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Instruction manual for the installation of a KLARO wastewater treatment system into the Carat XL / XXL



The subjects described in this instruction manual must be observed. Non-observance will void all warranty claims. For all additional articles purchased via GRAF you will receive separate installation instructions enclosed in the transport packaging.

It is essential to check the components for possible damage before moving them into the excavation pit.

You will receive a separate instruction manual for the operation and maintenance of the system.

Table of contents

1.	**Scope of delivery**	**2**
2.	**Notes**	**5**
3.	**Construction and functional principle**	**6**
4.	**Final assembly of tank domes and connecting the sludge recirculation**	**7**
5.	**Assembling the interior control cabinet**	**8**
6.	**Assembling the exterior control cabinet**	**13**
7.	**Laying the air hoses**	**19**
8.	**Commissioning**	**21**
9.	**Technical data control cabinets**	**22**
10.	**Appendix**	**24**

1. Scope of delivery

1.1 Included are:

- Tank with pre-assembled water treatment technology consisting of air lift pumps for charging, clear water extraction, and sludge recirculation as well as the aeration device.
- Mini walkable telescopic dome cover, optionally car or truck passable (at a surcharge).
- Control cabinet with control, valves and rotary vane compressor. For systems treating more than 165 PE, the technology is supplied as machine technology for assembly in an utility room.

  Optionally, the control cabinet is available as an exterior control cabinet.

Not included are:

- Underground pipes for tank connections and empty conduits. The required pipe diameters can be found in the technical drawings.
- Hoses to supply air from the control cabinet to the treatment plant. The required air hoses can be found in Table below.
  The hoses can be ordered using the following item numbers:

Hose package 3x 13 mm, 1x 19 mm, 10 metres	107190
Hose package 3x 13 mm, 1x 19 mm, 20 metres	107192

The hose packages are suitable for 38 and 46 PE sizes. For other sizes the PVC hoses can be ordered as rolled goods:

PVC hose 20 metres, transparent 13 mm	934011
PVC hose 20 metres, red 13 mm	934014
PVC hose 20 metres, black 13 mm	934017
PVC hose 20 metres, blue 19 mm	934020
PVC hose 20 metres, transparent 25 mm	934002

1. Scope of delivery

Table 1: Type range including technical data

System size	Tank	Type interior control cabinet	Type Exterior control cabinet	Type Compressor	Required air hoses
38 PE**	2x 8,500 l	Type 2	Exterior cabinet L	DT 4.16	3 x 13 mm 1 x 19 mm*
46 PE**	2x 10,000 l	Type 2	Exterior cabinet L	DT 4.16	3 x 13 mm 1 x 19 mm*
80 PE	4x 8,500 l	Type 3	Exterior cabinet XL	DTN 41	6 x 19 mm
100 PE	4x 10,000 l	Type 3	Exterior cabinet XL	DTN 41	6 x 19 mm
120 PE	5x 8,500 l	Type 4	Exterior cabinet XL	KDT 3.60	8 x 19 mm 1x 25 mm
145 PE	5x 10,000 l	Type 4	Exterior cabinet XL	KDT 3.80	8 x 19 mm 1x 25 mm
165 PE	7x 8,500 l	Machine technology	Exterior cabinet XXL	KDT 3,100	8 x 19 mm 4x 25 mm
200 PE	7x 10,000 l	Machine technology	Exterior cabinet XXL	KDT 3,100	8 x 19 mm 4x 25 mm
75 PE	2x 16,000 l	Type 3	Exterior cabinet XL	DTN 41	3 x 19 mm 1 x 25 mm
100 PE	2x 22,000 l	Type 3	Exterior cabinet XL	DTN 41	5 x 19 mm
100 PE**	2x 16,000 l	Type 3	Exterior cabinet XL	DTN 41	3 x 19 mm 1 x 25 mm
125 PE	2x 28,000 l	Type 3	Exterior cabinet XL	KDT 3.60	5 x 25 mm
150 PE	2x 32,000 l	Type 4	Exterior cabinet XL	KDT 3.80	6 x 25 mm
165 PE**	2x 26,000 l	Type 3	Exterior cabinet XL	KDT 3.60	5 x 25 mm
175 PE	2x 38,000 l	Type 4	Exterior cabinet XL	KDT 3.80	6 x 25 mm
200 PE	4x 22,000 l	Machine technology	Exterior cabinet XXL	KDT 3,100	10 x 25 mm
200 PE**	4x16,000 l	Machine technology	Exterior cabinet XXL	KDT 3,100	8 x 25 mm
220 PE	2x 44,000 l	Machine technology	Exterior cabinet XXL	KDT 3,100	9 x 25 mm
250 PE	1x 52,000 l + 2x 32,000 l	Machine technology	Exterior cabinet XXL	KDT 3,100	12 x 25 mm
275 PE	1x 32,000 l + 1x 16,000 l + 2x 28,000 l	Machine technology	Exterior cabinet XXL	KDT 3,100	10 x 25 mm
300 PE	1x 52,000 l + 2x 32,000 l	Machine technology	Exterior cabinet XXL	KDT 3,140	12 x 25 mm
300 PE**	4x 26,000 l	Machine technology	Exterior cabinet XXL	KDT 3,140	10 x 25 mm
350 PE	3x 22,000 l + 2x 38,000 l	Machine technology	Exterior cabinet XXL	KDT 3,140	12 x 25 mm
400 PE	3x 22,000 l + 2x 44,000 l	Machine technology	2x exterior cabinet XXL	2x KDT 3,100	18 x 25 mm

1. Scope of delivery

System size	Tank	Type interior control cabinet	Type Exterior control cabinet	Type Compressor	Required air hoses
450 / 500 PE	3x 22,000 l + 4x 32,000 l	Machine technology	2x exterior cabinet XXL	2x KDT 3,100	24 x 25 mm
550 / 600 PE	3x 26,000 l + 4x 32,000 l	Machine technology	2x exterior cabinet XXL	2x KDT 3,140	24 x 25 mm
650 / 700 PE	1x 42,000 l+ 2x 32,000 l + 4x 38,000 l	Machine technology	2x exterior cabinet XXL	2x KDT 3,140	24 x 25 mm
750 / 800 PE	1x 38,000 l + 3x 22,000 l + 6x 28,000 l	Machine technology	3x exterior cabinet XXL	3x KDT 3,100	30 x 25 mm
850 / 900 PE	1x 54000 l + 3x 22,000 l + 6x 34,000 l	Machine technology	3x exterior cabinet XXL	3x KDT 3,140	36 x 25 mm
950 / 1000 PE	1x 54,000 l + 3x 22,000 l + 6x 38,000 l	Machine technology	3x exterior cabinet XXL	3x KDT 3,140	36 x 25 mm

* can be ordered as hose package.
** only treatment class C

2. Notes

2.1 Safety

The national accident prevention regulations must be observed during all work. Particularly when inspecting the tanks, a 2nd person is required for safety reasons.

In addition, the relevant national regulations and standards must be observed during installation, assembly, maintenance, repair work, etc.

During all work on the system or parts thereof, always shut down the entire system and secure it against unauthorised re-start.

Always keep the tank cover closed, except when working in the tank. Otherwise, there is a high risk of an accident occurring. Only genuine GRAF covers or covers that GRAF has approved in writing must be used.

GRAF offers an extensive range of accessories, which are all coordinated to each other and can be expanded to form complete systems. The use of other accessories may impair the functionality of the system and invalidate liability for any resulting damage.

2.2 Assembly tool

The tool used to install the stainless steel hose clamps must be stainless steel. Otherwise, the stainless steel parts that have come into contact with the non-stainless steel tool may rust.

2.3 Aeration and ventilation

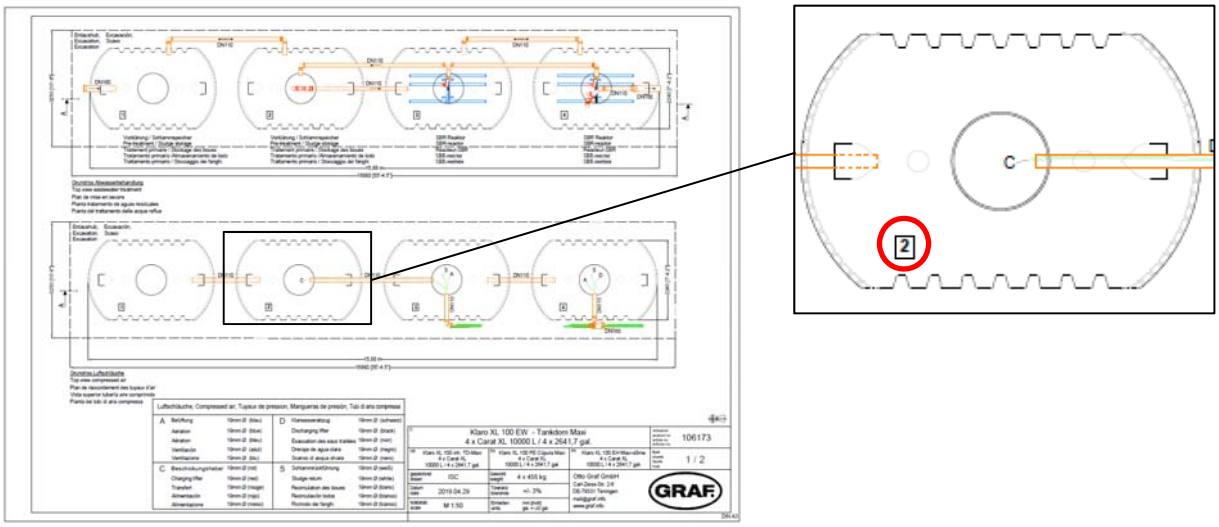
All containers are to be aerated and ventilated. Additional ventilation pipes or vents must be fitted if necessary. Ventilation pipes should be arranged to allow for natural ventilation (chimney effect).

2.4 Installation of the tanks

	To install the Carat XL and Carat XXL tanks, follow the installation instructions for the tanks. Please pay particular attention to the installation conditions of the tanks.

2.5 Labelling of the tanks

For installations with more than 2 tanks, the tanks are assigned numbers. The numbers can also be found in the technical drawings.



3. Construction and functional principle

The wastewater treatment system works according to the SBR process. A precise description of the process can be found in the operating logbook.

The system fundamentally consists of a preliminary cleaning/compensation tank and one or more SBR tanks.

The feed connection between the preliminary cleaning/sludge storage tank and the SBR tank is at the front, at the top of the tanks. The feed lift pump is attached directly to the connecting pipe.

The sludge return is attached to the dome shafts. It passes into the preliminary cleaning/sludge storage tank on an incline.

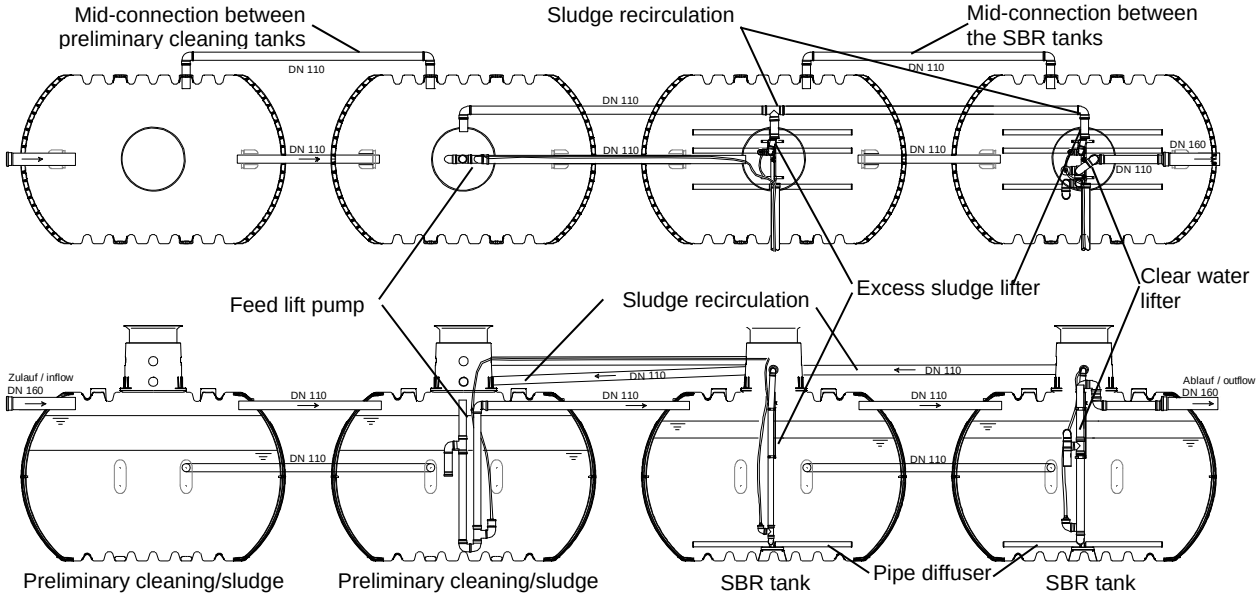
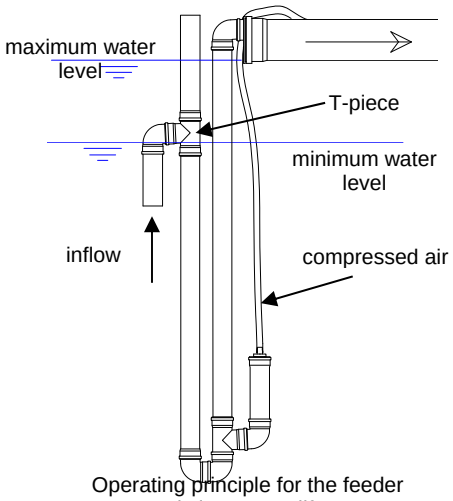


Figure 1: Example of a four-tank system.

The pumping processes are carried out using air lift pumps (or "mammoth" pumps) The special construction of the lifters ensures that the minimum water level is defined precisely (see adjacent figure) If the water level drops below the T-piece, no more water will be pumped out of the tank.



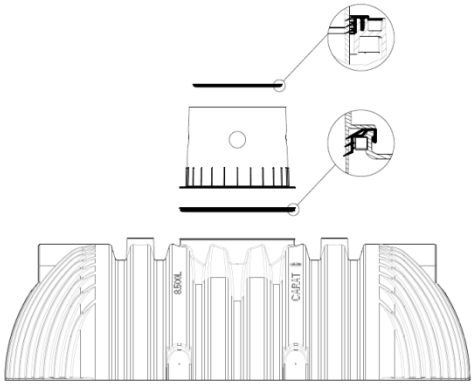
Operating principle for the feeder and clear water lifters

	Detailed technical drawings of the systems are available from Otto Graf GmbH and are applicable for assembly and installation. These drawings also contain details on the installation of the empty conduits and the air hoses.

4. Final assembly of tank domes and connecting the sludge recirculation

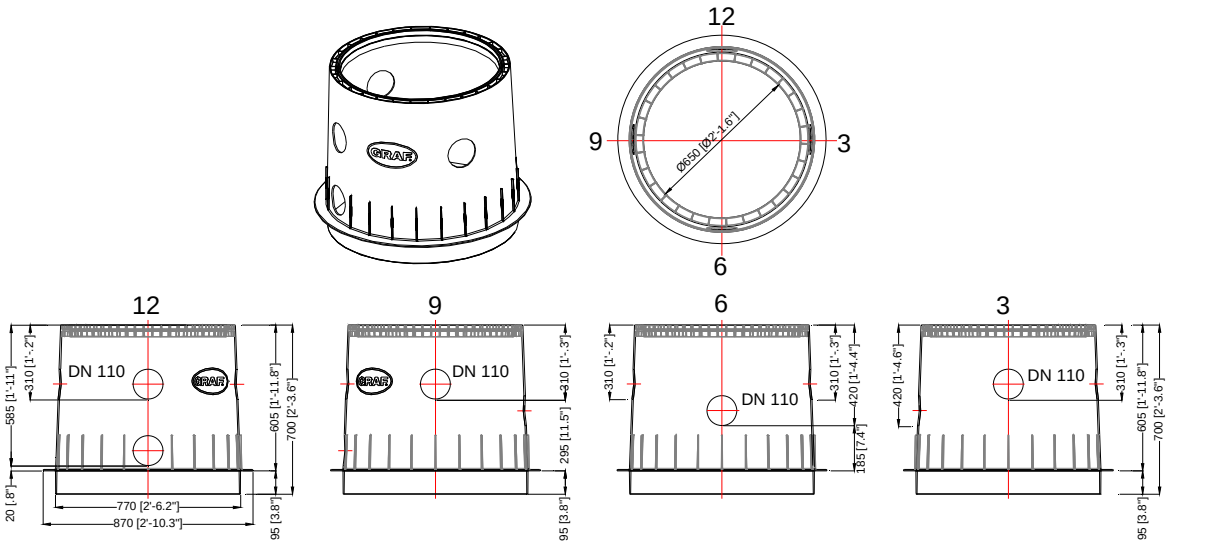
4.1 Final assembly of the tank domes

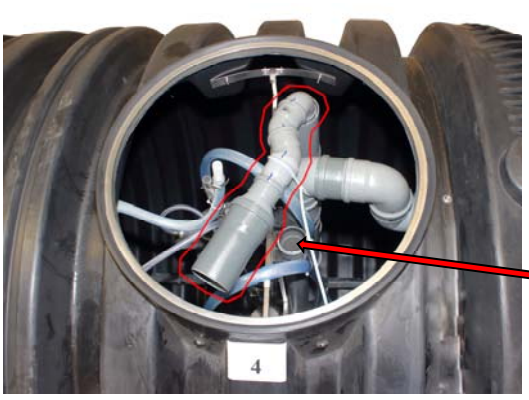
For logistical reasons, the wastewater treatment system is supplied without pre-assembled tank domes and telescopic dome cover. The tank installation instructions must be observed for the assembly!



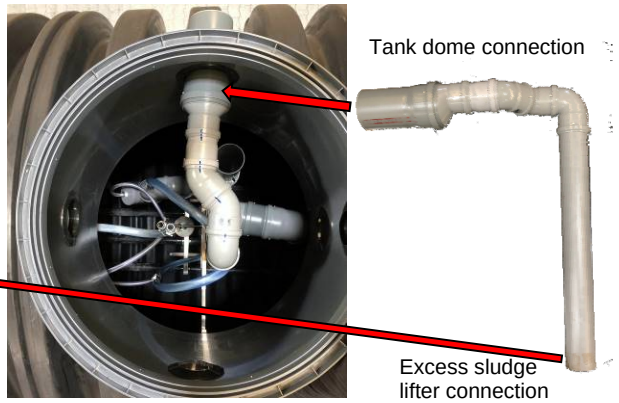
4.2 Connecting the sludge recirculation

A sludge recirculation is installed in each SBR tank. It must still be connected to the tank dome opening in the 6 o'clock position (middle opening) after assembly of the tank dome.





The connection pipes for sludge recirculation are supplied in the treatment plant. For transportation, the pipes are fixed with cable ties.



After assembling the tank dome, the connection piece is inserted through the tank dome with one end and plugged onto the sludge recirculation lifter with the other end.

5. Assembling the interior control cabinet

5.1 Selecting the location

When selecting the location for the control cabinet, the following must be considered:

- The control cabinet must be mounted above the highest water level in the tank to avoid overflowing and water intake by gravity in case of an accident
- The system generates noise! When operating, the air compressor generates continuous noise.
- The machine cabinet requires a separately protected electrical connection (16 amp, slow blow) The electrical connection serves as a mains disconnecting device and must be easily accessible at all times. Additional electrical fixtures on the same fuse may disrupt operation.
- The location of the machine cabinet must be a dry, cool and well-ventilated room. The cabinet, in particular the ventilation vents and the circuit breaker, must not be covered and must be freely accessible for maintenance work.
- The air hoses should not be longer than 20 metres.

5.2 Assembling the steel cabinet

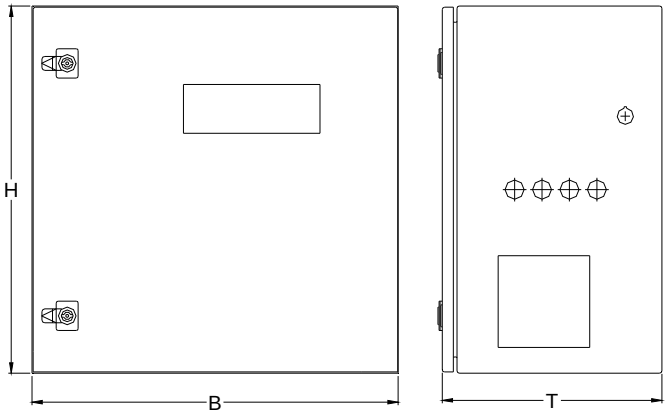
Technical data

Protection class: IP44

Material: Sheet steel 1.5 mm, powder coated

Colour: RAL 7032

Dimensions W x H x D [in mm]:
500 x 500 x 300 (interior cabinet 1)
600 x 600 x 330 (interior cabinet 2)
800 x 675 x 500 (interior cabinet 3)



5. Assembling the interior control cabinet

5.2.1 Assembling the interior cabinet type 1 & 2

Overview of parts



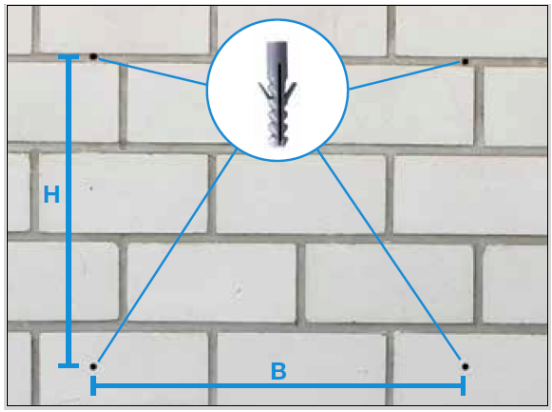
Item	Part	Quantity
1	Metal cabinet	1
2	Cabinet key	1
3	M10 wall plug	4
4	Wall bracket	4
5	M8 bolt, fine	4
6	Washer	4
7	M8 nut	4
8	M8 bolt	4







The black plastic key for opening the cabinet is attached to the main switch on the side. All assembly parts are located inside the cabinet.



Four M10 holes are needed in the wall to attach the cabinet. Refer to the table for spacing.

Cabinet type	W [mm]	H [mm]
Interior cabinet type 1	445	530
Interior cabinet type 2	545	630

Then insert the four M10 wall plugs into the holes.

5. Assembling the interior control cabinet







The wall brackets are to be attached at the holes in the cabinet as shown in the illustration. The brackets are fixed with the four M8 (fine) bolts and the corresponding washers and nuts.

Note
For cabinets with Becker compressors, the brackets are already pre-assembled



Lastly, the cabinet is fitted into the previously drilled holes using the M8 (rough) bolts.

Alternative:
First screw the M8 bolts up to 15 mm into the wall, then use the slots to hook the cabinet into the wall brackets.

5.2.2 Assembling the interior cabinet type 3



The control cabinet is supplied with the rubber-metal buffers pre-assembled. During installation, ensure that the location is stable (e.g. table), horizontal and level. An additional fixation is not necessary.

5. Assembling the interior control cabinet

5.2.3 Assembling the interior cabinet type 4

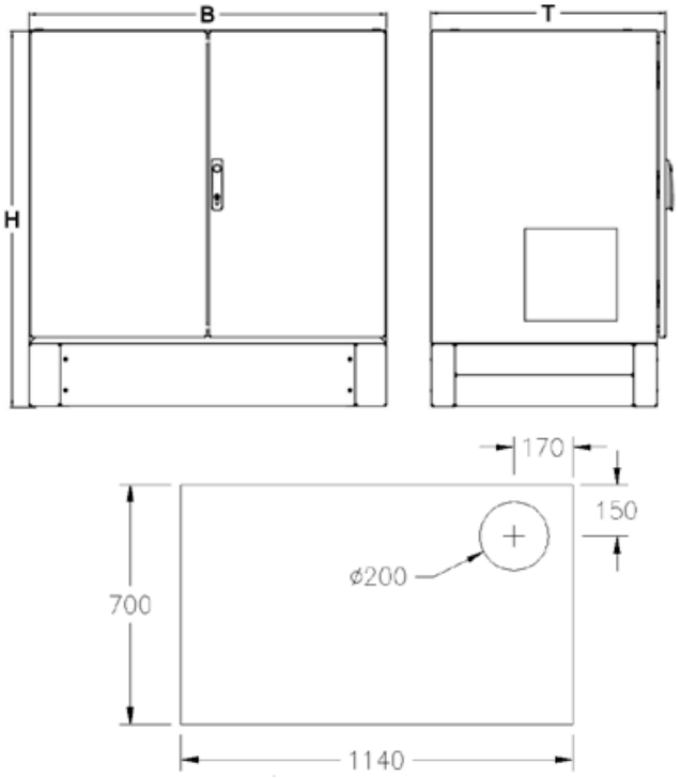
Technical data

Protection class: IP44

Material: Sheet steel 1.5 mm, powder coated

Colour: RAL 7032

Dimensions W x H x D [in mm]:
1140 x 1200 x 750



Overview of parts





Item	Part	Quantity
1	Metal cabinet	1
2	M16 eye bolt	4

5. Assembling the interior control cabinet



The control cabinet is supplied with the base pre-assembled. During installation, ensure that the surface is horizontal and level.

Four M16 eyebolts are supplied for relocating the cabinet. Before attaching the eye bolts to the cabinet, the poly plugs must be removed from the eye bolt holders in the roof. After relocating, the poly plugs must be put back in.

6. Assembling the exterior control cabinet

6.1 Selecting the location

The location must be cool and protected from direct sunlight during the summer months. The rear side of the round column/the sides of the cabinet must be installed with at least 10 cm clearance from the nearest wall. If shading is provided for on-site, this must be located on the rear or on the sides, leaving open space for the sufficient ventilation of the column/cabinet to avoid trapped heat.

- The control cabinet must be mounted above the highest water level in the tank to avoid overflowing and water intake by gravity in case of an accident
- The machine cabinet requires a separately protected electrical connection (16 amp, slow blow) Additional electrical fixtures on the same fuse may disrupt operation.
- The system generates noise! When operating, the air compressor generates continuous noise.
- The air hoses should be no longer than 20 metres.

6.2 Installation

A sufficiently wide and deep excavation should be provided at the planned location. The foundation base for the cabinets is to be assembled according to the accompanying assembly instructions. The empty conduit and the air hoses must be routed into the prepared excavation. The base is then to be inserted vertically into the excavation to a depth of approx. 60-64 cm.
Make sure that the cabinet is stable and secure and is installed vertically.

To reduce earth moisture, fill the empty space inside the base with appropriate base filling granulate (item no. 107607). The filling material can remain in the cabinet base permanently and does not need to be changed.
The granulate filling volume for a filling height of approx. 30 cm amounts to:

- Exterior cabinet L: 50 l (1 bag)



A cabinet open to the surrounding ground may result in corrosion damage on the electrical components if the ground is very damp!

6.3 Electrical connection



Fuse connections

The electrical connection of the control cabinet may only be carried out by a qualified electrician!
An underground cable must be laid to supply power to the cabinet. **This cable must be protected by a 16 amp fuse via the house installation and must be disconnectable from the mains.**

6.4 Assembling the plastic exterior cabinet

The plastic column intended for outdoor installation should be lowered into the ground up to the mark on the front of the cabinet. An excavation of sufficient depth must be provided for this purpose. In order to avoid overheating in summer, a location where the column is not permanently exposed to direct sunlight should be chosen.

6. Assembling the exterior control cabinet



An excavation with the following dimensions is to be made at the planned site:

Exterior cabinet L
Length approx. 585 mm Width approx. 315 mm Depth approx. 600 - 640 mm

The empty conduit and the air hoses must be routed into the prepared excavation.



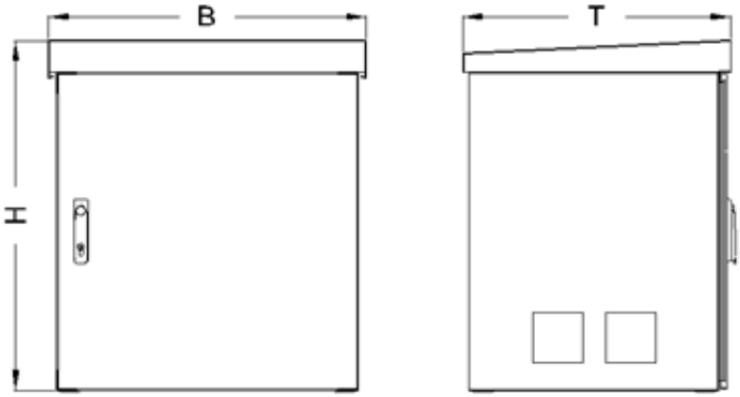
The foundation base for the exterior cabinet Universal is to be assembled according to the accompanying assembly instructions.

The cabinet is then to be inserted vertically into the excavation to a depth of approx. 60-64 cm. Make sure that the cabinet is stable and secure and is installed vertically.

6.4.1 Assembling the metal exterior control cabinet L

Technical data

Protection class:	IP44
Material:	Sheet steel 1.5 mm, powder coated
Colour:	RAL 7032
Dimensions: W x H x D [in mm]	800 x 880 x 675
Foundation:	Solid foundation is to be provided by the customer, for foundation plans refer to page 24.

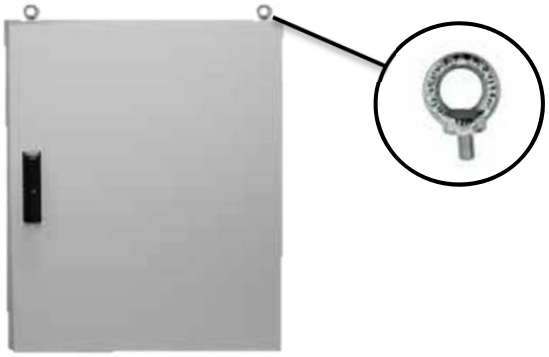


6. Assembling the exterior control cabinet

6.4.2 Foundation and relocation



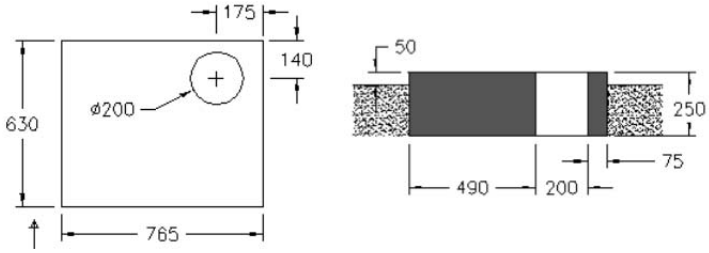
Item	Part	Quantity
1	Metal cabinet	1
2	M8 bolt	2
3	M10 dowel	2
4	Washer	2
5	M16 eye bolt	4



Four M16 eyebolts are supplied for relocating the cabinet. Before attaching the eyebolts to the cabinet, the fitted canopy and the poly plugs must be removed from the eye bolt holders. After relocating, the poly plugs must be reinserted and the canopy screwed on. The switch cabinet should be secured to the foundation with four M8 bolts (supplied).

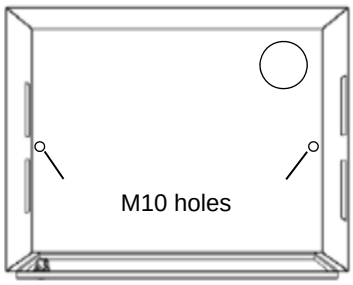


Before installation, a strip or solid foundation must be properly prepared.
For foundation plans refer to page 24.

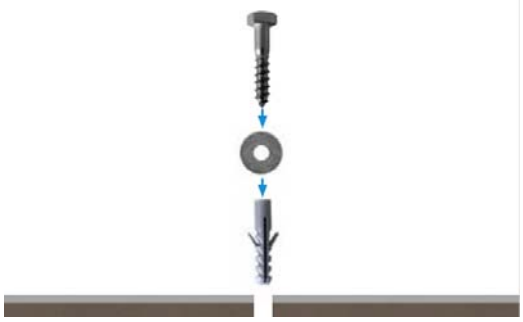


When the foundation is being cast, the drawn dimensions must be adhered to, particularly the position of the hole through which the hoses will be led later.

6. Assembling the exterior control cabinet



Two M10 holes must be drilled into the cabinet bottom, central to the side walls. These holes must be continued in the concrete foundation below.

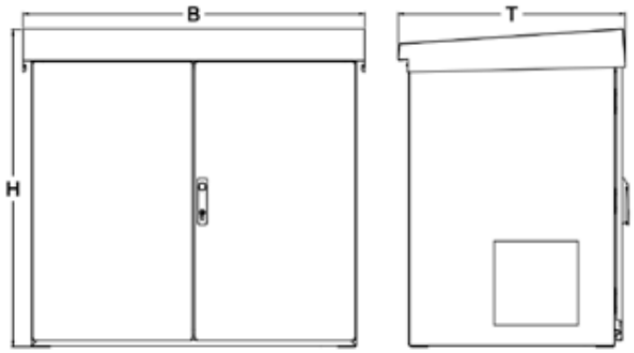


Insert the M10 dowels into the holes. Secure the switch cabinet with the aid of the two M8 screws (together with washers).

6. Assembling the exterior control cabinet

6.4.3 External steel cabinet XL

Technical data



Model:	IP44
Material:	Sheet steel 1.5 mm, powder coated
Colour:	RAL 7032
Dimensions: W x H x D [mm]	1200 x 1110 x 800
Foundation:	Solid foundation on-site

Foundation and relocation



Item	Part	Quantity
1	Metal cabinet	1
2	M8 bolt	4
3	M10 dowel	4
4	Washer	4
5	M16 eye bolt	4

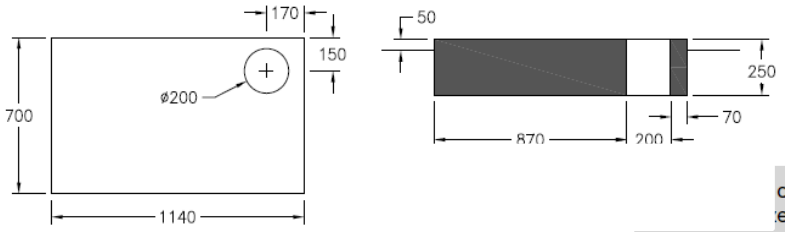


Four M16 eyebolts are supplied for relocating the cabinet. Before attaching the eyebolts to the cabinet, the fitted canopy and the poly plugs must be removed from the eye bolt holders. After relocating, the poly plugs must be reinserted and the canopy screwed on. The switch cabinet should be secured to the foundation with four M8 bolts (supplied).

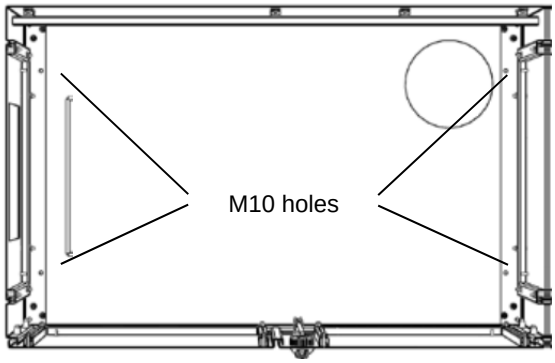
6. Assembling the exterior control cabinet



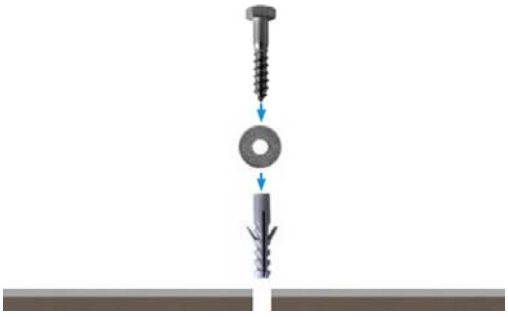
Before installation, a strip or solid foundation must be properly prepared. For foundation plans refer to page 24.



When the foundation is being cast, the drawn dimensions must be adhered to, particularly the position of the hole through which the hoses will be led later.



There are four M10 holes in the base of the cabinet. These holes must be continued in the concrete foundation below.



Insert the M10 dowels into the holes. Secure the switch cabinet with the aid of the four M8 screws (together with washers).

7. Laying the air hoses

7.1 Connecting the air hoses

The ventilation device and the air lift pumps must be connected to the valve strip inside the control cabinet.

When connecting, make sure that the hoses are attached to the correct connectors. To prevent mistaking the connections, the air lift pumps and the downpipe of the ventilation into the tank as well as the four connection points on the control cabinet are colour coded as follows:

Feed lift pump (red)	→	**red hose**
Ventilation (stainless steel)	→	**blue hose**
Drainage lift pump (black)	→	**black hose**
Excess sludge lift pump (grey)	→	**white (transparent) hose**

The connections must be joined according to their correct colours and then secured with hose clamps. Hoses are also available in the corresponding colours.



After the hoses have been installed and connected, the empty conduit ends must be closed off to prevent an exchange of gases between the wastewater treatment system and the environment of the control cabinet (dampness, odours).

We recommend the GRAF empty conduit cap made of PE foam (Item no. 107887); alternatively PU foam can be used.

7.2 Assembling the GRAF empty conduit cap made of PE foam



Insert the hoses from the empty conduit into the corresponding holes in the empty conduit cap.



Push the hose through the thin top layer. A plug of material remains stuck to the end of the hose.

7. Laying the air hoses



Cut off the hose end to remove this plug.



Push the empty conduit cap into the empty conduit until it is tightly sealed.

7.3 Empty conduit seal with PU foam

Since leaks can easily occur when foaming the empty conduit with PU foam, it is recommended to use the GRAF PE foam empty conduit cap.



The hose surfaces and conduit walls must be cleaned with water and slightly wetted with water.
When filling the hoses with PU foam, make sure that each of them is covered on all sides. To enhance the foaming and casing, the hoses should be moved slightly backwards and forwards.

8. Commissioning

The instruction manual is to be read and observed prior to commissioning.

After the Klaro setting-up kit has been installed, the entire system and the setting-up kit sampler should be filled with fresh water. Only then can the system be commissioned.

The two-pin earthed plug of the cabinet must be connected to the power socket. Now the EPP cabinet control starts. Metal and exterior cabinets first need the main switch to be set to the "I" position. The control unit displays the programme's serial and version number for a few seconds, before switching to automatic mode. The "Set date and time!" warning message then appears. It can be acknowledged by pressing the Esc key twice. If a "Temp. Max" warning message appears, please check whether the temperature sensor on the rear of the device is plugged in correctly. Now the system's current operating mode is displayed. In order to correctly store the operating hours and event reports, the date and time must be set via the relevant menu item. The system first runs in "cycle pause" until it reaches the first cycle start time.

The factory-set cycle start times are:

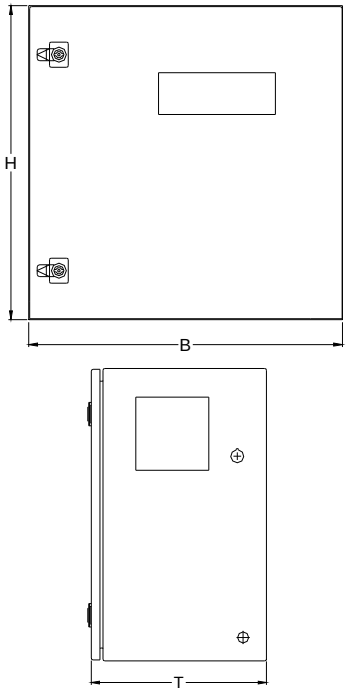
01:30 am, 07:30 am, 01:30 pm, 07:30 pm

The correct function of the ventilation system and the lifter should be checked in manual mode. This process is described in detail in the system's operating logbook. The ventilation bubble pattern must consistent and complete. The air lift pump only functions if the tank is sufficiently filled with water. For systems with a convenience control unit (KLplus), calibration with underload detection is required for operation. The relevant instructions can be found in the operating logbook.

9. Technical data control cabinets

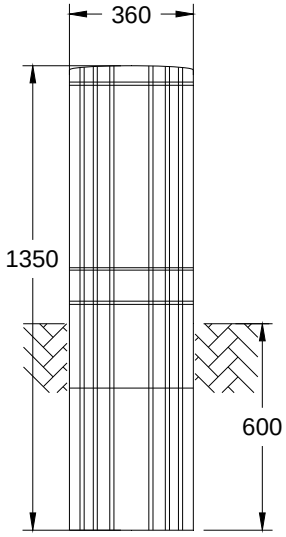
9.1 Steel interior cabinet

Model	IP44
Material	Sheet steel 1.5 mm
Colour	RAL 7032
Dimensions W x H x D in mm	500 x 500 x 300 (interior cabinet type 1) 600 x 600 x 330 (interior cabinet type 2) 800 x 675 x 500 (interior cabinet type 3)
Door	concealed hinges, open approx. 140°
Closure	Single closure
Electrical connection	On-site back-up fuse, voltage 230 V / 50 Hz (60 Hz available as special order)
Connections on the control cabinet	- Hose connectors 3x 13 mm, 1x 19 mm - Connection cable w/ two-pin earthed plug



9.2 Exterior column

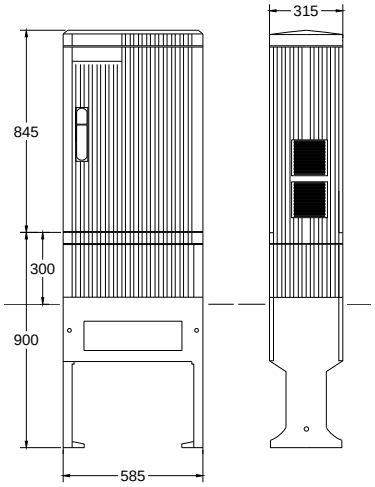
Model	IP44
Material	fibreglass-reinforced polyester type FS 833.5 according to DIN 16913 with re-cycled material
Colour	similar to RAL 7035 in stone structure
Dimensions	see figure on the right
Door	removable door
Closure	simple closure, a profile half cylinder is installed
Electrical connection	On-site back-up fuse, voltage 230 V / 50 Hz (60 Hz available as special order)
Base	Housing and base form one unit



9. Technical data control cabinets

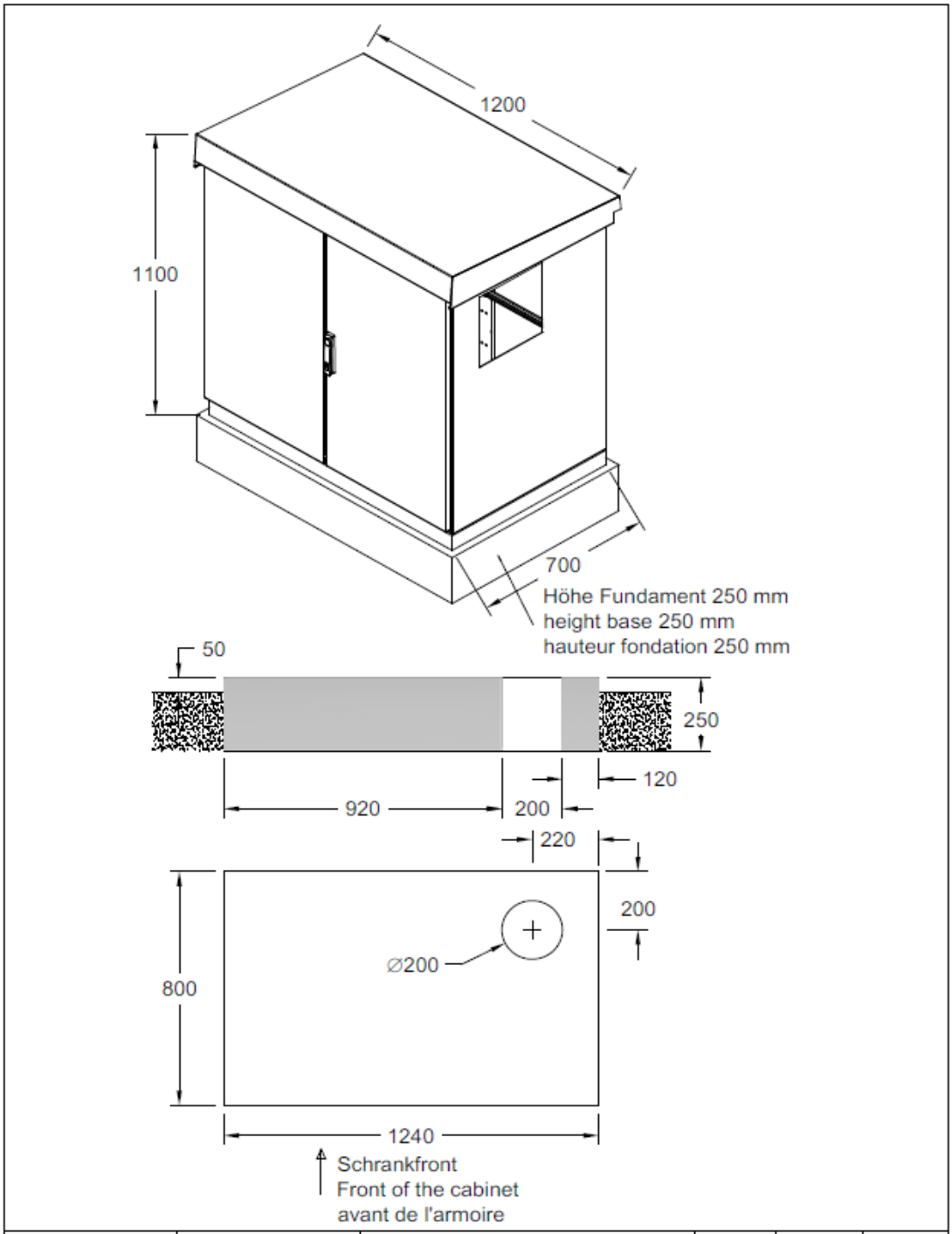
9.3 Exterior cabinet

Model	IP43
Material	fibreglass-reinforced polyester FS 833.5, EN 14598 and DIN 16913, protective insulation
Colour	light grey according to RAL 7035
Dimensions	see figure on the right
Door	Door with hinge and lever
Closure	3-point espagnolette lock, a profile half cylinder is installed
Electrical connection	On-site back-up fuse, voltage 230 V / 50 Hz (60 Hz available as special order)
Base	fibreglass-reinforced plastic in corresponding DIN size (mounted) with cable angle holder

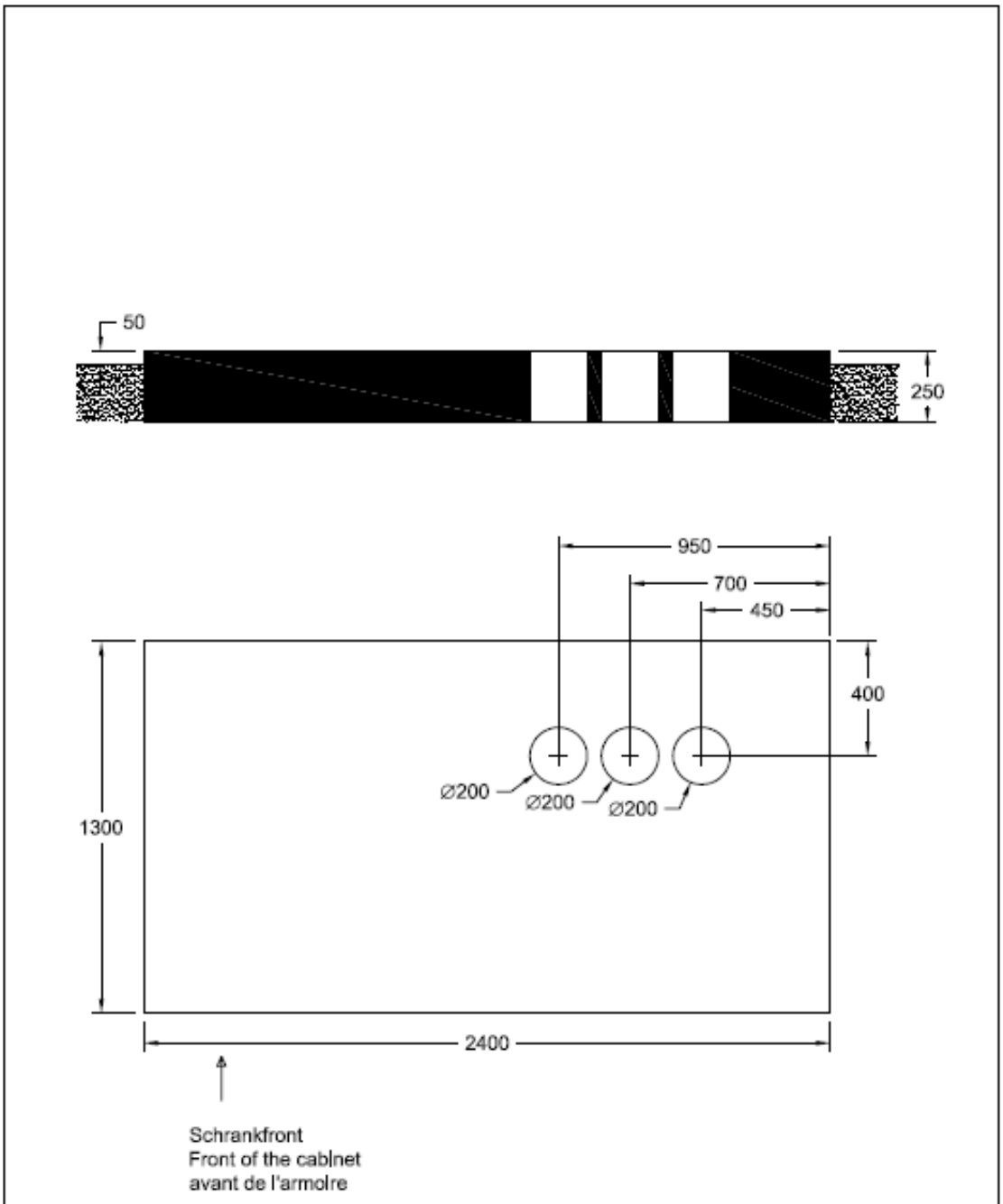


10. Appendix

10.1 Foundation plans



			Otto Graf GmbH Kunststofferzeugnisse 79331 Teningen	name Concrete base plate for external metal cabinet XL	scale	page 1 / no. of pages 1
2015	date	name	Carl-Zeiss-Str. 2-6 Telefon 07641/589-0 Telefax 07641/589-50 Email: info@graf-online.de www.graf-online.de	drawing no.		
edit	28.04.	Köh				
checked						
EDV no.						



			Otto Graf GmbH Kunststofferzeugnisse 79331 Teningen Carl-Zeiss-Str. 2-6 Telefon 07641/589-0 Telefax 07641/589-60 Email: Info@graf-online.de www.graf-online.de	name Concrete base plate for external metal cabinet XXL	scale	page 1 / no. of pages 1
2016	date	name		drawing no.		GRAF
edit	06.06.	DSC				
checked						
EDV no.						

10.2 Machine technology example

