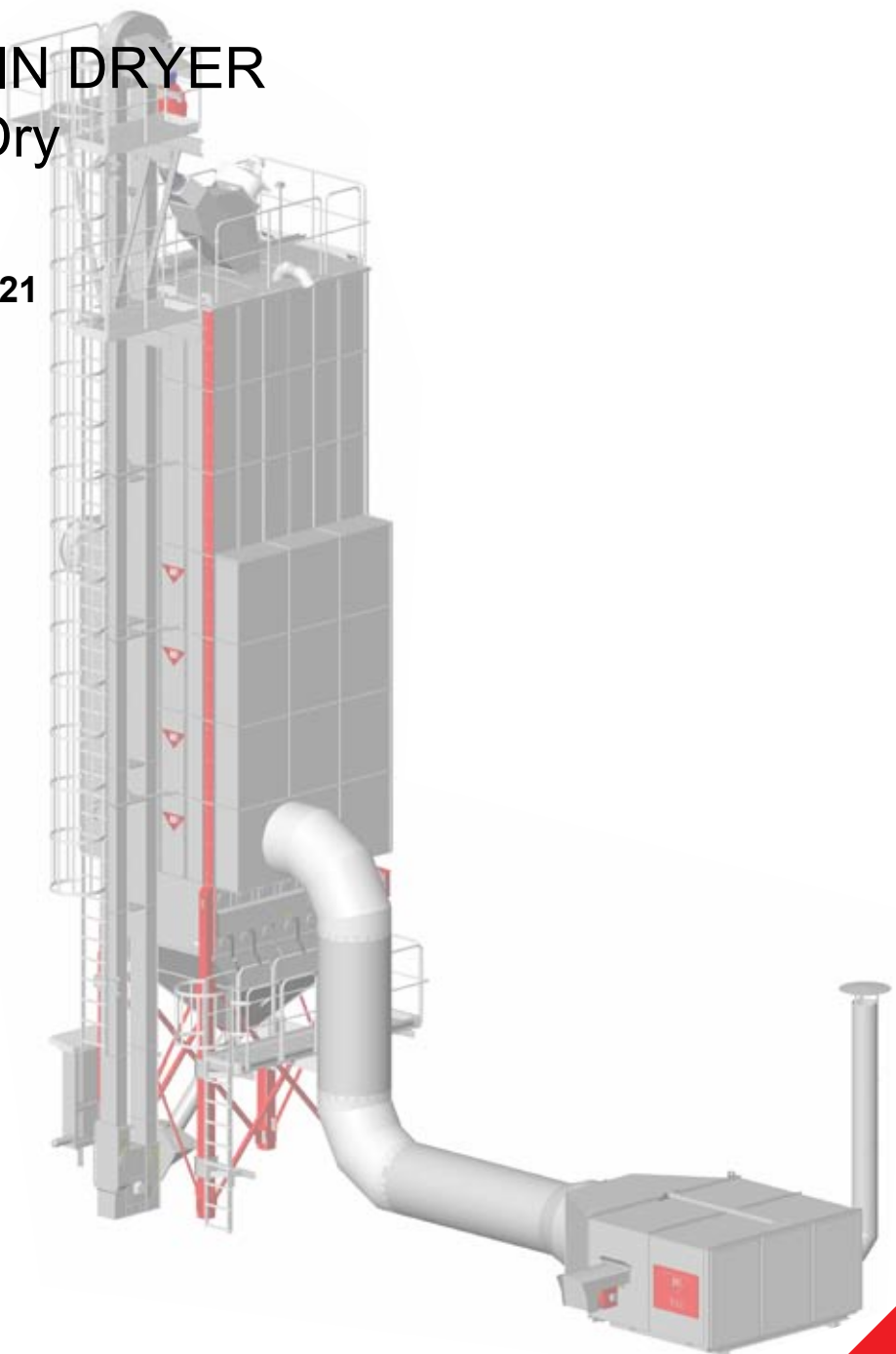


Installation and Operating Instructions

ANTTI GRAIN DRYER Antti Plug&Dry

408116 (en) 12-2021



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ANTTI PLUG&DRY

Read the Installation and Instruction Manual carefully before installing the machine and putting it into operation.

SELECTING LOCATION FOR THE DRYER

Locate the grain dryer as a part of the farm's centre of operations, taking into account possible traffic, noise and dust problems. Construct the roads in a manner enabling them to be trafficked with a full trailer round the year. If possible, locate the heater on the facade side of the building. When selecting location for the heater, observe in particular that it requires large amounts of clean air. The suction opening of the heater must be located as far from the outlet air pipes as possible, on the other side of the building. If you have doubts concerning the location, negotiate in advance with the local building and road authorities, and the fire chief.

The distance from the grain dryer to the land of the neighbour shall be at minimum 15 m, to the neighbouring building 20 m, to your own residential building 15 m, and to an outbuilding 12 m. (The minimum distance to your own buildings may vary from municipality to municipality, depending on how the new regulations are being locally interpreted). For dryers of category P2, the required distances may be shorter. Under certain conditions, a package dryer may fall into category P2. Consult the local fire chief or building supervisor for detailed instructions.

FOUNDATION

GROUND PRESSURE

When selecting suitable founding method for your dryer, apply the following base values for different soil types:

Moraine	0,4 – 0,8 MN/m ²
Gravel	0,2 – 0,6 MN/m ²
Sand	0,15 – 0,5 MN/m ²
Fine sand	0,1 – 0,4 MN/m ²

Clay and fine silt:

- soft (easy to work)	0,025 MN/m ²
- tough (hard to work)	0,050 MN/m ²
- solid (extremely hard to work)	0,1 MN/m ²

If you consider that the load-bearing capacity of the soil is difficult to determine, assign a specialist or order a ground survey. It is often a good idea to establish the form of the rock by means of a ground survey or a test excavation. Typically, the ground pressure caused by a dryer is 0.5–2.0 kg/cm² when the foundation is of raft type.



THE SPACE REQUIRED FOR THE INSTALLATION

The minimum requirement is that the foundation drawings are being followed.

In addition, you must take into account the space required for the installation, and the load-bearing capacity of the soil under the mobile crane.

The goods to be transported can be over 3 metres wide and fairly long. Therefore, the access to the foundation of the dryer must be unobstructed, and sufficient space must be reserved for turning the vehicles.

For the erection of the dryer, the mobile crane must be provided with unobstructed access near the installation site and a sufficiently sturdy standing base. There must not be any aerial electric or telephone lines at the erection site, within the reach of the mobile crane.

Instruction manual for erecting and operating the machine

This manual is intended for professional farmers. The use of the machine requires normal skills and general knowledge of farming.

Grain dryer type

This manual deals with installation and use of ANTTI PLUG&DRY.

PRESENTATION OF THE MACHINE

- Grain dryers are intended for drying of grain and seeds.
- The drying process comprises four phases:
 1. During the filling phase, the elevator transfers the grain from the filling hopper of the dryer into the dryer.
 2. During the drying phase, the grain circulates inside the dryer, and simultaneously, hot air is being sucked through the grain layers.
 3. During the cooling phase, the grain is being circulated inside the dryer, and cold outside air is being sucked through the grain layers.
 4. The ready-dried and cooled material is transferred by means of an elevator to the storage or to be loaded.

The dryer is delivered, as ordered, as pre-assembled units or in parts, and the final assembly shall take place at the installation site.



-
- The pedestal of the dryer comprises the dryer base and the feeder. The drying sections are installed on top of the base.
 - The drying unit comprises drying sections with triangular air ducts. The top tanks are stacked on top of the drying unit.
 - The volume of the dryer depends on the number of the sections and the top tanks, being installed one on top the other.
 - In addition to the main parts itemised above, the delivery also includes a number of smaller parts, the installation of which is described more in detail later in these instructions.

In dryers, the most significant source of noise is the axial blower/axial blowers. Refer to the blower manual for detailed information.

SAFETY

The dryer base has moving feeder parts that can cause an injury, if all the cover plates and hatches are not properly closed, while the machine is in operation!

NOTE!

Before opening or closing the bottom troughs, ensure that the inspection and cleaning hatches in the dryer base are closed.

Follow the local instructions for occupational safety.

INSTALLATION OF THE ANTTI PLUG&DRY

Refer to the erecting instructions 408076 for the dryer for installation of the sections and the other basic components. These instructions deal with the installation of the Plug&Dry dryer's model-specific components.

The installation work of the dryer requires precision. The work must be carried out on various levels, even at high elevations. Therefore, in addition to good installation skills, the work requires proper scaffolding/use of aerial work platforms and observation of all the safety issues. Especially, the dryer base and the sections are heavy. Lifting them requires sufficiently powerful machinery.

Pre-connected wiring is used for installations in the electric centre. Before starting the use, make sure that all the electric appliances are in order!



Weight of the dryer's components:

	2W	3W	4W
Base	725 kg	900 kg	1320 kg
Section (2 pcs, without air channel ends)	1080-1190 kg	1520-1635 kg	1960-2115 kg
Top section	220 kg	280 kg	355 kg
Top section with cover and handrails	400 kg	520 kg	655 kg

Please observe, when lifting the heavy components of the dryer:

- use all the lifting lugs on the components
- use the lifting lugs and a bracing when lifting the ready-assembled top tank
- ensure that the lifting hooks stay in position in the lugs, and that the crane being used is sufficiently powerful
- never go under or too near the components to be lifted
- the crane must be able to lower the component to be lifted slowly and precisely into position
- reserve 3–5 tools that can be used as guide pins such as, for example, pin punches of 5–8 mm in diameter

Provide all the horizontal seams with sealing band.

Note! If you wish to stack several sections, and lift them on top of the base in one go, use the separate lifting lugs (501010). Refer to the erecting instructions 408076 for detailed instructions. Attach the lifting lug by eight M8 bolts. Brace the lugs by fixing battens of 50x100 by the two holes to support the lugs so that the section end will not bend. Use the same lugs for lifting the top tanks.

The dryer can be assembled from larger sub-assemblies. All the drying sections and the top tanks can be lifted into place using the robust lugs on the top. The maximum load, allowed to be lifted is 6,750 kg. An example: the top tanks and the top tank cover with handrails can be assembled while the section is still on the ground. Tighten all the bolts – use M10 bolts for fixing the vertical supports. Lift this large sub-assembly on top of the base or the lower-lying sections.

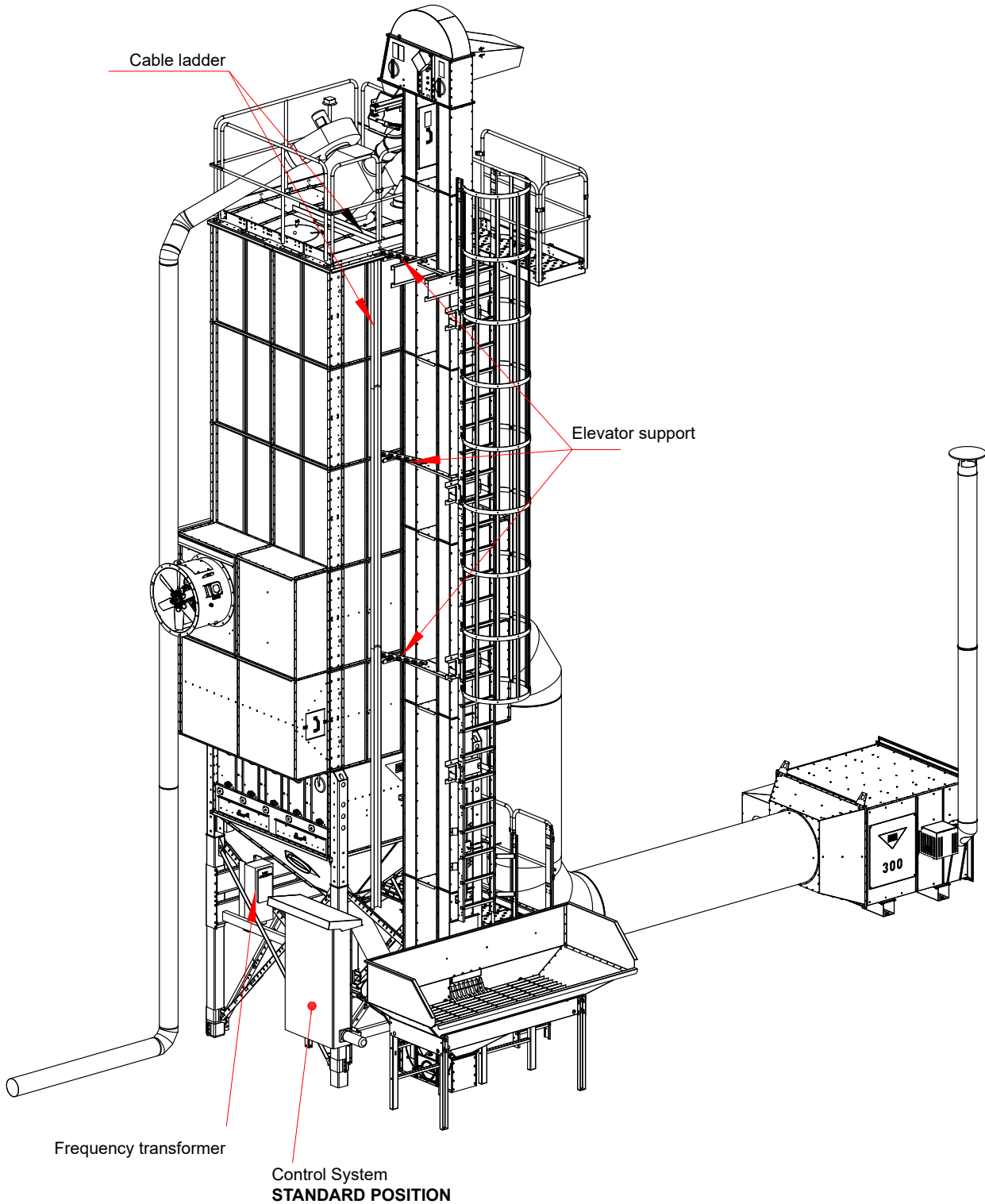
NOTE!

The total weight of the sub-assembly is several tonnes, so a heavy crane is required. Verify the load-bearing capacity of the soil, before the lifting.

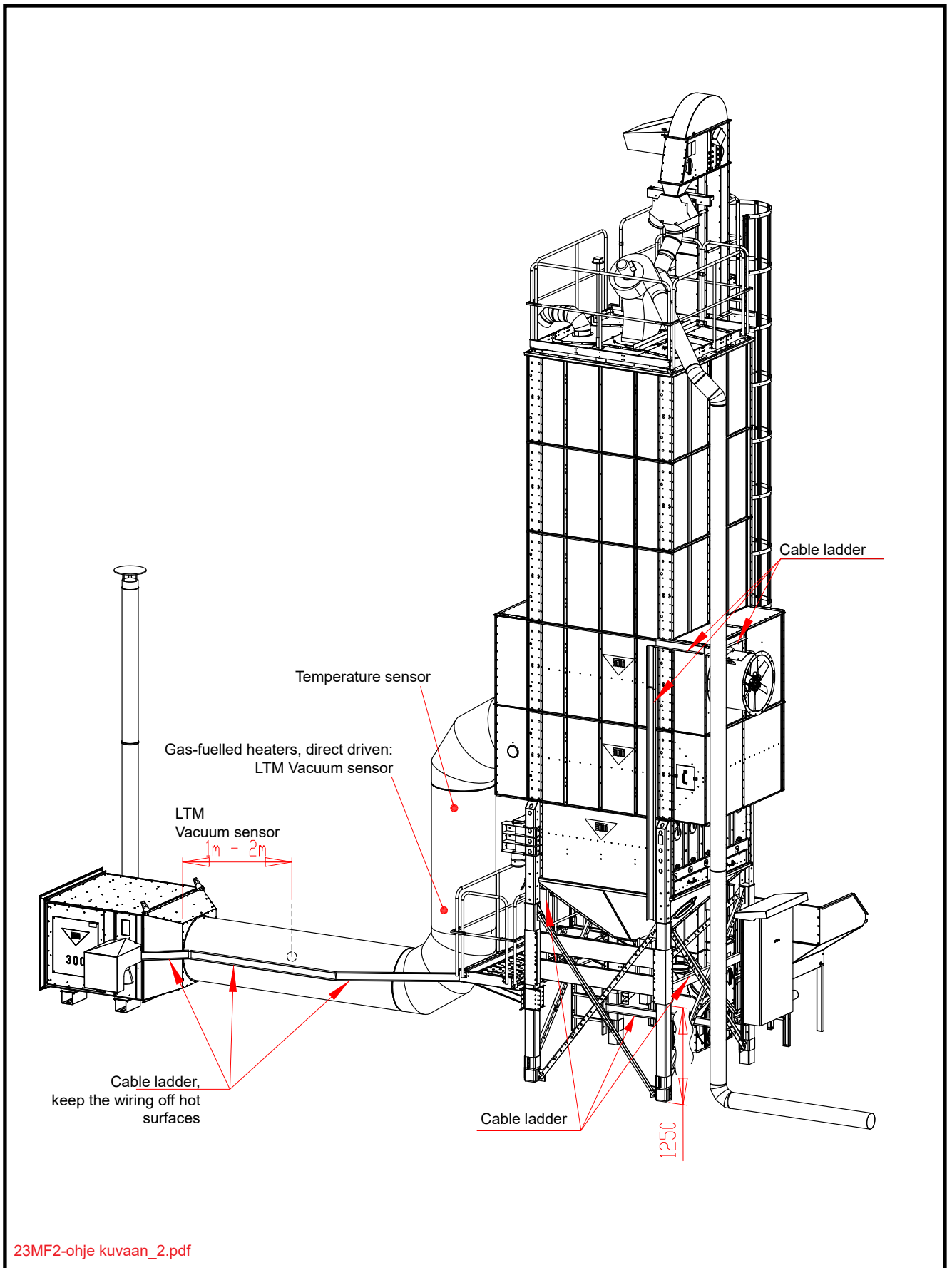


Principle drawings of different dryer types with accessories

Principle drawing of the assembly



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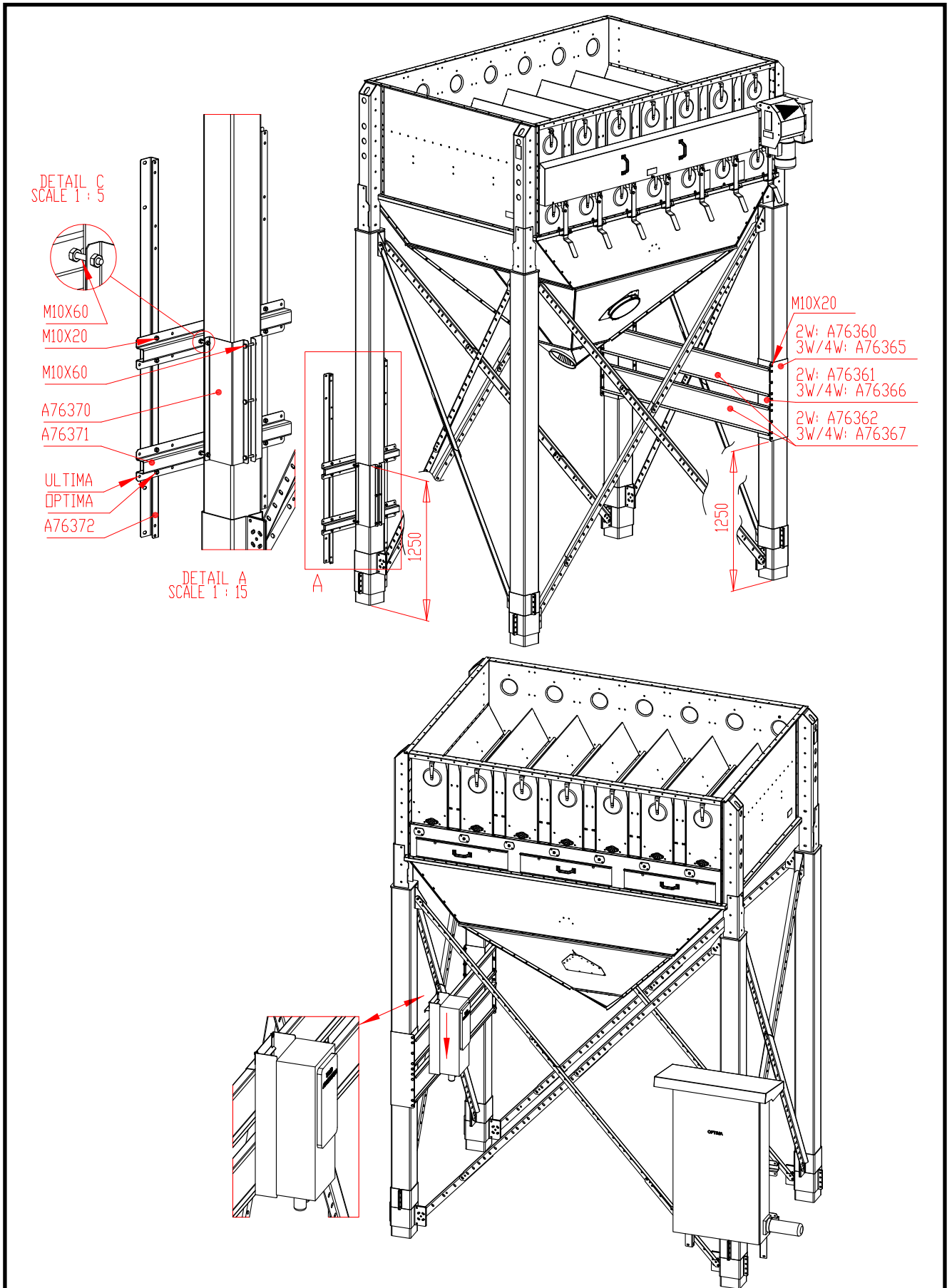


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Installing the electric cabinet and the bracket for the frequency transformer















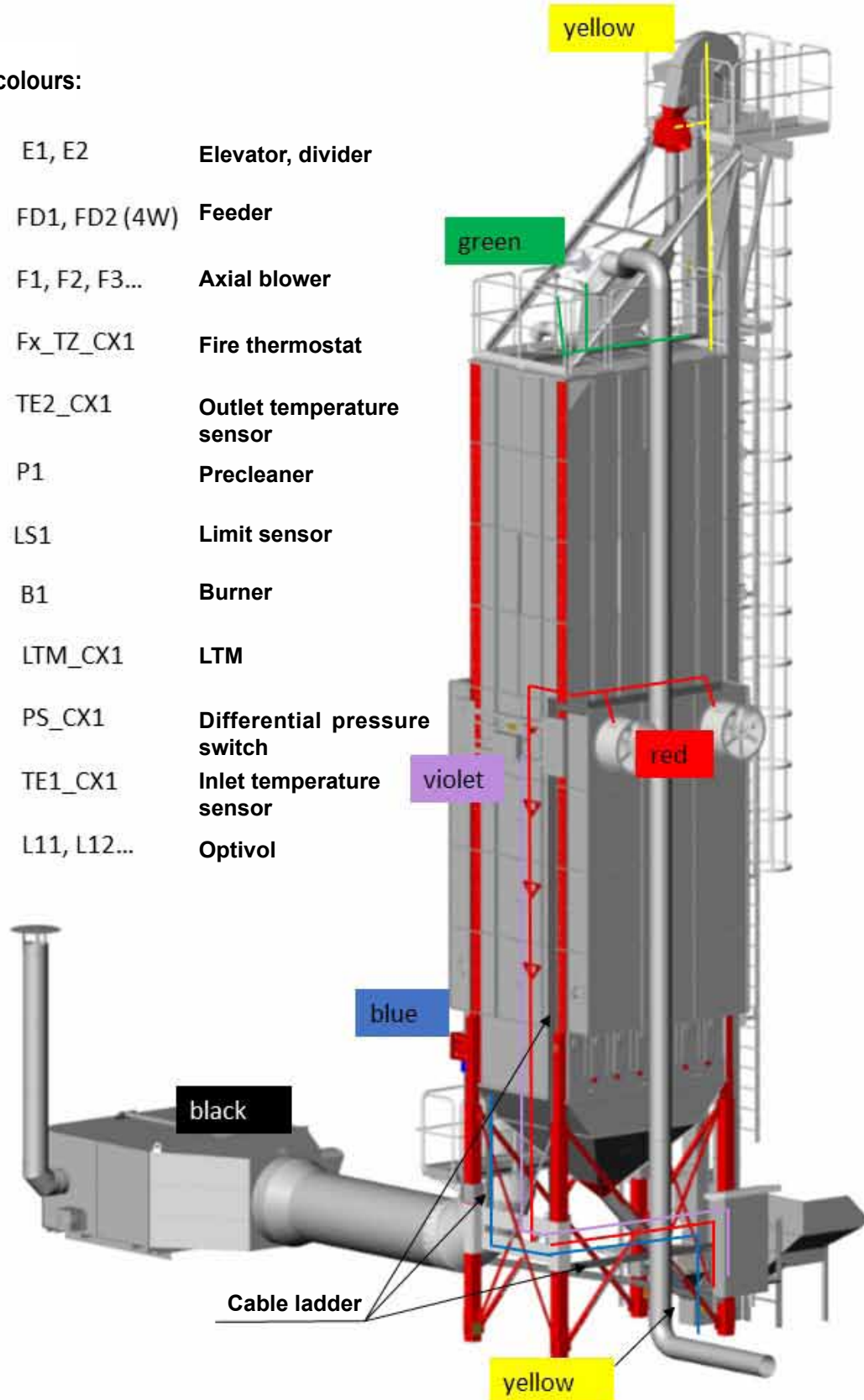


Principle drawing of the cable routing, E1

The outlet temperature sensor TE2_CX1 shall be installed in the blower on the left side. If there are blowers in more than just one row, the outlet temperature sensor shall be installed in the one lying lowest on the left-hand side.

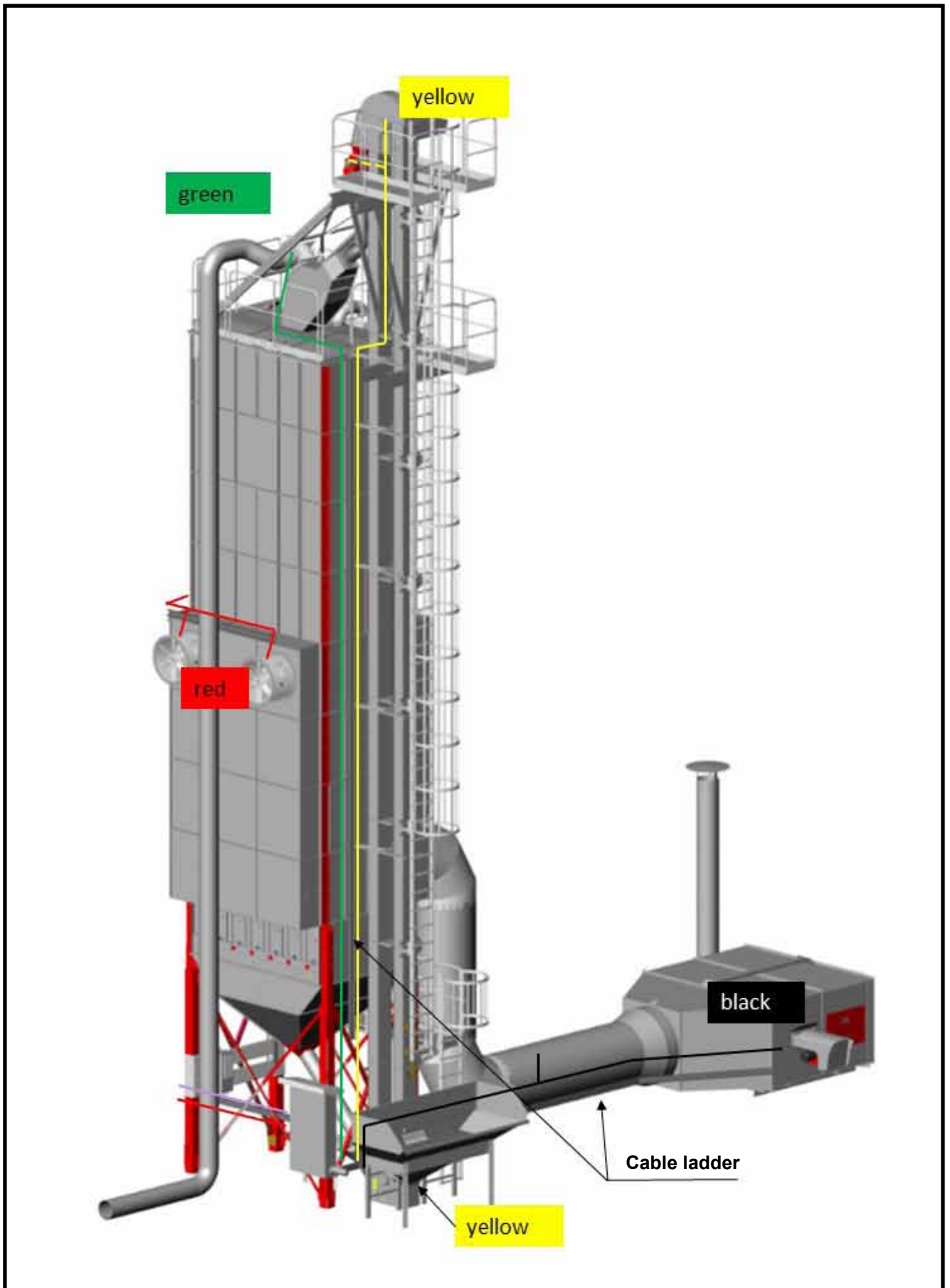
Unit-specific colours:

	yellow	E1, E2	Elevator, divider
	blue	FD1, FD2 (4W)	Feeder
	red	F1, F2, F3...	Axial blower
	red	Fx_TZ_CX1	Fire thermostat
	red	TE2_CX1	Outlet temperature sensor
	green	P1	Precleaner
	green	LS1	Limit sensor
	black	B1	Burner
	black	LTM_CX1	LTM
	black	PS_CX1	Differential pressure switch
	black	TE1_CX1	Inlet temperature sensor
	violet	L11, L12...	Optivol

















Unit-specific cabling, E1

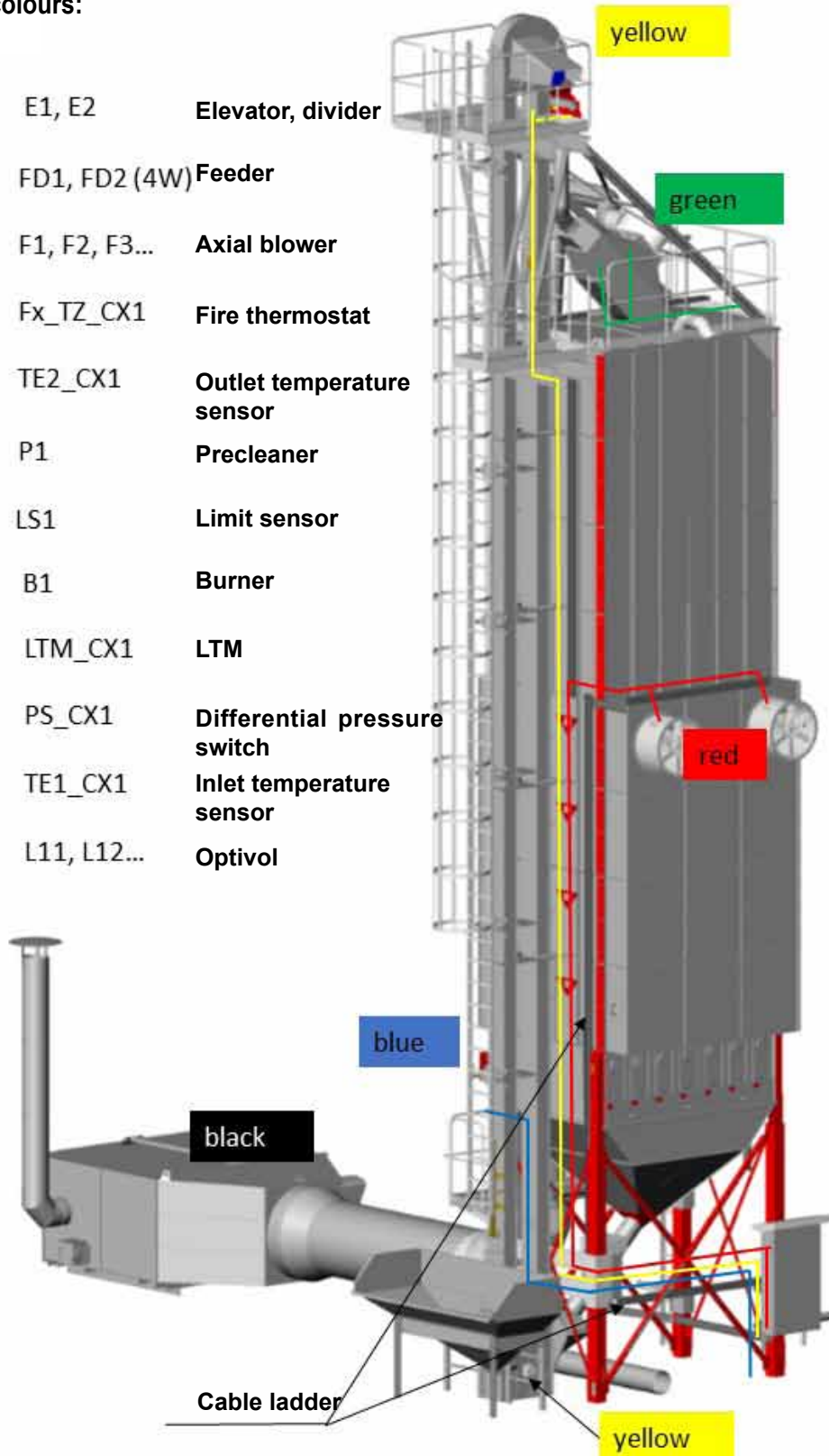




Principle drawing of the cable routing, E2

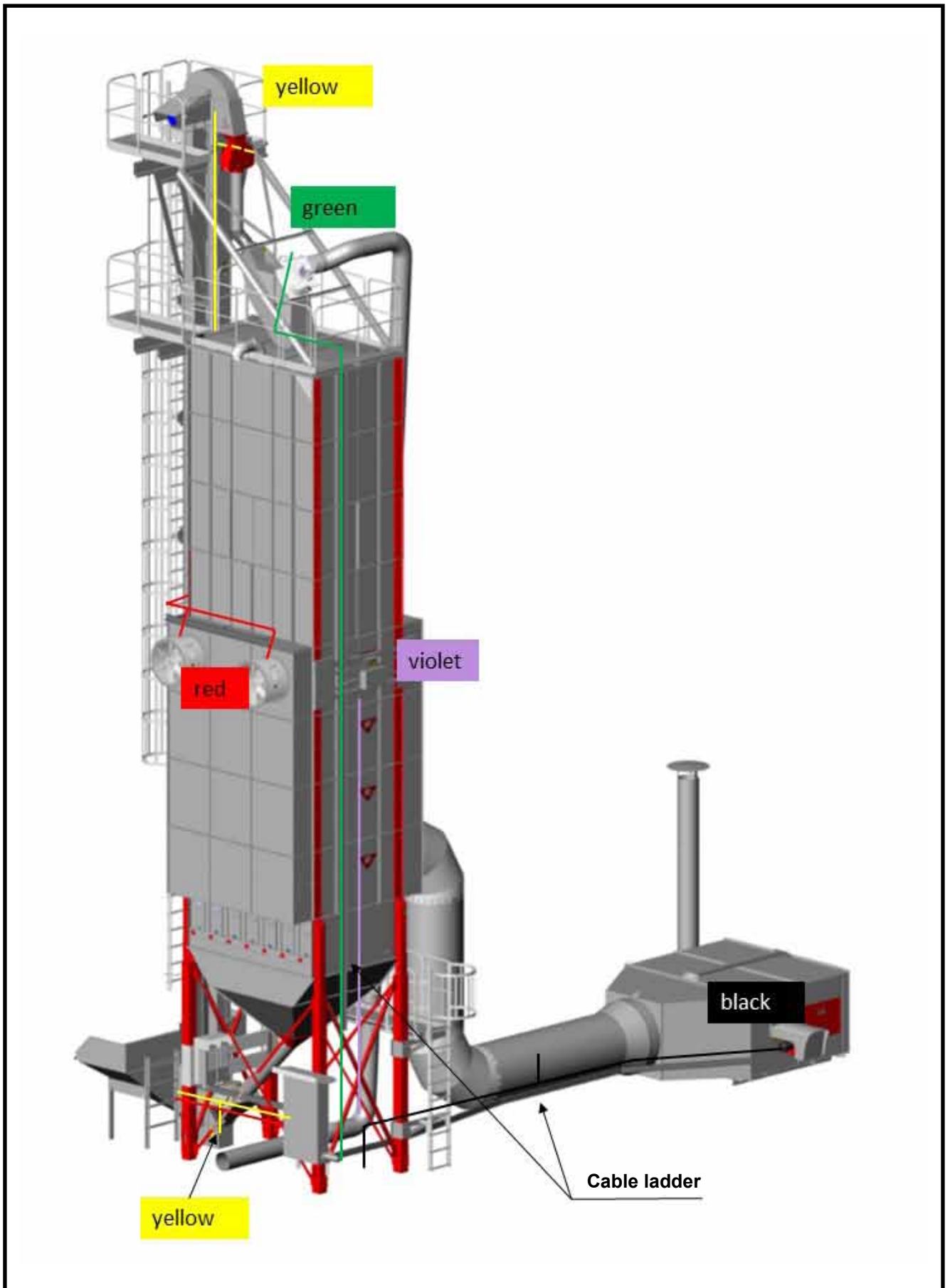
Unit-specific colours:

	yellow	E1, E2	Elevator, divider
	blue	FD1, FD2 (4W)	Feeder
	red	F1, F2, F3...	Axial blower
	red	Fx_TZ_CX1	Fire thermostat
	red	TE2_CX1	Outlet temperature sensor
	green	P1	Precleaner
	green	LS1	Limit sensor
	black	B1	Burner
	black	LTM_CX1	LTM
	black	PS_CX1	Differential pressure switch
	black	TE1_CX1	Inlet temperature sensor
	violet	L11, L12...	Optivol





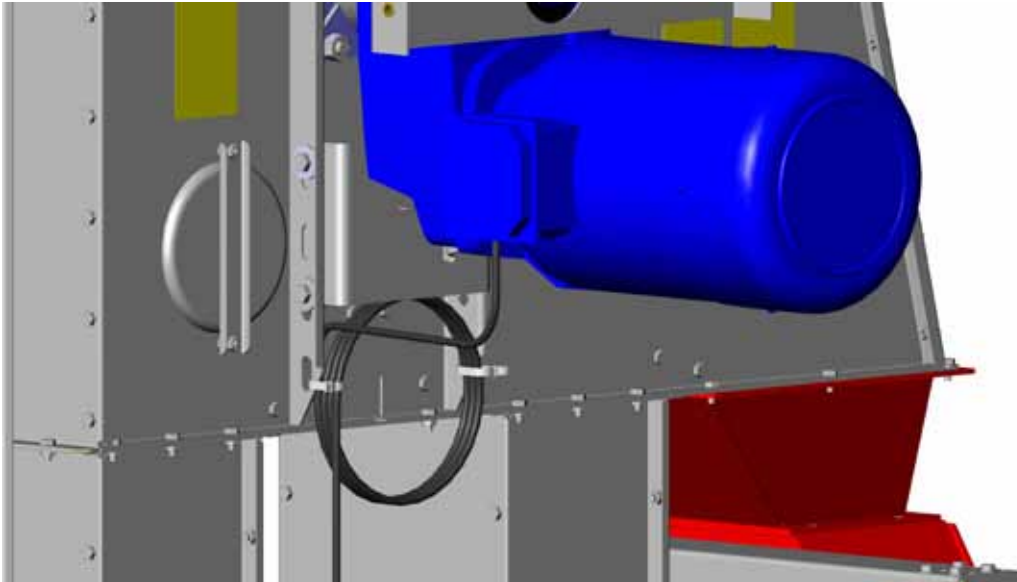
Unit-specific cabling, E2





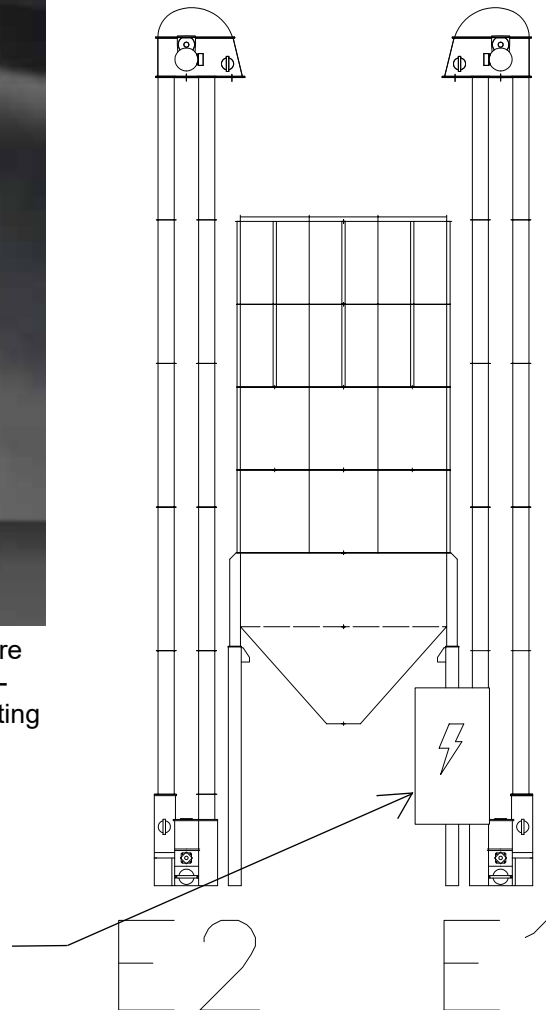
Example of connector IDs and possible excess cable length

Attach the cables to the motors, actuators, and sensors, starting from the control centre, leaving any excess length of the cable coiled near the unit or sensor, not under the centre.



The cables shall be tied to the cable ladder, making sure that no loading, resulting e.g. from the weight of the cables, will be subjected to the connectors or the connecting boxes of the motors.

The location of the elevator with respect to the electric cabinet, the default location of the electric cabinet.





Electric installations

After having assembled the entire machinery, install last the cable ladders and the wiring. Install the cable ladders in full length from the bottom to the top. Cut off the uppermost cable ladder at the height of the dryer's top using side-cutting pliers or an angle grinder.

The conductors for the following units are routed from the upper part of the dryer:

- Elevator
- Pre-cleaner
- Level guard

If the electric cabinet has been agreed to be relocated from its standard location, when placing the order, the cables will be shipped with the specified additional length.

Additional length refers to the total length of the cable. The length cannot be altered after placing the order. The actual distance of the electric cabinet from its default location depends on the route selected for the cable.

Fold the possible excess length of the cable on the cable ladder or cut the cable and reconnect it using a branch box. If you will place the cabinet further away than agreed, extend the cables accordingly using a branch box.

Route the conductors to the electric centre, and connect them to the inlet as marked in the conductor Attach the conductors to the cable ladders using cable ties. On vertical ladder the tying points shall be 50 cm apart, and on horizontal ladder, 100 cm apart. You can "hide" the excess length of the conductor by folding it inside the trough.

Install the pressure difference sensor, the PTC sensor and the LTM thermostat in the air pipe coming from the heater. Provide the axial blower on the outlet side with a PTC sensor and a fire thermostat.

- The electric conductors must be at a distance of at least 50 mm from the surface of the heating pipe to avoid the risk of overheating.

The electricity supply to the grain dryer – like to any other building on the farm – must be protected with a fault current switch in accordance with the valid legislation.

It is recommended that the electricity supply be protected by means of proper overvoltage protection.



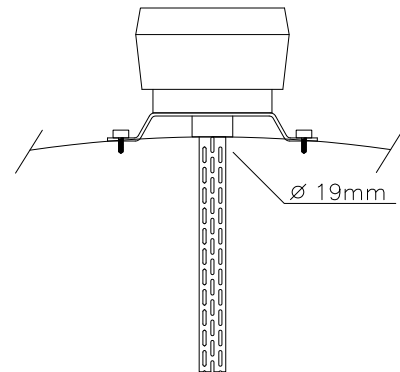
Installation

Installing the LTM thermostat

The LTM thermostat is a double-thermostat, which includes a temperature limiter and the after-cooling system for the heater.

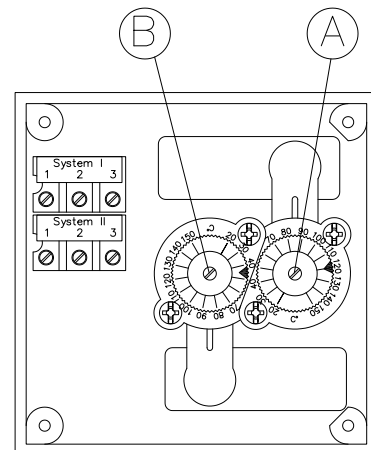
The LTM thermostat is installed in the inlet air pipe, at a distance of 0.5–2 m from the heater. Drill a hole of 19 mm for the thermostat in the pipe, press the thermostat into the hole and fix it with screws.

SEE THE DRAWING ON PAGE 9 FOR THE INSTALLATION PLACE

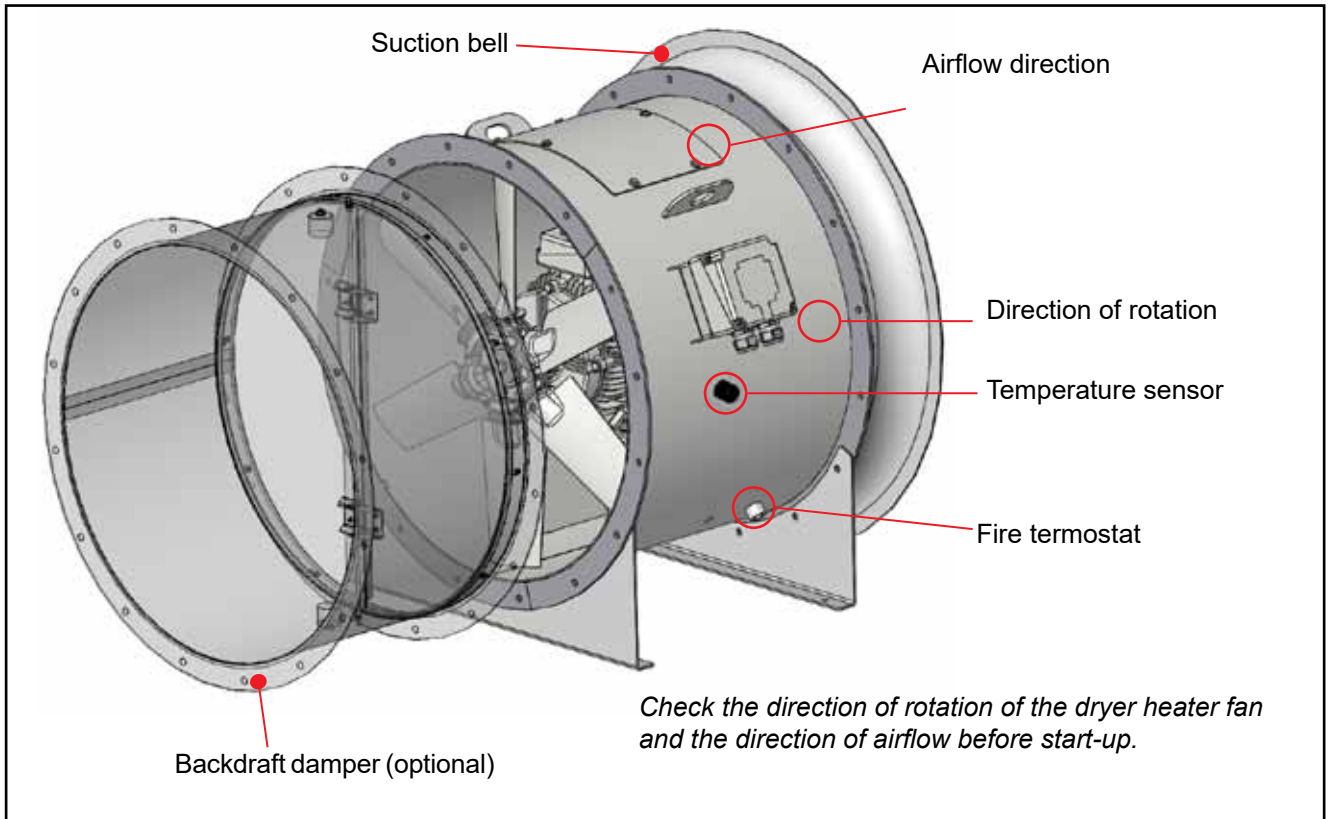


Set the temperature limiter 20 °C above the maximum allowed operating temperature of the heater. For example: if the maximum allowed operating temperature of the heater is 100 °C, set the temperature limiter to 120 °C. The after-cooling system shall always be set to 45 °C.

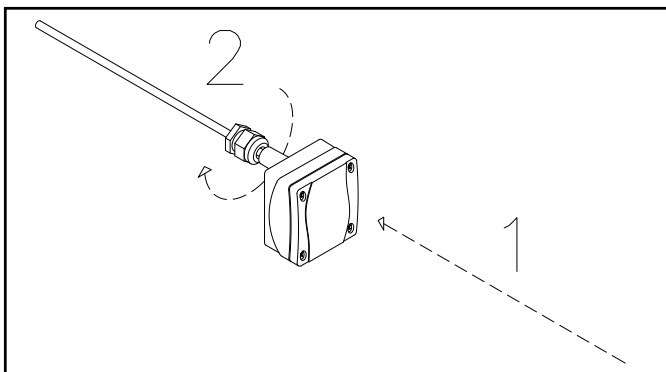
A – Temperature limiter (LIMIT)
B – After-cooling (FAN)



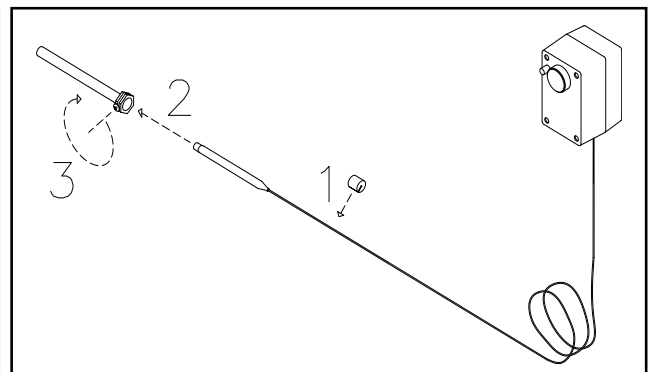
Installing the temperature transmitter and the fire thermostat in the axial blower



Correct installation of the blower and direction of rotation of the impeller are absolutely crucial. The arrows indicating the direction of the airflow and the direction of rotation are punched in the nameplate and the arrow indicating the direction of rotation is punched in the impeller blades.



Installation of the temperature transmitter



installation of the fire thermostat

The fire thermostat and the outlet temperature sensor shall be installed in their designated installation points as shown in the adjacent drawings





Installing the vacuum sensor

Fix the sensor unit (1) on the wall in an upright position, as shown in the drawing.

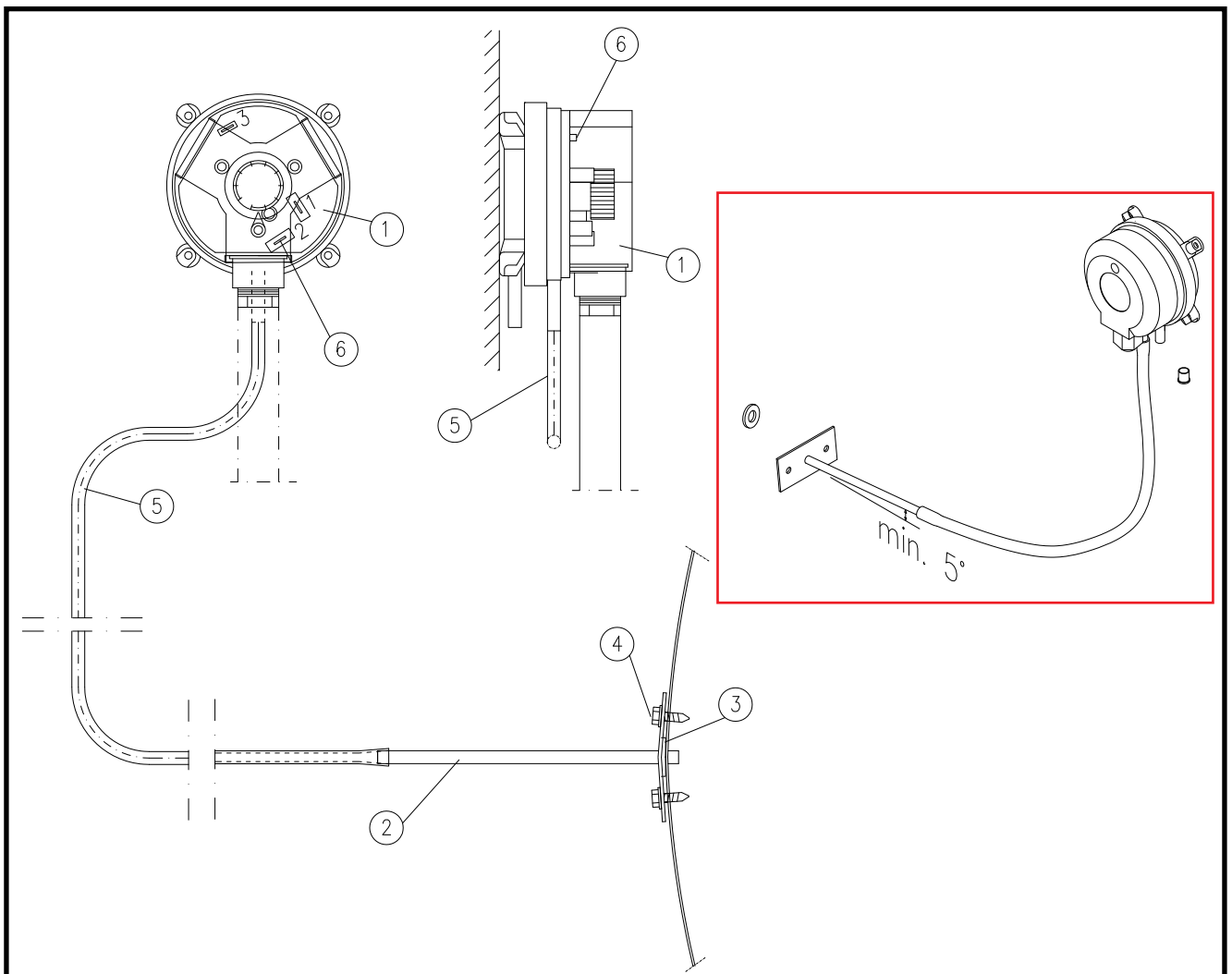
Drill an 8 mm hole in the air pipe for the lead-through sleeve. Fix the lead-through sleeve using self-tapping screws (4). Do not forget to place the rubber washer (3) between the pipe and the lead-through sleeve.

Connect the PVC hose to the "upper" connector (5) of the sensor unit; the cover plug of the connector, closest to the wall, must be removed. Connect the other end of the hose to the lead-through sleeve.

Connect the cable, using the Abico-connectors included in the delivery, to the terminals 2 and 3 (6), as shown in the wiring diagram.

The pressure is adjusted by means of the disc, located in the centre of the sensor unit. Set the sensor to such a pressure value, that the positions 2-3 of the change-over contact will be switched on, even if the air adjuster plate is in its minimum position.

If the change-over switch is not switched on, the oil burner will not start.





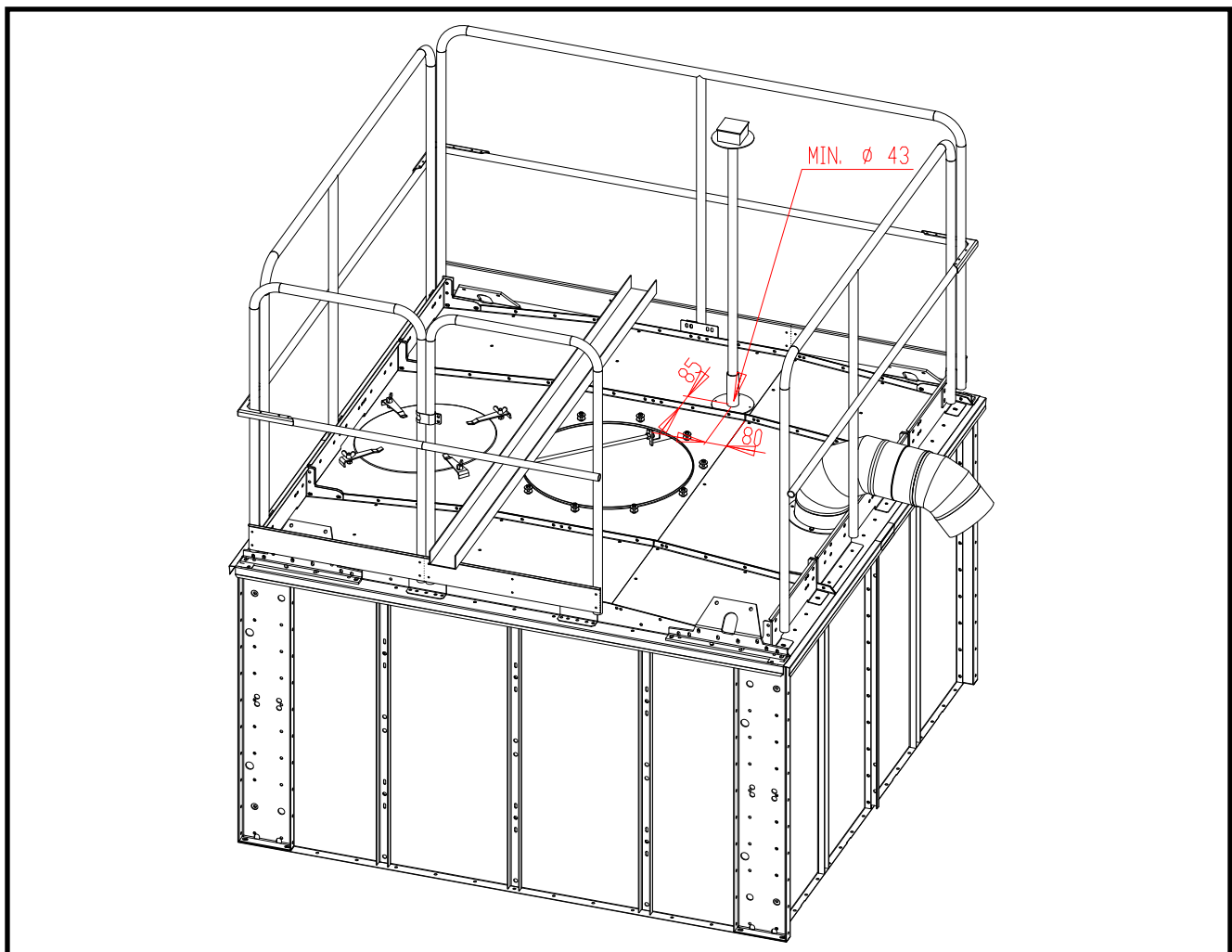
Installing the upper limit sensor (Capacitive, adjustable)

The delivery of the dryer machinery includes a capacitive level guard with an adjustable rod.

Installation dimensions for the upper limit sensor are presented in the drawing below. Seal the joint between the bracket and the cover using mastic glue. Install the sensor sufficiently low to prevent the elevator from congesting during the first times of use. The correct height of the sensor is about 60 cm from the top.

Follow the dryer's filling rate during the first filling and drying rounds. You must search out the correct height for the upper limit sensor, because in practice, it varies. Observe that the grain mass expands in the beginning of the drying phase. Therefore, some space must be reserved for the pre-cleaner. Fix the height position of the sensor using the wing screw.

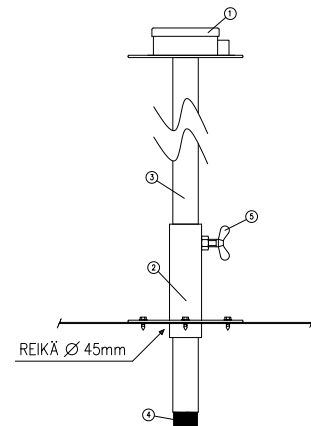
Over time, the sensor's head may get dirty and start transmitting wrong data. Due to the above reason, the sensor head should be cleaned from time to time.



Drill a hole of 45 mm in the top of the dryer or the storage silo, and install in it the holder for the sensor pipe (2).

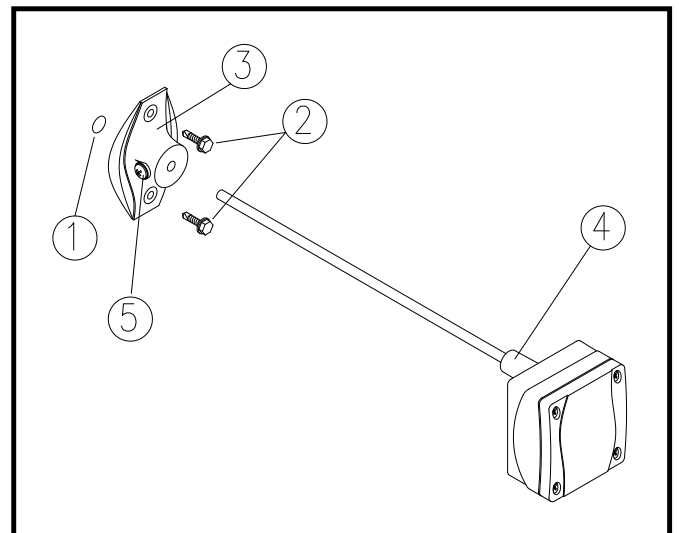
Push the sensor pipe (3) into the grain space so that the feeler (4) comes at the desired height of the upper limit. Lock the sensor pipe in position by tightening the locking bolt (3).

Connect the upper limit sensor to the system in the connecting box (1) in accordance with the wiring diagram.



Installing the temperature transmitter in the duct

Install the temperature transmitter (4) in the air pipe using the installation flange (3). Drill an 8 mm hole (1) in the inlet air pipe. Fix the installation flange at the hole in the pipe, using self-tapping screws (2). Insert the sensor of the temperature transmitter into the pipe through the installation flange, and tighten it in place with the lock screw (5).







Installing the fire thermostat in the duct

Attach the thermostat unit (1) to the wall according to the drawing.

Drill in the air pipe a hole of 16 mm for the sensor holder (2). Fix the holder to the air pipe using screws.

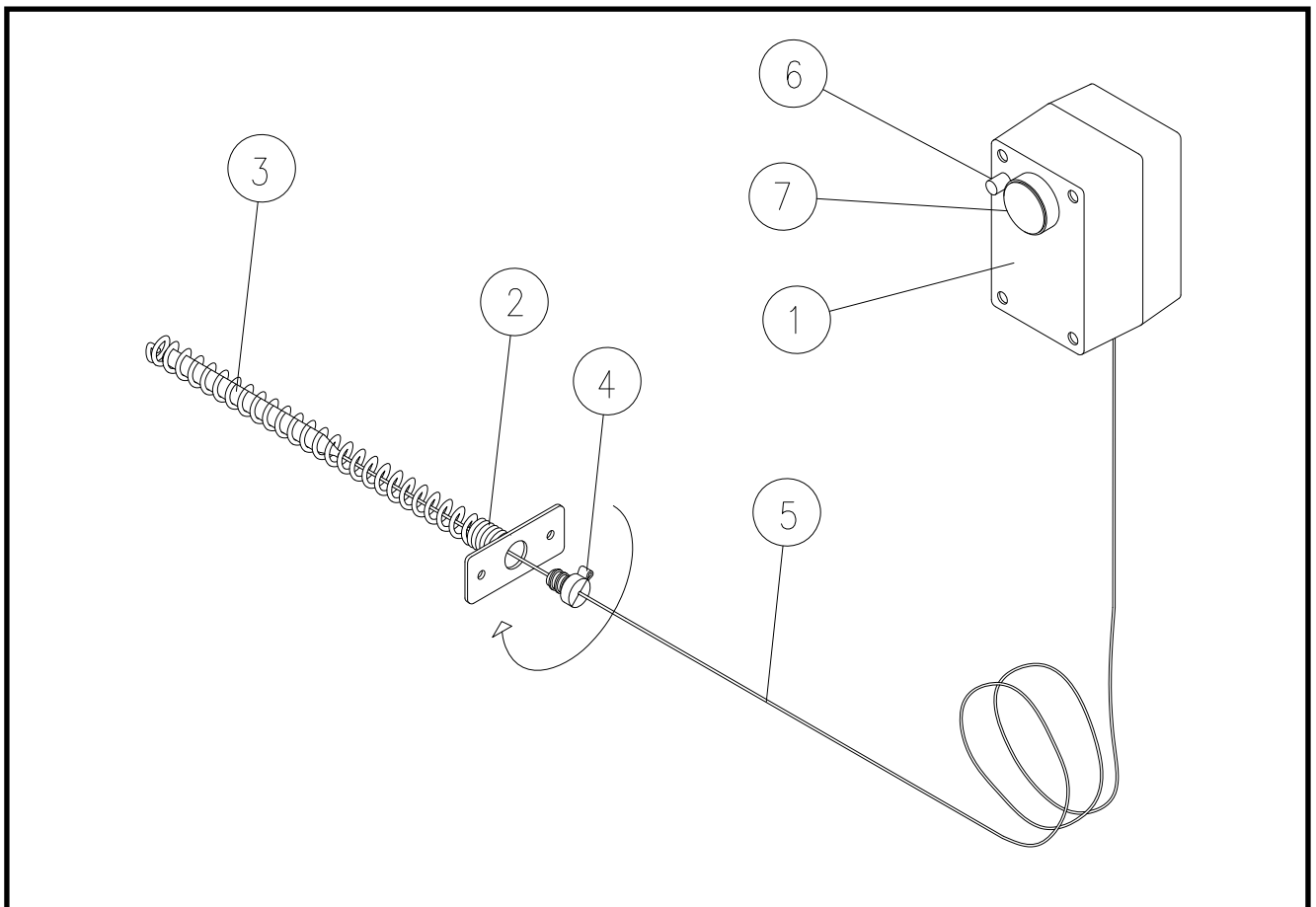
Push the feeler (3) of the thermostat's capillary pipe (5) into the sensor's holder, and lock it by clamping the locking collar (4) on the capillary pipe and twisting it into the holder.

Set the operating temperature via the adjustment wheel (7). Set the operating temperature of the fire thermostat 10°C higher than the maximum temperature of the outlet air, however, to at least 50°C.

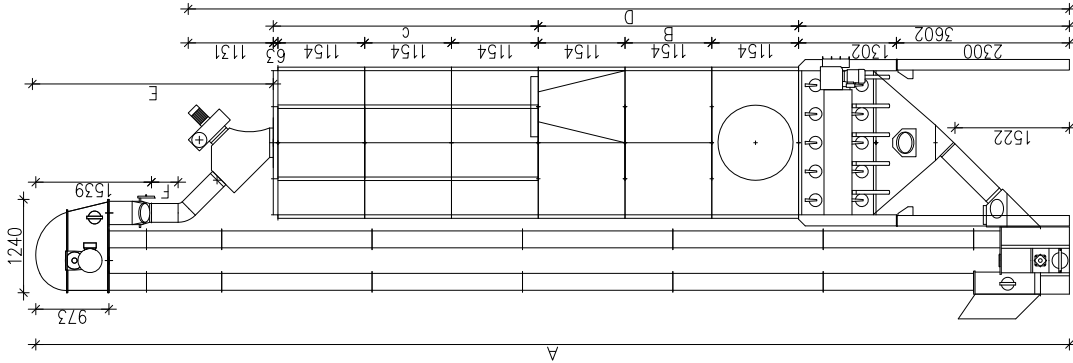
Ensure that the fire thermostat is active by depressing the reset button (6).

Connect the fire thermostat to the system in accordance with the wiring diagram.

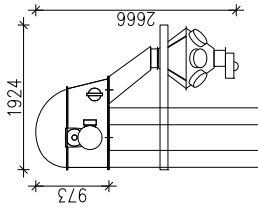
The fire thermostat shuts down all the operations of the dryer immediately after the pre-set temperature has been reached, for example, as a result of fire inside the dryer. The fire thermostat is delivered with the blowers. A fire thermostat is installed in every outlet pipe from the blower.



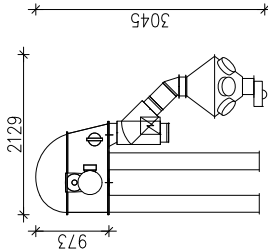
3-tj/way



6-tj/way



2-tj/way + 6-tj/way



A:	Elevaattorin mitta	Elevator height
B:	Lämpökennojen mitta	Dimension of drying sections
C:	Yläsäiliöt + kansi mitta	Dimension of top sections + roof
D:	Koneen kokonaiskorkeus + esipuhdistin mitta	Total height of dryer + pre-cleaner
E:	Elevaattorin yläpään ja kannen välinen mitta	Dimension between the elevator top and the dryer roof
F:	Suoran putken pituus välillä 3-teijakeja - valukäyrä	Straight pipes length between 3-way divider - cast elbow

Jalustatyyppi / Base type	2W
Jalusta / base m ³	2,00
kenno / section m ³	3,12
yläsäiliö / top section m ³	4,32

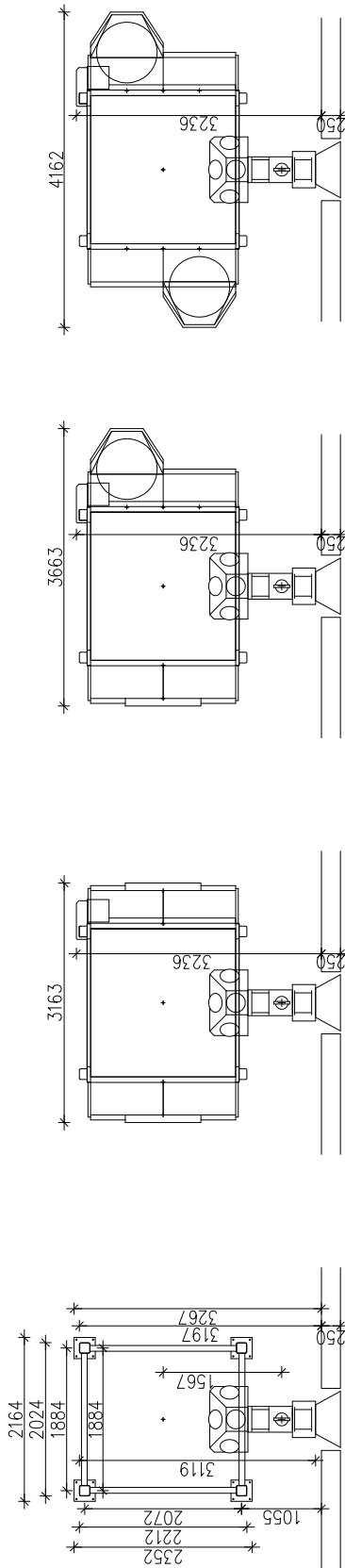
A160 esipuhdistin / pre-cleaner

2W	500 mm ilmapäädty / air channel ends										1000 mm ilmapäädty / air channel ends		
	22	23	33	43	44	45	55	65	75	85			
V [m ³]	16,9	21,2	24,3	27,4	31,8	36,1	39,2	42,3	45,4	48,6			
A 3-tj / way [mm]	11200	12200	13700	14700	15700	16700	18200	19200	20700	21700			
A 6-tj / way	12200	13200	14700	15700	16700	18200	19200	20200	21200	22700			
A 2-tj/way + 6-tj /way [mm]	12200	13700	14700	15700	17200	18200	19200	20700	21700	22700			
B [mm]	2308	2308	3462	4616	4616	4616	5770	6924	8078	9232			
C [mm]	2371	3525	3525	3525	4679	5833	5833	5833	5833	5833			
D [mm]	9412	10566	11720	12874	14028	15182	16336	17490	18644	19798			
E 3-tj / way [mm]	2966	2812	3158	3004	2850	3186	3042	2888	3234	3080			
E 6-tj / way [mm]	3966	3812	4158	4004	3850	4196	4042	3888	3734	4080			
E 2-tj/way + 6-tj /way [mm]	3966	4312	4158	4004	4350	4196	4042	4388	4234	4080			
F 3-tj / way [mm]	163	9	355	201	47	393	239	85	431	277			

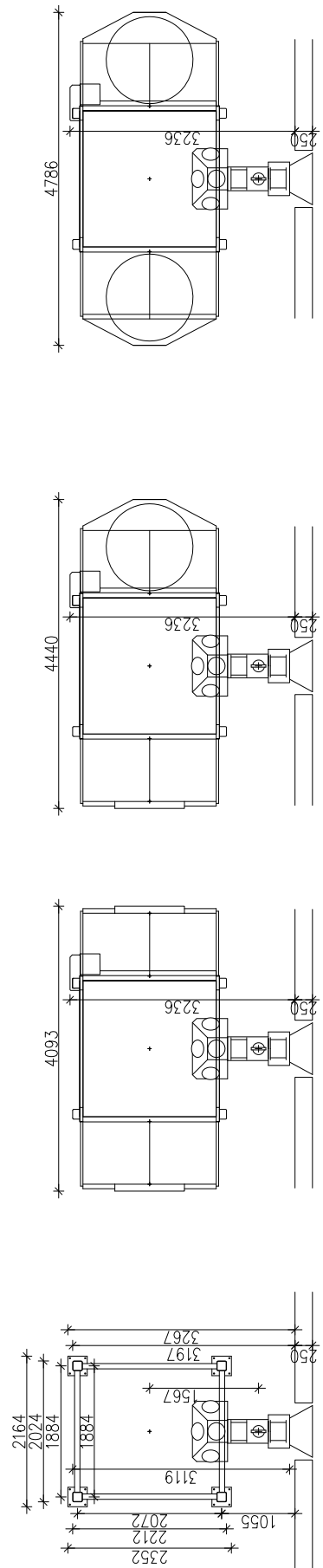


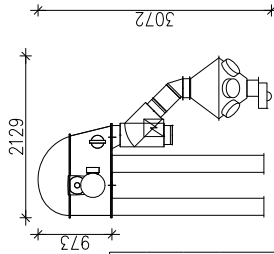
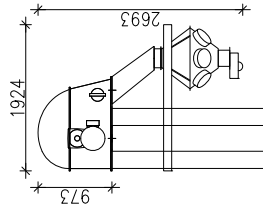
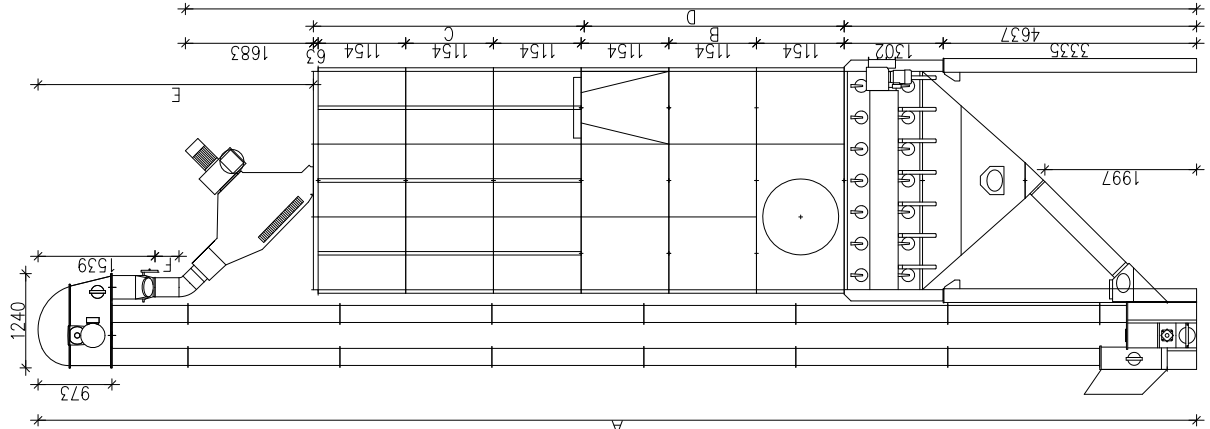
2W

500 mm ilmapäädyt / air channel ends



1000 mm ilmapäädyt / air channel ends



2- tj/way + 6- tj/way

6- tj/way

3- tj/way


A:	Elevaattorin mitta	Elevator height
B:	Lämpökennojen mitta	Dimension of drying sections
C:	Yläsäiliöt + kansi mitta	Dimension of top sections + roof
D:	Koneen kokonaiskorkeus + esipuhdistin mitta	Total height of dryer + pre-cleaner
E:	Elevaattorin yläpään ja kannen välinen mitta	Dimension between the elevator top and the dryer roof
F:	Suoran putken pituus väillä 3-tiejakaja - valukäyrä	Straight pipes length between 3-way divider - cast elbow

Jalustatyyppi /Base type	3W
jaluusta / base m ³	3,00
kenno / section m ³	4,68
yläsäiliö / top section m ³	6,64

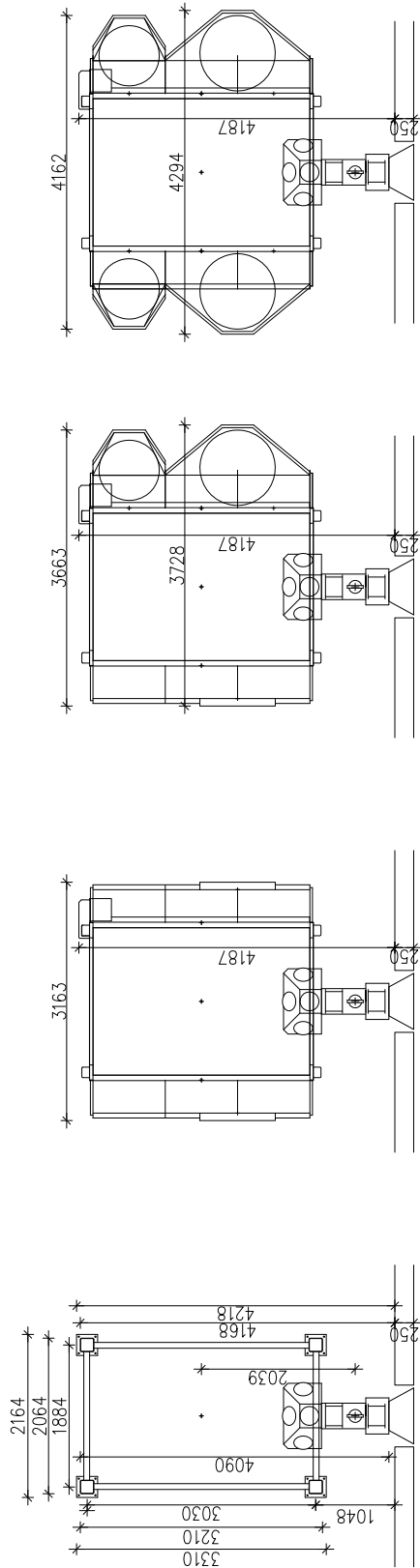
P 250 esipuhdistin / pre-cleaner

3W	500 mm ilmapäädyt / air channel ends						1000 mm ilmapäädyt / air channel ends					
	22	23	33	34	44	45	54	55	65	75	85	
V [m ³]	25,3	31,8	36,5	43,0	47,6	54,1	52,3	58,8	63,5	68,2	72,8	
A 3- tj /way [mm]	12700	14200	15200	16200	17200	18700	18700	19700	20700	22200	23200	
A 6- tj /way	13700	14700	16200	17200	18200	19700	19700	20700	21700	23200	24200	
A 2- tj/way + 6- tj /way [mm]	14200	15200	16200	17700	18700	19700	19700	20700	22200	23200	24200	
B [mm]	2308	2308	3462	3462	4616	4616	5770	5770	6924	8078	9232	
C [mm]	2371	3525	3525	4679	4679	5833	4679	5833	5833	5833	5833	
D [mm]	10999	12153	13307	14461	15615	16769	16769	17923	19077	20231	21385	
E 3- tj /way [mm]	3431	3777	3623	3469	3315	3661	3661	3507	3353	3699	3545	
E 6- tj / way	4431	4277	4623	4469	4315	4661	4661	4507	4353	4699	4545	
E 2- tj/way + 6- tj /way [mm]	4931	4777	4623	4969	4815	4661	4661	4507	4853	4699	4545	
F 3- tj /way[mm]	124	470	316	162	8	354	354	200	46	392	238	

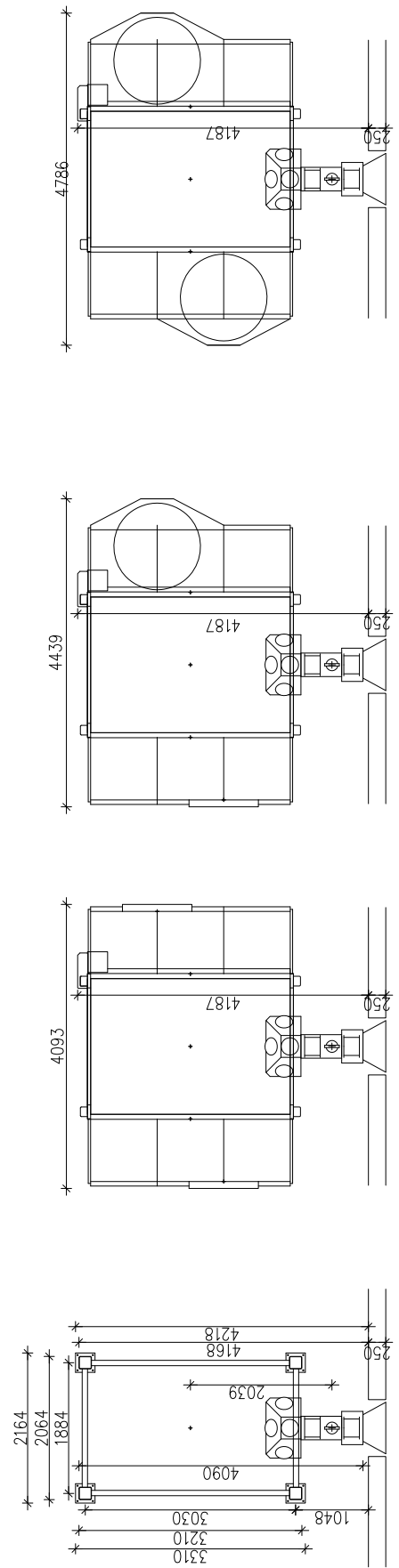


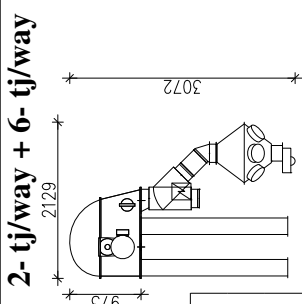
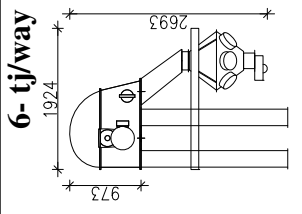
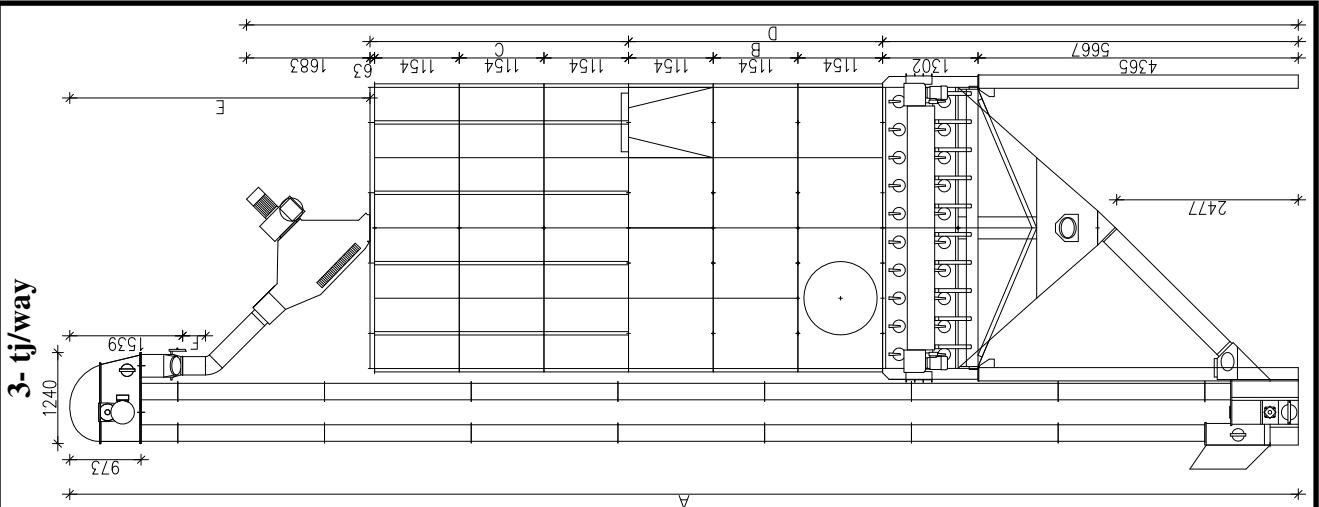
3W

500 mm ilmapäädyt / air channel ends



1000 mm ilmapäädyt / air channel ends





A:	Elevaattorin mitta	Elevator height
B:	Lämpökemnojen mitta	Dimension of drying sections
C:	Yläsäiliöt + kansi mitta	Dimension of top sections + roof
D:	Koneen kokonaiskorkeus + esipuhdistin mitta	Total height of dryer + pre-cleaner
E:	Elevaattorin yläpään ja kannen välinen mitta	Dimension between the elevator top and the dryer roof
F:	Suoran putken pituus välillä 3-itejakaja - valukäyrä	Straight pipes length between 3-way divider - cast elbow

Jalustatyyppi / Base type	4W
Jalusta / base m ³	4,00
kenno / section m ³	6,24
yläsäiliö / top section m ³	8,64

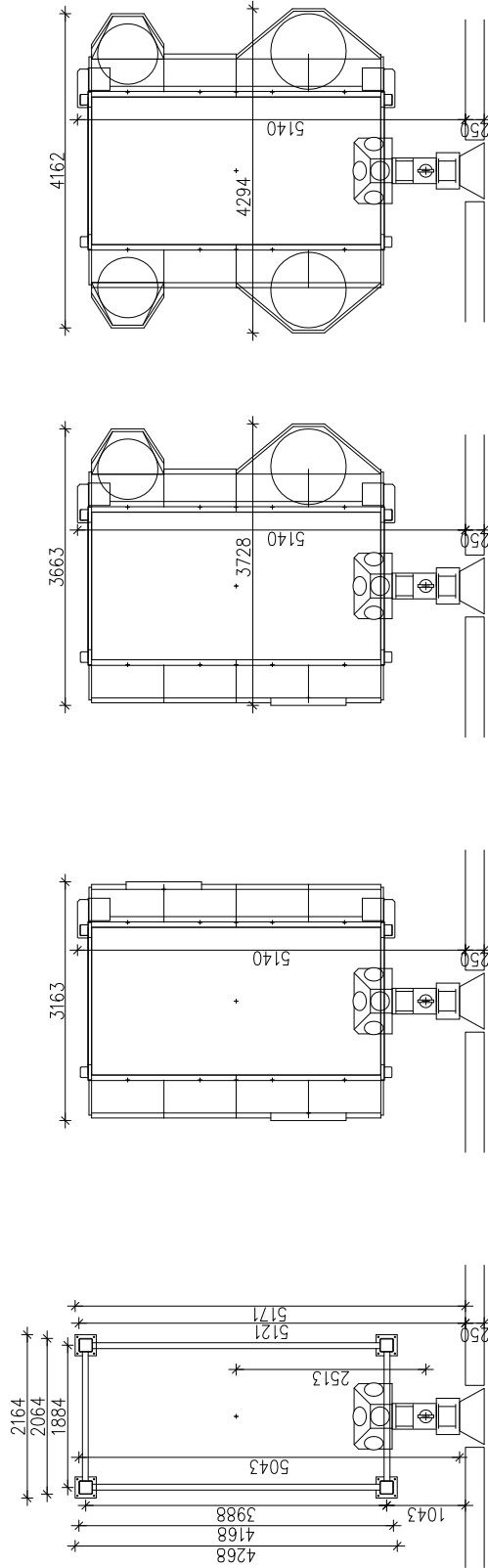
P 250 esipuhdistin / pre-cleaner

4W	500 mm ilmapäädtyt / air channel ends					1000 mm ilmapäädtyt / air channel ends					
	23	33	34	43	44	45	54	55	65	75	85
V [m ³]	42,4	48,6	57,3	54,8	63,5	72,2	69,8	78,4	84,6	90,8	97,1
A 3 -tj /way [mm]	15700	16700	17700	17700	18700	20200	20200	21200	22200	23700	24700
A 6 -tj /way	16200	17700	18700	18700	19700	21200	21200	22200	23200	24700	25700
A 2 -tj /way + 6 -tj /way [mm]	16700	17700	18700	18700	20200	21200	21200	22200	23700	24700	25700
B [mm]	2308	3462	3462	4616	4616	4616	5770	5770	6924	8079	9232
C [mm]	3525	3525	4679	3525	4679	5833	4679	5833	5833	5833	5833
D [mm]	13183	14337	15491	15446	16645	17799	17799	18953	20107	21261	22415
E 3 -tj /way [mm]	4247	4093	3939	3984	3785	4131	4131	3977	3823	4169	4015
E 6 -tj / way	4747	5093	4939	4984	4785	5131	5131	4977	4823	5169	5015
E 2 -tj /way + 6 -tj /way [mm]	5247	5093	4939	4984	5285	5131	5131	4977	5323	5169	5015
F 3 -tj /way [mm]	466	312	158	251	4	350	350	289	42	388	234

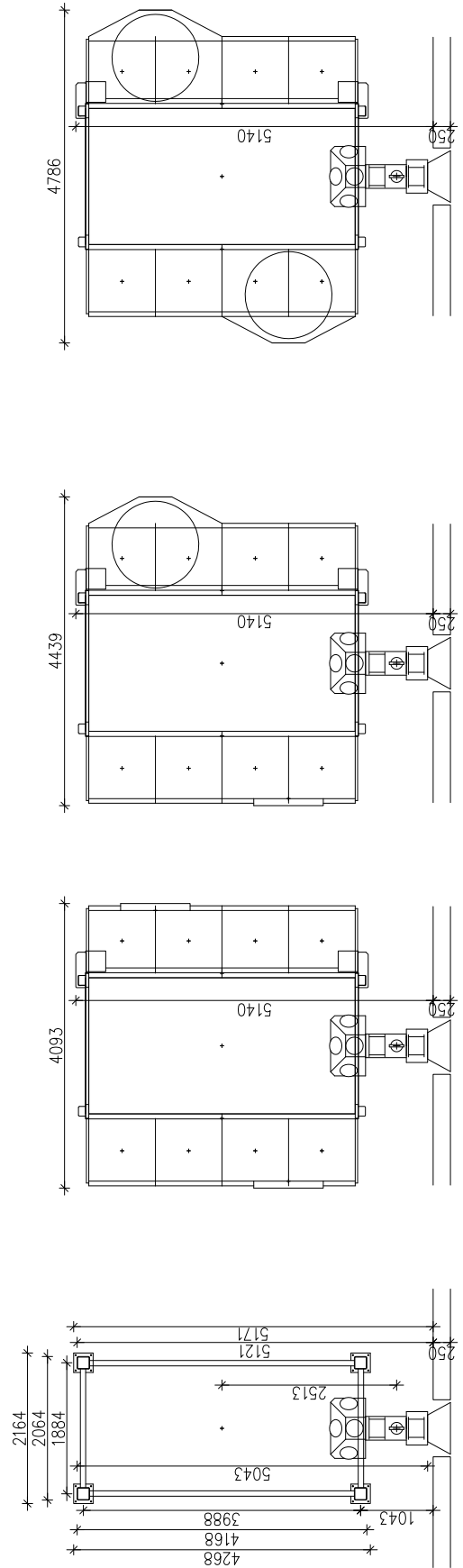


4W

500 mm ilmapäädýt / air channel ends



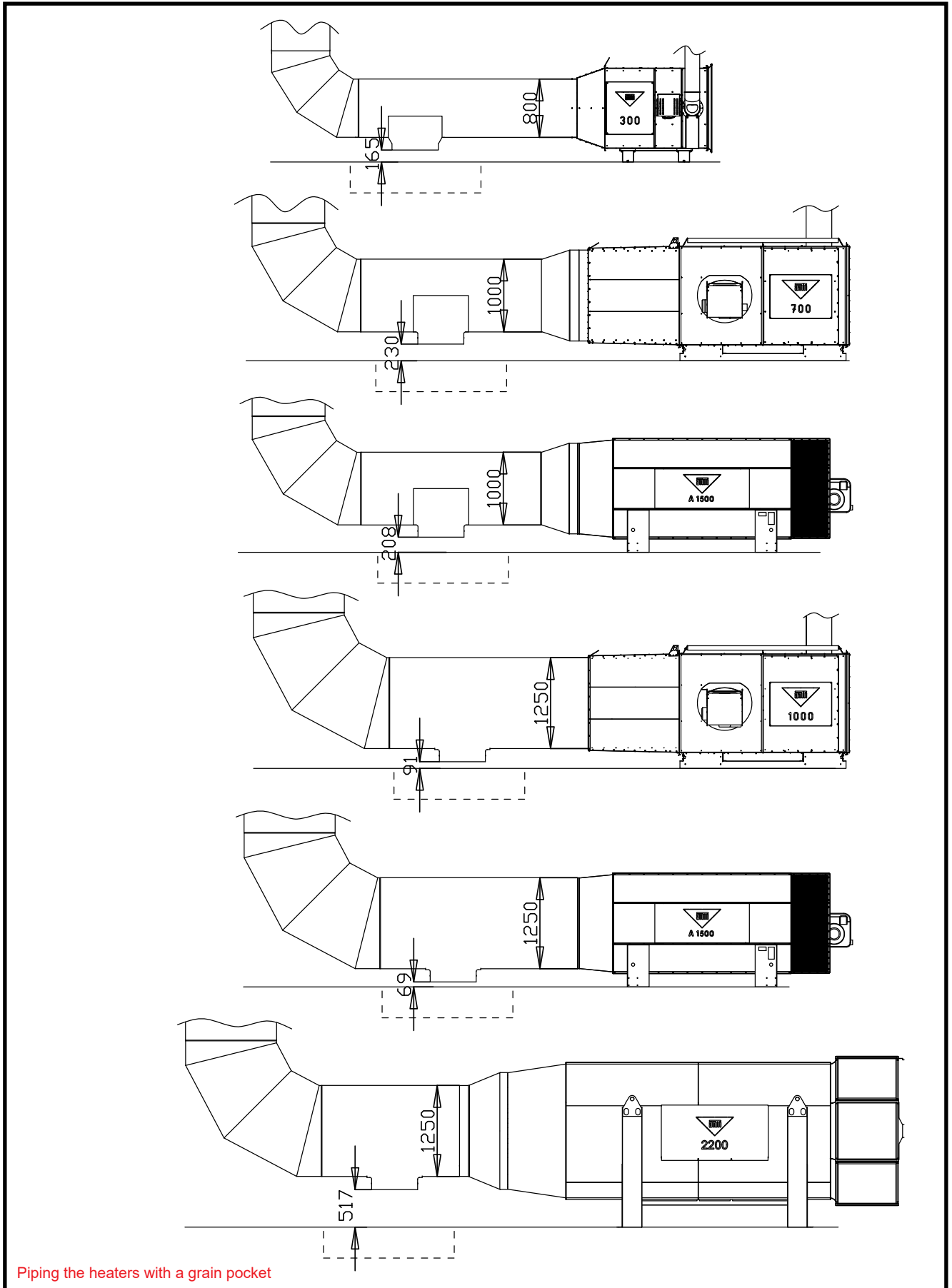
1000 mm ilmapäädýt / air channel ends





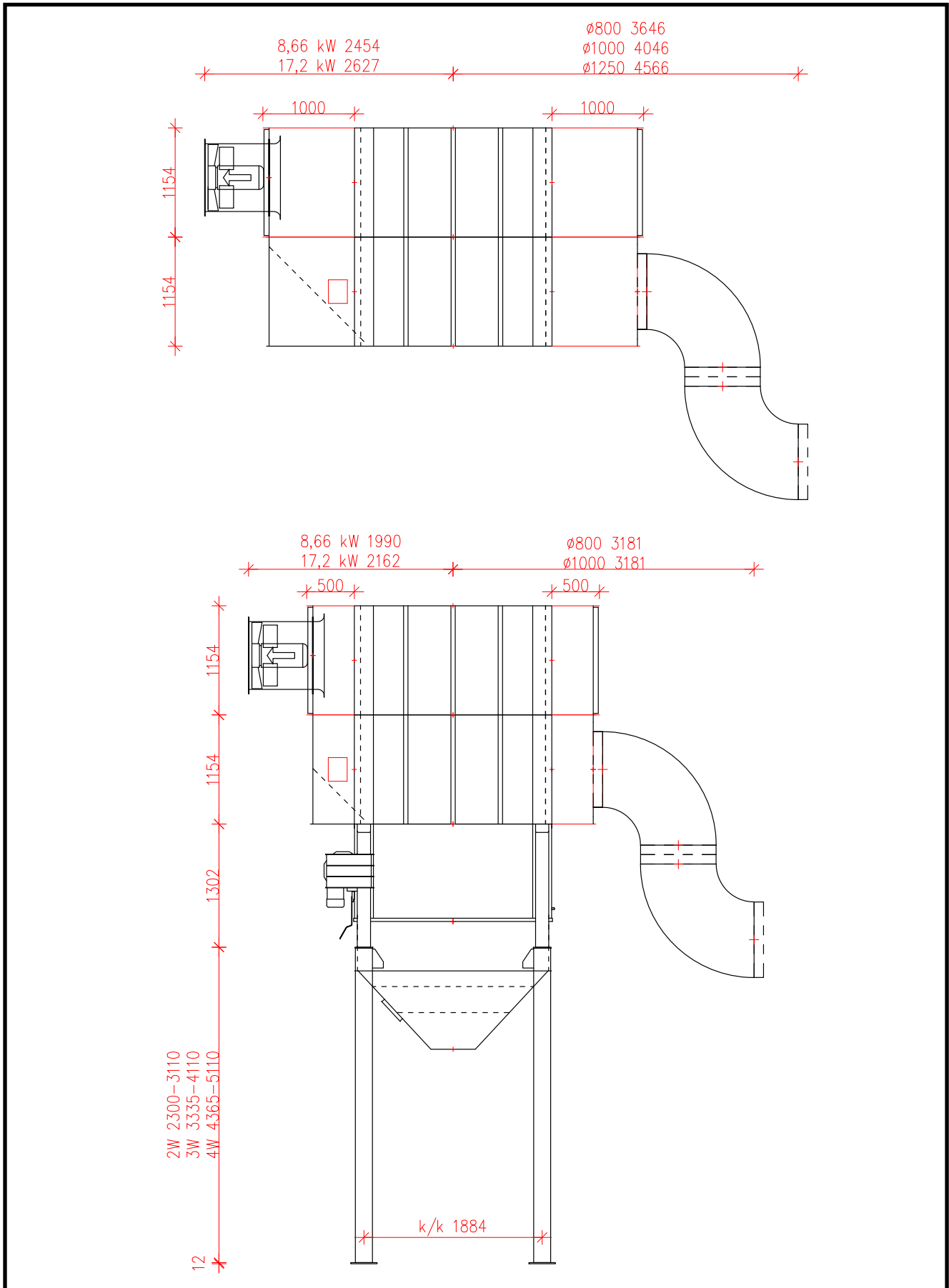


Piping the heaters with a grain pocket



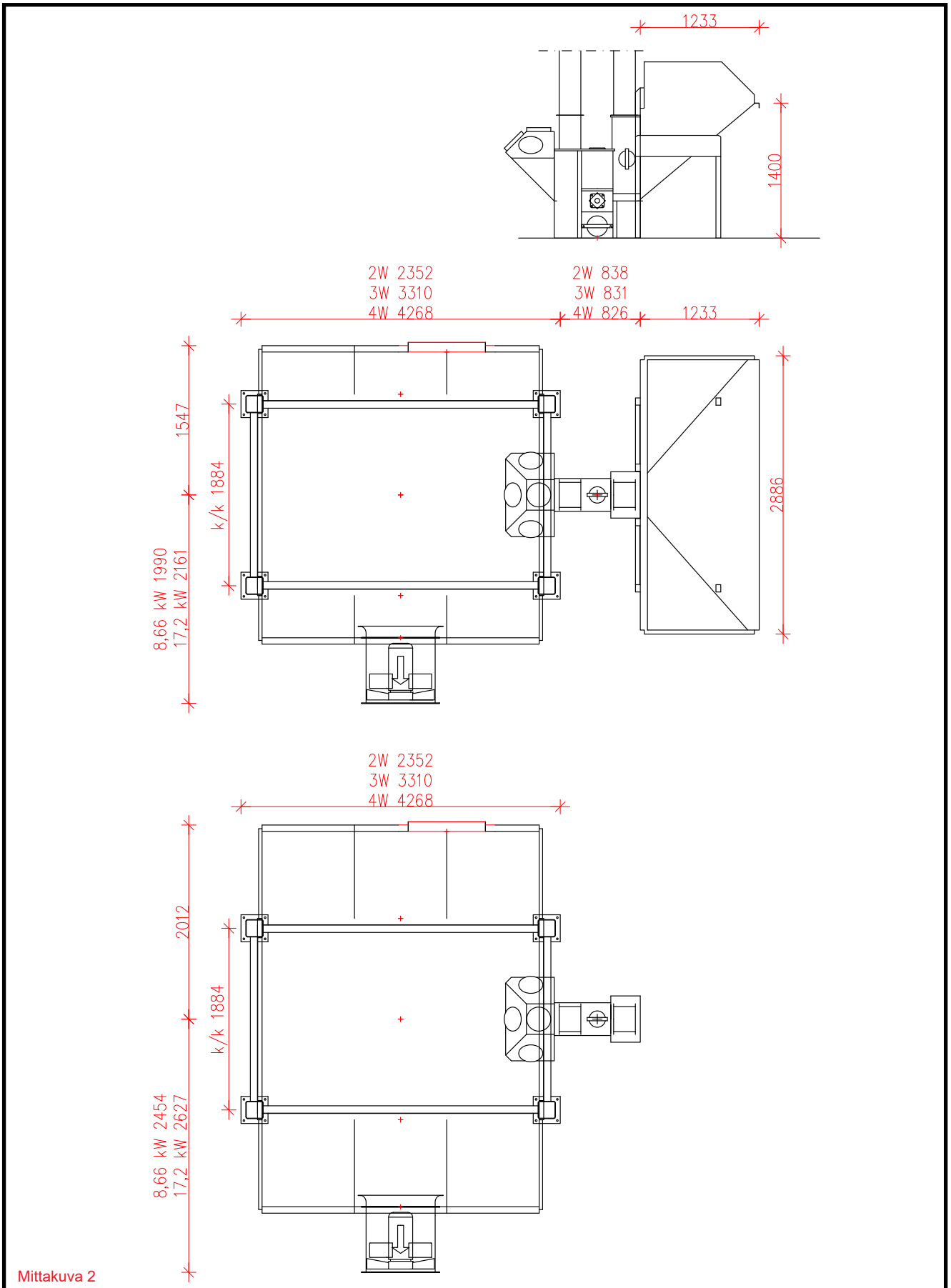


Dimensioning of the basic parts viewed from the side





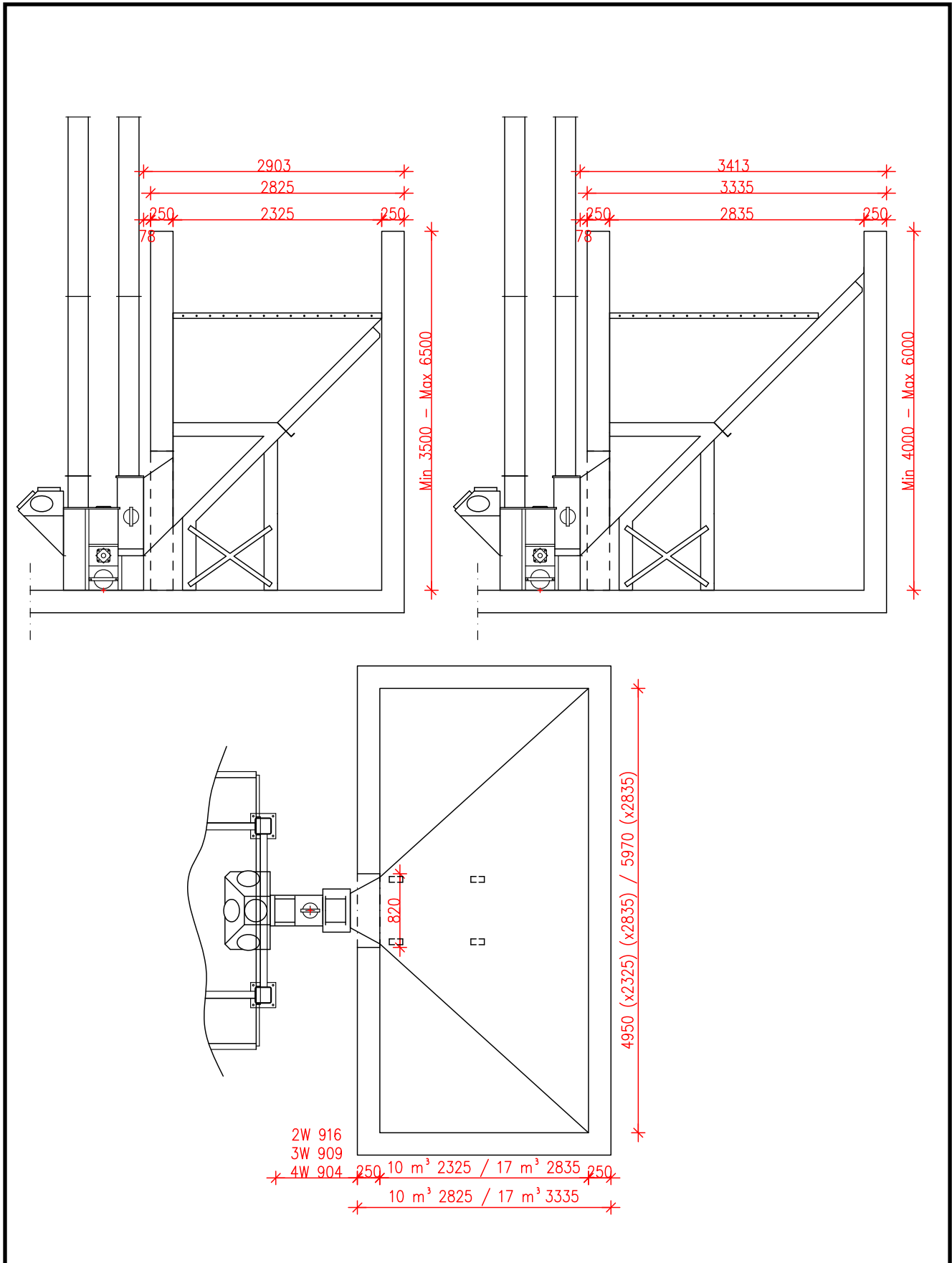
Dimensioning of the basic parts with a small intake pit viewed from above



Mittakuva 2

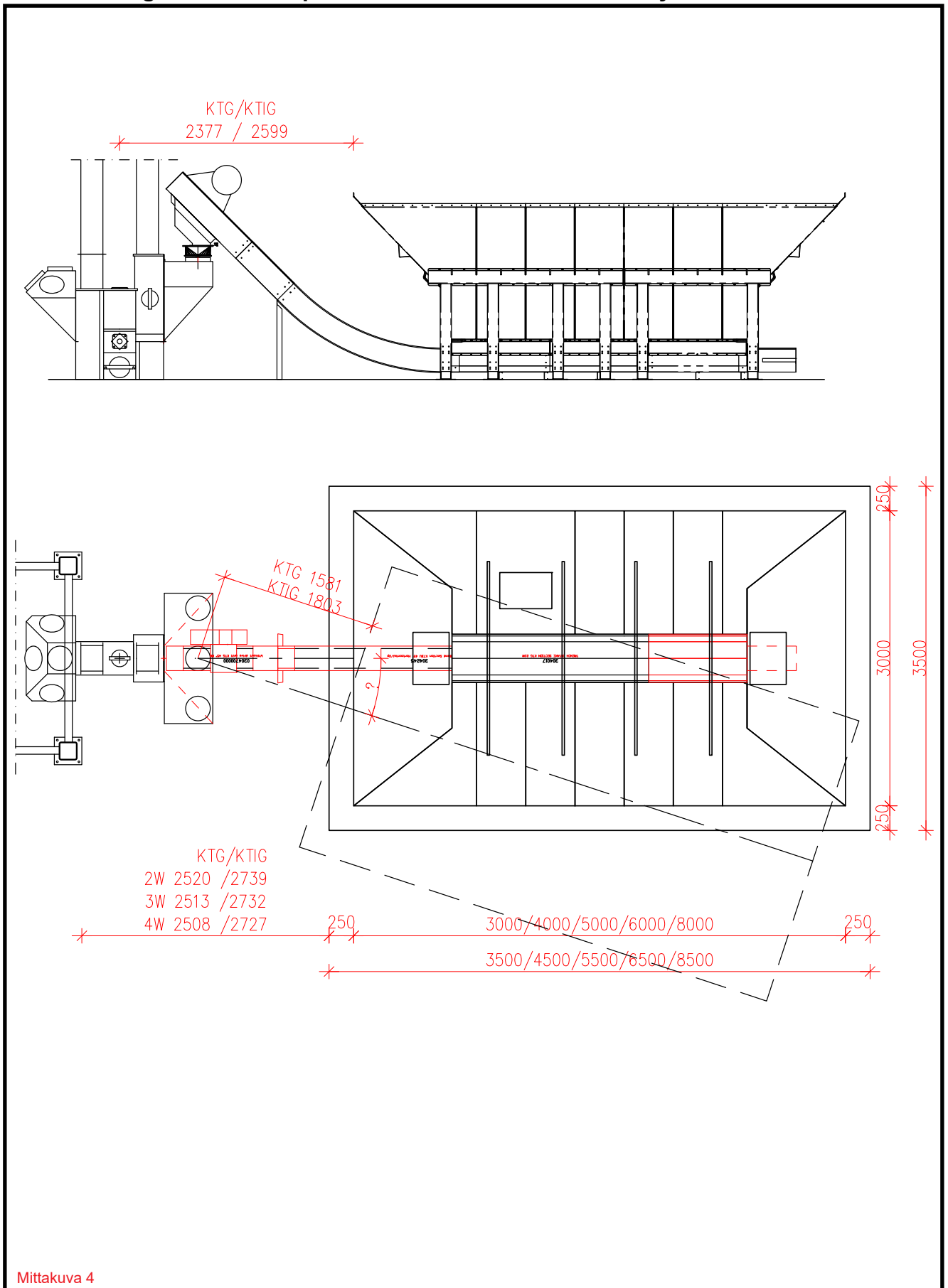


Principle dimensioning drawings for the 10 m³ and 17m³ intake pits





Dimensioning of the intake pit to be used with a chain conveyor



Mittakuva 4



Installing the base and the legs

Attach the legs to the base and lift it onto the concrete foundation that is fitted with bond plates. Bring the base into the level position. To ensure the proper operation of the dryer, use a water level to verify that the top surface of the base is absolutely **level** before continuing the installation work.

The maximum height of the machinery, to be installed outdoors using expansion anchors, is (because of the wind load) 8 rows. A machinery higher than this must be attached by welding to the bond plates embedded in the concrete. Attach the foot plates to the concrete foundation using M16x140 expansion anchors, 4 anchors/plate. Drill a D16 hole, 140 mm deep, for the expansion anchors. Clean the drilled hole before installing the anchor. (Ensure that the concrete foundation has hardened sufficiently after the casting to provide firm attachment of the anchors). The expansion anchors are delivered with the extension legs. The foot plate can also be attached using a M16 chemical anchor. Note! Each anchor must be able to withstand a pull of 16 kN. Refer to the specific assembly instructions for the legs and the cross-braces, provided separately for each model.

Sections, air channel ends

The drying sections are delivered either pre-assembled or in parts. The air channel ends are not yet in place in the ready-assembled drying sections. The air channel ends of the export model are delivered in parts. The air channel ends can be assembled and attached to the sections while still on the ground. Provide each joint with a sealing strip. While lifting the sections into place, make sure that they come in the right way. The inlet side of the sections shall come on the trough-rod side of the base.

For proper operation of the dryer it is essential that the air inside the triangular channels of the sections flows in the correct direction: the open end of the triangular channel halves shall be come on the section's inlet side (facing to the heater).

Before lifting the lowest section into place, affix self-adhesive sealing strips to the upper surfaces of the base. Place the strip on the inner edge of the horizontal contact surfaces of the base and the section. Provide all the joints with seals.

Use M10x20 bolts for joining together the corner reinforcement legs of the sections and the top tanks. Refer to the specific assembly instructions for the top tanks, provided separately for each model.

NOTE! Remove the lifting lugs (501010) as soon as the sections are in place!

Top tanks and cover with handrails

The top tanks are delivered either pre-assembled or in parts. Place a sealing strip on the inner edge of the horizontal contact surfaces of the top tank. Provide all the joints with seals.

Use M10x20 bolts for joining together the corner reinforcement legs of the sections and the top tanks.

The top tanks and the sections can all be joined together while still on the ground, and lifted up in one go. NOTE! Observe the weight.

Refer to the specific assembly instructions for the top tanks, provided separately for each model.



Installing the elevator and the ladder

Assembly in accordance with the instructions 408010.

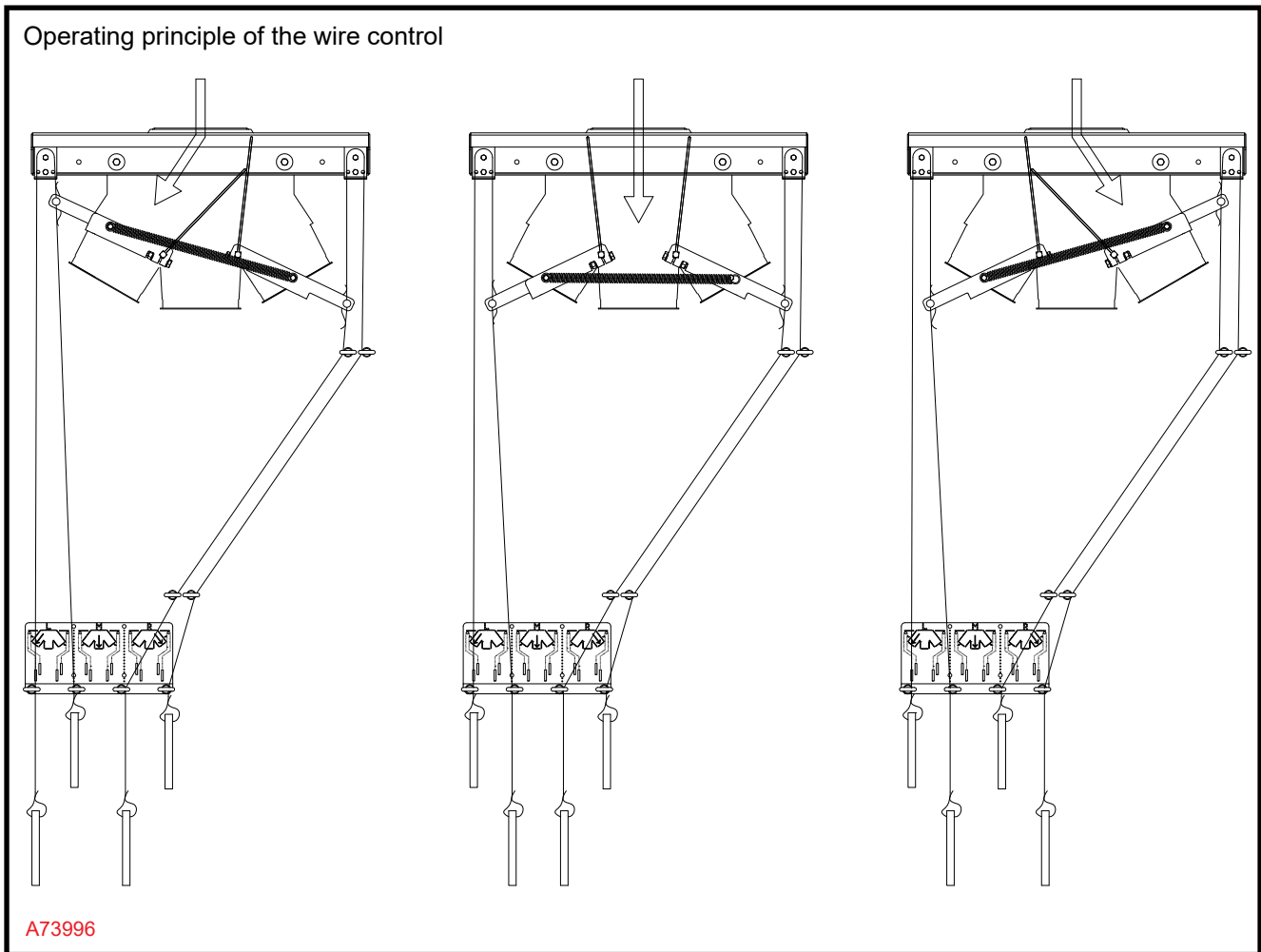
Bolt-assembled hopper 10m³ / 17m³

Assembly in accordance with the instructions 408110.

The intake pit with Skandia conveyor

To be assembled in accordance with the instructions 408115.

Wire control of the 3-way divider



Attach the divider to the conversion part of the elevator, and install the bearer for the wire control pulleys at the side of the divider. Connect the wires to the control levers of the divider, and on one side, route the wires directly to the lower control unit, and on the other side, route them via the eyebolts to the other control lever, avoiding too sharp angles. See drawing: "Operating principle of the wire control"

Install the circulation pipes between the elevator and the dryer. Make sure that the fall angle of the piping is 45° (1:1).



Air piping

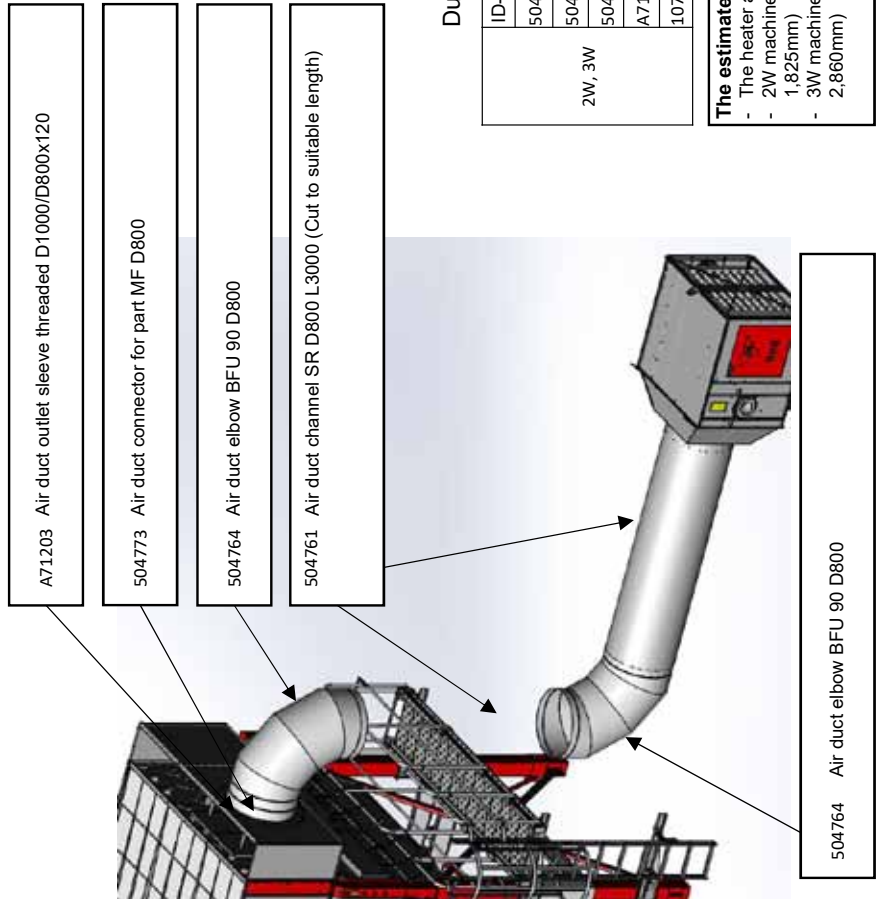
WARNING! Foreign particles inside the heater are a fire hazard!

The outlet air from the dryer is often dusty and contains debris, in particular at the final phase of the drying process. Therefore, you should always try to route the outlet air pipe to the opposite side of the dryer building to the inlet of suction air to the dryer heater.

WARNING! Debris in the suction air of the heater constitutes a fire hazard!

Example drawings presenting how to install the air ducts with optimised extension legs (see pages 40–46)

Machinery: 2W, 3W
 Duct size: D800
 Oil heater: 300-500kW



Duct parts:

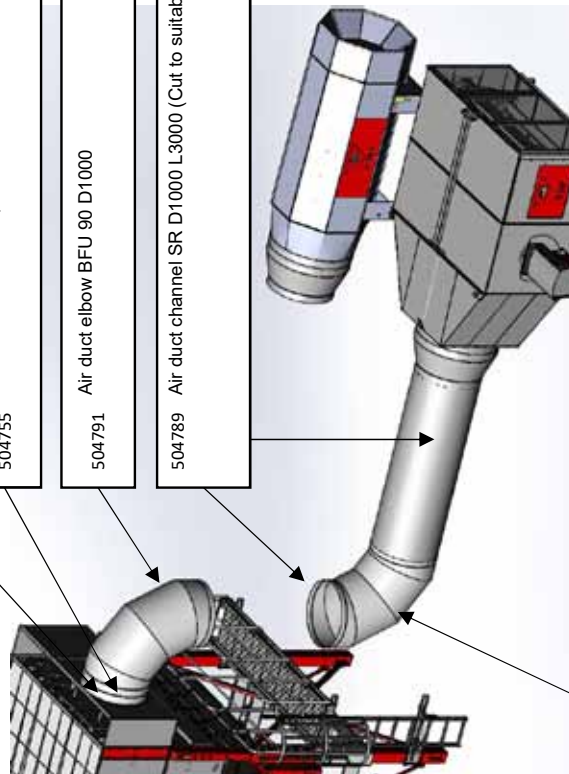
ID-code	Denom. 1	Denom. 2	pcs.
504761	AIR DUCT CHANNEL SR	D800 L3000	2
504764	AIR DUCT ELBOW	BFU 90 D800	2
504773	AIR SUCT CONNECTOR FOR PART	MF D800	1
A71203	AIR DUCT OUTLET SLEEVE THREADED	D1000/D800X120	1
107720	SELF-TAPPING HEXAGON SCREW	DIN 7504K Zn 4,8x13	24

The estimated amount of duct parts assumed that

- The heater and the machinery are on the same level.
- 2W machinery with extension leg of 2,300mm (Indicatively, the required air duct length for the vertical part is 1,825mm)
- 3W machinery with extension leg of 3,335mm (Indicatively, the required air duct length for the vertical part is 2,860mm)

Machinery: 2W, 3W
 Duct size: D1000
 Oil heater: 700kW
 Gas-fuelled heater: 1500kW

- A71200 Air duct outlet sleeve threaded D1000/D1000x120
- 504755 Air duct connector for part MF D1000
- 504791 Air duct elbow BFU 90 D1000
- 504789 Air duct channel SR D1000 L3000 (Cut to suitable length)



504791 Air duct elbow BFU 90 D1000

Duct parts:

ID-code	Denom. 1	Denom. 2	pcs.
504789	AIR DUCT CHANNEL SR	D1000 L3000	2
504791	AIR DUCT ELBOW	BFU 90 D1000	2
504755	AIR SUCT CONNECTOR FOR PART	MF D1000	1
A71200	AIR DUCT OUTLET SLEEVE THREADED	D1000/D1000X120	1
107720	SELF-TAPPING HEXAGON SCREW	DIN 7504K Zn 4,8x13	24

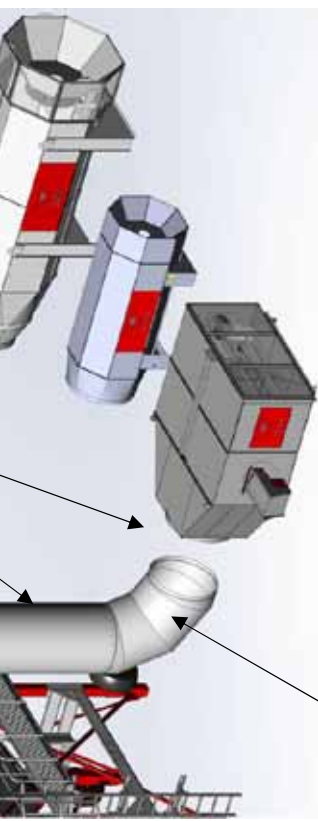
The estimated amount of duct parts assumed that

- The heater and the machinery are on the same level.
- 2W machinery with extension leg of 2,300mm (Indicatively, the required air duct length for the vertical part is 1,825mm)
- 3W machinery with extension leg of 3,335mm (Indicatively, the required air duct length for the vertical part is 2,860mm)

Machinery: 3W, 4W
 Duct size: D1250
 Oil heater: 1000kW
 Gas-fuelled heater: 1500kW
 Gas-fuelled heater: 2200kW

- A71201 Air duct outlet sleeve threaded D1250/D1250x120
- 504801 Air duct connector for part MF D1250
- 504797 Air duct elbow BFU 90 D1250
- 504795 Air duct channel SR D1250 L3000 (Cut to suitable length)

A76553 Conversion part D1600/1250



504797 Air duct elbow BFU 90 D1250

pcs.

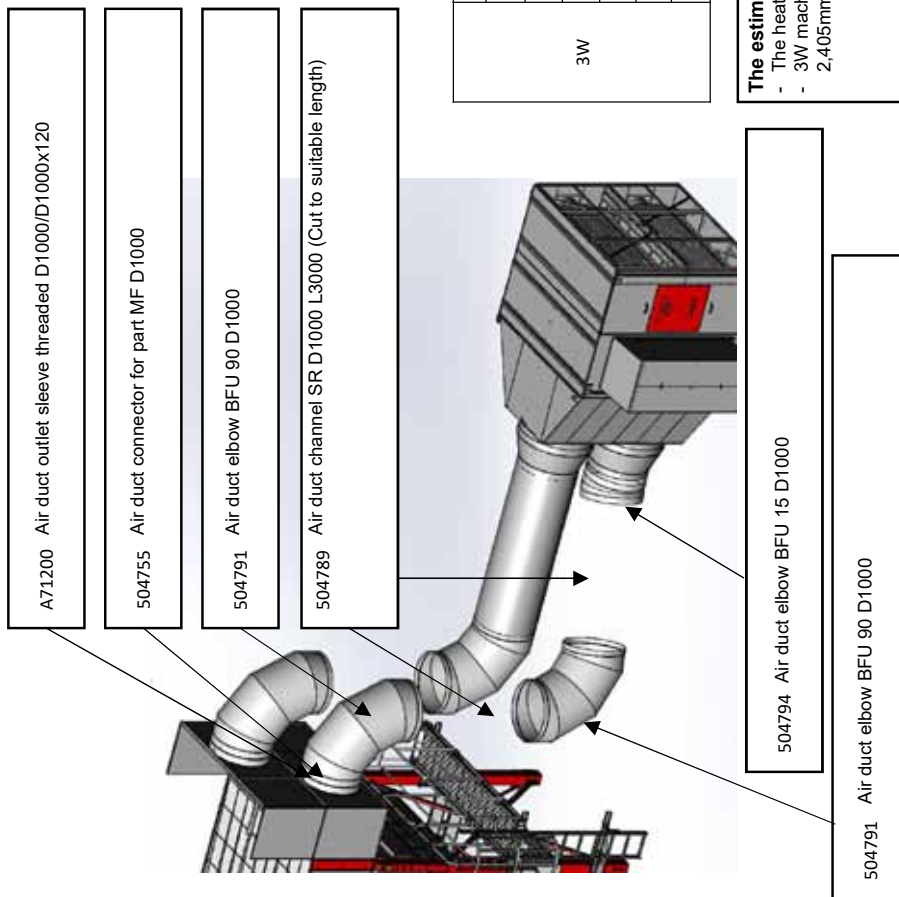
Duct parts:

ID-code	Denom. 1	Denom. 2
504795	AIR DUCT CHANNEL SR	D1250 L3000
504797	AIR DUCT ELBOW	BFU 90 D1250
504801	AIR SUCT CONNECTOR FOR PART	MF D1250
A71201	AIR DUCT OUTLET SLEEVE THREADED	D1250/D1250X120
107720	SELF-TAPPING HEXAGON SCREW	DIN 7504K Zn 4,8x13
3W, 4W		
		2
		2
		1
		1
		24

The estimated amount of duct parts assumed that

- On the 3W machinery, the heater will be on the same level with the machinery.
- 3W machinery with extension leg of 3335mm (Indicatively, the required air duct length for the vertical part is 2860mm. 2200kW is 1684 mm.)
- On the 4W machinery, the heater will be raised by 140mm from the base level of the machinery. (not 2200 kW)
- 4W machinery with extension leg of 4365mm (Indicatively, the required air duct length for the vertical part is 3000mm. 2200kW is 2720 mm.)

Machinery: 3W
 Duct size: D1000
 Oil heater: 1400KW



Duct parts:

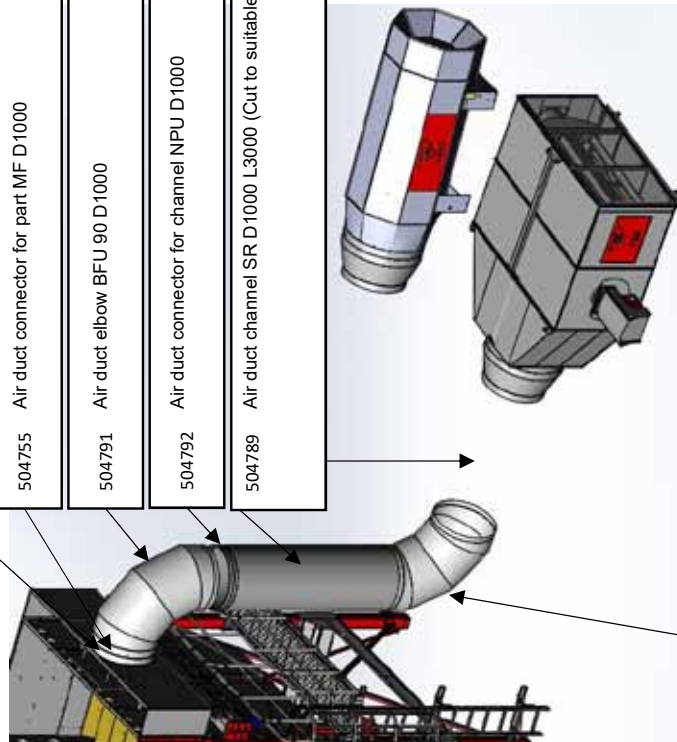
ID-code	Denom. 1	Denom. 2	pcs.
504789	AIR DUCT CHANNEL SR	D1000 L3000	4
504791	AIR DUCT ELBOW	BFU 90 D1000	4
504755	AIR SUCT CONNECTOR FOR PART	MF D1000	2
A71200	AIR DUCT OUTLET SLEEVE THREADED	D1000/D1000X120	2
504794	AIR DUCT ELBOW	BFU 15 D1000	1
107720	SELF-TAPPING HEXAGON SCREW	DIN 7504K Zn 4,8x13	52

The estimated amount of duct parts assumed that:

- The heater and the machinery are on the same level.
- 3W machinery with extension leg of 3,335mm (Indicatively, the required air duct length for the vertical parts is 2,405mm and 2,255mm)

Machinery: 4W
 Duct size: D1000
 Oil heater: 700kW
 Gas-fuelled heater: 1500kW

- A71200 Air duct outlet sleeve threaded D1000/D1000x120
- 504755 Air duct connector for part MF D1000
- 504791 Air duct elbow BFU 90 D1000
- 504792 Air duct connector for channel NPU D1000
- 504789 Air duct channel SR D1000 L3000 (Cut to suitable length)



504791 Air duct elbow BFU 90 D1000

Duct parts:

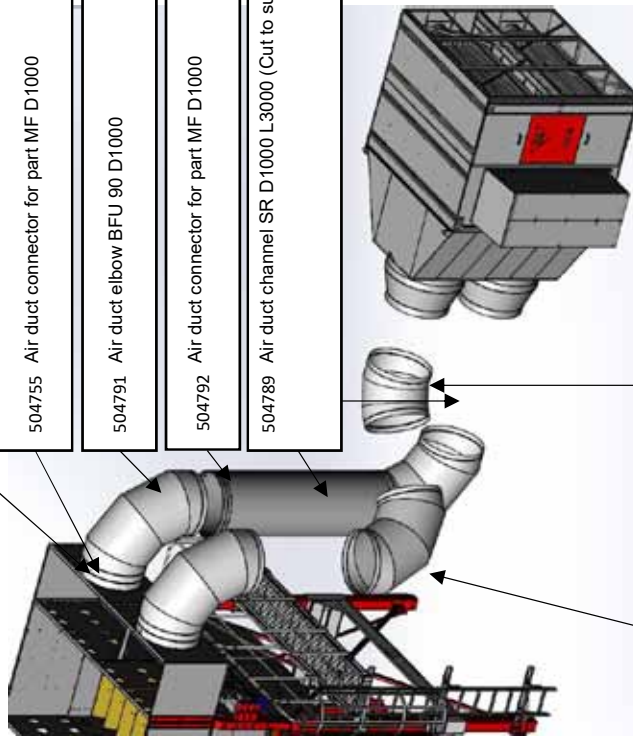
ID-code	Denom. 1	Denom. 2	pcs.
504789	AIR DUCT CHANNEL SR	D1000 L3000	2
504791	AIR DUCT ELBOW	BFU 90 D1000	2
504755	AIR SUCT CONNECTOR FOR PART	MF D1000	1
A71200	AIR DUCT OUTLET SLEEVE THREADED	D1000/D1000x120	1
504794	AIR DUCT ELBOW	BFU 15 D1000	1
107720	SELF-TAPPING HEXAGON SCREW	DIN 7504K Zn 4,8x13	32

The estimated amount of duct parts assumed that

- The heater and the machinery are on the same level.
- 4W machinery with extension leg of 4,365mm (Indicatively, the required air duct length for the vertical part is 3,335mm)

Machinery: 4W
 Duct size: D1000
 Oil heater: 1400kW

- A71200 Air duct outlet sleeve threaded D1000/D1000x120
- 504755 Air duct connector for part MF D1000
- 504791 Air duct elbow BFU 90 D1000
- 504792 Air duct connector for part MF D1000
- 504789 Air duct channel SR D1000 L.3000 (Cut to suitable length)



504793 Air duct elbow BFU 45 D1000

504791 Air duct elbow BFU 90 D1000

Duct parts:

ID-code	Denom. 1	Denom. 2	pcs.
504789	AIR DUCT CHANNEL SR	D1000 L3000	4
504791	AIR DUCT ELBOW	BFU 90 D1000	4
504755	AIR SUCT CONNECTOR FOR PART	MF D1000	2
A71200	AIR DUCT OUTLET SLEEVE THREADED	D1000/D1000x120	2
504793	AIR DUCT ELBOW	BFU 45 D1000	1
504792	AIR SUCT CONNECTOR FOR CHANNEL	NPU D1000	1
107720	SELF-TAPPING HEXAGON SCREW	DIN 7504K Zn 4,8x13	64

The estimated amount of duct parts assumed that

- The heater and the machinery are on the same level.
- 4W machinery with extension leg of 4,365mm (Indicatively, the required air duct length for the vertical parts is 2,130mm and 3,435mm)

Machinery: 4W
 Duct size: D1250
 Oil heater: 2000kW

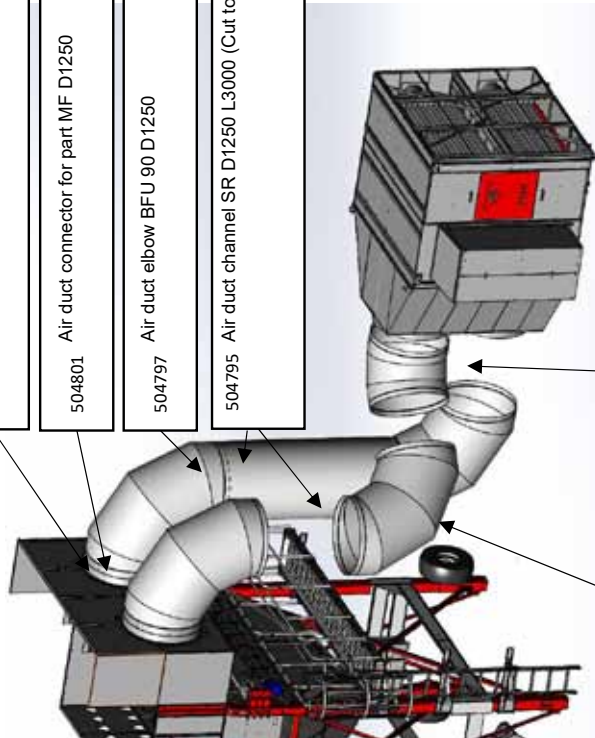
- A71201 Air duct outlet sleeve threaded D1000/D1250x120
- 504801 Air duct connector for part MF D1250
- 504797 Air duct elbow BFU 90 D1250
- 504795 Air duct channel SR D1250 L3000 (Cut to suitable length)

Duct parts:

ID-code	Denom. 1	Denom. 2	pcs.
504795	AIR DUCT CHANNEL SR	D1250 L3000	3
504797	AIR DUCT ELBOW	BFU 90 D1250	4
504801	AIR SUCT CONNECTOR FOR PART	MF D1250	2
A71201	AIR DUCT OUTLET SLEEVE THREADED	D1250/D1250X120	2
504798	AIR DUCT ELBOW	BFU 15 D1250	1
107720	SELF-TAPPING HEXAGON SCREW	DIN 7504K Zn 4,8x13	56

The estimated amount of duct parts assumed that

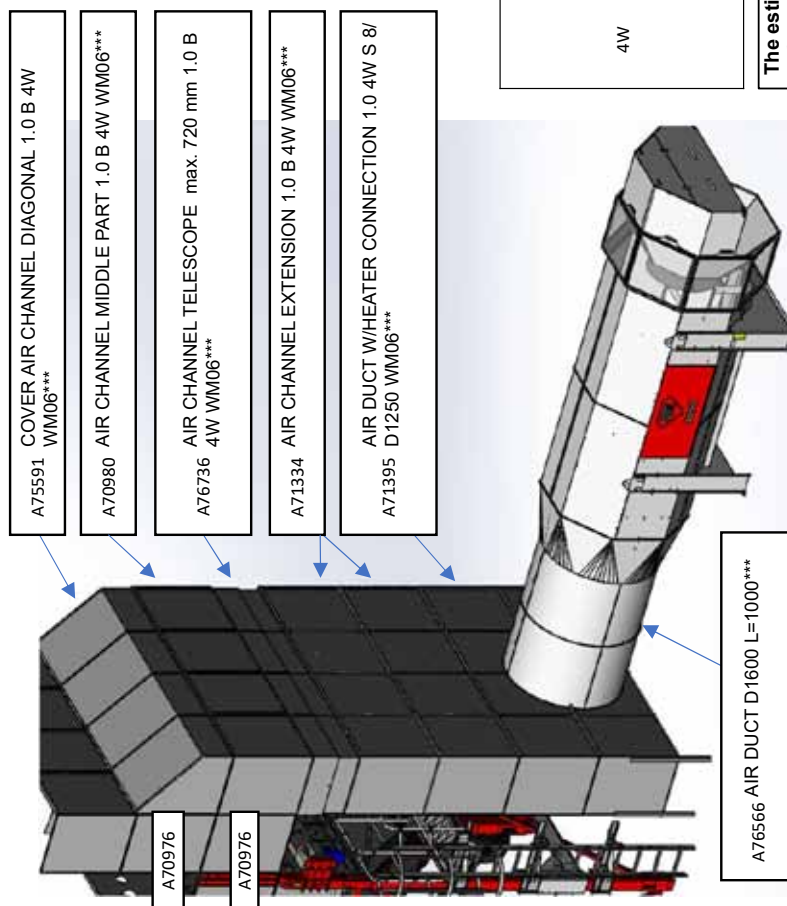
- On the 4W machinery, the heater will be raised by 240mm from the base level of the machinery.
- 4W machinery with extension leg of 4,365mm (Indicatively, the required air duct length for the vertical parts is 1604mm and 3000mm)



504798 Air duct elbow BFU 45 D1250

504797 Air duct elbow BFU 90 D1250

Machinery: 4W
 Duct size: D1600
 Gas-fuelled heater: 3000kW



Duct parts:

ID-code	Denom. 1	Denom. 2	pcs.
A76566	AIR DUCT D1600	L=1000 ***	2
A71395	AIR DUCT W/HEATER CONNECTION	1.0 4W S 8/D1250 WM06 ***	1
A71334	AIR CHANNEL EXTENSION	1.0 4W WM06 ***	2
A76736	AIR CHANNEL TELESCOPE	MAX. 720MM 1.0 4W WM06 ***	1
A70980	AIR CHANNEL MIDDLE PART	1.0 B 4W WM06 ***	1
A75591	COVER AIR CHANNEL DIAGONAL	1.0 B 4W WM06 ***	1

The estimated amount of duct parts assumed that

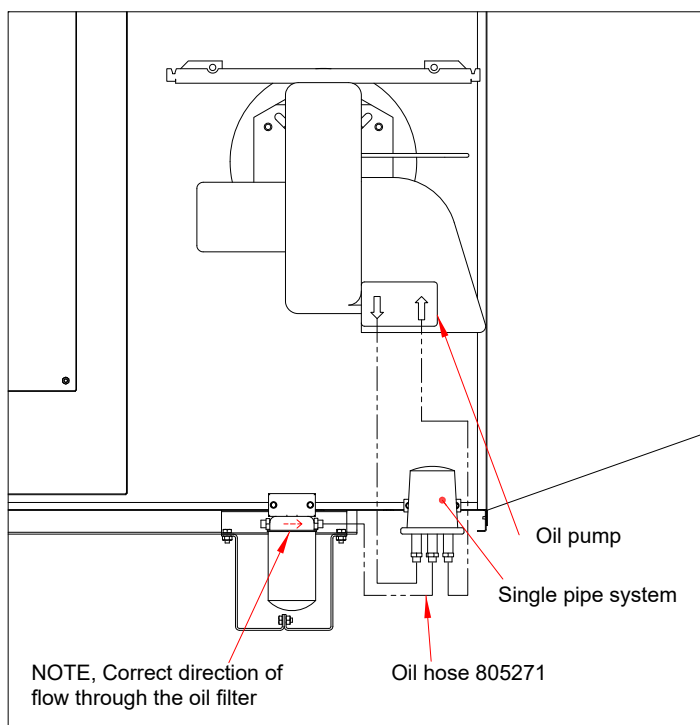
- On the 4W machinery, the heater will be on the same level with the machinery.
- 4W machinery with extension leg of 4365mm.



Fuel pipes

The heaters has a single-pipe fuel system, so there is no need to route more than one pipe from the fuel tank to the fuel filter located at the side of the heater. The "excess" fuel, returning from the burner, recirculates to the burner, and additionally, the required fuel flows through the filter to the recirculation unit.

Illustrative drawing of the fuel pipes:



Installing the debris piping for the pre-cleaner

NOTE! The debris piping must always be routed to the opposite side of the dryer to the inlet air opening of the dryer heater.
Debris in the inlet air of the dryer heater is a fire hazard!

Route down the debris piping for the pre-cleaner on the side of the dryer.
Install the debris piping using the parts intended for this purpose: The ventilation pipes D200 or D315 and the elbows of 45 and 90 degrees. Support the piping at every 3–4 metres using, for example, perforated steel band.

It pays to route the debris pipe of the pre-cleaner to a cyclone (option) that separates the dust and debris from the air. This helps keep the surroundings of the dryer clean and tidy.
The dust cyclones can be purchased from Antti-Teollisuus



STARTING UP



Particular caution must be exercised during the start-up and the test run. Only an authorised electrician is allowed to change the settings of the protective devices. Always switch off the decoupling switch of the device or the mains switch before carrying out any tasks that require the protective covers of the devices to be opened. Only an authorised electrician is allowed to carry out tasks that require that the electric connections be changed or the connecting boxes be opened.

Always before testing the machinery, check visually that all the installations have been properly completed, and all the protective covers are in place and all the cover plates are closed. Also the start-up inspection according to the regulations for the electro-technical industry must have been performed, where applicable.

Also check before the test run that the current values for the motor protection switches and the thermo-relays match the values given in the nameplates of the motors.

Elevator

Check the installation and connection of the underspeed guard for the elevator. Check also that the distance between the guard's sensor and the rotator plate is correct. If the elevator is equipped with a back rotation preventer, it must be removed before the test run.



Start the elevator. The elevator should now start. Check and, as required, change the direction of rotation of the elevator. Stop the elevator.

Check the operation of the electronic underspeed guard by removing the guard's sensor. Start the elevator. The elevator should first start and then stop after about 8 seconds of operation.

Pre-cleaner



Start the pre-cleaner. Check and, as required, change the direction of rotation of the pre-cleaner.



Feeder



To test run the feeder, first switch on the elevator and the bottom screw. Start the feeder. The feeder should start. The direction of rotation of the feeder motor has no significance. If the feeder is equipped with a frequency converter controlled rotation speed adjustment, check also its operation.

Blower



Start the blower. The blower should start. Check, and as required, change the direction of rotation of the motor.

Burner

Only an authorised oil burner fitter is allowed to start up the burner. Before testing the oil burner, check that the nozzles installed in it are the ones mentioned in the heater's manual. The maximum allowed oil flow, mentioned in the heater's nameplate, must not be exceeded.

LTM thermostat



Start the blower and the burner in accordance with the instructions above. Allow the temperature to rise to 80 °C. Open the LTM thermostat's box. Turn the setting of the LTM thermostat's overheat protection lower than the temperature of the inlet air. The burner shall now stop, and the blower shall continue to run. As soon as the temperature of the inlet air drops below 45 °C, the burner shall restart. After having finished the test, return the setting of the overheat protection to the value mentioned above.



THERMAL INSULATION

Insulating the sections has proved to be the most profitable method of saving energy. According to drying experiments, the saving of energy (or increase of efficiency) ranges from 10 to 15 per cent, depending on the external conditions. A hard stone wool insulation 30 mm thick, reduces the conduction of heat via the outer surfaces to a tenth (82 W/m). It pays to insulate even the top tanks and the sides of the base. This prevents condensing on the inner surfaces, and keeps the dryer tidy and clean on the inside. Insulating the "cold" parts improves even the operation of the dryer.

We recommend using stone wool board with aluminium foil as the insulation material. A 30mm thick board fits perfectly between the external folds of the dryer's outer joints. Use adhesive spikes to ensure that the boards stay in place (if necessary, use aluminium tape).

Insulating the hot air duct (or the ascending part of the outlet pipe, if installed) is even more profitable. For these objects we recommend using stone wool insulation reinforced by net and covered with aluminium foil.

To make the insulation work easier, you can download the installation instructions 408061 for the StandAlone dryer from our material bank on the website of Antti-Teollisuus. You can even purchase the installation kit from Antti-Teollisuus.

OPERATION INSTRUCTIONS FOR THE DRYER MACHINERY (detailed instructions)

Initial adjustment and checking of the dryer

Checking the dryer:

- check that the adjustment of the feeder's speed on the eccentric of the gear motor is not set too high for the first experiments with grain, and that the potentiometer is at point 1. This makes it easier to increase the settings during the operation.
- check that there are no foreign objects, such as, for example, pieces of board or other loose items, inside the dryer
- check that the troughs of the feeders are in the "closed" position
- with the troughs of the feeders in the "closed" position, look from below that the edges of all troughs are on a level – if this is not the case, adjust them as required by moving the holder cam of the emptying cam
- it pays to set the eccentric adjuster of the feeder machinery into such a position, that the capacity of the elevator and/or the bottom screw does not fall short even if the frequency converter is in its fastest position

Drying

In the beginning, when the grain is still moist, the circulation speed can be low. The moisture will evaporate quickly. The heat energy is required for evaporating the water. The temperature of the corn does not rise. During the drying experiments was established that, as the circulation speed was decreased towards the end, also the efficiency was decreased (in combination with reducing the air flow, this, however, slightly improved the overall efficiency). Increasing the circulation speed improves the efficiency, and even more importantly, levels down the humidity differences within the drying batch, because the time that the grain stays in the top tank is shorter. Decrease the feeding rate. For cereal the position of the eccentric shall be 1.5–2.0 with the default value of the frequency converter 50 Hz. When commencing the drying of the first batch, it is best to keep the settings at first low and increase the feeding speed only after the correct values for the other adjustments have been found.



Start the elevator and the pre-cleaner (turn first the selector switch to position E) and tip some grain into the hopper. When opening the sluice gate on the ascending side, the feeding rate very rarely exceeds the lifting capacity of the elevator.

You can start the heater via the bypass button (in the automatic control centre) even if the filling has not yet been completed, but usually, the heater will not be started until the filling has been finished.

Observe the feeding process through the openings in the base. Visually estimated, the amount of grain running down from both edges of each trough should be the same (the feeder blades at the sides may feed slightly more than the other blades). The grain must not congest in the bottom cone. As the drying proceeds, the feeding rate will gradually increase.

Adjust the air flow of the pre-cleaners to as high as possible, however, keeping a watch that no full-weight grains end up among debris. Adjust the pre-cleaner to operate as efficiently as possible as instructed in the manual for the pre-cleaner.

For normal drying, the suitable drying air temperature is 65–80 °C. For bread grain, seed grain and malt grain, the upper limit is 70 °C, for turnip rape it is 65 °C, and for peas around 50 °C. It is possible to apply a temperature, as high as 100 °C, for the fodder grain. The temperature is kept constant by means of a suitable pair of nozzles. The burner must operate continuously. If the overheat functionality of the temperature limiter stops the burner, the burner's main nozzle is too large or the injection pressure of the burner is too high.

Adjust the air flow from the heater's air openings so that no grains of normal weight will fly to the outlet end. For turnip rape slight "over flight" is allowed.

Keep an eye on how the drying proceeds. Measure the moisture content from time to time. Once the desired storage humidity is reached, the setting of the outlet air channel thermostat shall be gradually decreased until the signal light for the burner goes out (indicating that the burner has stopped). The setting of the outlet air channel thermostat will now be left in such a position, that next time, when same kind of grain will be dried under roughly same kind of conditions, the automation system is able to cut off the drying process as soon as the same moisture content percentage has been reached. Write down the readings of the outlet air channel thermostat's temperature display (at the end of the drying process) and the outside air temperature. After you have written down notes from several drying batches, you can later make use of them and define even more precise settings for the cut-off temperature of the drying automation.

Cooling

After the drying, the grain must be properly cooled. The cooling process can take less than an hour only in exceptionally cold weather conditions. If the dryer has more top tanks than drying sections, the time required for cooling will be longer. During cooling phase, the moisture content of the grain may still drop slightly, but while in the storage it will resume due to evening out. It pays to measure the moisture content of the grain also after the cooling. As the circulation time of the batch during the cooling phase, depending on the size of the dryer, may be 1–2 hours, readjust the settings for the next batches taking into account that the entire grain volume must have time to circulate inside the dryer at least one full round. (To measure the circulation time in the most reliable way, empty the dryer at the circulation speed and measure the time).



DRYING TECHNICS

During the drying process, you will face a lot of issues, that you should familiarise yourself with in advance.

Adjusting the temperature

1. The primary means of raising the temperature is to increase the oil flow. The auxiliary nozzle of the 2-stage burner will burn intermittently as long as additional heat energy will be required. If the nozzles, not even together, cannot maintain the desired temperature, increase the feeding pressure or change the nozzles to larger ones. These measures, however, are only applicable within the limits for the maximum oil flow allowed for the burner. Refer to the heater manual for more detailed instructions.
2. As the weather gets colder, you may have to make use of other methods of adjusting the temperature. The next method to be applied for raising the temperature (after the maximum oil supply already is in use) is to throttle the air flow. The air flow into the heater is reduced by means of a frequency transformer.

Grain variety

The setting of the thermostat and the outlet air temperature slightly vary from variety to variety. If the outlet air temperature 37–38 °C corresponds to the moisture content of 14 % on wheat, the corresponding value for 2-row barley is 38–39 °C, for 6-row barley and oat 34–35 °C, and for turnip rape 32–33 °C (moisture content 9 %). The values may vary from farm to farm, but their order does not change.

Grass seeds

Drying grass seeds requires special arrangements. Tip the load into the filling hopper keeping pace with the elevator. Moist seeds arch easily. The pre-cleaner shall not be used. The circulation speed can be the same as with the grain. Throttle the flow of the drying air until the seeds no longer fly out of the drying section. Do not start the burner until the moisture content has dropped under 25 %. After that you can keep the burner intermittently switched on 0.5–1 hours. Select the sizes of the nozzles so that the drying air temperature will not rise higher than 40–50 °C. Towards the end, the temperature can be increased by 10 degrees.

Turnip rape and rape

The drying must be commenced immediately after the harvesting. Too high drying air temperature spoils the quality of the oil seeds. The upper limit of the temperature is about 65 °C provided that the circulation time is one hour. The air flow must be limited so that only a non-significant amount of seeds will fly into the outlet air channel (in terms of efficiency, slight "over flight" is, however, positive).

Drying peas

Especially moist peas are difficult to dry. The drying time required is long so as to avoid damaging the surface. If the moisture content is over 20 %, the drying air temperature must not exceed 40 °C. Towards the end, the temperature can be increased by about 10 °C, and/or an interval of 24 hours be kept to allow the moisture to even out. If the peas are really moist, we recommend drying them at intervals, keeping the heat on for two hours, and cooling for half an hour.



Drying temperature

The more uniform the drying temperature, the better the automation operates. If the drying air temperature, however, drops, for example, by 5 °C, the cut-off temperature of the outlet air temperature must be decreased by 1.5–2 °C. If this is not observed, the grain will become 1–2 % dryer.

MAINTENANCE AND OPERATING ADJUSTMENTS

From time to time, check that the scrapers keep the bucket belt pulleys clean. Also check the bucket belt for tightness. As required, tighten the belt by shortening (see the instructions in the elevator manual).

Check that the pressure ends and the return ends are clean (through the doors).

Option: For drying partial batches, close the drying section shutter doors so that no harmful vacuum will be generated inside the top tank.

Note! If the air flow into the sections is restricted by means of shutter doors, the volume of air must also be reduced so that the pressure inside the sections will not rise too high (the counter-pressure must be the same as during conventional drying)(the counter-pressure must be the same as during conventional drying). The shutters of the air channels must be provided with open-closed stickers as a reminder of their operating positions at later times of use.

Keep an eye on possible over flight of the grains and the drying temperature. When drying partial batches, the drying automation is less accurate.

In connection with change of variety to be dried, the elevator boot, the bottom suction fan and the feeder shall be cleaned, and for some time air blown into the empty dryer by means of the dryer heater.



ECONOMICAL DRYING

You must select the operating mode as a compromise between the output and the economy. Applying suitable methods, you will be able to improve them both at the same time.

Thermal economy

The correct drying air temperature is the most important factor impacting on the efficiency and economy.

Remember the first main rule:

If the amount of air remains the same, raising the temperature will result in higher output and better economy. As the temperature rises, the drying air's ability to absorb steam is multiplied, and the output increases abruptly. Under normal air pressure, for example, the following amounts of steam correspond to relative humidity of 100 %.

		grams of water in m ³ of air
at 0 °C	5	
at 20 °C	17	“”
at 30 °C	30	“”
at 50 °C	83	“”
at 60 °C	130	“”
at 70 °C	220	“”
at 75 °C	242	“”

Remember that the lower the relative humidity of the drying air, the faster water evaporates from the corns.

One m³ of the dryer heater's suction air at a temperature of +10 °C, and with relative humidity of 90 %, contains 8 g of water. When it is heated to +70 °C, it expands by about 50 %. This amount of air still contains the same 8 g of water, corresponding to the relative humidity of 2.7 %. The air almost "sucks" moisture from the corn. Because the relative humidity of the suction air is less significant, hot air drying is efficient and economical even when it is raining.

Need to reduce the amount of air

You may have dimensioned your dryer and dryer heater following the standards, but you still may encounter situations, where the maximum temperature allowed for the heater (maximum nozzle size) will not raise the drying air temperature sufficiently. In this case, you need to throttle the air flow as much as is necessary to make the temperature of the drying air rise. This way you will be able to improve both the dryer's output and economy.



An example of the drying air's ability to absorb steam with the same amount of heat, mixed with different amounts of air:

For warming 10,000 m³ of air from 0 °C to 50 °C is required the same amount of heat than for warming 7,100 m³ of air from 0 °C to 70 °C. Blowing these amounts of air through the grain layers in the dryer, will drop the temperature by the middle of the drying time to about 20 and 27 degrees respectively. Then 10,000 m³ of air at +20 °C can at maximum contain 170 kg of water and 7,100 m³ of air at +27 °C can at maximum contain 188 kg of water. When the air at 0 °C can contain 5 g of water/m³, then with 10,000 m³ of air at 50 °C will go in 50 kg and come out 136 kg (= 86 kg net), and with 7,100 m³ of air at 70 °C will go in 35 kg and come out 150 kg (= 115 kg net).

In practice, the higher the temperature inside the corn during drying, the quicker the water will evaporate causing a pressure difference. This improves the drying efficiency even more than theoretical calculations suggest.

If you are aiming at good economy, you should in certain situations reduce the air amount even if there is no true need to raise the temperature. The aim is to make the air flow through the grain layers sufficiently slowly. If the air is flowing too fast, it may not be able to evaporate the amount of water entirely that it otherwise would be able to absorb. If the air leaves the heater too dry (i.e. too hot), useful heat energy will also be wasted. If you reduce the amount of air, you may need to reduce the oil flow as well (the 2-stage automation does this automatically). This is a concrete way of saving energy.

Equilibrium moisture content

The dryer the grain gets, the slower the water evaporates from the grains. As a result, the relative humidity of the outlet air decreases as the drying proceeds.

How to reduce the amount of air

The air flow into the heater is reduced by means of a frequency transformer.

If the air flow into the heater is restricted too much, the drying air temperature will rise too high, and the upper limit thermostat will stop the burner from time to time. Do not let this happen, as it would drastically reduce the efficiency of the drying process, and strain the dryer heater clearly more than if the production of heat was constant. For remedy, increase the air flow or reduce the oil flow.



Measuring the amounts of air

The amounts of air can only be measured under test conditions. Relatively, the amount of air can, however, be measured by measuring the pressure of air inside the dryer's inlet air channel. The pressure of air is indicated by the height difference of the water surfaces.

Example! 15 mm below zero and 15 mm above zero makes together 30 mm of water column (counter-pressure)

The more the air flow is throttled, the lower the counter-pressure.

The desired value for grain is 20–40 mm and for turnip rape 30 mm.

Large variations in results are due to changed measuring locations, and the properties of the pipelines. Therefore, the counter-pressure meter is better suited to measuring variations within one dryer unit rather than comparing different dryers.

OTHER FACTORS OF ECONOMICAL DRYING

Avoid drying too much (for example: for drying from 14 % to 12 %, you need the same amount of energy than for drying from 19 % to 14 %).

Avoid drying partial batches, because then the output will also be partial and the output will be reduced.

The settings of the oil burner affect the thermal efficiency directly. The adjustments of the burning air must be correct. If you change nozzles or change the oil pressure, readjust the burning air flow.

Assign a specialised oil burner workshop for maintenance of the burner at intervals of 2–3 years – also the nozzles shall be changed. This way you may not need to maintain the burner yourself at all.

The operator must, however, keep the heater room and the protective net for the suction air opening clean of dust and debris.

Good maintenance of the machinery improves the economy of the operation.

After each annual sweeping, ensure after closing the sweeping door that the seal of the door is absolutely tight.

Avoid drying in the night time, At night the drying always requires more purchased energy than in the daytime.

Make sure that the elevator lifts the grain at full power during the filling and the emptying.

Keep the output setting of the pre-cleaner's blower as high as possible keeping in mind the limit for the variety in question.



POSSIBLE MALFUNCTIONS

If the feeder stops and the signal light "Circulation failure" is illuminated

- the fuse for the feeder motor has blown
- the elevator has stopped

If the elevator stops, and the signal light "Circulation failure" is illuminated, (as a result of the above, the feeder and the burner will stop in the automatic position).

- see the malfunctions of the elevator in the Installation and Instruction Manual for the elevator.

Malfunctions in the burner:

- out of oil
- light resistance cell sooty or blown
- water in the oil filter or the filter is clogged
- one of the shutter valves for the oil pipes is closed
- thermo-relay for the motor has tripped
- service switch for the oil burner is in position 0
- no supply of air to the burner
- refer to the Installation and Instruction Manuals for the dryer heater and the oil burner for more detailed malfunction tables

If the signal lights for the drying and the cooling phases in the automatic centre are illuminated simultaneously, while the selector switch is in position MANUAL, and –when the switch is turned into position AUTOMATIC – the burner stops, then turn the cooling timer to position 0. Reset the cooling time, and check that the temperature setting of the digital thermostat is higher than the temperature inside the outlet channel. Press the Start button of the dryer. The drying process will commence normally.

Note! the elevator, the bottom screw and the feeder must be running.

SERVICE AND WINTER MAINTENANCE

Lubricate once a week

- elevator bearings
- feeder bearings
- transmission arms of the feeder (2–3 drops of oil)

Annually

- maintenance of the oil burner (assign a specialist)
- checking the feeder motor gearbox (check oil leaks)



Winter maintenance

Clean the dryer thoroughly Clean the dryer's bottom cone, the feeders, the air channel ends, and the inner surfaces of the top tanks. Clean the blower of the pre-cleaner.

Leave the cleaning doors open, but close the suction opening of the dryer heater. Close the doors at the elevator boot to prevent the rodents from eating the bucket belt.

GUARANTEE

The guarantee period for the Antti-dryers is one (1) operating season. The guarantee covers defects in material and workmanship. Separate guarantee terms issued by the respective importer apply to the electric motors.

A prerequisite for validity of the guarantee is that the instructions issued by the manufacturer and the valid regulations have been followed during installation, use and service of the dryer.

A prerequisite for validity of the product guarantee is that the control system and the components used are approved by Antti-Teollisuus.

All matters related to the guarantee shall be agreed upon with the manufacturer before any action is taken.



Translation of original

EU Declaration of Conformity

ANTTI-TEOLLISUUS OY
Koskentie 89
FI-25340 KANUNKI; SALO
Tel.: +358 (0)2 7744700

declares that

ANTTI PLUG&DRY DRYER

conforms with the provisions of the following directives:

- **Machine Directive 2006/42/EC**

Salo 21.02.2020

Kalle Isotalo
Managing Director

Compiler of technical file

ANTTI-TEOLLISUUS OY
Koskentie 89
25340 KANUNKI, SALO