they are equipped with a pre-filter that traps dust and extends the life of the plates. This precaution ensures significant cost savings because it avoids the premature pores clogging of the activated carbon.

The filter boxes can be installed both horizontally and vertically, inside or outside the workplace. The special charcoal plates arrangement improves the efficiency of the filters and reduces the total pressure loss.

The possibility of overlapping or putting side by side multiple filter boxes allows to increase the flow, improving the efficiency and therefore the quantity of absorbed toxic substances. The charcoal plates replacement is simple and does not require particular DPI (personal protective equipment): the simplicity is due also to the particular coating which restrains the micro-powder released from the granules of coal.



Esempio di installazione di un cassonetto PROJECTCARBO con elettroaspiratore



Granuli carbone attivo



Lastre carbone attivo



La filtrazione dell'aria mediante carboni attivi è un processo di depurazione largamente utilizzato in quasi tutti i settori produttivi.

Il processo di adsorbimento permette di trattenere le sostanze inquinanti sulla superficie dei granuli di carbone impregnati di specifiche sostanze chimiche.

La specifica sostanza agisce come un solvente ed elimina le sostanze inquinanti dall'aria filtrata.

PROJECT PLAST vanta un'esperienza decennale nella scelta e nel dimensionamento delle batterie filtranti a carbone attivo.

E' infatti fondamentale installare il numero di batterie filtranti in relazione alla portata d'aria ed anche al tipo di sostanza inquinante che si desidera eliminare.



The air filtration through activated charcoal is a purification process widely used in almost all industries.

The adsorption process allows to retain any pollutants on the charcoal granules impregnated with specific chemicals.

The specific substance acts as a solvent and eliminates the pollutants from the filtered air.

PROJECT PLAST has many years of experience in the selection and sizing of activated charcoal filtering batteries.

It is essential to install the number of filter packs in relation both to the air flow and to the type of pollutant that needs to be removed.

| A                  | SC | RZ | RS | RA | RK | RN | PUR |
|--------------------|----|----|----|----|----|----|-----|
| Acetaldeide        | ☹  |    |    |    | ☺  |    | ☺   |
| Acetica, anidride  | ☺  |    |    |    |    |    |     |
| Acetico, acido     | ☹  |    |    |    |    |    |     |
| Acetilene          | ☹  |    |    | ☺  | ☺  |    | ☺   |
| Aceto, odore di    | ☺  |    |    | ☺  |    |    |     |
| Acetone            | ☹  |    |    |    |    |    |     |
| Aceto nitrile      | ☹  |    |    |    |    |    |     |
| Acido bromidrico   |    |    |    | ☺  |    |    |     |
| Acido cianidrico   |    |    |    |    | ☺  |    |     |
| Acido cloridrico   |    |    |    | ☺  |    |    |     |
| Acido fluoridrico  |    |    |    | ☺  |    |    |     |
| Acido formico      | ☹  |    |    |    | ☺  |    |     |
| Acido fosforico    |    |    |    | ☺  |    |    |     |
| Acido iodidrico    |    |    |    | ☺  |    |    |     |
| Acido lattico      | ☺  |    |    |    |    |    |     |
| Acido nitrico      |    |    |    | ☺  |    |    |     |
| Acido palmitico    | ☺  |    |    |    |    |    |     |
| Acido propionico   | ☺  |    |    |    |    |    |     |
| Acido solforico    |    |    |    | ☺  |    |    |     |
| Acido urico        | ☺  |    |    |    |    |    |     |
| Acido valerico     | ☺  |    |    |    |    |    |     |
| Acrilico, acido    | ☺  |    |    |    |    |    |     |
| Acrilonitrile      | ☺  |    |    |    |    |    |     |
| Acroleina          | ☹  |    |    |    | ☺  |    |     |
| Adesivi            | ☺  |    |    |    |    |    | ☺   |
| Alcool metilico    | ☹  |    |    |    |    |    |     |
| Aldeide valerica   | ☺  |    |    |    |    |    |     |
| Allile, cloruro    | ☺  |    |    |    |    |    |     |
| Amile acetato      | ☺  |    |    |    |    |    |     |
| Amilico, alcol     | ☺  |    |    |    |    |    |     |
| Amilico, etere     | ☺  |    |    |    |    |    |     |
| Ammine             | ☹  |    |    |    |    | ☺  |     |
| Ammoniaca          |    |    |    |    |    | ☺  | ☺   |
| Anidride solforica |    |    |    | ☺  |    |    |     |
| Anidride solforosa |    |    |    | ☺  |    |    | ☺   |
| Anilina            | ☺  |    |    |    |    | ☺  | ☺   |
| Antisettici        | ☺  |    |    |    |    |    |     |
| Asfalto, vapori di | ☹  |    |    |    |    |    |     |
| Azoto ossidi di    | ☹  |    |    | ☹  |    |    |     |

- ☺ Alta capacità di adsorbimento.  
1 Kg di carbone attivo adsorbe la sostanza in misura dal 20 al 50% del proprio peso. Mediamente il 30%
- ☹ Media capacità di adsorbimento.  
1 Kg di carbone attivo adsorbe la sostanza in misura dal 10 al 25% del proprio peso. Mediamente il 15%
- ☹ Moderata capacità di adsorbimento.  
Può essere sufficiente in condizioni particolari.

| B                  | SC | RZ | RS | RA | RK | RN | PUR |
|--------------------|----|----|----|----|----|----|-----|
| Benzene            | ☺  |    |    |    |    |    |     |
| Benzina, vapori di | ☺  |    |    |    |    |    |     |
| Bromo              | ☺  |    |    |    |    |    |     |
| Butadiene          | ☹  |    |    |    |    |    |     |
| Butano             | ☹  |    |    |    |    |    |     |
| Butanone           | ☺  |    |    |    |    |    |     |
| Butil acetato      | ☺  |    |    |    |    |    |     |
| Butil alcool       | ☺  |    |    |    |    |    |     |
| Butilcellosolve    | ☺  |    |    |    |    |    |     |
| Butilcloruro       | ☺  |    |    |    |    |    |     |
| Butilene           | ☹  |    |    |    |    |    |     |
| Butiletere         | ☺  |    |    |    |    |    |     |
| Butirrica, aldeide | ☹  |    |    |    |    |    |     |
| Butirrico, acido   | ☺  |    |    |    |    |    |     |

| C                      | SC | RZ | RS | RA | RK | RN | PUR |
|------------------------|----|----|----|----|----|----|-----|
| Canfora                | ☺  |    |    |    |    |    |     |
| Caprilico, acido       | ☺  |    |    |    |    |    |     |
| Carbolico, acido       | ☺  |    |    |    |    |    | ☺   |
| Carbonica, anidride    | ☹  |    |    |    |    |    |     |
| Carbonio monossido     |    |    |    |    |    |    |     |
| Carbonio tetracloruro  | ☺  |    |    |    |    |    |     |
| Carbonio, solfuro      | ☺  |    |    |    |    |    |     |
| Carta macero, odore di | ☺  |    |    |    |    |    | ☺   |
| Catrame, odore di      | ☺  |    |    |    |    |    | ☺   |
| Cellosolve acetato     | ☺  |    |    |    |    |    |     |
| Cibo, aroma di         | ☺  |    |    |    |    |    | ☺   |
| Cicloesano             | ☺  |    |    |    |    |    |     |
| Cicloesanolo           | ☺  |    |    |    |    |    |     |
| Cicloesanone           | ☺  |    |    |    |    |    |     |
| Cicloesene             | ☺  |    |    |    |    |    |     |
| Cloro                  | ☹  |    |    |    |    |    |     |
| Clorobenzene           | ☺  |    |    |    |    |    |     |
| Clorobutadiene         | ☺  |    |    |    |    |    |     |
| Cloroformio            | ☺  |    |    |    |    |    |     |
| Cloronitropropano      | ☺  |    |    |    |    |    |     |
| Cloropicrina           | ☺  |    |    |    |    |    |     |
| Cloruro di metilene    | ☺  |    |    |    |    |    |     |
| Combustibili liquidi   | ☺  |    |    |    |    |    |     |
| Combustione odori      | ☹  |    |    |    |    |    | ☺   |
| Corpo, odore del       | ☺  |    |    |    |    |    | ☺   |
| Creosoto               | ☺  |    |    |    |    |    |     |
| Cresolo                | ☺  |    |    |    |    |    |     |
| Cucina, odori di       | ☺  |    |    |    |    |    | ☺   |

La presente lista ha carattere puramente indicativo e prescinde dalle condizioni operative: temperatura, pressione concentrazione, velocità del flusso e portata.



## D

|                         | SC | RZ | RS | RA | RK | RN | PUR |
|-------------------------|----|----|----|----|----|----|-----|
| Decano                  | ☺  |    |    |    |    |    |     |
| Detergenti              | ☺  |    |    |    |    |    |     |
| Dibromometano           | ☺  |    |    |    |    |    |     |
| Diciclopentadiene       | ☺  |    |    |    |    |    |     |
| Dicloro tetrafluoromet. | ☺  |    |    |    |    |    |     |
| Diclorobenzene          | ☺  |    |    |    |    |    |     |
| Diclorodifluorometano   | ☺  |    |    |    |    |    |     |
| Dicloroetano            | ☺  |    |    |    |    |    |     |
| Dicloroetilene          | ☺  |    |    |    |    |    |     |
| Dicloroetiletere        | ☺  |    |    |    |    |    |     |
| Dicloromonofluorom.     | ☺  |    |    |    |    |    |     |
| Dicloro-nitroetano      | ☺  |    |    |    |    |    |     |
| Dicloropropano          | ☺  |    |    |    |    |    |     |
| Dietil chetone          | ☺  |    |    |    |    |    |     |
| Dimetil anilina         | ☺  |    |    |    |    |    |     |
| Dimetilsolfato          | ☺  |    |    |    |    |    |     |
| Dimetilsolfuro          | ☺  | ☺  |    |    |    |    |     |
| Diossano                | ☺  |    |    |    |    |    |     |
| Dipropilchetone         | ☺  |    |    |    |    |    |     |

## E

|                   |   |   |  |  |  |  |   |
|-------------------|---|---|--|--|--|--|---|
| Epicloridrina     | ☺ |   |  |  |  |  |   |
| Eptano            | ☺ |   |  |  |  |  |   |
| Eptilene          | ☺ |   |  |  |  |  |   |
| Esano             | ☺ |   |  |  |  |  |   |
| Esene             | ☺ |   |  |  |  |  |   |
| Esino             | ☺ |   |  |  |  |  |   |
| Etano             |   |   |  |  |  |  |   |
| Etere etilico     | ☺ |   |  |  |  |  |   |
| Etil benzene      | ☺ |   |  |  |  |  |   |
| Etil mercaptano   |   | ☺ |  |  |  |  |   |
| Etil silicato     | ☺ |   |  |  |  |  |   |
| Etile acetato     | ☺ |   |  |  |  |  |   |
| Etile acrilato    | ☺ |   |  |  |  |  |   |
| Etile bromuro     | ☺ |   |  |  |  |  |   |
| Etile cloruro     | ☺ |   |  |  |  |  |   |
| Etile formiato    | ☺ |   |  |  |  |  |   |
| Etilen cloridrina | ☺ |   |  |  |  |  |   |
| Etilene           |   |   |  |  |  |  |   |
| Etilene dicloruro | ☺ |   |  |  |  |  | ☺ |
| Etilene ossido    | ☺ |   |  |  |  |  |   |
| Etilico, alcool   | ☺ |   |  |  |  |  |   |

## F

|                      | SC | RZ | RS | RA | RK | RN | PUR |
|----------------------|----|----|----|----|----|----|-----|
| Fenolo               | ☺  |    |    |    |    |    |     |
| Fertilizzanti        | ☺  |    |    |    |    |    |     |
| Foqna, odore di      | ☺  |    |    |    |    |    | ☺   |
| Formaldeide          | ☺  | ☺  |    |    | ☺  |    | ☺   |
| Fosgene              | ☺  |    |    |    |    |    |     |
| Freon 11             | ☺  |    |    |    |    |    |     |
| Freon 113            | ☺  |    |    |    |    |    |     |
| Freon 12             | ☺  |    |    |    |    |    |     |
| Frutta matura, odore | ☺  |    |    |    |    |    | ☺   |
| Frutta, essenze      | ☺  |    |    |    |    |    | ☺   |
| Fumi di combustione  | ☺  |    |    |    |    |    |     |

## G

|                     |   |  |  |  |   |  |   |
|---------------------|---|--|--|--|---|--|---|
| Gas tossici         | ☺ |  |  |  | ☺ |  |   |
| Gasolio, vapori di  | ☺ |  |  |  |   |  |   |
| Gomma, odore di     | ☺ |  |  |  |   |  | ☺ |
| Grassi lubrificanti | ☺ |  |  |  |   |  |   |

## I

|                      |   |   |  |  |  |  |   |
|----------------------|---|---|--|--|--|--|---|
| Idrogeno             |   |   |  |  |  |  |   |
| Idrogeno seleniato   |   | ☺ |  |  |  |  |   |
| Idrogeno solforato   |   | ☺ |  |  |  |  | ☺ |
| Inchiostri, odore di | ☺ |   |  |  |  |  | ☺ |
| Iodio                | ☺ |   |  |  |  |  |   |
| Iodoformio           | ☺ |   |  |  |  |  |   |
| Isopropile acetato   | ☺ |   |  |  |  |  |   |
| Isopropilico alcool  | ☺ |   |  |  |  |  |   |
| Isopropile cloruro   | ☺ |   |  |  |  |  |   |
| Isopropile etere     | ☺ |   |  |  |  |  |   |

## K

|          |   |  |  |  |  |  |  |
|----------|---|--|--|--|--|--|--|
| Kerosene | ☺ |  |  |  |  |  |  |
| Kripto   | ☺ |  |  |  |  |  |  |

## L

|                   |   |  |  |  |  |  |   |
|-------------------|---|--|--|--|--|--|---|
| Limone, essenza   | ☺ |  |  |  |  |  | ☺ |
| Liquori, odori di | ☺ |  |  |  |  |  | ☺ |
| Lisolo            | ☺ |  |  |  |  |  |   |

La presente lista ha carattere puramente indicativo e prescinde dalle condizioni operative: temperatura, pressione concentrazione, velocità del flusso e portata.

# Carboni attivi

# Activated Charcoal

## M

|                        | SC | RZ | RS | RA | RK | RN | PUR |
|------------------------|----|----|----|----|----|----|-----|
| Macello, odore di      | ☺  |    |    |    |    |    | ☺   |
| Mentolo                | ☺  |    |    |    |    |    | ☺   |
| Mercaptani             | ☺  |    |    |    |    |    | ☺   |
| Mercurio, vapori di    |    |    | ☺  |    |    |    |     |
| Mesitile ossido        | ☺  |    |    |    |    |    |     |
| Metano                 |    |    |    |    |    |    |     |
| Metil cellosolve       | ☺  |    |    |    |    |    |     |
| Metil cellosolve acet. | ☺  |    |    |    |    |    |     |
| Metil cicloesano       | ☺  |    |    |    |    |    |     |
| Metil cicloesanololo   | ☺  |    |    |    |    |    |     |
| Metil cicloesanonone   | ☺  |    |    |    |    |    |     |
| Metil cloroformio      | ☺  |    |    |    |    |    |     |
| Metil etere            | ☺  |    |    |    |    |    |     |
| Metil glicole          | ☺  |    |    |    |    |    |     |
| Metil mercaptano       |    | ☺  |    |    |    |    |     |
| Metil-butil chetone    | ☺  |    |    |    |    |    |     |
| Metile acetato         | ☺  |    |    |    |    |    |     |
| Metile acrilato        | ☺  |    |    |    |    |    |     |
| Metile bromuro         | ☺  |    |    |    |    |    |     |
| Metile cloruro         | ☺  |    |    |    |    |    |     |
| Metile formiato        | ☺  |    |    |    |    |    |     |
| Metil-etil chetone     | ☺  |    |    |    |    |    |     |
| Metil-isobutil chetone | ☺  |    |    |    |    |    |     |
| Metilmetacri. estere   | ☺  |    |    |    |    |    |     |
| Monoclorobenzene       | ☺  |    |    |    |    |    |     |
| Monofluoro tricl.met.  | ☺  |    |    |    |    |    |     |

## N

|                |   |  |  |  |  |  |   |
|----------------|---|--|--|--|--|--|---|
| Nafta          | ☺ |  |  |  |  |  |   |
| Naftalene      | ☺ |  |  |  |  |  |   |
| Nicotina       | ☺ |  |  |  |  |  | ☺ |
| Nitrobenzene   | ☺ |  |  |  |  |  |   |
| Nitroetano     | ☺ |  |  |  |  |  |   |
| Nitroglicerina | ☺ |  |  |  |  |  |   |
| Nitrometano    | ☺ |  |  |  |  |  |   |
| Nitropropano   | ☺ |  |  |  |  |  |   |
| Nitrotoluene   | ☺ |  |  |  |  |  |   |
| Nonano         | ☺ |  |  |  |  |  |   |

## O

|                    |   |  |  |  |  |  |   |
|--------------------|---|--|--|--|--|--|---|
| Oli lubrificanti   | ☺ |  |  |  |  |  |   |
| Ospedale, odore di | ☺ |  |  |  |  |  | ☺ |
| Ottana             | ☺ |  |  |  |  |  |   |
| Ottene             | ☺ |  |  |  |  |  |   |
| Ozono              | ☺ |  |  |  |  |  |   |

## P

|                      | SC | RZ | RS | RA | RK | RN | PUR |
|----------------------|----|----|----|----|----|----|-----|
| Para-dicloro benzene | ☺  |    |    |    |    |    |     |
| Pentano              | ☺  |    |    |    |    |    |     |
| Pentanone            | ☺  |    |    |    |    |    |     |
| Pentilene            | ☺  |    | ☺  |    |    |    |     |
| Pentino              | ☺  |    |    |    |    |    |     |
| Percloroetilene      | ☺  |    |    |    |    |    |     |
| Pesce, odore di      | ☺  |    |    |    |    |    | ☺   |
| Pesticidi            | ☺  |    |    |    |    |    |     |
| Propano              | ☺  |    |    |    |    |    |     |
| Propil acetato       | ☺  |    |    |    |    |    |     |
| Propil alcool        | ☺  |    |    |    |    |    |     |
| Propil etere         | ☺  |    |    |    |    |    |     |
| Propil mercaptano    | ☺  | ☺  |    |    |    |    |     |
| Propile cloruro      | ☺  |    |    |    |    |    |     |
| Propionaldeide       | ☺  |    |    |    |    |    |     |

## S

|                    |   |  |  |  |  |  |   |
|--------------------|---|--|--|--|--|--|---|
| Sangue, odore di   | ☺ |  |  |  |  |  | ☺ |
| Sigarette, fumo di | ☺ |  |  |  |  |  | ☺ |
| Stirene monomero   | ☺ |  |  |  |  |  |   |

## T

|                      |   |  |  |  |  |  |  |
|----------------------|---|--|--|--|--|--|--|
| Tiofene              | ☺ |  |  |  |  |  |  |
| Toluen di-isocianato | ☺ |  |  |  |  |  |  |
| Toluene              | ☺ |  |  |  |  |  |  |
| Trementina           | ☺ |  |  |  |  |  |  |
| Tricloro etilene     | ☺ |  |  |  |  |  |  |
| Tricloroetano        | ☺ |  |  |  |  |  |  |

## U

|      |   |  |  |  |  |  |  |
|------|---|--|--|--|--|--|--|
| Urea | ☺ |  |  |  |  |  |  |
|------|---|--|--|--|--|--|--|

## V

|                       |   |  |  |  |  |  |  |
|-----------------------|---|--|--|--|--|--|--|
| Vernice, vapori di    | ☺ |  |  |  |  |  |  |
| Vinile acetato        | ☺ |  |  |  |  |  |  |
| Vinile cloruro monom. | ☺ |  |  |  |  |  |  |

## X

|        |   |  |  |  |  |  |  |
|--------|---|--|--|--|--|--|--|
| Xeno   | ☺ |  |  |  |  |  |  |
| Xilene | ☺ |  |  |  |  |  |  |



I cassonetti per le batterie filtranti sono realizzati in PVC, materiale in grado di resistere agli agenti chimici ed atmosferici.

Sono costruiti in diverse misure per contenere il numero di batterie filtranti necessarie in relazione alla portata d'aria.

Il pre-filtro installato all'ingresso trattiene la polvere, prolungando la vita dei filtri a carbone attivo.

I flussi aerodinamici dei cassonetti sono stati ottimizzati per ridurre le perdite di carico.



The filter boxes are made of PVC, a material capable of withstanding the chemical and atmospheric agents.

They are manufactured in different sizes to accommodate the necessary number of filtering batteries in relation to the air flow.

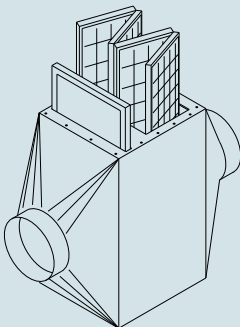
The pre-filter installed at the inlet traps dust to extend the life of the activated carbon filters.

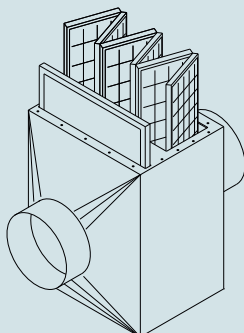
The aerodynamic flows of filter boxes have been optimized to reduce the load losses.

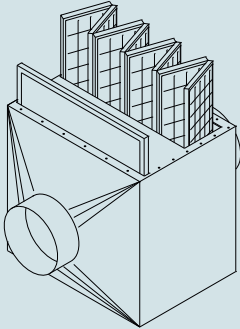


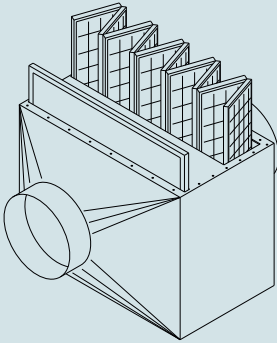
Cassonetti completo di lastre a carbone attivo e prefiltro antipolvere opzionale.

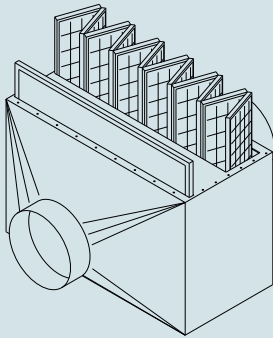


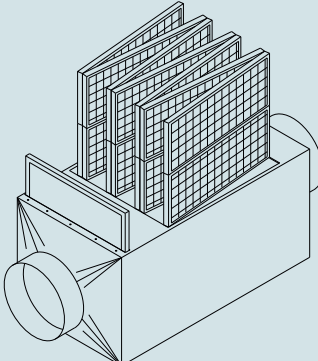
| Cassonetto 04                                                                     |        | 600 mc/h                                                                                                                                                                                       | Filter Box 04                                                                                                                                                                    |
|-----------------------------------------------------------------------------------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Codice / Item                                                                     |        | Cassonetto filtri a carboni attivi, realizzato interamente in PVC bianco, idoneo per portate fino a 600 mc/h.<br><br>Il codice comprende:<br><br>n. 1 cassonetto<br>n. 4 filtri carbone attivo | Filter box for activated charcoal, interely made of white PVC, suitable for airflows until 600 mc/h.<br><br>The item contains:<br><br>n. 1 filter box<br>n. 4 activated charcoal |
| Acidi / Acids                                                                     | PCPR04 |                                                                                                                                                                                                |                                                                                                                                                                                  |
| Solventi / Solvent                                                                | PCPN04 |                                                                                                                                                                                                |                                                                                                                                                                                  |
|  |        |                                                                                                                                                                                                |                                                                                                                                                                                  |
| Dimensioni / Dimensions                                                           |        | Accessori a richiesta:                                                                                                                                                                         | Accessories on request:                                                                                                                                                          |
| 750x320x590 mm<br>Ø 200 mm                                                        |        | - prefiltro antipolvere PFP004<br>- Kit supporti per cassonetto PCPSPC4                                                                                                                        | - dustproof prefilter PFP004<br>- filter Box support KIT PCPSPC4                                                                                                                 |

| Cassonetto 06                                                                       |        | 900 mc/h                                                                                                                                                                                       | Filter Box 06                                                                                                                                                                    |
|-------------------------------------------------------------------------------------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Codice / Item                                                                       |        | Cassonetto filtri a carboni attivi, realizzato interamente in PVC bianco, idoneo per portate fino a 900 mc/h.<br><br>Il codice comprende:<br><br>n. 1 cassonetto<br>n. 6 filtri carbone attivo | Filter box for activated charcoal, interely made of white PVC, suitable for airflows until 900 mc/h.<br><br>The item contains:<br><br>n. 1 filter box<br>n. 6 activated charcoal |
| Acidi / Acids                                                                       | PCPR06 |                                                                                                                                                                                                |                                                                                                                                                                                  |
| Solventi / Solvent                                                                  | PCPN06 |                                                                                                                                                                                                |                                                                                                                                                                                  |
|  |        | Accessori a richiesta:<br><br>- prefiltro antipolvere PFP006<br>- Kit supporti per cassonetto PCPSPC6                                                                                          | Accessories on request:<br><br>- dustproof prefilter PFP006<br>- filter Box support KIT PCPSPC6                                                                                  |
| Dimensioni / Dimensions                                                             |        |                                                                                                                                                                                                |                                                                                                                                                                                  |
| 750x470x590 mm<br>Ø 250 mm                                                          |        |                                                                                                                                                                                                |                                                                                                                                                                                  |

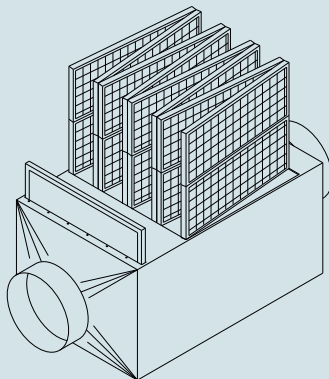
| Cassonetto 08                                                                                         |  | 1200 mc/h                                                                                                                                                                                       | Filter Box 08                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Codice / Item</b><br><b>Acidi / Acids</b> <b>PCPR08</b><br><b>Solventi / Solvent</b> <b>PCPN08</b> |  | Cassonetto filtri a carboni attivi, realizzato interamente in PVC bianco, idoneo per portate fino a 1200 mc/h.<br><br>Il codice comprende:<br><br>n. 1 cassonetto<br>n. 8 filtri carbone attivo | Filter box for activated charcoal, interely made of white PVC, suitable for airflows until 1200 mc/h.<br><br>The item contains:<br><br>n. 1 filter box<br>n. 8 activated charcoal |
|                      |  | Accessori a richiesta:<br><br>- prefiltro antipolvere                      PFP008<br>- Kit supporti per cassonetto    PCPSPC8                                                                   | Accessories on request:<br><br>- dustproof prefilter                      PFP008<br>- filter Box support KIT                PCPSPC8                                               |
| <b>Dimensioni / Dimensions</b><br><br>850x620x590 mm<br>Ø 250 mm                                      |  |                                                                                                                                                                                                 |                                                                                                                                                                                   |

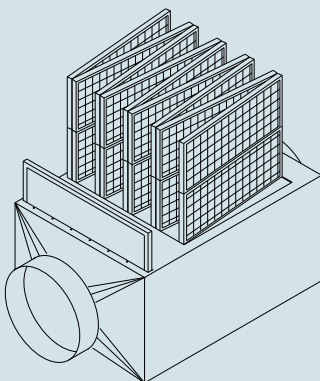
| Cassonetto 10                                                                                         |  | 1500 mc/h                                                                                                                                                                                        | Filter Box 10                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Codice / Item</b><br><b>Acidi / Acids</b> <b>PCPR10</b><br><b>Solventi / Solvent</b> <b>PCPN10</b> |  | Cassonetto filtri a carboni attivi, realizzato interamente in PVC bianco, idoneo per portate fino a 1500 mc/h.<br><br>Il codice comprende:<br><br>n. 1 cassonetto<br>n. 10 filtri carbone attivo | Filter box for activated charcoal, interely made of white PVC, suitable for airflows until 1500 mc/h.<br><br>The item contains:<br><br>n. 1 filter box<br>n. 10 activated charcoal |
|                    |  | Accessori a richiesta:<br><br>- prefiltro antipolvere                      PFP010<br>- Kit supporti per cassonetto    PCPSPC10                                                                   | Accessories on request:<br><br>- dustproof prefilter                      PFP010<br>- filter Box support KIT                PCPSPC10                                               |
| <b>Dimensioni / Dimensions</b><br><br>950x770x590 mm<br>Ø 315 mm                                      |  |                                                                                                                                                                                                  |                                                                                                                                                                                    |

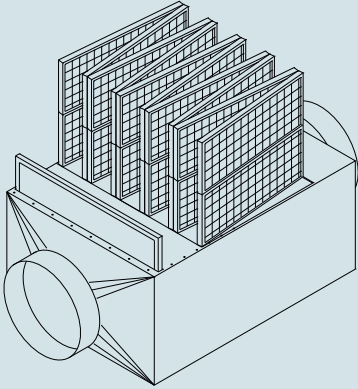
| Cassonetto 12                                                                     |        | 1800 mc/h                                                                                                                                                                                        | Filter Box 12                                                                                                                                                                      |
|-----------------------------------------------------------------------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Codice / Item                                                                     |        | Cassonetto filtri a carboni attivi, realizzato interamente in PVC bianco, idoneo per portate fino a 1800 mc/h.<br><br>Il codice comprende:<br><br>n. 1 cassonetto<br>n. 12 filtri carbone attivo | Filter box for activated charcoal, interely made of white PVC, suitable for airflows until 1800 mc/h.<br><br>The item contains:<br><br>n. 1 filter box<br>n. 12 activated charcoal |
| Acidi / Acids                                                                     | PCPR12 |                                                                                                                                                                                                  |                                                                                                                                                                                    |
| Solventi / Solvent                                                                | PCPN12 |                                                                                                                                                                                                  |                                                                                                                                                                                    |
|  |        |                                                                                                                                                                                                  |                                                                                                                                                                                    |
| Dimensioni / Dimensions                                                           |        | Accessori a richiesta:                                                                                                                                                                           | Accessories on request:                                                                                                                                                            |
| 1050x920x590 mm<br>Ø 315 mm                                                       |        | - prefiltro antipolvere PFP012<br>- Kit supporti per cassonetto PCPSPC12                                                                                                                         | - dustproof prefilter PFP012<br>- filter Box support KIT PCPSPC12                                                                                                                  |

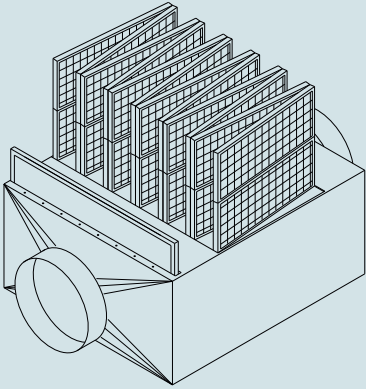
| Cassonetto 14                                                                       |        | 2100 mc/h                                                                                                                                                                                        | Filter Box 14                                                                                                                                                                      |
|-------------------------------------------------------------------------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Codice / Item                                                                       |        | Cassonetto filtri a carboni attivi, realizzato interamente in PVC bianco, idoneo per portate fino a 2100 mc/h.<br><br>Il codice comprende:<br><br>n. 1 cassonetto<br>n. 14 filtri carbone attivo | Filter box for activated charcoal, interely made of white PVC, suitable for airflows until 2100 mc/h.<br><br>The item contains:<br><br>n. 1 filter box<br>n. 14 activated charcoal |
| Acidi / Acids                                                                       | PCPR14 |                                                                                                                                                                                                  |                                                                                                                                                                                    |
| Solventi / Solvent                                                                  | PCPN14 | Accessori a richiesta:<br><br>- prefiltro antipolvere PFP014<br>- Kit supporti per cassonetto PCPSPC14                                                                                           | Accessories on request:<br><br>- dustproof prefilter PFP014<br>- filter Box support KIT PCPSPC14                                                                                   |
|  |        |                                                                                                                                                                                                  |                                                                                                                                                                                    |
| Dimensioni / Dimensions                                                             |        |                                                                                                                                                                                                  |                                                                                                                                                                                    |
| 1350x545x490 mm<br>Ø 315 mm                                                         |        |                                                                                                                                                                                                  |                                                                                                                                                                                    |



| Cassonetto 16                                                                     |        | 2400 mc/h                                                                                                                                                                                        | Filter Box 16                                                                                                                                                                      |
|-----------------------------------------------------------------------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Codice / Item                                                                     |        | Cassonetto filtri a carboni attivi, realizzato interamente in PVC bianco, idoneo per portate fino a 2400 mc/h.<br><br>Il codice comprende:<br><br>n. 1 cassonetto<br>n. 16 filtri carbone attivo | Filter box for activated charcoal, interely made of white PVC, suitable for airflows until 2400 mc/h.<br><br>The item contains:<br><br>n. 1 filter box<br>n. 16 activated charcoal |
| Acidi / Acids                                                                     | PCPR16 |                                                                                                                                                                                                  |                                                                                                                                                                                    |
| Solventi / Solvent                                                                | PCPN16 |                                                                                                                                                                                                  |                                                                                                                                                                                    |
|  |        |                                                                                                                                                                                                  |                                                                                                                                                                                    |
| Dimensioni / Dimensions                                                           |        | Accessori a richiesta:                                                                                                                                                                           | Accessories on request:                                                                                                                                                            |
| 1350x620x490 mm<br>Ø 315 mm                                                       |        | - prefiltro antipolvere PFP016<br>- Kit supporti per cassonetto PCPSPC16                                                                                                                         | - dustproof prefilter PFP016<br>- filter Box support KIT PCPSPC16                                                                                                                  |

| Cassonetto 18                                                                       |        | 2700 mc/h                                                                                                                                                                                       | Filter Box 18                                                                                                                                                                     |
|-------------------------------------------------------------------------------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Codice / Item                                                                       |        | Cassonetto filtri a carboni attivi, realizzato interamente in PVC bianco, idoneo per portate fino a 900 mc/h.<br><br>Il codice comprende:<br><br>n. 1 cassonetto<br>n. 18 filtri carbone attivo | Filter box for activated charcoal, interely made of white PVC, suitable for airflows until 900 mc/h.<br><br>The item contains:<br><br>n. 1 filter box<br>n. 18 activated charcoal |
| Acidi / Acids                                                                       | PCPR18 |                                                                                                                                                                                                 |                                                                                                                                                                                   |
| Solventi / Solvent                                                                  | PCPN18 |                                                                                                                                                                                                 |                                                                                                                                                                                   |
|  |        | Accessori a richiesta:<br><br>- prefiltro antipolvere PFP018<br>- Kit supporti per cassonetto PCPSPC18                                                                                          | Accessories on request:<br><br>- dustproof prefilter PFP018<br>- filter Box support KIT PCPSPC18                                                                                  |
| Dimensioni / Dimensions                                                             |        |                                                                                                                                                                                                 |                                                                                                                                                                                   |
| 1350x695x490 mm<br>Ø 400 mm                                                         |        |                                                                                                                                                                                                 |                                                                                                                                                                                   |

| Cassonetto 20                                                                                         |  | 3000 mc/h                                                                                                                                                                                        | Filter Box 20                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Codice / Item</b><br><b>Acidi / Acids</b> <b>PCPR20</b><br><b>Solventi / Solvent</b> <b>PCPN20</b> |  | Cassonetto filtri a carboni attivi, realizzato interamente in PVC bianco, idoneo per portate fino a 3000 mc/h.<br><br>Il codice comprende:<br><br>n. 1 cassonetto<br>n. 20 filtri carbone attivo | Filter box for activated charcoal, interely made of white PVC, suitable for airflows until 3000 mc/h.<br><br>The item contains:<br><br>n. 1 filter box<br>n. 20 activated charcoal |
|                      |  | <b>Accessori a richiesta:</b><br><br>- prefiltro antipolvere                      PFP020<br>- Kit supporti per cassonetto    PCPSPC20                                                            | <b>Accessories on request:</b><br><br>- dustproof prefilter                      PFP020<br>- filter Box support KIT                PCPSPC20                                        |
| <b>Dimensioni / Dimensions</b><br><br>1450x770x490 mm<br>Ø 400 mm                                     |  |                                                                                                                                                                                                  |                                                                                                                                                                                    |

| Cassonetto 24                                                                                         |  | 3600 mc/h                                                                                                                                                                                       | Filter Box 24                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Codice / Item</b><br><b>Acidi / Acids</b> <b>PCPR24</b><br><b>Solventi / Solvent</b> <b>PCPN24</b> |  | Cassonetto filtri a carboni attivi, realizzato interamente in PVC bianco, idoneo per portate fino a 3600 mc/h.<br><br>Il codice comprende:<br><br>n. 1 cassonetto<br>n. 6 filtri carbone attivo | Filter box for activated charcoal, interely made of white PVC, suitable for airflows until 3600 mc/h.<br><br>The item contains:<br><br>n. 1 filter box<br>n. 6 activated charcoal |
|                     |  | <b>Accessori a richiesta:</b><br><br>- prefiltro antipolvere                      PFP024<br>- Kit supporti per cassonetto    PCPSPC24                                                           | <b>Accessories on request:</b><br><br>- dustproof prefilter                      PFP024<br>- filter Box support KIT                PCPSPC24                                       |
| <b>Dimensioni / Dimensions</b><br><br>1450x920x490 mm<br>Ø 400 mm                                     |  |                                                                                                                                                                                                 |                                                                                                                                                                                   |



I cassonetti con doppia batteria filtrante permettono di ridurre le emissioni inquinanti utilizzando due diverse tipologie di batterie.

Grazie a questa duplice opzione è possibile installare filtri con diversi agenti adsorbenti aumentando quindi l'efficacia dell'abbattimento.

Ad esempio, è quindi possibile installare batterie filtranti per vapori acidi nel primo stadio e vapori di mercurio nel secondo.

Alternativamente è possibile applicare un filtro assoluto ed eliminare successivamente possibili residui di solventi.

Opzionalmente è possibile installare un pre-filtro antipolvere per ridurre l'intasamento dei pori dei carboni.



The filter boxes with dual filtering battery can reduce emissions by using two different types of barrier.

Thanks to this double option it is possible to install filters with different adsorbents and to increase the efficiency.

For example, it is possible to install filtering batteries for acid vapours in the first stage and mercury vapours in the second one.

Alternatively, it is possible to apply a HEPA filter and then remove any possible residues of solvents.

Moreover, there is even the possibility to install a pre-filter to reduce pores clogging of the activated carbon.



Cassonetto PROJECTCARBO con doppia barriera filtrante e prefiltro opzionale



# Cassonetti per rischio chimico e batteriologico



Particolare attenzione meritano i cassonetti per filtrazioni combinate: filtri HEPA + carboni attivi.

I filtri HEPA trattengono sia la polvere che i microrganismi. La filtrazione avviene attraverso un processo definibile come «setaccio»; le particelle di dimensioni superiori alle maglie del filtro rimangono bloccate.

La successiva filtrazione di tipo «chimico» riduce l'emissione di inquinanti grazie all'abbattimento ottenuto tramite le sostanze adsorbenti (vedere tabella pag. 7), di cui i filtri sono impregnati.

Al fine di garantire la massima sicurezza durante la manutenzione, i cassonetti possono essere dotati di alloggiamento per il BAG-IN / BAG-OUT.



Filter boxes for combined filtration needs special attention: HEPA filters + activated charcoal.

HEPA filters retain dust and micro-organisms. Filtering is performed through a process called "sieve". The particles which are larger than the filter mesh are blocked.

The following chemical filtration reduces the emission of pollutants. It is due to obtained with adsorbents (see table on p. 7) in the filters.

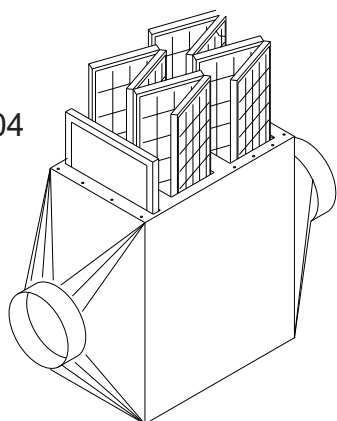
In order to ensure maximum safety during maintenance, filter boxes can be equipped with retainer for the BAG-IN/OUT-BAG.



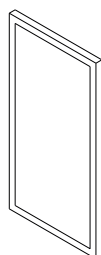
Cassonetto con filtri assoluti e con carbone attivato.

| Cassonetto 04                                                           | 600 mc/h                                                                                                                                      | Filter Box 04                                                                                                                          |
|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Codice / Item                                                           | Cassonetto filtri a carboni attivi, realizzato interamente in PVC bianco, idoneo per portate fino a 600 mc/h.<br><br>Il codice comprende:     | Filter box for activated charcoal, interely made of white PVC, suitable for airflows until 600 mc/h.<br><br>The item contains:         |
| Acidi + Solventi / Acids + Solvents<br>PCPRN0404                        | n. 1 cassonetto<br>n. 4 batterie filtranti per acidi<br>n. 4 batterie filtranti per solventi                                                  | n. 1 filter box<br>n. 4 activated charcoal for acids<br>n. 4 activated charcoal for solvents                                           |
| Assoluto + Acidi / HEPA + Acids<br>PCPAR0404                            | n. 1 cassonetto<br>n. 1 filtro assoluto (600 mc/h)<br>n. 4 batterie filtranti per acidi                                                       | n. 1 filter box<br>n. 1 hepa filter (600 mc/h)<br>n. 4 activated charcoal for acids                                                    |
| Assoluto + Solventi/Acids + Solvents<br>PCPAN0404                       | n. 1 cassonetto<br>n. 1 filtro assoluto (600 mc/h)<br>n. 4 batterie filtranti per solventi                                                    | n. 1 filter box<br>n. 1 hepa filter (600 mc/h)<br>n. 4 activated charcoal for solvents                                                 |
| Dimensioni / Dimensions<br><br>PCPRN0404<br>1050x320x590 mm<br>Ø 200 mm | Accessori a richiesta:<br><br>- prefiltro antipolvere PCF0004<br>- supporto BAG IN / BAG OUT PCPSBG4<br>- Kit supporti per cassonetto PCPSPC4 | Accessories on request:<br><br>- dustproof prefilter PCF0004<br>- BAG IN / BAG OUT support PCPSBG4<br>- Filter Box support KIT PCPSPC4 |

PCPRN0404



Prefiltro antipolvere  
Dustproof prefilter

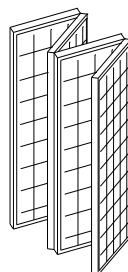


(optional)

Cod. PFP004

+

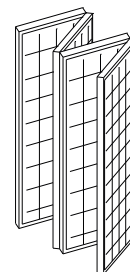
Filtri carbone attivo  
Activated charcoal filters



Filtri PLSCN x 4 pz.

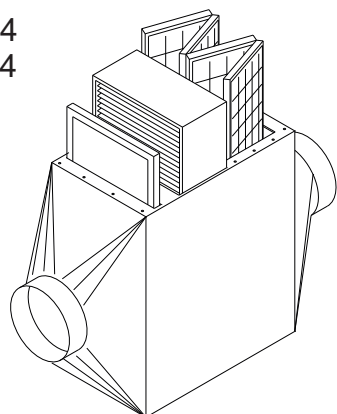
+

Filtri carbone attivo  
Activated charcoal filters

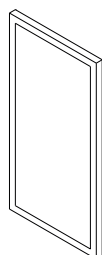


Filtri PLRAR x 4 pz.

PCPAR0404  
PCPAN0404



Prefiltro antipolvere  
Dustproof prefilter

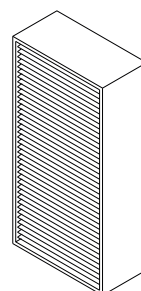


(optional)

Cod. PFP004

+

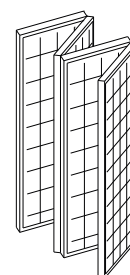
Filtro assoluto  
HEPA filter



Cod. PFA0004

+

Filtri carbone attivo  
Activated charcoal filters



Cod. PLSCN x 4pz.  
Cod. PLRAR x 4pz.

# Cassonetto 06

900 mc/h

Filter Box 06

Codice / Item

Cassonetto filtri a carboni attivi, realizzato interamente in PVC bianco, idoneo per portate fino a 900 mc/h.

Filter box for activated charcoal, interely made of white PVC, suitable for airflows until 900 mc/h.

Il codice comprende:

The item contains:

Acidi + Solventi / Acids + Solvents

PCPRN0606

n. 1 cassonetto  
n. 6 batterie filtranti per acidi  
n. 6 batterie filtranti per solventi

n. 1 filter box  
n. 6 activated charcoal for acids  
n. 6 activated charcoal for solvents

Assoluto + Acidi / HEPA + Acids

PCPAR0606

n. 1 cassonetto  
n. 1 filtro assoluto (900 mc/h)  
n. 6 batterie filtranti per acidi

n. 1 filter box  
n. 1 hepa filter (900 mc/h)  
n. 6 activated charcoal for acids

Assoluto + Solventi/Acids + Solvents

PCPAN0606

n. 1 cassonetto  
n. 1 filtro assoluto (900 mc/h)  
n. 6 batterie filtranti per solventi

n. 1 filter box  
n. 1 hepa filter (900 mc/h)  
n. 6 activated charcoal for solvents

Dimensioni / Dimensions

Accessori a richiesta:

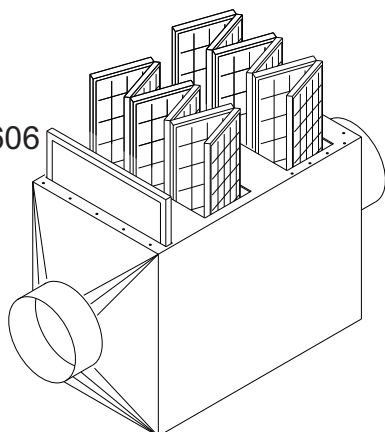
Accessories on request:

PCPRN0606  
1050x470x590 mm  
Ø 250 mm

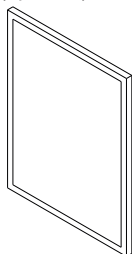
- prefiltro antipolvere PCF0006  
- supporto BAG IN / BAG OUT PCPSBG6  
- Kit supporti per cassonetto PCPSPC6

- dustproof prefilter PCF0006  
- BAG IN / BAG OUT support PCPSBG6  
- Filter Box support KIT PCPSPC6

PCPRN0606

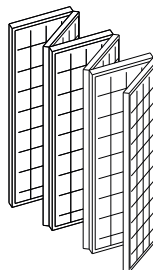


Prefiltro antipolvere  
Dustproof prefilter  
(optional)



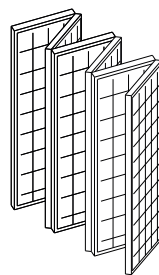
Cod. PFP006

Filtri carbone attivo  
Activated charcoal filters



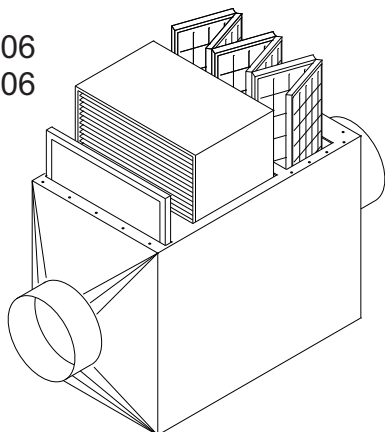
Filtri PLSCN x 6 pz.

Filtri carbone attivo  
Activated charcoal filters

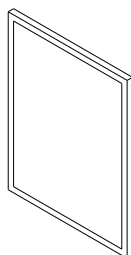


Filtri PLRAR x 6 pz.

PCPAR0606  
PCPAN0606

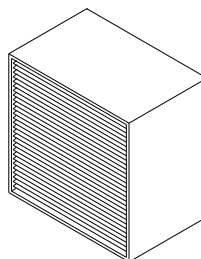


Prefiltro antipolvere  
Dustproof prefilter  
(optional)



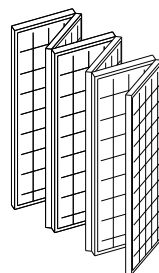
Cod. PFP006

Filtro assoluto  
HEPA filter



Cod. PFA0006

Filtri carbone attivo  
Activated charcoal filters



Cod. PLSCN x 6pz.  
Cod. PLRAR x 6pz.



# Cassonetto 08

1200 mc/h

# Filter Box 08

## Codice / Item

Cassonetto filtri a carboni attivi, realizzato interamente in PVC bianco, idoneo per portate fino a 1200 mc/h.

Filter box for activated charcoal, interely made of white PVC, suitable for airflows until 1200 mc/h.

Il codice comprende:

The item contains:

## Acidi + Solventi / Acids + Solvents

PCPRN0808

n. 1 cassonetto  
n. 8 batterie filtranti per acidi  
n. 8 batterie filtranti per solventi

n. 1 filter box  
n. 8 activated charcoal for acids  
n. 8 activated charcoal for solvents

## Assoluto + Acidi / HEPA + Acids

PCPAR0808

n. 1 cassonetto  
n. 1 filtro assoluto (1200 mc/h)  
n. 8 batterie filtranti per acidi

n. 1 filter box  
n. 1 hepa filter (1200 mc/h)  
n. 8 activated charcoal for acids

## Assoluto + Solventi/Acids + Solvents

PCPAN0808

n. 1 cassonetto  
n. 1 filtro assoluto (1200 mc/h)  
n. 8 batterie filtranti per solventi

n. 1 filter box  
n. 1 hepa filter (1200 mc/h)  
n. 8 activated charcoal for solvents

## Dimensioni / Dimensions

PCPRN0808

1150x620x590 mm

Ø 250 mm

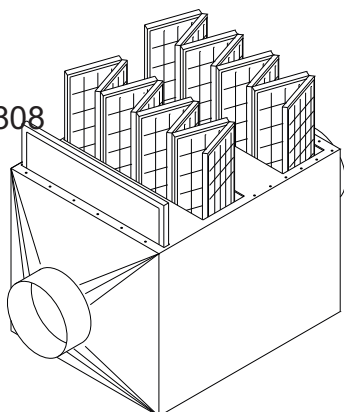
## Accessori a richiesta:

- prefiltro antipolvere PCF0008  
- supporto BAG IN / BAG OUT PCPSBG8  
- Kit supporti per cassonetto PCPSPC8

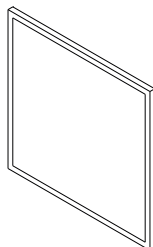
## Accessories on request:

- dustproof prefilter PCF0008  
- BAG IN / BAG OUT support PCPSBG8  
- Filter Box support KIT PCPSPC8

PCPRN0808

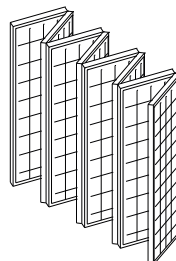


Prefiltro antipolvere  
Dustproof prefilter  
(optional)



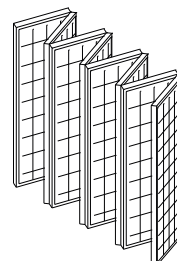
Cod. PFP008

Filtri carbone attivo  
Activated charcoal filters



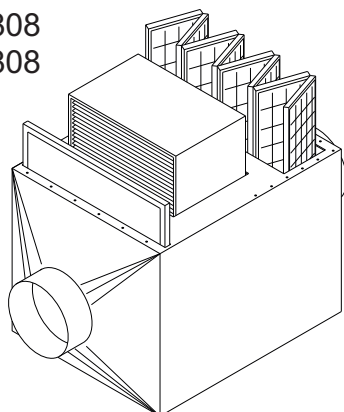
Filtri PLSCN x 8 pz.

Filtri carbone attivo  
Activated charcoal filters

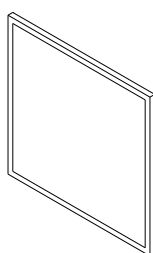


Filtri PLRAR x 8 pz.

PCPAR0808  
PCPAN0808

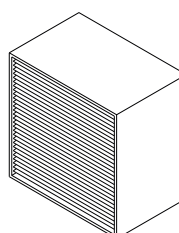


Prefiltro antipolvere  
Dustproof prefilter  
(optional)



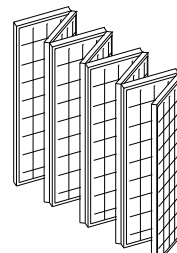
Cod. PFP008

Filtro assoluto  
HEPA filter



Cod. PFA0008

Filtri carbone attivo  
Activated charcoal filters



Cod. PLSCN x 8pz.  
Cod. PLRAR x 8pz.

## Cassonetto 10

1500 mc/h

## Filter Box 10

### Codice / Item

Cassonetto filtri a carboni attivi, realizzato interamente in PVC bianco, idoneo per portate fino a 1500 mc/h.

Filter box for activated charcoal, interely made of white PVC, suitable for airflows until 1500 mc/h.

Il codice comprende:

The item contains:

### Acidi + Solventi / Acids + Solvents

PCPRN0606

n. 1 cassonetto  
n. 10 batterie filtranti per acidi  
n. 10 batterie filtranti per solventi

n. 1 filter box  
n. 10 activated charcoal for acids  
n. 10 activated charcoal for solvents

### Assoluto + Acidi / HEPA + Acids

PCPAR0606

n. 1 cassonetto  
n. 1 filtro assoluto (1500 mc/h)  
n. 10 batterie filtranti per acidi

n. 1 filter box  
n. 1 hepa filter (1500 mc/h)  
n. 10 activated charcoal for acids

### Assoluto + Solventi/Acids + Solvents

PCPAN0606

n. 1 cassonetto  
n. 1 filtro assoluto (1500 mc/h)  
n. 10 batterie filtranti per solventi

n. 1 filter box  
n. 1 hepa filter (1500 mc/h)  
n. 10 activated charcoal for solvents

### Dimensioni / Dimensions

**PCPRN1010**  
**1250x770x590 mm**  
Ø 315 mm

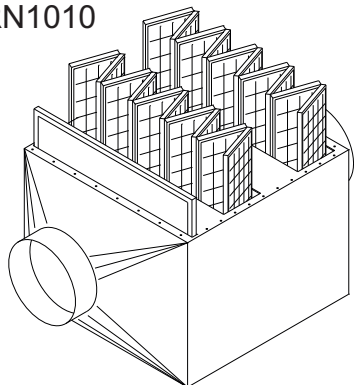
### Accessori a richiesta:

- prefiltro antipolvere PCF0010  
- supporto BAG IN / BAG OUT PCPSBG10  
- Kit supporti per cassonetto PCPSPC10

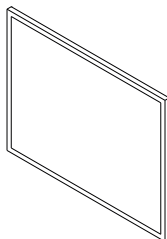
### Accessories on request:

- dustproof prefilter PCF0010  
- BAG IN / BAG OUT support PCPSBG10  
- Filter Box support KIT PCPSPC10

### PCPRN1010

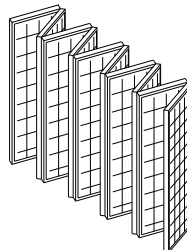


Prefiltro antipolvere  
Dustproof prefilter  
(optional)



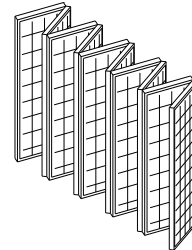
Cod. PFP010

Filtri carbone attivo  
Activated charcoal filters



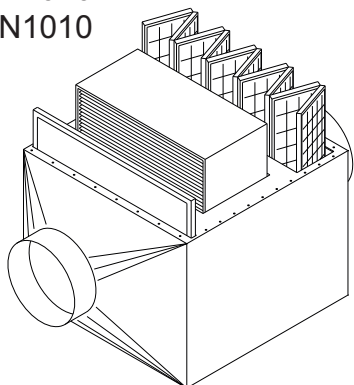
Filtri PLSCN x 10 pz.

Filtri carbone attivo  
Activated charcoal filters

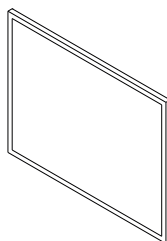


Filtri PLRAR x 10 pz.

### PCPAR1010 PCPAN1010

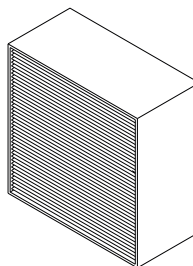


Prefiltro antipolvere  
Dustproof prefilter  
(optional)



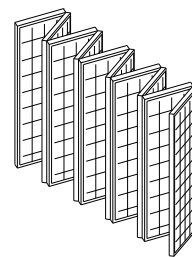
Cod. PFP010

Filtro assoluto  
HEPA filter



Cod. PFA0010

Filtri carbone attivo  
Activated charcoal filters



Cod. PLSCN x 10pz.  
Cod. PLRAR x 10pz.



La Project Plast, azienda leader nei sistemi di aspirazione, dispone di un'ampia gamma di soluzioni aspiranti.

Alcune soluzioni possono essere preassemblate in fabbrica, riducendo i tempi di installazione in cantiere. quindi ridotti, con notevoli vantaggi.

Grazie ai basamenti «galleggianti», i gruppi aspiranti preassemblati non richiedono predisposizione nelle pavimentazioni di supporto.

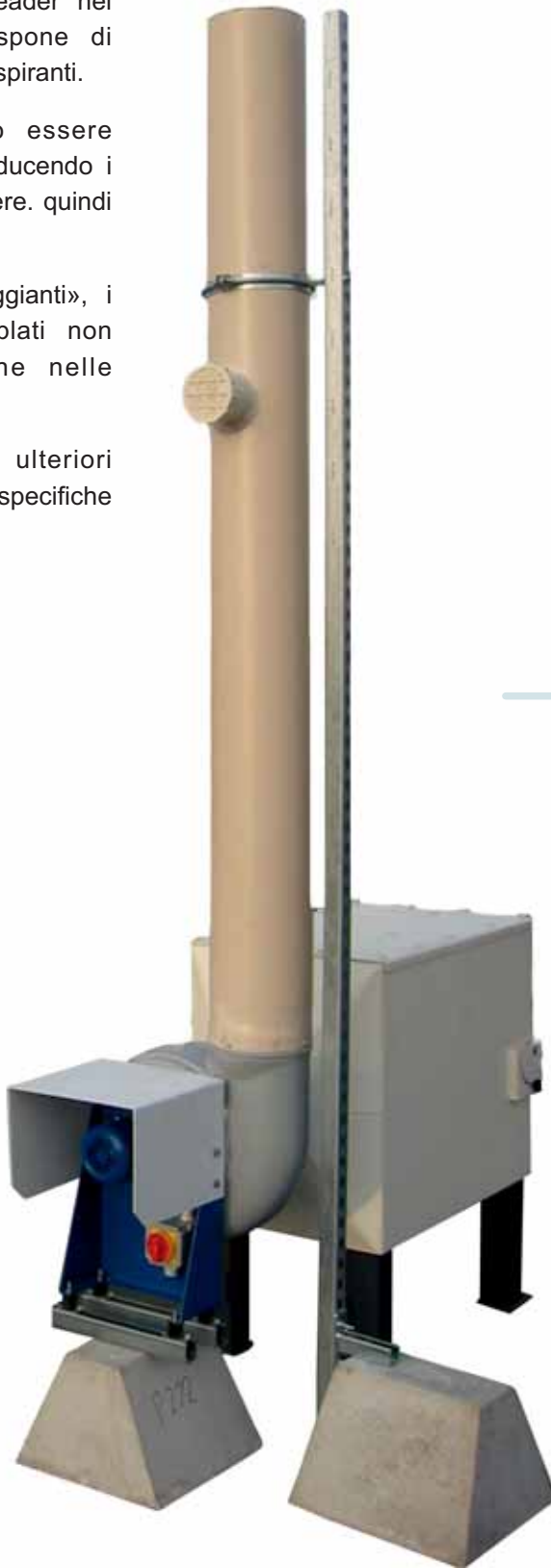
Possono essere studiate ulteriori soluzioni in relazione alle specifiche esigenze del cliente.

Project Plast, a leader in vacuum systems, offers a wide range of aspirating solutions.

Some of these can be pre-assembled at the factory cutting down the installation time in site.

Thanks to the "floating" bases, the pre-assembled aspirating groups do not require any preparation of the floor support.

Other solutions may be found according to specific requirements or needs.



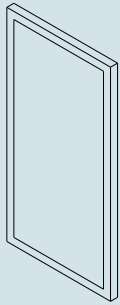
Sistema aspirante composto da cassonetto filtri ed elettroventilatore installato su base autoportante.



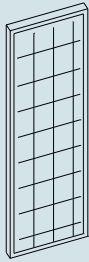
# Prefiltri e carboni attivi



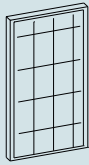
## Prefiltri per tutti i cassonetti

|                                                                                   | Codice | Descrizione                          | Dimensioni  | Filtrazione |
|-----------------------------------------------------------------------------------|--------|--------------------------------------|-------------|-------------|
|  | PFP004 | Prefiltro per cassonetto a 4 lastre  | 577x295 mm  | POLVERE     |
|                                                                                   | PFP006 | Prefiltro per cassonetto a 6 lastre  | 577x445 mm  |             |
|                                                                                   | PFP008 | Prefiltro per cassonetto a 8 lastre  | 577x595 mm  |             |
|                                                                                   | PFP010 | Prefiltro per cassonetto a 10 lastre | 577x745 mm  |             |
|                                                                                   | PFP012 | Prefiltro per cassonetto a 12 lastre | 577x895 mm  |             |
|                                                                                   | PFP014 | Prefiltro per cassonetto a 14 lastre | 467x520 mm  |             |
|                                                                                   | PFP016 | Prefiltro per cassonetto a 16 lastre | 467x595 mm  |             |
|                                                                                   | PFP018 | Prefiltro per cassonetto a 18 lastre | 467x670 mm  |             |
|                                                                                   | PFP020 | Prefiltro per cassonetto a 20 lastre | 467x745 mm  |             |
|                                                                                   | PFP022 | Prefiltro per cassonetto a 22 lastre | 467x895 mm  |             |
|                                                                                   | PFP024 | Prefiltro per cassonetto a 24 lastre | 467x1120 mm |             |

## Batterie filtranti CARBONE ATTIVO

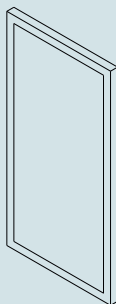
|                                                                                     | Codice | Descrizione                 | Dimensioni | Filtrazione |
|-------------------------------------------------------------------------------------|--------|-----------------------------|------------|-------------|
|  | PLSCN  | Batterie filtranti 1 lastra | 580x235 mm | SOLVENTI    |
|                                                                                     | PLRAR  |                             |            | ACIDI       |
|                                                                                     | PLAL0  |                             |            | ODORI       |
|                                                                                     | PLRKF  |                             |            | FORMALDEIDE |
|                                                                                     | PLNP0  |                             |            | RADIO ISOT. |
|                                                                                     | PLRSA  |                             |            | MERCURIO    |

## Batterie filtranti CARBONE ATTIVO

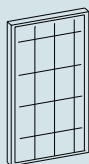
|                                                                                     | Codice | Descrizione                 | Dimensioni | Filtrazione |
|-------------------------------------------------------------------------------------|--------|-----------------------------|------------|-------------|
|  | PLCN5  | Batterie filtranti ½ lastra | 290x235 mm | SOLVENTI    |
|                                                                                     | PLCR5  |                             |            | ACIDI       |
|                                                                                     |        |                             |            |             |

# Prefilters and active charcoals



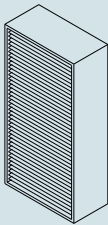
| Prefilter for all filter box                                                      |        |                                            |             |            |
|-----------------------------------------------------------------------------------|--------|--------------------------------------------|-------------|------------|
|                                                                                   | Code   | Description                                | Dimensions  | Filtration |
|  | PFP004 | Dustproof prefilter for filter box 04 slab | 577x295 mm  | DUST       |
|                                                                                   | PFP006 | Dustproof prefilter for filter box 06 slab | 577x445 mm  |            |
|                                                                                   | PFP008 | Dustproof prefilter for filter box 08 slab | 577x595 mm  |            |
|                                                                                   | PFP010 | Dustproof prefilter for filter box 10 slab | 577x745 mm  |            |
|                                                                                   | PFP012 | Dustproof prefilter for filter box 12 slab | 577x895 mm  |            |
|                                                                                   | PFP014 | Dustproof prefilter for filter box 14 slab | 467x520 mm  |            |
|                                                                                   | PFP016 | Dustproof prefilter for filter box 16 slab | 467x595 mm  |            |
|                                                                                   | PFP018 | Dustproof prefilter for filter box 18 slab | 467x670 mm  |            |
|                                                                                   | PFP020 | Dustproof prefilter for filter box 20 slab | 467x745 mm  |            |
|                                                                                   | PFP022 | Dustproof prefilter for filter box 22 slab | 467x895 mm  |            |
|                                                                                   | PFP024 | Dustproof prefilter for filter box 24 slab | 467x1120 mm |            |

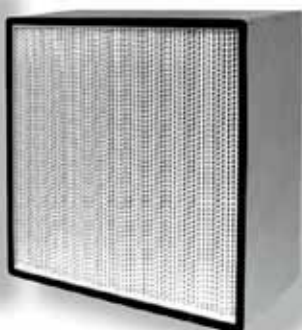
| ACTIVATED CHOARCOAL filtering batteries                                             |       |                                   |            |               |
|-------------------------------------------------------------------------------------|-------|-----------------------------------|------------|---------------|
|                                                                                     | Code  | Description                       | Dimensions | Filtration    |
|  | PLSCN | Filter activated choarcoal 1 slab | 580x235 mm | SOLVENTS      |
|                                                                                     | PLRAR |                                   |            | ACID          |
|                                                                                     | PLAL0 |                                   |            | SMELLS        |
|                                                                                     | PLRKF |                                   |            | FORMALD.      |
|                                                                                     | PLNP0 |                                   |            | RADIO ISOTOP. |
|                                                                                     | PLRSA |                                   |            | MERCURY       |

| ACTIVATED CHOARCOAL filtering batteries                                             |       |                                     |            |            |
|-------------------------------------------------------------------------------------|-------|-------------------------------------|------------|------------|
|                                                                                     | Code  | Description                         | Dimensions | Filtration |
|  | PLCN5 | Filter activated choarcoal 1/2 slab | 290x235 mm | SOLVENTS   |
|                                                                                     | PLCR5 |                                     |            | ACIDS      |
|                                                                                     |       |                                     |            |            |

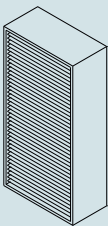


## Filtri assoluti HEPA

|                                                                                   | Codice  | Descrizione                                      | Dimensioni | Filtrazione                                                                                     |
|-----------------------------------------------------------------------------------|---------|--------------------------------------------------|------------|-------------------------------------------------------------------------------------------------|
|  | PFA0004 | Filtro HEPA, classe H14, eff. 99,999%, 300 mc/h  | 305x610 mm | ASSOLUTA<br> |
|                                                                                   | PFA0006 | Filtro HEPA, classe H14, eff. 99,999%, 600 mc/h  | 595x595 mm |                                                                                                 |
|                                                                                   | PFA0008 | Filtro HEPA, classe H14, eff. 99,999%, 600 mc/h  | 457x457 mm |                                                                                                 |
|                                                                                   | PFA0010 | Filtro HEPA, classe H14, eff. 99,999%, 1500 mc/h | 610x610 mm |                                                                                                 |
|                                                                                   |         |                                                  |            |                                                                                                 |



## HEPA Filters

|                                                                                     | Item    | Description                                     | Dimensions | Filtration                                                                                        |
|-------------------------------------------------------------------------------------|---------|-------------------------------------------------|------------|---------------------------------------------------------------------------------------------------|
|  | PFA0004 | Filter HEPA, class H14, eff. 99,999%, 300 mc/h  | 305x610 mm | ABSOLUTE<br> |
|                                                                                     | PFA0006 | Filter HEPA, class H14, eff. 99,999%, 600 mc/h  | 595x595 mm |                                                                                                   |
|                                                                                     | PFA0008 | Filter HEPA, class H14, eff. 99,999%, 600 mc/h  | 457x457 mm |                                                                                                   |
|                                                                                     | PFA0010 | Filter HEPA, class H14, eff. 99,999%, 1500 mc/h | 610x610 mm |                                                                                                   |
|                                                                                     |         |                                                 |            |                                                                                                   |





A series of horizontal dotted lines for writing notes.



