



Technical Description (Realization Phase)

Fire Training Unit with Smoke Cleaning System

Mid and West Wales Fire and Rescue Services, Earlswood site

Rev. 01

All Updates in **blue** color

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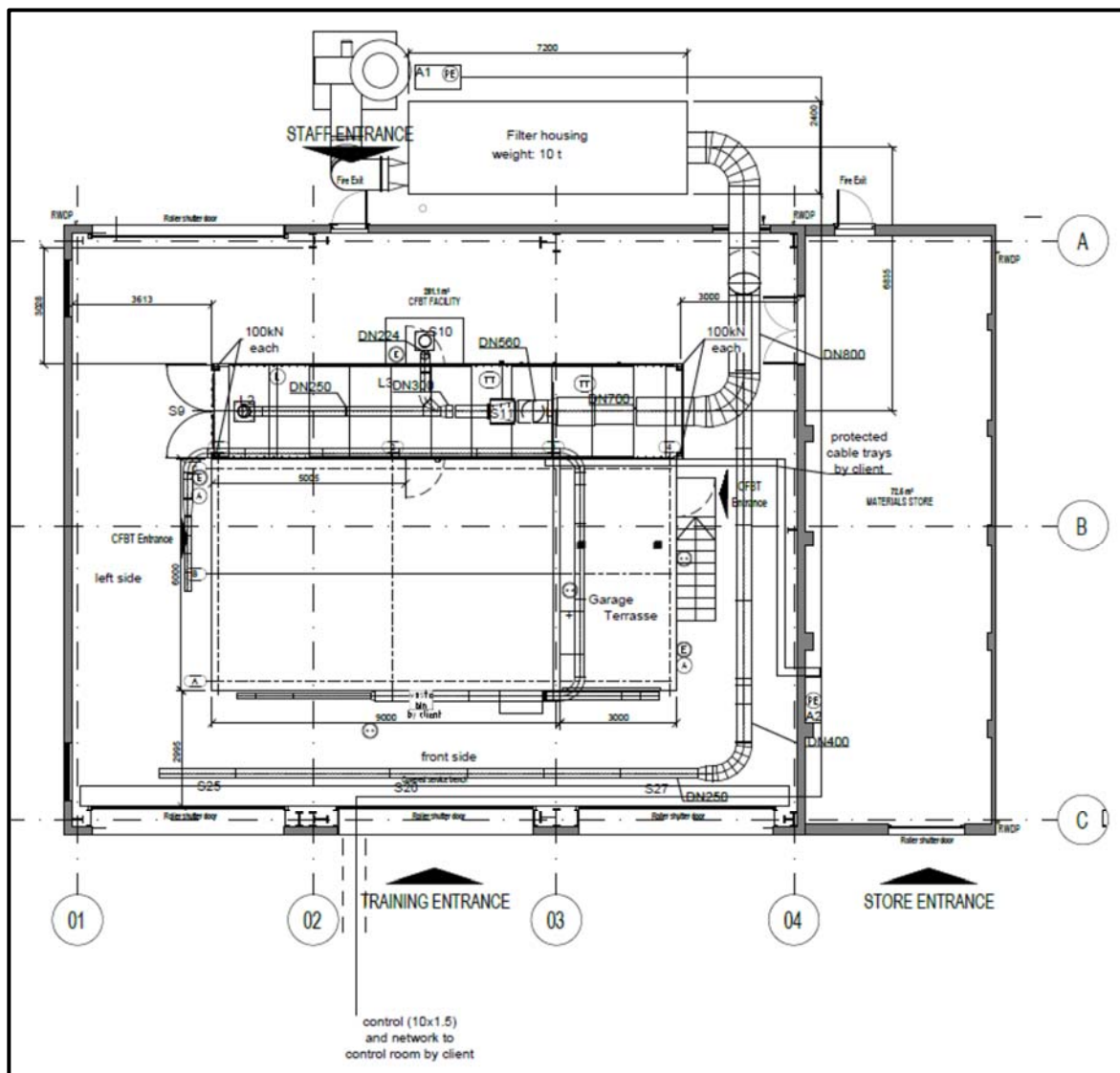
1 Overview

To be supplied is a Fire training system consisting of a demo/attack container unit and a connected building complex, that all is connected to a smoke capture and cleaning system.

The fire training unit is described in Chapter 2 and the smoke cleaning system which is adapted to this fire training unit in Chapter 3.

The system is designed to be implemented and erected inside the existing 3 bay workshop (giraffe) building at Earlswood site. The smoke filtering unit, including fan, silencer, compressor, Aerosil-Dosing station and stack will be placed on the outside nearby, ~~e.g. back or any side~~ of the Giraffe-building.

A control device, from which the operator can control the fire training system, is installed in the control room (housing of the control room in scope of MAWW). An additional touch screen will be installed in the switch cabinet A1 (smoke cleaning system) for detailed information about the smoke cleaning system, next to the building (outside). The control will be connected to the demo/attack container, the CFBT-Building / Inner Building and the smoke extraction and cleaning system.



Plan view giraffe building with domestic and demo/attack unit (sectional)

Please note latest revision of Dräger Layout drawing 11098167.

2 Fire Training Unit

2.1 General

The fire zone and the observation & attack zone are installed in a 40'-Container. Attached to this a domestic kind of building will be erected in a steelwork structure for further training purposes. The building will be housed by the existing Giraffe-building.

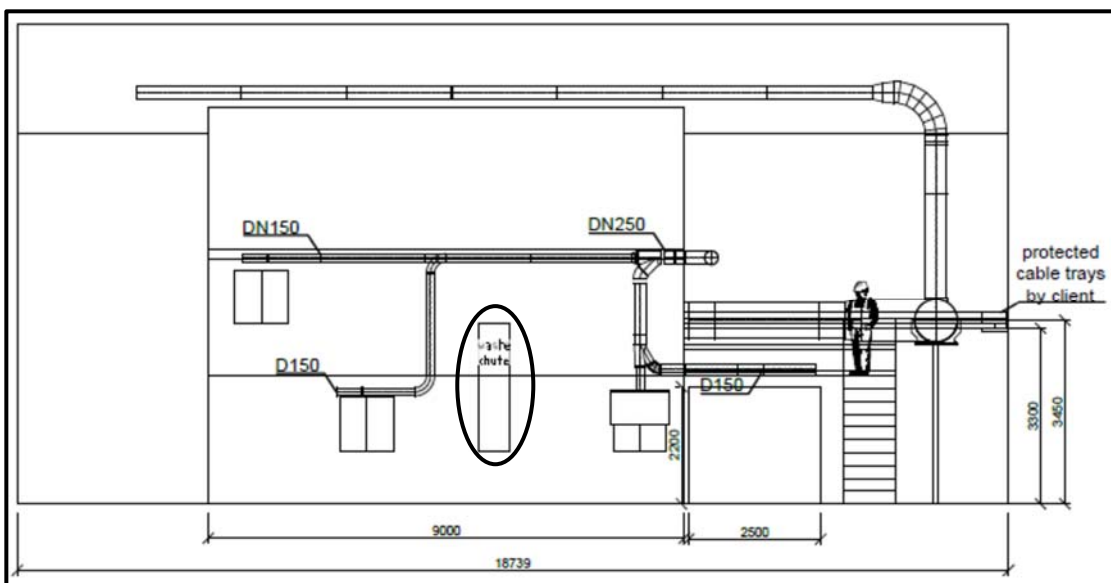
The fire training unit is designed to achieve the following objectives:

- Feeling of real heat, smoke, and water vapor through the use of wood-fired fire points
- Observation of thermodynamic processes in a fire room with Rollover
- Recognize the imminent signs of a Rollover
- Behavior of protective clothing during a Rollover
- Use of effective extinguishing techniques to prevent a Rollover
- Procedure in the event of a fire in a confined space
- Extinguishing with different nozzles
- Search & rescue training

The system is designed in accordance with DIN 14097-1 (Fire Brigade Simulation Facilities - Part 1: General structural requirements) and DIN 14097-3 (Firefighter simulation installations - Part 3: Solid fuel simulation installations) to ensure the highest level of safety for this type of unit.

2.2 CFBT-Building / Inner Building (1 pc)

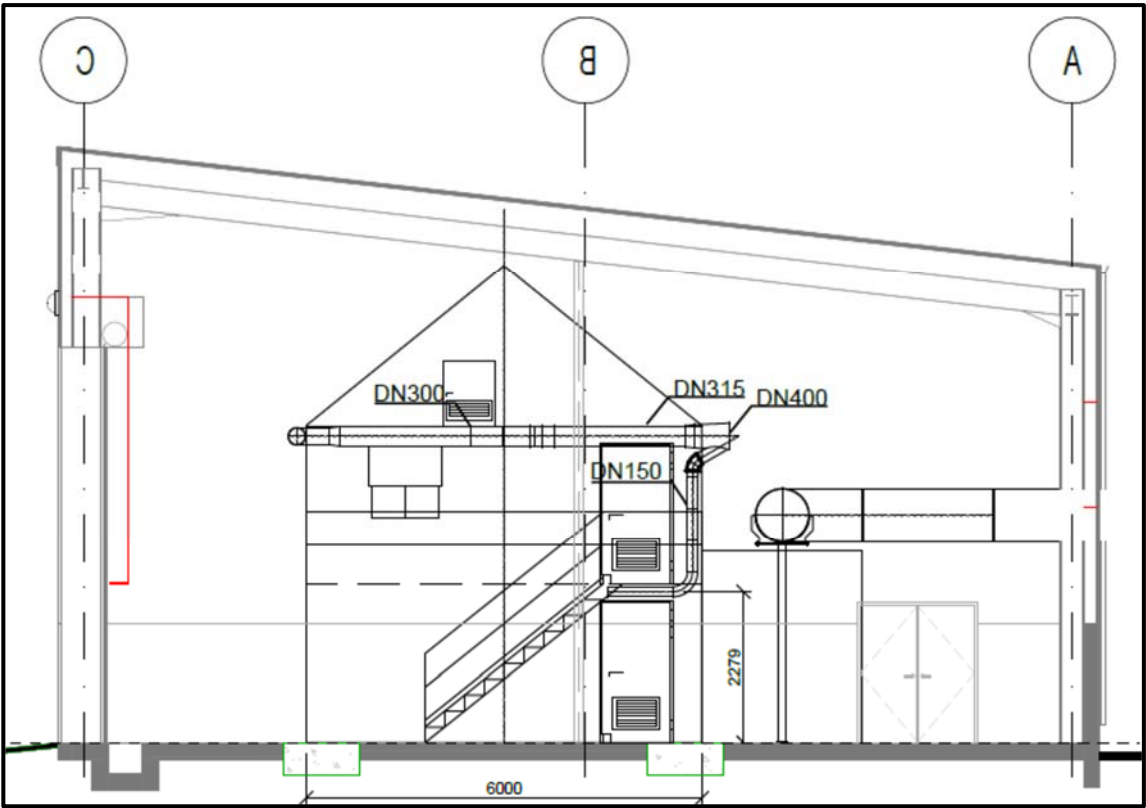
This building made of a steel frame construction, has been specially designed for simulating typical fire inside a house. The building is constructed as a three-story and has compartment rooms that can be equipped with mobile fire cribs.



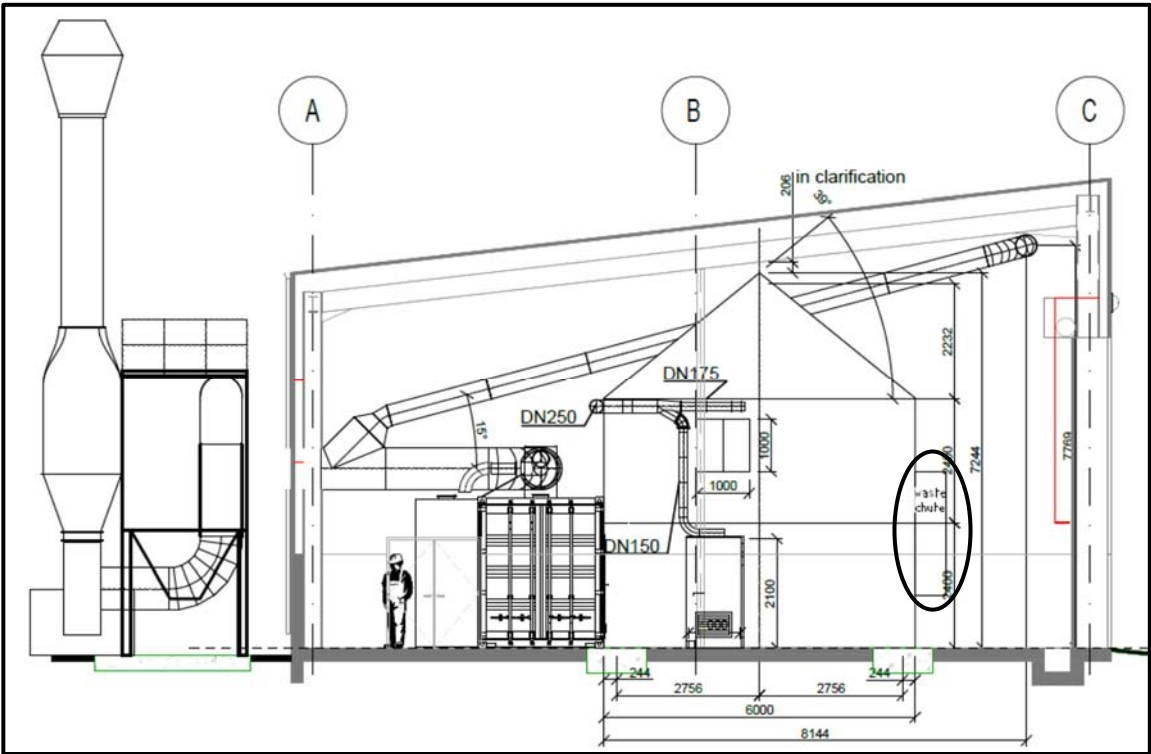
Front Elevation incl. position of waste chute

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Right Elevation



Left Elevation incl. position of waste chute

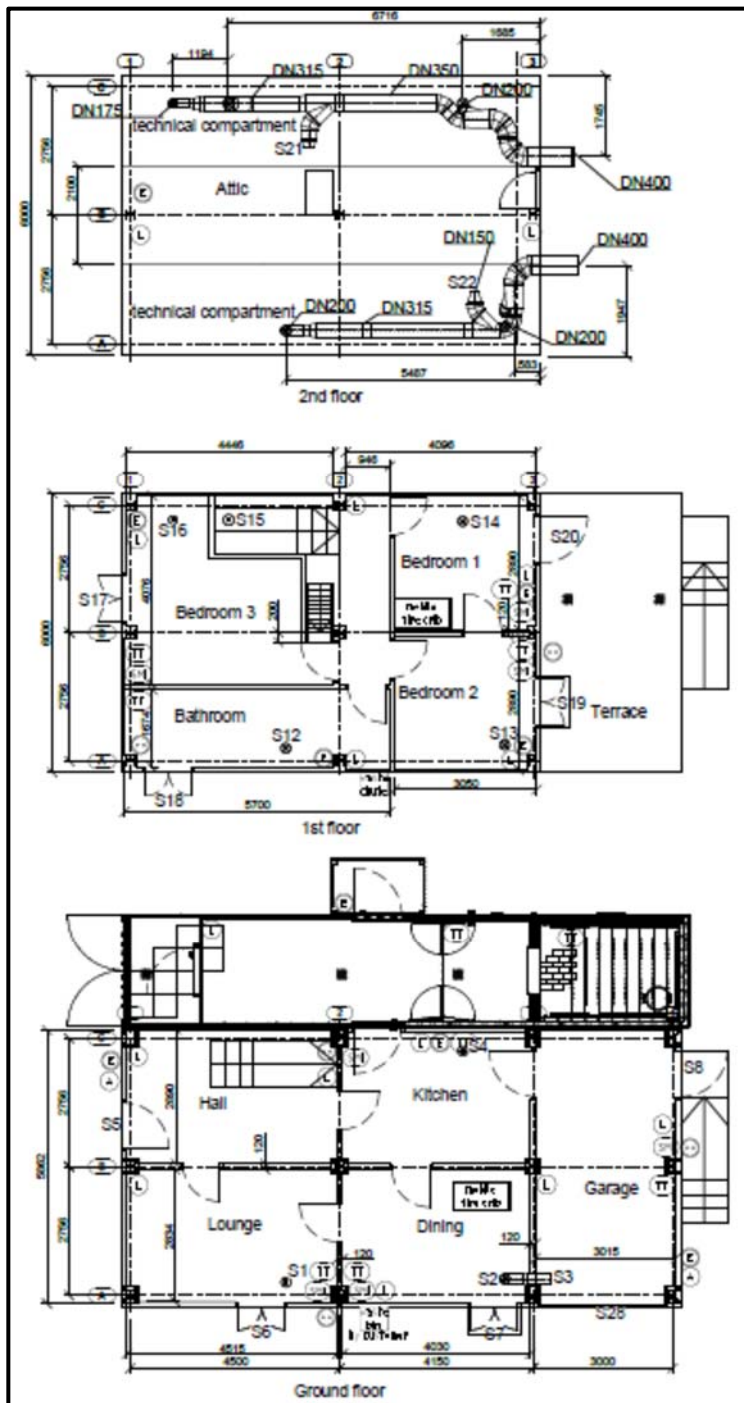
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The steel construction comprises a steel framework made from galvanized steel profiles, facade and roof with paneling and trapezoidal profiles. The floors will be made of non-slip steel floor plate (galvanized checkered plates). Walls will be equipped with a sufficient smooth lining. The walls will be insulated with 100 mm stonewool insulation. Each training room contains drainage for discharging the water which was used for extinguishing.

The water from the 1st floor will drain through small gaps of the ground floor ceiling which provides a realistic training scenario.



Proposed layout for domestic

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The internal staircase to the upper floors is a heavy-duty galvanized steel construction and carries a minimum ten treads with standard size risers made of non-slip materials (stair width 800mm).

The building is equipped with 5 x steel opening windows (1000mm x 1000mm, complete with handles and shot bolts on two sides of unit structure. Window openings are equipped with operable steel shutters.

Installation of three external doors, opening direction up to customer decision. Each external door will be equipped with a breakout, closed with chains, to allow fire hoses to pass through. The building is equipped with connection to the attack unit. Additional 10 x internal doors are installed.

All doors and windows are designed to withstand the extreme operating conditions during fire fighter training.

On ground floor acc. to the proposed design there is a hall with stairs, 3 rooms and a garage with roller shutter door. Two double leaf windows.

First floor has a small landing area, from where 4 rooms are accessible, and 3 windows.

2nd floor with one room straight at the landing.

Installation of an external platform on top of the garage with staircase and handrails. All parts hot galvanized. Floors will be made of slip-resistant sheets, treads made with grids.



3D model of steel structure (above) Floor (1st/2nd) made of galvanized durbar plates

Dimensions (LxWxH):	approx. 12.000 x 6.000 x 7.500 mm
Quantity of Levels:	3
Kind of Roof:	pitch roof
Size of platform:	app. 18 m ²

Examples:



Building structure with demo/attack unit



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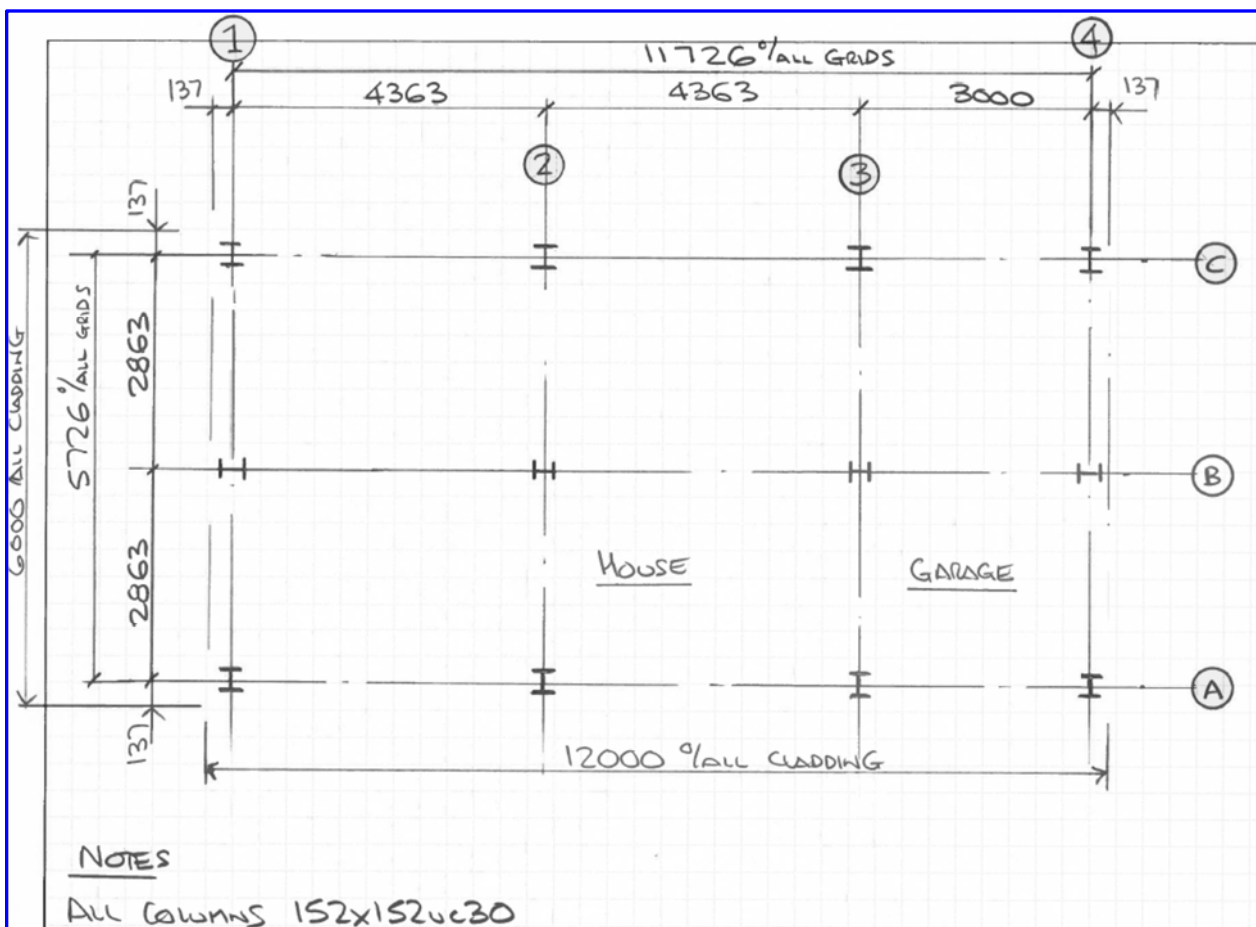
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Windows for ladder access:

It will be 2 windows on the first floor (window no. S17 and S18), the window on the left hand side of the front elevation and the one on the left hand side elevation as you look from the front of the building (window no. S17 and S18).

Anchoring and level of the CFBT-building (preliminary):

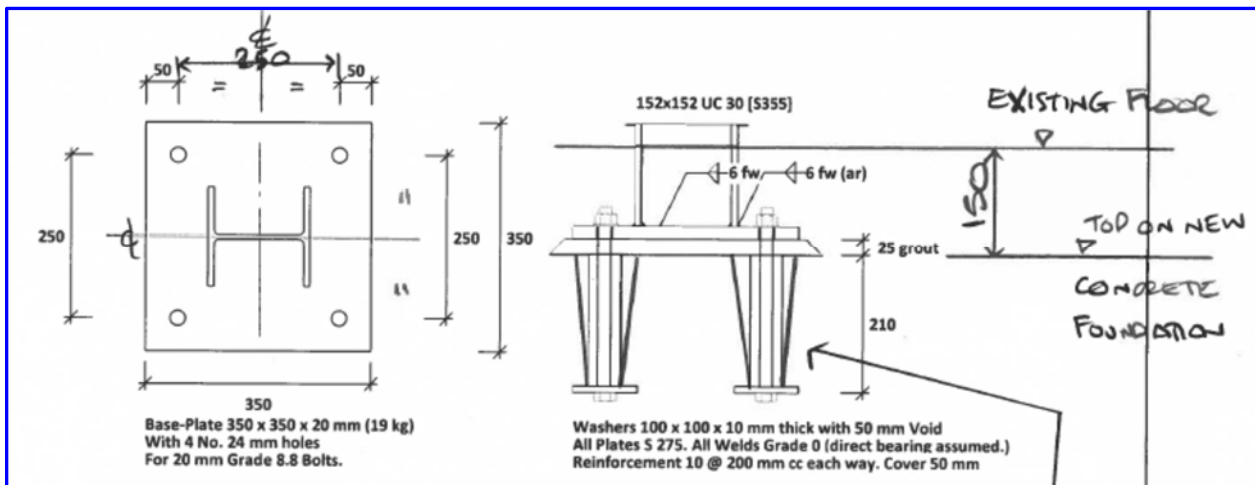
The building will consist of 12 pcs of steel H-columns with a size of app. 152 x 152 mm. All columns will have a foot plate which will be fixed in the concrete floor / new concrete foundation at the same level.



Example of H-columns

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Example of foot plate

Drainage in the CFBT-Building (ground floor) and in the Giraffe-Building:

The floor in the Giraffe-building will be equipped with a small slope for water drainage. Design on-going by the Architect / MAWW.

The sealing of the CFBT-building to the floor of the Giraffe-building: will be described if the drainage is designed.

2.2.1 Waste chute (1 pc)

Installation of a **waste chute** from the first floor to the ground floor for easier ash removal into a dustbin on ground floor (external). The size (LxWxH) is app. 2,400 (depending on final position) x 400 x 400 mm.

Characteristics:

- Waste chute with a size of (WxHxL) 400 x 300 x app. 2.400 mm
- Opening in the 1st floor protected with a hinged closing steel flap (app. 3 mm), app. 400 mm above floor level (note below picture)
- Hinges on top of the flap, flap can be locked in open and closed position to avoid falling down
- Position: in front of the building, opening in the bathroom 1st floor >> note drawing 11098167.
- Waste chute ends app. 1.1 m above ground floor level to fill the waste bin shown below
- Horizontal steel plate with rubber protection around the end of the waste chute (acc. to the attached picture), waste bin out of scope
- Material: pre-galvanized / galvanized steel (note pictures below)
- incl. all holders at the building

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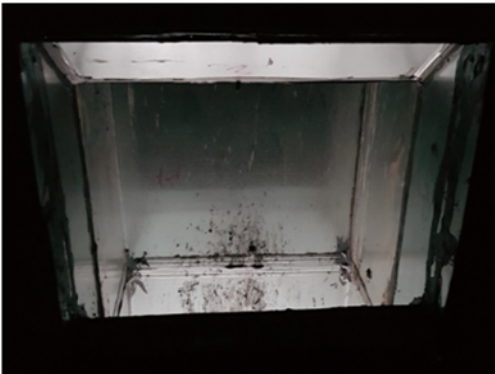
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Example (view from inside of the building)



Example (view from outside of the building) **Size of waste bin required from MAWW**

Associated planning documents:

- 11098167_1_1_xx_Layout_Fire_Training_Unit
- **Steelwork design / Static calculation no.**

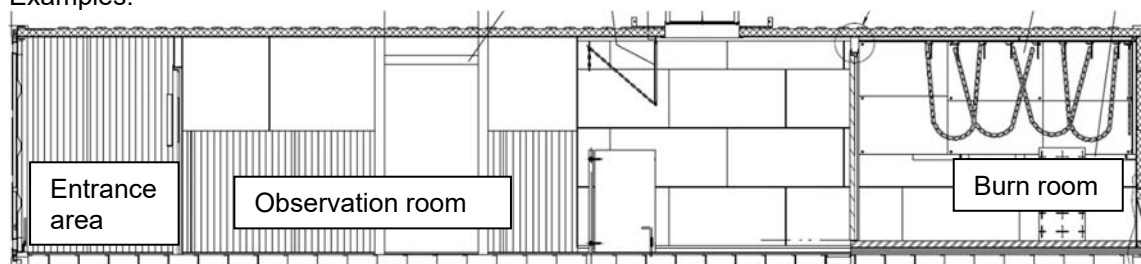
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2.3 Demonstration / Attack Unit (1 pc)

This training facility is used to observe the rollover, to get used to heat as well for tactical firefighting.

Examples:



40' high cube fire training container

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40' Highcube –wood fired training simulator with entrance area, observation and burn room, next to the steel building, consisting of:

Burn Room:

- Room size similar to a 10' ISO standard container (app. length 3m, width 2.4m, height 2.9 m),
- app. 500 mm elevated in reference to the observation room
- container walls have a 80 mm of heat-resistant insulation (WLG 040, Heat resistant Class DIN EN 13501 A1) and are covered with weathering steel (e.g. Corten, thickness: 5 mm)
- bolted extra fire cladding (3mm Corten) on walls and ceiling for increased lifetime, exchangeable
- No wall between burn room and observation room
- Supports under the cantilever part of the container
- U 80-profiles at the side walls to hold the wood plates
- miscellaneous eyelets and shackles with chains to fix the wooden panels at the side walls and the ceiling
- Floor covered with firebricks on a split bed, firebricks will not be destroyed by heat and water due to high density
- Heat resistant fire crib, made of weathering steel (e.g. Corten), 5 mm

Observation Room:

- Room size: length app. 7,50 m, width app. 2.44 m and height app. 2.59 m)
- The container ceiling (completely) and the container walls in the area up to 3m to the fire zone have 80 mm of heat-resistant insulation (WLG 040, Heat resistant Class DIN EN 13501 A1) and are covered with steel sheet (e.g. Corten, thickness: 5 mm)
- Additional steel sheets on the side walls (half height) in the rest of the container
- Rear wall portion uninsulated but covered with steel sheets
- In the rear area is a fire-resistant door (1000 x 2150 mm) with panic function to the entrance area
- The chimney has a flap which can be operated from in- and outside and is lockable, size: app. 600 x 600 mm
- Smoke screen, adjustable height approx. 660 mm for sufficient smoke management
- The floor is made of concrete slabs, approx. 500 x 500 mm, thickness approx. 50 mm, installed on a gravel bed.
- Installation of a drainage channel with a 300 mm wide grid

Entrance area:

- Room size (LxWxH) app. 1.500 x 2.440 x 2.591 mm
- An original container double door, door fixing points for open position
- Ceiling and walls not insulated
- Floor made of concrete slabs
- Connection to the smoke extraction & cleaning system

Cover on the roof of the container above the chimney:

- Special heat-resistant cover (stainless steel) to extract smoke from the observation area connected to the smoke treatment system pipe.

Cover at the side entrance of the container:

- Smoke extraction hood
- Size (LxWxH): approx. 1.20 x 1.2 x 0.5 m
- Entry opening with a size of (LxH): approx. 1.00 x 2.10 m
- including pipe connection to the smoke extraction system
- Made of steel sheets (e.g. CORTEN), painted dark

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General:

- All original floor coverings made of wood are removed and replaced by steel
- Underbody of the container covered with a protective layer
- All connections are smoke-tight
- Emergency stop installed at the external doors of the container for activation of emergency smoke extraction
- All moving parts can be easily handled with fire protection gloves.
- Service life approx. 10 years, depending on proper use and regular maintenance
- 3 x fire resistant doors (1000 x 2150 mm) with panic function (1 x to outside, 1 x to entrance area and 1 x to the domestic building)
- Opening with chains as hose channel, size: 300 x 300 mm
- Flexible smoke barrier across the width, height app. 660 mm
- Solid entering stage to burning chamber
- Floor with concrete slaps
- Installation of a drainage channel with 300 mm wide grid
- Installation of thermocouples at different heights
- Installation of two instructor safety shields (app. 1100 x 650 mm)

Advantages:

- Sufficient room height due to Highcube container which prevents too much heat influence on the trainees
- Life span of up to 10 years in case of proper use due to sufficient heat insulation
- Rollover effects can be simulated very easily by a professional trainer
- High temperature resistance in the fire zone (1 - 2 hours 500 °C, short duration 700 °C)
- Extinguishing training from a safe distance to the fire zone
- Well-designed smoke hoods at each entrance to secure sufficient smoke capture
- Less consumption of wood due to special fire zone design
- Different kind of wood (panels and pallets) can be used in combination
- Safe installation due to fabrication acc. DIN-Standard for Fire Brigade Simulation Facilities

External dimensions (LxWxH):

approx. 12,192 x 2,438 x 2,895 mm

Weight of the complete equipment:

approx. 12,000 kg

Exterior painting:

dark colour, industrial paint, without sanding

Note: For safety reasons it is recommended to leave the container doors open during the exercises to secure additional emergency ways.

Example:



Training in a wood fired 40' Rollover Container

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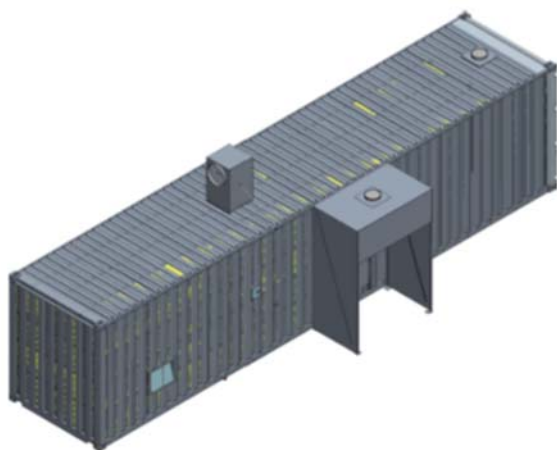
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Inner view of the burn room with a floor made of fire resistant bricks and flexible smoke barrier for the regulation of the smoke entrance into the observation room



Chimney with lockable flap on the roof of the observation room covered by a special rollover extraction hood (hood made of stainless steel)



Heat resistant smoke curtains will be installed at the side entrance door and the container doors to reduce the smoke outlet to the Giraffe building during the training

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2nd thermal protection layer in the fire zone, made of 1.5 / 2 mm stainless steel (side wall / ceiling). This layer is designed as wearing part and needs to be removed after some years depending on the training cycles.

Correct placement of the fire compartment with fuel:

Before each exercise, the fire compartment is lined with uncoated, solvent-free chipboard. For this purpose, the plate elements are inserted or mounted in the receiving devices provided in the fire compartment. The holders and holders are for a maximum assembly of 12 m² with chipboard (4 to 16 mm thick). In addition, a wood-tipped barrel is set up to ignite the initial fire.

It is possible (but not recommended) to add up to 3 wooden pallets in the middle of the burn room. In this case it is very important to monitor the temperature in the fire compartment with the temperature monitoring to avoid overheating of the system.

Note: Incorrect and improper loading of the fire compartment with fuel deviant from the manual and resulting in a higher fire load can endanger persons and cause damage to the heat protection of the container and the container itself. No liability or warranty is accepted for persons and material damage resulting from improper use.

Example:



Correct placement of the wood in the fire room



Additional use of wooden pallets (max 3 pcs)

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Monitoring of temperature of the fire zone to avoid overheating

Temperature monitoring in the fire zone by the control system with thermocouples to monitor the operation of the system and to avoid heat damage. A temperature sensor will be installed in the upper part of the fire zone.

Temperature monitoring allows the operator to observe cooling times and temperatures, allowing a long lifetime of the installation and to integrate them into the exercise process.

Dräger will provide operating instructions for temperature limits, recommended breaks between each training session and cooling procedures.

Emergency alarm

Installation of an alarm system by activating a boat bell according to DIN 14097-3. This bell will be installed in a corner inside the simulation area and can be activated in case of an emergency from the inside.

Example:



Associated planning documents:

- ES-020-133 (6033)_11210532_00_Wood-fired-Container_Approval_Drawing_Rev_00

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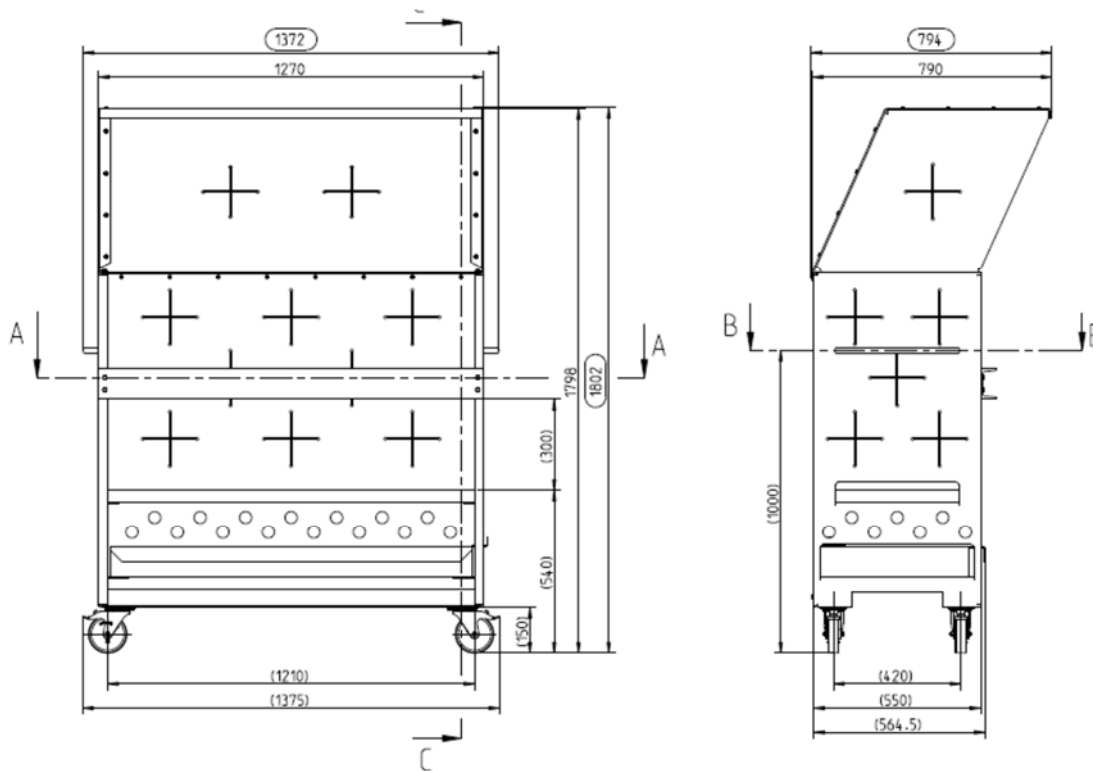
2.4 Mobile fire cribs (2 pcs)

Delivery of two mobile fire cribs for extinguishing training. The cribs are made of weather resistant steel (e.g. Corten) to provide a sufficient heat resistance. The maximum load is app. 2 to 3 Euro-Pallets and depends on the critical heat influence on the ceiling. A heat resistant roof prevents flames from touching the ceiling of the building. The cribs are equipped with 4 wheels for movable operation. Two mobile cribs in scope, more to be delivered optional.

Example:



Mobile fire crib



3 Smoke Cleaning System (1 pc)

Dräger is using a mechanical dry filtration system for the smoke cleaning because the cleaning performance fulfills relevant standards for environmental protection and the investment costs, and the operation costs are much lower compared to other systems (e.g. wet filtration system / washer or smoke re-burn system).

The CO₂-emission is much lower compared to a smoke re-burn systems which needs a lot of burning gas for cleaning purposes. Gas or water supply lines are not required for a dry filtration system.

It is important to know that no smoke, no water steam or other aerosols are visible at the outlet of the chimney.

The dry filtration system technology does not create aggressive fluids or high internal temperatures. Due to these facts the system has a high availability, a long lifespan of more than 25 years (annual maintenance required) and less maintenance costs. No mandatory corrosion will occur during a lifespan of 15 years in case of burning wood only and sufficient annual maintenance.

The planned filtration system will not filter VOCs (volatile organic compounds) and gases such as CH₄, NO_x or Sulphur dioxide, as this is only a mechanical filtration. In case of burning clean wood, these gases will be created in a very less amount below the allowed limits of the relevant environmental standard.

Dräger has planned to work together with the following supplier for dry filtration system: Company CORAL (France / Italy, www.coral.eu). The following description meets the proposed technology from CORAL. In the case that another supplier has to be contracted than the components could have different characteristics which would not have influence of the general function of the system.

Smoke treatment system for filtering the fumes emitted by a fire container or fire cribs in domestic building.

Basic design features:

- Temperature of the air to be treated: < 200°C sec. (automatic temperature reduction by fresh air bypass)
- Maximum extraction rate: approx. 33,000 m³/h at 150°C (corresponding to app. 21,300 Nm³/h at 20°C).
- Characteristics of pollutants (nature: dry wood smoke; concentration: low; explosive: no).
- The fumes are not loaded with toxic products (dry wooden pallets or hardboard panels, not treated with chemicals).
- Classified as EXPlosive ATmosphere: no.
- The discharge rate will be max. 20 mg per standard cubic meter of dust (total mass). Most of the smaller particles (PM₁₀, PM_{2.5}) will also be filtered by the smoke cleaning unit, but the amount cannot be evaluated in detail.

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This chapter describes the technical design of the smoke extract and cleaning system for the carbonaceous Fire Training Units Domestic building and Demo/Attack container.

The smoke extraction and cleaning system is connected to both units. For safety reasons only the container or fire cribs in domestic shall be used at a time, not both at the same time. The smoke will be extracted via a pipe system which is equipped with automatic and manual louvres to channel the smoke from the training units to the extract & cleaning system.

The smoke extract system is capable of being activated by a single emergency button located on the control cabinets and on several locations at both units. Additionally, the smoke extraction & cleaning system can be activated after training to ventilate the training rooms.

During training mode, the smoke is captured only on the outside above each window and door and the roof flap of the container, as well as at distinct positions in the workshop building.

In an emergency situation, the smoke can be extracted in accordance with DIN14097-1:2018-05, section 5.4.12, providing visibility of at least 2m in 1m height above ground within the training room within 120s.

No negative pressure will hinder the doors from being opened as long as the outer building has enough openings for fresh air intake.

At each burn area, Dräger will provide a manually operated air inlet to allow the introduction of fresh combustion air into the training rooms.

Please note:

Dräger offers a smoke extraction system with a dry gas flue cleaning system (filtration system). This filter system fulfills the requirements of the tender concerning the max. dusting of the clean air of 20 mg/Nm³. The big advantage of this system is the small amount of lifecycle cost because the filter elements can be used between 5 and 10 years before replacement depending on the frequency of use and relevant maintenance activities.

This filter system does not reduce other non-visible substances beside dust like nitrogen oxides (NO_x), carbon dioxide (CO₂) and sulfur oxides (SO_x – if present).

3.1 Components of the smoke extraction and cleaning system

The dry flue gas cleaning plant exists of a filter system with an extraction flow of app. 33,000 m³/h at 150° C. The filter system consists of the following components (the characteristics of the components may change without less of functionality of the whole system acc. to the availability on the market):

The cleaning system consists of one filter housing, constructed in three sections, incl. cleaning facility, funnel and a discharge opening sealed to the waste box.

The filter housing contains several rows of filter hose made of long-lasting filter material, and clean gas covers. The dust collection hopper will be equipped with an access door and an auger complete with drive. The dust is collected in a weathertight and sealed waste box that can be easily replaced without direct contact with the waste (the waste box is not in scope).

The hose filter is equipped with a fully-automatic cleaning system of the filter hoses by compressed air pulses. The hose cleaning process works without any interruption of the smoke extraction of the training unit.

A compressor for the system is supplied, as well. Cleaning cycles are controlled automatically.

The filter hoses are replaced on the clean gas side. Every section is equipped with a clean gas cover.

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For the reliability and long life of the filter unit it is important, that only dry-wood is used as fuel for the fire cribs. It has to be ensured that no burning particles are sucked into the filter from the fire rooms. Therefore, a spark separator is installed in the ducting line, coming from the internal fire places.

The system includes an exhaust fan which is installed at the clean gas side of the system.

The system contains one piece clean gas pipeline from the filter's clean gas connection via the fan and a app. 10 to 12 m-high exhaust pipeline into the atmosphere made of corrosion protected steel, complete with fittings, pipe bends and flanges as well as all necessary supports.

The system contains ducting with various diameters from the filter to the domestic building and to demo & attack unit the domestic building including necessary T-pieces and shut-off valves and limit switches. Individual extraction points at the building openings like windows and doors will be fitted with hoods and pipe throttle valves are manually adjustable.

All ducting, as well as the hoods on doors and windows is made of galvanized steel, painted mild steel or stainless steel depending on the design and the functionality. The hood on the roof of the container will be made of stainless steel.

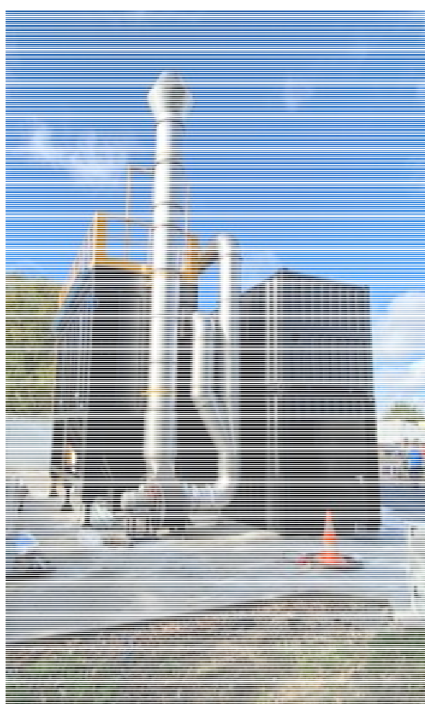
The internal smoke extraction is connected from the outside, with electric flaps for automatic operation. Pass-through Inserts (grids/flaps) for air in- and outlets are in scope of Dräger.

The smoke cleaning system will be equipped with a spark separator installed in the pipe system. Additionally, pre-coating dosing station is installed in a separate housing. Depending on the frequency of use of the system a pre coating material needs to be filled in the dosing station manually by the operator of the system.

Additionally, the system will be equipped with a silencer in the clean gas side between fan and chimney.

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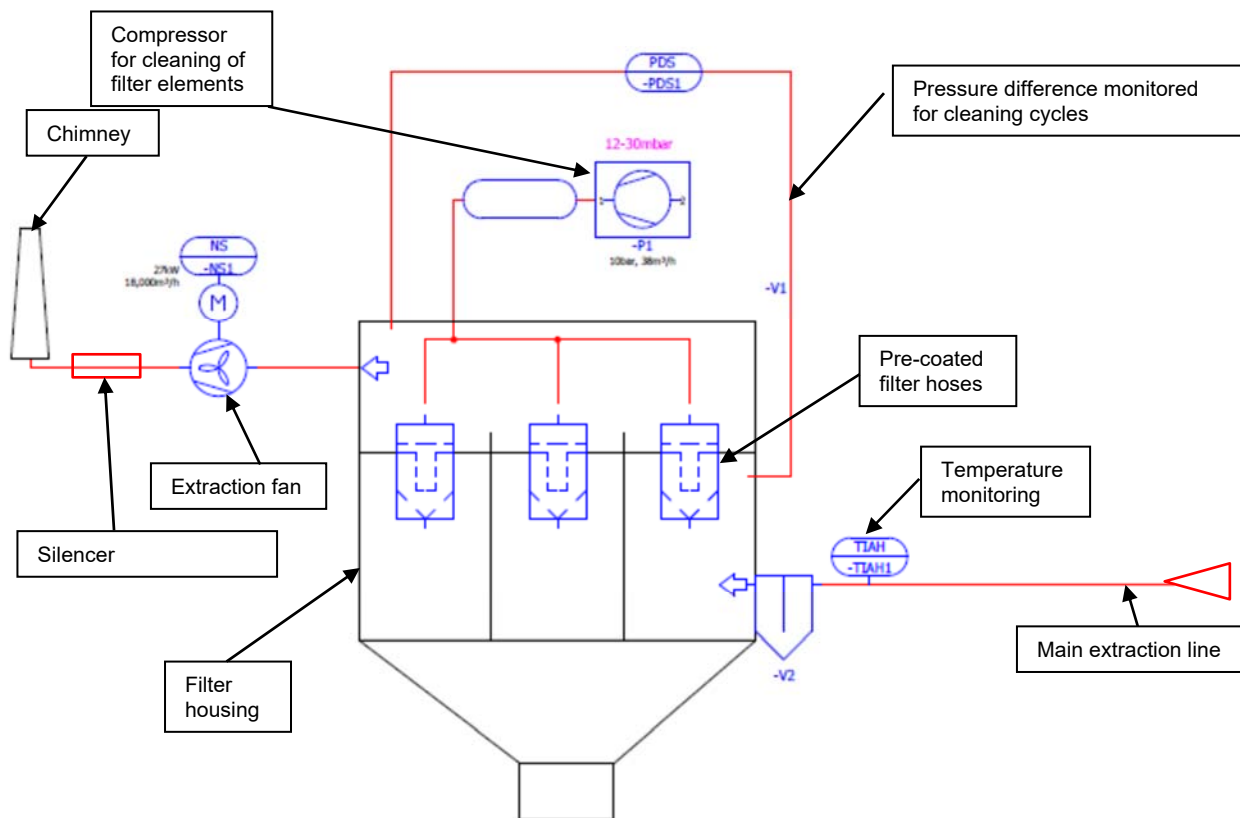
Filter housing with ducting, fan, spark separator, pre-coating dosing station and stack (Example La Roche / France)

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The smoke cleaning unit will be equipped with an additional touch screen for operation of the smoke cleaning system and for failure analysis.

The main signals will be transferred also in the external control room to allow the monitoring of the system for the most important process characteristics.



Functional diagram of smoke cleaning system

Smoke cleaning performance:

The discharge rate will be max. 20 mg/Nm³ in total dust (total mass).

The planned filtration system will not filter VOCs and any gases like CH₄, NO_x or Sulphur dioxide because it is a mechanical filtration only.

Provisions for positive pressure ventilation:

Dräger has considered the provisions for the positive pressure ventilation in the design, by a massive air exchange rate for the whole surrounding building. Ventilation rate for giraffe building during training brings full air exchange in app. 4 minutes. Thereby, enough fresh air for breathing is ensured at all times inside the giraffe building and the smoke is rapidly collected, providing full visual view on the PPV effects. This secures that as much smoke as possible will be exhausted, also during positive pressure ventilation while windows remain fully visible and usable.

Technical description (Realization phase)

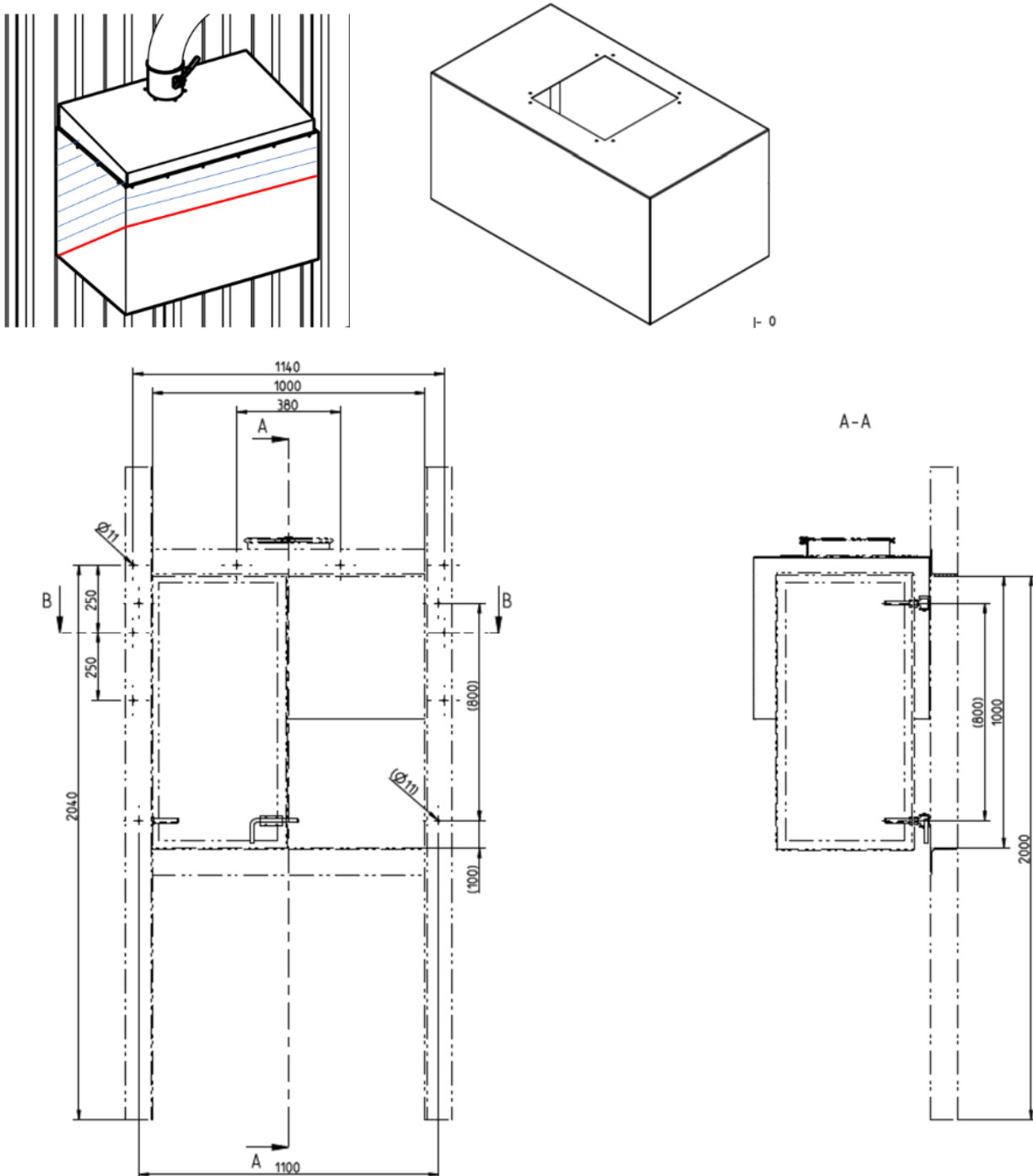
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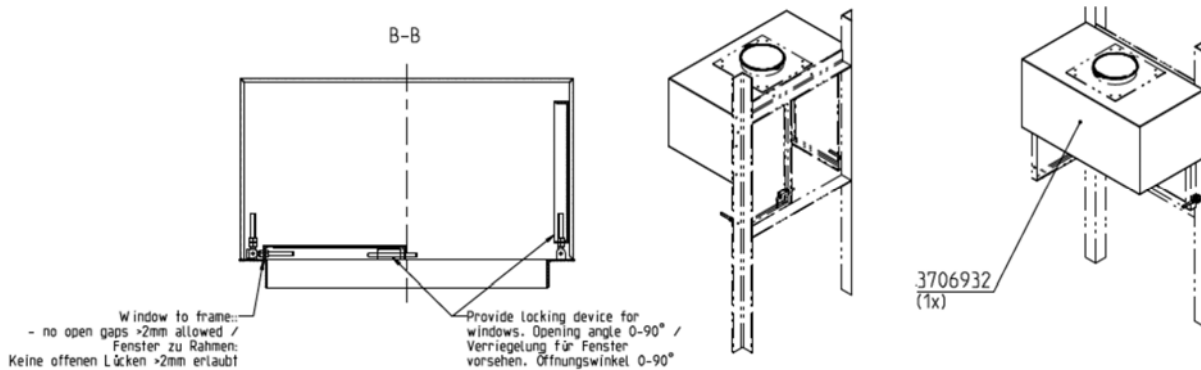
Additional special PPV window hoods (limiting physical as well as visual access to the window from outside), to be provided for window openings S7 and S19. The opening of the hood is at the bottom only to prevent too much loss of smoke. All other sides are closed by metal sheets. The smoke will be exhaust via the duct line into the filter system.

Example:



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Installation of the hoods at the window frames

Please note: It is not possible to exhaust the whole amount of smoke in case of PPV-training. Smoke residuals will be extracted from upper area of the giraffe building.

3.1.1 Dry filter and dust collector with automatic cleaning (1 pc)

The dry AIR-COM filter is a very good sleeve dust depurator by full automatic compressed air system.

Dust air is pushed inside the filter through inlet connected to the hopper. In this area bigger particles will fall down because of a sensible air speed decrease in comparison with what calculated for the inlet mouth.

By means of depression created by a centrifugal Electro-ventilator inside the cell, air will be conveyed to filtering sleeves passing from outside to the inside.

A compressed air jet will be injected inside the filtering sleeves creating a counter-current shaking (breaking wave) making precipitate the particles deposited outside the sleeves.

This air jet will be cyclically blown by a net of nozzles inside the respective venturi pipes connected to the filtering sleeves, which suck the external air and amplify it in comparison with the quality received, by nozzles. Dust filtering will fall in the hopper, collected into the hopper, collected ~~and discarded by means of a screw~~ in 4 pcs of waste bins (included in scope of delivery).

The filter is equipped with support legs, scroll electric connections between valves and cyclic regulator, check door, stair and gallery according with the regulations in force, doors to change the sleeves on the upper part of the filter, insulated plenum for Electro-valves.

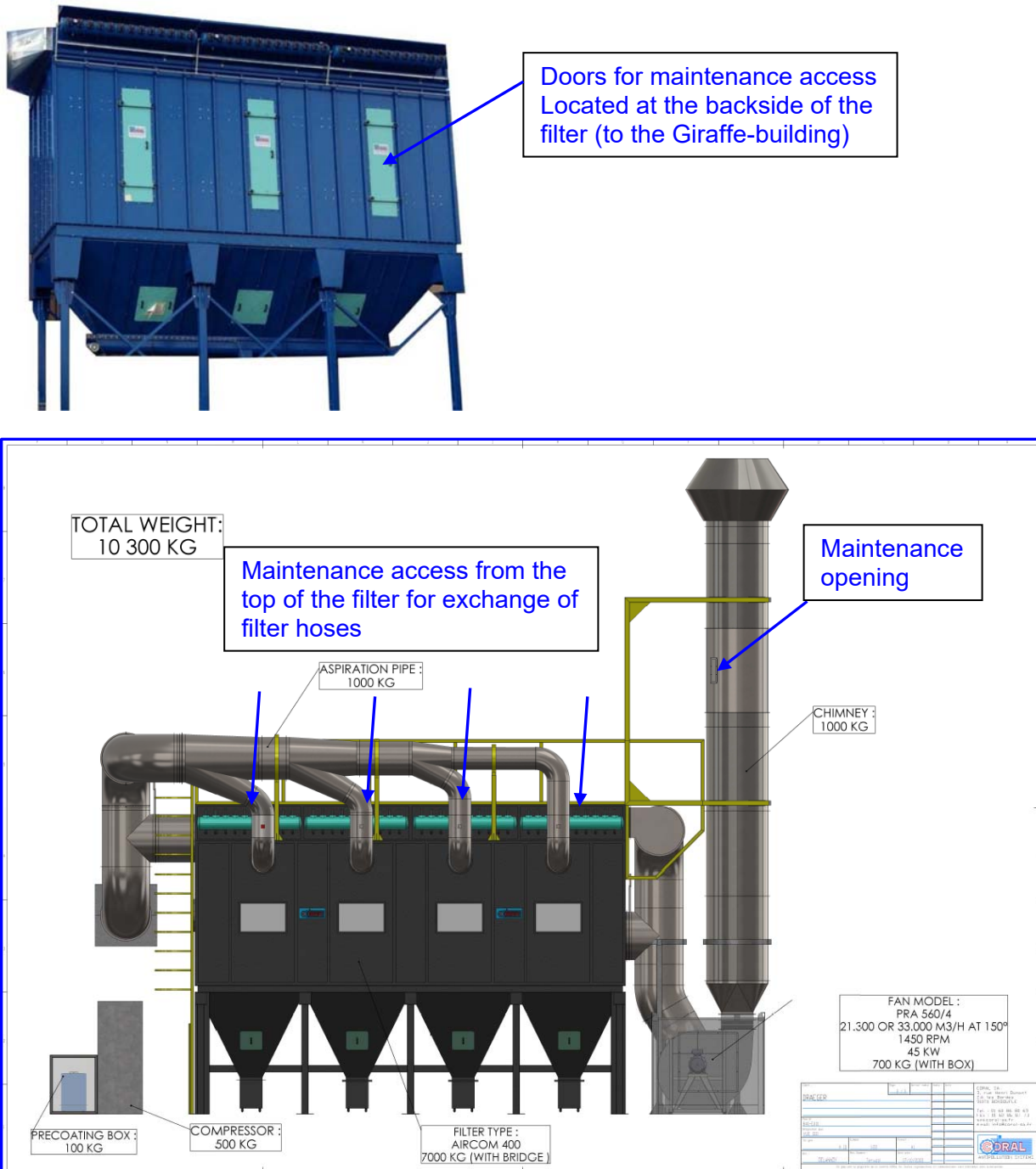
Filter power management:

At the start of the operation, a pre-coating is carried out with a filter powder. This tip increases the filtering power. When the pressure drop reaches saturation, the electronic board activates the cleaning system. At each cleaning, the pre-coating is automatically renewed.

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Example:



The waste from the filter will be collected in 4 pcs of waste bins below the filter hoppers. Each waste bin is equipped with a level control with two signals: Empty / Nearly Full. The signals will be forwarded to the screen in the control room. Additionally, a visual alarm (alarm lamp) at the filter unit will show that one of the waste bins needs to be emptied.

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Aerosil dosing :

Aerosil is a white, non-toxic silica powder used for filtration. This is dosed and introduced sequentially with the fumes to prevent vapours and dust from clogging, otherwise the filters would quickly be damaged.



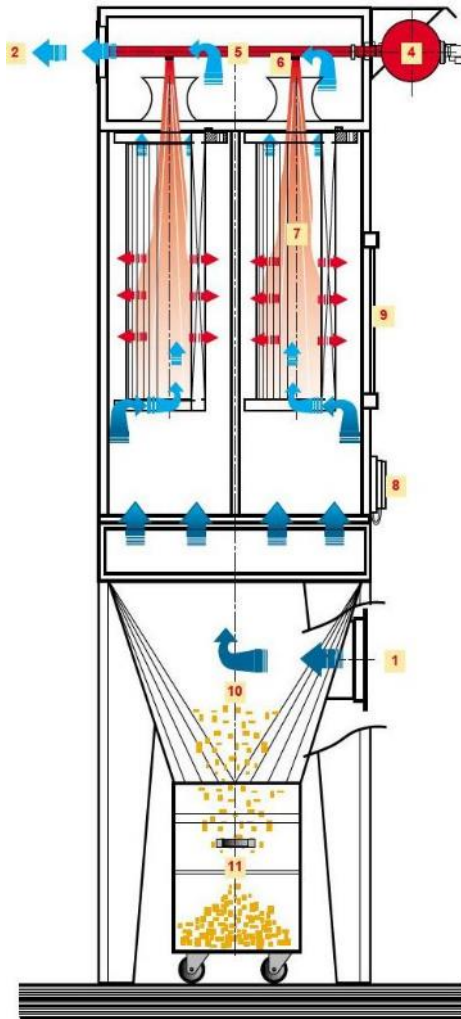
The Aerosil is available as 10 kg bags / 20 bags on a pallet.

App. 200 to 400 kg Aerosil will be needed per year for an operation time of 400 hours.
A dry storage room for at least two Euro-Pallets should be available on side.

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OPERATING PRINCIPLE:



The polluted air arrives in the lower part of the sleeves through an inlet (1) located at the level of the hopper (10).

Dusts of high particle size contained in the extracted air fall directly into the dust container due to the sudden reduction in their speed (11).

The lighter dust will be retained by the filter media of the bags (7). The filtered air comes out at the top, perfectly clean (2).

Media cleaning is ensured by the compressed air injection clogging system (4) controlled by a cyclically controlled timer (8) of the solenoid valves (3), cleaning one row of cartridges at a time.

The compressed air counter-blowing (5-6) is amplified by "venturi" positioned above each handle.

This results in an almost constant level of pressure drop and air flow.

An inspection door (9) allows the maintenance of the filter elements to be carried out

Staffing equipment:

- o 3 dust collection bins on wheels with manual isolation damper

TECHNICAL SPECIFICATIONS

Dimensions ≈	app. 8.000 x 3.000 mm
Height ≈	app. 8.000 mm
Weight:	app. 8.000 kg

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3.1.2 Centrifugal exhaust fan (1 pc)

High efficiency exhaust fan used to draw in clean, or polluted air with medium and high pressure.

The fairing is made of painted steel sheet, entirely welded, able to guarantee a perfect air resistance.

The statically and dynamically balanced reversed blade turbine is connected directly to the self-ventilated electric motor in accordance with European standards.

All the supports of the electro-vacuum cleaner (chase, base) are also made of thick sheet metal.

TECHNICAL SPECIFICATIONS

Type:	PRA 560/4
Air flow rate	33.000 m ³ /h at 150°C
Installed power	45 kW
Cooling Fan:	0,18 kW

Motor protection rating	IP 55
Supply voltage	3 x 400 V - 50 Hz.
Start:	Inverter-Start
Weight:	app. 800 kg

Fan incl. housing:



3.1.3 Ducting (1 set)

The diameters range from 200 to 700 mm and develop a linear length $\approx$ 80 m, including all required sections, flaps, bows, supports.

The height of the chimney is app. 10 to 12 meters.

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The main duct pipe (app. 500 kg) needs to be hanged up from the ceiling of the giraffe building. The suspension for the main duct pipe to the ceiling will be provided by the prime contractor / customer.

Overpressure protection (explosion protection):

In the event of a deflagration in the smoke cleaning system, the excess pressure will be evacuated via the damper which is used also for fresh air intake. Additionally, protection panels will be installed in the filter. The System will not be certified as an ATEX system because the accumulation of burnable gases will be prevented by the fresh air flow.

3.1.4 Spark separator (1 pc)

As long as the unit operates only with wooden pallets and the pallets are ignited by wood (no paper or materials that create volatile hot parts), the extraction system can be used without a spark separator. If the owner of the training simulator is not sure of the combustion and ignition materials, or if he wishes to avoid dangerous situations in the event of non-compliance with the operating manual for authorized fuels, the additional installation of a spark arrester is necessary and mandatory.

Thanks to the spark separator, the sparks present in the extracted smoke are projected, by cyclonic effect, into a retention tank provided for this purpose.

Example:



3.1.5 Compressor (1 pc)

The compressor is used to clean the filters and remove dust from the collector. It also allows the operation of electro-pneumatic dampers.

TECHNICAL CHARACTERISTICS:

Voltage:	3x400 VAC
The power:	7.5 kW, max. 51 m³/hour
Pressure:	Max 10 bar
Housing:	Sandwich panel with powder coated sheet structure, incl. door, fresh air opening and condensate outlet, roof with slope

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Others:

- Power lines in compliance with standards, carried out by qualified personnel.
- A PT 100 sensor is used to measure the temperature in the collector. If the temperature is above 200°C, we open a fresh air intake to create dilution.
- The fan start is controlled by a variable speed drive, limiting the start current calls and regulating the fan wheel speed in nominal phase.
It makes it possible to save energy and to decrease the sound power in case of medium use of the system.
- Installation of the electrical cabinet near the fan.

3.1.6 Silencer (1 pc)

The use of an absorbent phono material such as rock wool allows the silencer to withstand high temperatures, thus considerably reducing the noise pollution generated by the installation.

The silencer will be installed at the fan outlet and keeps noise emissions within acceptable limits.

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3.1.7 Cleaning Performance

The smoke cleaning system provides a cleaning performance acc. the standard *DIRECTIVE (EU) 2015/2193 of the European Parliament and of the council on the limitation of emissions of certain pollutants into the air from medium combustion plants*:

Emission limit values (mg/Nm³) for new medium combustion plants other than engines and gas turbines

Pollutant	Solid biomass	Other solid fuels	Gas oil	Liquid fuels other than gas oil	Natural gas	Gaseous fuels other than natural gas
SO ₂	200 ⁽¹⁾	400	—	350 ⁽²⁾	—	35 ⁽³⁾ ⁽⁴⁾
NO _x	300 ⁽⁵⁾	300 ⁽⁵⁾	200	300 ⁽⁶⁾	100	200
Dust	20 ⁽⁷⁾	20 ⁽⁷⁾	—	20 ⁽⁸⁾	—	—

NO_x and SO₂ will not be emitted as long untreated wood will be burned.

The emission limit of max. 20 mg/Nm³ (Dust) acc. to the above-mentioned standard can be confirmed. No visible smoke will be emitted from the chimney after the smoke cleaning.

Residuals of smoke can be emitted at the entrance doors of the fire training unit if open to enter the. Dräger is using sufficient extraction hoods above each entrance to minimize this less of smoke.

3.1.8 Advantages of the smoke cleaning system

- Flow rate in accordance with relevant standard for Fire Training Units DIN 14097-1 (visibility after 2 min of start of emergency extraction) to perform the latest safety standard
- No visible smoke or steam at the outlet of the chimney
- Cleaning performance in accordance with relevant European standard
- Less life cycle / operation costs because no water or gas consumption
- Less CO₂-emission
- High availability because of less complexity of the system
- Less maintenance costs because no aggressive or hot fluids or gas will be used, that could damage the system

Associated planning documents:

- 11098167_1_1_xx_Layout_Fire_Training_Unit
- 11097777_xx_MAWW_P&I-Diagramm
- Planning of duct system and outside arrangement no. 840_EXxx

4 Control system (1 set)

The control system is installed in the switchboards A1 and A2 located next to domestic and smoke cleaning unit. The heart of the system is a PLC-module which coordinates the required activities of the system. The PLC system will be connected via modem to secure a sufficient online remote support in case of updates, adjustments and system faults.

There is a PC with monitor installed in the external control room ([housing in scope of customer / prime contractor](#)) for system control and monitoring by the operator.

Log on requires use of a control key. Furthermore, there's one emergency pushbutton installed on a table console. Audible alarms and flashlight for emergency information are placed on the training facility. An additional key switch is installed to allow remote access.

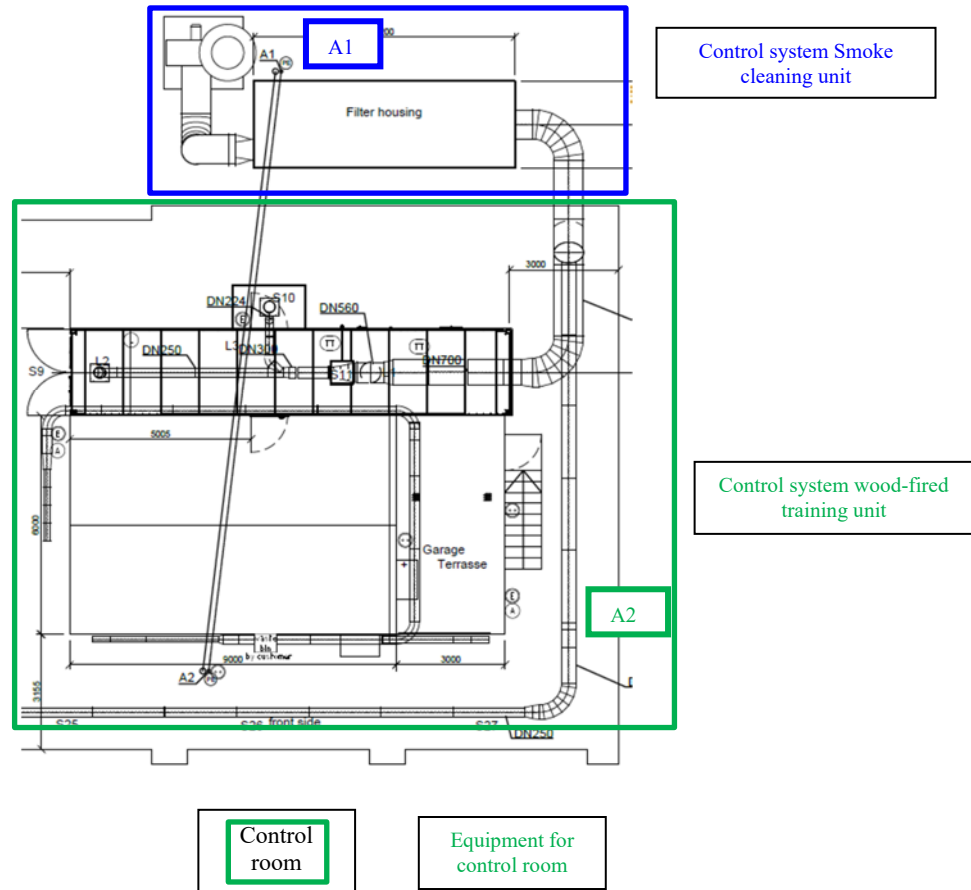
After system self-initialization and self-testing, the user can start training in the chosen training unit (building or container) with a single button. After training is done training mode is stopped in the software by a single touch and normal smoke extraction starts.

The emergency lights will be automatically switched on in an emergency case or can be switched on manually as room lights.

All cabling for emergency light, emergency buttons and power sockets, is led in safe distance to the fireplaces with protection for the cables against mechanical damage and heat.



Example of PC-driven control station



Schematic of the control system

Power supply:

A1: 400V app. 124A (detailed values acc. Power Balance)

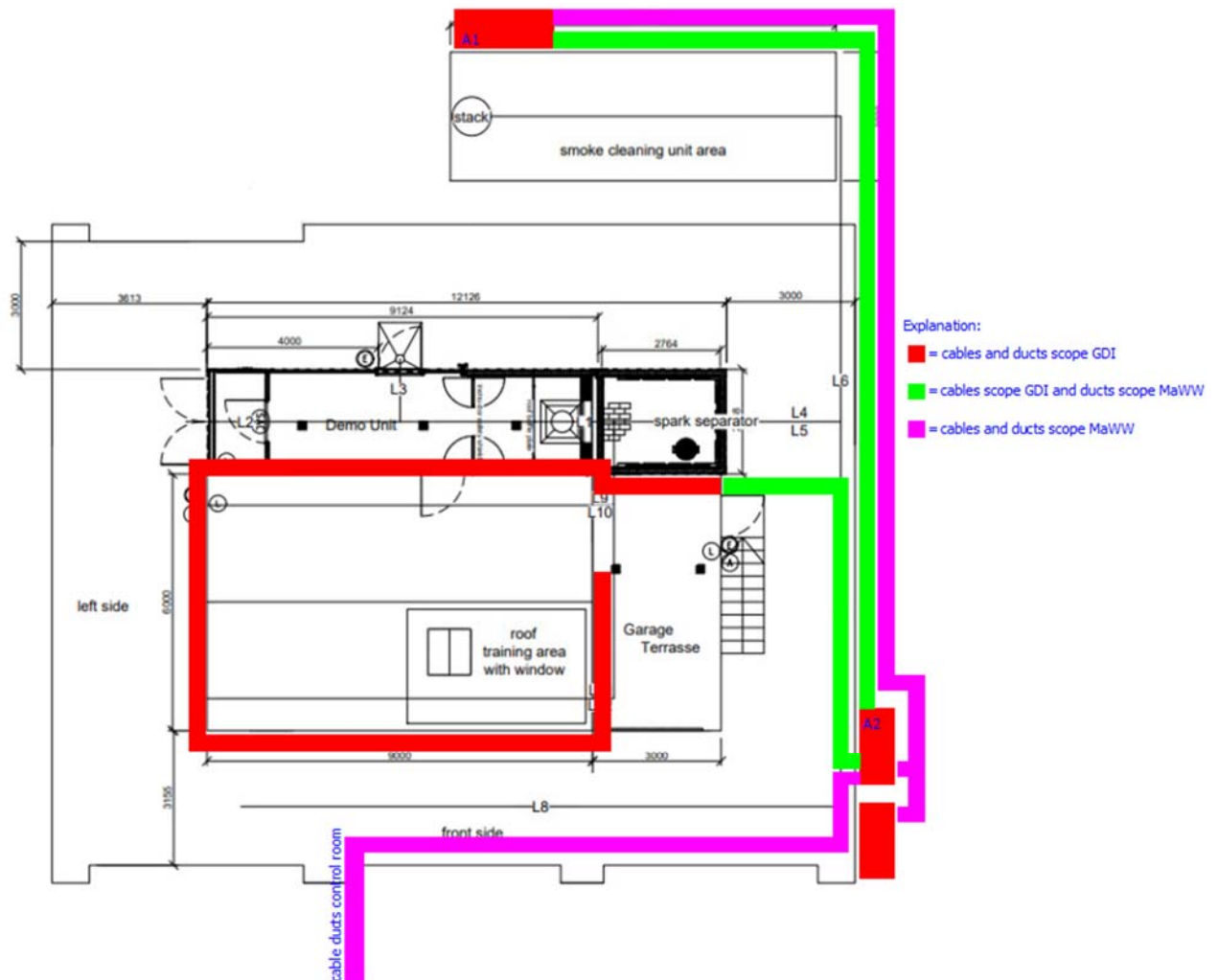
A2: 400V app. 32A (detailed values acc. Power Balance)

4.2 Components of the control system

4.2.1 Cabling and Ducting

The cable routes including the cables for the power supply at A1 and A2 are within MaWW. The cables to the control room are also within the scope of MaWW as well as the cable route for the cables between inner building and A2 (note below picture).

Single cables to switches, lamps, etc. installed in protective pipes acc. British Standard



Example cable ducts for training building:



e.g. OBO Bettermann

Metal cable ducts in different sizes

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4.2.2 Electrical Cabinet (A1) (1 pc)

The cabinet includes main switch, fuses, protection switches, plc, digital in- and outputs, relays, and terminals to connect all components of the smoke cleaning system (without automatic laps).

Characteristics:

- Powder coated switch board, IP 54
- Housing with front door
- Access to the control elements via plexiglass pane incl. magnetic lock



Example of the switchboard incl. housing

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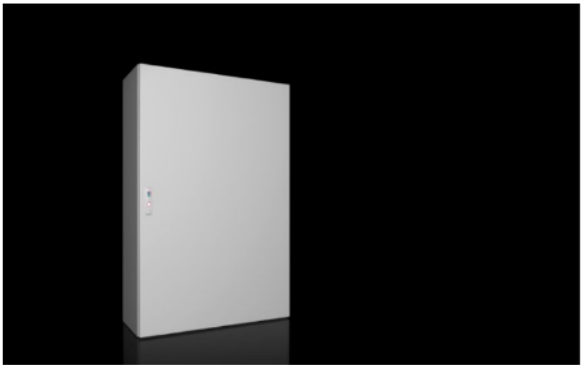
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Touchscreen in the switchboard A1 for failure analysis and maintenance of the smoke cleaning system.

4.2.3 Electrical Cabinet (A2) (1 pc)

The cabinet includes main switch, fuses, protection switches, plc, digital in- and outputs, relays, and terminals to connect field components in the wood fired container and in the training building.



Product lifecycle: **Active**

Article number: **AX 1280.000**

Compact enclosure AX Basic enclosure AX, sheet steel

System perfection. The new compact enclosure AX (sheet steel) offers maximum data quality and consistency in engineering, and flexibility and safety in assembly and interior installation.

Dimensions (LxWxH): approx. 800 x 1200 x 300 mm
Color: e.g RAL7035

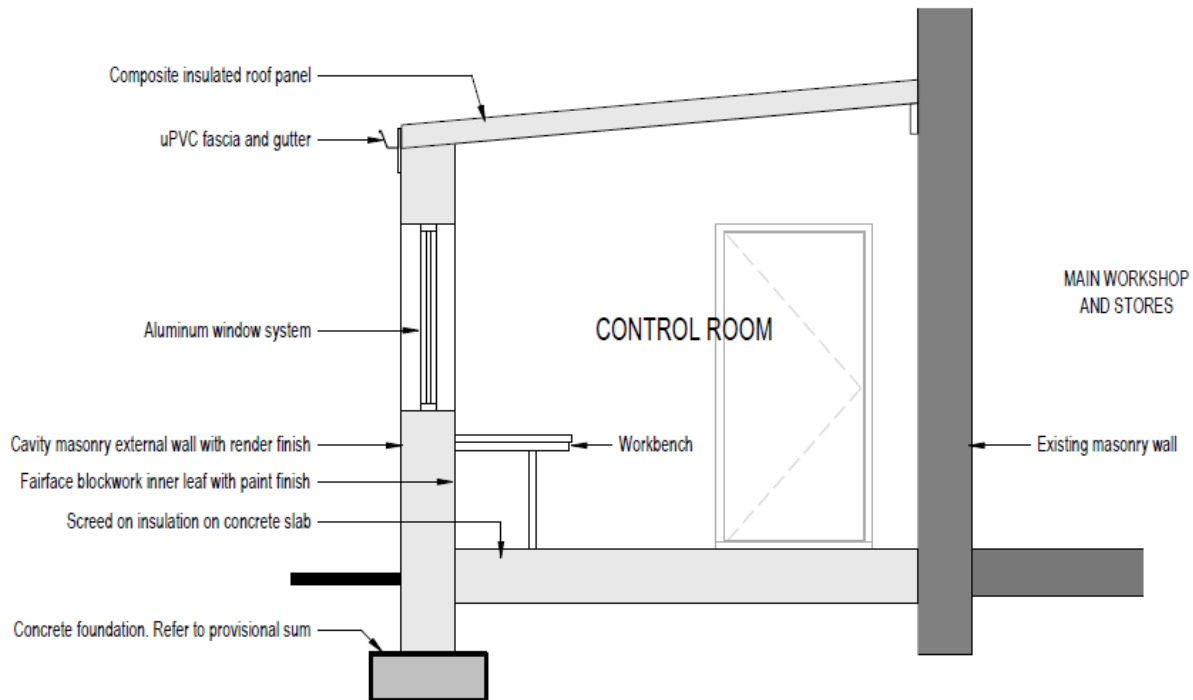
The cabinet is installed in a neighboring building (material store). The wiring to the field components is realized to provided service ducts or cable pipes.

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4.3 Control room (1 room)

The external control room as shown below is in scope of customer.



The control room will be equipped by Dräger with the following control and observation elements:

- Personal Computer (PC) with all necessary software and licenses for control and monitoring of the unit
- Human Interface (HMI) is a 21" monitor, keyboard and mouse
- Desk for hardwired emergency stop switch and key switches for operator access and remote access
- Office desk and office chair

The following cables need to be provided by the customer between the giraffe building and the external control room:

- 1 x Network cable CAT 7
- 1 x Control cable 10 x 1.5
- 1 x Power supply cable 230 V or power supply in the control room (under clarification)

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4.3.1 Electrical Cabinet (1 pc)

To mount components like VPN router, switches and for easy access to connection points between interface points **an additional switchboard A3 will be installed.**



Product lifecycle: **Active**

Article number: **AX 1034.000**

Compact enclosure AX Basic enclosure AX, sheet steel

System perfection. The new compact enclosure AX (sheet steel) offers maximum data quality and consistency in engineering, and flexibility and safety in assembly and interior installation.

Dimensions (LxWxH): approx. 300 x 400 x 210 mm
Color: e.g RAL7035

4.3.2 Computer system (1 pc)

The computer system consists of:



Personal Computer

(Minimal requirements)

CPU: Intel i5 Processor or similar
RAM: At least 8 GB
Graphics: 1920 x 1080
System: Windows 10 Professional
(64-bit) or higher

Connections:

- min. 1 LAN connector
- Possibility to connect 2 digital monitors
- at least 4 USB-Ports



Monitor min. 21"
e.g. Dell Professional P2213 22"

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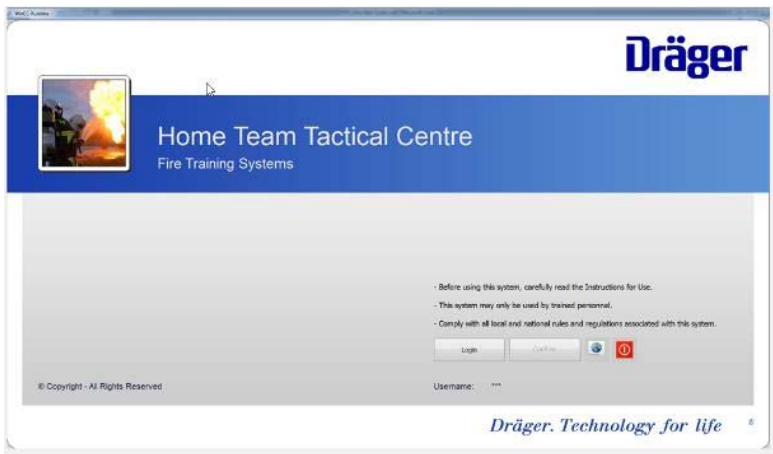


Wireless keyboard + mouse
e.g. Dell Pro KM5221W

4.3.3 Software and license (1 set)

Programmable logic controller PLC with visualization via PC for full automatic operation of the facility equipment. Therefor the software WinCC Runtime Professional is needed to host the visualization (HMI) at the control computer.

SIMATIC WinCC RT Professional, 128 PowerTags V17, runtime software in TIA Portal, single license	Download:	6AV2105-0BA07-0AH0
	DVD:	6AV2105-0BA07-0AA0



The customer specific control software will be programmed according to the wiring diagram and will be delivered by Dräger.

4.3.4 Control panel (1 pcs)

For easy access to main facility functions there is a table control panel.

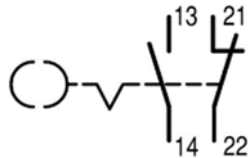


- Key switch to set system to training mode
- Key switch to turn on remote access
- E-Stop

Technical description (Realization phase)

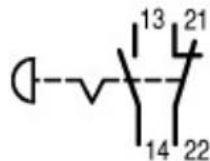
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Panel consist of:



e.g. Eaton
Selector switch, 1NO+1NC, 2 Pos (2 pcs)

Type: M22-WRS/K11
Number: 216517



e.g. Eaton
Emergency-Stop pushbutton, 1N/O+1N/C (1 pcs)

Type: M22-PV/K11
Number: 216516



Desk housing 250 x 181,2 x 68,2 mm, IP40 (1 pcs)

Type: ATPH 1865-250
Dimensions: 250 x 181,2 x 68,2 mm

4.3.5 Desk / Workbench (1 pc)

A stable worktable is required in the control room. The PC system is located at this place. The system is monitored from here.



Dimensions (LxWxH): app. 800x1500x1080 mm
Load capacity: 500kg
Height: adjustable in the range
760 - 1,080 mm

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4.3.6 Chair (1 pcs)

For the control room an ergonomic office chair needs to be provided.



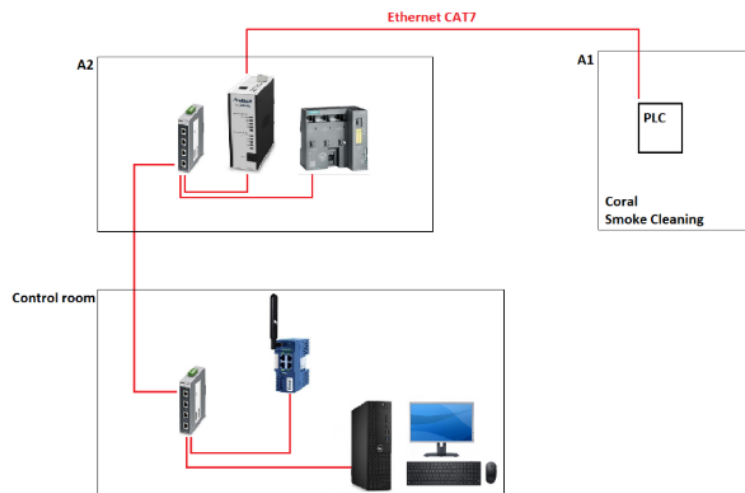
Brand:
Dimensions (WxDxH):

Conway 24hr Backcare Chair
660(w) x 600(d) x 1230mm(h)

4.3.7 Facility Network

All network components will be connected to insure the communication between the single facility parts like main cabinet and control room.

Network topology



4.3.8 Additional network components (1 set)

In addition to parts like PLC and Computer there are further equipment, which is needed to ensure the connection. The components should be installed in the control room.

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Switch (2 pcs)
e.g. Phoenix Contact FL SWITCH SFNT 5TX

Wide-temperature Ethernet switch, 5 TP RJ45 ports, automatic detection of data transmission speed of 10/100 Mbps (RJ45)



VPN-Router (1 pcs)
Ewon COSY 131 LTE Europe
EC6133G/WEC6133G

This router is used to connect the system in case of remote service. It's possible to use an internet connection provided by the customer. Alternately it is possible to use a SIM-Card for mobile connection.



GSM 2G 3G 4G antenna 3dBi SMA with 5m cable
WEW40902K incl. holder (1 pcs)

4.3.9 Interface to smoke cleaning system between A1 and A2 (1 pc)

To connect the plc of the fire training facility with the plc of the smoke cleaning is used a gateway connection. The Anybus X-gateway connects two PROFINET IO networks with each other and thus enables the seamless flow of information between the two PLC systems.



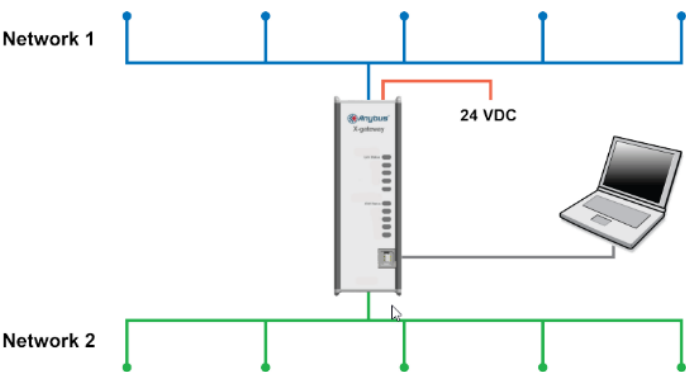
Technical Specifications	
Model name	Anybus X-gateway
Dimensions (L x W x H)	114 x 44 x 127 mm
Weight	400 g
Operating temperature	-25 to +65 °C (IEC 60068-2-1 and IEC 60068-2-2) (max. +50 °C for fibre optic interfaces)
Storage temperature	-40 to +85 °C (IEC 60068-2-1 and IEC 60068-2-2)
Humidity range	5–95 % RH, non-condensing (IEC 60068-2-30)
Pressure range	85–105 kPa
Power supply	24 V ±20 % DC regulated power source
Current consumption	Typical: 200 mA @ 24 VDC Maximum: 400 mA @ 24 VDC
Configuration port	USB (USB to CAN cable not included)
Galvanic isolation	Yes, on both network sides
Mechanical rating	IP20, NEMA rating 1
Mounting	DIN rail (EN 50022) Network shield conductance via DIN rail
Certifications	See www.anybus.com/support

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The gateway is installed in the cabinet of the fire training system (A2). For connection between both plc there is a CAT7 network cable needed.

4.4 Electrical Equipment in the CFBT-Building and Wood-fired Container

4.4.1 Temperature monitoring (1 set)

For monitoring the temperatures, Dräger will install 2 thermocouples in each fire room on different heights (1 m and 2m height, protected against mechanical damage). These sensors will be connected to the control system. In case of over temperature, the smoke extraction system will be activated to remove heat. Additionally, the demo/ attack unit will be equipped with thermocouples in observation and burn room.

Example:



Characteristics:

Sensors (Brand: Conatex):



TYPE K NiCr-Ni 1000mm (10 pcs)	T57MK126AL1000Z0
TYPE K NiCr-Ni 3000mm (10 pcs)	T57MK126AL3000Z0

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Thermo-couple-coupling:



Miniature connectors
 NiCr-Ni, Typ K
 (20 pcs)

TM5M22PKI

Thermo couple cable:
 Color code (BS4937):



Miniature connectors
 NiCr-Ni, Typ K
 (20 pcs)

TM6KGXGVX02D2



To protect the connection point inside cable tray of sensor use a IP65 terminal box or cable sleeve.

4.4.2 Emergency lighting (1 set)

The building and the container will be equipped with low level heat and smoke resistant lighting for use to illuminate the training unit. This lighting system will be linked to the emergency alarm which will illuminate all lighting. This consists of:

- LED-spotlights made of metal incl. step protection (15 in total sum)

Characteristic:



SIRENA LWL 15
 44005
 15W/10-30V/1710lm

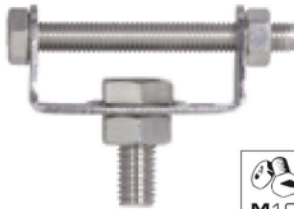
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In dotazione
Supplied with
Fourni avec



STAFFA DI FISSAGGIO
MOUNTING BRACKET
BRIDE DE FIXATION



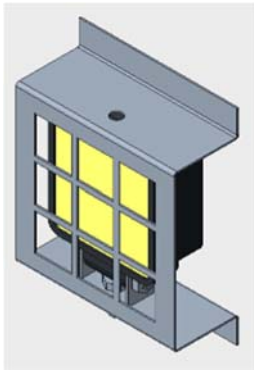
LED work lamp ideal for professional vehicle lighting applications. The super bright Osram LEDs allow using the device **LWL 15W 9LED** for over 30000 hours drastically reducing maintenance costs and enhancing energy savings.

Voltage
10/30V DC +/-10%

Mechanical features
Polycarbonate lens with diecast aluminum body. Stainless steel mounting bracket supplied. Fixing through screw M10.

Optical features
9x super bright Osram LEDs.
Color temperature 6000K.
Light beam 60°.

Housing of the light:



4.4.3 Emergency shut-off (1 set)

For secure shut down of the equipment in case of an emergency.

Activation of smoke extraction and lighting equipment is provided. This consists of:

- At least 1 unit push buttons (made of metal) at the entrances to the training unit, 1 pc on each corridor and other relevant positions, including fastening plate (10 pcs in total sum)
- ~~Safety bars beneath and above~~ Housing of the push button to avoid unintended activation (e.g. by knocking it with compressed air breathing apparatus).
- Installation in the door area about 600 mm above the ground.
- Cabling inside metal tube (heat protection).
- Redundant cabling.

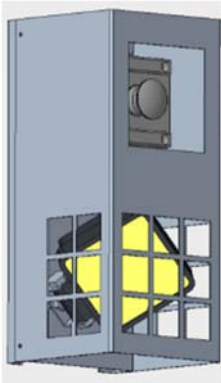
Housing of emergency stop, combined with light:

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4.4.4 Sockets for artificial smoke generation (5 pcs.)

The buildings will be equipped with suitable sockets for the power supply of smoke generators. The sockets will lose electrical power if one of the emergency buttons in the building will be pressed. Protection type IP 65
Max. two smoke generators can be run at the same time.

Example:



4.4.5 Battery Powered Backup (1 pc)

Installation of a Battery Powered Backup, incl.

- Battery Powered Backup for all emergency lights (15 pcs) for a duration of 10 min
- Uninterruptable Power Supply (UPS) for the PLC-system (at least 10 min)
- Uninterruptable Power Supply (UPS) for the PC in the control room (at least 10 min)

Associated planning documents:

- 11098167_1_1_xx_Layout_Fire_Training_Unit
- 11097777_xx_MAWW_P&I-Diagramm
- 11098356_xx_Single_Line_Diagramm
- 6033_MAWW_FRS_Power_Balance_Rev_xx

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5 Project Services

Partial acceptance before installation

Dräger will organize and carry out a practical factory test on the containers before installation.

Transport and unloading

Dräger ensures the complete transport of the complete equipment, in accordance with the following:

- Transport logistics coordination
- Availability of shipping documents
- Transport insurance
- On-site unloading on foundations and concrete surfaces prepared by the customer

Installation, commissioning and on-site acceptance test (Site Acceptance Test / SAT)

Installation of the fire training unit, consisting of:

- Installation of the entire fire training unit, including the smoke extraction system, at the prepared destination.
- Commissioning and adjustment of the smoke extraction and smoke cleaning system
- System test by burning wood
- Checking the smoke tightness of the system
- Site acceptance test and delivery to the customer

Documentation

Two (2) copies of complete and detailed operations and maintenance manuals for the newly provided system will be delivered in hard copy in English and one copy on CD/DVD.

Composed of:

- Instruction manual
- General drawings
- Connection diagrams
- Spare parts list
- Maintenance manual for operators
- Confirmation after EC Regulations for the smoke extraction system

Theoretical and practical training including hot training.

Introduction for trainers to learn how the unit works. Up to 10 people can participate in the training, which also includes instructions on preventive maintenance work, which takes place over one day.

Composed of:

- Theoretical sessions on the functioning and functionality of the system
- Practical sessions on newly installed equipment, including hot training
- Setting the smoke extraction system
- Preventive maintenance training (Level 1)

All necessary fire-fighting equipment, vehicles, extinguishing agents and wooden panels will be provided by the customer.

Technical description (Realization phase)

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Quality

Dräger guarantees that all the equipment it supplies is manufactured with top quality materials and without production defects. The manufacture of the equipment for the smoke extraction system will be carried out in accordance with ISO 9001.

Dräger's own quality management will ensure that during manufacture, installation and commissioning, the agreed standards and the requirements of tenders and contracts are met at a high level of quality.

Maintenance and technical support

Dräger has many subsidiaries with dedicated teams of trained service technicians, who coordinate and carry out all maintenance and servicing operations. Maintenance is carried out when the maintenance contract is commissioned by the local subsidiary Dräger or distributor.

In addition, Dräger offers online support with direct access to remote control and system diagnostics.

During operation and maintenance training, Dräger will train in the execution of preventive maintenance procedures to enable the customer to solve minor system problems, which reduces operating costs and increases the useful life of the fire training system.

6 Interfaces

- 2 x power connection 400 V (+/- 5%) / [app. 124 A](#) and 32 A / 50 Hz (+/- 0,2Hz), TN-S network, connected to Dräger switch cabinets A1 and A2 acc. power balance sheet for the main supply. The Max. current can be redefined in the project phase after detailed design review/approval.
- 3 x power connection 230 V in the control room
- Foundations for smoke cleaning unit, wood-fired container and in-house-training building including grounding points

7 Standards

The design and installation of the equipment proposed by Dräger will comply with the following codes and standards:

DIN 14097-1 and -3

Fire brigade training facilities

Part 1: General Requirements

Part 3: Wood-fired Training Facilities

IEC 60346

International Wiring Standard, Low Voltage Electrical Installations

DIRECTIVE (EU) 2015/2193 of the European Parliament and of the council

Limitation of emissions of certain pollutants into the air from medium combustion plants: Dust only

8 Exclusions

The following items are not included in our scope and must be provided by the customer:

- Foundations and concrete surface (with grounding points) for the fire training system.
- Earthing of the equipotential connection of our installation.
- Securing paved access roads for unit delivery (not accounted for any hard standing).
- Power supply (400 V, 3 phases) according to technical requirements to be supplied to Draeger connection point.
- Fuel supply (wooden panels / pallets) and extinguishing water.
- Underground ducting
- Drainage and drainage installations to receive and evacuate fire-fighting water on ground floor.
- Connection point for lightning protection system.
- All necessary building control and planning permits and their acceptance by third parties.
- The warranty excludes components in direct contact with flames (irrelevant deformation of steel components, black rust).
- Civil engineering works required to be carried out according to the design plan, including metal work to be sealed, glazing works, modifications to elements that are not part of our supply (training props, such as furniture, accessories, etc.).
- Clearance (Removal and disposal of existing unit/buildings) and protection of access and work areas.
- The disposal of waste from the site in the container provided by the customer.
- Moving any equipment or installation that may interfere with the installation of our equipment.
- Any penalty or liquidated damages payments
- Every service or delivery that is not explicitly included in the described scope of supply of Dräger in this offer
- Outer building (giraffe) and any required changes of the building (e.g. breakthroughs, supports for pipes, fresh air-inlets or outlets, additional sealing against smoke less etc.)
- The welfare facilities will be provided by the customer for Dräger and its subcontracted employees.
- The giraffe building and other existing containers can be used by Dräger and its subcontractors for storage of material.
- The main duct pipe (app. 500 kg) needs to be hanged up from the ceiling of the giraffe building. The suspension for the main duct pipe to the ceiling will be provided by the prime contractor / customer.
- Lightning protection for the chimney, smoke cleaning plant incl. connection point will be provided by others.
- Any structural surveys required to establish the suitability of the buildings and foundations. A survey will be required by the company that is completing the civil works.