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SCREW CONVEYORS

Model: PS220-N3/200

PS220-N4/150

PS220-N4/200

PS220-N4/300

PS220-N6/300

PS220-N7.5/200

PS220-N7.5/300

PS160-N1.5/400

PS160-N3.0/400

PS220-PN-N7.5

PS220-PN-KOSZ

PSW60

PSW220-BIN100

PSW220-BIN200

PSW500

PSW1000

PSW1500

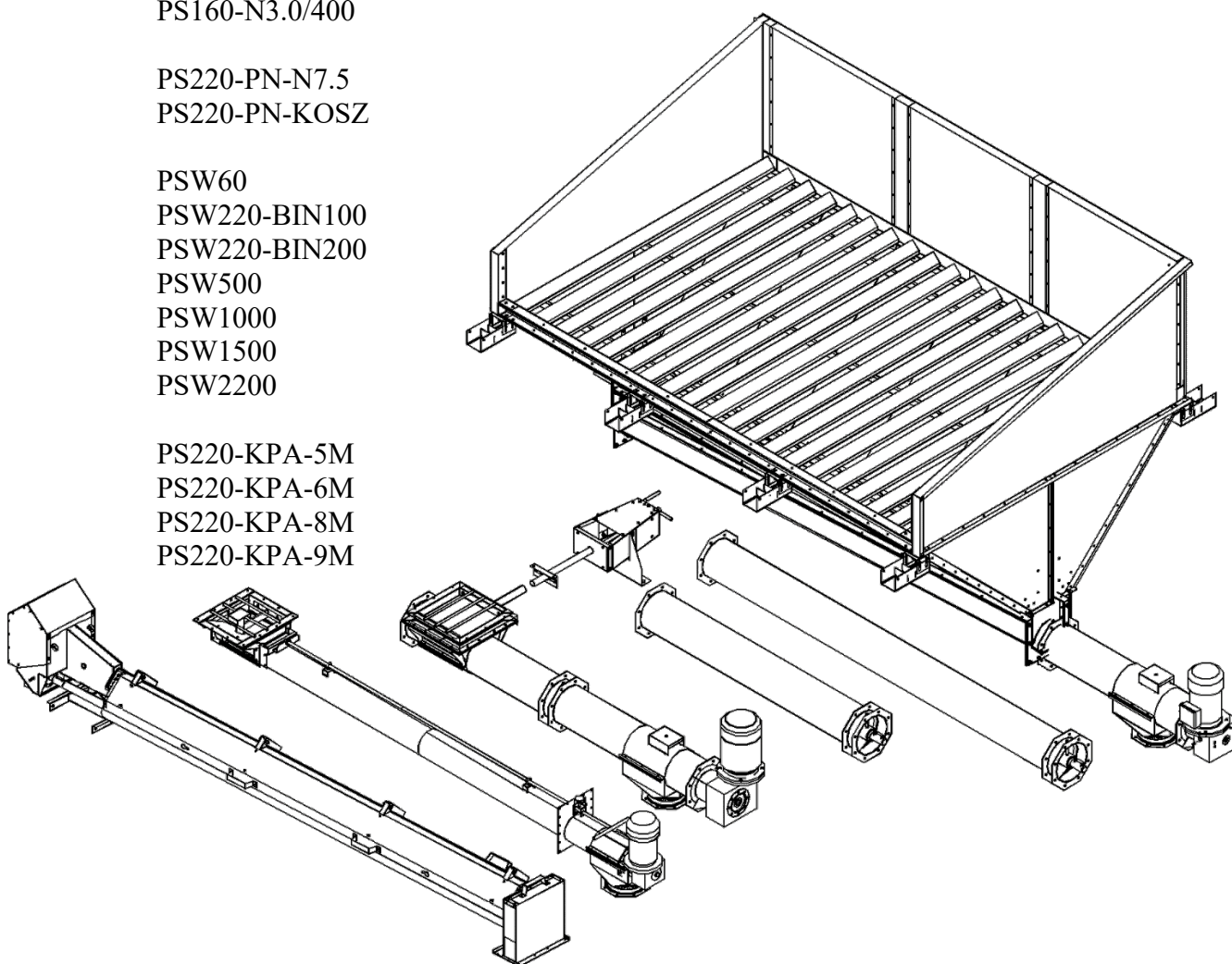
PSW2200

PS220-KPA-5M

PS220-KPA-6M

PS220-KPA-8M

PS220-KPA-9M



OPERATING MANUAL

Drawings and descriptions included in this manual may contain optional and special components, not provided in the standard version. Before placing an order, the Customer may obtain comprehensive and up-to-date information on the products to be ordered. We reserve the right to make changes in our products. All rights reserved. Any reproduction, even partial, solely with our consent.



Aleksandrów Kujawski/A4 format

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Chapter I. General and introductory information

1. Introduction

The Operating Manual aims at acquainting the user with a correct operation of the purchased product. This Operating Manual contains practical guidelines that must be known to an operator of the screw conveyor system. **If any content of this Operating Manual is not understood by or is unclear for the user, please, contact the producer or its representative.**



This operating manual forms an integral part of the product, and should be kept for further use.



Before starting to operate screw conveyors, read this operating manual, and, in particular, the chapters concerning safety at work.



Each use of the device for purposes other than those specified in the operating manual will be treated as the misuse.

The manufacturer of the product shall not be held responsible for damages resulting from misuse. The user bears the sole risk related to the misuse. All and any unauthorised changes to the product design exclude the manufacturer's responsibility regarding any resultant damages.



Screw conveyors are high power electromechanical devices. Incorrect operation may cause fire, fatal electric shock, burning, or other severe injury.



The warning sign in the operating manual indicates that the special caution must be exercised because of the danger to people and possibility of product damage.

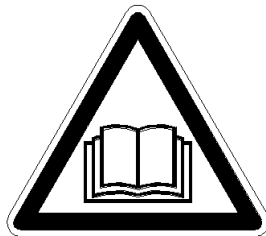
2. Safety

2.1. Basic safety rules

1. People employed to use or operate the screw conveyors, as well as people within the area of their operation are obliged to adhere to general OHS regulations.
2. The user is obliged to read and understand operating manuals for the screw conveyors and for all other auxiliary equipment, and to strictly adhere to them.
3. Before the device is started, check the location to which the grain will be transported (e.g., a silo) for presence of any people or animals.
4. In particular, the following is forbidden:
 - operation by any "third" persons, who are not familiar with the Operating Manual;
 - operation by any persons that are ill or intoxicated (with alcohol or narcotic drugs, etc.) or by minors.
5. The location of the conveyor work and its controllers should be secured against any access of children and unauthorised people.
6. A conveyor owner is obliged to provide it with detailed occupational health and safety instructions.
7. In the event of bad lighting conditions, a location where the conveyor is operated should be equipped with additional general lighting.
8. During its operation, the screw conveyor must be supervised at all times.
9. Conveyors and their surroundings should always be kept tidy and clean.
10. It is forbidden to switch on the conveyor without guards or to remove them during work.
11. An electric motor cannot be covered by any items. Before each starting up, remove accumulated dust from the engine. Ignoring above recommendations poses a risk of engine overheating or a fire.
12. The power supply system to which the conveyor is connected should be equipped with sufficient differential current and short-circuit protective devices, a PE protective cable, and voltage failure and phase sequence relays.
13. All components of the power supply system must be secured against any damage.
14. In the event of any power outage, turn the main switch into the "O" position and secure it with a padlock. Switch all devices cooperating with the conveyor off.
15. Design development, construction of a wiring system and the first test start-up of the conveyor must be performed by a person holding relevant licences, on a basis of guidelines provided in this operating manual.
16. Descriptions and diagrams of the power supply system provided in this operating manual represent general guidelines for development of a design for the power supply system by authorised people.
17. Any modifications of the above diagrams can only be made in such way that all protective functions of the devices specified in descriptions and diagrams are maintained.
18. At least once a year, the user should order a qualified electrician holding relevant licences to inspect all electric equipment components.
19. A power supply cable should not be twisted or exposed to a risk of cutting. Any damages pose a risk of electrical shock.
20. The power supply cable must be routed in such way that it does not pose any other hazards.
21. It is forbidden for the conveyor motor to operate with the O-Y-Δ switch in the position "Y" for longer than 10 seconds. Continuous work in this position poses a risk of a damage to the engine.
22. The motor should be switched off by smoothly switching the O-Y-Δ switch to the position "O".
23. The user itself shall equip the main switch with the padlock securing the devices against start-up by unauthorised people, as well as against an unintended start-up during maintenance operations.
24. The user is responsible for correct connection of power delivery points and their correct operation.
25. A location where the conveyor is operated must be used and maintained in a way preventing fire, and it should be provided with fire extinguishing equipment, including a dry powder or carbon-dioxide extinguisher.
26. In the event of the fire:
 - evacuate people from the danger zone;
 - call the fire brigade;
 - disconnect the device from the power supply;
 - start extinguishing fire.
27. Extinguishing electrical systems fires with water or a foam extinguisher is forbidden.
28. Before commencing installation it should be checked whether the conveyor and its components were not damaged during transport or storage.
29. When it is necessary to transport the conveyor by lifting it, the conveyor should be suspended on special eyes on its body, labelled as "LIFTING EYES".
30. When the operation is completed, secure the main switch with a padlock.
31. When any situation posing a threat to human life or health occurs, the device must be switched off immediately and disconnected from the mains.
32. The technical servicing, maintenance and/or repairs must be performed only when the power supply is disconnected with the main switch that is secured with a padlock.
33. The user is obliged to read the operating manual for electrical motors, and to adhere to it.
34. When the conveyors work together with BIN type silos, then the user is obliged to read the operating manual for those silos and strictly adhere to it.

35. BIN type silos, with which the conveyors work, must be equipped with an emergency duct (if it is not provided as a standard feature of the said silos) for unloading the silo in the event of the conveyor failure or grain aggregation over the conveyor inlet.
36. It is strictly forbidden to start the PSW screw conveyor in a silo with a central grain inlet to the under-floor screw conveyor covered with grain (for any reasons). Before starting up the PSW conveyor, check if the guard of the PSW screw drive (in the silo axis) is not covered with grain.
37. Warning signs, nominal plates and other information provided on the equipment must be kept legible and clean. When the signs or marks mentioned above are damaged or destroyed, or a part containing them is replaced, new plates should be purchased from BIN Company and installed on the product.
38. When the Investor itself or any other installation company not authorised by BIN installs the screw conveyor(s) (for reasons independent of the producer), the Investor is obliged to obtain the detailed screw conveyor installation instruction and placing (sticking) warning and information signs on the product.
39. When the device is delivered without a nominal plate or the nominal plate is destroyed, the user should notify this to the producer to receive its copy.
40. It is forbidden to make any changes in design or to change the intended use of the equipment without the producer's consent in writing.

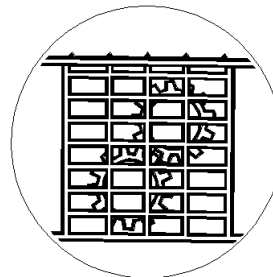
2.2. Information and warning signs



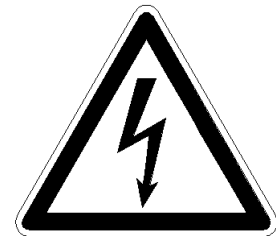
**READ
OPERATING
MANUAL**



**ATTENTION!
DANGER**



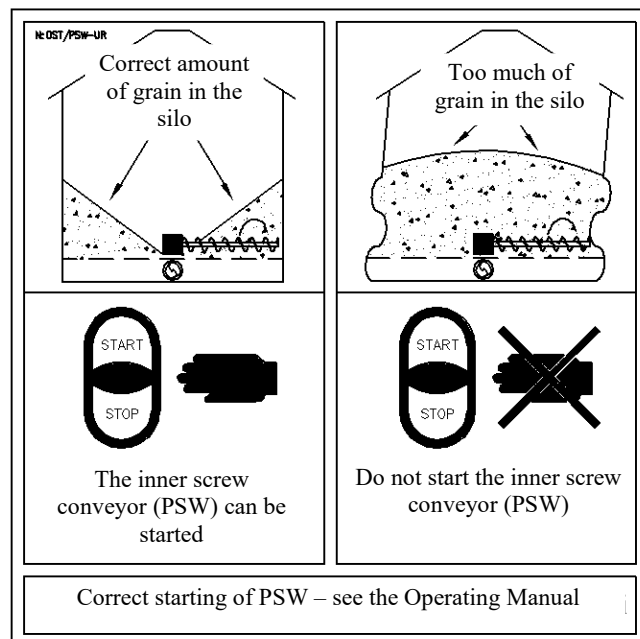
**USE
GUARDS**



**RISK OF
ELECTRIC
SHOCK**



**NO USE OF NAKED FLAME
OR SMOKING**



**CORRECT STARTING OF THE PSW
CONVEYOR**

Nominal plate

	BIN Sp. z o.o. 87-700 Aleksandrów Kujawski ul. Narutowicza 12 www.bin.agro.pl
	Model:
	Rok produkcji:
	Numer seryjny:
	Masa:
	Moc:
	Napięcie:
	Częstotliwość:
	Stopień ochrony:
	Dalsze informacje zostały podane w instrukcji obsługi.
	

Model:
Year of production:
Serial number:
Weight
Power:
Voltage:
Frequency:
Protection class:
Further information – see the Operating Manual

All information and warning signs, and the nominal plate with the CE mark are placed on the screw cover, the body and the hopper of the vertical screw conveyor, and on the top rims of the inlet hopper (except for a plate “correct start-up of the PSW conveyor” – installed on the silo jacket near the bottom hatch).



Note! Warning signs, nominal plates and other information provided on the equipment must be kept legible and clean. When the signs or marks mentioned above are damaged or destroyed, or a part containing them is replaced, new plates should be purchased from BIN Company and installed on the product.

3. Ordering the product

Orders for conveyors and spare parts can be placed with BIN Sp. z o.o. or with authorised BIN sales representatives. Each time, before purchasing any components a person placing the order should consult the manufacturer or a sales representative in detail about planned investment. The manufacturer prepares a complete conveyor, including ordered auxiliary equipment, spare parts, etc.

4. Transport of purchased devices

Transport of the components is arranged by a seller or the ordering person, under an additional agreement. The components require a vehicle of dimensions and capacity resulting from data provided in Chapters II, III, IV, and V par.1.2. The cargo body of the vehicle must be provided with a tight tarpaulin. In transport, all equipment must be secured against sudden movement. All conveyors are equipped with handles for lifting marked with a mark on products – Fig. I.1. Feed hoppers, PSW1500 and PSW2200, are delivered on 2 and 3 meter pallets.

Loading and unloading should be performed with forklift trucks of capacity resulting from data provided in Chapters II, III, IV and V par.1.2.



LIFTING EYE

Fig. I.1. Marking of lifting handles



IT IS FORBIDDEN TO CARRY THE LOAD ABOVE PEOPLE AND ANIMALS

DURING TRANSPORT AND STORAGE CONVEYOR MODULES SHOULD BE PROTECTED AGAINST MOISTURE, ESPECIALLY COMPONENTS OF THE ELECTRICAL WIRING.

When the components become wet, they must be dried thoroughly, and their correct operation must be verified. Storage of wet elements may cause irreversible changes in the product parameters. The manufacturer shall not be held responsible for the above-mentioned defects resulting from a failure to observe the above recommendations.

Chapter II. PS220 conveyors

1. General product description

The list of appliances produced within the frames of PS220 screw conveyors system.

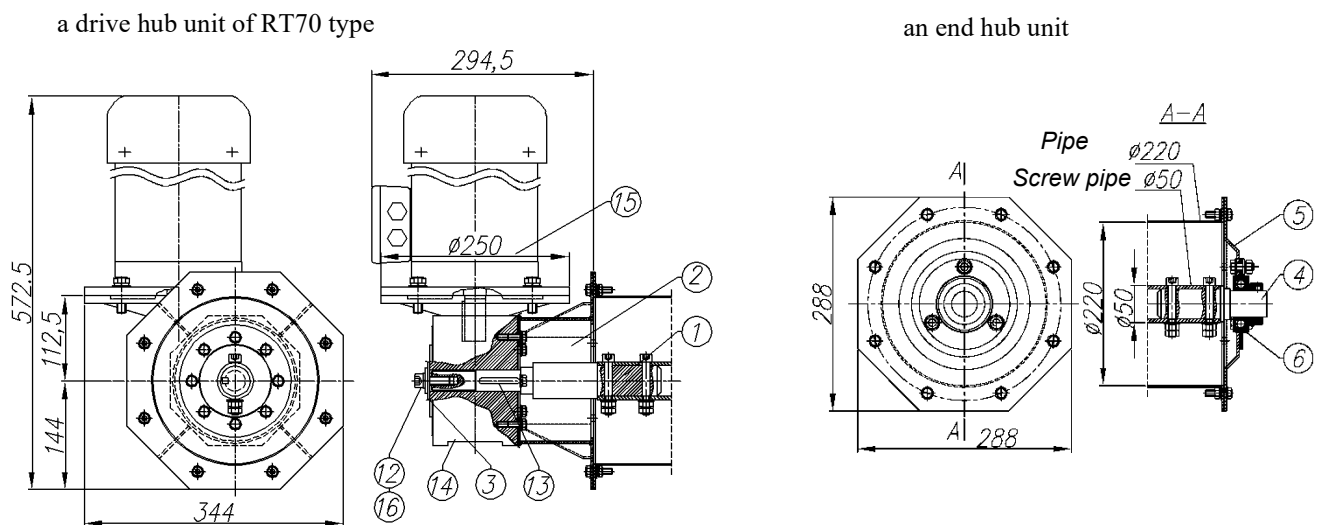


Fig. II.1 PS220-N3/200-screw conveyor –220 – a drive of power $P=3\text{kW}$, $n=200\text{ rpm}$

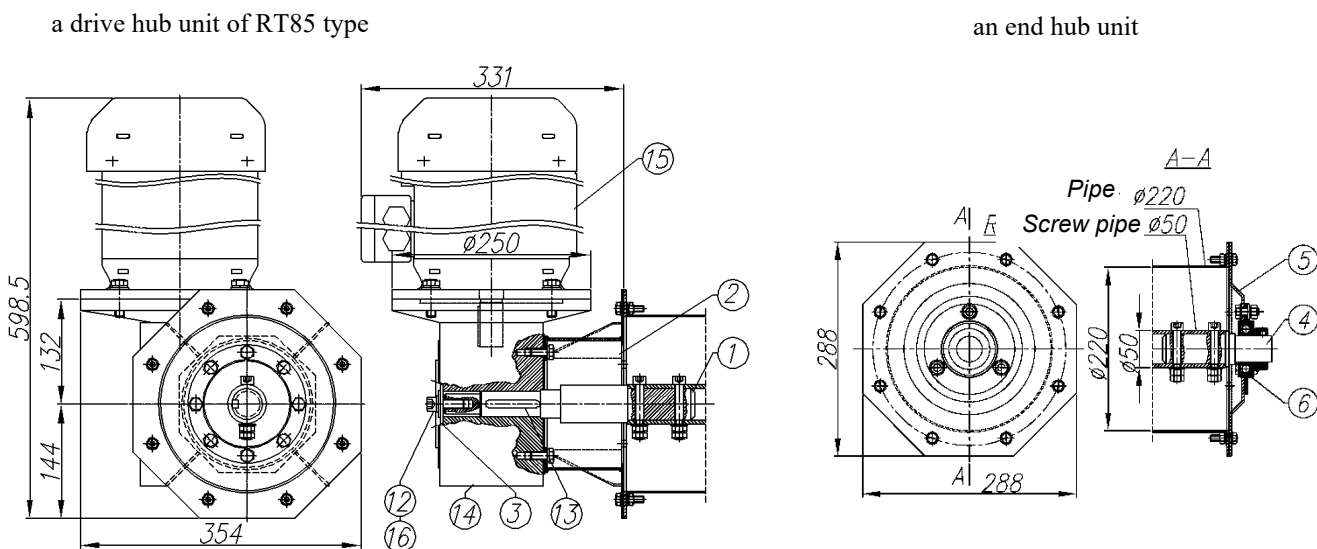


Fig. II.2 PS220-N4/150-screw conveyor –220 – a drive of power $P=4\text{kW}$, $n=150\text{ rpm}$

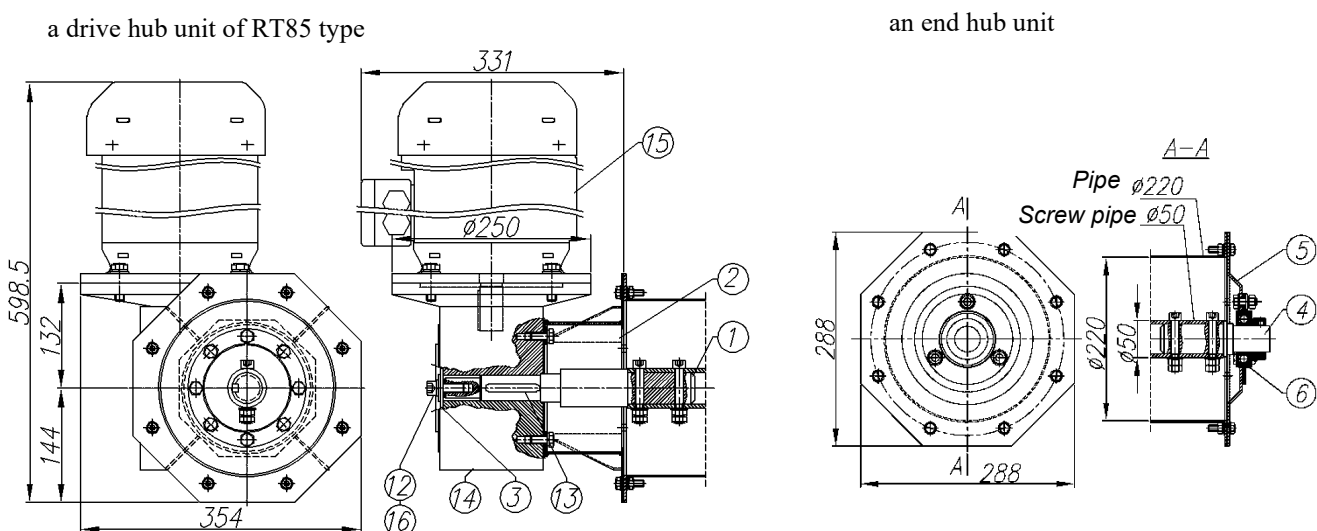


Fig. II.3 PS220-N4/200-screw conveyor —220 – a drive of power $P=4\text{kW}$, $n=200\text{ rpm}$

a drive hub unit of RT85 type

an end hub unit

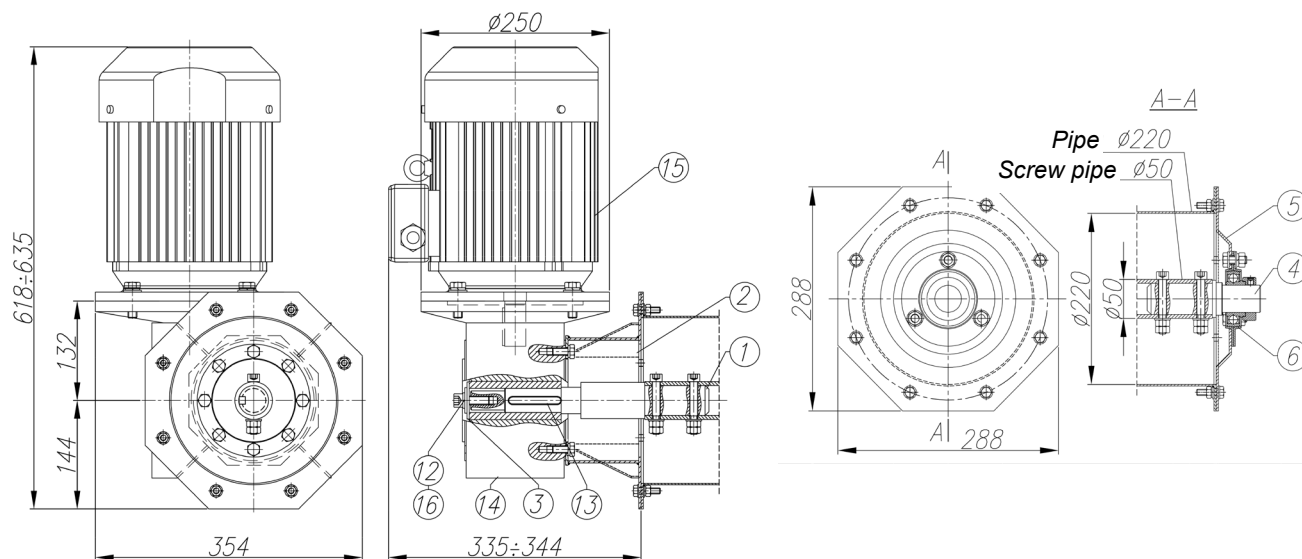


Fig. II.4 PS220-N4/300-screw conveyor –220 – a drive of power $P=4\text{ kW}$, $n=300\text{ rpm}$

a drive hub unit of RT85 type

an end hub unit

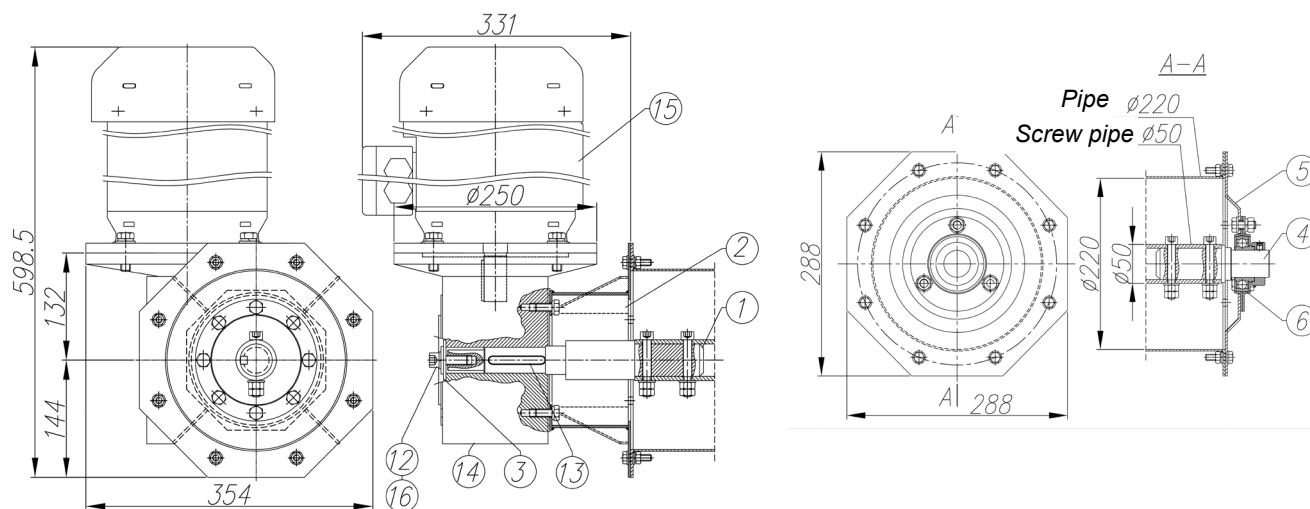


Fig. II.5 **PS220-N6/300**-screw conveyor –220 – a drive of power $P=6\text{kW}$, $n=300\text{ rpm}$

a drive hub unit of RT110 type

an end hub unit

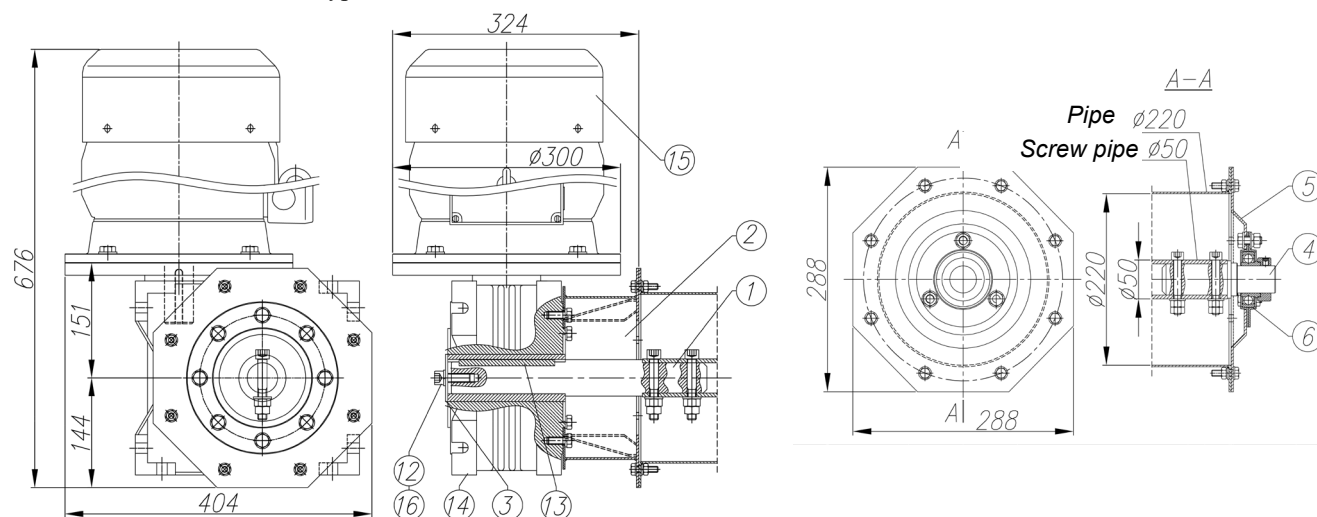


Fig. II.6 **PS220-N7.5/200**-screw conveyor –220 – a drive of power $P=7.5\text{kW}$, $n=200\text{ rpm}$

a drive hub unit of RT110 type

an end hub unit

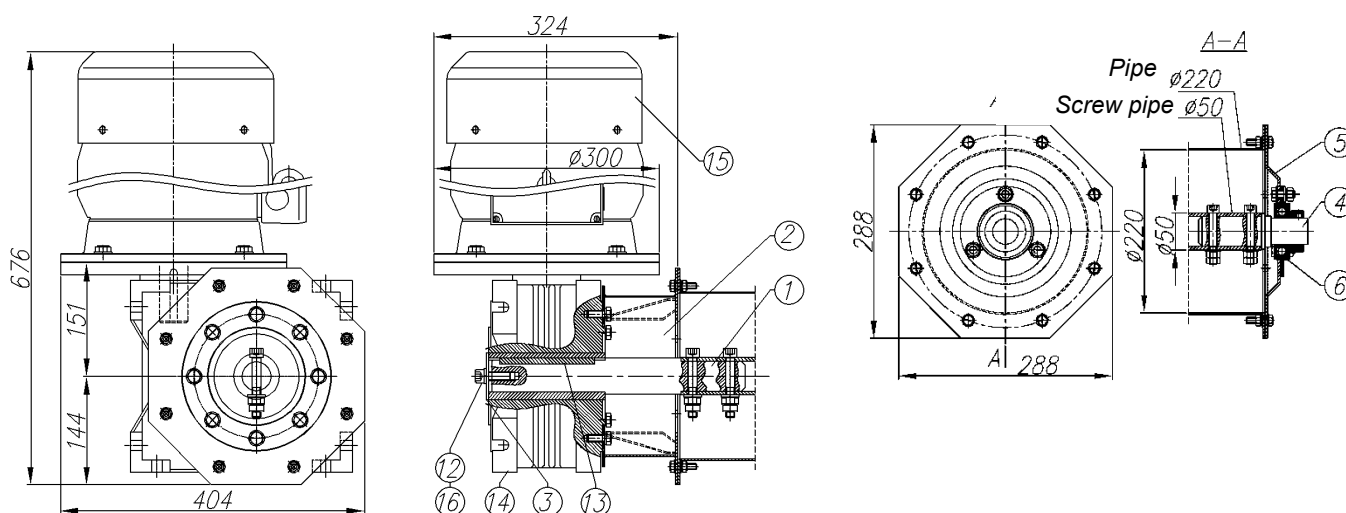


Fig. II.7 **PS220-N7.5/300**-screw conveyor –220 – a drive of power $P=7.5\text{ kW}$, $n=300\text{ rpm}$

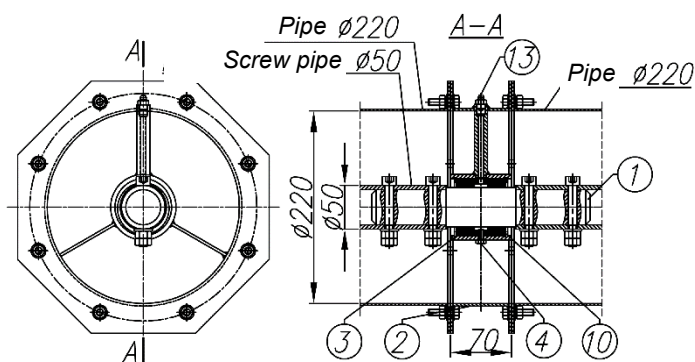


Fig.II.8 **PS220-LOZ/P1**- screw conveyor –220 – intermediate polyamide bearing.

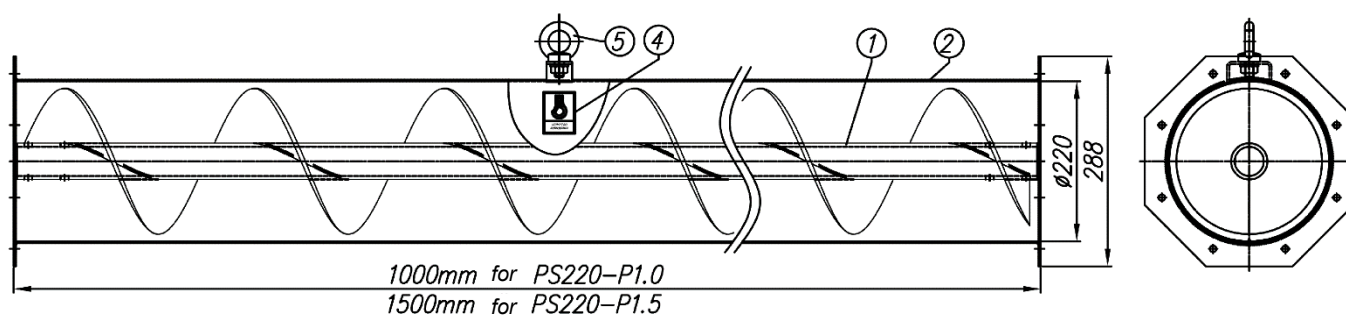


Fig.II.9 **PS220-P1.0**- screw conveyor –220 – 1 m extension
PS220-P1.5- screw conveyor –220 – 1.5 m extension

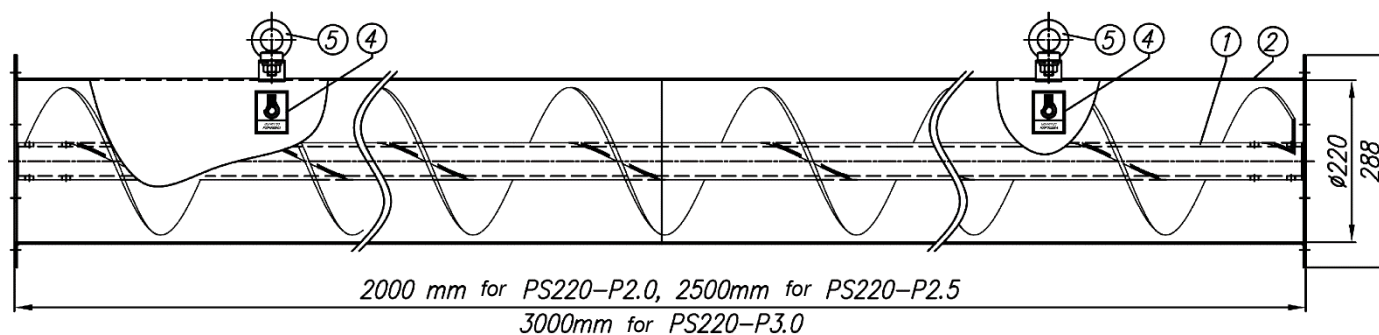


Fig.II.10 **PS220-P2.0**- screw conveyor –220 – 2.0 m extension
PS220-P2.5- screw conveyor –220 – 2.5 m extension
PS220-P3.0- screw conveyor –220 – 3 m extension

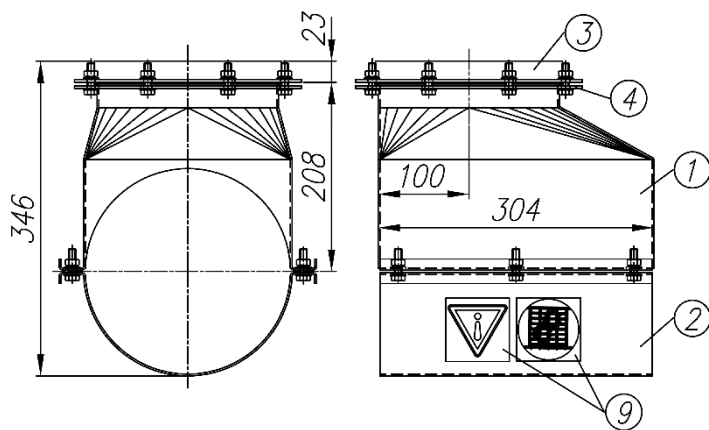


Fig.II.11 PSU220-I/O-200- screw conveyor –220 – an inlet/outlet –200 to the screw conveyor

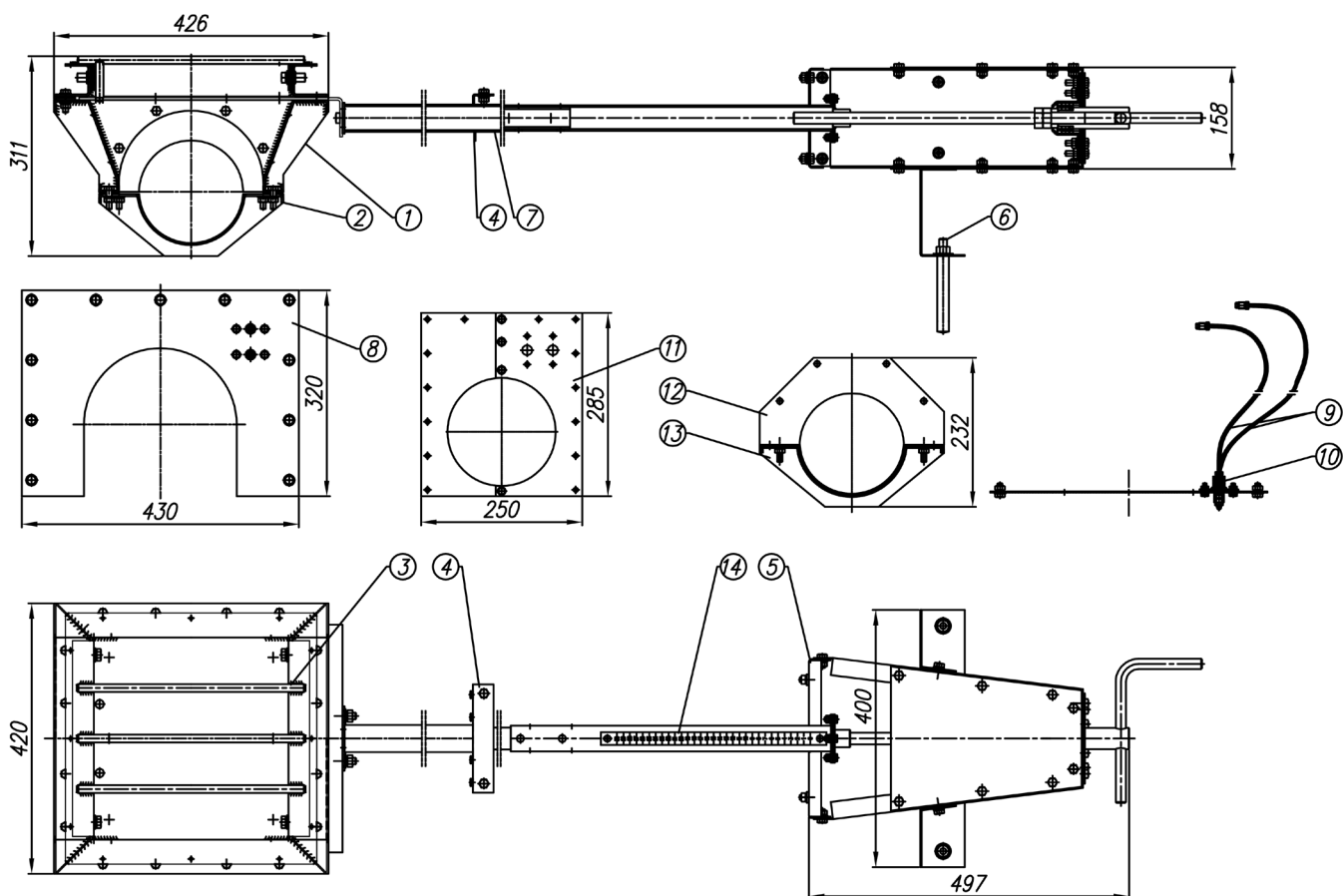


Fig.II.12 PSU220-WL-CENT-screw conveyor –220 –a central inlet from a silo to the screw conveyor

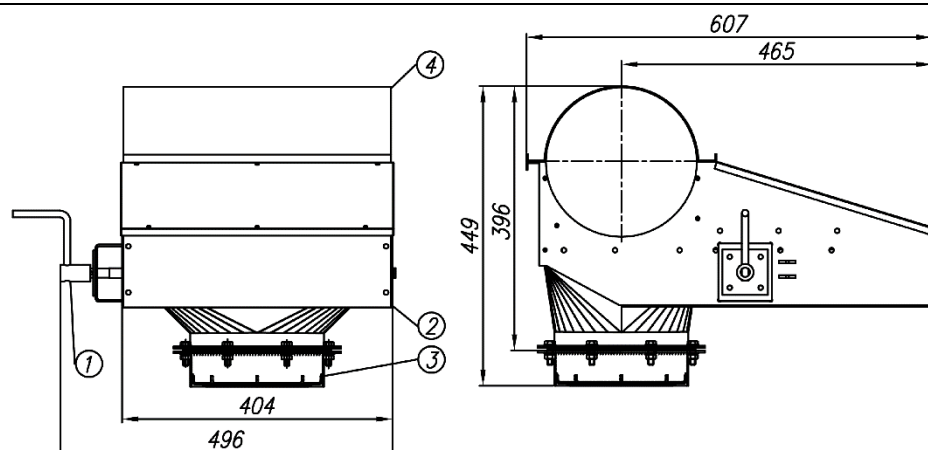


Fig.II.13 PSU220-ZASUW_1-screw conveyor –220 – an outlet shutter of the screw conveyor

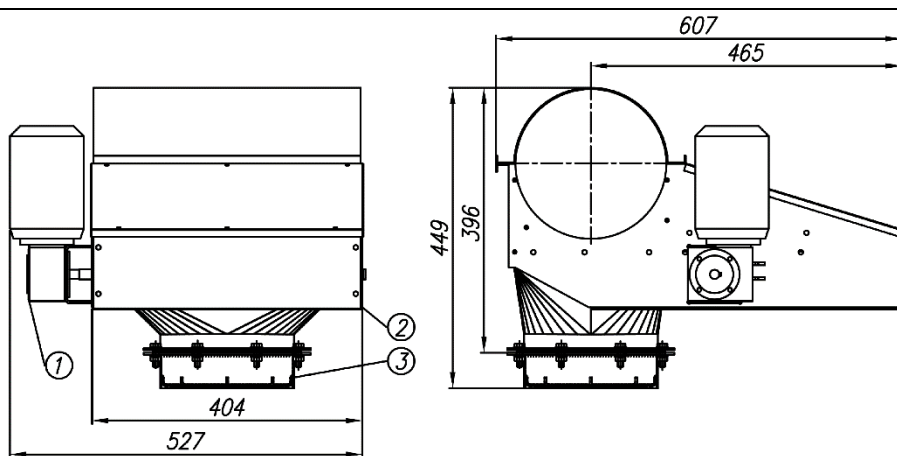


Fig.II.14 PSU220-ZASUW_1 + PSU220-ZASNAP1-screw conveyor-220 –an outlet shutter of the screw conveyor with the electrical motor

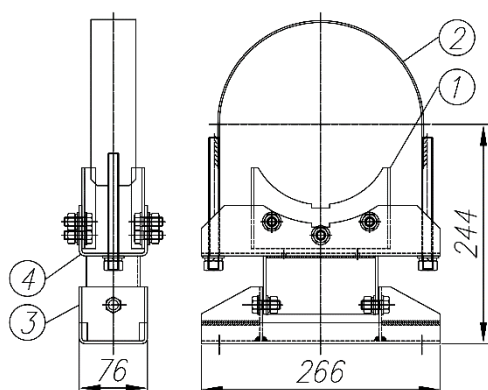


Fig.II.15 MOCRUR200-pipe fittings for screw conveyors –160 and –220

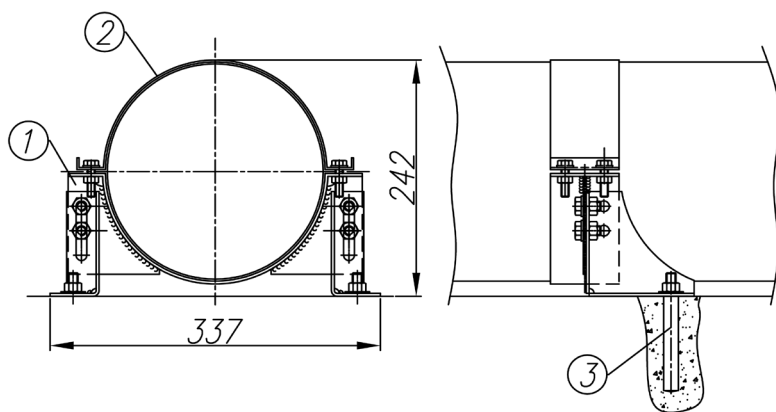
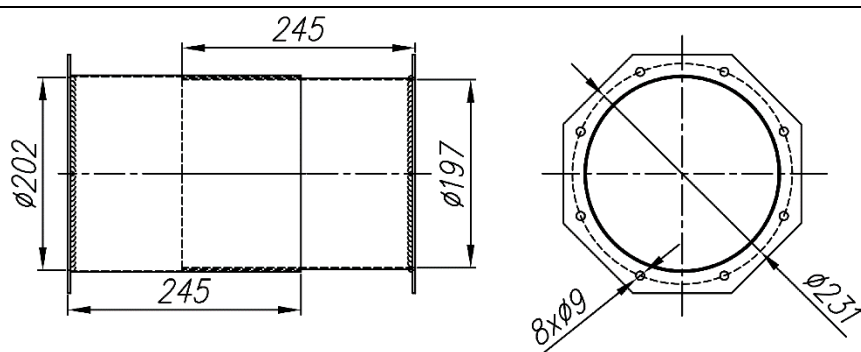


Fig.II.16 PS220-MOCBET – fixing of screw conveyor –220 pipes to concrete.



1.1. Product design and intended use

Intended use of PS220 conveyors

Screw conveyors PS220 are intended to be used for transport of cereal and maize grain, and oil seeds. Furthermore, they can collect transported material from under feed hoppers, unloading hoppers, tanks or conveyors, and move it to other tanks or conveyors. In particular, they can be used to transport grain from/to silos manufactured by BIN, between silos, and from an inlet hopper to a bucket conveyor, etc.

Conveyor PS220 design

The PS220 screw conveyors are of modular design. All units produced as a part of the PS220 system are shown in the Section II, item 1, of this Operating Manual. The selection of applied modules is influenced by technological and technical requirements, as well as investor's needs. The design of individual modules is as follows:

-PS220-N3/200-A 3 kW, 200 rpm drive (Fig. II.1) consists of a worm reducer, 14, of a reduction ratio $i = 7$, driven by an electric motor, 15, of a 3kW motor power and rotational speed of 1500 rpm; the reducer is mounted on a special adapter, 2, facilitating installation of other PS220 conveyor system modules. The drive hub, 1, mounted on the reducer via a key joint, 13 transfers the drive power from the electric motor, 15, via the reducer, 14. Moreover, the PS220-N3/200 includes the end hub unit, comprising of the end flange, 5, to which the bearing unit, 6, with an end hub, 4, are connected. The complete module also includes bolts, nuts and washers, which are necessary to install other PS220 system modules, as well as safety (warning) signs (stickers), a nominal plate and electric equipment.

-PS220-N4/150-A 4 kW, 150 rpm drive (Fig. II.2) consists of a worm reducer, 14, of a reduction ratio $i = 10$, driven by an electric motor, 15, of a 4 kW motor power and rotational speed of 1500 rpm; the reducer is mounted on a special adapter, 2, facilitating installation of other PS220 conveyor system modules. The drive hub, 1, mounted on the reducer via a key joint, 13 transfers the drive power from the electric motor, 15, via the reducer, 14. Moreover, the PS220-N4/150 includes the end hub unit, comprising of the end flange, 5, to which the bearing unit, 6, with an end hub, 4, are connected. The complete module also includes bolts, nuts and washers, which are necessary to install other PS220 system modules, as well as safety (warning) signs (stickers), a nominal plate and electric equipment.

-PS220-N4/200-A 4 kW, 200 rpm drive (Fig. II.3) consists of a worm reducer, 14, of a reduction ratio $i = 7$, driven by an electric motor, 15, of a 4 kW motor power and rotational speed of 1500 rpm; the reducer is mounted on a special adapter, 2, facilitating installation of other PS220 conveyor system modules. The drive hub, 1, mounted on the reducer via a key joint, 13 transfers the drive power from the electric motor, 15, via the reducer, 14. Moreover, the PS220-N4/200 includes the end hub unit, comprising of the end flange, 5, to which the bearing unit, 6, with an end hub, 4, are connected. The complete module also includes bolts, nuts and washers, which are necessary to install other PS220 system modules, as well as safety (warning) signs (stickers), a nominal plate and electric equipment.

-PS220-N4/300-A 4kW, $n=300$ rpm drive (Fig. III.4) consists of a worm reducer, 14, of a reduction ratio $i = 10$, driven by an electric motor, 15, of a motor power 4kW and rotational speed of 3000 rpm. The reducer is mounted on a special adapter, 2, facilitating installation of other PS220 conveyor system modules. The drive hub, 1, mounted on the reducer via a key joint, 13 transfers the drive power from the electric motor, 15, via the reducer, 14. Moreover, the PS220-N4/300 includes the end hub unit, comprising of the end flange, 5, to which the bearing unit, 6, with an end hub, 4, are connected. The complete module also includes bolts, nuts and washers, which are necessary to install other PS220 system modules, as well as safety (warning) signs (stickers), a nominal plate and electric equipment.

-PS220-N6/300-A 6 kW, $n=300$ rpm drive (Fig. III.5) consists of a worm reducer, 14, of a reduction ratio $i = 10$, driven by an electric motor, 15, of a motor power of 6 kW and rotational speed of 3000 rpm. The motor is started with the O-Y- Δ switch. The reducer is mounted on a special adapter, 2, facilitating installation of other PS220 conveyor system modules. The drive hub, 1, mounted on the reducer via a key joint, 13 transfers the drive power from the electric motor, 15, via the reducer, 14. Moreover, the PS220-N6/300 includes the end hub unit, comprising of the end flange, 5, to which the bearing unit, 6, with an end hub, 4, are connected. The complete module also includes bolts, nuts and washers, which are necessary to install other PS220 system modules, as well as safety (warning) signs (stickers), a nominal plate and electric equipment.

-PS220-N7.5/200 - A 7.5 kW, $n=200$ rpm drive (Fig. III.6) consists of a worm reducer, 14, of a reduction ratio $i = 15$, driven by an electric motor, 15, of a motor power of 7.5 kW and rotational speed of 3000 rpm. The motor is started with the O-Y- Δ switch. The reducer is mounted on a special adapter, 2, facilitating installation of other PS220 conveyor system modules. The drive hub, 1, mounted on the reducer via a key joint, 13 transfers the drive power from the electric motor, 15, via the reducer, 14. Moreover, the PS220-N7.5/200 includes the end hub unit, comprising of the end flange, 5, to which the bearing unit, 6, with an end hub, 4, are connected. The complete module also includes bolts, nuts and washers, which are necessary to install other PS220 system modules, as well as safety (warning) signs (stickers), a nominal plate and electric equipment.

- PS220-N7.5/300** - A 7.5 kW, n=300 rpm drive (Fig. III.7) consists of a worm reducer, 14, of a reduction ratio $i = 10$, driven by an electric motor, 15, of a motor power of 7.5 kW and rotational speed of 3000 rpm. The motor is started with the O-Y-Δ switch. The reducer is mounted on a special adapter, 2, facilitating installation of other PS220 conveyor system modules. The drive hub, 1, mounted on the reducer via a key joint, 13 transfers the drive power from the electric motor, 15, via the reducer, 14. Moreover, the PS220-N7.5/300 includes the end hub unit, comprising of the end flange, 5, to which the bearing unit, 6, with an end hub, 4, are connected. The complete module also includes bolts, nuts and washers, which are necessary to install other PS220 system modules, as well as safety (warning) signs (stickers), a nominal plate and electric equipment.
- PS220-LOZ/P1**-A polyamide intermediate bearing (Fig. II.8), consists of a bearing casing, 2, in which a slide bearing, 3, is mounted and secured with circlips, 10, and a bolt, 4. The slide bearing, 3, is used for installation of the intermediate hub, 1, and it is lubricated via the special lubrication bore ending with a greasing nip, 13. The complete module also includes bolts, nuts and washers, which are necessary to install other PS220 system modules.
- PS220-P1.0**-a 1 m extension (Fig.II.9); this module includes a 990 mm and –200 mm long screw, 1, and a 1000 mm and –220 mm long screw casing (an extension pipe), 2. The casing, 2, is provided with a transport eye, 5, and its labelling sticker, 4.
- PS220-P1.5**-a 1.5 m extension (Fig.II.9); this module includes a 1490 mm and –200 mm long screw, 1, and a 1500 mm and –220 mm long screw casing (an extension pipe), 2. The casing, 2, is provided with a transport eye, 5, and its labelling sticker, 4.
- PS220-P2.0**-a 2.0 m extension (Fig.II.10), this module includes a 1990 mm and –200 mm long screw, 1, and a 2000 mm and –220 mm long screw casing (an extension pipe), 2. The casing, 2, is provided with two transport eyes, 5, and their labelling stickers, 4.
- PS220-P2.5**-a 2.5 m extension (Fig.II.10), this module includes a 2490 mm and –200 mm long screw, 1, and a 2500 mm and –220 mm long screw casing (an extension pipe), 2. The casing, 2, is provided with two transport eyes, 5, and their labelling stickers, 4.
- PS220-P3.0**-a 3 m extension (Fig.II.10), this module includes a 2990 mm and –200 mm long screw, 1, and a 3000 mm and –220 mm long screw casing (an extension pipe), 2. The casing, 2, is provided with two transport eyes, 5, and their labelling stickers, 4.
- PSU220-I/O-200**- an inlet/outlet –200 (Fig.II.11) consists of a body, 1, which, together with a clamp, 2, facilitates installation of this unit on the screw conveyor casing (pipe) of –220 mm. To ensure a required level of safety, the inlet/outlet is provided with a guard, 3, screwed to the flange, 4.
- PSU220-WL-CENT**-The central inlet from the silo to the screw conveyor (Fig. II.12) is a module, with which the PS160 or PS220 screw conveyor systems may be operated as an underfloor unloading screw conveyor for BIN silos. This module consists of the body, 1, which is connected to the silo bottom and to the PS160 or PS220 screw conveyor. The central inlet can be connected to the PS160 conveyor using sealings, 12, and the Ø160 clamp, 13. The body, 1, contains a shutter controlled with a pull cable, 7, equipped with an indicator, 14, showing the width of shutter opening as centimetres, and connected to a control lever, 5, fixed to the silo side wall (shell) and the foundation slab with rawplugs, 6. To ensure a required level of safety, the central inlet is provided with a guard, 3, screwed to the body, 1. Moreover, this module includes the silo jacket cover, 8, with PS220-LOZ/P1 intermediate bearing lubrication system parts, 9 and 10, mounted on it, and an additional PS160 silo jacket cover, 11. When the central inlet is connected to the PS160 conveyor, the PS160 silo jacket cover, 11, should be used, after items 9 and 10 for lubrication of intermediate bearings, PS160-LOZ/P1, are installed on it.
- PSU220-ZASUW_1**-an outlet shutter for the screw conveyor (Figs. II.13 and II.14) consists of a body, 2, together with a clamp, 4, to be installed on the conveyor of the PS220 system. The body, 2, contains a shutter, controlled either manually, with lever 1 (Fig.II.13) or with a gearmotor, 1 (Fig. II.14). To ensure a required level of safety, the outlet shutter is provided with a guard, 3, screwed to a flange the body, 2.
- MOCRUR200**-fixing of pipes of the screw conveyors –160 and –220 (Fig.II.15) consists of a two-part base (a fixed part, 3, fixed to the floor, and a mobile part, 4, enabling installation of the conveyor PS220 at various angles to the floor) and a clamp, 2. Reducing elements, 1, are fixed to the mobile part, 4, and they should be removed when pipes of 220 mm in diameter are installed. The said reducing elements, 1, must be used when pipes of 160 mm in diameter are installed.
- PS220-MOCBET**-fixing of pipes of the screw conveyor –220 (Fig.II.16) consists of a base, 1, of an adjustable height, and of a clamp, 2. The fixing is provided with rawplugs, 3, for permanent fixing of the conveyor to concrete.
- RURATEL200-0.4**-a telescopic pipe of a maximum length of 450 mm (Fig.II.17) that consists of two parts, each 245 mm long. One pipe has an inner diameter of 197 mm, so it can be inserted into the other pipe of an inner diameter of 202 mm. Both pipes are equipped with identical flanges for installation to modules of the PS220 system and/or to other devices.

1.2. Technical specification and completing

Table II.1 Technical specification of PS220 system modules.

Product	Motor type	Nominal motor power	Engine rotational speed	Power supply voltage	Frequency	Protection degree (IP)	Screw rotational speed	Screw diameter (Ø)	Total length	Total height	Dimensions (diameter) of inlet/outlet	Device weight
	-	kW	rpm	V	Hz	-	rpm	mm	mm	mm	mm	kg
PS220-N3/200	Skg100L-4B	3.0	1500	3x400	50	54	200	-	-	573	-	85
PS220-N4/150	Skg112M-4	4.0	1500	3x400	50	54	150	-	-	599	-	95
PS220-N4/200	Skg112M-4	4.0	1500	3x400	50	54	200	-	-	599	-	95
PS220-N4/300	3SIEK112M2,6 1LE1003-1BA22FA4	4.0	3000	3x400	50	54	300	-	-	max. 635	-	95
PS220-N6/300	Skg112M-2PC	6.0	3000	3x400	50	54	300	-	-	599	-	98
PS220-N7.5/200	Skg132S-2B	7.5	3000	3x400	50	54	200	-	-	676	-	160
PS220-N7.5/300	Skg132S-2B	7.5	3000	3x400	50	54	300	-	-	676	-	160
PS220-LOZ/P1	-	-	-	-	-	-	-	-	250	-	-	7
PS220-P1.0	-	-	-	-	-	-	-	Ø200	1000	-	-	26
PS220-P1.5	-	-	-	-	-	-	-	Ø200	1500	-	-	37
PS220-P2.0	-	-	-	-	-	-	-	Ø200	2000	-	-	48
PS220-P2.5	-	-	-	-	-	-	-	Ø200	2500	-	-	58
PS220-P3.0	-	-	-	-	-	-	-	Ø200	3000	-	-	68
PSU220-I/O-200	-	-	-	-	-	-	-	-	304	419	Ø200	12
PSU220-WL-CENT	-	-	-	-	-	-	-	-	-	311	315x315	74
PSU220-ZASUW_1	-	-	-	-	-	-	-	-	607	448	Ø200	30
PSU220-ZASUW_1 PSU220-ZASNAP1	Skg56-4B	0.09	1380	3x400	50	54	-	-	607	448	Ø200	30
MOCRUR200	-	-	-	-	-	-	-	-	-	360	-	6
PS220-MOCBET	-	-	-	-	-	-	-	-	-	242	-	6
RURATEL200-0.4	-	-	-	-	-	-	-	-	max.450	-	Ø202/Ø197	7

*In no device shown in the manual, the level of noise exceeds 70 dB(A).

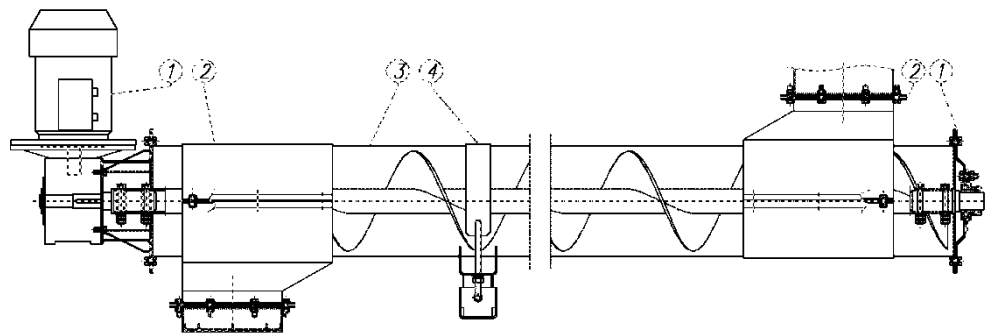


Fig.II.18 PS220-a basic set-up

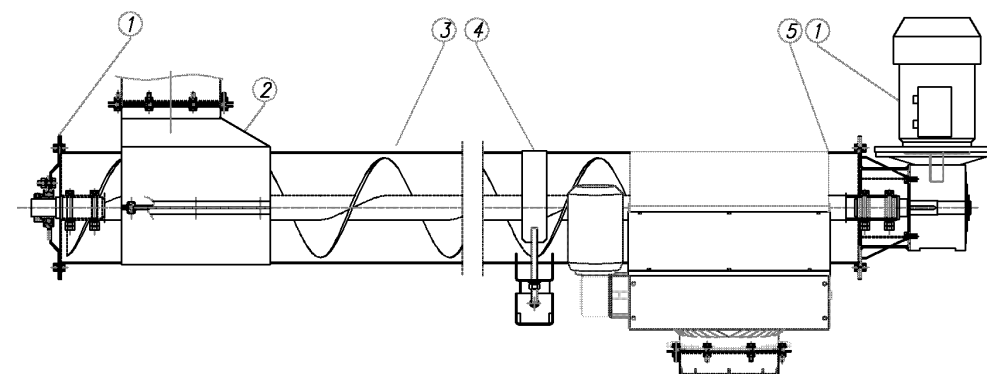


Fig II.19 PS220-a set-up including PSU220-ZASUW_1 and PSU220-ZASNAP1

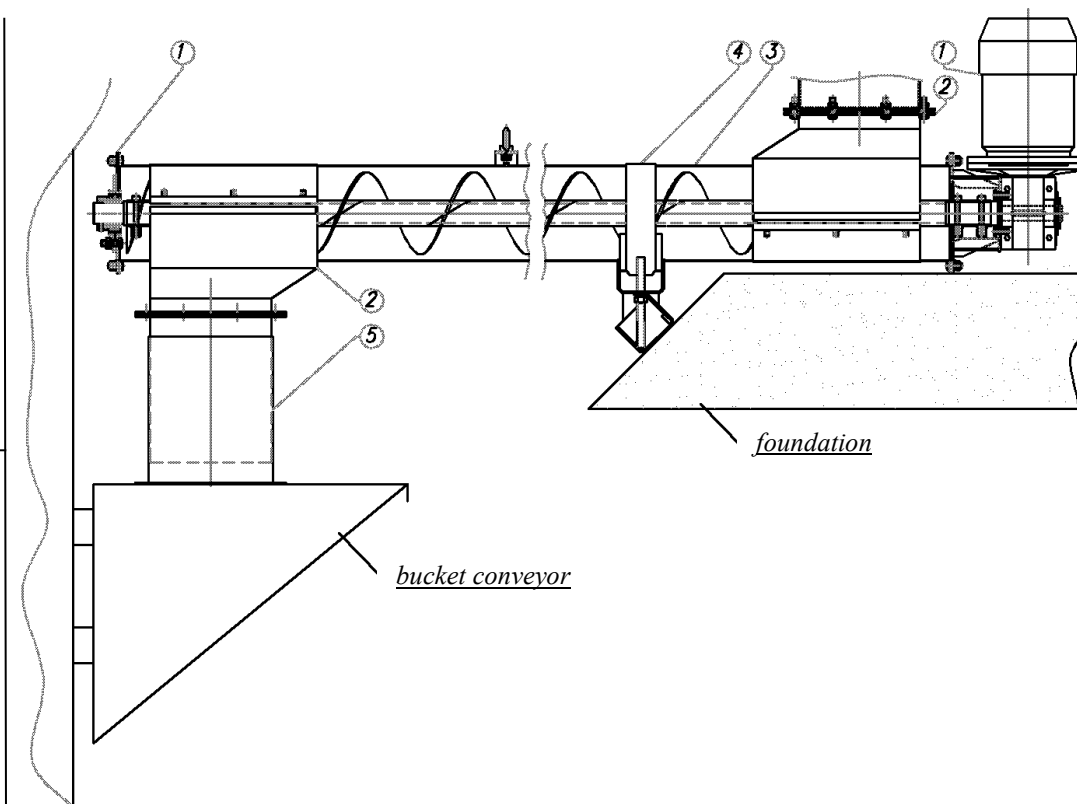


Fig.II.20 PS220-a set-up with RURATEL200-0.4

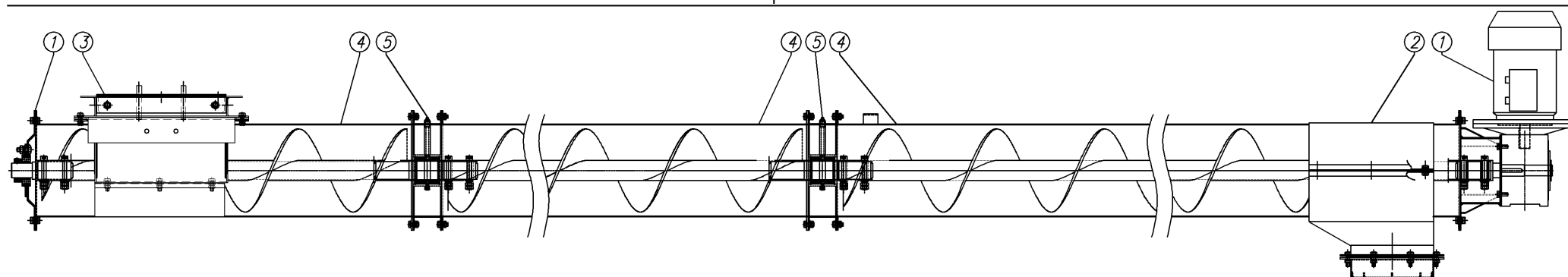


Fig.II.21 PS220-a set-up with PSU220-WL-CENT

- a) The simplest setting of the screw conveyor consisting of the PS220 system modules (Fig. II.18) includes: drive, 1 - PS220-N3/200, PS220-N4/150, PS220-N4/200, PS220-N4/300, PS220-N6/300, PS220-N7.5/200, or PS220-N7.5/300, extension, 3 - PS220-P1.0, PS220-P1.5, PS220-P2.0, PS220-P2.5, or PS220-P3.0, inlet/outlet, 2 - PSU220-I/O-200 (2 pieces) and a fixing system, 4, MOCRUR200 or PS220-MOCBET in a quantity adjusted to installation conditions and the conveyor length (adhering to a principle that the conveyor is fixed at every 4.5 m).
- b) When a conveyor of a considerable length needs to be constructed - Fig.II.21 (however, with the entire length of the conveyor not exceeding 9 m for PS220-N3/200, PS220-N6/300 or PS220-N4/300 drives, 12 m for PS220-N4/150 or PS220-N4/200 drives, or 15 m for PS220-N7.5/200 or PS220-N7.5/300 drives), several extensions, 4, must be installed using intermediate bearings PS220-LOZ/P1, 5.
- c) With a telescopic pipe (Fig. II.20), 5, RURATEL200-0.4, the screw conveyor can be connected to other technological equipment, such as bucket elevators, silos, etc.
- d) When an outlet from the screw conveyor needs to be completely closed (Fig.II.19), then an outlet shutter PSU220-ZASUW_1, 5, controlled manually or with the electrical drive PSU220-ZASNAP1 must be used.
- e) PS220 screw conveyors can be used as underfloor unloading devices for BIN silos (Fig. II.21). For this purpose, add the conveyor central inlet, 3, PSU220-WL-CENT.

2. Installation and start-up

2.1. Conveyor installation

Screw conveyors from the PS220 system, depending on needs and their intended use, can be assembled in very different ways. A manufacturer provides for horizontal or inclined operation of these devices (Fig..II.22, Fig.II.23 and Tables II.2, II.3, II.4, II.5, II.6, II.7 and II.8). However, regardless of the method and the type of operation, the conveyors must be installed on a stable base, and a distance between components fixing the conveyor pipe to the base should not exceed 4.5 m. The conveyor should be installed in a way ensuring its stable position (supported) at its ends, i.e., near the driving gearmotor and the end hub. This type of installation prevents unforeseen movement of the conveyor, vibrations, etc.

The pipe fixings MOCRUR200 manufactured by BIN , with reducing elements for installation of conveyors of a smaller pipe diameter removed, or PS220-MOCBET for fixing the conveyor to the foundations can be used as elements fixing conveyors to their base.

Depending on the needs and a type of the PS220 units used, (inlet and outlet) holes should be made in the conveyor pipe and components for fixing of the above units should be installed (Fig. II.24).

Installation of the conveyors requires use of special equipment, and relevant know-how. Therefore, the equipment can only be installed by installation companies authorised by BIN. The installation company should cooperate with an entity ordering installation, in terms of works organisation, financial settlements, and acceptance of installation works.



When the Investor itself or any other installation company not authorised by BIN installs the conveyor(s), the Investor is obliged to obtain the detailed conveyor installation instruction from the manufacturer and place (stick) warning and information signs on the product.

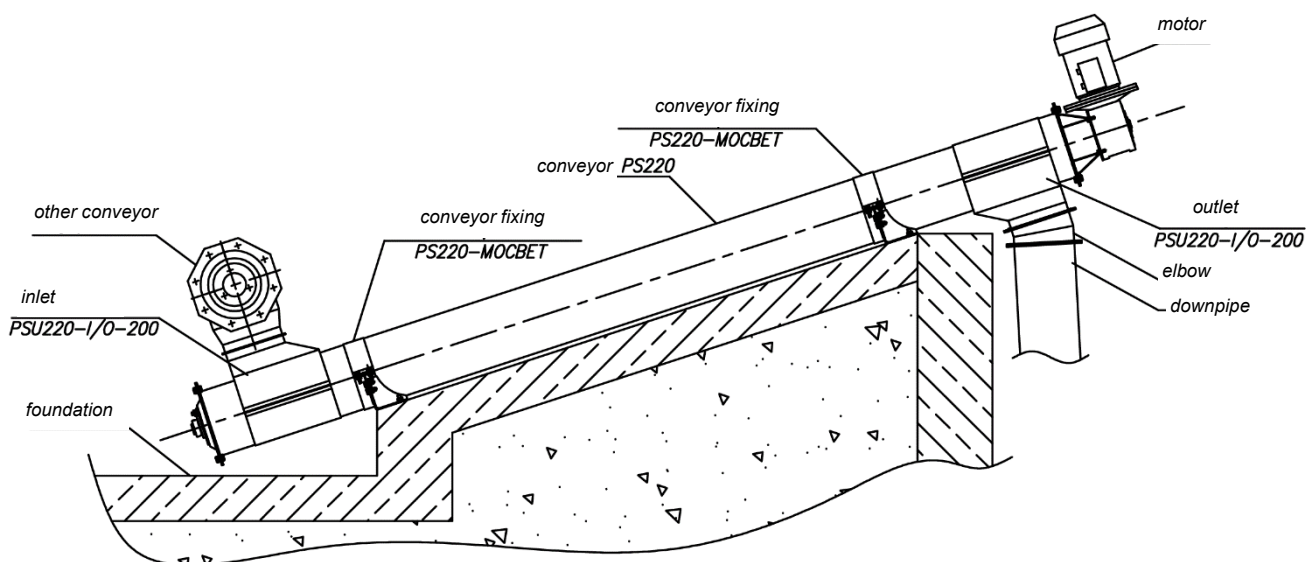
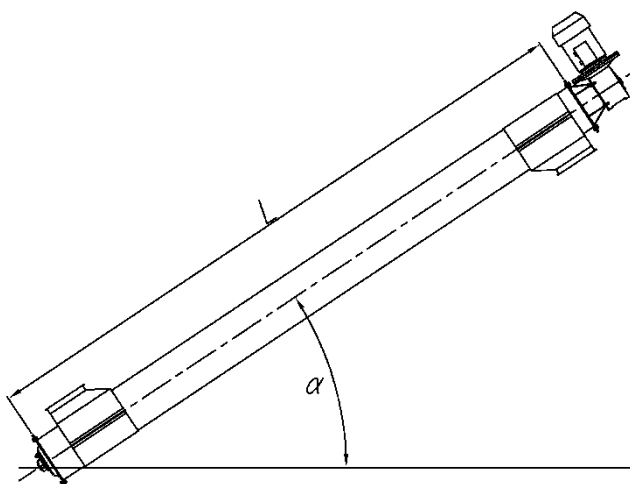


Fig.II.22 An example for installation of a PS220 screw conveyor



L - the conveyor length as m;
 α - conveyor incline angle as °,
 φ_{\max} - maximum filling of a conveyor with transported material, as %;
 W - capacity as tonnes/hour

Fig.II.23 Labelling for tables 2, 3, 4, 5, 6, 7, 8

Table II.2 Indicative data for designing screw conveyors using the PS220-N3/200 module.

L (m)	$\alpha = 0^\circ$		$\alpha = 10^\circ$		$\alpha = 15^\circ$		$\alpha = 20^\circ$		$\alpha = 25^\circ$	
	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)
3	85	48	85	42	85	38	85	35	85	32
6	85	48	85	42	85	38	85	35	85	32
9	78	45	75	37	80	36	85	35	85	32

Table II.3 Indicative data for designing screw conveyors using the PS220-N4/150 module.

L (m)	$\alpha = 0^\circ$	
	φ_{\max} (%)	W (tonnes/hours)
3	85	24
6	85	24
9	78	22
12	78	22

Table II.4 Indicative data for designing screw conveyors using the PS220-N4/200 module.

L (m)	$\alpha = 0^\circ$		$\alpha = 10^\circ$		$\alpha = 15^\circ$		$\alpha = 20^\circ$		$\alpha = 25^\circ$	
	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)
3	85	48	85	42	85	38	85	35	85	32
6	85	48	85	42	85	38	85	35	85	32
9	78	45	75	37	80	36	85	35	85	32
12	78	45	75	37	80	36	85	35	85	32

Table II.5 Indicative data for designing screw conveyors using the PS220-N4/300 module.

L (m)	$\alpha = 0^\circ$		$\alpha = 10^\circ$		$\alpha = 15^\circ$		$\alpha = 20^\circ$		$\alpha = 25^\circ$	
	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)
3	85	70	85	60	85	55	85	51	85	46
6	85	70	85	60	85	55	85	51	85	46
9	78	64	85	60	85	55	85	51	85	46

Table II.6 Indicative data for designing screw conveyors using the PS220-N6/300 module.

L (m)	$\alpha = 0^\circ$		$\alpha = 10^\circ$		$\alpha = 15^\circ$		$\alpha = 20^\circ$		$\alpha = 25^\circ$	
	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)
3	85	70	85	60	85	55	85	51	85	46
6	85	70	85	60	85	55	85	51	85	46
9	85	70	85	60	85	55	85	51	85	46

Table II.7 Indicative data for designing screw conveyors using the PS220-N7.5/200 module.

L (m)	$\alpha = 0^\circ$		$\alpha = 10^\circ$		$\alpha = 15^\circ$		$\alpha = 20^\circ$		$\alpha = 25^\circ$	
	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)
3	85	46	85	40	85	37	85	34	85	31
6	85	46	85	40	85	37	85	34	85	31
9	78	43	75	36	80	35	85	34	85	31
12	78	43	75	36	80	35	85	34	85	31
15	78	43	75	36	80	35	85	34	85	31

Table II.8 Indicative data for designing screw conveyors using the PS220-N7.5/300 module.

L (m)	$\alpha = 0^\circ$		$\alpha = 10^\circ$		$\alpha = 15^\circ$		$\alpha = 20^\circ$		$\alpha = 25^\circ$	
	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)	φ_{\max} (%)	W (tonnes/hours)
3	85	70	85	60	85	55	85	50	85	45
6	85	70	85	60	85	55	85	50	85	45
9	78	64	85	60	85	55	85	50	85	45
12	78	64	85	60	85	55	85	50	85	45
15	78	64	85	60	85	55	85	50	85	45

When designing or working with a system of conveyors, it should be remembered that capacity of those devices depends, among others, on:

- type of transported material;
- moisture content of transported material;
- contamination level;
- conveyor incline angle;
- level of conveyor through filling.

Therefore, values specified in tables II.2, II.3, II.4, II.5, II.6, II.7 and II.8 should be treated solely as indicative and general guidelines for designing a conveyor system.

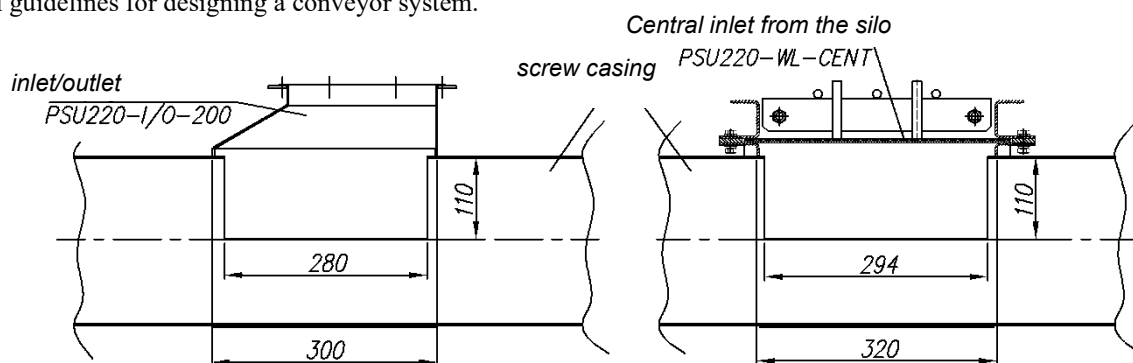


Fig. II.24 Installation method for PSU220-I/O-200 and PSU220-WL-CENT modules.



When using PS220 screw conveyors as unloading devices in BIN silos, it is forbidden to install more than one (in one silo) PSU220-WL-CENT inlet or installing that inlet not centrally.



The total length of a screw conveyor assembled of the PS220 modules cannot exceed 9 m for PS220-N3/200, PS220-N4/300 or PS220-N6/300 drives, 12 m for the PS220-N4/150 or PS220-N4/200, and 15 m for the PS220-N7.5/200 or PS220-N7.5/300 drive.



The manufacturer does not provide for conveyor work with an uncovered (open) inlet/outlet. Both inlet and outlet should be adapted for connection of auxiliary devices (pipes of other conveyors, downpipes, etc.) or use securing covers being standard equipment of relevant PS220 systems.

2.2. Electrical systems and start-up

The manufacturer equips conveyors with the following electrical subunits:

- three-phase electric motor;
- lockable main switch;
- lockable star-delta starter (concerns PS220-N6/300, PS220-N7.5/200, PS220-N7.5/300);
- rotation direction switch (for PSU220-ZASNA1),
- limit switch with a roller (for PSU220-ZASNA1),
- motor (thermal) switch,
- undervoltage release,
- housing for the thermal switch and the undervoltage release.

The design documentation of the investment must include appropriate design study for the wiring system, taking into account the conveyor connection together with auxiliary equipment. The investor is responsible for drawing up such design study by a person holding relevant licences in accordance with current legislation.

The investor is responsible for construction of the electrical wiring system in accordance with the said design study by an electrician holding relevant licences.

Regardless of the function and construction method, the design study and the constructed wiring system must meet the following requirements:

- motor correctly connected (as required by a motor manufacturer),
- motor secured by a correct connection and adjustment of the thermal switch;

- securing against unintended starting of the conveyor after power outage;
- option for securing the conveyor against unintended start (e.g., a lockable main switch),
- voltage supplied to all units should be within ranges specified by manufacturers of those units;
- function for automatic stop of the conveyor work in the event of any incorrect work of accessories (e.g., failure of another conveyor) or people entering areas dangerous for them (e.g., a silo in which the conveyor works)

The investor is responsible for delivery (at its own expense) of all electrical equipment and units not being a part of conveyor equipment, but necessary for construction of required electrical wiring.

The investor is responsible for providing guidelines of the conveyor manufacturer (included in this operating manual) to a person designing and constructing the wiring system.

A person constructing the wiring system should perform the first test starting of the conveyor, check correctness of the motor rotations and consistence of current values on nominal plates of the motor and the thermal switch.

The producer requires a written confirmation of construction and checking of the wiring system by an electrician holding required licences.

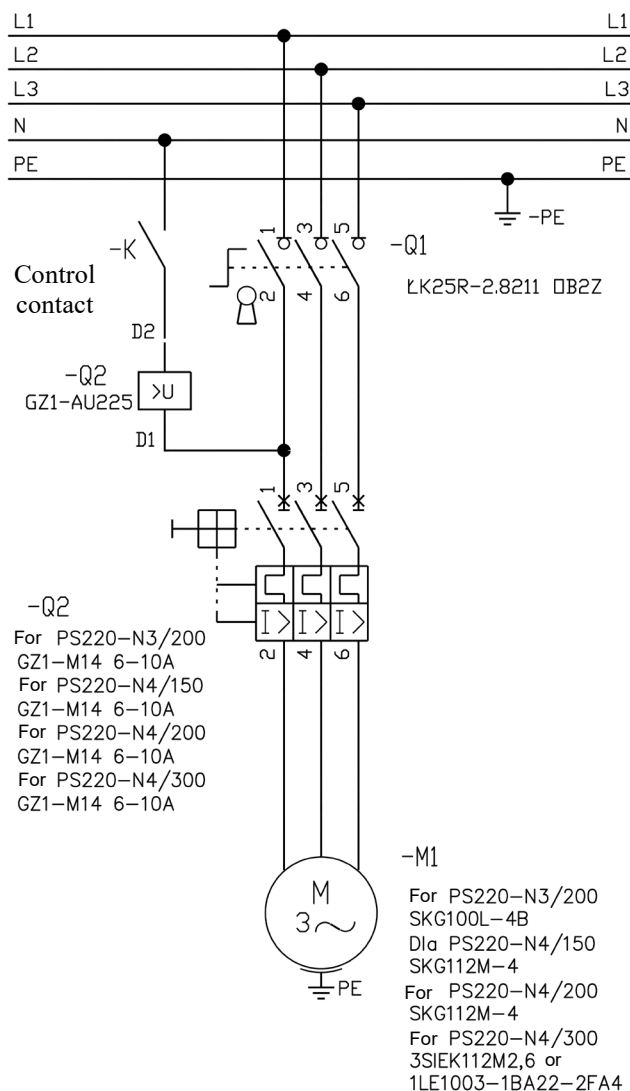


Diagram II.1. An example of the electrical wiring system for PS220-N3/200, PS220-N4/150, PS220-N4/200, and PS220-N4/300 conveyors.

The above diagram represents general guidelines for construction of the wiring system for the PS220 conveyor. The units used can be replaced by equivalent devices having identical functions. The investor is responsible for drawing up of a design study for the electrical wiring by a person holding relevant licences in accordance with current legislation. The investor is responsible for construction of the electrical wiring system in accordance with the said design study by an electrician holding relevant licences.

- M1: Three-phase electric motor,
- Q2: Thermal overcurrent circuit breaker with undervoltage release,
- Q1: Lockable main switch;
- K: The control contact; when closed, the contact enables operation of PS220, when open, PS220 cannot work; the contact should open in the case of:
 - an attempt to enter the silo by opening a manhole when PS220 operates as an unloading/loading conveyor for the silo;
 - stopping of the conveyor or other equipment responsible for efficient reception of grain from PS220,
 - other conditions (depending on individual investment solutions), when further work of PS220 may pose a threat to health or life of humans or animals, or may result in a damage to the conveyor or other equipment.

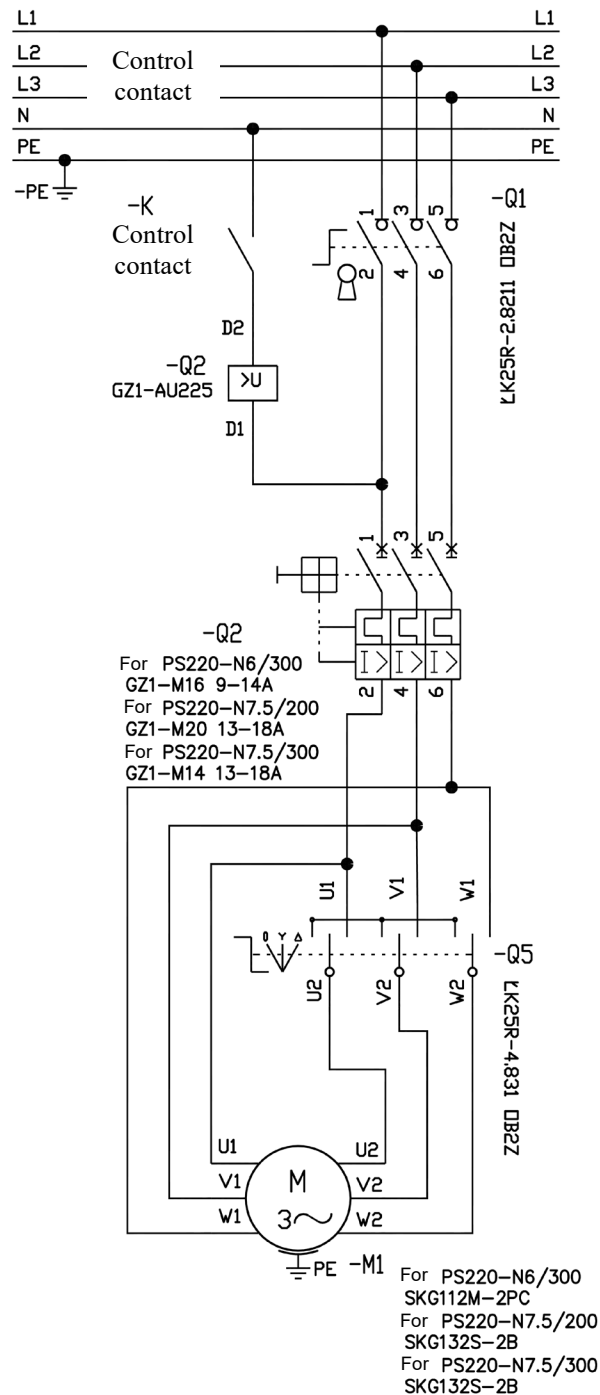


Diagram II.2. An example of the electrical wiring system for PS220-N6/300, PS220-N7.5/200 and PS220-N7.5/300 conveyors.

The above diagram represents general guidelines for construction of the wiring system for the PS220 conveyor. The units used can be replaced by equivalent devices having identical functions. The investor is responsible for drawing up of a design study for the electrical wiring by a person holding relevant licences in accordance with current legislation. The investor is responsible for construction of the electrical wiring system in accordance with the said design study by an electrician holding relevant licences.

- M1: Three-phase electric motor,
- Q2: Thermal overcurrent circuit breaker with undervoltage release,
- Q1: Lockable main switch;
- Q5: Lockable star-delta starter switch;
- K: The control contact; when closed, the contact enables operation of PS220, when open, PS220 cannot work; the contact should open in the case of:
 - an attempt to enter the silo by opening a manhole when PS220 operates as an unloading/loading conveyor for the silo;
 - stopping of the conveyor or other equipment responsible for efficient reception of grain from PS220,
 - other conditions (depending on individual investment solutions), when further work of PS220 may pose a threat to health or life of humans or animals, or may result in a damage to the conveyor or other equipment.

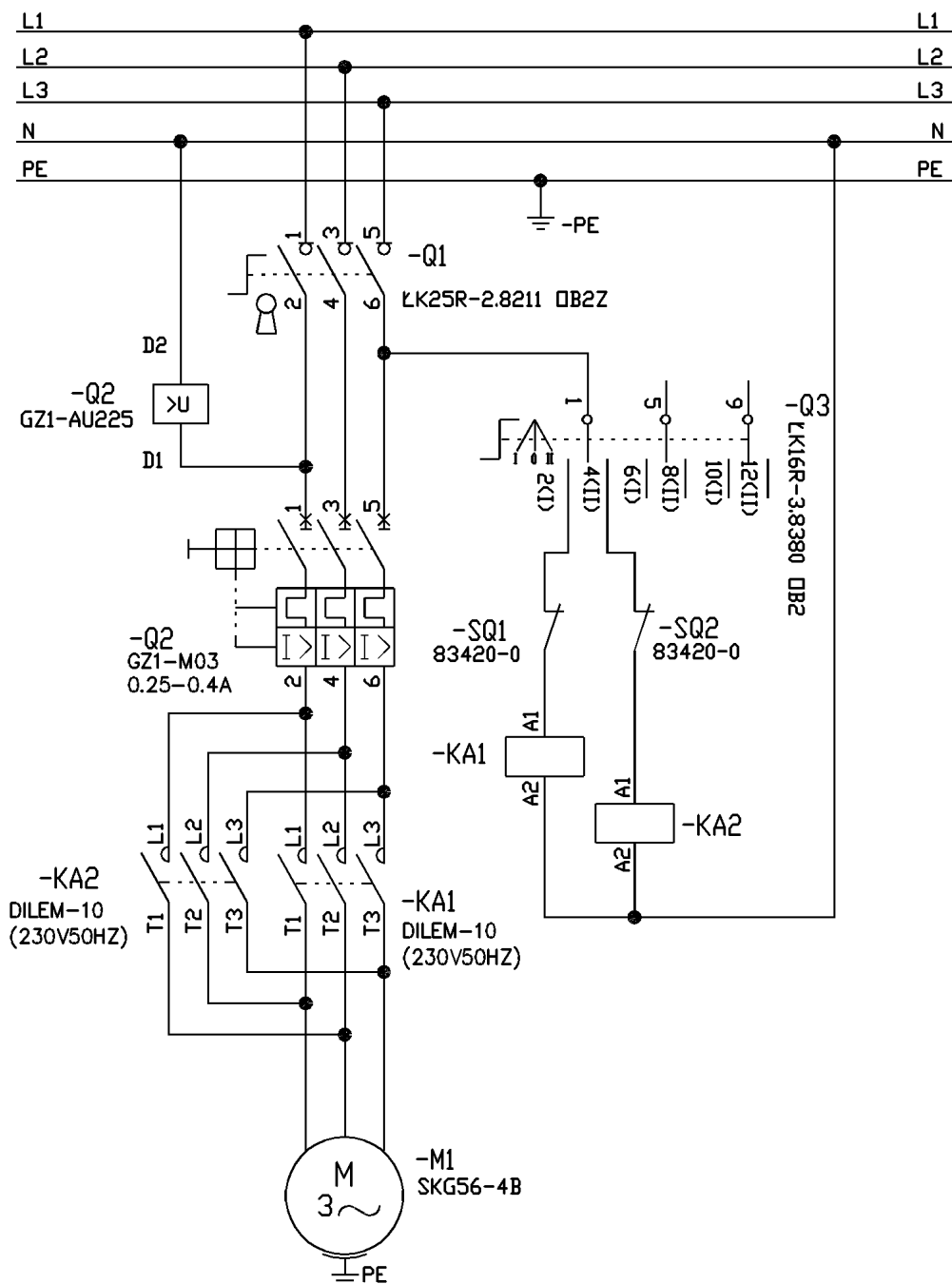


Diagram II.3. An example of a wiring system for the shutter PSU220-ZASUW_1 + PSU220-ZASNAP1.

The above diagram represents general guidelines for construction of the wiring system for the PSU220-ZASUW_1 + PSU220-ZASNAP1 outlet shutters. The units used can be replaced by equivalent devices having identical functions. The investor is responsible for drawing up of a design study for the electrical wiring by a person holding relevant licences in accordance with current legislation. The investor is responsible for construction of the electrical wiring system in accordance with the said design study by an electrician holding relevant licences.

- M1: Three-phase electric motor,
- Q2: Thermal overcurrent circuit breaker with undervoltage release,
- Q1: Lockable main switch;
- Q3: Rotation direction switch 1-0-2;
- KA1, KA2: Power contactor DILEM,
- SQ1, SQ2: Limit switch with a roller

3. Operation

3.1. Operation of conveyors

Methods for starting and stopping the conveyor may differ from those described below. This results from a design of the electrical wiring system, in which used electrical units (mainly control devices) differ from those delivered by the conveyor manufacturer.

Starting the conveyor

PS220-N3/200, PS220-N4/150, PS220-N4/200 and PS220-N4/300

- Set the main switch in the position "I" (Fig.II.25),
- Press the black on button on the motor switch (Fig. II.25);

PS220-N6/300, PS220-N7.5/200 and PS220-N7.5/300

- Press the black on button on the motor switch (Fig. II.26);
- Set the 0-Y-Δ switch (Fig.II.26.) in the position "Y" and wait ca. 10 seconds until the motor reaches its full speed;
- Set the 0-Y- Δ switch in the "Δ" position.

Stopping the conveyor

PS220-N3/200, PS220-N4/150, PS220-N4/200 and PS220-N4/300

- Cut the grain inflow to the conveyor (close the shutters) and wait until the device is completely empty,
- Press the red off button on the motor switch (Fig. II.25).
- Set the main switch in the position "0" (Fig.II.25);

PS220-N6/300, PS220-N7.5/200 and PS220-N7.5/300

- Cut the grain inflow to the conveyor (close the shutters) and wait until the device is completely empty,
- Set the 0-Y-Δ switch (Fig.II.26.) smoothly in the "0" position;
- Press the red off button on the motor switch (Fig. II.26).

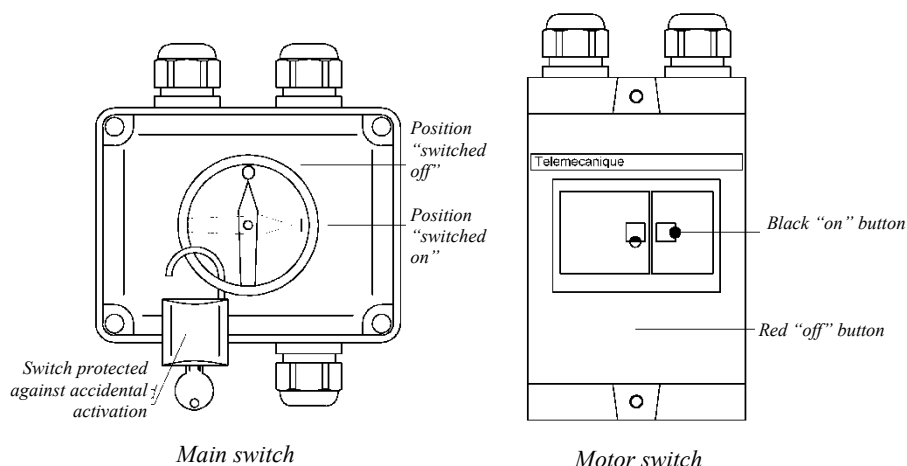


Fig.II.25. Conveyor control devices for PS220-N3/200, PS220-N4/150, PS220-N4/200 and PS220-N4/300

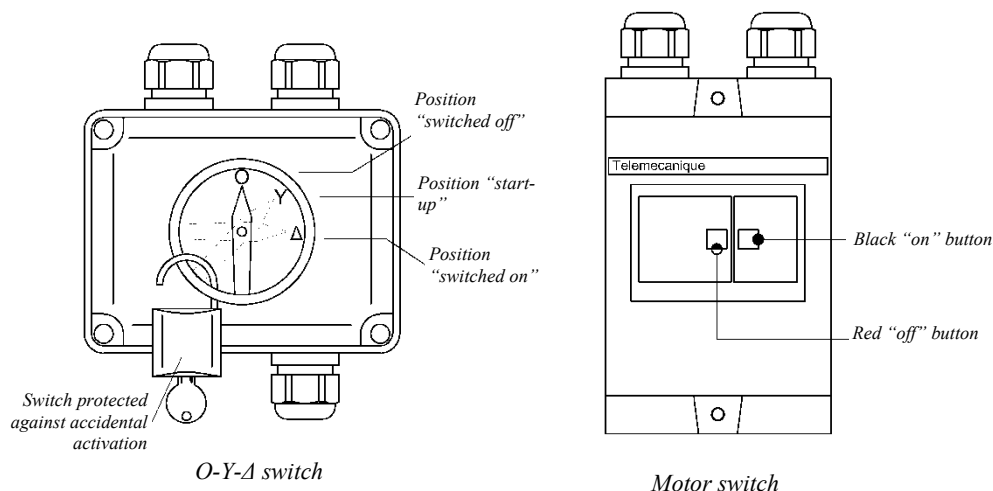


Fig.II.26. Conveyor control devices for PS220-N6/300, PS220-N7.5/200 and PS220-N7.5/300

Grain transport

Before starting the grain transport:

- check the operational condition of conveyors and their accessories;
- ensure that there are no people at locations of grain inlet and outlet;
- arrange efficient collection of material from the conveyor outlet, to prevent its blocking (overload).

It is forbidden to stop the conveyor which pipe and screw are covered with grain. This may cause problem with restarting it.



Screw conveyors must be constructed in such way that they are provided with devices dosing and cutting off the flow of transported material. The use of such devices prevents conveyor overfilling (blocking) and damaging.

The system of conveyors is not suitable for transport of material that is highly contaminated, locally aggregated, etc. Any attempt to transport such grain may result in overload or damage, and in consequence, stopping of the device.

When the above remarks are considered, the conveyor can be started.



In an emergency, stop the device by pressing the red STOP button on the motor switch.

In the case of power outage, the system of conveyors will be permanently stopped. Restoring of power supply will not restart the devices automatically. To restart the conveyors, repeat the starting sequence from the beginning.



All conveyors are designated for working with the filling ratio not exceeding 85%. When this ratio is exceeded, the motion resistance increases significantly, and this may result in overload and blocking of the drive system (including the motor).

3.2. Conveyor maintenance

Correct and punctual maintenance inspections, maintenance and possible repairs guarantee availability of the full operating capacity of the conveyors and prevent their premature and excessive wear.

Periodic maintenance and current overhauls

Periodic maintenance covers:

- inspection of safety devices, that is, a motor switch, a main switch, etc. (correct operation, no mechanical damage, etc.);
- inspection of the electrical wiring system by an authorised electrician;
- inspection of a technical condition of welded, screwed and other connections;
- inspection of anti-corrosion coatings;
- inspection of sliding and rolling bearings;
- lubrication of sliding bearings;
- cleaning and lubrication of a shutter drive screw;
- inspection of other moving and fixed components.

Maintenance frequency:

Periodic maintenance frequency should be adapted to intensity of use, but it should take place at least once a year. All safety devices, i.e., the motor switch, the main switch, and other, should be inspected at least once a month or before each start of conveyors, as well as after each longer break in operation.



At least once a year, the User should order a qualified electrician holding relevant licences to inspect all electric equipment components.



The conveyors are equipped with a system for lubrication of sliding bearings. These bearings should be filled with grease after every 30 hours of work.



When the central inlet, PSU220-WL-CENT, is used, (after each start) the drive screw of the control shutter should be cleaned and lubricated with solid grease.

The regular maintenance includes small repairs, and possible repairs of anti-corrosion coats. Anti-corrosion coating of screws can be damaged during installation (tightening). In such case, regular repairs include applying anti-corrosion coatings on damaged surfaces.

General overhaul

Overhauls are performed according to a scope and needs, depending on screw wear, connections condition, etc. (at least once every 8 years), and during them relevant parts are either repaired or replaced with new.

Such overhauls cover the scope of regular maintenance and:

- replacement of roller and sliding bearings, gaskets, etc.
- applying of new anti-corrosion coatings;
- other relevant repairs.



All damages must be repaired immediately, and parts that are damaged or worn must be repaired or replaced with new ones.

Chapter III. PS160 conveyors

1. General product description

The list of appliances produced within the PS160 screw conveyors system.

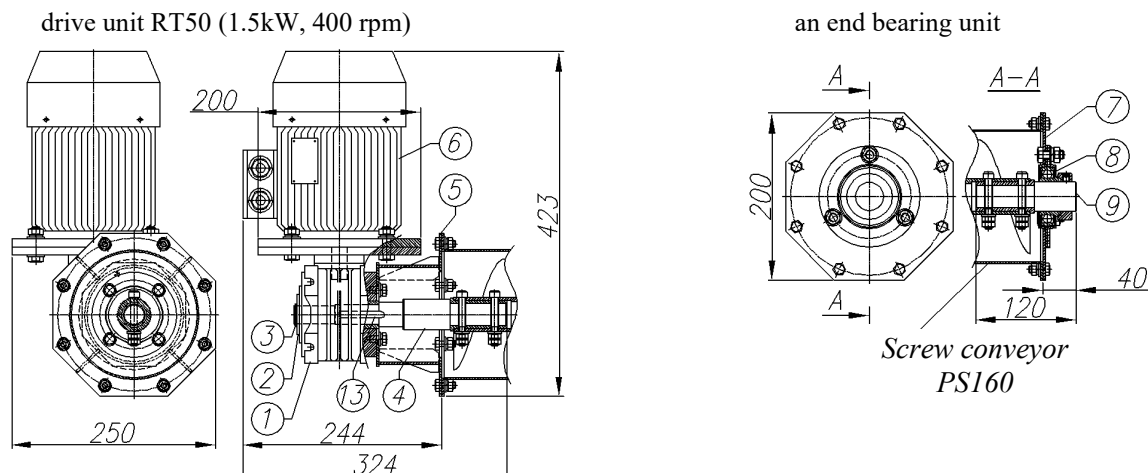


Fig.III.1 PS160-N1.5/400- a screw conveyor of $\varnothing 160$ mm – drive power $P=1.5$ kW, output rotational speed of 400 rpm

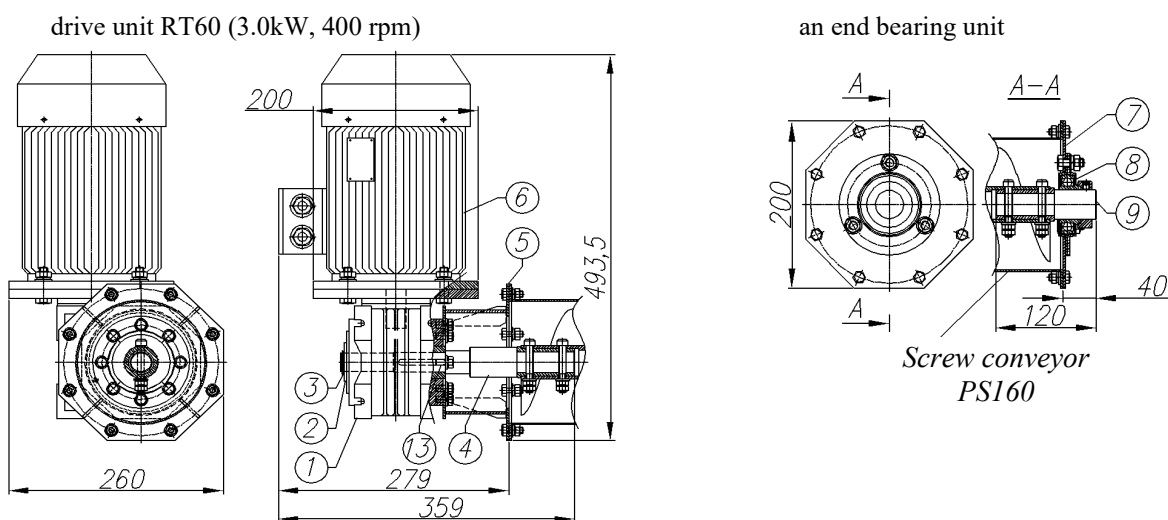


Fig.III.2 PS160-N3.0/400- a screw conveyor of $\varnothing 160$ mm – drive power $P=3.0$ kW, output rotational speed of 400 rpm

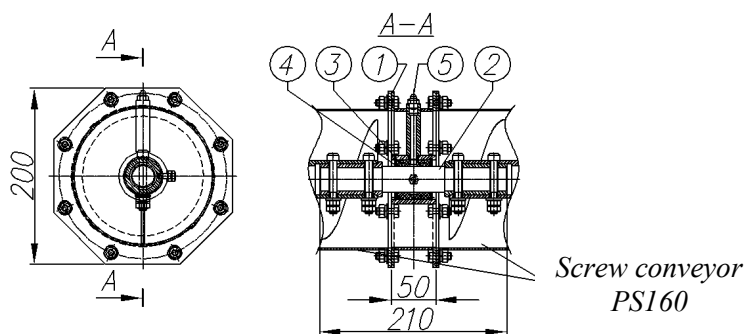


Fig.III.3 PS160-LOZ/P1-a screw conveyor of $\varnothing 160$ mm – intermediate polyamide bearing.

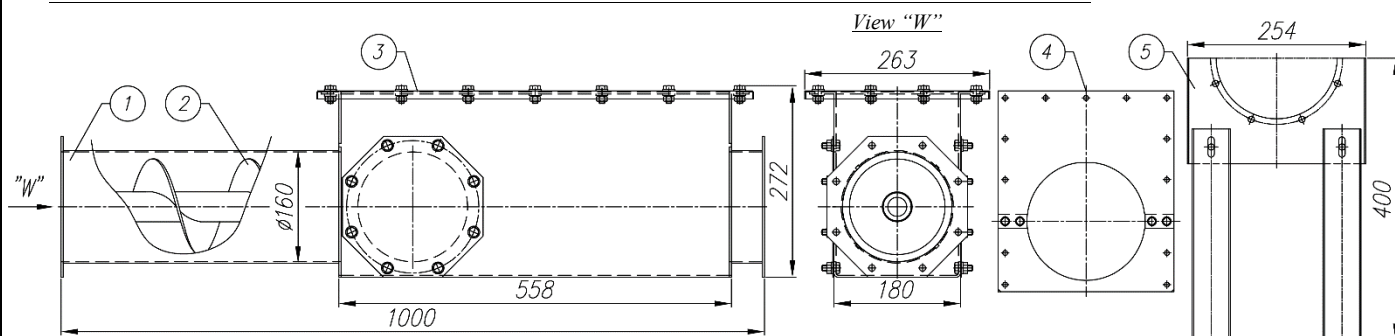


Fig.III.4 **PS160-P1.0X** – a screw conveyor extension of Ø160 mm, 1 m.

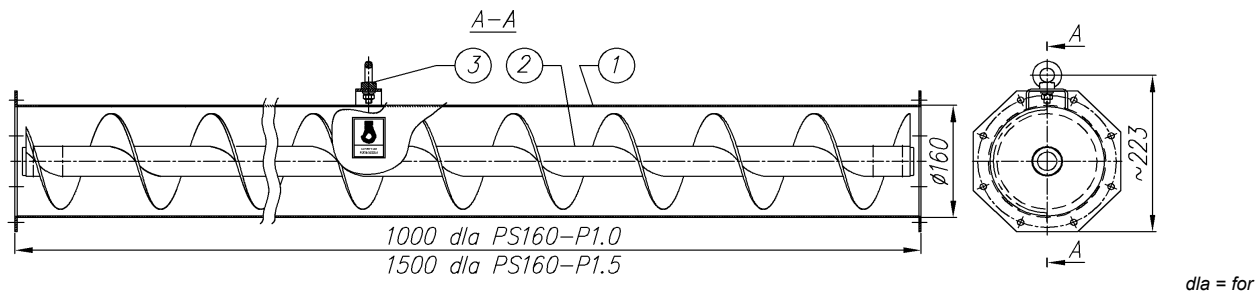


Fig.III.5 **PS160-P1.0**-a screw conveyor of –160 mm – 1 m.

PS160-P1.5-a screw conveyor of –160 mm – 1.5 m.

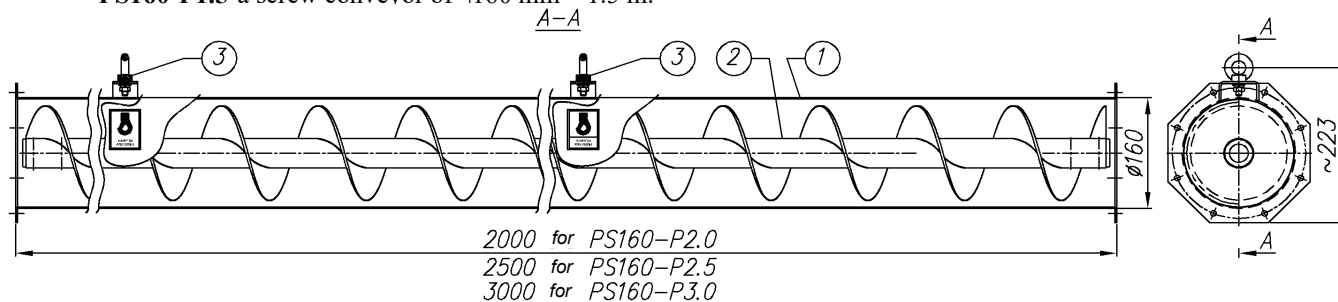


Fig.III.6 **PS160-P2.5**-a screw conveyor of –160 mm – 2.5 m.

PS160-P2.0-a screw conveyor of –160 mm – 2.0 m.

PS160-P3.0-a screw conveyor of –160 mm – 3.0 m.

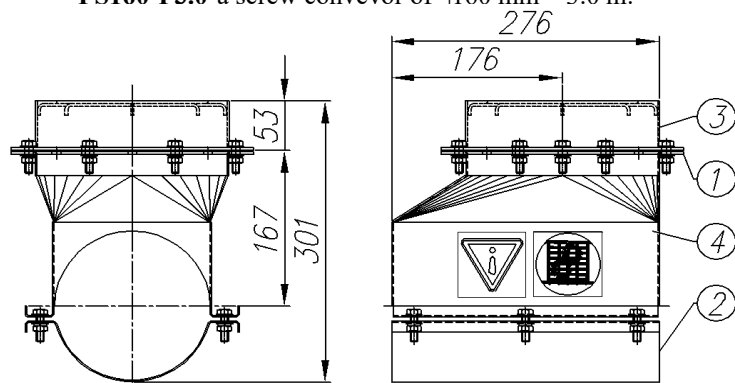


Fig.III.7 **PSU160-I/O-200**-an inlet/outlet of Ø200 to the screw conveyor PS160

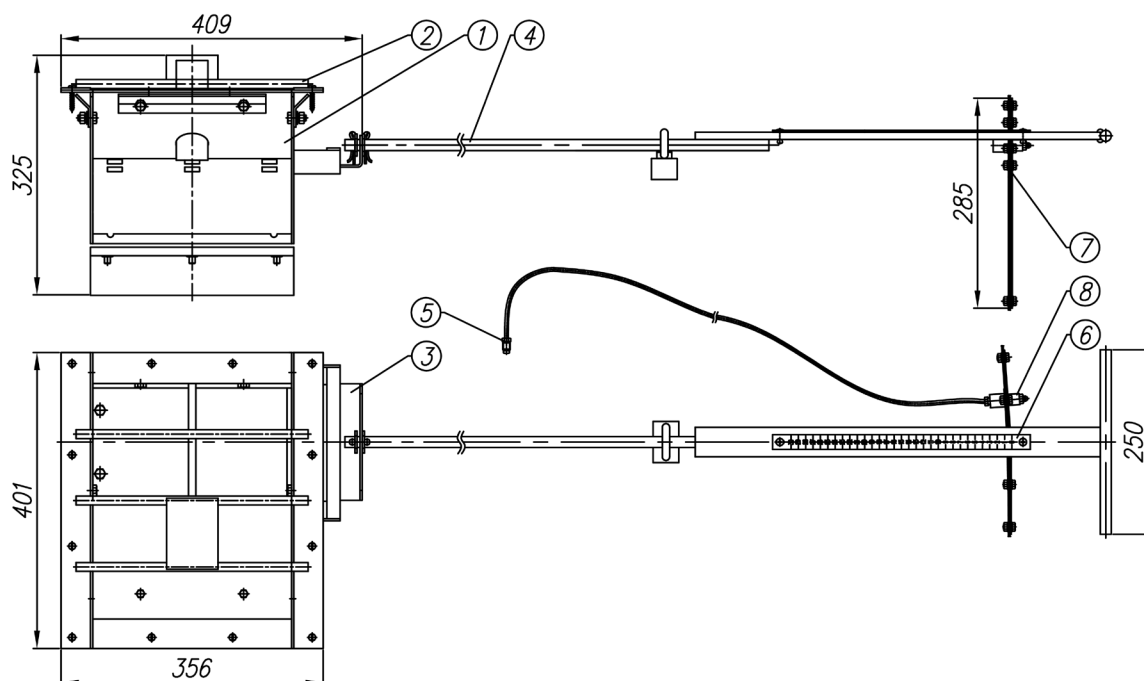


Fig.III.8 **PSU160-WL-CENT**- a central outlet from the silo to the screw conveyor PS160

1.1. Product design and intended use

Intended use of PS160 conveyors

Screw conveyors PS160 are intended to be used for transport of cereal and maize grain, and oil seeds. Furthermore, they can collect transported material from under feed hoppers, unloading hoppers, tanks or conveyors, and move it to other tanks or conveyors. In particular, they can be used to transport grain from/to silos manufactured by BIN, between silos, and from an inlet hopper to a bucket conveyor, etc.

Conveyor PS160 design

The PS160 screw conveyors are of modular design. All units produced as a part of the PS160 system are shown in the Section III.1 of this operating manual. The selection of applied modules is influenced by technological and technical requirements, as well as investor's needs. The design of individual modules is as follows:

-PS160-N1.5/400-A 1.5 kW, 400 rpm drive (Fig. III.1) consists of a worm reducer, 1, of a reduction ratio $i = 7$, driven by an electric motor, 6, of a motor power 1.5 kW and rotational speed of 3000 rpm; the reducer is mounted on a special adapter, 5, facilitating installation of other PS160 conveyor system modules. The drive hub, 4, mounted on the reducer, 1, via a key joint, 13, a circlip, 3, and a hexagonal washer, 2, transfers the drive power from the electric motor, 6, via the reducer. Moreover, the PS160-N1.5/400 includes the end hub unit, comprising of the end flange, 7, to which the bearing unit, 8, with an end hub, 9, is connected. The complete module also includes bolts, nuts and washers, which are necessary to install other PS160 system modules, as well as safety signs (stickers), a nominal plate and electric equipment.

-PS160-N3.0/400-A 3.0 kW, $n=400$ rpm drive (Fig. III.2) consists of a worm reducer, 1, of a reduction ratio $i = 7$, driven by an electric motor, 6, of a motor power 3.0 kW and rotational speed of 3000 rpm. The reducer is mounted on a special adapter, 5, facilitating installation of other PS160 conveyor system modules. The drive hub, 4, mounted on the reducer via a key joint, 13, a circlip, 3, and a hexagonal washers, 2, transfers the drive power from the electric motor, 6, via the reducer, 1. Moreover, the PS160-N3.0/400 includes the end hub unit, comprising of the end flange, 7, to which the bearing unit, 8, with an end hub, 9, is connected. The complete module also includes bolts, nuts and washers, which are necessary to install other PS160 system modules, as well as safety signs (stickers), a nominal plate and electric equipment.

-PS160-LOZ/P1-A polyamide intermediate bearing (see Fig. III.3), consists of a bearing casing, 1, in which a slide bearing, 3, is mounted and secured with circlips, 4. The slide bearing, 3, is used for installation of the intermediate hub, 2, and it is lubricated via the special lubrication bore ending with a greasing nip, 5. The complete module also includes bolts, nuts and washers, which are necessary to install other PS160 system modules.

-PS160-P1.0X- a screw conveyor extension of $\sim 160\text{mm} - 1\text{ m}$ long (Fig. III.4). This module includes a screw, 2, 980 mm long and \sim of 136 mm, and screw casing, 1, 1000 mm long, 2 covers, 4, and fixing of the extension, 5.

The extension has holes in side walls and a cover, 3, with which one or two PS160 conveyors can be connected at a right angle. A PS220 conveyor can be connected on the top, after making a hole in the cover, 3. The fixing system for the extension, 5, is used to support the conveyor and fix it to the foundation.

-PS160-P1.0- a screw conveyor of $\sim 160\text{ mm} - 1\text{ m}$ long (Fig. III.5) includes a screw, 2, 980 mm long and \sim of 136 mm, and screw casing, 1, 1000 mm long and \sim of 160 mm. The casing, 1, is provided with a transport eye, 3, its labelling sticker, 4, and a nominal plate.

PS160-P1.5- a screw conveyor of $\sim 160\text{ mm} - 1.5\text{m}$ long (Fig. III.5) includes a screw, 2, 1480mm long and \sim of 136 mm, and screw casing, 1, 1500mm long and \sim of 160 mm. The casing, 1, is provided with a transport eye, 3, and its labelling sticker.

PS160-P2.0- a screw conveyor of $\sim 160\text{ mm} - 2.0\text{ m}$ long (Fig. III.6) includes a screw, 2, 1980 mm long and \sim of 136 mm, and screw casing, 1, 2000 mm long and \sim of 160 mm. The casing, 1, is provided with two transport eyes, 3, and their labelling stickers.

PS160-P2.5- a screw conveyor of $\sim 160\text{ mm} - 2.5\text{m}$ long (Fig. III.6) includes a screw, 2, 2480mm long and \sim of 136 mm, and screw casing, 1, 2500mm long and \sim of 160 mm. The casing, 1, is provided with two transport eyes, 3, and their labelling stickers.

PS160-P3.0- a screw conveyor of $\sim 160\text{ mm} - 3.0\text{m}$ long (Fig. III.6) includes a screw, 2, 2980mm long and \sim of 136 mm, and screw casing, 1, 3000mm long and \sim of 160 mm. The casing, 1, is provided with two transport eyes, 3, and their labelling stickers.

-PSU160-I/O-200- inlet/outlet of $\varnothing 200$ for the screw conveyor PS160 (Fig. III.7), consists of a body, 4, which, together with a clamp, 2, facilitates installation of this unit on the screw conveyor casing, of $\sim 160\text{ mm}$. To ensure a required level of safety, the inlet/outlet is provided with a guard, 3, screwed to the flange, 1.

-PSU160-WL-CENT-The central inlet from the silo to the screw conveyor (Fig. III.8) is a module, with which the PS160 screw conveyor systems may be operated as an underfloor unloading screw conveyor for BIN silos. This module consists of the body, 1, which is connected to the silo bottom and to the PS160 screw conveyor. The body, 1, contains a shutter, 3, controlled by a pull cable, 4, equipped with an indicator, 6, showing the width of shutter opening as centimetres. To ensure a required level of safety, the central inlet is provided with a guard, 2, screwed to the body, 1. Moreover, this module includes the silo jacket cover, 7, with PS160-LOZ/P1 intermediate bearing lubrication system parts, 5 and 8, mounted on it.

1.2. Technical specification and completing

		PS160-N1.5/400	PS160-N3.0/400	PS160-LOZ/P1	PS160-P1.0X	PS160-P1.0	PS160-P1.5	PS160-P2.0	PS160-P2.5	PS160-P3.0	PSU160-I/O-200	PSU160-WL-CENT
Motor type		Skg80 2PC	Skg90L 2PC	-	-	-	-	-	-	-	-	-
Nominal motor power	kW	1.5	3.0	-	-	-	-	-	-	-	-	-
Engine rotational speed	rpm	3000	3000	-	-	-	-	-	-	-	-	-
Power supply voltage	V	3x400	3x400	-	-	-	-	-	-	-	-	-
Frequency	Hz	50	50	-	-	-	-	-	-	-	-	-
Protection class (IP)		54	54	-	-	-	-	-	-	-	-	-
Screw rotational speed	rpm	400	400	-	-	-	-	-	-	-	-	-
Screw diameter (Ø)	mm	-	-	-	136	136	136	136	136	136	-	-
Total length	mm	-	-	210	1000	1000	1500	2000	2500	3000	276	-
Total height	mm	423	493.5	-	265	-	-	-	-	-	301	325
Dimensions (diameter) of	mm	-	-	-	-	-	-	-	-	-	200	356x401
Device weight	kg	22	29	4.5	40	20	28	36	44	52	8	33

Table III.1 Technical specification of PS160 system modules.

In no device shown in the manual, the level of noise exceeds 70 dB(A).

- The simplest version of the screw conveyor constructed of PS160 system modules (Fig. III.9) consists of: a drive, 3, PS160-N1.5/400 or PS160-N3.0/400; a screw conveyor, 1, PS160-P1.0, PS160-P1.5, PS160-P2.0, PS160-P2.5, or PS160-P3.0; an inlet/outlet, 2, PSU160-I/O-200 (2 pieces) and a fitting MOCRUR200, in the number sufficient for installation conditions and the screw conveyor length (the rule is that the screw conveyor should be fixed every 3 m).
- When construction of a very long screw conveyor is required (Fig. III.12) (however, of a total screw conveyor length not exceeding 6 m for PS160-N1.5/400 drive, and 12 m for the PS160-N3.0/400 drive), install several screw conveyor extension pieces, 1, using intermediate bearings, 5, PS160-LOZ/P1.
- With a telescopic pipe (Fig. II.11), 9, RURATEL200-0.4, the screw conveyor can be connected to other technological equipment, such as bucket elevators, silos, etc.
- PS160 screw conveyors can be used as underfloor unloading devices for BIN silos (Fig. III.10 and III.12). For this purpose, add the central inlet, 8, PSU160-WL-CENT (Fig. III.8) or the central inlet, 7, PSU220-WL-CENT (Fig. III.12). When the PS160 conveyor works with PSW220-BIN100 or PSW220-BIN200, then it should be fitted with PSU160-WL-CENT or PSU220-WL-CEN (chapter IV). When an internal screw conveyor PSW500, PSW1000, PSW1500 or PSW2200 is used with the underfloor PS160 conveyor, only the central inlet PSU220-WL-CENT should be included in the system.
- With the conveyor extension, PS160-P1.0X, one or two PS160 conveyors can be connected at a right angle at the same level through intermediate bearings (PS160-LOZ/P1). A possible direction of grain transport is shown in Fig. III.16. (arrows in a frame). A simultaneous reception of transported material is possible only from one conveyor - direction.

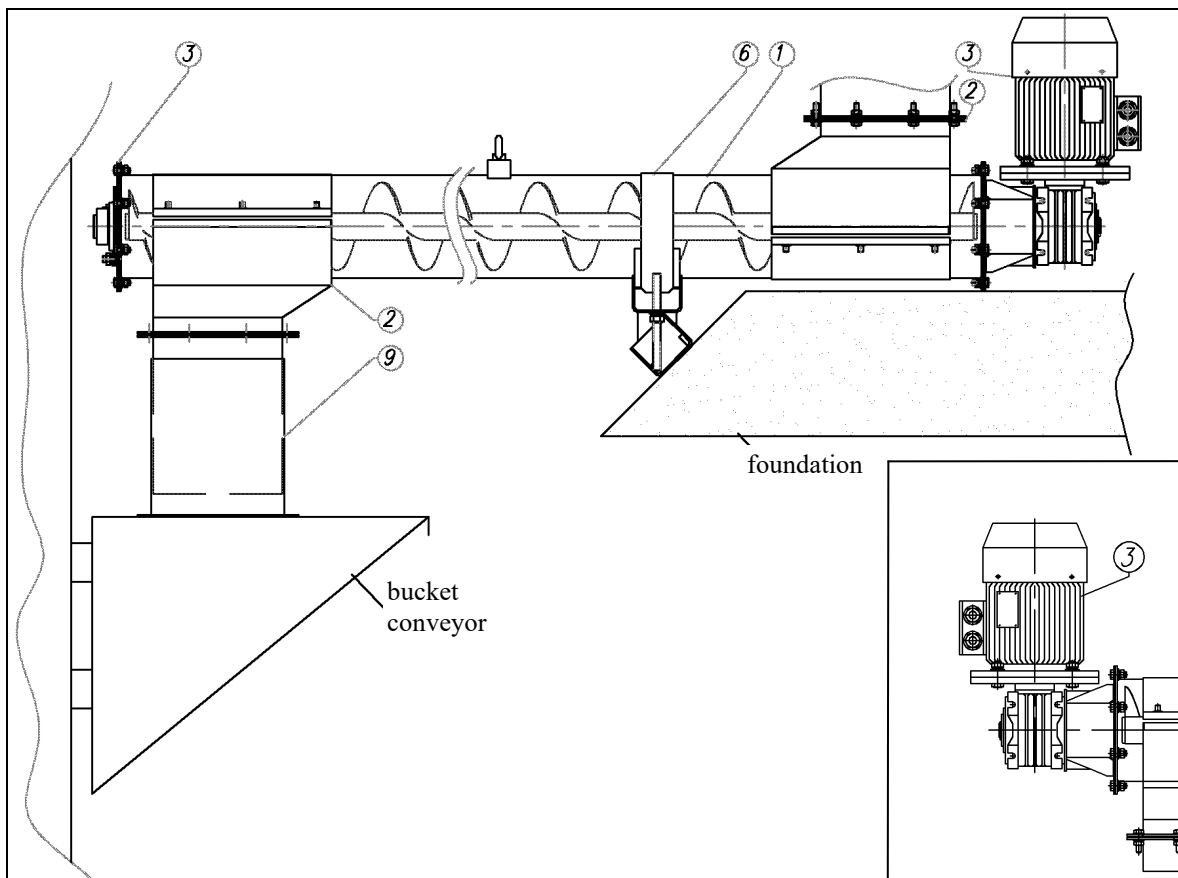


Fig.III.11 PS160-a set-up with RURATEL200-0.4

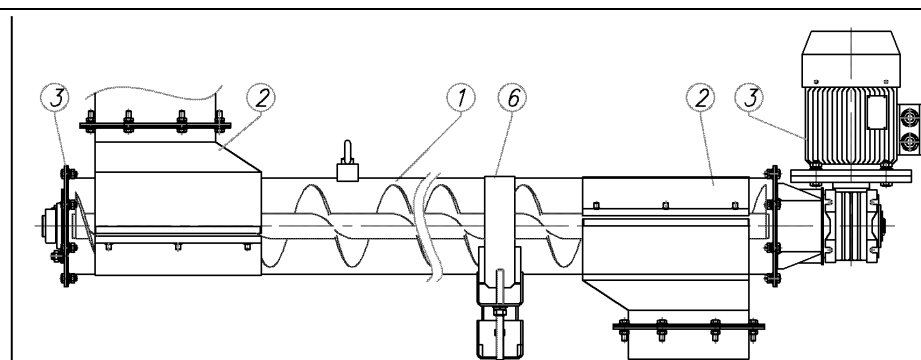


Fig.III.9 PS160- a basic set-up

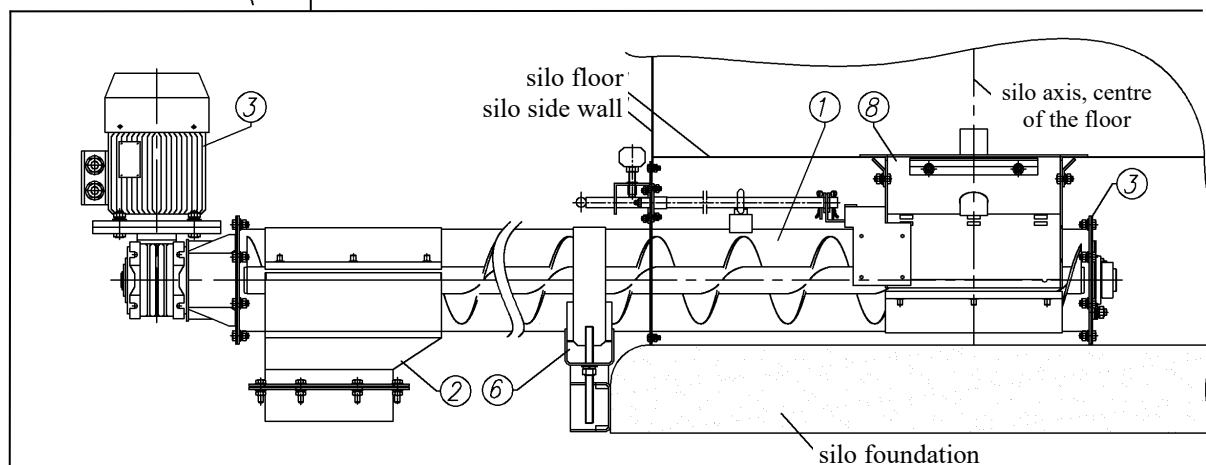


Fig.III.10 PS160-a set-up with PSU160-WL-CENT

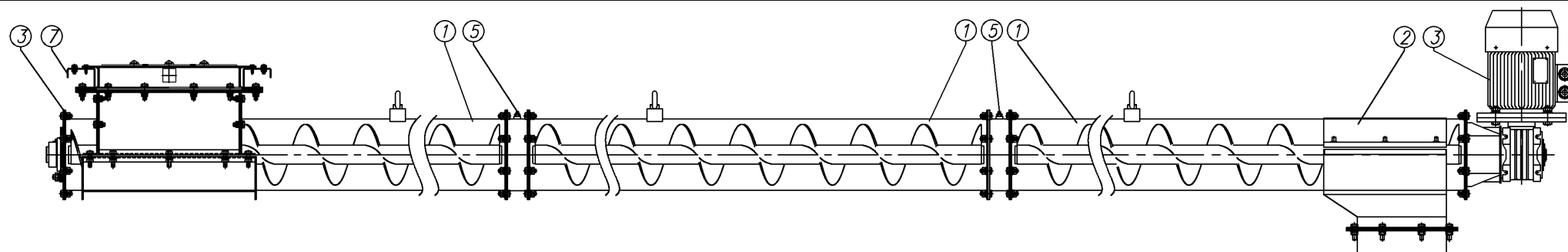


Fig.III.12 PS160-a set-up with PSU220-WL-CENT

2. Installation and start-up

2.1. Conveyor installation

Screw conveyors from the PS160 system, depending on needs and their intended use, can be assembled in very different ways. The manufacturer accepts an option for horizontal operation of these devices. However, regardless of the method and the type of operation, the conveyors must be installed on a stable base, and a distance between components fixing the conveyor housing to the base should not exceed 3 m. The conveyor should be installed in a way ensuring its stable position (supported) at its ends, i.e., near the driving gearmotor and the end hub. This type of installation prevents unforeseen movement of the conveyor, vibrations, etc.

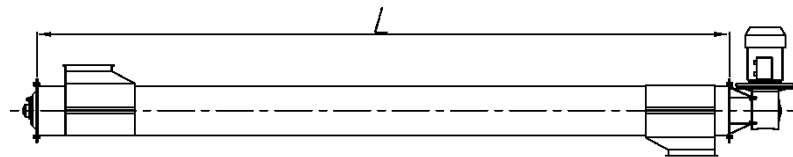
A pipe fixing element, MOCRUR200, manufactured by BIN should be used to fix conveyors to the base.

Depending on the needs and a type of the PS160 units used, (inlet and outlet) holes should be made in the conveyor housing and components for fixing of the above units should be installed (Figs. III.13, III.14 and III.15).

Installation of the conveyors requires use of special equipment, and relevant know-how. Therefore, the equipment can only be installed by installation companies authorised by BIN. The installation company should cooperate with an entity ordering installation, in terms of works organisation, financial settlements, and acceptance of installation works.



When the Investor itself or any other installation company not authorised by BIN installs the conveyor(s), the Investor is obliged to obtain the detailed conveyor installation instruction from the manufacturer and place (stick) warning and information signs on the product.



L - the conveyor length as m;

α - conveyor incline angle as $^{\circ}$,

φ_{\max} – maximum filling of a conveyor with transported material, as %;

W - capacity as tonnes/hour

Fig.III.13 Indications for tables 3 and 4.

L (m)	$\alpha = 0^{\circ}$	
	φ_{\max} (%)	W (tonnes/hour)
3	80	28
4.5	75	26
5	70	24
6	65	23

Table III.2 Indicative data for designing screw conveyors using the PS160-N1.5/400 module.

L (m)	$\alpha = 0^{\circ}$	
	φ_{\max} (%)	W (tonnes/hour)
7	75	27
8	70	25
9	70	25

Table III.3 Indicative data for designing screw conveyors using the PS160-N3.0/400 module.

When designing or working with a system of conveyors, it should be remembered that capacity of those devices depends, among others, on:

- type of transported material;
- moisture content of transported material;
- contamination level;
- level of conveyor through filling.

Therefore, values specified in tables III.2 and III.3 should be treated solely as indicative and general guidelines for designing a conveyor system.



When using PS160 screw conveyors as unloading devices in BIN silos, it is forbidden to install more than one (in one silo) PSU160-WL-CENT or PSU220-WL-CENT inlet or installing that inlet not centrally.



The total length of the screw conveyor constructed using PS160 modules cannot exceed 6 m for the PS160-N1.5/400 drive, and 12m for the PS160-N3.0/400 drive.



The manufacturer does not provide for conveyor work with an uncovered (open) inlet/outlet. Both inlet and outlet should be adapted for connection of auxiliary devices (pipes of other conveyors, downpipes, etc.) or use securing covers being standard equipment of relevant PS16 systems.

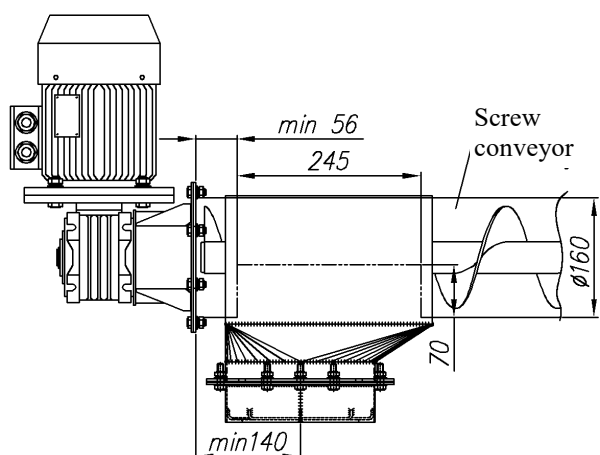


Fig. III.14 Installation method for the PS160-I/O-200

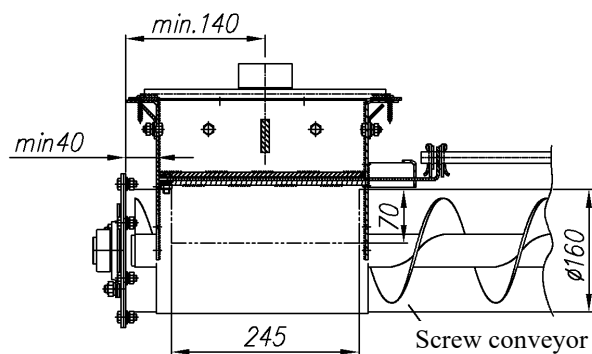


Fig. III.15 Installation method for the PS160-WL-CENT module.

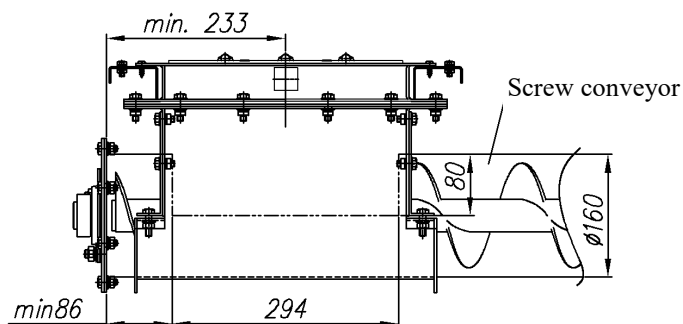


Fig. III.16 Installation method for the PS220-WL-CENT module.

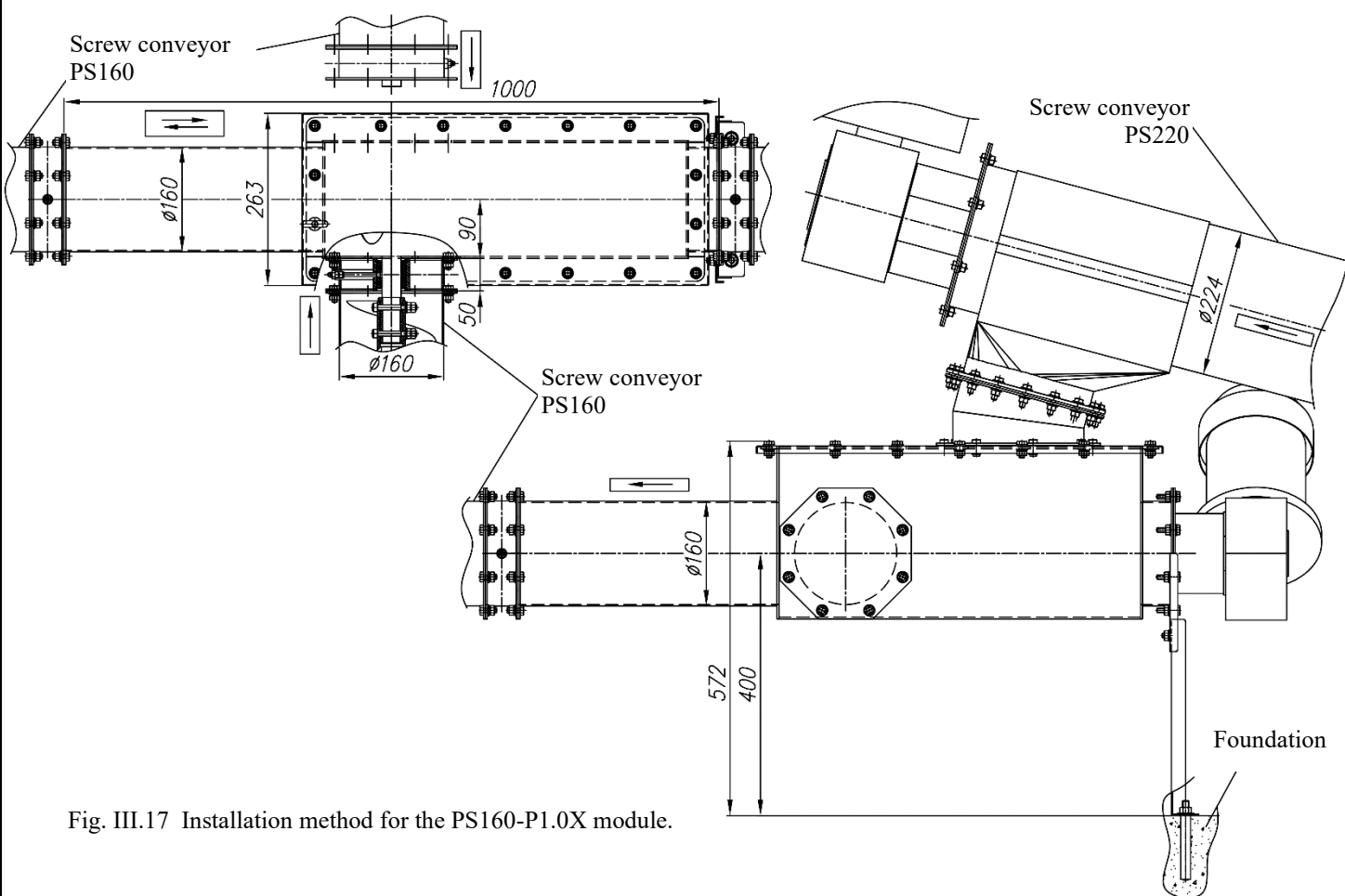


Fig. III.17 Installation method for the PS160-P1.0X module.

2.2. Electrical systems and start-up

The manufacturer equips conveyors with the following electrical subunits:

- three-phase electric motor;
- lockable main switch;
- motor (thermal) switch,
- undervoltage release,
- housing for the thermal switch and the undervoltage release.

The design documentation of the investment must include appropriate design study for the wiring system, taking into account the conveyor connection together with auxiliary equipment. The investor is responsible for drawing up such design study by a person holding relevant licences in accordance with current legislation.

The investor is responsible for construction of the electrical wiring system in accordance with the said design study by an electrician holding relevant licences.

Regardless of the function and construction method, the design study and the constructed wiring system must meet the following requirements:

- motor correctly connected (as required by a motor manufacturer),
- motor secured by a correct connection and adjustment of the thermal switch;
- securing against unintended starting of the conveyor after power outage;
- option for securing the conveyor against unintended start (e.g., a lockable main switch),
- voltage supplied to all units should be within ranges specified by manufacturers of those units;
- function for automatic stop of the conveyor work in the event of any incorrect work of accessories (e.g., failure of another conveyor) or people entering areas dangerous for them (e.g., a silo in which the conveyor works)

The investor is responsible for delivery (at its own expense) of all electrical equipment and units not being a part of the conveyor equipment, but necessary for construction of required electrical wiring.

The investor is responsible for providing guidelines of the conveyor manufacturer (included in this operating manual) to a person designing and constructing the wiring system.

A person constructing the wiring system should perform the first test starting of the conveyor, check correctness of the motor rotations and consistence of current values on nominal plates of the motor and the thermal switch.

The producer requires a written confirmation of construction and checking of the wiring system by an electrician holding required licences.

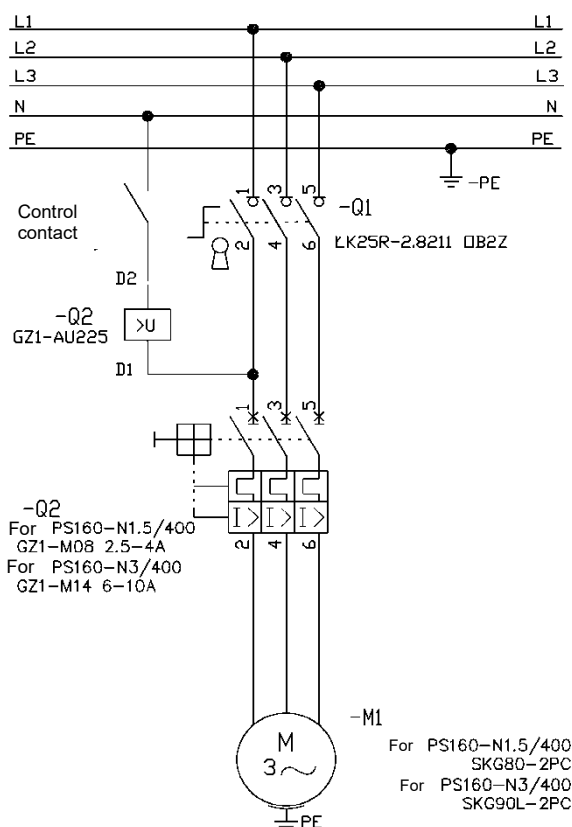


Diagram III.1. An example of wiring for the PS160-N1.5/400 and PS160-N3.0/400 conveyors.

The above diagram represents general guidelines for construction of the wiring system for the PS160 conveyor. The units used can be replaced by equivalent devices having identical functions. The investor is responsible for drawing up of a design study for the electrical wiring by a person holding relevant licences in accordance with current legislation. The investor is responsible for construction of the electrical wiring system in accordance with the said design study by an electrician holding relevant licences.

- M1: Three-phase electric motor,
- Q2: Thermal overcurrent circuit breaker with undervoltage release,
- Q1: Lockable main switch;

- K: The control contact; when closed, the contact enables operation of PS160, when open, PS160 cannot work; the contact should open in the case of:
- an attempt to enter the silo by opening a manhole when PS160 operates as an unloading/loading conveyor for the silo;
 - stopping of the conveyor or other equipment responsible for efficient reception of grain from PS160,
 - other conditions (depending on individual investment solutions), when further work of PS160 may pose a threat to health or life of humans or animals, or may result in a damage to the conveyor or other equipment.

3. Operation

3.1. Operation of conveyors

Methods for starting and stopping the conveyor may differ from those described below. This results from a design of the electrical wiring system, in which used electrical units (mainly control devices) differ from those delivered by the conveyor manufacturer.

Starting the conveyor

PS160-N1.5/400 or PS160-N3.0/400

- Set the main switch in the position "I" (Fig.III.16),
- Press the black on button on the motor switch (Fig. III.16);

Stopping the conveyor

PS160-N1.5/400 or PS160-N3.0/400

- Cut the grain inflow to the conveyor (close the shutters) and wait until the device is completely empty,
- Press the red off button on the motor switch (Fig. III.16).
- Set the main switch in the position "0" (Fig.III.16),

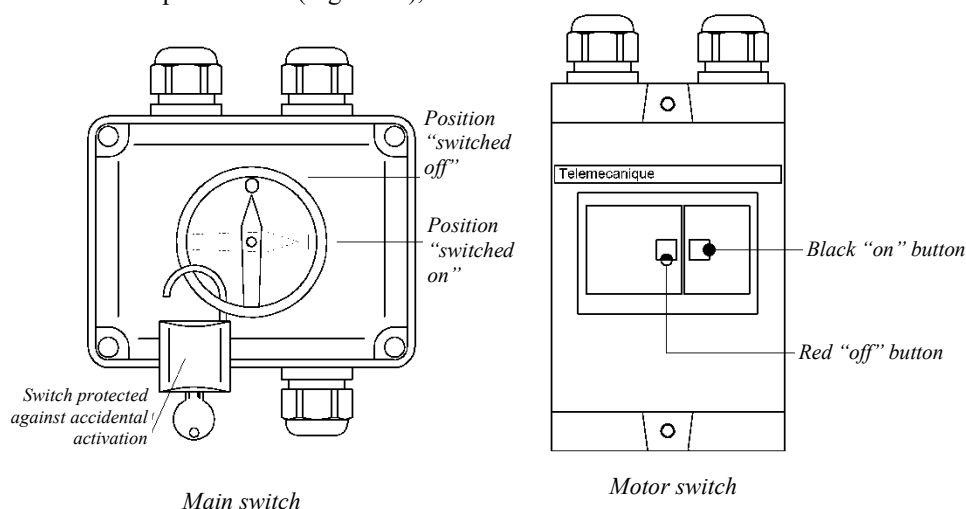


Fig.III.18. Conveyor control devices for PS160-N1.5/400 or PS160-N3.0/400

Grain transport

Before starting the grain transport:

- check the operational condition of conveyors and their accessories;
- ensure that there are no people at locations of grain inlet and outlet;
- arrange efficient collection of material from the conveyor outlet, to prevent its blocking (overload).

It is forbidden to stop the conveyor which pipe and screw are covered with grain. This may cause problem with restarting it.



Screw conveyors must be constructed in such way that they are provided with devices dosing and cutting off the flow of transported material. The use of such devices prevents conveyor overfilling (blocking) and damaging.

The system of conveyors is not suitable for transport of material that is highly contaminated, locally aggregated, etc. Any attempt to transport such grain may result in overload or damage, and in consequence, stopping of the device.

When the above remarks are considered, the conveyor can be started.



In an emergency, stop the device by pressing the red STOP button on the motor switch.

In the case of power outage, the system of conveyors will be permanently stopped. Restoring of power supply will not restart the devices automatically. To restart the conveyors, repeat the starting sequence from the beginning.



All conveyors are designated for working with the filling ratio not exceeding 85%. When this ratio is exceeded, the motion resistance increases significantly, and this may result in overload and blocking of the drive system (including the motor).

3.2. Conveyor maintenance

Correct and punctual maintenance inspections, maintenance and possible repairs guarantee availability of the full operating capacity of the conveyors and prevent their premature and excessive wear.

Periodic maintenance and current overhauls

Periodic maintenance covers:

- inspection of safety devices, that is, a motor switch, a main switch, etc. (correct operation, no mechanical damage, etc.);
- inspection of the electrical wiring system by an authorised electrician;
- inspection of a technical condition of welded, screwed and other connections;
- inspection of anti-corrosion coatings;
- inspection of sliding and rolling bearings;
- lubrication of sliding bearings;
- cleaning and lubrication of a shutter drive screw;
- inspection of other moving and fixed components.

Maintenance frequency:

The periodic inspection frequency should be adapted to intensity of use, but they should take place at least once a year. All safety devices, i.e., the motor switch, the main switch, and other, should be inspected at least once a month or before each start of conveyors, as well as after each longer break in operation.



At least once a year, the User should order a qualified electrician holding relevant licences to inspect all electric equipment components.



The conveyors are equipped with a system for lubrication of sliding bearings. These bearings should be filled with grease after every 30 hours of work.



When the central inlet, PSU220-WL-CENT, is used, (after each start) the drive screw of the control shutter should be cleaned and lubricated with solid grease.

The regular maintenance includes small repairs, and possible repairs of anti-corrosion coats. Anti-corrosion coating of screws can be damaged during installation (tightening). In such case, regular repairs include applying anti-corrosion coatings on damaged surfaces.

General overhaul

Overhauls are performed according to a scope and needs, depending on screw wear, connections condition, etc. (at least once every 8 years), and during them relevant parts are either repaired or replaced with new.

Such overhauls cover the scope of regular maintenance and:

- replacement of roller and sliding bearings, gaskets, etc.
- applying of new anti-corrosion coatings;
- other relevant repairs.



All damages must be repaired immediately, and parts that are damaged or worn must be repaired or replaced with new ones.

Chapter IV. Vertical screw conveyor PS220-PN

1. General product description

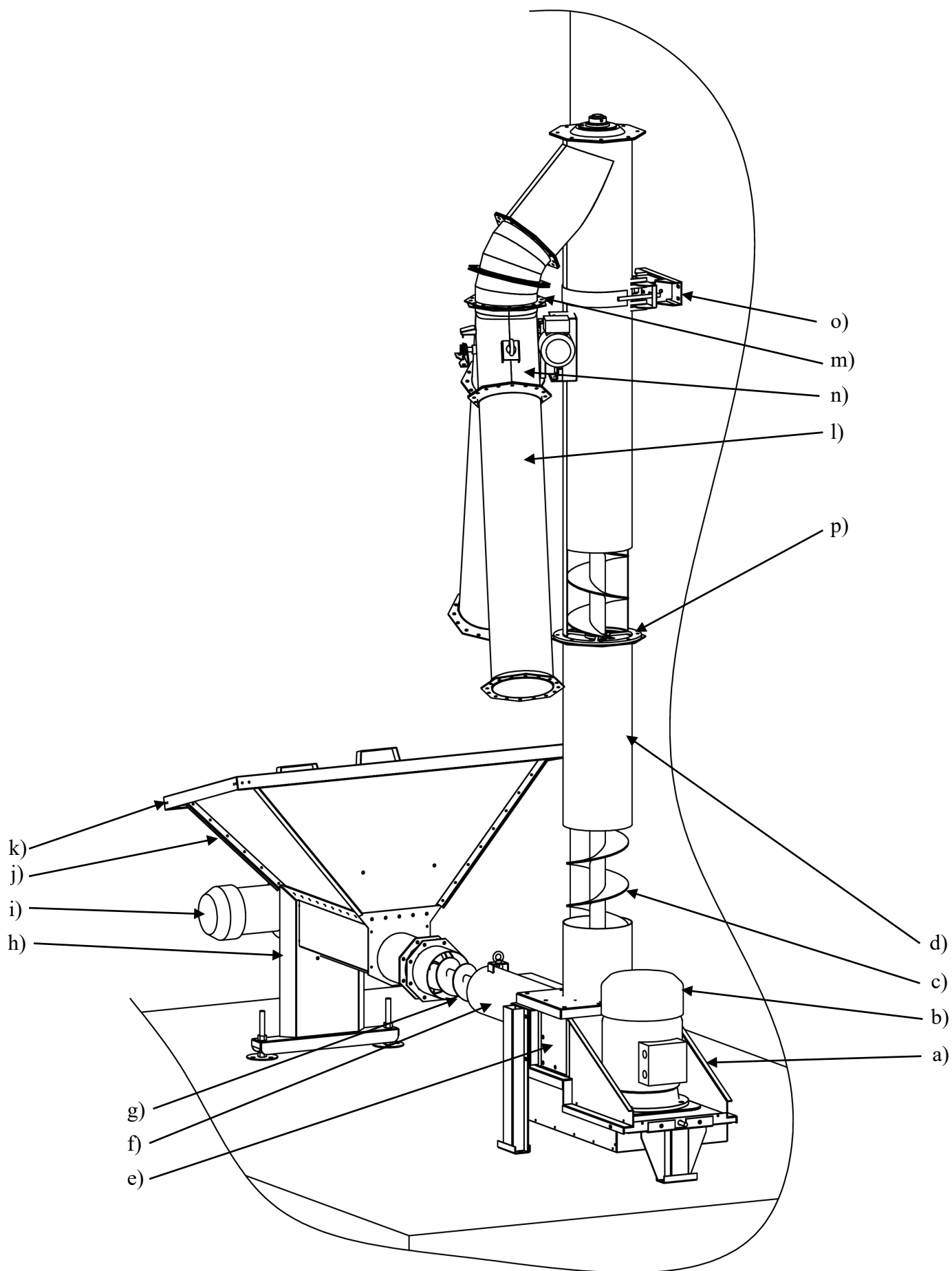


Fig. IV.1 Design and basic arrangement of the conveyor.

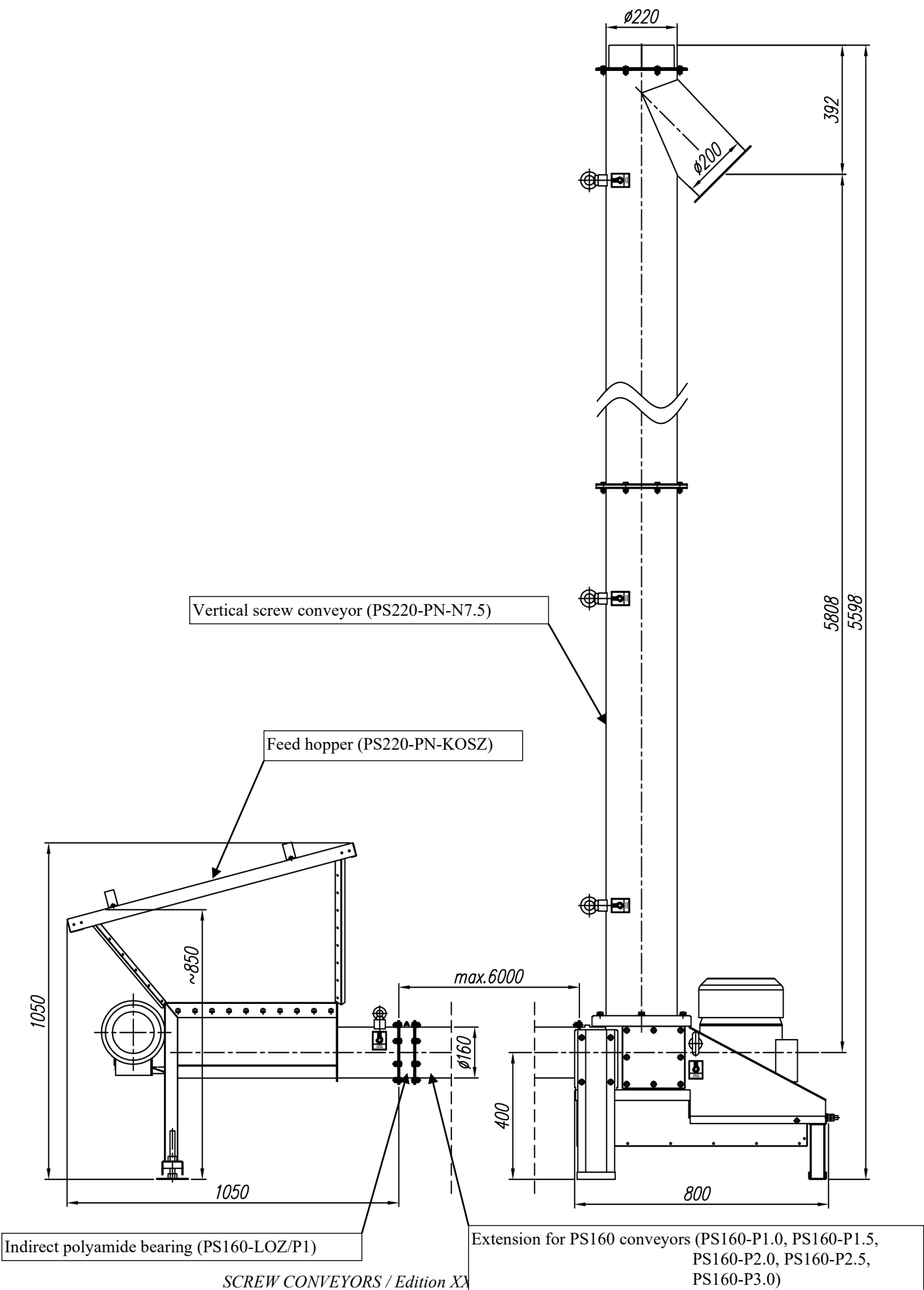


Fig. IV.2 The vertical screw conveyor with a feed hopper - basic dimensions.

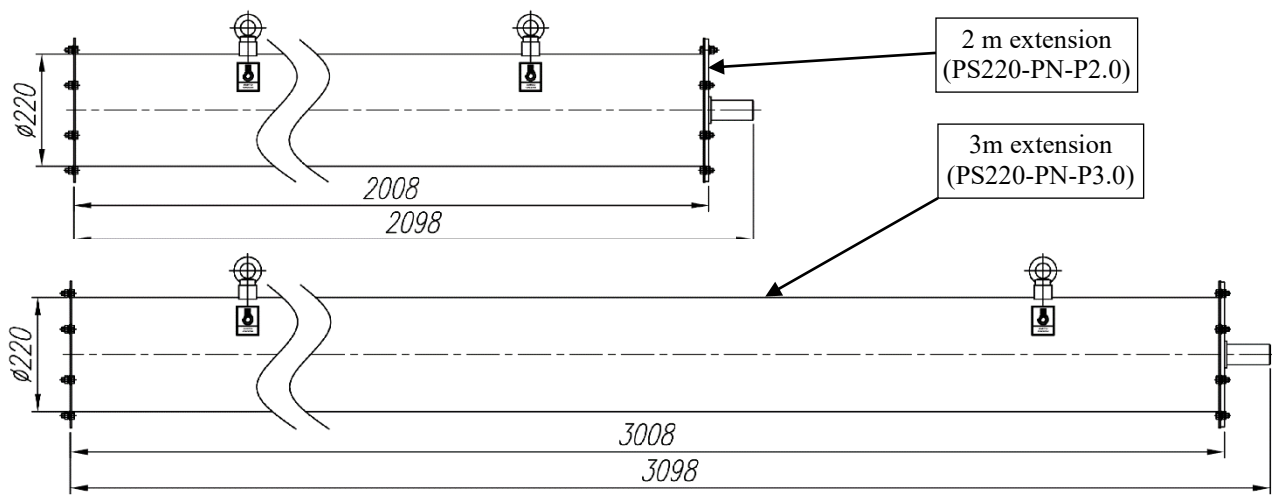


Fig. IV.3 Extensions of the vertical screw conveyor - basic dimensions.

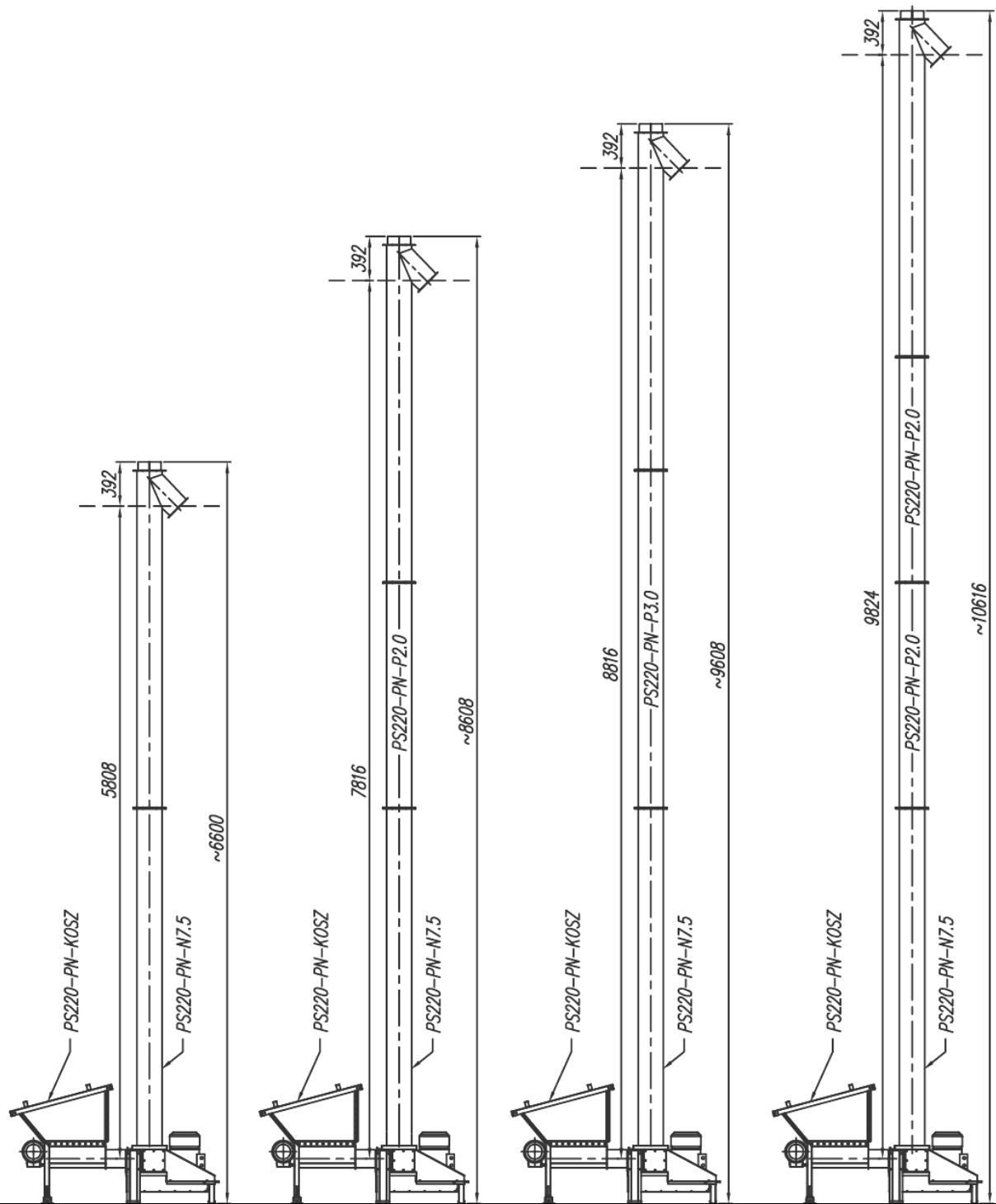


Fig. IV.4 Vertical screw conveyor - lifting height of 5.8 m, 7.8 m, 8.8 m, and 9.8 m (diagram).

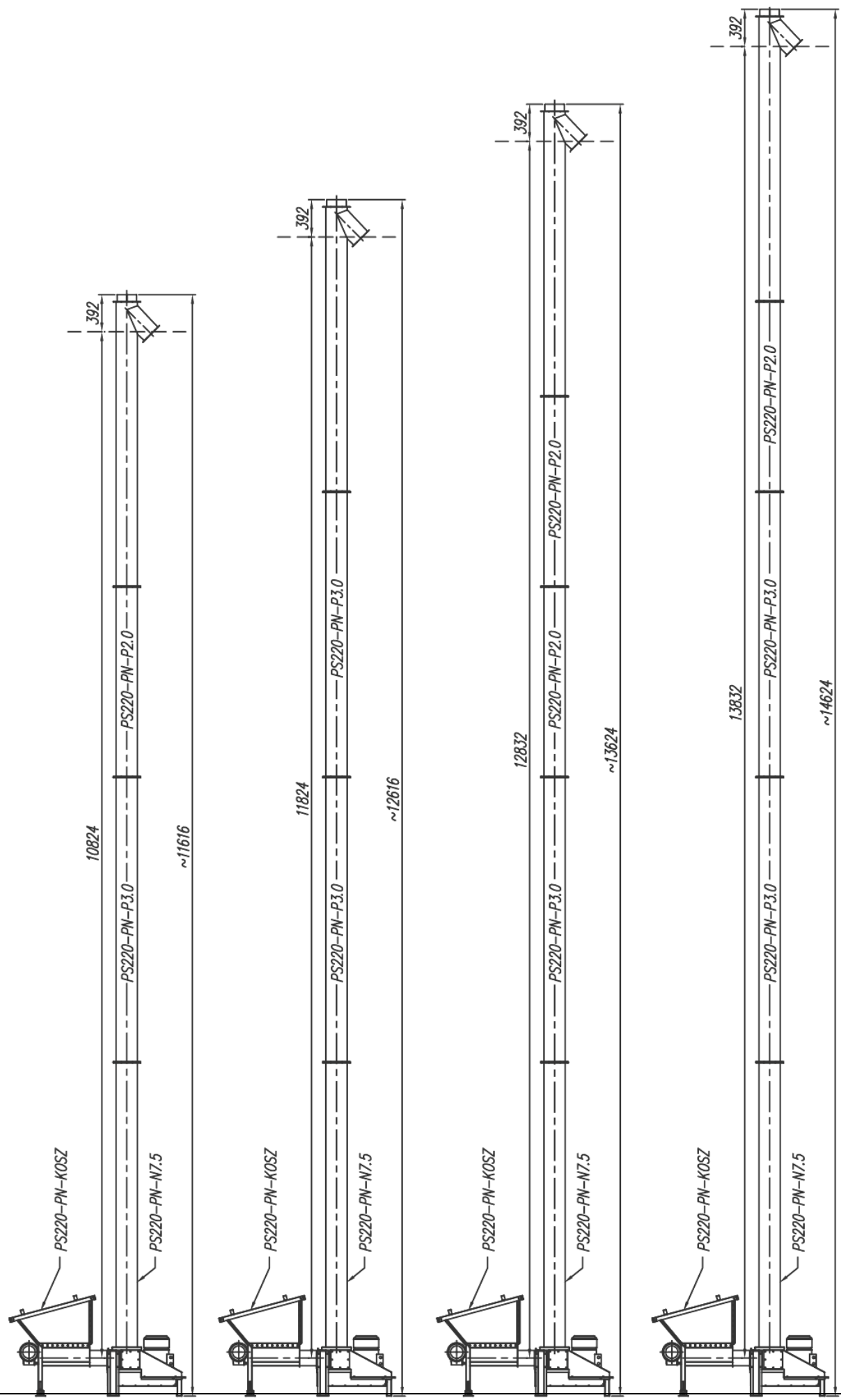


Fig. IV.5 Vertical screw conveyor - lifting height of 10.8 m, 11.8 m, 12.8 m, and 13.8 m (diagram).

1.1. Product design and intended use

Vertical screw conveyors, PS220-PN, are stationary devices intended to be used for vertical transport of cereal and maize grain, and oil seeds. They enable transport of material to a certain height, while requiring small space for their erection. They are necessary to construct and organise grain storage places. Particularly useful for loading and unloading of grain silos.

NOTE: The screw conveyor must always be fixed to structural components, ensuring its stability. This function can be fulfilled by other structure or specially constructed tower.

The picking list of each screw conveyor should contain:

- PS220-PN-N7.5 - a vertical screw conveyor of a total height of 6.6 m;
- PS220-PN-KOSZ - a feed hopper for a vertical conveyor;
- PS220-PN-P3.0 - vertical conveyor extension of a total length of 3 m;
for a vertical conveyor of the total height of 9.6 m - 1 piece PS220-PN-P3.0,
for a vertical conveyor of the total height of 11.6 m - 1 piece PS220-PN-P3.0,
for a vertical conveyor of the total height of 12.6 m - 2 pieces PS220-PN-P3.0,
for a vertical conveyor of the total height of 13.6 m - 1 piece PS220-PN-P3.0,
for a vertical conveyor of the total height of 14.6 m - 2 pieces PS220-PN-P3.0,
- PS220-PN-P2.0 - vertical conveyor extension of a total length of 2 m;
for a vertical conveyor of the total height of 8.6 m - 1 piece PS220-PN-P2.0,
for a vertical conveyor of the total height of 10.6 m - 2 pieces PS220-PN-P2.0,
for a vertical conveyor of the total height of 11.6 m - 1 piece PS220-PN-P2.0,
for a vertical conveyor of the total height of 13.6 m - 2 pieces PS220-PN-P2.0,
for a vertical conveyor of the total height of 14.6 m - 1 piece PS220-PN-P2.0.

Furthermore (depending on the investment intended use and needs), vertical screw conveyors can be provided with the following units and devices:

- PS160-P1.0, PS160-P1.5, PS160-P2.0, PS160-P2.5, PS160-P3.0 - extensions for the PS160 screw conveyor should be used to move the feed hopper, PS220-PN-KOSZ, away from the vertical conveyor PS220-PN-N7.5,
- PS160-LOZ/P1 - an intermediate polyamide bearing, should be installed when extensions of the PS160 screw conveyor were used;
- the remaining devices and subunits of the PS160 conveyor system, described in Chapter III of this operating manual
- MOCRUR200 - fixing for pipes, can be used for fixing the vertical conveyor to other structures or constructions;
- PS220-MOCBET - fixing for pipes of PS220 screw conveyors - with rawplugs for permanent fixing of conveyors to concrete.
- PK-ROZ2-200, PK-ROZ2-200/NE or PK-ROZ6-200 - two-way or six-way separators;
- RURA SP-200-1, RURA SP-200-2 - downpipes of Ø 200 mm,

Fig. IV.1 shows a PS220-PN conveyor, with its basic working unit being a screw, c), of Ø 200 mm, installed vertically in a casing, d), of Ø 220 mm and equipped with sliding bearings, p). The screw is driven by a 7.5 kW electrical motor, b), through a chain drive. The conveyor is fixed to the base with steel rawplugs, through conveyor supports fixed to the body. A spigot is installed in the conveyor body, a), for connection of the feed hopper, PS220-PN-KOSZ. The feed hopper consist of the hopper base, h), with the hopper, j), fixed to it. The hopper is equipped with a cover, k), securing it against rain and snow. A screw of 116 mm in diameter is installed in the feed hopper, driven by a 3kW electric motor, i).

When it is necessary to move the feed hopper, PS220-PN-KOSZ, away from the vertical conveyor, PS220-PN-N7.5, an extension and an intermediate bearing for conveyors of the PS160 system should be used. Furthermore, the vertical conveyor can be equipped with devices and subunits for efficient reception of transported material. They include separators, m), downpipes, l), elbows, n), pipe fixings, o), etc.

1.2. Technical specification

		PS220-PN-N7.5	PS220-PN-KOSZ	PS220-PN-P3.0	PS220-PN-P2.0
Motor type		Skg132M-4	Skg90L 2PC	-	-
Nominal motor power	kW	7.5	3.0	-	-
Engine rotational speed	rpm	1500	3000	-	-
Power supply voltage	V	3x400	3x400	-	-
Frequency	Hz	50	50	-	-
Screw rotational speed	rpm	500	400	500	500
Screw diameter (Ø)	mm	200	116	200	200
Device weight	kg	320	93	79	57
Nominal capacity	tonnes/h	up to 24*			

Table IV.1 Technical specification of a vertical screw conveyor

* the nominal capacity is determined by the material bulk density, depending on its type, size, moisture content, contamination level, etc.:

24t/h (for wheat of bulk density of 750 kg/m³)

19 t/h (for oats of bulk density of 600 kg/m³)

In no device shown in the manual, the level of noise exceeds 70 dB(A).

2. Initial operations and preparing the conveyor for operation

2.1. Conveyor installation



Installation of conveyors requires use of appropriate lifting equipment, including a freight lift and a basket lift for personnel.

Installation of the conveyors requires use of special equipment, and relevant know-how. Therefore, the equipment can only be installed by installation companies authorised by BIN. The installation company should cooperate with an entity ordering installation, in terms of works organisation, financial settlements, and acceptance of installation works.



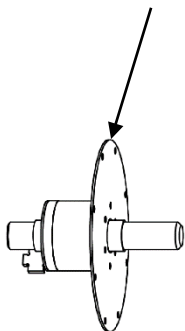
When the investor itself or any other installation company not authorised by BIN performs installation works, the Investor is obliged to obtain the detailed installation instruction from the

During installation, use lifting equipment of capacity appropriate for data specified in Table IV.1 and Figs.IV.2 and IV.3. All activities related to correct placing, appropriate fixing the conveyor along its entire height, and anchoring of the silo are performed by the investor. Anchoring means fixing the conveyor and the feed hopper to the concrete substrate with steel rawplugs (a standard part of devices - 6 pieces for the vertical conveyor and 2 pieces for the feed hopper). Correct anchoring of the conveyor must take into account conditions specified in Table IV.2 and Fig. IV.7.



It is forbidden to use and operate the conveyor that is not anchored to the substrate or not fixed to an appropriate support (along the entire conveyor height). Conveyor anchoring and fixing should be done strictly adhering to all conditions presented in Figs.IV.7 and IV.8, and Table IV.2.

A set of roller bearings of the chain drive



The conveyor screw

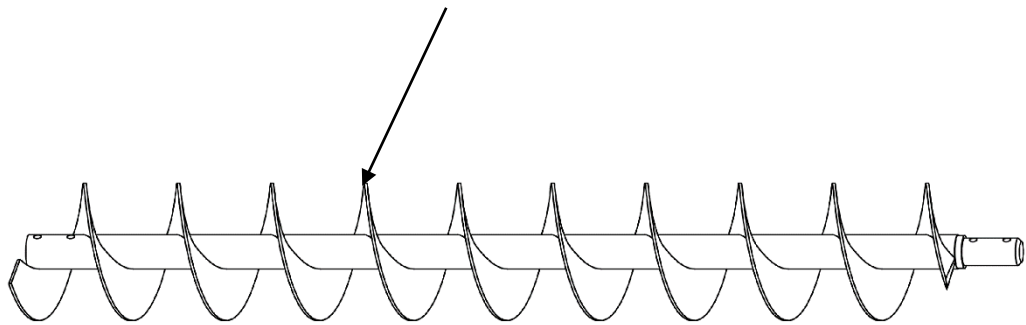


Fig. IV.6. Installation of the conveyor screws and of a set of roller bearings of the chain drive.



It is strictly forbidden to install the hub of the chain drive bearings to screws when the set of bearings is fixed to the conveyor body.

Before the screws are installed, the set of bearing must be dismounted (completely) from the body, Fig. IV.6. When the set of bearings is screwed to the body, then inserting the hub into the screw (particularly, by hammering it in) may damage the thrust bearing of the set.

Equipment	vertical screw conveyor	conveyor feed hopper
Steel rawplugs	M10/Ø16x120	M10/Ø16x120
Number of steel rawplugs (per one device)	6	2
Rawplugs installation - torque	40 Nm	40 Nm
Installation of rawplugs - a diameter of a hole in foundations	Ø 16mm	Ø 16mm
A minimum rawplug distance from the foundation edge	100 mm	100 mm

Table IV.2 Anchoring conditions for a vertical screw conveyor

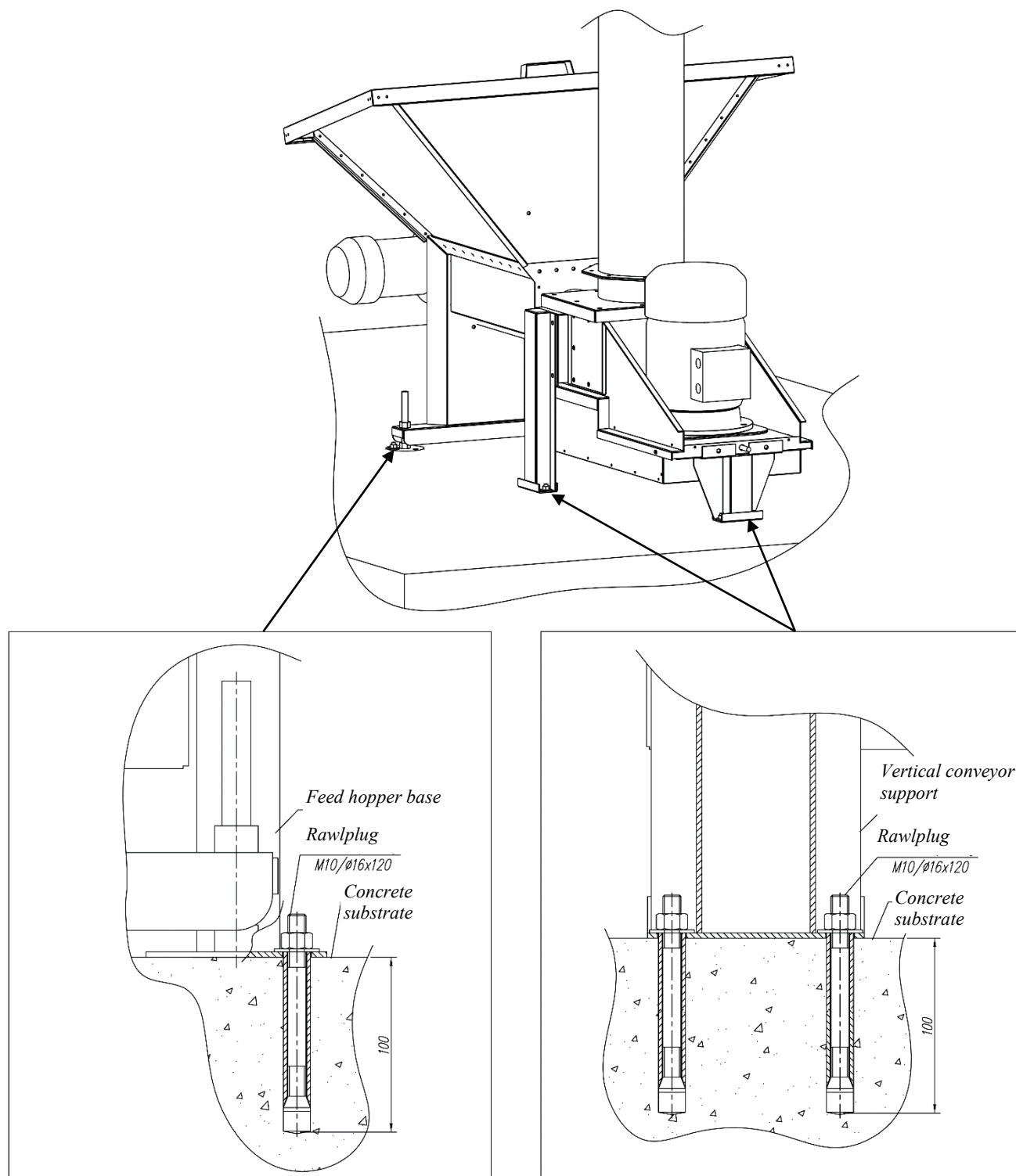


Fig. IV.7 A method for anchoring a screw conveyor and a feed hopper.

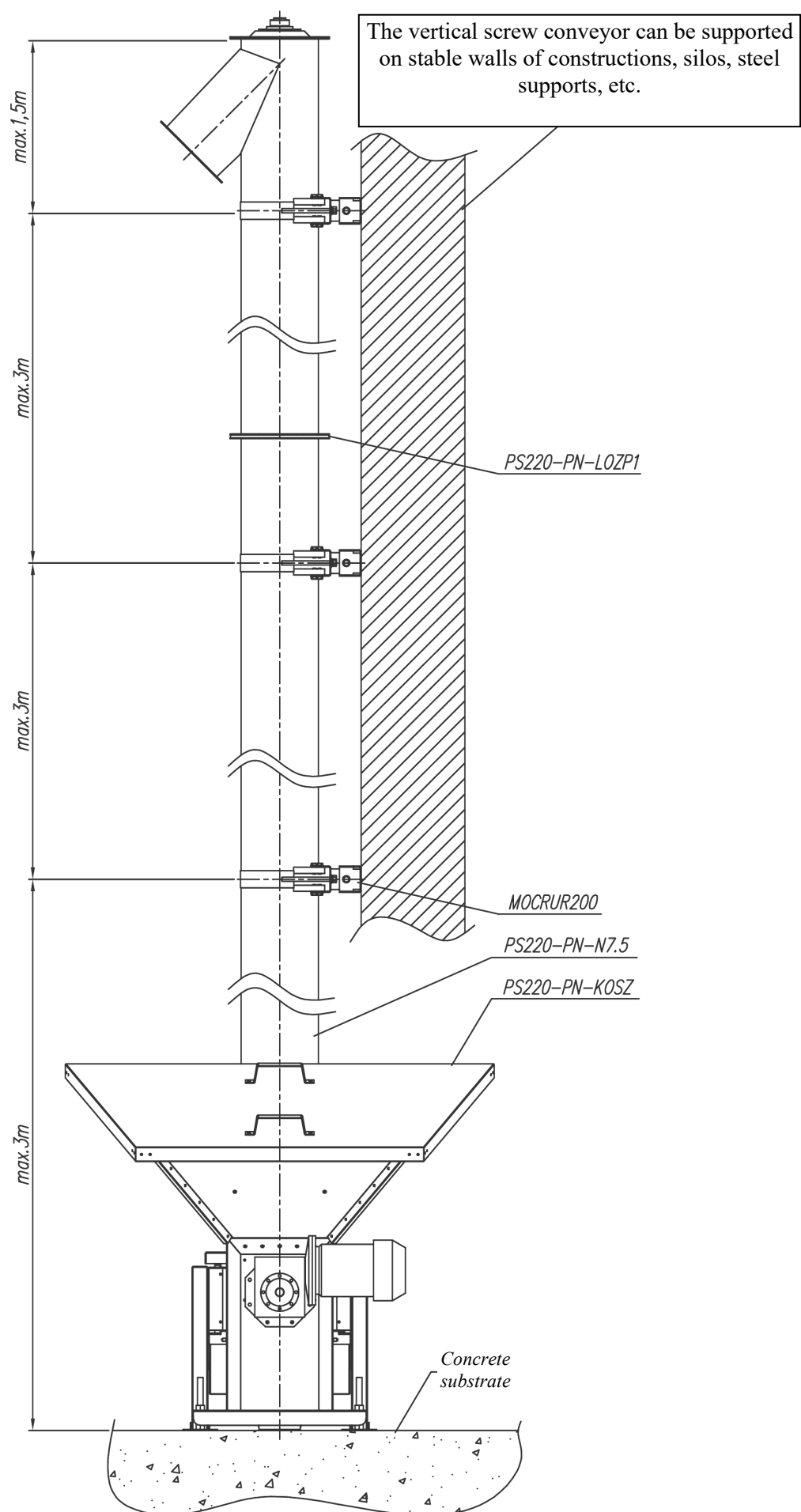


Fig. IV.8 Conditions for fixing a conveyor to a support.

2.2. Electrical systems and start-up

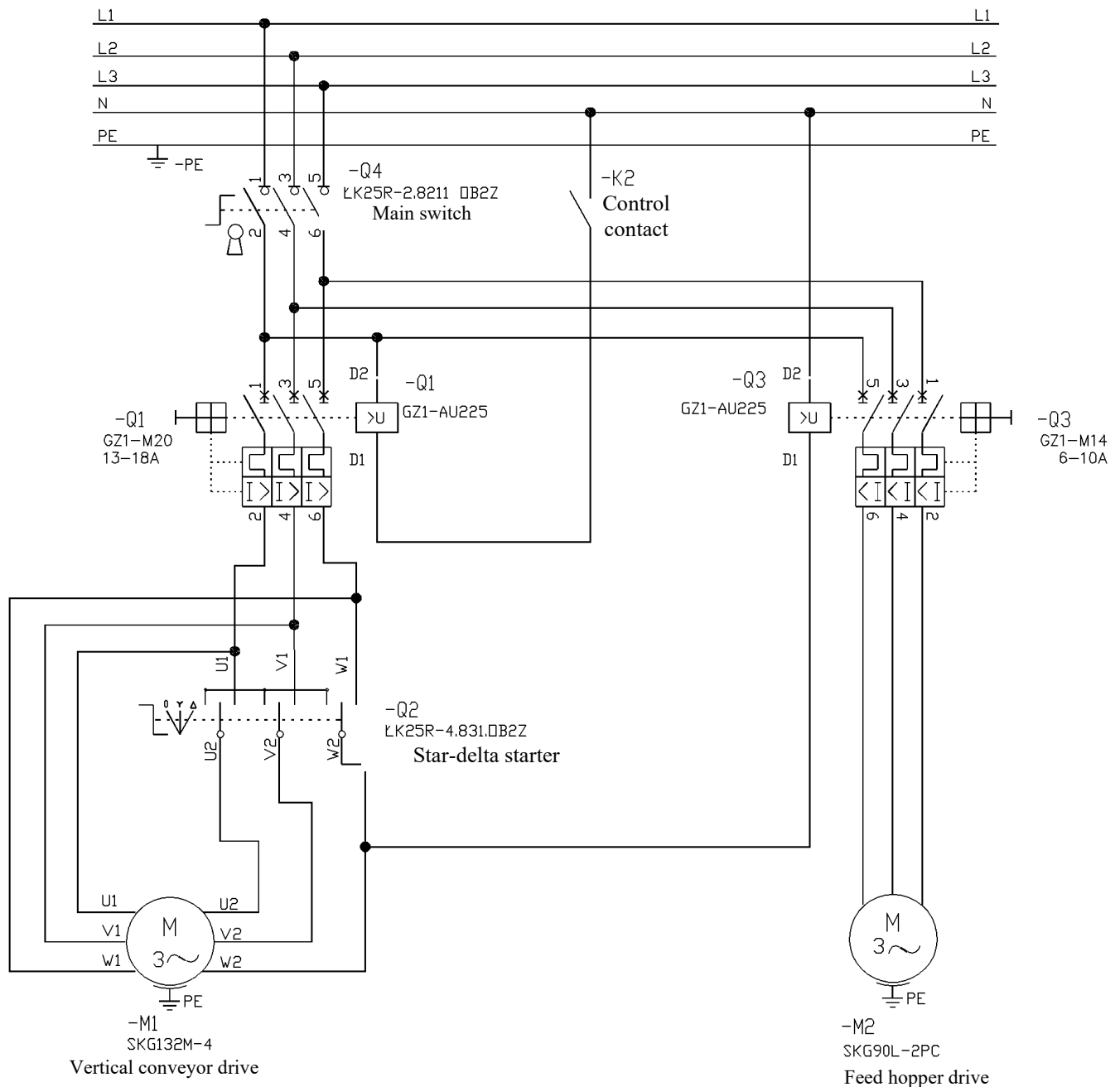


Diagram IV.1. An example of the electrical wiring system for the vertical screw conveyor PS220-PN-N7.5 and the feed hopper, PS220-PN-KOSZ.

The above diagram represents general guidelines for construction of the wiring system for a vertical conveyor with a feed hopper. The units used can be replaced by equivalent devices having identical functions. The investor is responsible for drawing up of a design study for the electrical wiring by a person holding relevant licences in accordance with current legislation. The investor is responsible for construction of the electrical wiring system in accordance with the said design study by an electrician holding relevant licences.

- M2: Three-phase electric motor of the feed hopper drive,
- M1: Three-phase electric motor of the vertical conveyor drive,
- Q3: Motor thermal overcurrent circuit breaker with undervoltage release - M2
- Q1: Motor thermal overcurrent circuit breaker with undervoltage release - M1
- Q2: Lockable star-delta starter switch;
- Q4: Lockable main switch;
- K: The control contact; when closed, the contact enables operation of PS220-PN devices, when open, PS220-PN devices cannot work; the contact should open in the case of:
 - an attempt to enter the silo by opening a manhole when PS220-PN operates as an unloading/loading conveyor for the silo;
 - stopping of the conveyor or other equipment responsible for efficient reception of grain from PS220-PN;
 - other conditions (depending on individual investment solutions), when further work of PS220-PN may pose a threat to health or life of humans or animals, or may result in a damage to the conveyor or other equipment.

The manufacturer equips vertical conveyors and feed hoppers with the following electrical subunits:

- three-phase electric motor;
- Lockable star-delta starter switch (excluding the feed hopper);
- Lockable main switch (excluding the vertical conveyor);
- motor (thermal) switch,
- undervoltage release,
- housing for the thermal switch and the undervoltage release.

The design documentation of the investment must include appropriate design study for the wiring system, taking into account the conveyor connection together with auxiliary equipment. The investor is responsible for drawing up such design study by a person holding relevant licences in accordance with current legislation.

The investor is responsible for construction of the electrical wiring system in accordance with the said design study by an electrician holding relevant licences.

Regardless of the function and construction method, the design study and the constructed wiring system must meet the following requirements:

- motor correctly connected (as required by a motor manufacturer),
- motor secured by a correct connection and adjustment of thermal switches;
- securing against unintended starting of the conveyor and the feed hopper after power outage;
- option for securing the conveyor and the feed hopper against unintended start (e.g., a main switch and a star-delta starter switch locked with a padlock);
- voltage supplied to all units should be within ranges specified by manufacturers of those units;
- function for automatic stop of the conveyor and the feed hopper work in the event of any incorrect work of accessories (e.g., failure of another conveyor) or people entering areas dangerous for them (e.g., a silo in which the conveyor works);

The investor is responsible for delivery (at its own expense) of all electrical equipment and units not being a part of the conveyor and feed hopper equipment, but necessary for construction of required electrical wiring. The investor is responsible for providing guidelines of the conveyor and feed hopper manufacturer (included in this operating manual) to a person designing and constructing the wiring system.

A person constructing the wiring system should perform the first test starting of the conveyor and the feed hopper, check correctness of the motor rotations and consistence of current values on nominal plates of the motors and the thermal switches.

The producer requires a written confirmation of construction and checking of the wiring system by an electrician holding required licences.

2.3. Fire prevention

The investor is obliged to fulfil all obligations related to fire prevention, including ensuring access and evacuation routes, access to sources of extinguishing water, and distribution of extinguishing equipment and fire safety instructions. Fire prevention aspects are governed by the Regulation of the Minister of Interior and Administration of 7 June 2010 concerning fire prevention in buildings, other structures, and terrains (Journal of Laws, 2010, No. 109, item 719) and the Minister of Interior and Administration Regulation of 24 July 2009 concerning supplies of water for extinguishing purposes and fire department access roads (Journal of Laws 2009, No. 124, Item 1030).

2.4. Installation of power delivery points

Installation of power delivery points and power supply for the vertical screw conveyor and auxiliary devices should be performed by licensed electricians according to the current law and an individual facility plan.

3. Operation

3.1. Operation of conveyors

Methods for starting and stopping the vertical conveyor and feed hopper may differ from those described below. This results from a design of the electrical wiring system, in which used electrical units (mainly control devices) differ from those delivered by the conveyor manufacturer.

Starting the PS220-PN-N7.5 conveyor and the PS220-PN-KOSZ feed hopper

- Press the black ON button on the motor switch of the vertical conveyor (Fig. IV.10);
- Set the 0-Y-Δ switch (Fig.IV.10.) in the position "Y" and wait ca. 10 seconds until the motor reaches its full speed;
- Set the 0-Y- Δ switch in the "Δ" position;
- Set the main switch of the feed hopper in the position "I" (Fig.IV.9),
- Press the black ON button on the motor switch of the feed hopper (Fig. IV.9);

Stopping the PS220-PN-N7.5 conveyor and the PS220-PN-KOSZ feed hopper

- Wait until the feed hopper is completely empty;
- Press the red OFF button on the motor switch of the feed hopper (Fig. IV.9);
- Set the main switch of the feed hopper in the position "0" (Fig.IV.9),
- Set the 0-Y-Δ switch of the screw conveyor (Fig.IV.10.) smoothly in the "0" position;
- Press the red OFF button on the motor switch of the screw conveyor (Fig. IV.10);

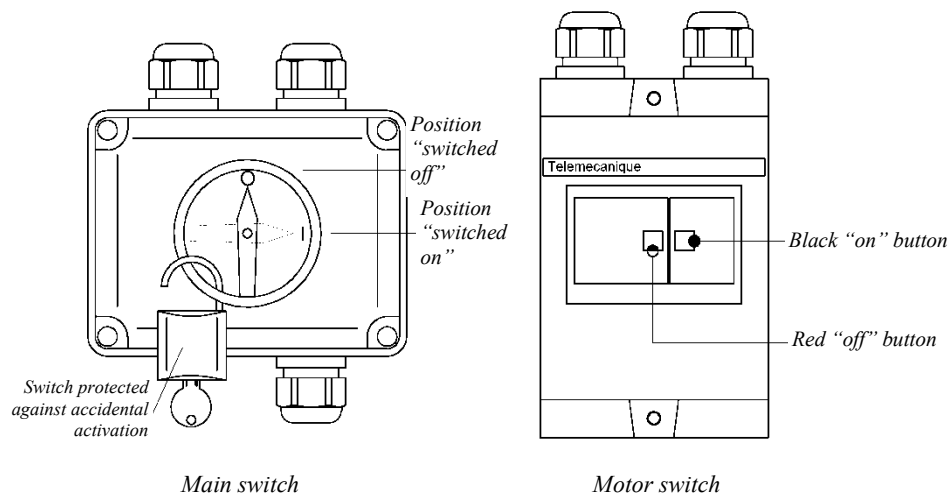


Fig.IV.9 Control equipment of the feed hopper PS220-PN-KOSZ.

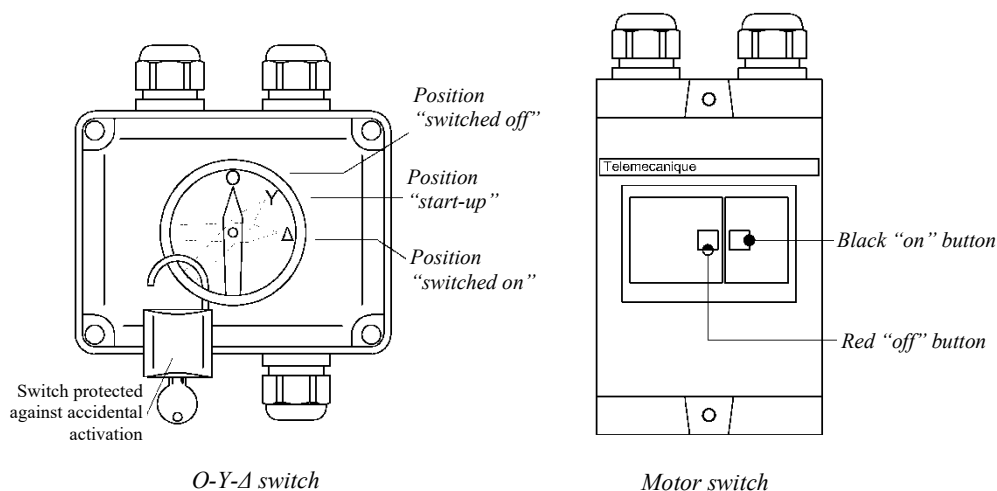


Fig.IV.10. Control equipment for the PS220-PN-N7.5 conveyor

Grain transport

Before starting the grain transport:

- check the operational condition of conveyors and their accessories;
- ensure that there are no people at locations of grain outlet;
- arrange efficient collection of material from the conveyor outlet, to prevent its blocking (overload).

The vertical screw conveyor is not suitable for transport of material that is highly contaminated, locally aggregated, etc. Any attempt to transport such grain may result in overload or damage, and in consequence, stopping of the device.

When the above remarks are considered, the conveyor can be started.



In an emergency, stop the device by pressing the red STOP button on the motor switch of the screw conveyor Fig. IV.10.

In the case of power outage, the system of conveyors will be permanently stopped. Restoring of power supply will not restart the devices automatically. To restart the conveyors, repeat the starting sequence from the beginning.



When the vertical screw conveyor or the feed hopper is used, a noise caused by the working chain drive and screws (screw hitting the casing) can be heard. Phenomena of this type result from necessary design solutions ensuring normal operation of those devices. They do not contribute to damage or premature wear of any unit of the vertical conveyor and the feed hopper.

When operation of the devices is completed, the feed hopper should be secured with a cover against rain and snow. Installation and dismantling of the cover is shown in Fig. IV.11.

Cover installation:

- place the cover on a bottom wall of the feed hopper (at place 1);
- move the cover (as far as possible) in direction A, and lower it in direction C;
- move the cover in direction B.

Cover dismantling:

- move the cover (as far as possible) in direction A;
- lift the cover (at place 2) in direction D;
- move the cover in direction B;
- place the cover at a place where it will not hinder further operation of devices

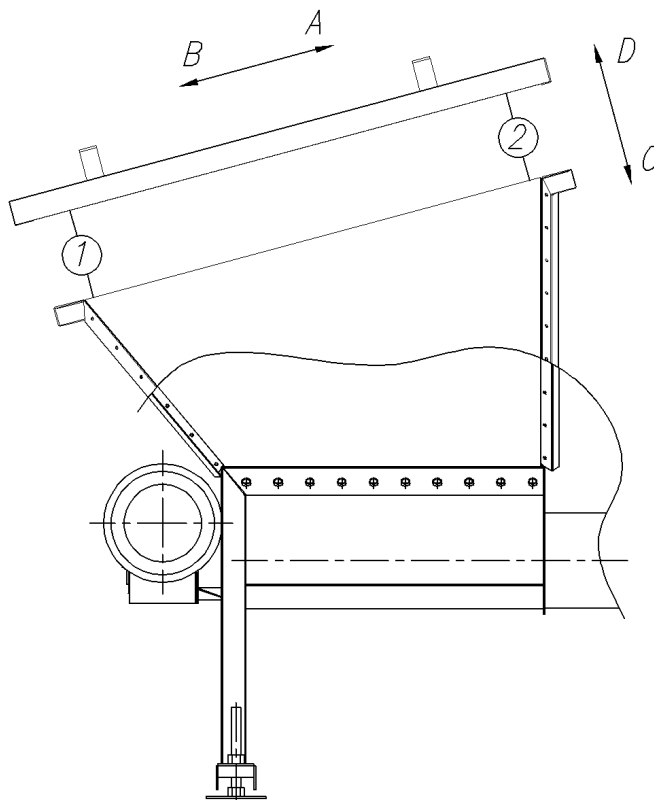


Fig. IV.11. Installation and dismantling of the feed hopper cover.

The vertical screw conveyor is equipped with an inspection hole for removal of transported material in the event of the equipment failure or problems with power supply Fig.IV.12. Before starting to dismantle an inspection manhole cover, the conveyor must be stopped by switching the power supply off. The main switch of the feed hopper and the 0-Y-Δ switch of

the conveyor must be secured with a padlock against unintended switching on. Do not remove transported material from the operating area of the screw with your hands. Always use a spade or other tools for this purpose.



It is strictly forbidden to open the cover of the inspection manhole when the conveyor is



Never put your hand or any other part of your body in the operating area of the

3.2. Conveyor maintenance

Correct and punctual maintenance inspections, maintenance and possible repairs guarantee availability of the full operating capacity of the devices and prevent their premature and excessive wear.

3.2.1. Periodic maintenance and current overhauls

Periodic maintenance covers:

- adjusting chain tension for the chain drive, Fig. IV.12;
- lubricating chain of the chain drive, Fig. IV.12;
- lubricating roller bearings of the chain drive, Fig. IV.12;
- lubricating sliding bearings of the feed hopper, Fig. IV.12;
- inspection of safety devices, that is, a motor switch, a main switch, an 0-Y-Δ switch, etc. (correct operation, no mechanical damage, etc.);
- inspection of the electrical wiring system by an authorised electrician;
- inspection of a technical condition of welded, screwed and other connections;
- inspection of anti-corrosion coatings;
- inspection of sliding and rolling bearings;
- inspection of other moving and fixed components.

Maintenance frequency:

Periodic maintenance frequency should be adapted to intensity of use, but it should take place at least once a year. All safety devices, i.e., the motor switch, the 0-Y-Δ switch, and other, should be inspected at least once a month or before each start of the conveyor.



At least once a year, the User should order a qualified electrician holding relevant licences to inspect all electric equipment components. The person performing the maintenance should draw up a report on inspection.

The first time lubrication of the chain of the chain drive should be performed after first two hours of operation, and then after every 30 hours of the device operation.

Adjustments of the chain tensioning, lubrication of the chain drive roller bearings, and of sliding bearings should be performed after every 30 hours of the conveyor operation in accordance with conditions described in Fig. IV.12.



To lubricate the chain of the chain drive, use only greases intended to be used for such chains. Do not use lubricants for bearings, oil or solid grease, etc., because this may lead to an earlier elongation of the chain and damaging of the drive.

The regular maintenance includes small repairs, and possible repairs of anti-corrosion coats. The user should maintain a conveyor maintenance logbook.



Anti-corrosion coating of screws can be damaged during installation (tightening). In such case, regular repairs include applying anti-corrosion coatings on damaged surfaces.

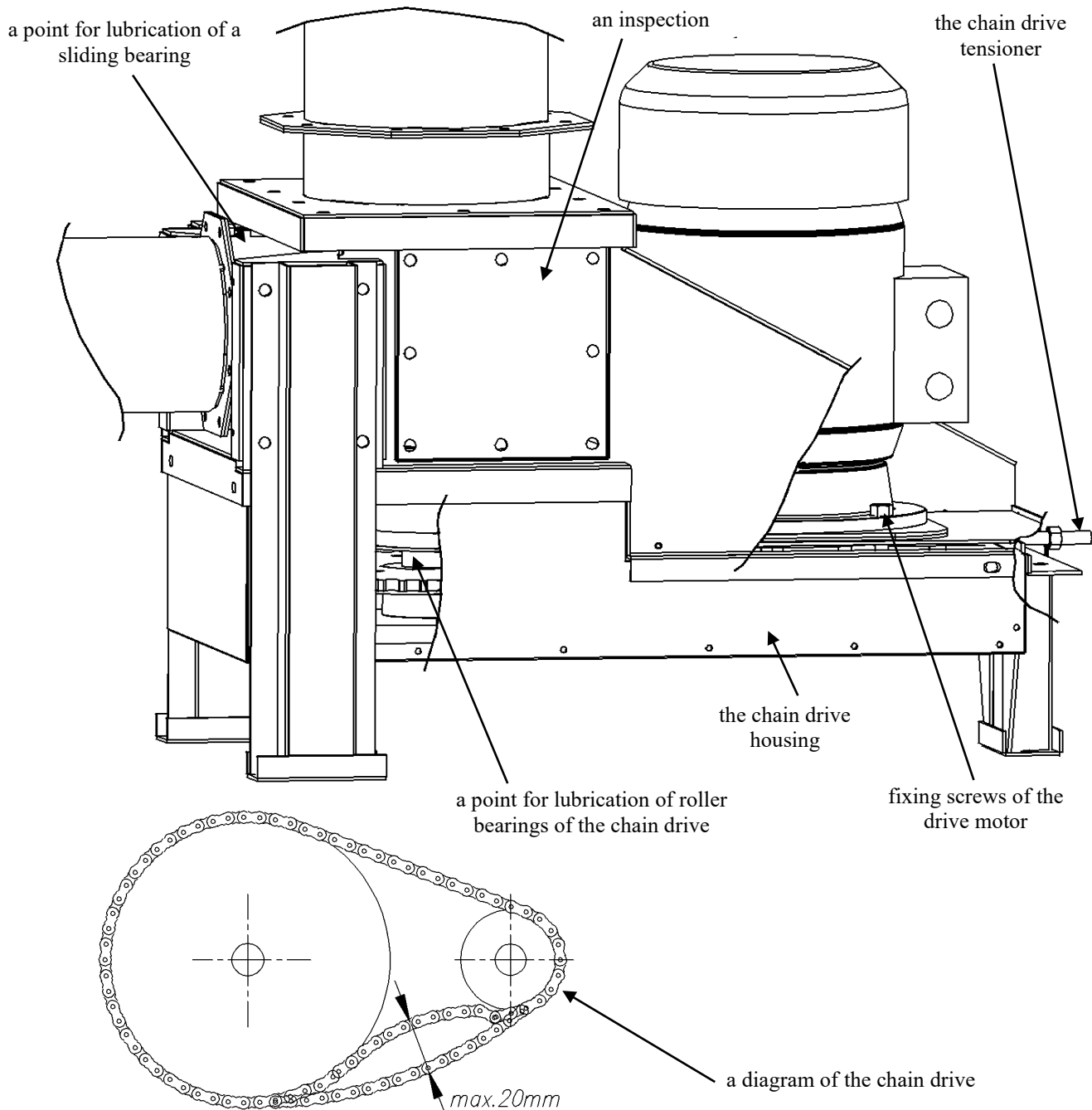


Fig. IV.12 Basic maintenance activities for the screw conveyor

Adjusting chain tension for the chain drive



Before starting any maintenance activities, you must disconnect the power supply to the conveyor and secure it against unintended switching on.

- dismantle the chain drive housing;
- measure the chain slack at several places, pressing on the cable and turning the drive (variable chain slack during turning of the drive, within 0–20 mm, is normal and does not indicate any damage to devices);
- if the cable deflection exceeds 20 mm, adjust the chain tensioning;
- loosen fixing screws of the drive motor;
- tighten a nut of the tensioner by 0.5–1 turn;
- tighten fixing screws of the drive motor;
- measure the chain slack (as described above), if the cable deflection is still incorrect, then tighten or loosen the tensioner nut after loosening fixing screws of the drive motor;
- repeat the above activities, until the correct tensioning of the chain is achieved;
- when the chain adjustment is completed, fix the drive housing.

3.2.2. General overhaul

Overhauls are performed according to a scope and needs, depending on screw, drives, connections, etc., wear, and during them relevant parts are either repaired or replaced with new. Such overhauls cover the scope of regular maintenance and:

- replacement of the chain and the chain wheels of the drive;
- replacement of roller and sliding bearings, gaskets, etc.
- applying of new anti-corrosion coatings;
- other relevant repairs.



All damages must be repaired immediately, and parts that are damaged or worn must be repaired or replaced with new ones.

Chapter V. PSW conveyors

1. General product description

1.1. Product design and intended use

Intended use of PSW conveyors

The internal screw conveyor (PSW) is used to unload BIN silos, and is an auxiliary device facilitating unloading of the remaining grain that did not enter gravitationally the underfloor unloading conveyor. Usually, this corresponds to 10–20% of the silo capacity. Cooperating underfloor and internal conveyors enable unloading of a silo, excluding locations that are inaccessible due to their design (i.e., the area of the internal ladder installation, the emergency duct, etc.). The internal screw conveyor cannot be installed alone in the silo - it always works together with the unloading underfloor screw-conveyor.

Design of PSW conveyors

The underfloor unloading conveyor enables unloading of grain that is gravitationally (under its own weight) transported to the central inlet in the middle of the floor. Because the silo bottom is flat, some grain cannot get into the outlet automatically. For example, about 30 tonnes of grain remains in BIN200 silos. The grain remaining in the silo can be removed by manually moving it to the central inlet or by installing an internal screw conveyor, PSW, which will move the majority of grain to the central inlet mechanically. The PSW internal screw conveyors are dedicated for BIN60, BIN100, BIN200, BIN500, BIN1000, BIN1500 and BIN2200 silos. Due to a significant quantity of grain remaining in BIN500, BIN1000, BIN1500 and BIN2200 silos, installation of PSW conveyors is definitely recommended.

The internal screw conveyor (PSW) transports the grain along the silo radius to the centrally located outlet, at the same time travelling around the silo axis clockwise (when looking down towards the silo floor). The grain is gradually unloaded, until nearly full circle is made.

The internal screw conveyor (PSW), Figs. V.1, V.2, V.3, V.4, V.5, and V.6, consists of a body, 1, for installation of a screw, 7, being a basic working unit of the conveyor. A spiral of a screw in the PSW60 conveyor, Fig.V.1, is $\varnothing 200$ mm in diameter. A spiral of a screw in PSW220-BIN100 and PSW220-BIN200 conveyors, Fig. V.2, is $\varnothing 116$ mm in diameter. A spiral of a screw in the PSW500 conveyor, Fig.V.3, and the PSW1000 conveyor, Fig.V.4 has a variable diameter of $\varnothing 116/\varnothing 136$ mm. A spiral of a screw in the PSW1500 conveyor, Fig.V.5, has a variable diameter of $\varnothing 100/\varnothing 116/\varnothing 136$ mm, and in the PSW2200 conveyor, Fig.V.6 has a uniform diameter of $\varnothing 136$ mm. The screw, 7, is driven by the electric motor, 8, through the screw reducer, 9, mounted on the body, 1. The rotational movement of the PSW conveyor along the route, 5, is ensured by the wheel, 3, driven by the said motor, 8, through the screw, 7. The PSW2200, Fig. V.6, is the sole exception, where the wheel, 3, has a separate drive from an additional electric motor, 21. The drive wheel, 3, is installed directly on the screw, 7, of PSW220-BIN100 and PSW220-BIN200 conveyors (Fig. V.2) or through a reducer in PSW500, PSW1000, PSW1500 and PSW2200 conveyors (Figs. V.3, V.4, V.5 and V.6). The drive wheel, 3, of PSW220-BIN100 and PSW220-BIN200 conveyors, Fig.V.2, has a protective cover, 4, installed for the loading. PSW2200 conveyors are provided with a protective duct, 16, and other conveyors are provided with a tilted screw cover, 17. The cover, 17, and the duct, 16, prevent complete covering of the screw, 7, during the silo loading. The PSW conveyors are installed in the silo axis using the central stand fixed to the central inlet, 11, or the triple inlet, 19 (concerns PSW2200). Furthermore, during the silo loading, the body, 1, of the conveyor is supported on the special support, 6. PSW1500 has two supports, 6, and in the PSW2200, the special moving cart, 20, works as the support. The electric motors, 8 and 21, of the conveyors are equipped with protective covers. PSW conveyors are equipped with units enabling routing of required power supply cables. They include: a cover of the inspection manhole, 13, a shielding pipe for the cable, 14, steel shielding of the cable, 12 and a bracket, 15. Furthermore, conveyors are equipped with transport handles, 10, and information and warning markings.

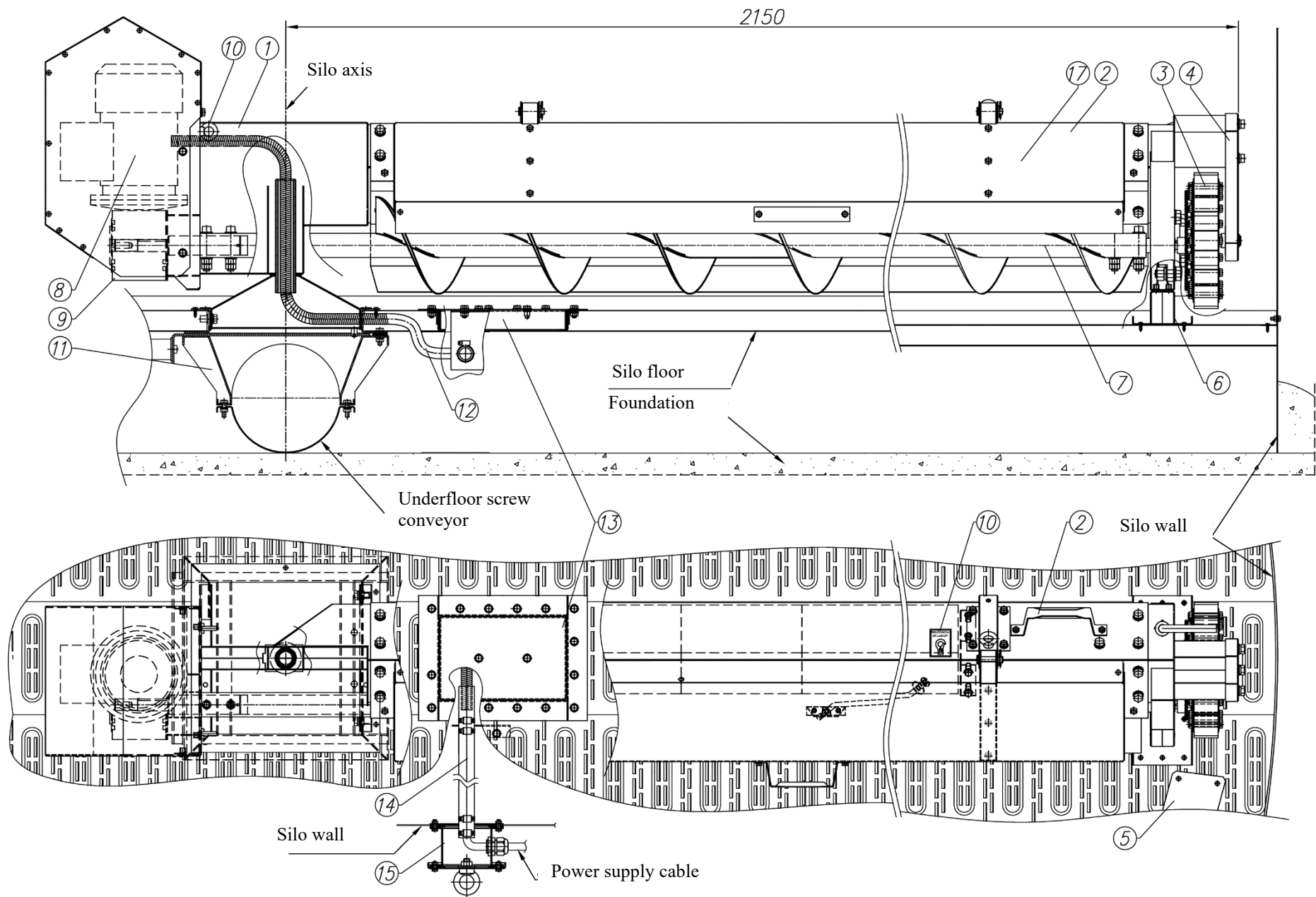


Fig.V.1 Internal screw conveyor, PSW60, for BIN60 silos.

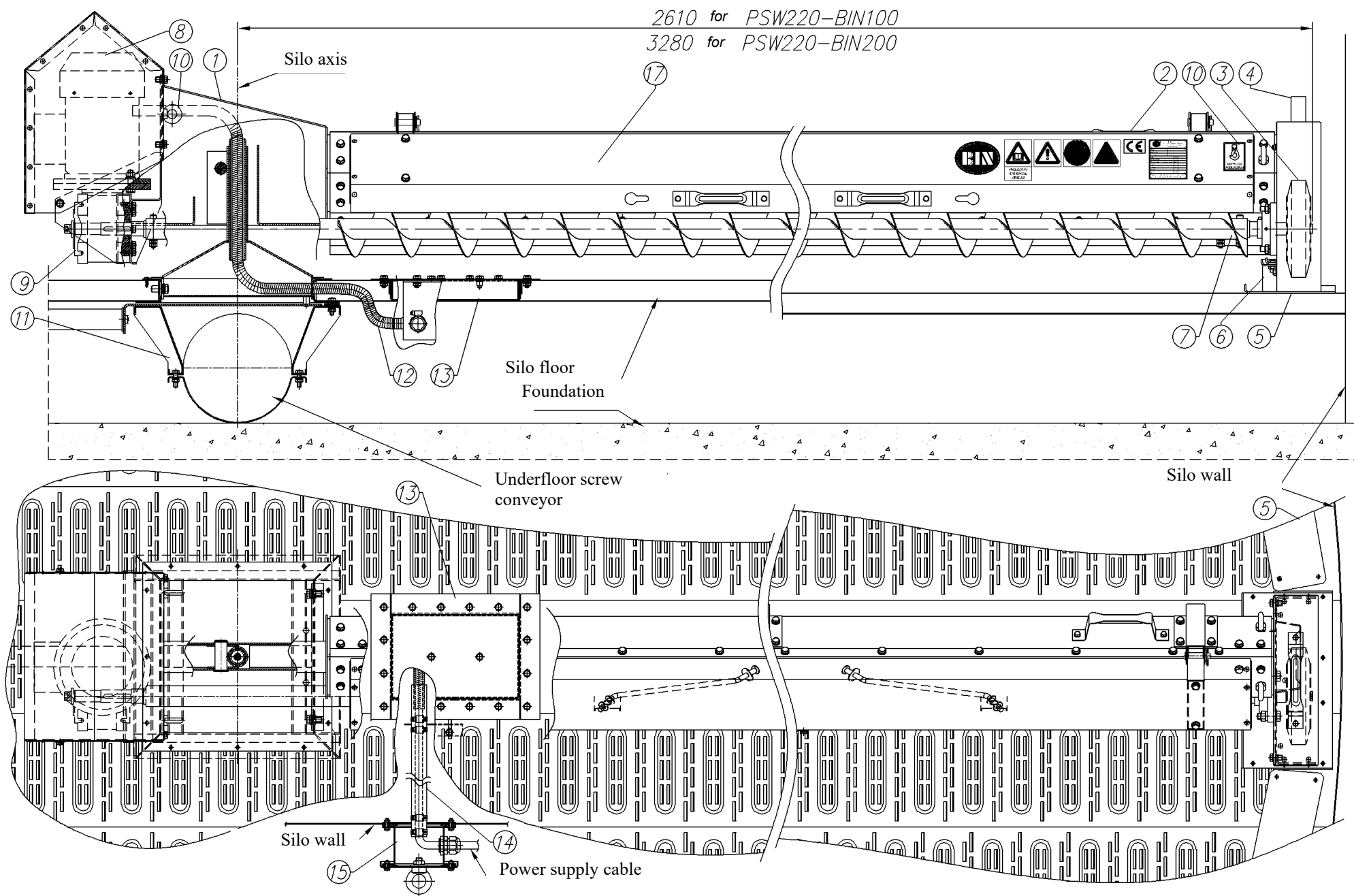


Fig.V.2 Internal screw conveyors, PSW220-BIN100 and PSW220-BIN200 for BIN100 and BIN200 silos.

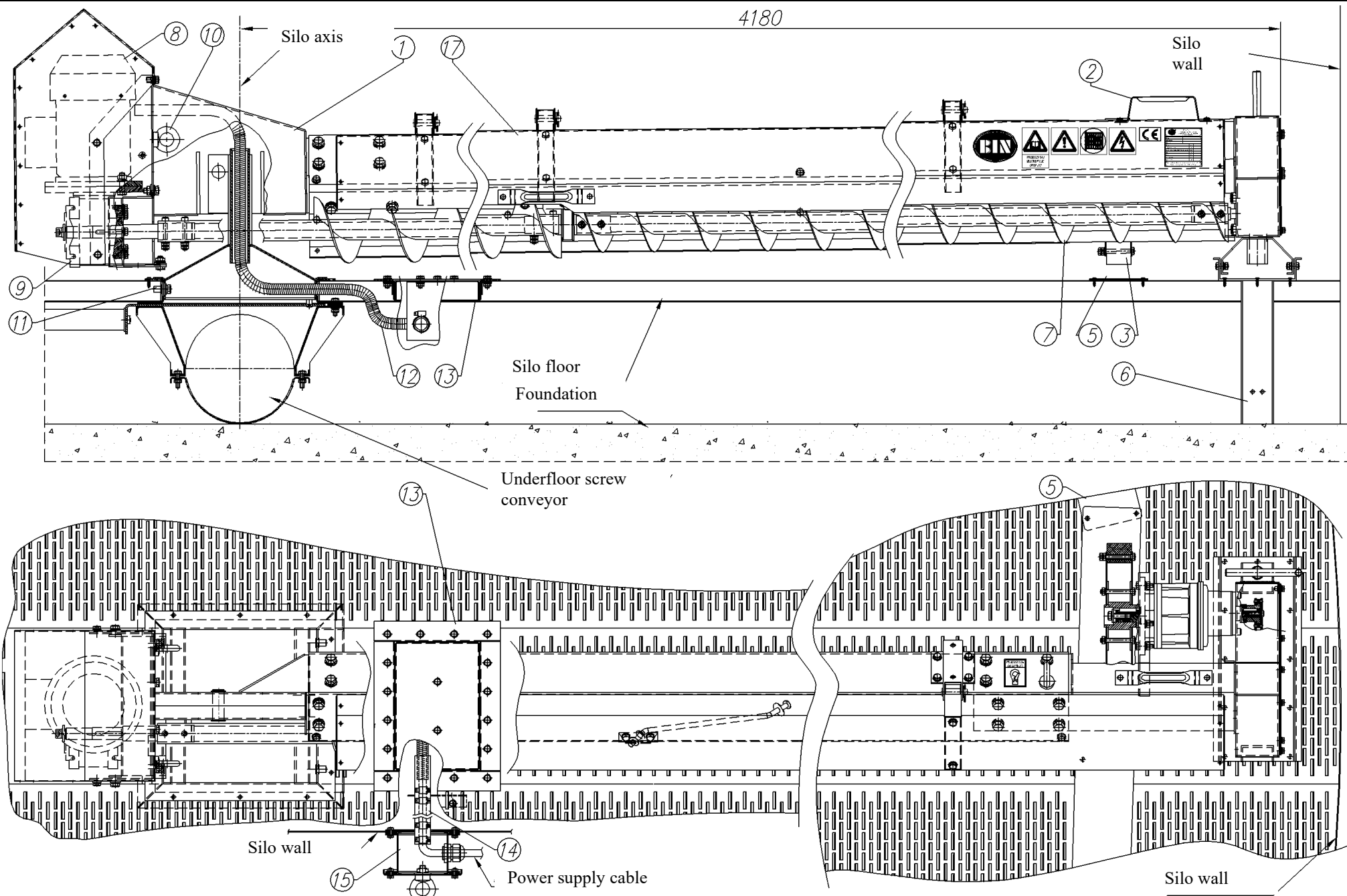


Fig.V.3 Internal screw conveyor, PSW500, for BIN500 silos.

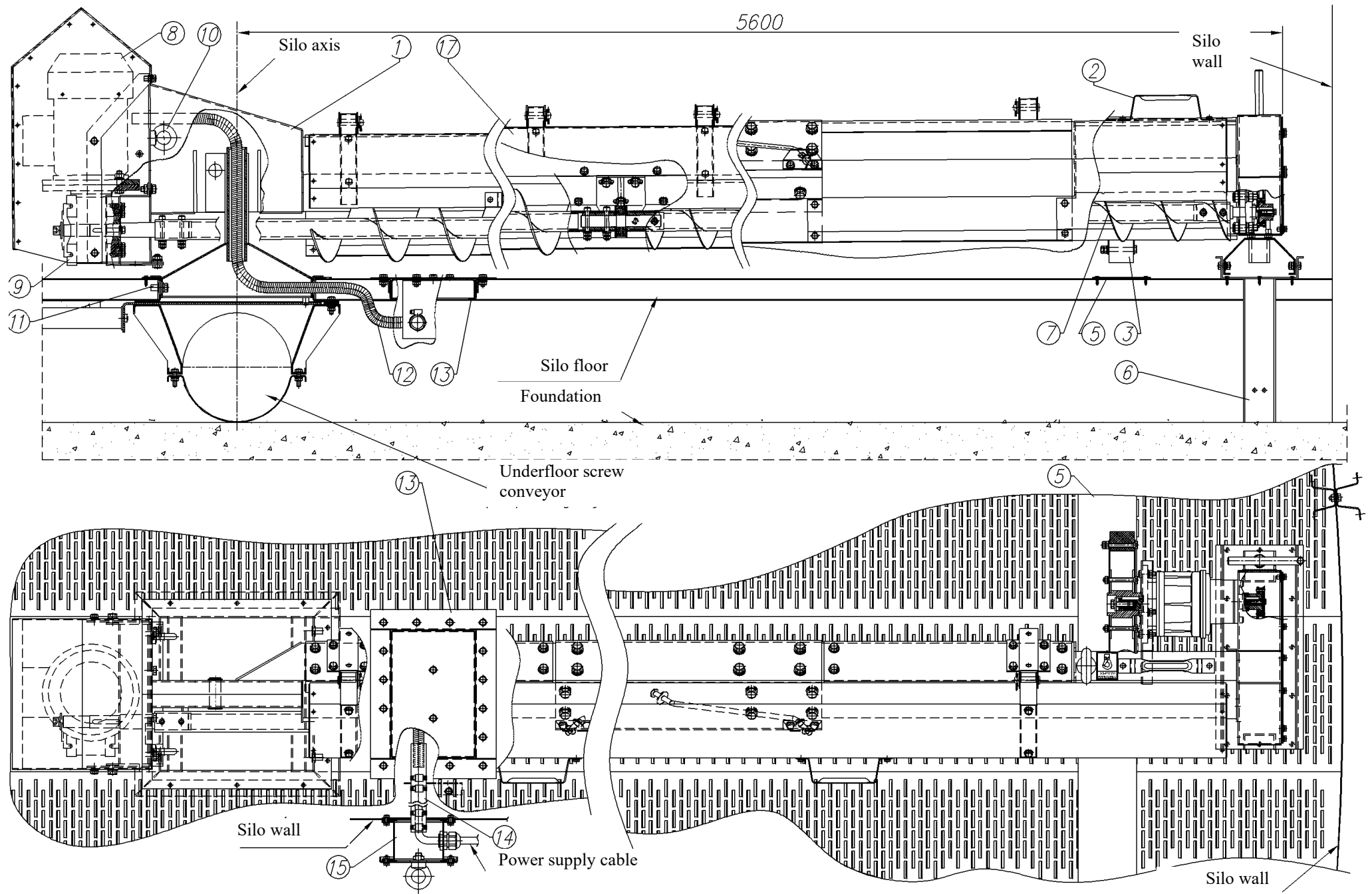


Fig.V.4 Internal screw conveyor, PSW1000, for BIN1000 silos.

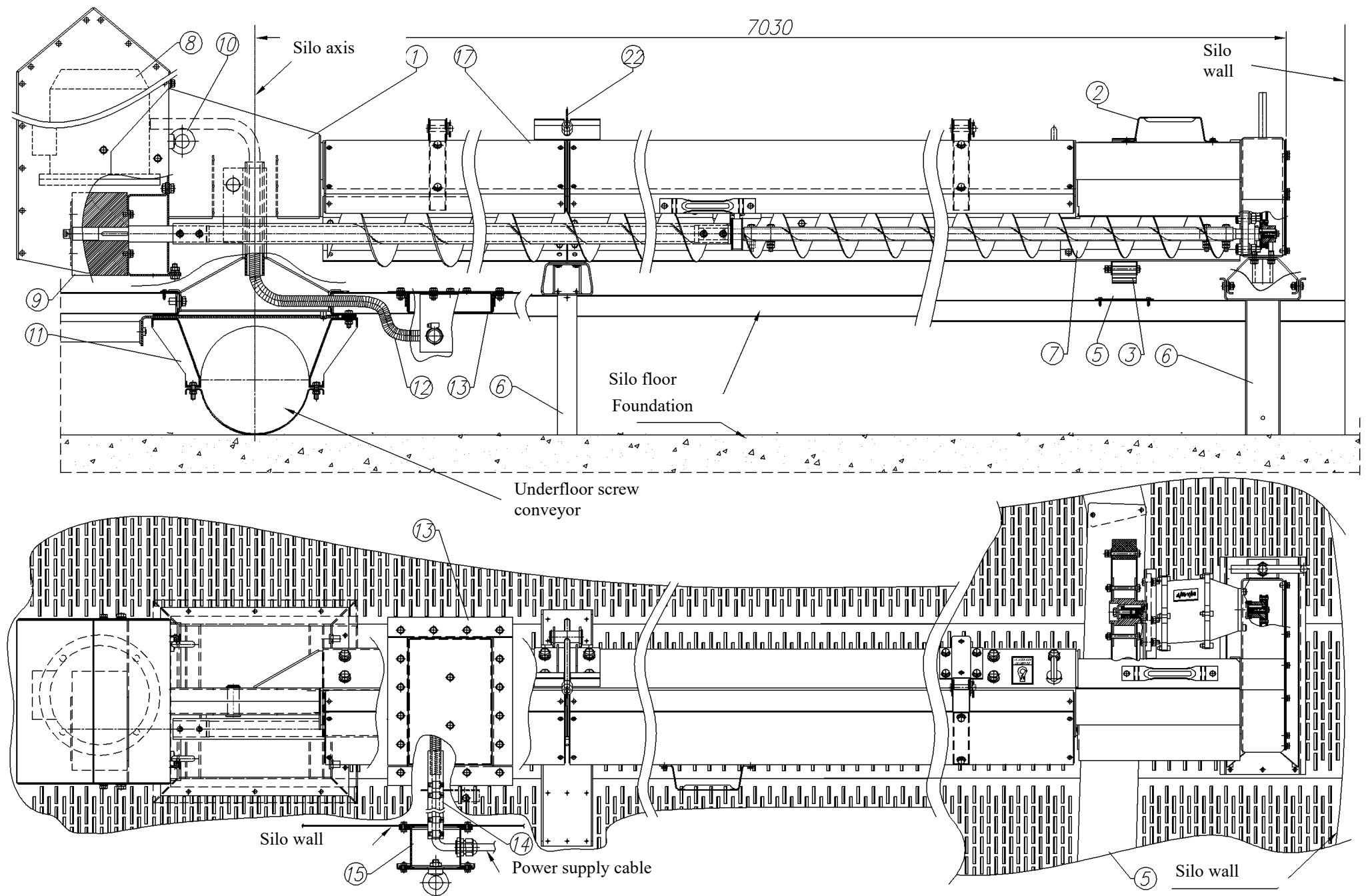


Fig.V.5 Internal screw conveyor, PSW1500, for BIN1500 silos.

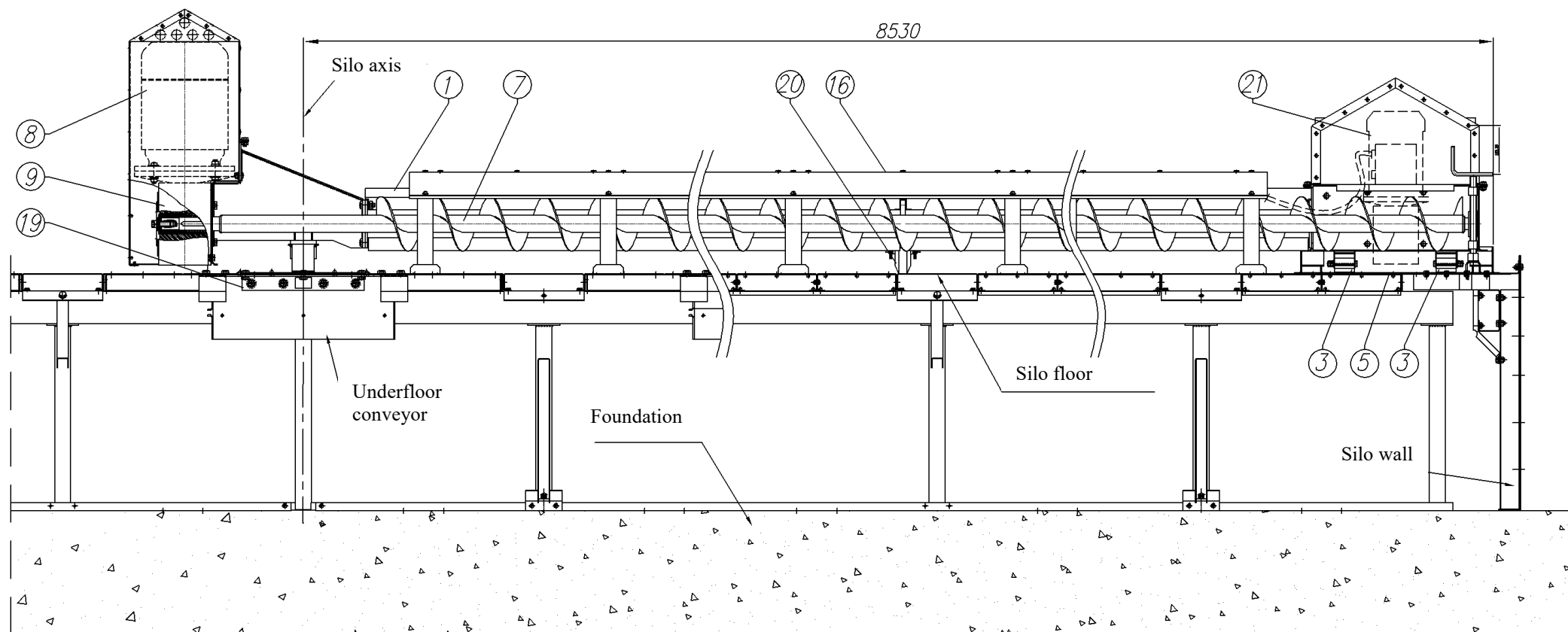


Fig.V.6 Internal screw conveyor, PSW2200, for BIN2200 silos.

1.2. Technical specification

Item			PSW60	PSW220-BIN100/ PSW220-BIN200	PSW500	PSW1000	PSW1500	PSW2200
1.	Type and location		internal screw	internal screw	internal screw	internal screw	internal screw	internal screw
2.	Motor type		II 2D EX tD A21 IP65 T125C SKg90L-4	II 2D EX tD A21 IP65 T125C SKh90S-2	II 2D EX tD A21 IP65 T125C SKh90L-2	II 2D EX tD A21 IP65 T125C SKh90L-2	II 2D EX tD A21 IP65 T125C SKg100L-2	SKg112M-2PC / II 2D EX tD A21 IP65 T125C SKh71-4B
3.	Nominal motor power	kW	1.5	1.5	2.2	2.2	3.0	6.0 / 0.37
4.	Power supply voltage	V	3x400	3x400	3x400	3x400	3x400	3x400
5.	Engine rotational speed	rpm	1500	2855	2855	2855	2845	2910/1440
6.	Gear type	-	gear-screw	gear-screw	gear-screw chain	gear-screw chain	gear-screw chain	gear-screw
7.	Screw rotational speed	rpm	75	408	408	408	408	415
8.	Screw diameter	mm	Ø200	Ø116	Ø116/Ø136	Ø116/Ø136	Ø100/Ø116/Ø136	Ø136
9.	Nominal capacity	tonnes/hou	up to 12	up to 18	up to 24	up to 24	up to 24	up to 35
10.	Total length	mm	2660	3050 / 3750	4650	6100	7500	8950
11.	Weight	kg	190	170 / 190	340	400	490	680

In no device shown in the manual, the level of noise exceeds 70 dB(A).

Table V.1. Technical specification of PSW conveyors.

2. Installation and start-up

2.1. Conveyor installation



The internal screw conveyor cannot be installed alone in the silo - it always works together with the unloading underfloor screw-conveyor.

Installation of the conveyors requires use of special equipment, and relevant know-how. Therefore, the equipment can only be installed by installation companies authorised by BIN. The installation company should cooperate with an entity ordering installation, in terms of works organisation, financial settlements, and acceptance of installation works.



When the investor itself or any other installation company not authorised by BIN performs installation works, the Investor is obliged to obtain the detailed installation instruction from the manufacturer.

2.2. Electrical systems and start-up

The manufacturer equips conveyors with the following electrical subunits:

- three-phase electric motor;
- lockable main switch;
- lockable star-delta starter switch (concerns PSW2200),
- motor (thermal) switch,
- undervoltage release,
- rotation direction switch (for conveyors PSW500, PSW1000, PSW1500 and PSW2200),
- housing for the thermal switch and the undervoltage release.
- power supply cable, in the quantity required to route it outside the silo shell (concerns PSW2200)

The design documentation of the investment must include appropriate design study for the wiring system, taking into account the conveyor connection together with auxiliary equipment. The investor is responsible for drawing up such design study by a person holding relevant licences in accordance with current legislation.

The investor is responsible for construction of the electrical wiring system in accordance with the said design study by an electrician holding relevant licences.

Regardless of the function and construction method, the design study and the constructed wiring system must meet the following requirements:

- motor correctly connected (as required by a motor manufacturer),
- motor secured by a correct connection and adjustment of the thermal switch;
- securing against unintended starting of the conveyor after power outage;
- option for securing the conveyor against unintended start (e.g., a lockable main switch),
- voltage supplied to all units should be within ranges specified by manufacturers of those units;
- function for automatic stop of the conveyor work in the event of any incorrect work of accessories (e.g., failure of another conveyor) or people entering areas dangerous for them (e.g., a silo in which the conveyor works)

The investor is responsible for delivery (at its own expense) of all electrical equipment and units not being a part of the conveyor equipment, but necessary for construction of required electrical wiring.

The investor is responsible for providing guidelines of the conveyor manufacturer (included in this operating manual) to a person designing and constructing the wiring system.

A person constructing the wiring system should perform the first test starting of the conveyor, check correctness of the motor rotations and consistence of current values on nominal plates of the motor and the thermal switch.

The producer requires a written confirmation of construction and checking of the wiring system by an electrician holding required licences.

A cascade connection between the underfloor conveyor and PSW is recommended, preventing starting of the PSW conveyor when the underfloor conveyor is not working.

Some of the cable supplying PSW conveyors must be routed under the silo floor (Fig. V.7). To enable its installation and later operation, an inspection manhole is provided in the silo floor, to which a shielding pipe, RHDPE, is routed (excluding PSW2200). The other end of the shielding pipe is outside the silo shell. The power supply cable should be routed in the RHDPE pipe to the inspection manhole. Then insert it in the steel shield and connect to the drive motor. The power supply cable should be routed with some excess length, so it is not damaged when the PSW conveyor rotates around the silo axis. When the silo cable is installed, the end of the steel casing (of a minimum length of 50 mm) should be inserted into the RHDPE pipe.

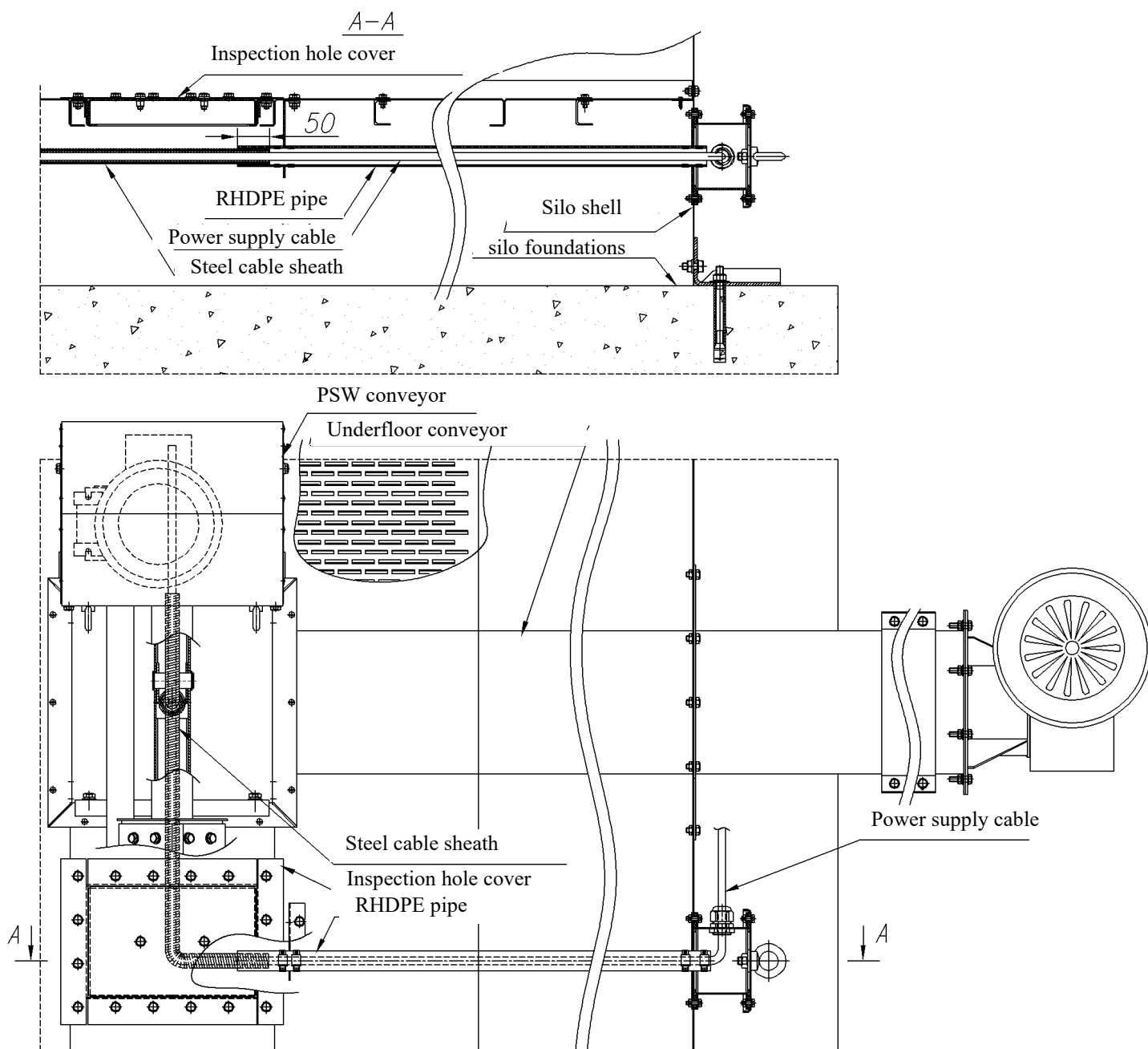


Fig. V.7 Installation of a supply cable for PSW conveyors (except for PSW2200).

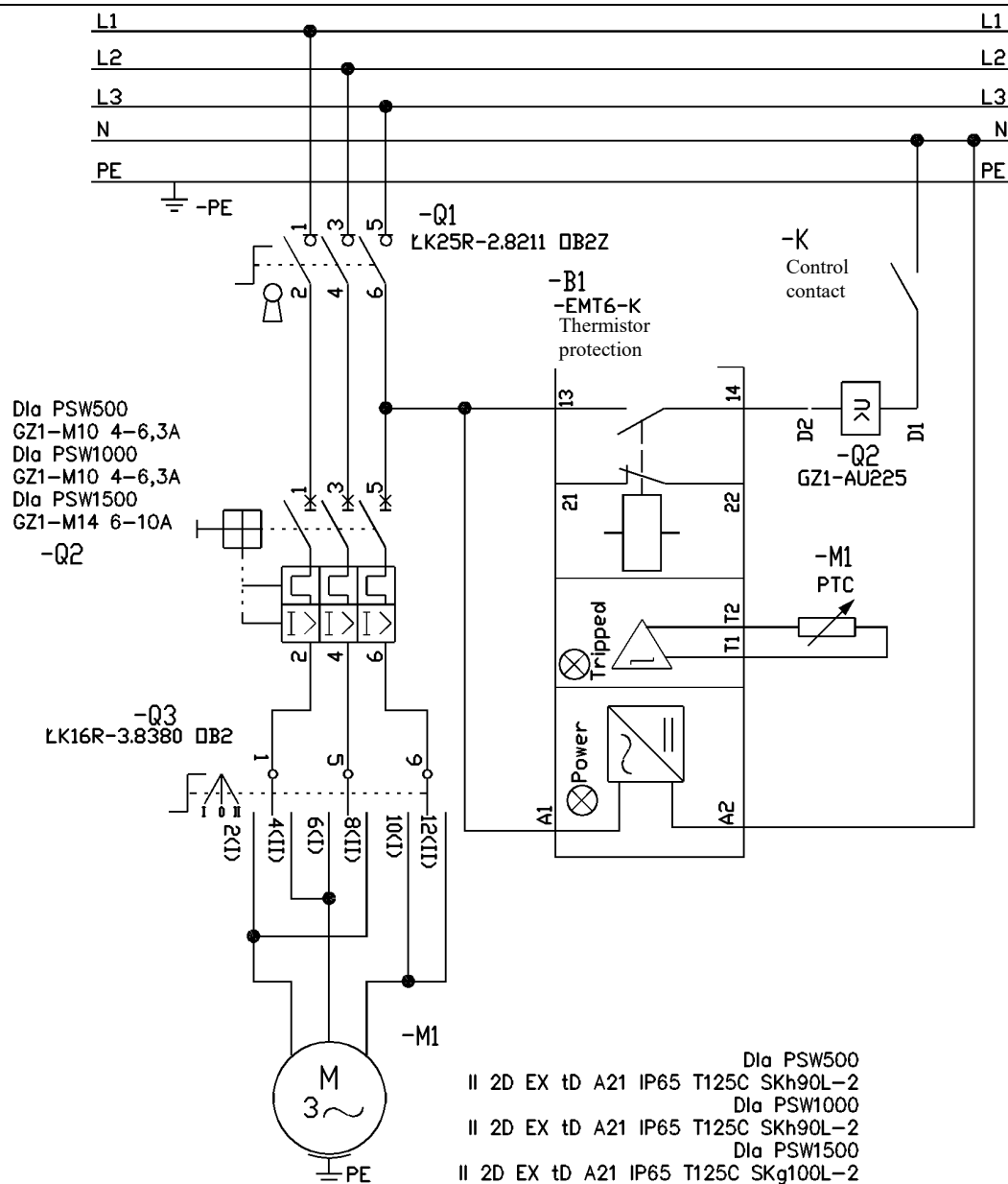


Diagram V.2. An example of the wiring diagram for PSW500, PSW1000 and PSW1500 conveyors.

The above diagram represents general guidelines for construction of the wiring system for the PSW conveyor. The units used can be replaced by equivalent devices having identical functions. The investor is responsible for drawing up of a design study for the electrical wiring by a person holding relevant licences in accordance with current legislation. The investor is responsible for construction of the electrical wiring system in accordance with the said design study by an electrician holding relevant licences.

- M1: Three-phase electric motor with a PTC thermistor probe,
- Q2: Thermal overcurrent circuit breaker with undervoltage release,
- Q1: Lockable main switch;
- Q3: Rotation direction switch 1-0-2;
- B1: Thermistor securing devices of the machine, stops the PSW operation when the temperature of the electric motor is too high (125°C)
- K: The control contact; when closed, the contact enables operation of PSW, when open, PSW cannot work; the contact should open in the case of:
 - an attempt to enter the silo by opening manholes,
 - initiation of silo loading,
 - stopping of the underfloor conveyor or other equipment responsible for efficient reception of grain from PSW,
 - other conditions (depending on individual investment solutions), when further work of PSW may pose a threat to health or life of humans or animals, or may result in a damage to the conveyor or other equipment.

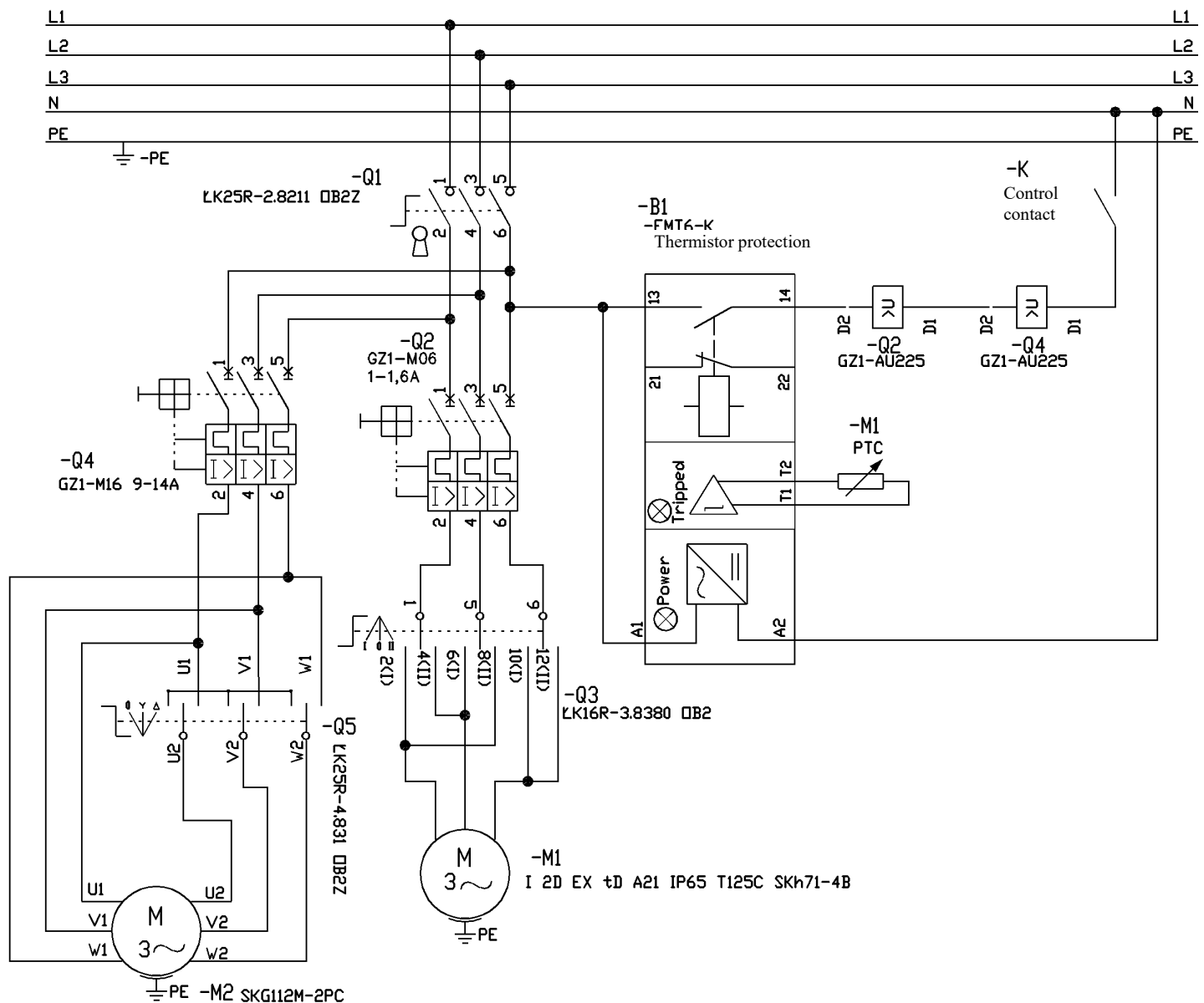


Diagram V.3. An example of the wiring diagram for PSW2200 conveyor.

The above diagram represents general guidelines for construction of the wiring system for the PSW conveyor. The units used can be replaced by equivalent devices having identical functions. The investor is responsible for drawing up of a design study for the electrical wiring by a person holding relevant licences in accordance with current legislation. The investor is responsible for construction of the electrical wiring system in accordance with the said design study by an electrician holding relevant licences.

- M2: Three-phase electric motor of the screw drive,
- M1: Three-phase electric motor of the PSW drive with a PTC thermistor probe,
- Q4: Motor thermal overcurrent circuit breaker with undervoltage release - M2
- Q2: Motor thermal overcurrent circuit breaker with undervoltage release - M1
- Q1: Lockable main switch;
- Q3: Rotation direction switch 1-0-2;
- Q5: Lockable star-delta starter switch;
- B1: Thermistor securing devices of the machine, stops the PSW operation when the temperature of the electric motor is too high (125°C)
- K: The control contact; when closed, the contact enables operation of PSW, when open, PSW cannot work; the contact should open in the case of:
 - an attempt to enter the silo by opening manholes,
 - initiation of silo loading,
 - stopping of the underfloor conveyor or other equipment responsible for efficient reception of grain from PSW,
 - other conditions (depending on individual investment solutions), when further work of PSW may pose a threat to health or life of humans or animals, or may result in a damage to the conveyor or other equipment.

3. Operation

3.1. Operation of conveyors

Before starting loading the silo:

- check the operational condition of conveyors and their accessories;
- ensure efficient reception of the material, to prevent conveyor overloading;
- PSW60 (Fig.V.1), PSW220-BIN100 and PSW220-BIN200 (Fig.V.2) - conveyors should be placed on a support, 6, allowing free work of the conveyor under the grain layer, secure the drive wheel by installing the cover, 4, (does not include PSW60), remove a cover of the spiral, 17, from its supports and place on the conveyor body.
- PSW500, PSW1000, PSW1500 - conveyors should be placed on a support, 6, allowing free work of the conveyor under the grain layer (install the protective device, 22 - concerns PSW1500, Fig.V.5), remove a cover of the spiral, 17, from its supports and place on the conveyor body.
- PSW2200 - install the conveyor on the support and lock, place the protective duct, 16, on the conveyor.
- close the inlet shutter to the underfloor conveyor,
- perform a short start-up of the equipment, to verify its correct operation.



Before the conveyors are started, make sure there are no people or animals in the silo. It is strictly forbidden for people or animals to be present in the silo during work of any equipment working with the silo. Switch off all electrical equipment before entering the silo.



It is strictly forbidden to start the PSW screw conveyor in a silo with a central grain inlet to the underfloor screw conveyor is covered with grain (for any reasons).



Each time before grain is poured into the silo, the PSW-1500 conveyor MUST be secured with a screw on the middle support. If it is not secured this way, the device may be damaged.



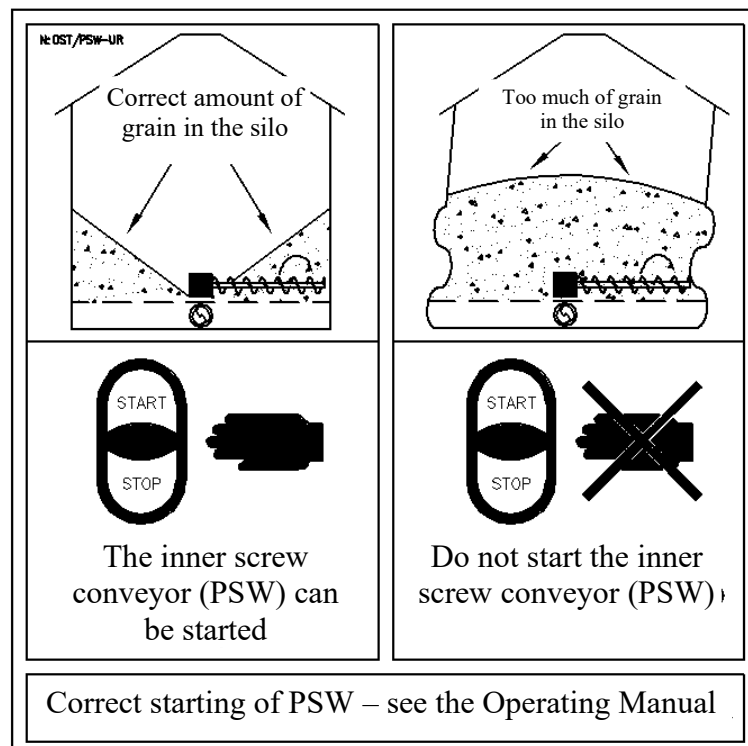
Each time before grain is poured into the silo, the PSW-2200 conveyor MUST be secured by covering it with a protective duct. If it is not secured this way, the device may be damaged.



Before each pouring of grain into the silo THE USER IS INSTRUCTED to secure the PSW60, PSW-220-BIN100, PSW220-BIN200, PSW500, PSW1000 and PSW1500 conveyors by removing the spiral cover from its supports and placing it on the conveyor body. If it is not secured this way, the device may be damaged.



It is strictly forbidden to start the PSW conveyor that is completely covered with grain - see the table below.
(Each time before starting up the PSW conveyor, check if the guard of the PSW screw drive (in the silo axis) is not covered with grain. Starting the PSW above which there is so much grain that the motor guard is covered may damage the silo)



Unloading - operation

Methods for starting and stopping the conveyor may differ from those described below. This results from a design of the electrical wiring system, in which used electrical units (mainly control devices) differ from those delivered by the conveyor manufacturer.

Version 1 Concerns silos equipped with an underfloor conveyor and with PSW60, PSW220-BIN100 or PSW220-BIN200

- 1.1 Make sure there are no people in the silo.
- 1.2 Check if the door in the cover of the external ladder and the bottom manhole are closed. Close, if necessary.
- 1.3 Switch the main switch on.
- 1.4 Start the underfloor conveyor by pressing the black button on the switch.
- 1.5 Gradually, slowly open the grain shutter.
- 1.6 Leave the shutter open for even and stable work of the conveyor.
- 1.7 The underfloor conveyor can be kept working until the gravitational feeding to the inlet is completed.

To remove grain remaining in the silo:

Check if the guard of the screw drive motor (in the silo axis) is visible - a requirement for safe switching on of the PSW !

- 1.8 Start the PSW conveyor by pressing the black button on the PSW switch.
- 1.9 Wait until the PSW conveyor transports the grain accumulated over it into the central inlet.
- 1.10 Stop both conveyors by pressing the red button on the switch.
- 1.11 Switch the power off with the main switch.
- 1.12 Secure the main switch with a padlock against an unexpected activation.
- 1.13 Enter the silo, lift the cover of the spiral, 17, and put in on the supports, remove the cover of the drive wheel, remove the PSW conveyor from the support.
- 1.14 Restart the conveyor following the items 1.1 to 1.7.
- 1.15 Start the PSW conveyor by pressing the black button on the PSW switch.
- 1.16 Underfloor and PSW conveyors can be kept working until the PSW moves from the position "Start of the PSW work" to the position "End of the PSW work", as in Fig.VII.1
- 1.17 When the silo is completely emptied, stop the underfloor and the PSW conveyors.
- 1.18 Switch the power off with the main switch.
- 1.19 Secure the main switch with a padlock against an unexpected activation by unauthorised persons.

Version 2 Concerns silos equipped with an underfloor conveyor and with PSW500, PSW1000, and PSW1500

- 2.1 Make sure there are no people in the silo.
- 2.2 Check if the door in the cover of the external ladder and the bottom manhole are closed. Close, if necessary.
- 2.3 Switch the main switch on.
- 2.4 Start the underfloor conveyor by pressing the black button on the switch.
- 2.5 Gradually, slowly open the grain shutter.
- 2.6 Leave the shutter open for even and stable work of the conveyor.
- 2.7 The underfloor conveyor can be kept working until the gravitational feeding to the inlet is completed.

To remove grain remaining in the silo:

Check if the guard of the screw drive motor (in the silo axis) is visible - a requirement for safe switching on of the PSW !

- 2.8 Start the PSW conveyor by pressing the black button on the PSW switch.
- 2.9 Wait until the PSW conveyor transports the grain accumulated over it into the central inlet.
- 2.10 Stop both conveyors by pressing the red button on the switch.
- 2.11 Switch the power off with the main switch.
- 2.12 Secure the main switch with a padlock against an unexpected activation.
- 2.13 Enter the silo, remove the protection, 22, on the middle support (excluding PSW500 and PSW1000), loosen the securing knob and remove the PSW conveyor from the supports, 6; lift the spiral cover, 17, and put on supports.
- 2.14 Restart the underfloor conveyor following the items 3.1 to 3.7.
- 2.15 Set the PSW direction switch in position "1" (forward).
- 2.16 Start the PSW conveyor by pressing the black button on the PSW switch.
- 2.17 Underfloor and PSW conveyors can be kept working until the PSW moves from the position "Start of the PSW work" to the position "End of the PSW work", as in Fig.VII.1
- 2.18 When the silo is completely emptied, stop the underfloor and the PSW conveyors.

To withdraw the PSW conveyor from the position "End of PSW operation" to the position "Beginning of PSW operation", as in Fig. VII.1:

For correct backing of the PSW conveyor it is necessary to completely clean the silo floor of grain residues left after conveyor work .

- 2.19 Restart the underfloor conveyor following the items 3.1 to 3.7.
- 2.20 Set the PSW direction switch in position "2" (backward).
- 2.21 Start the PSW conveyor by pressing the black button on the PSW switch.
- 2.22 PSW conveyors can be kept working until the PSW moves from the position "End of the PSW work" to the position "Start of the PSW work", as in Fig.VII.1
- 2.23 Switch the power off with the main switch.
- 2.24 Secure the main switch with a padlock against an unexpected activation by unauthorised persons.

Version 3 Concerns silos equipped with an underfloor conveyor and PSW2200

- 3.1 Make sure there are no people in the silo.
- 3.2 Check if the door in the cover of the external ladder and the bottom manhole are closed. Close, if necessary.
- 3.3 Switch the main switch on.
- 3.4 Start the underfloor conveyor by pressing the black button on the switch.
- 3.5 Gradually, slowly open the grain shutter.
- 3.6 Leave the shutter open for even and stable work of the conveyor.
- 3.7 The underfloor conveyor can be kept working until the gravitational feeding to the inlet is completed.

To remove grain remaining in the silo:

Check if the guard of the screw drive motor (in the silo axis) is visible - a requirement for safe switching on of the PSW !

- 3.8 Press the black button on the PSW-Screw switch to start the screw of the PSW conveyor, and then turn the star-delta starter to the "star" position. After about 3 seconds, switch to the "delta" position.
- 3.9 Wait until the PSW conveyor transports the grain accumulated over it into the central inlet.
- 3.10 Stop the underfloor conveyor by pressing the red button on the underfloor conveyor switch.
- 3.11 Switch the power off with the main switch.
- 3.12 Secure the main switch with a padlock against an unexpected activation.
- 3.13 Enter the silo, remove the protective duct above the conveyor, and unblock the conveyor using the knob.
- 3.14 Restart the underfloor conveyor following the items 4.1 to 4.7.
- 3.15 Press the black button on the PSW-Screw switch to start the screw of the PSW conveyor, and then turn the star-delta starter to the "star" position. After about 3 seconds, switch to the "delta" position.
- 3.16 Set the PSW direction switch in position "1" (forward).
- 3.17 Start the PSW conveyor drive by pressing the black button on the PSW switch-Drive.
- 3.18 Underfloor and PSW conveyors can be kept working until the PSW moves from the position "Start of the PSW work" to the position "End of the PSW work", as in Fig.VII.1
- 3.19 When the silo is completely emptied, stop the underfloor and the PSW conveyors.

To withdraw the PSW conveyor from the position "End of PSW operation" to the position "Beginning of PSW operation", as in Fig. VII.1:

For correct backing of the PSW conveyor it is necessary to completely clean the silo floor of grain residues left after conveyor work.

- 3.20 Repeat actions from 4.14 to 4.15
- 3.21 Set the PSW direction switch in position "2" (backward).
- 3.22 Start the PSW conveyor drive by pressing the black button on the PSW switch-Drive.
- 3.23 PSW conveyors can be kept working until the PSW moves from the position "End of the PSW work" to the position "Start of the PSW work", as in Fig.VII.1
- 3.24 Switch the power off with the main switch.
- 3.25 Secure the main switch with a padlock against an unexpected activation by unauthorised persons.



Due to properties of the electrical wiring system, the PSW conveyor can make only one complete circle around the silo axis. When one complete cycle of work is completed, the conveyor must be BACKED into the position "Start of the PSW work" according to Fig.VII.1. PSW500, PSW1000, PSW1500 and PSW2200 conveyors have a BACKING function (versions 3 and 4).

In an emergency, stop the device by pressing the red STOP button on the motor switch.

In the event of any attempt to enter the silo through the top or the bottom manhole, when conveyors are operating, relevant switches should immediately stop the devices. To restart the conveyors, repeat the starting procedure from the beginning.

In the case of power outage, the system of conveyors will be permanently stopped. Restoring of power supply will not restart the devices automatically. To restart the conveyors, repeat the starting procedure from the beginning.

It is not recommended to stop the conveyor when its screw is covered with grain. This may cause problem with restarting it.

The system of conveyors is not suitable for transport of material that is highly contaminated, locally aggregated, etc. Any attempt to transport such grain may result in overload or damage, and in consequence, stopping of the device.

3.2. Conveyor maintenance

Correct and punctual maintenance inspections, maintenance and possible repairs guarantee availability of the full operating capacity of the conveyors and prevent their premature and excessive wear.

Periodic maintenance and current overhauls

Periodic maintenance covers:

- inspection of safety devices, that is, a motor switch, a main switch, etc. (correct operation, no mechanical damage, etc.);
- inspection of the electrical wiring system by an authorised electrician;
- inspection of a technical condition of welded, screwed and other connections;
- inspection of anti-corrosion coatings;
- inspection of rolling bearings;
- inspection of other moving and fixed components.

Maintenance frequency:

Periodic inspection frequency should be adapted to intensity of use, but they should take place at least once a year. All safety devices, i.e., the motor switch, the main switch, and other, should be inspected at least once a month or before each start of the conveyors.



At least once a year, the User should order a qualified electrician holding relevant licences to inspect all electric equipment components.

The regular maintenance includes small repairs, and possible repairs of anti-corrosion coats. Anti-corrosion coating of screws can be damaged during installation (tightening). In such case, regular repairs include applying anti-corrosion coatings on damaged surfaces.

General overhaul

Overhauls are performed according to a scope and needs, depending on screw wear, connections condition, etc. (at least once every 8 years), and during them relevant parts are either repaired or replaced with new.

Such overhauls cover the scope of regular maintenance and:

- replacement of roller bearings, gaskets, etc.
- applying of new anti-corrosion coatings;
- other relevant repairs.



All damages must be repaired immediately, and parts that are damaged or worn must be repaired or replaced with new ones.

Chapter VI. Inlet hopper

1. General product description

1.1. Product design and intended use

The inlet hopper is a basic device used to construct an unloading point for cereal and maize grain and oil seeds. It is intended to be used to unload material from agricultural transport trailers and cargo bodies of lorries. It facilitates material transport to warehouses, silos or other places for grain and seeds storage with screw, bucket and other conveyors.

Especially, it can be used to construct unloading points for BIN silos.

The following models of PS220-KPA feed hoppers are available:

- PS220-KPA-5M - 5 m long inlet hopper
- PS220-KPA- 6M - 6 m long inlet hopper
- PS220-KPA- 8M - 8 m long inlet hopper
- PS220-KPA- 9M - 9 m long inlet hopper

Each inlet hopper must be equipped with one of the extensions and a relevant PS220 drive for transport and unloading of grain from the hopper to auxiliary equipment:

- PS220-P1.0, PS220-P1.5, PS220-P2.0, PS220-P2.5, PS220-P3.0- screw conveyor extensions
- PS220-N3/200, PS220-N4/150, PS220-N4/200, PS220-N4/300, PS220-N6/300, PS220-N7.5/200, PS220-N7.5/300 – screw conveyor drives

To install the inlet hopper correctly, use required PS220 units:

- PSU220-I/O-200- unloading/loading of PS220 screw conveyors
- MOCRUR200- fixing for screw conveyor pipes
- PS220-MOCBET – fixing of the PS220 conveyor to concrete.

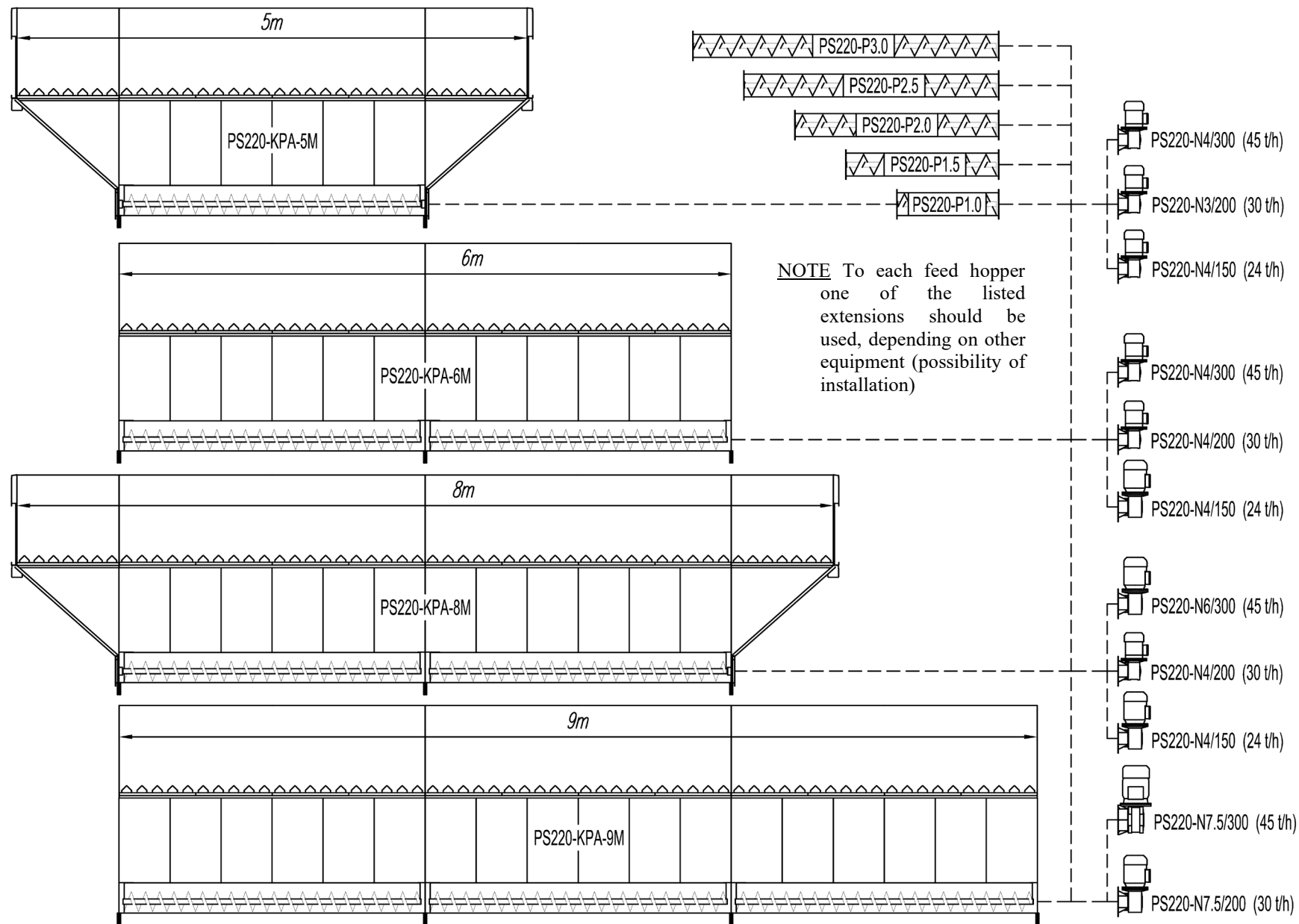


Fig. VI.1 A diagram for arranging individual models of PS220-KPA hoppers with necessary equipment.

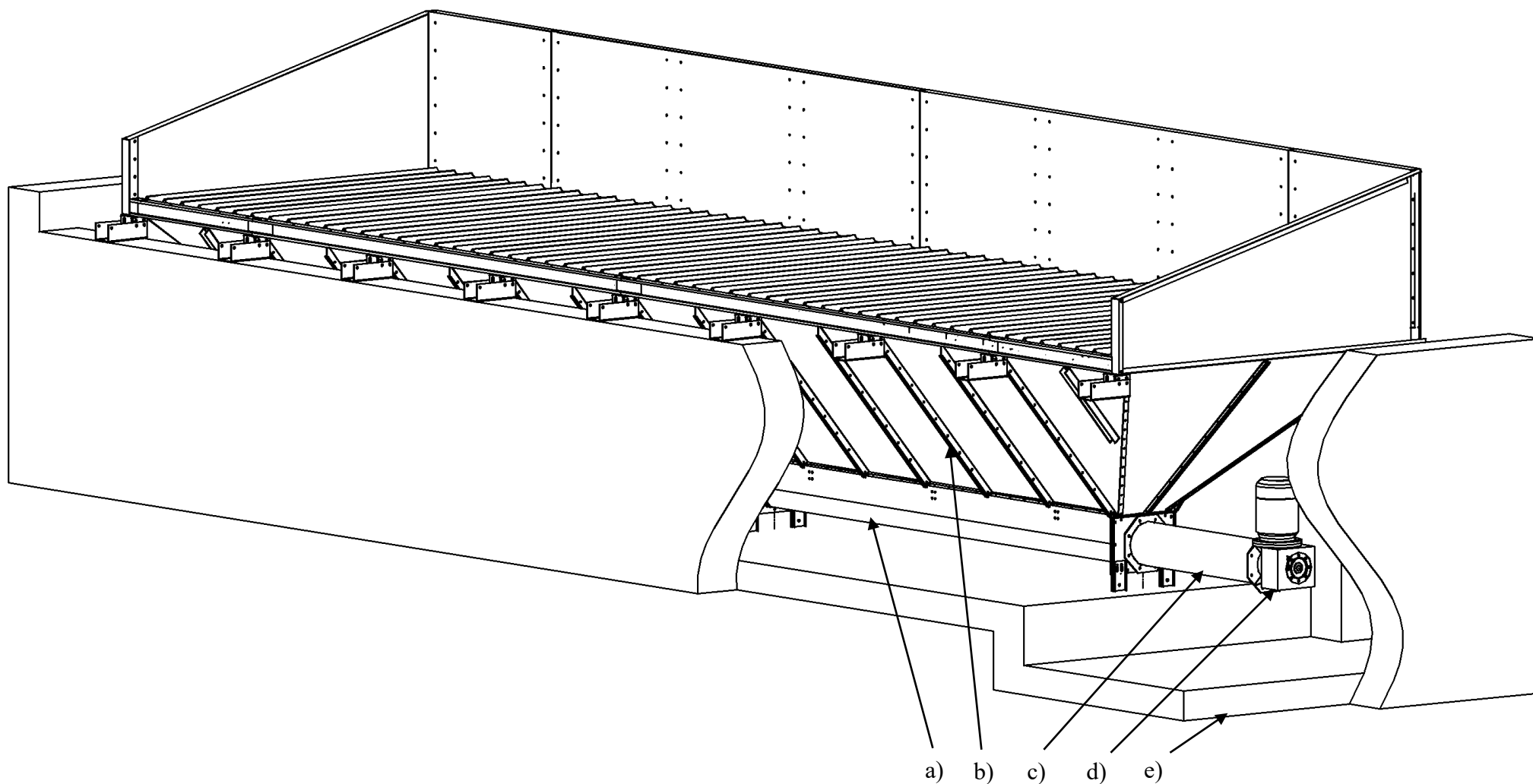


Fig. VI.2 Design of the inlet hopper of the PS220-KPA type.

a) INLET HOPPER CONVEYOR

The inlet hopper conveyor is a screw conveyor with a screw of ca. 200 mm in diameter and 3 m to 9 m long. The screw is installed in an open housing supported on the foundation, with a guard on its upper part. The screw housing was equipped with flanges enabling installation of the screw conveyors of the PS220 type. The screw is equipped with hubs for installation of sliding bearings necessary for normal operation of the device. Depending on the inlet hopper length, the screw has bearings installed in 2, 3 or 4 places. The conveyor is a device installed in the bottom part of the inlet hopper, for transport of material from the hopper to accessories. The screw is driven by the electric motor through the screw reducer and the relevant screw conveyor of the PS220 type. All conveyor components are provided with the anti-corrosion protection in form of zinc or paint coating.

b) INLET HOPPER BODY

The inlet hopper body is a set of components forming a hopper of a volume ranging from 4 m³ to 8.5 m³. The bottom part of the body is formed of four segmented walls: two side walls inclined at 50° in relation to the foundation surface, and two end walls, inclined at 40° in relation to the foundation surface. The upper part of the body is formed by three segmented walls, one side and two end walls. The upper and the bottom part are separated by a segmented openwork grate. The body is fixed to the inlet hopper conveyor and supported on the foundation, to which it is fixed with steel rawplugs. The individual components of the body are made of hot-dip galvanised steel, secured this way against corrosion.

c) PS220 SCREW CONVEYOR

To extend the inlet hopper conveyor, install one of the PS220 screw conveyors. These are 1 m, 1.5 m, 2 m, 2.5 m and 3 m-long conveyors, adapted to installation of one of the PS220 drives. The length of the installed conveyor depends on the way of installation of auxiliary equipment, to which material from the inlet hopper is transported. In each case, the length of the PS220 conveyor and a method for its stable support on the foundation, e.g., by using pipe fixing, MOCRUR200 or fixing to concrete, PS220-MOCBET, must be selected individually. When designing a set of unloading equipment with the PS220-KPA hopper, use of appropriate outlet equipment PSU220-I/O200 must also be provided for. Other information on the design of the PS220 conveyors is provided in Chapter II, page 7 of this Manual.

d) DRIVE TO THE CONVEYOR

Each inlet hopper of the PS220-KPA type should be equipped with a drive consisting of an electric motor, a screw reducer, and installation components. The type of the drive used depends on the length and the planned capacity of the inlet hopper and other equipment cooperating with it. Other information on the design of the PS220 drives is provided in Chapter II, pages 8 and 9 of this Manual.

e) FOUNDATION

The investor should order construction of appropriate foundation, together with drawing up of its documentation, and relevant tests from persons holding required licences, in accordance with the current legislation.

The foundations shape, dimensions and construction depend on machines and equipment working with the inlet hopper, and on user's individual operational conditions. Considering the above, foundations for the hopper working with a bucket conveyor will differ from those for the hopper working with a screw conveyor; the type of foundations will also vary depending on the inlet hopper length, etc.

A correctly designed and constructed foundation is one of preconditions for correct installation, and safe and failure-free operation of the inlet hopper.

The data below concerning the foundation design is indicative and are not binding for an authorised person designing the foundation. It indicates to the investor and the authorised designer of the foundation, the most important issues to be included, while considering local investment conditions.

- guidelines for designing foundations

- geotechnical conditions - when designing foundations for the PS220-KPA inlet hopper, local geotechnical conditions should be considered;
- minimum foundation thickness and shape - as in Figs. VI.3 and VI.4;
- minimum concrete class- C20/25 (B25);
- reinforcement - when designing foundations for the PS220-KPA inlet hopper, a relevant reinforcement should be designed each time;
- the inlet hopper should be fixed to the foundation with steel rawplug connections.

- Conditions for foundation slab construction and acceptance

- foundations should be constructed in accordance with the construction practices and guidelines included in this Operating Manual;
- a topsoil layer and non-load bearing layers under the foundation must be removed;

- backfill the dug pit with sand laid in layers of ca. 30 cm and compacted to $\rho = 0.6 - 0.7$;
- construct sand and cement bedding for the foundation, of class 7.5–10 MPa (substrate of C8/10 lean concrete), at least 100 mm thick;
- foundation drainage should be provided;
- before concrete works, a reinforcement report should be drawn up together with a construction site manager;
- acceptance of the foundation in a presence of a construction site manager, an installation company manager and the investor's representative is precondition for starting installation of the inlet hopper;
- the construction site manager confirms acceptance of the foundation with an entry in the construction site logbook, before starting installation of the inlet hopper;
- when the foundations are constructed incorrectly, installation of the inlet hopper may be cancelled;
- for feed hoppers installed near bucket conveyors or other equipment and structures having their own foundations, individual foundations must definitely be separated with expansion joints;
- when pouring concrete for foundations, it is important to maintain correct dimensions, and the concrete must be vibrated;
- considering the varying ground conditions in a given area, each time optimum foundation reinforcement and thickness are specified by an authorised person who designs the foundations.

BIN Sp. z o.o. shall not be held responsible for any feed hopper damage and other damage resulting from incorrect design and construction of the foundations.

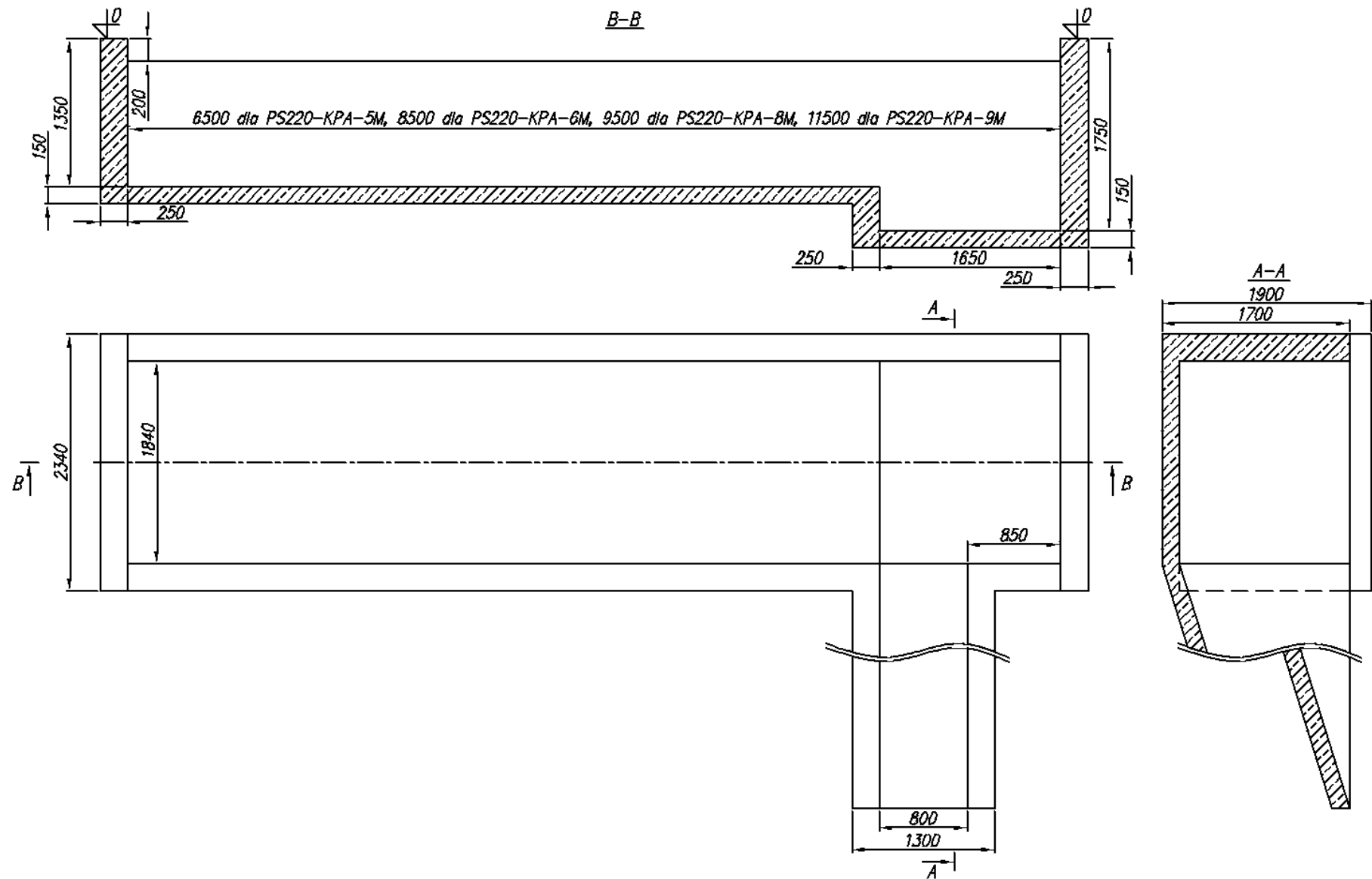


Fig. VI.3 Guidelines for designing foundations of the PS220-KPA inlet hopper working with the PS220 screw conveyor.

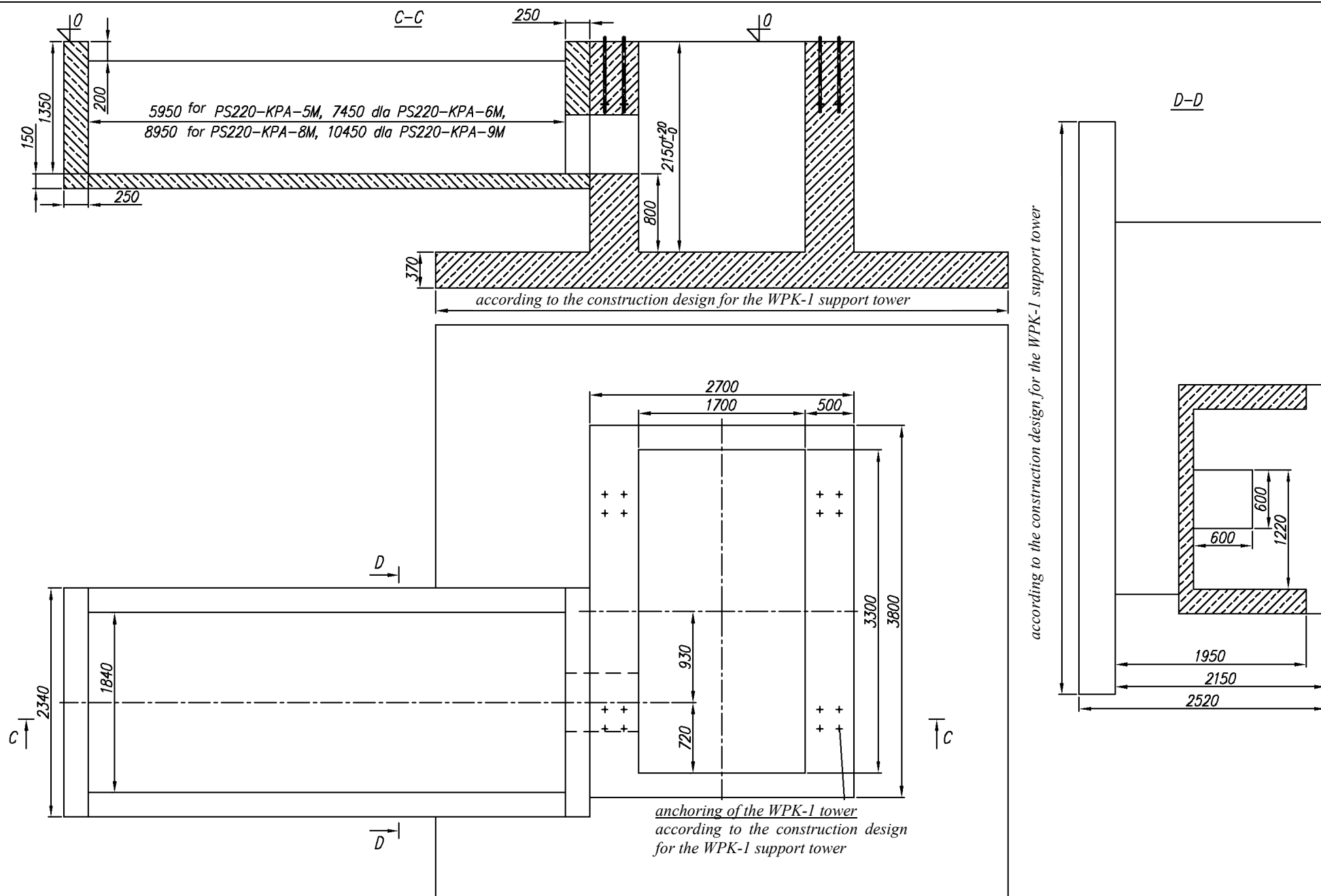


Fig. VI.4 Guidelines for designing foundations of the PS220-KPA inlet hopper working with the PK250 bucket conveyor and the WPK-1 support tower.

1.2. Inlet hopper technical specification

Table VI.1 Inlet hopper technical specification.

	hopper length m	hopper width m	hopper capacity m ³	conveyor length (without an extension and a drive) m	screw diameter mm	hopper weight (without an extension and a drive) kg
PS220-KPA-5M	5	1.85	3.95	3	200	770
PS220-KPA-6M	6	1.85	5.60	6	200	1015
PS220-KPA-8M	8	1.85	6.75	6	200	1215
PS220-KPA-9M	9	1.85	8.40	9	200	1460

*In no device shown in the manual, the level of noise exceeds 70 dB(A).

1.3. Recommended methods for connecting the feed hopper to transport equipment.

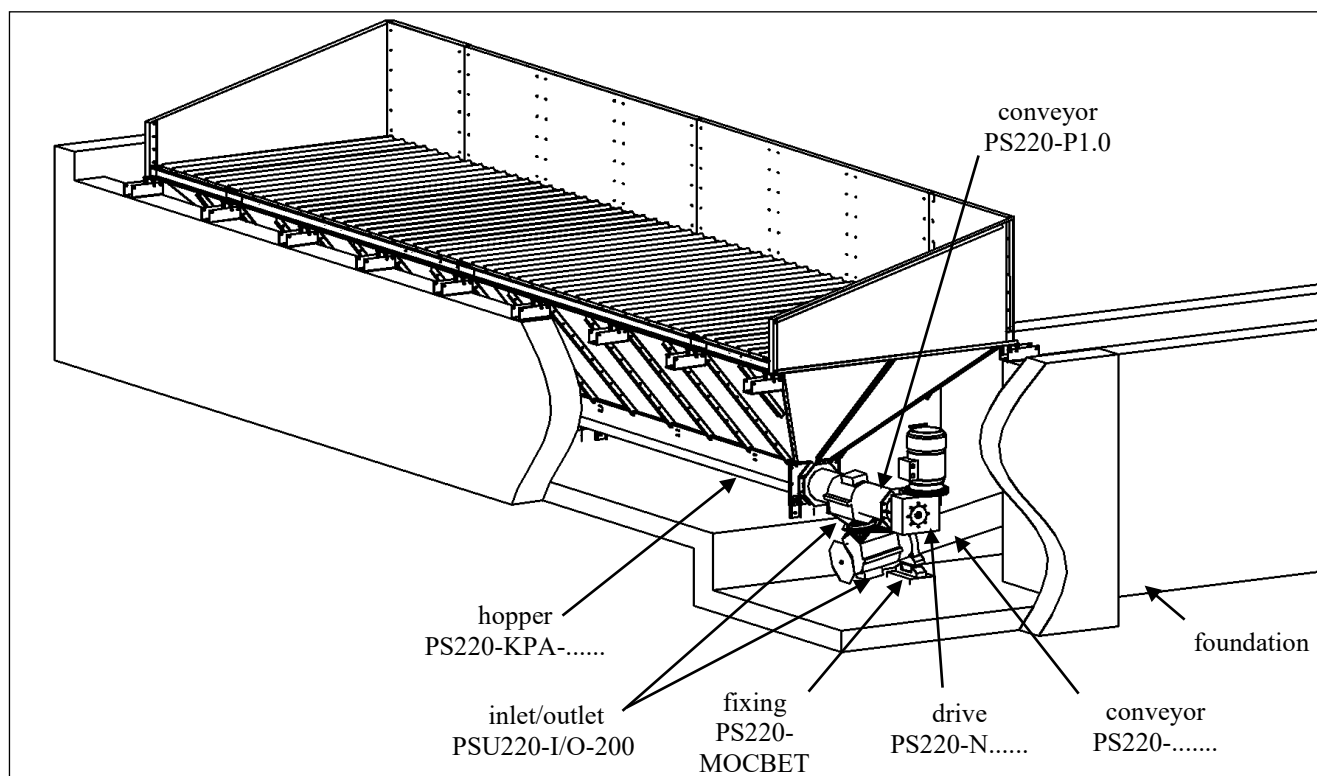


Fig. VI.5 Transport of material from the inlet hopper through the screw conveyor - an example

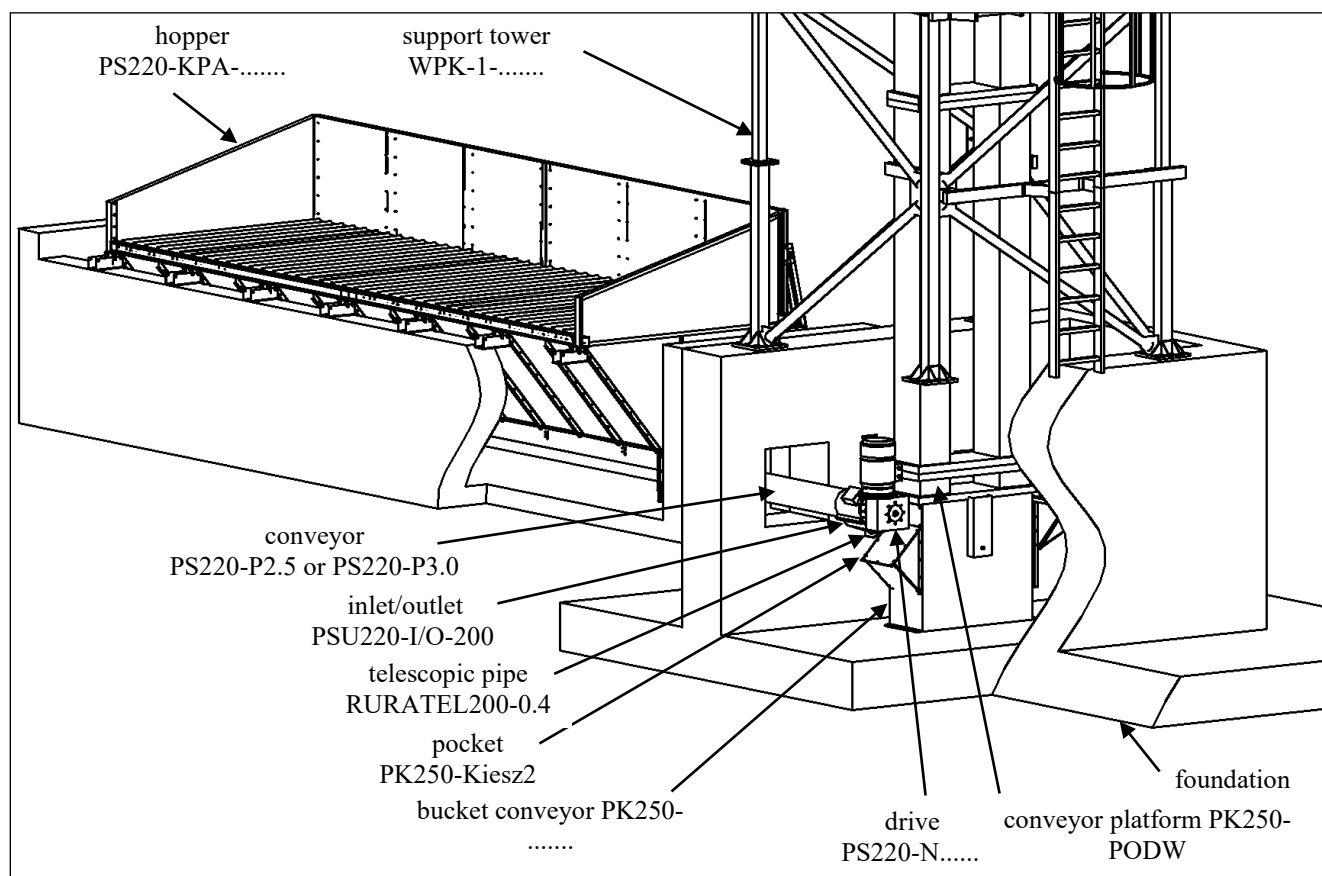


Fig. VI.6 Transport of material from the inlet hopper through the bucket conveyor - an example

The type of devices transferring material from the inlet hopper, as well as the way of their installation depends on the type and the way of work of warehouses, silos, etc.

In the case of any doubts concerning selection of the above auxiliary equipment, contact the manufacturer (BIN Sp. z o. o.) or its sales representatives.

2. Initial operations and preparing the feed hopper for operation

2.1. Investor initial activities

2.1.1. Formal and legal arrangements for the investment

Construction of feed hoppers together with associated facilities and equipment should be conducted in accordance with the current Construction Law:

- The Construction Law Act of 07/07/1994 (Journal of Laws No. 89, item 414, as amended)
- Minister of Agriculture and Food Economy Regulation of 7 October 1997 concerning technical requirements that should be met by agricultural construction and their location (Journal of Laws No. 132, item 887).

The investor responsible for meeting all formal and legal issues, including the design. The designer is responsible for preparing a foundations design for the feed hopper and associated facilities or equipment (when used), preparing a land development plan, and other works required under the current law or arrangements with the investor.

. This operating manual contains guidelines for designing foundations, together with sizes of inlet hoppers. The complete design documentation of inlet hoppers was drawn up at BIN spółka z o.o. Feed hoppers were designed in accordance with current standards and regulations

The investor is obliged to provide the user with necessary information concerning rules of operation (starting, stopping, controlling, signalisation, etc.) for the feed hopper and all equipment used together with it, including emergency procedures in the event of a fire, trapping, blocking of material in the equipment, and similar situations.

2.1.2. Device location

The inlet hopper should work under a roofing. A decision about location of the inlet hopper should be made in accordance with the current Construction Law. The investor is responsible for fulfilling all obligations in this respect.

When making a decision about the location, make sure that the ground will be able to transfer loads from the inlet hopper filled with grain. Inlet hoppers should be located at a sufficient distance from overhead power lines. The devices can be constructed at a distance no less than 15 m from the place of storing organic fertilisers, manure, liquid manure or slurry. Certain units of the inlet hopper (the conveyor, the drive, etc.) are usually installed below the ground level. The said subunits should be effectively secured against access of ground and stormwaters, etc. It is forbidden to install and operate the inlet hopper with its subunits covered by water (groundwater, stormwater, etc.).

2.2. Installation and start-up

2.2.1. Installation

The installation of the inlet hopper requires the use of special equipment and relevant training. Therefore, the device can only be installed by an installation company authorised by BIN. The installation company should cooperate with an entity ordering installation, in terms of works organisation, financial settlements, and acceptance of installation works. Due to risks related to the installation works, it is forbidden for the investor or other companies not authorised by BIN to perform installation works. Installation works can start when the required foundation is constructed and all product components are collected in a required place

2.2.2. Electrical systems and start-up

Conditions that should be met by the electrical system of the inlet hopper and by its electrical subunits are the same as for the PS220 screw conveyors.

The manufacturer equips the inlet hopper with the following electrical subunits:

- three-phase electric motor;
- lockable main switch;
- lockable star-delta starter (concerns PS220-N6/300, PS220-N7.5/200, PS220-N7.5/300);
- motor (thermal) switch,
- undervoltage release,
- housing for the thermal switch and the undervoltage release.

The design documentation of the investment must include appropriate design study for the wiring system, taking into account the inlet hopper connection together with auxiliary equipment. The investor is responsible for drawing up such design study by a person holding relevant licences in accordance with current legislation.

The investor is responsible for construction of the electrical wiring system in accordance with the said design study by an electrician holding relevant licences.

Regardless of the function and construction method, the design study and the constructed wiring system must meet the following requirements:

- motor correctly connected (as required by a motor manufacturer),
- motor secured by a correct connection and adjustment of the thermal switch;
- securing against unintended starting of the hopper after power outage;
- option for securing the hopper against unintended start (e.g., a lockable main switch),
- voltage supplied to all units should be within ranges specified by manufacturers of those units;
- function for automatic stop of the hopper work in the event of any incorrect work of accessories (e.g., failure of a conveyor) or people entering areas dangerous for them (e.g., a silo during loading)

The investor is responsible for delivery (at its own expense) of all electrical equipment and units not being a part of the hopper equipment, but necessary for construction of required electrical wiring.

The investor is responsible for providing guidelines of the hopper manufacturer (included in this operating manual) to a person designing and constructing the wiring system.

A person constructing the wiring system should perform the first test starting of the inlet hopper, check correctness of the motor rotations and consistence of current values on nominal plates of the motor and the thermal switch.

The producer requires a written confirmation of construction and checking of the wiring system by an electrician holding required licences.

2.3. Investor final activities

After installation of the inlet hopper and construction of the wiring system, the investor is responsible for pouring concrete around supports on which the device rests, and for construction of security railings preventing vehicles from driving over the inlet hopper (Fig. VI.7).

Furthermore, the investor should, itself and at its own expense, construct guards for those parts of the foundation which are not used by the device for technological reasons, and may pose a threat of sliding, tripping, or falling from a height.

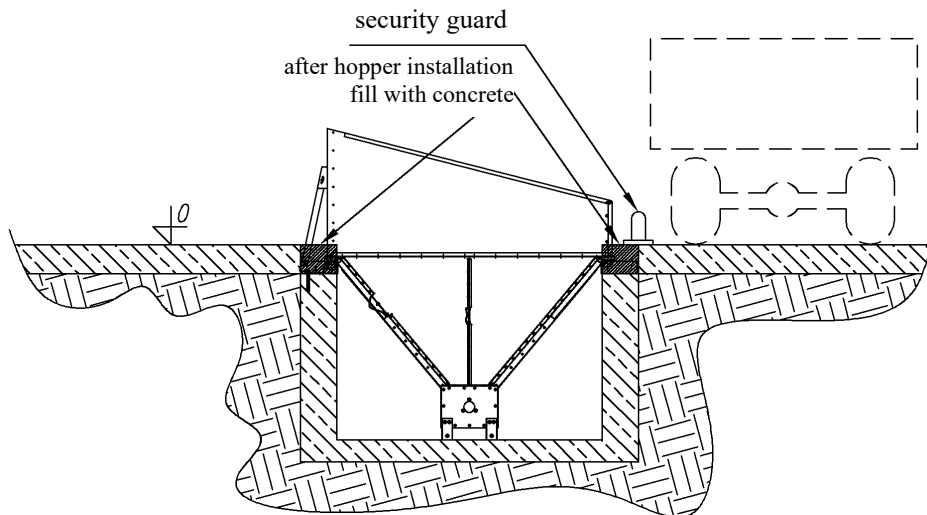


Fig. VI.7 A way for pouring concrete and constructing access routes to the inlet hopper - an example.



The investor should, itself and at its own expense, secure the hopper against penetration of water (especially from rain or snow). An appropriate roofing over the hopper, as well as required foundations and paved access routes, etc., should be constructed, so no water can penetrate into the device.

2.3.1. Fire prevention

The investor is obliged to fulfil all obligations related to fire prevention, including ensuring access and evacuation routes, access to sources of extinguishing water, and distribution of extinguishing equipment and fire safety instructions. Fire prevention aspects are governed by the Regulation of the Minister of Interior and Administration of 7 June 2010 concerning fire prevention in buildings, other structures, and terrains (Journal of Laws, 2010, No. 109, item 719) and the Minister of Interior and Administration Regulation of 24 July 2009 concerning supplies of water for extinguishing purposes and fire department access roads (Journal of Laws 2009, No. 124, Item 1030).

2.3.2. Installation of power delivery points

Installation of power delivery points and supply for the inlet hopper and auxiliary devices should be performed by a licensed electrician according to the current law and an individual facility plan.

3. Operation

3.1. Feed hopper operation

Methods for starting and stopping the inlet hopper may differ from those described below. This results from a design of the electrical wiring system, in which used electrical units (mainly control devices) differ from those delivered by the feed hopper manufacturer.

3.1.1. Equipment Activation

PS220-N3/200, PS220-N4/150, PS220-N4/200 and PS220-N4/300

- Set the main switch in the position "I",
- Press the black ON button on the motor switch.

PS220-N6/300, PS220-N7.5/200, PS220-N7.5/300

- Press the black ON button on the motor switch.
- Set the 0-Y-Δ switch in the position "Y" and wait ca. 10 seconds until the motor reaches its full speed;
- Set the 0-Y- Δ switch in the "Δ" position.

3.1.2. Stopping the device

PS220-N3/200, PS220-N4/150, PS220-N4/200 and PS220-N4/300

- Cut the grain inflow to the inlet hopper (close the shutters) and wait until the device is completely empty,
- Press the red OFF button on the motor switch.
- Set the main switch in the position "0",

PS220-N6/300, PS220-N7.5/200, PS220-N7.5/300

- Cut the grain inflow to the inlet hopper (close the shutters) and wait until the device is completely empty,
- Set the 0-Y-Δ switch smoothly in the "0" position;
- Press the red OFF button on the motor switch.

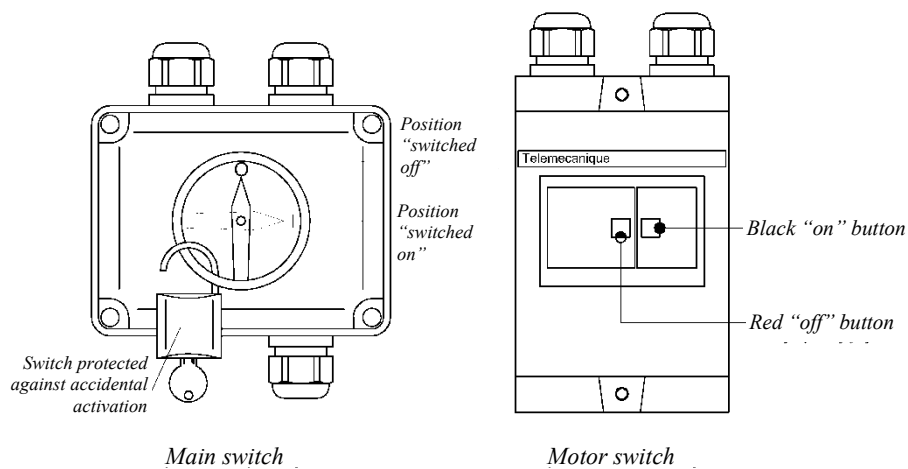


Fig.VI.8 Control devices of the inlet hopper with PS220-N3/200, PS220-N4/150, PS220-N4/200, and PS220-N4/300 drives.

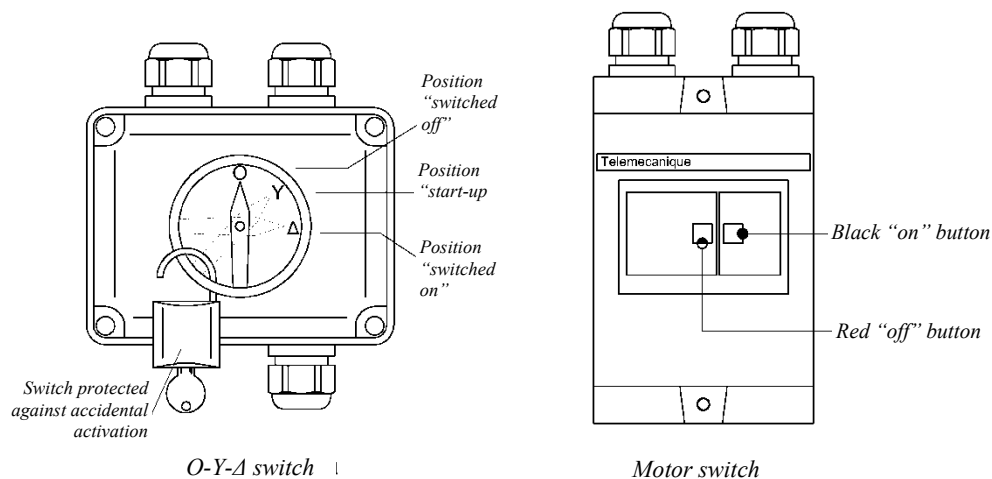


Fig.VI.9 Control devices of the inlet hopper with PS220-N6/300, PS220-N7.5/200 and PS220-N7.5/3000 drives.

3.1.3. Grain transport

Before starting the grain transport:

- check the operational condition of the inlet hopper and its accessories;
- ensure that there are no people at locations of grain outlet;
- arrange efficient collection of material from the conveyor outlet, to prevent its overload.

When the above remarks are considered, start the feed hopper in accordance with rules described in section 3.1.1 of this Manual.



In an emergency, stop the device by pressing the red STOP button on the motor switch.

In the case of power outage, the inlet hopper will be permanently stopped. Restoring of power supply will not restart the devices automatically. To restart the inlet hopper, repeat the starting procedure (item 3.1.1) from the beginning.

To stop the inlet hopper, follow the rules specified in section 3.1.2 of this Manual.



After filling the inlet hopper with grain, it must be started immediately. It is forbidden to store grain in the inlet hopper. Material that is contaminated or with high moisture content (especially maize grain) should be poured into the hopper in small portions. Failure to follow the above recommendations may result in problems with starting the device and in consequence, to its damage.

3.2. Inlet hopper maintenance

Correct and punctual maintenance inspections, maintenance and possible repairs guarantee availability of the full operating capacity of the devices and prevent their premature and excessive wear.

3.2.1. Periodic maintenance and current overhauls

Periodic maintenance covers:

- inspection of safety devices, that is, a motor switch, a main switch, etc. (correct operation, no mechanical damage, etc.);
- inspection of the electrical wiring system by an authorised electrician;
- inspection of a technical condition of welded, screwed and other connections;
- inspection of anti-corrosion coatings;
- inspection of sliding and rolling bearings;
- lubrication of sliding bearings;
- inspection of other moving and fixed components.

Maintenance frequency:

Periodic maintenance frequency should be adapted to intensity of use, but it should take place at least once a year. All safety devices, i.e., the motor switch, the main switch, and other, should be inspected at least once a month or before each start of the inlet hopper.



At least once a year, the User should order a qualified electrician holding relevant licences to inspect all electric equipment components. The person performing the maintenance should draw up a report on inspection.

Sliding bearings of the inlet hopper conveyors should be lubricated after each 30 hours of operation.

The regular maintenance includes small repairs, and possible repairs of anti-corrosion coats.

The user should maintain an inlet hopper maintenance logbook.



Anti-corrosion coating of screws can be damaged during installation (tightening). In such case, regular repairs include applying anti-corrosion coatings on damaged surfaces.

3.2.2. General overhaul

Overhauls are performed according to a scope and needs, depending on screw connections, etc., wear, and during them relevant parts are either repaired or replaced with new. Such overhauls cover the scope of regular maintenance and:

- replacement of roller and sliding bearings, gaskets, etc.
- applying of new anti-corrosion coatings;
- other relevant repairs.



All damages must be repaired immediately, and parts that are damaged or worn must be repaired or replaced with new ones.

Chapter VII. Unloading systems for BIN silos

1. Principle of operation

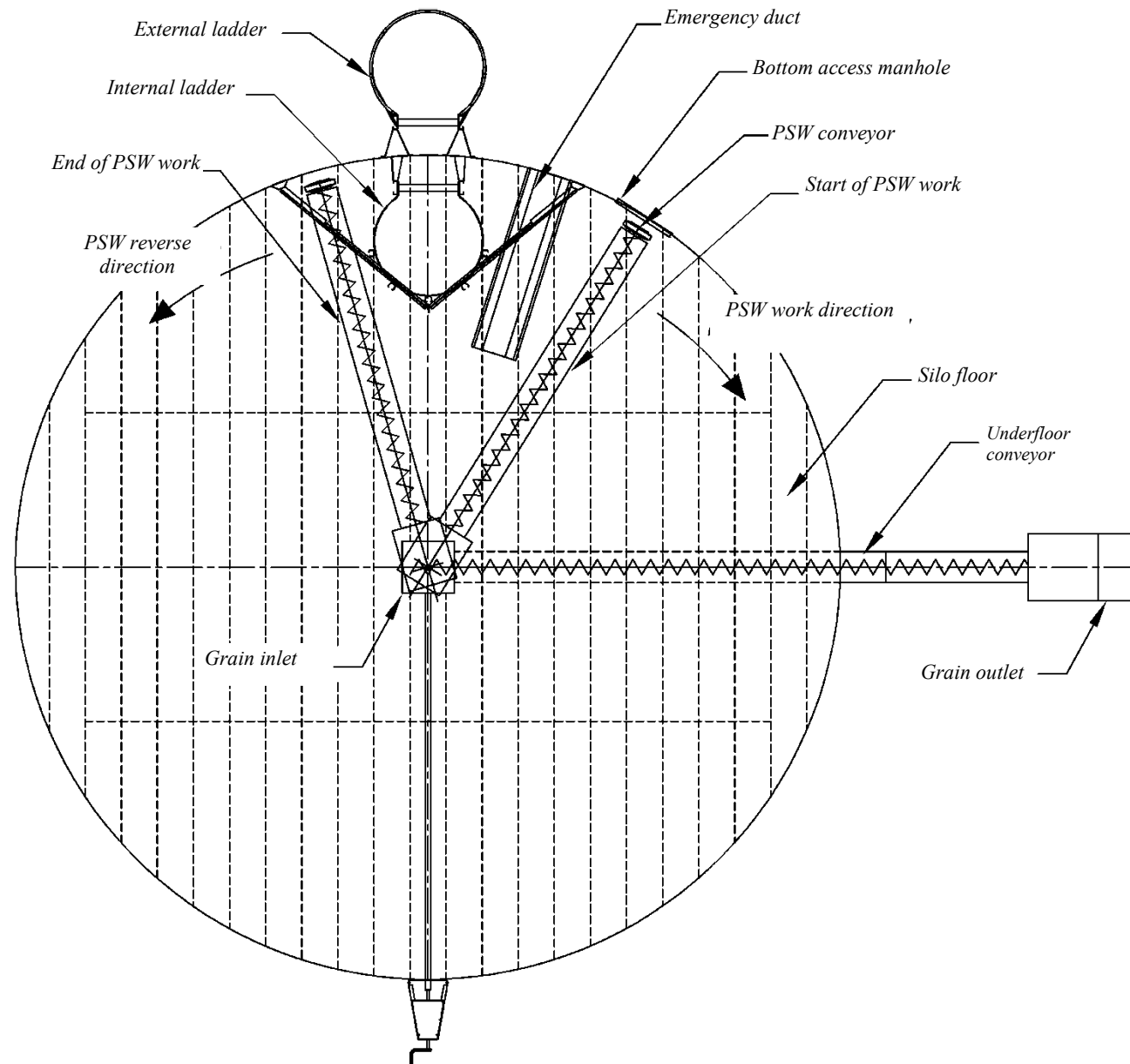


Fig. VII.1 A diagram of operation of a screw conveyors system for BIN silo unloading.

Chapter VIII. Final and supplementary information

1. Storage

When the device is not used for a longer time, empty completely the conveyors completely, clean them and perform all necessary repairs and maintenance.

The drive unit of the underfloor conveyor and the inlet hopper together with a screw should be preferably dismantled, preventive maintenance should be performed and they should be stored in a dry room. When those units are left at the location of their operation, it is recommended to cover them against any influence of weather conditions.

When starting the equipment after a longer break in use, follow the guidelines for the start-up (specified in this Operating Manual).

2. Disassembling and disposal

When it is found that the device cannot be no longer operated:

- dismantle all conveyor parts and units;
- sort the parts according to a location and a method for their disposal;
- all metal, plastic and other parts and units should be transferred to specialist entities processing and disposing of such materials;
- secure other parts against possible adverse effects on humans, animals, and the natural environment



When performing disassembling and disposal operations, observe safety and security precautions specified for transport and handling activities (specified in this Operating Manual).

As of 08/11/2022 I approve for use the Operating Manual:

title - "Screw conveyors"

review - XXIII

issued on - 08/11/2022

Chief Constructor
Mieczysław Laskowski

.....
(signature)

3. Warranty and warranty card

BIN Spółka z o. o. guarantees correct operation of the purchased product from our company. The warranty covers 12 months from the date of sales and is valid only together with a proof of sales issued to a user by us or by our representative. The guarantee covers free of charge removal of defects significantly compromising functions of the product. Therefore, application of warranty provisions under Article 558.1 of the Civil Code is explicitly excluded.

General Guarantee Terms And Conditions

1. The territory of the Guarantee Application
This guarantee is valid within the territory of Poland. The warrantor shall cover costs of transport related to an accepted warranty complaint for a distance of up to 250 kilometres covered, according to standard rates.
2. The warranty does not apply to defects resulting from incorrect or excessive operation, natural wear of parts, or other reasons outside the manufacturer's control.
3. The warranty shall not cover any other costs unspecified above, especially costs being a consequence of the equipment stoppage.
4. The guarantee shall become void in the following cases:
 - use of the product contrary to its intended use;
 - when installation was incorrect or any unapproved changes were made;
 - works requiring specialist licences were performed by unauthorised persons;

Specific Guarantee Terms And Conditions

1. In the case of products:
 - containing electric motors, the guarantee for motors is granted by their manufacturer;
 - delivered as components - a customer will verify condition of these components on delivery, and then will store them on its own responsibility until they are assembled. Flat components of galvanised sheets require special attention. They should be stored in a way ensuring a free flow of air around each component. When wet galvanised metal sheets are in contact with each other, permanent spots form, even during a short-term storage.
2. When arrangements made during placement of an order or included in the Operating Manual include obligations for a buyer, then the warranty does not cover consequences of failure to perform or incorrect performance of these obligations.
3. Outdated financial liabilities of a buyer towards the warrantor or the seller result in a loss of the warranty rights until the outstanding liabilities are covered.

Mode for exercising guarantee rights

Any defects found a customer notifies to the seller in writing. The seller shall notify the customer about a way of handling its complaint, a place and a time of warranty repair no later than within 14 days.

Manufacturer:

BIN Sp. z o.o.
87-700 Aleksandrów Kujawski
at Narutowicza 12

.....
The Vendor:

*(seller's signature is not required when an invoice
includes a note of granting the warranty)*