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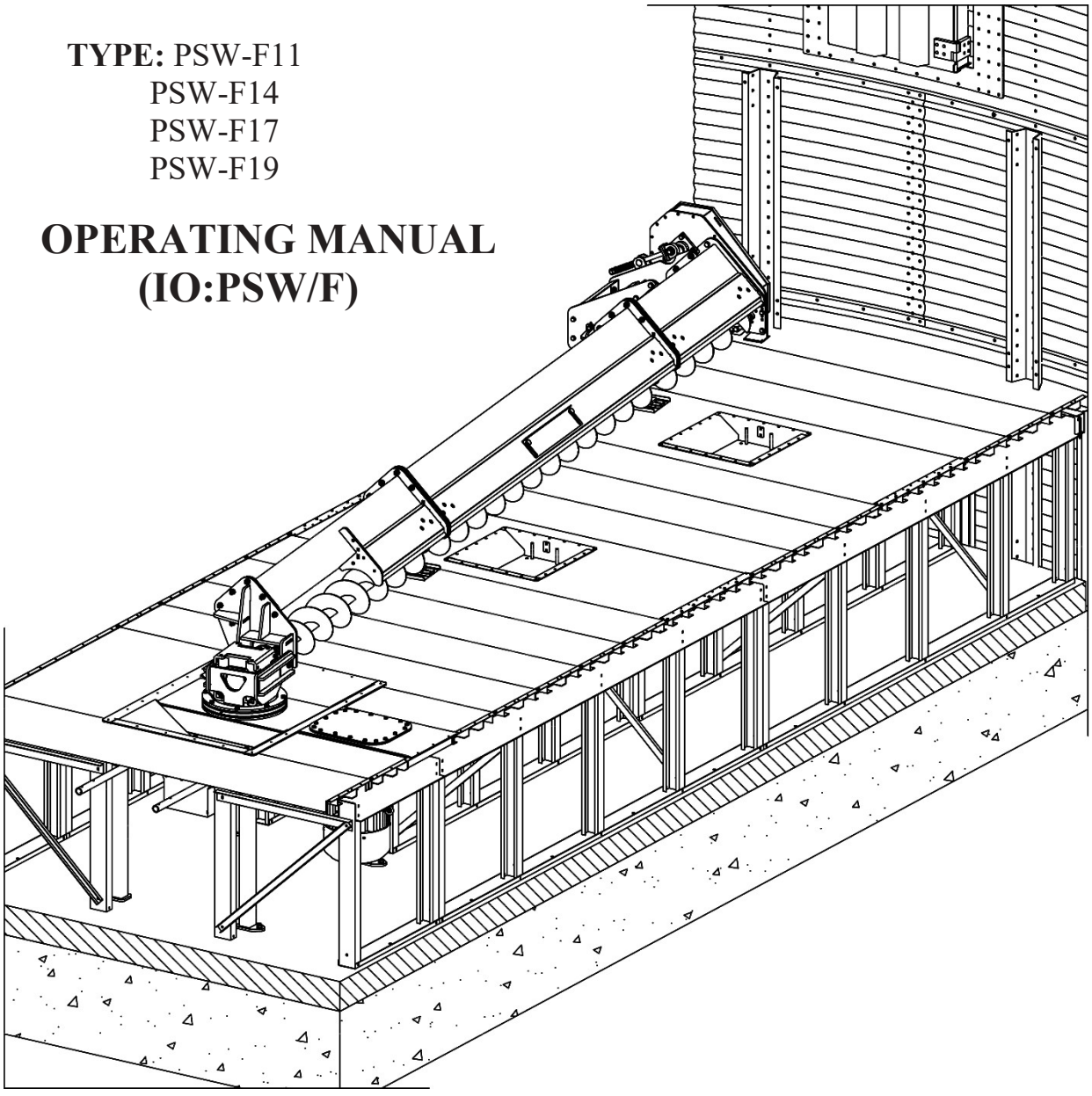
INTERNAL SCREW CONVEYORS PSW-F

FOR UNLOADING OF FLAT BOTTOM SILOS OF FBIN TYPE

TYPE: PSW-F11
PSW-F14
PSW-F17
PSW-F19

OPERATING MANUAL (IO:PSW/F)



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Aleksandrów Kujawski/A4 format

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Introduction

The aim of this operating manual is to acquaint the user with proper operation of the purchased product. This Operating Manual contains practical guidelines that must be known to the operator of internal screw conveyors. **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 internal 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 all related risk. All and any unauthorised changes to the product design exclude the manufacturer's responsibility regarding any resultant damages.

Conveyors are high power electromechanical devices. Its incorrect operation may cause fire, fatal electric shock, burns or other severe injuries.

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.

It is strictly forbidden to open the relief inlets when there is too much grain in the silo, enough to cover the central inlet opening so it is not clearly visible. Opening the relief inlets in the silo containing too much grain may result in deformation or even bursting of the silo shell during unloading.

1. Safety

1.1. Basic safety rules

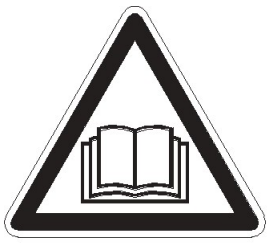
1. People employed to use or operate the PSW conveyors, as well as people within the area of their operation are obliged to adhere to general OHS regulations.
2. The user is obliged to read and understand this operating manual for the screw conveyors and manuals for all other auxiliary equipment, and to strictly adhere to them.
3. Before the device is started, check the location to which the grain will be transported 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 under an influence of alcohol or narcotic drugs, or by minors.
5. If grain is to be racked manually into PSW unloading inlets in the silo floor, the conveyor and all cooperating equipment must be stopped.
6. It is strictly forbidden to put hands into unloading inlets of the PSW conveyor.
7. The location of the conveyor work and its controllers should be secured against any access of children and unauthorised people.
8. A conveyor owner is obliged to provide it with detailed occupational health and safety instructions.
9. In the event of bad lighting conditions, a location where the conveyor is operated should be equipped with additional general lighting.
10. During its operation, the PSW conveyor must be supervised at all times.
11. Conveyors and their surroundings should always be kept tidy and clean.
12. It is forbidden to switch on the conveyor without guards or to remove them during work.
13. An electric motor cannot be covered by any items. Failure to observe this recommendation may result in a risk of motor overheating or a fire.
14. 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.
15. All components of the power supply system must be secured against any damage.
16. Designing, construction of an electrical 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.
17. Descriptions and diagrams of the electrical system included in this operating manual represent general guidelines for a design study for the electrical systems by licensed persons.
18. 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.
19. At least once a year, the User should order a qualified electrician holding relevant licences to inspect all electric equipment components.
20. A supply power cable should not be twisted or exposed to a risk of cutting. Its damage may cause an electric shock.
21. The power supply cable must be routed in such way that it does not pose any other hazards.
22. The user is responsible for correct connection of power delivery points and their correct operation.
23. 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.
24. 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.
25. Extinguishing electrical systems fires with a water or a foam extinguisher is forbidden.
26. Before commencing installation, check whether the conveyor and its components were not damaged during transport or storage.
27. When any situation posing a threat to human life or health occurs, the device must be switched off immediately and disconnected from the mains.
28. The repair and maintenance operations can only be conducted by able-bodied adults holding relevant qualifications.

29. The user is obliged to adhere to guidelines provided for in operating manuals of the electric motor and a screw motion detector supplied together with the PSW conveyor.
30. The user is obliged to read and understand operating manuals for a silo in which the PSW conveyor is installed, and to strictly adhere to it.
31. The FBIN type silo, with which the PSW conveyor operates, must be equipped with an emergency duct (if it is not a standard feature of the said silo), for unloading the silo in the event of the conveyor failure, or grain aggregation above the PSW inlets.
32. It is strictly forbidden to open the relief inlets when there is too much grain in the silo, enough to cover the central inlet opening so it is not clearly visible. Opening the relief inlets in the silo containing too much grain may result in deformation or even bursting of the silo shell during unloading.
33. It is strictly forbidden to start the PSW screw conveyor in a silo with a central grain inlet to the under-floor screw conveyor is covered with grain (for any reasons). Before starting up the PSW conveyor, check if the central inlet into the underfloor PSW conveyor (in the silo axis) is not covered with grain.
34. The conveyors are labelled with safety marks. Each user is obliged to learn their meaning.
35. Warning signs, nominal plates and other information 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, replacing damaged ones.
36. 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.
37. In the case when the device is delivered without the nominal plate, or the said plate is destroyed, the user should notify the producer in writing about this fact to obtain its duplicate.
38. 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.

1.2. Information and warning signs

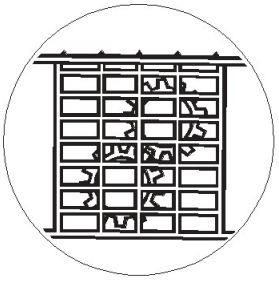
Information and warning signs are installed on the conveyor body. A correct motor rotational direction is marked on the motor cover near its fan. The nominal plate with a CE mark and the plate "normal start-up of the PSW conveyor" are placed on the silo shell near the bottom manhole.

Note! Warning signs, nominal plates and other information 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, replacing damaged ones.

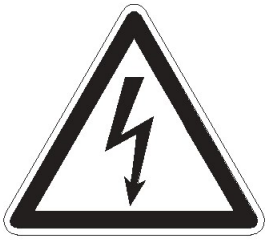


READ OPERATING MANUAL

ATTENTION! DANGER

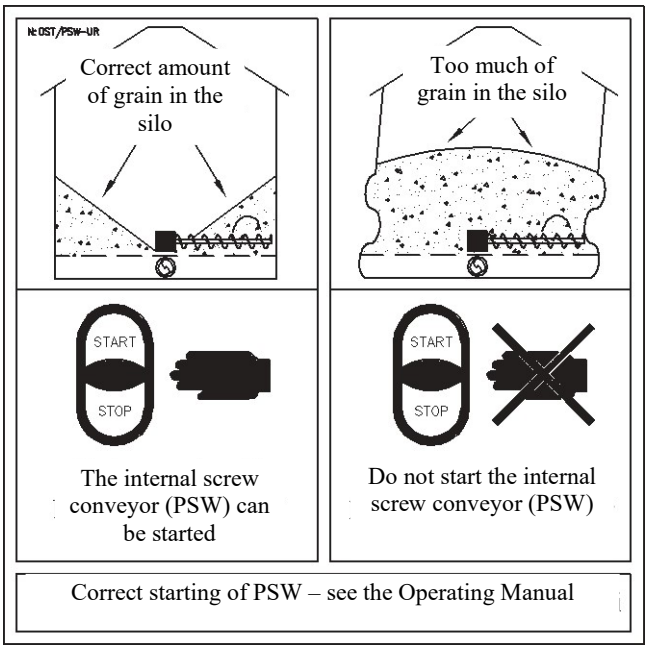


USE GUARDS



RISK OF ELECTRIC SHOCK

Correct start-up of the conveyor PSW



Correct direction of the electrical motor rotations

Nominal plate

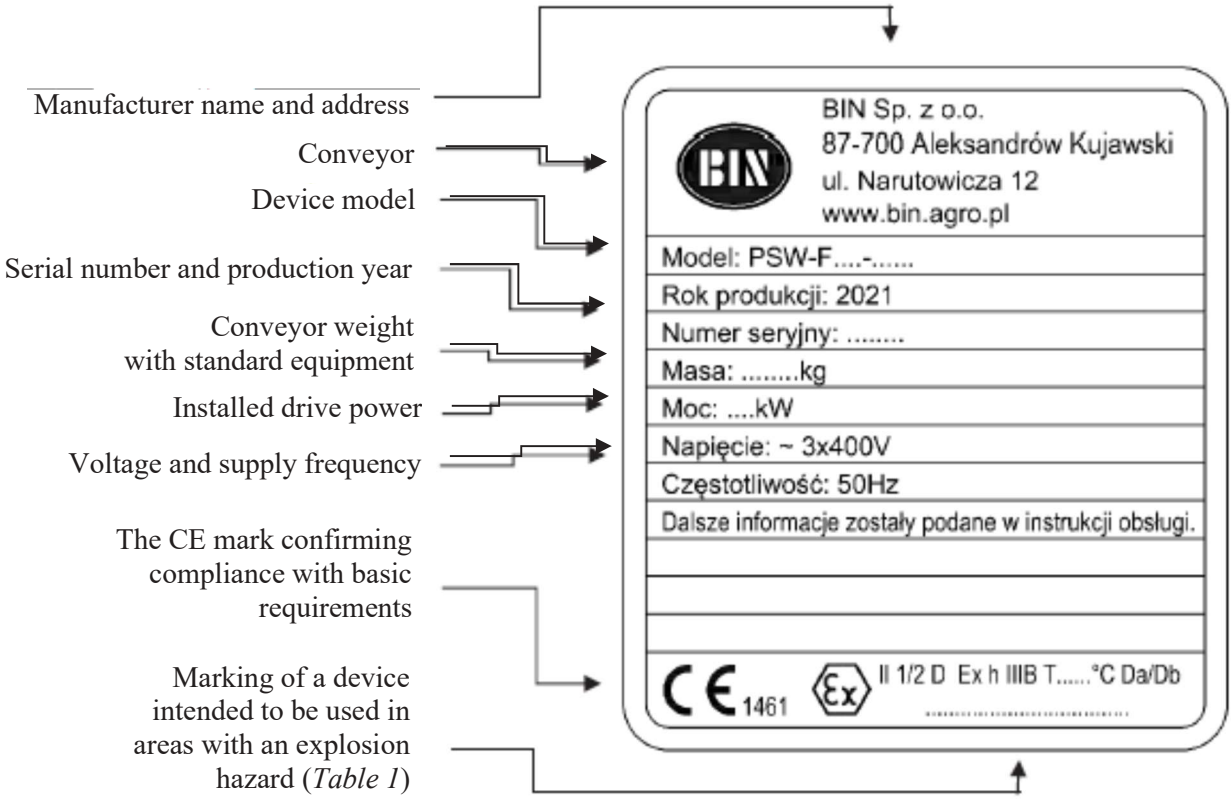
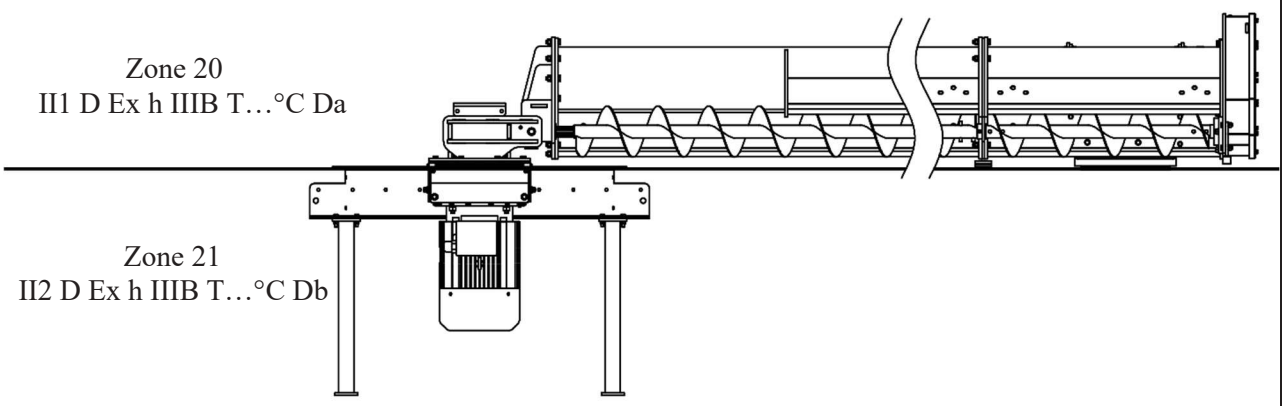


Table 1 Marking of a device intended to be used in explosion hazard areas.

	Marking of an explosion proof protection.
II	Group of devices: **II** - to be used at locations other than mining plants
1/2	Category of devices to be used in zones: **1** in zones 0 and 20 **2** in zones 1 and 21
D	**D** - dust explosive atmospheres
Ex	A symbol indicating that a device corresponds to one or several types of the explosion-proof design
h	Non-electrical equipment for explosive atmospheres - symbol
IIIB	Marking of the non-electrical equipment group: **IIIB** - equipment intended to be used at locations with explosive dust atmospheres other than in mines and corresponding to flammable airborne particles and non-conductive dust
T…..ºC	Maximum equipment surface temperature.
Da/Db	Equipment Protection Level (EPL): **Da** - equipment for explosive atmospheres due to the presence of combustible dust, which does not constitute a source of ignition in normal operation, when subject to expected failures, or when subject to rare failures **Db** - equipment for explosive atmospheres due to the presence of combustible dust, which does not constitute a source of ignition in normal operation, or when subject to expected failures



2. General product description

2.1. Intended use of the conveyor

The internal screw conveyor (PSW) is used to unload FBIN silos manufactured by BIN Sp. z o.o. , and is an auxiliary device facilitating unloading of the remaining grain that did not enter gravitationally the underfloor unloading conveyor. Usually it is about 10–20% of the silo loading capacity. The internal screw conveyor cannot be installed alone in the silo - it always works together with the underfloor unloading conveyor. Cooperating underfloor and internal conveyors enable unloading of a silo.

Table 2 Intended use and equipment of PSW-F conveyors.

<table>
<tr><td colspan="2"></td><td colspan="4">FBIN silo</td></tr>
<tr><td colspan="2"></td><td>FBIN11</td><td>FBIN14</td><td>FBIN17</td><td>FBIN19</td></tr>
<tr><td colspan="2">PSW of a nominal unloading capacity of up to 45 tonnes/h and the installed drive power of 7.5 kW</td><td>PSW-F11-7.5</td><td>PSW-F14-7.5</td><td>PSW-F17-7.5</td><td>PSW-F19-7.5</td></tr>
<tr><td colspan="2">PSW of a nominal unloading capacity of up to 80 tonnes/h and the installed drive power of 11 kW</td><td>PSW-F11-11.0</td><td>PSW-F14-11.0</td><td>PSW-F17-11.0</td><td>PSW-F19-11.0</td></tr>
<tr><td rowspan="5">Not a standard PSW accessory</td><td>Required PSW equipment for silos with a steel floor on steel trusses</td><td colspan="4">PSW-FAKC-PDS
(it is equipped with a shutter of the ZPR-1 central inlet manufactured by BIN)</td></tr>
<tr><td>Required PSW equipment for silos with a concrete floor on steel trusses and unaccessible maintenance channel</td><td colspan="4">PSW-FAKC-PDB1
(it is equipped with a shutter of the ZPR-1 central inlet manufactured by BIN)</td></tr>
<tr><td>Required PSW equipment for silos with a concrete floor on steel trusses and man-accessible maintenance channel</td><td colspan="4">PSW-FAKC-PDB2
(a central inlet is not equipped with a shutter)</td></tr>
<tr><td rowspan="2">The required number of relief inlets for PSW start-up, apart from the central unloading inlet</td><td>2</td><td>2</td><td>2</td><td>3</td></tr>
<tr><td colspan="4">Maintain the minimum dimensions of an individual relief inlet of about 0.25 x 0.25 m</td></tr>
<tr><td></td><td colspan="4">NOTE!
The PSW-F type conveyor is not adapted to installation with a silo equipped with a steel floor on concrete blocks, or other floors not listed in this table. When a silo is equipped with a floor other than those listed or of a modified design, the conveyor or its equipment must be designed and constructed in a customised way.</td></tr>
</table>

A correctly selected internal screw conveyor for a given FBIN silo consists of a relevant PSW-F…..-…… + PSW-FAKC-……. + PSW start-up relief inlets. The PSW conveyor should cooperate with an underfloor conveyor of a larger or equal nominal unloading capacity. When a PSW conveyor of a capacity exceeding that of an underfloor conveyor is installed, its correct operation will not be possible, and it may result in a damage to the devices.

A technological connection (a spigot, a connection, etc.) of the central inlet and the PSW start-up relief inlets with the underfloor conveyor is not a part of any PSW unit. A connection between the PSW conveyor and the underfloor conveyor must be designed and constructed individually, depending on the underfloor conveyor design.

A system of type ZPR-1 shutters manufactured by BIN can be used as relief inlets for PSW start-up, and to control the central inlet.

An operating cycle of the PSW conveyor ends with its full turn around a vertical axis of a silo in which it was installed. If necessary (when a layer of grain remaining on the silo floor is too thick), the conveyor can perform another and successive operating cycles. When the PSW operation ends, a layer of grain of 4 to 8 cm thick should remain in the silo floor, to be removed manually by the user.

2.2. Technical data

Table 3 Product technical data

		PSW-F 11-7.5	PSW-F 11-11.0	PSW-F 14-7.5	PSW-F 14-11.0	PSW-F 17-7.5	PSW-F 17-11.0	PSW-F 19-7.5	PSW-F 19-11.0
Drive type		Electrical motor							
Motor nominal power	kW	7.5	11.0	7.5	11.0	7.5	11.0	7.5	11.0
Supply voltage	V	3x400							
Motor rotational speed	rpm	1450							
Types of gears used		A belt drive with wheels and a timing belt, a transmission helical gear (bevel), and a chain drive.							
Screw diameter	mm	200							
Screw rotational speed	rpm	200	355	200	355	200	355	200	355
Conveyor installation length 1)	mm	5600		7000		8200		9400	
Ambient temperature	°C	-20 to +40							
Conveyor installation height 2)	mm	520±20 conveyor body / 610±20 chain drive housing							
Conveyor nominal capacity 3)	tonnes/h	up to 45	up to 80	up to 45	up to 80	up to 45	up to 80	up to 45	up to 80
Device weight 4)	kg	1150	1190	1240	1280	1365	1405	1420	1460

1. The conveyor installation length represents a length measured from the silo vertical axis to the furthest part of the device.
2. The conveyor installation height represents a height measured from the silo floor surface to the highest part of the body/housing of the device chain drive.
3. The conveyor nominal capacity is determined by the material bulk density, depending on its type, size, moisture content, contamination level, etc.:
   45 or 80 tonnes/h (for wheat of bulk density of 750 kg/m^3), respectively; 35 or 65 tonnes/h (for oats of bulk density of 600 kg/m^3).
4. The device weight with standard equipment (excluding the weight of optional equipment, e.g., relief inlets for the PSW start-up, on-floor accessories, etc.)
5. In no device shown in the manual, the level of noise exceeds 70 dB(A).

2.3. Design description

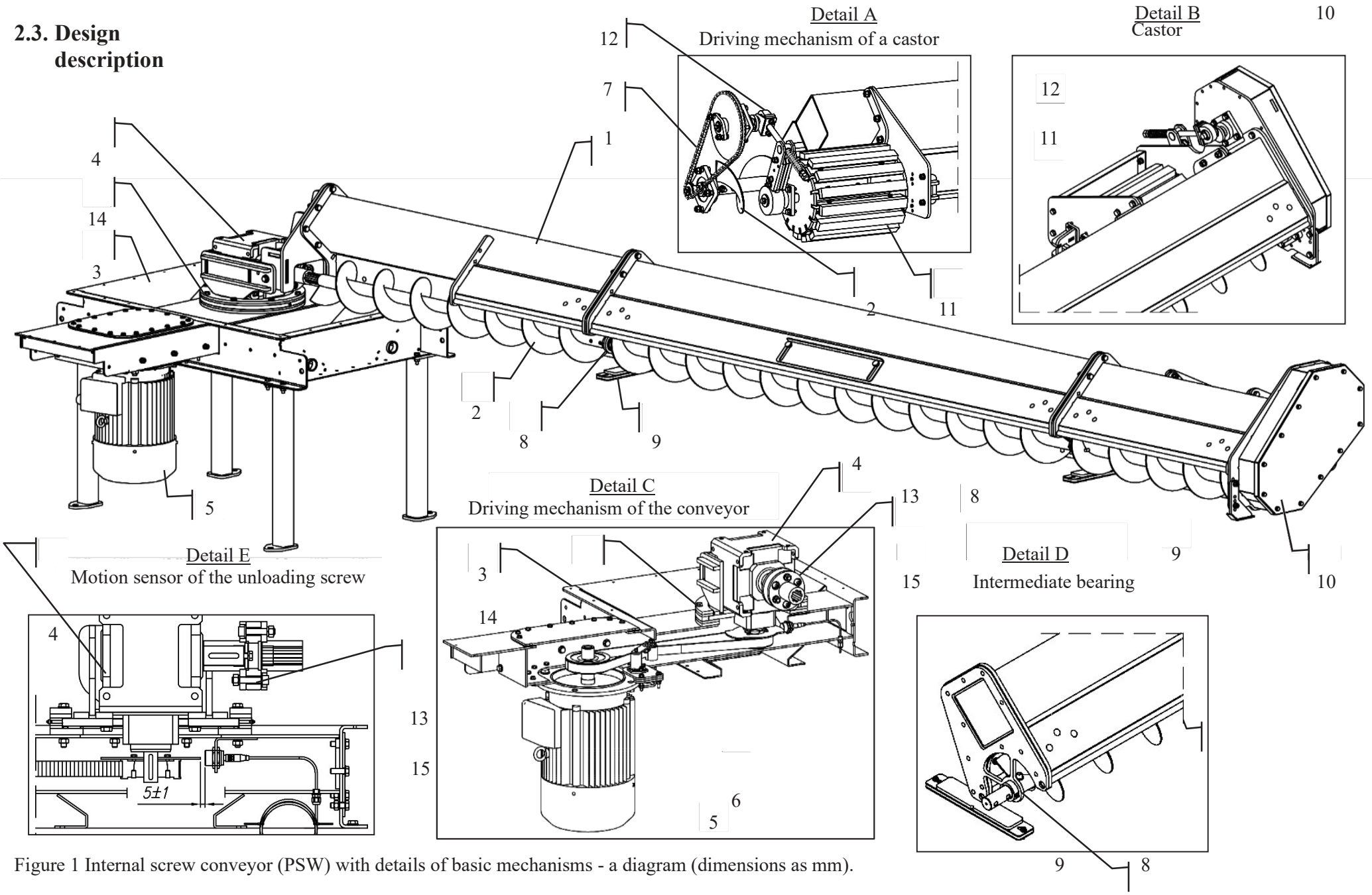


Figure 1 Internal screw conveyor (PSW) with details of basic mechanisms - a diagram (dimensions as mm).

Item 1 Conveyor body

Item 2 Unloading screw

Item 3 Central inlet
Item 4 Transmission helical gear (bevel)
Item 5 Electrical motor
Item 6 Belt drive
Item 7 Chain drive
Item 8 Intermediate bearing
Item 9 Body support
Item 10 Chain drive housing
Item 11 Conveyor castor
Item 12 Castor drive
Item 13 Unloading screw joint
Item 14 Conveyor turntable
Item 15 Motion sensor of the unloading screw

FBIN silos are unloaded in two stages:
- At the first stage, the unloading underfloor conveyor enables unloading of grain that gravitationally (under its own weight) enters the central inlet - item 3 - installed in the centre of the floor. However, the silo floor is horizontal and some amount of grain cannot enter the central inlet - item 3 this way. For example, about 660 tonnes of grain remains in FBIN19 silos.
- At the second stage, the remaining amount of grain can be removed from the silo by installing the internal screw conveyor PSW, which will mechanically rake the majority of grain into the central inlet - Item 3. The internal screw conveyor (PSW) transports the grain along the silo radius to the centrally located inlet, at the same time travelling around the silo axis clockwise (when looking down towards the silo floor). The grain is gradually unloaded, until a full circle is made.

The internal screw conveyor (PSW) with details of its basic mechanisms is shown in Figure 1. The conveyor consists of a body - Item 1, in which the unloading screw - Item 2, is installed, representing the basic operating unit of the conveyor. Furthermore, the body is provided with the top and bottom covers of the unloading screws and supports - Item 9, used to support the conveyor when it is not in operation. The unloading screw is fixed to the body with intermediate bearings - Item 8, and a joint - Item 13, among others. It has a spiral of 200 mm in diameter and is driven by an electric motor - Item 5 through a belt drive - Item 6 and a bevel drive - Item 4. The conveyor is equipped with a motion sensor of the unloading screw - Item 15, which cuts off the power supply to the electric motor - Item 5 in the event of failure and stopping of the unloading screw. The conveyor turntable - Item 14, enables rotational movement of the PSW conveyor around the silo vertical axis. The rotational movement of the PSW conveyor is effected with the castor - Item 11, driven by the unloading screw - Item 2 through a chain drive - Item 7. Furthermore, the PSW conveyor is equipped with a cable shielding pipe with a handle, and information and warning signs.

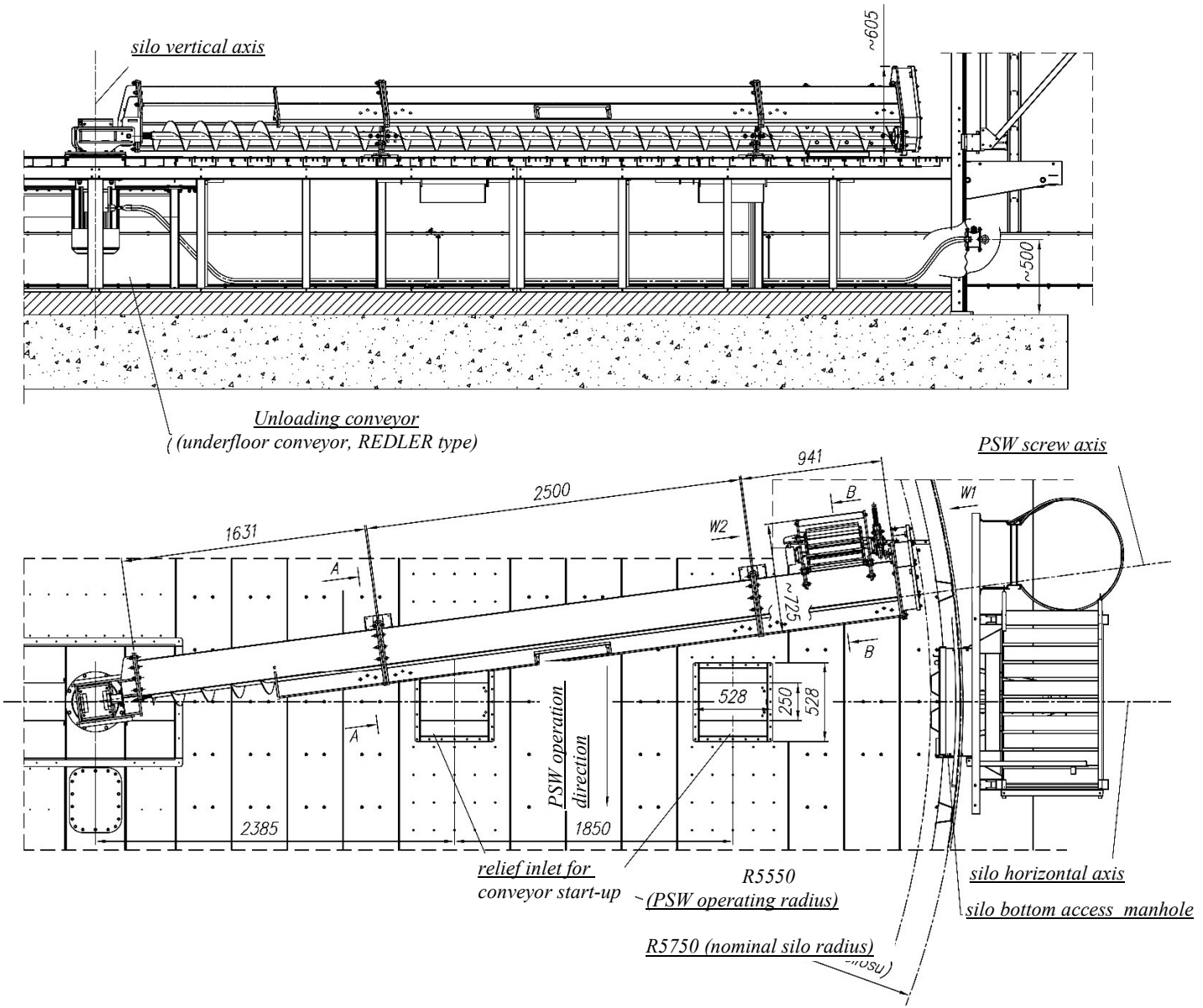


Figure 2 Basic installation dimensions of the internal screw conveyor, type PSW-11 (dimensions as mm).

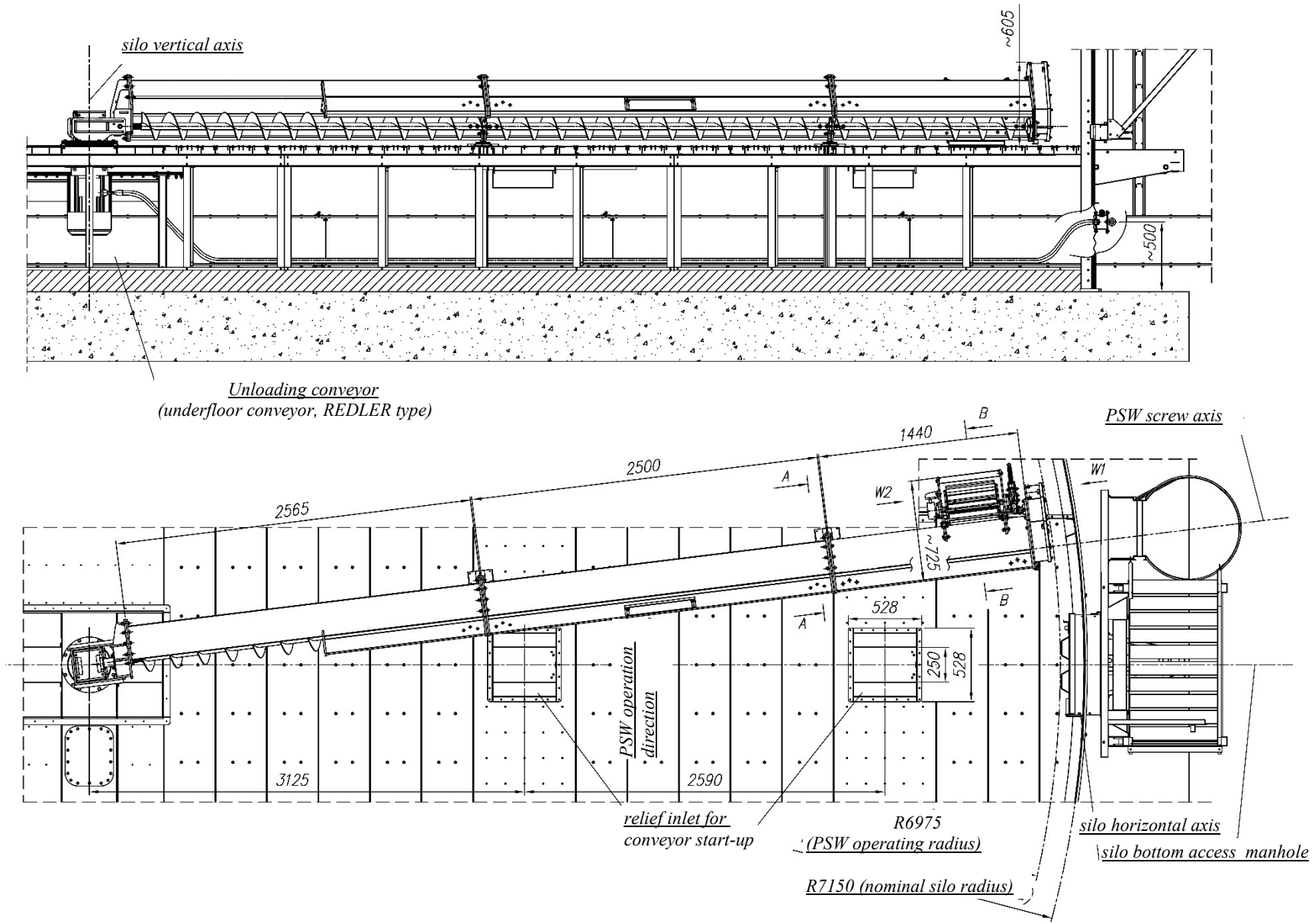


Figure 3 Basic installation dimensions of the internal screw conveyor, type PSW-14 (dimensions as mm).

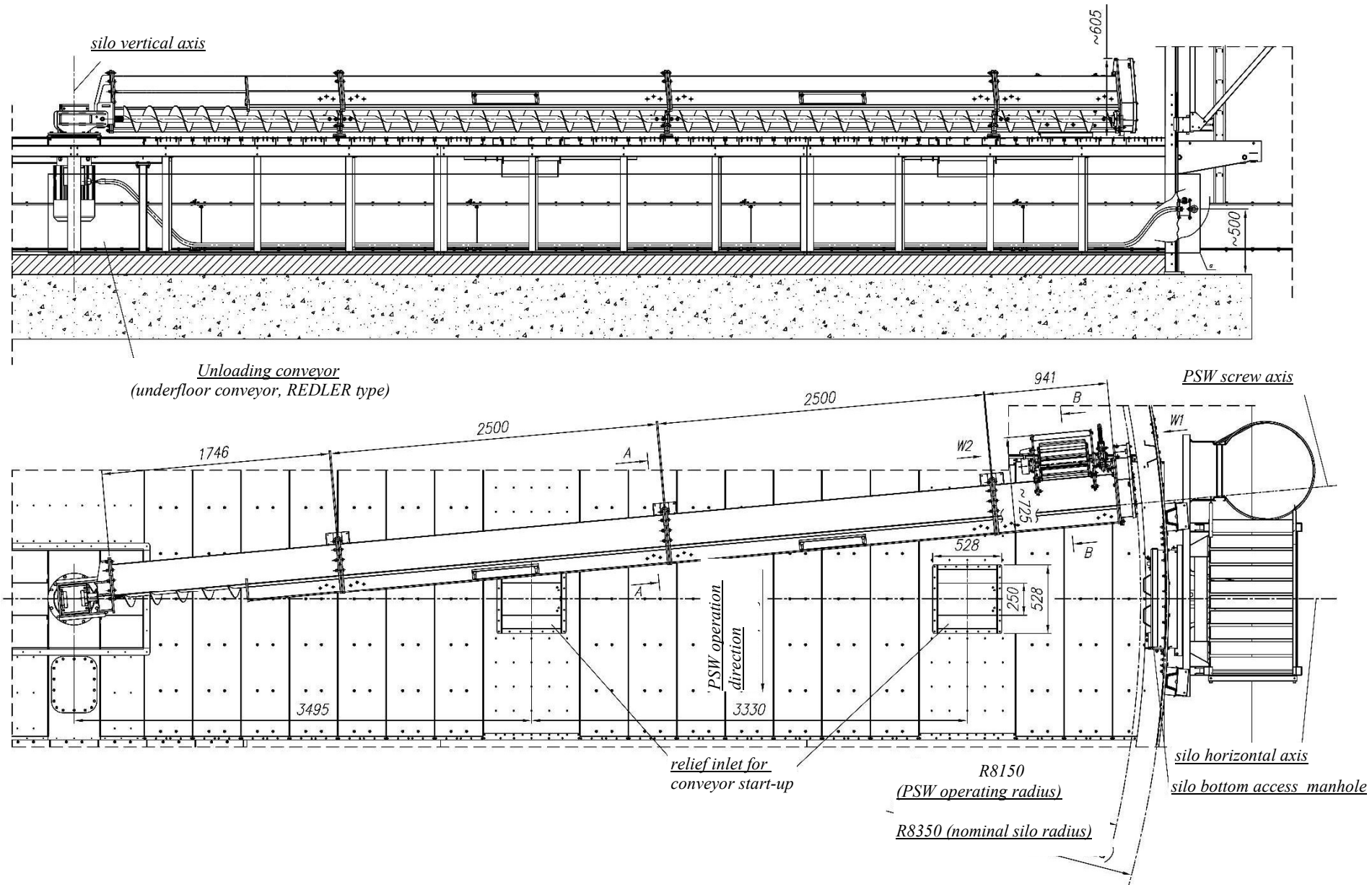


Figure 4 Basic installation dimensions of the internal screw conveyor, type PSW-17 (dimensions as mm).

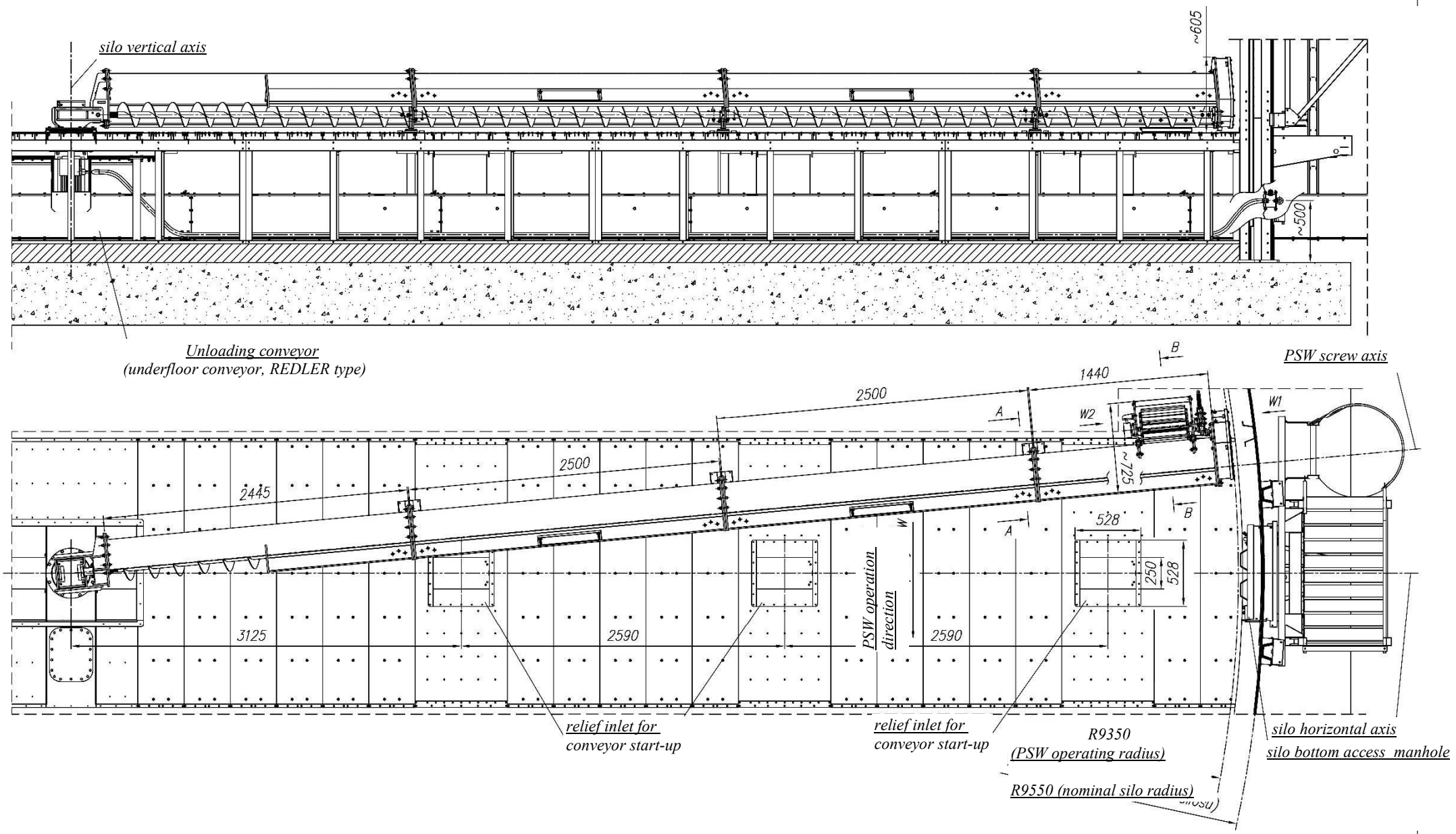


Figure 5 Basic installation dimensions of the internal screw conveyor, type PSW-19 (dimensions as mm).

3. Initial operations and preparing the conveyor for operation

3.1. 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.

3.2. 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 - Table 4. The vehicle trailer must be provided with tight tarpaulin. In transport all equipment must be secured against sudden movement. Loading and unloading should be performed with forklift trucks of capacity resulting from data - Table 4.

Table 4 Internal screw conveyor packed for transport - weight and dimensions.

	Number of packages	Package dimensions	Product weight with packaging
	qty.	cm	kg
PSW-F11-7.5	2	315x100x90	730
		150x135x140	520
PSW-F11-11.0	2	315x100x90	730
		150x135x140	560
PSW-F14-7.5	2	265x100x116	820
		150x135x140	520
PSW-F14-11.0	2	265x100x116	820
		150x135x140	560
PSW-F17-7.5	2	265x100x135	945
		150x135x140	520
PSW-F17-11.0	2	265x100x135	945
		150x135x140	560
PSW-F19-7.5	2	260x100x126	990
		150x135x140	520
PSW-F19-11.0	2	260x100x126	990
		150x135x140	560
PSW-FAKC-PDS	1	195x80x50	210
PSW-FAKC-PDB1	1	185x150x35	375
PSW-FAKC-PDB2	1	185x150x35	330

IT IS FORBIDDEN TO CARRY THE LOAD ABOVE PEOPLE AND ANIMALS

DURING TRANSPORT AND STORAGE CONVEYOR SUBASSEMBLIES 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 producer shall not be held responsible for the above-mentioned defects resulting from not following the recommendations.

3.3. Conveyor installation

The internal screw conveyor cannot be installed alone in the silo, it must always work together with the underfloor unloading 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. Furthermore, the installation company authorised by BIN should install the specified conveyor equipment, excluding construction of and connection to the power supply grid.

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

Basic installation conditions and adjustments for the PSW conveyor:

- Maintain the start position (before filling the silo with grain) of the body in relation to auxiliary relief openings for PSW start-up and the bottom access manhole (Figures *2*, 3, 4, and 5). A change in location of auxiliary openings may make the installation and operation of PSW impossible.
- After installation, the PSW conveyor cam make any number of full turns around the vertical silo axis (360°) in a direction of its operation. Regardless of a direction of rotations of a driving motor and/or the screw, the castor always rotates in the same direction (Figure 6, cross-section B-B). A reverse movement of the PSW conveyor with the castor wheel is impossible.
- The conveyor screw height above the floor can be adjusted by lifting or lowering of the castor wheel (Figure 7, View W1 and W2). A standard height of the screw above the floor is 45 mm on average (Figure 6, cross-section B-B, setting No. 2 - Figure 7, View W1 and W2). By lowering or lifting the castor wheel, the screw height above the ground is adjusted within ±18 mm.
- After installation and correct setting of PSW in relation of the auxiliary openings, the body supports (Figure 1, item 9) must be installed, maintaining their position and a distance from the body flanges (Figure 6, Cross-section A-A). If necessary, lift or lower the support and the castor wheel scrapper (Figure 7, View W1 and Figure 6, cross-section B-B).
- After installation and possible adjustments, perform a test rotation of PSW around the silo vertical axis. No part of the conveyor (screws, bodies, supports, a scrapper, etc., apart from the castor wheel) should be in contact with the floor and the silo shell.

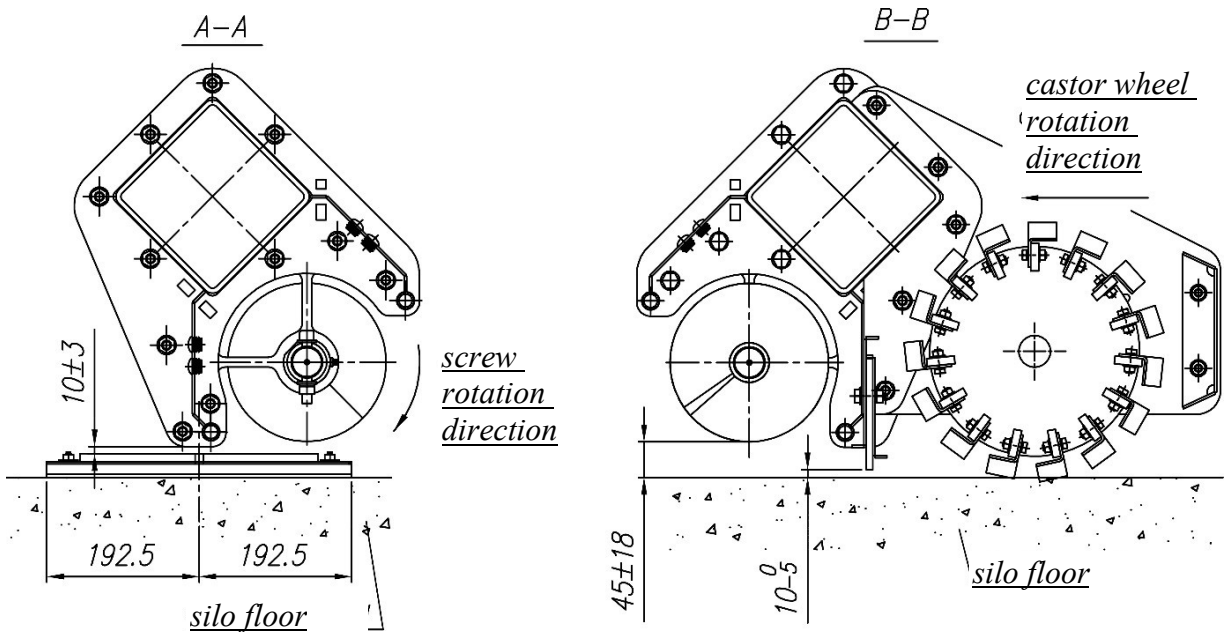


Figure 6 Basic dimensions and installation conditions for PSW (cross-sections - Figures 2, 3, 4 and 5) - dimensions as mm.

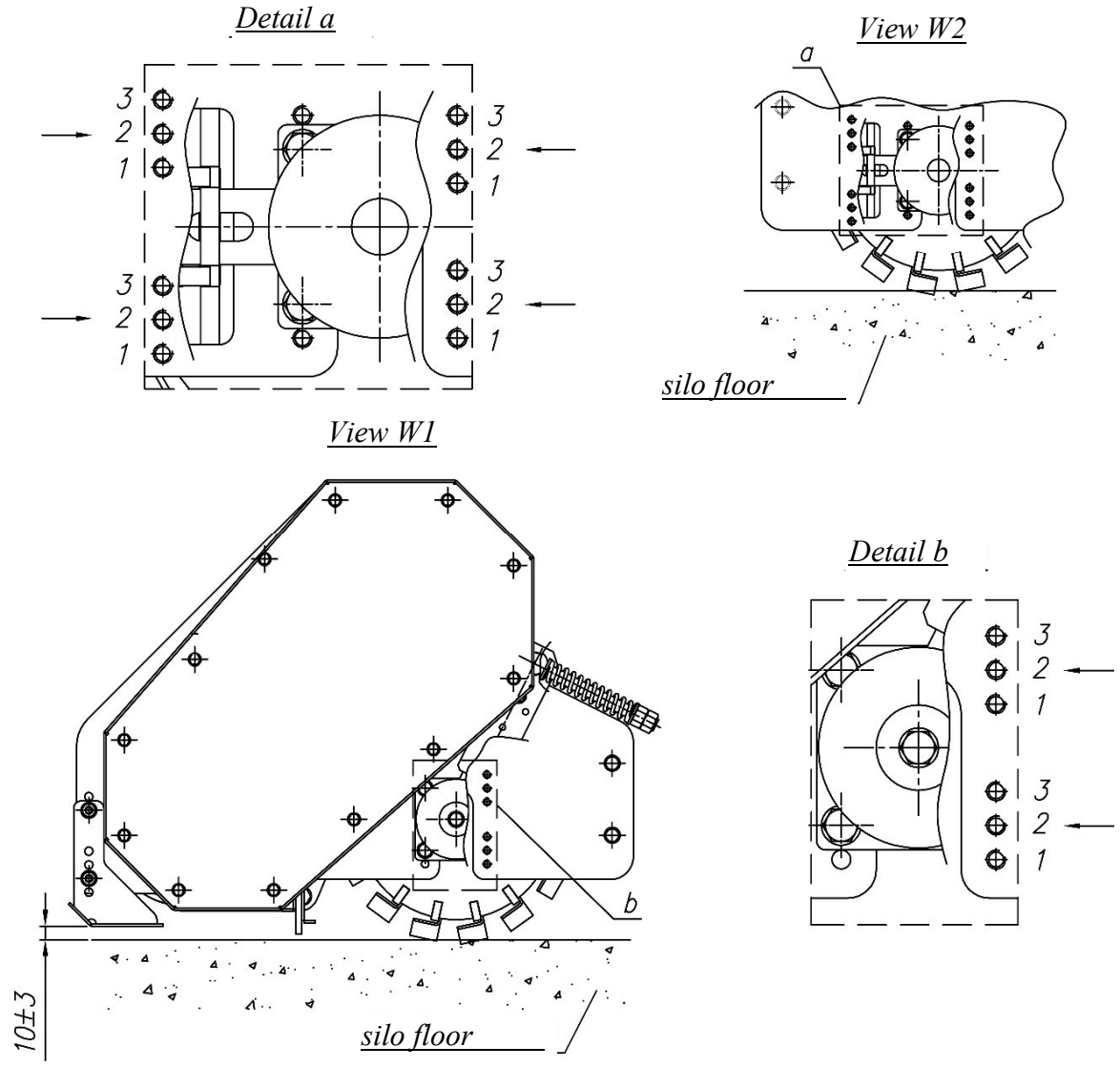


Figure 7 Adjustments of the conveyor (views - Figures 2, 3, 4, and 5) - dimensions as mm.

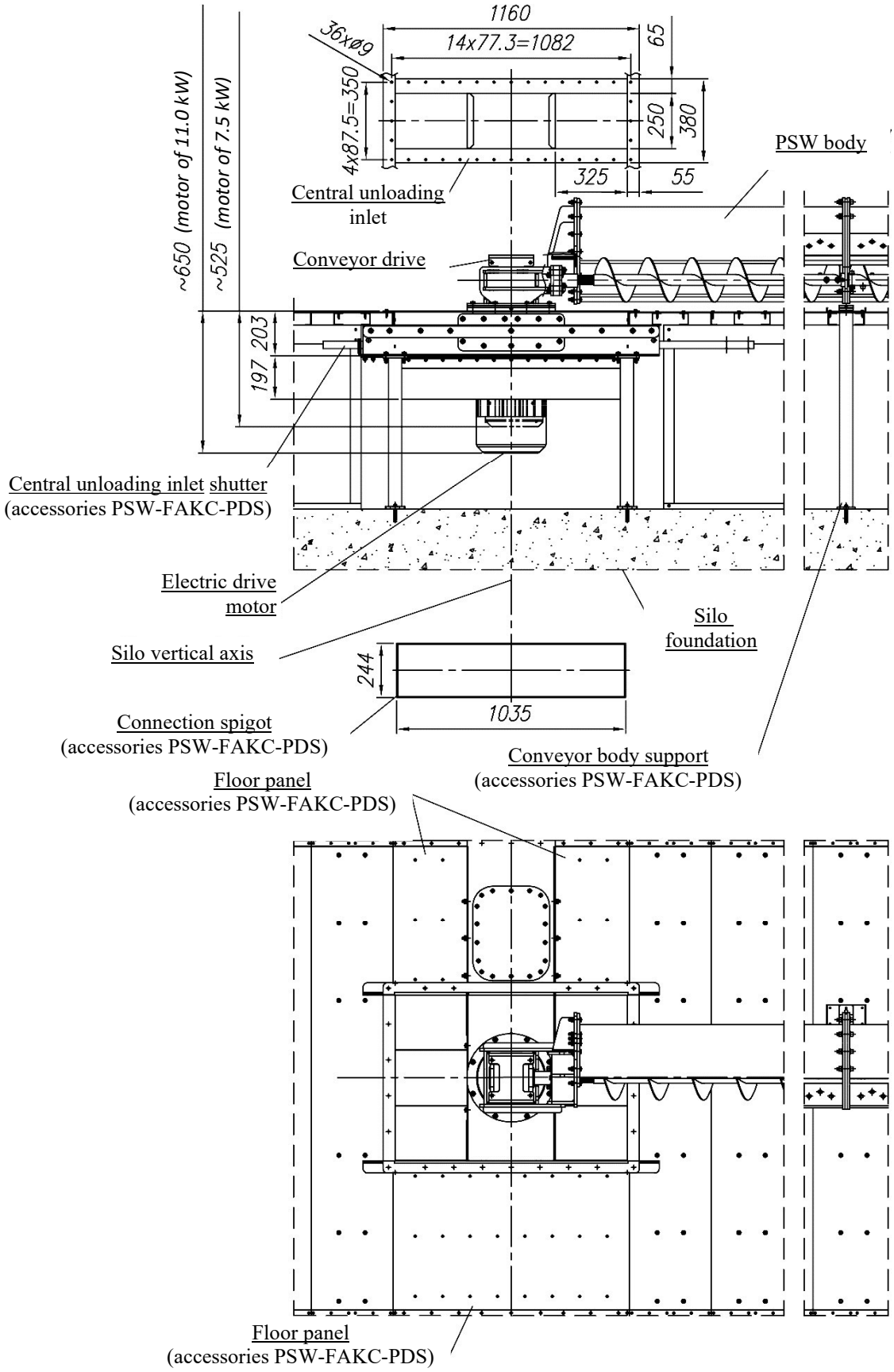


Figure 8 Installation of PSW equipped with accessories, type PSW-FAKC-PDS in silos with a steel floor on steel trusses (dimensions as mm).

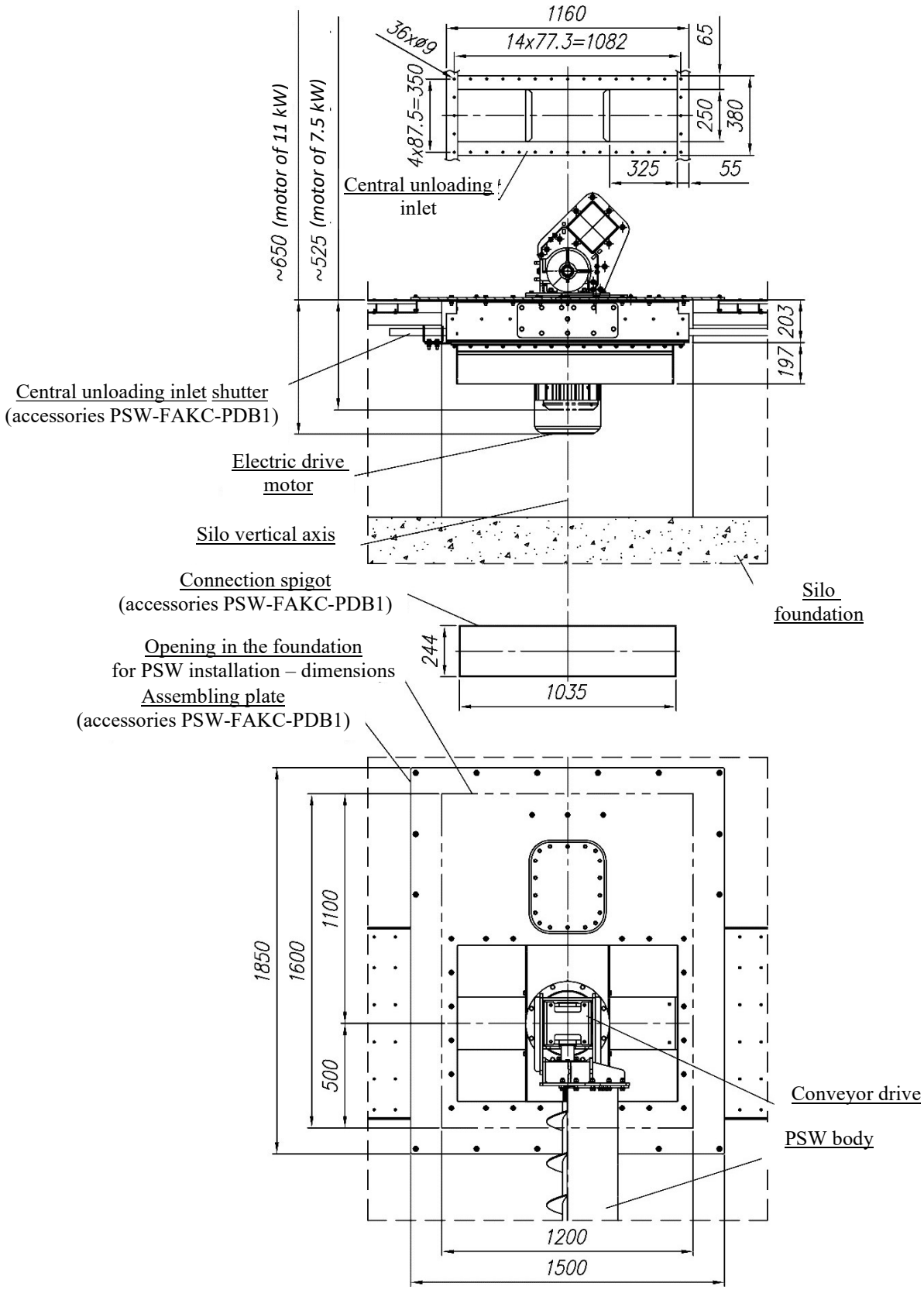


Figure 9 Installation of PSW equipped with accessories, type PSW-FAKC-PDB in silos with a concrete floor and non-accessible maintenance duct (dimensions as mm).

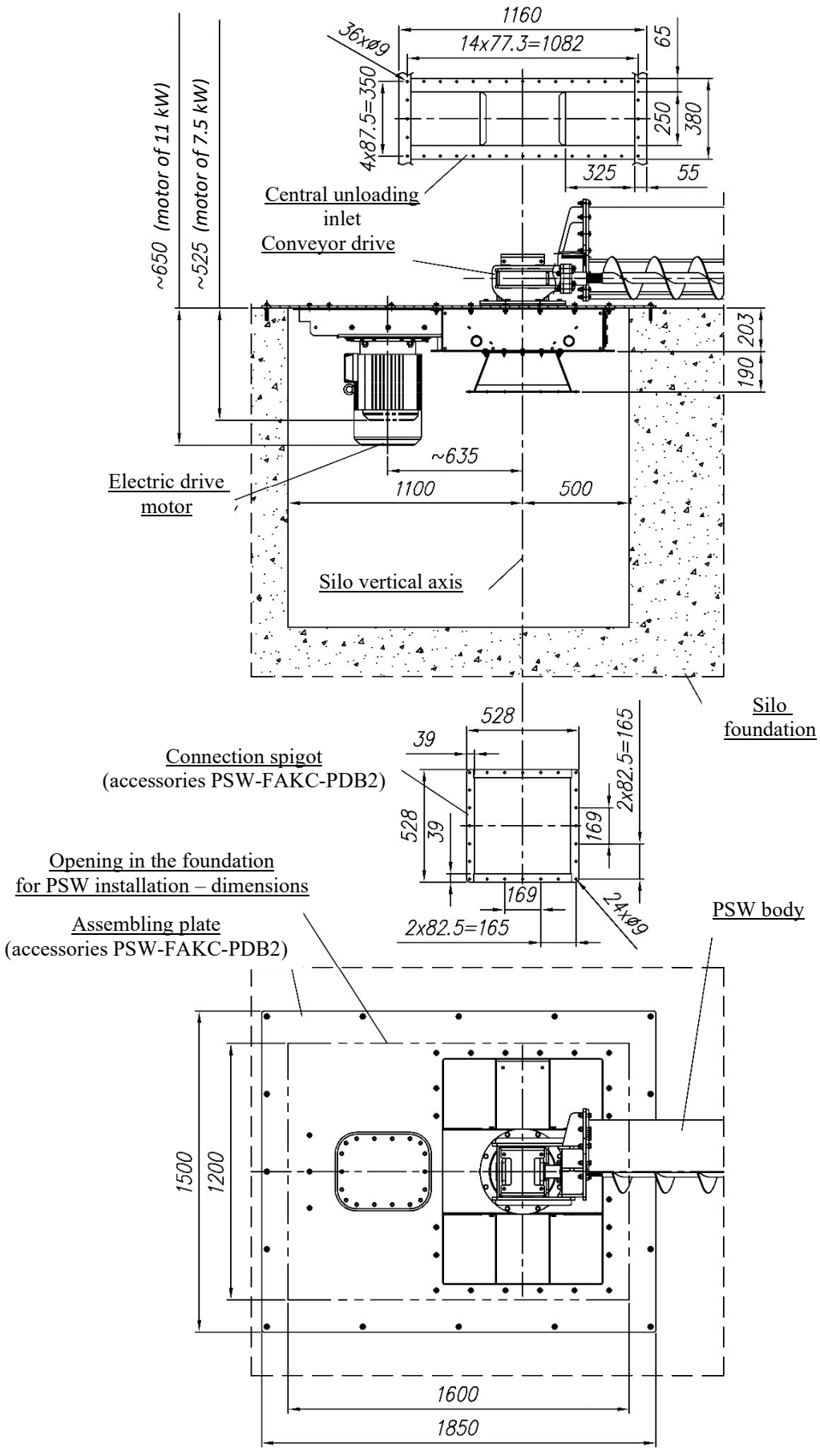


Figure 10 Installation of PSW equipped with accessories, type PSW-FAKC-PDB2 in silos with a concrete floor and man-accessible maintenance duct (dimensions as mm).

3.4. Electrical systems and start-up

The manufacturer provides the conveyors with the following electrical units:
- electrical three-phase motor with PTC sensors, M1,
- motion sensor of the unloading screw– SQ1.

The investment design documentation must contain a relevant design study for the electrical system, including connection of the conveyor with its accessories. The investor is responsible for drawing up of this 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), including its effective earthing;
- motor protected by a correctly connected and set thermal switch (the switch is not included as the conveyor equipment);
- protection against sudden starting of the conveyor after the power drop;
- an option of securing against unexpected switching of the conveyor on (the Q1 switch is not included as the conveyor equipment);
- 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) - switches and/or sensors are not included as the conveyor equipment;
- a function of automatic power cut off for the driving motor following stopping of the unloading screw due to a failure (the motion sensor SQ1 is included as the conveyor equipment);
- function of stopping operation of the electric motor when its acceptable temperature is exceeded (PTC sensors of the electric motor) - the conveyor motor is equipped with PTC sensors.

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 making available 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 necessary, preventing starting of the PSW conveyor when the underfloor conveyor is not working.

Usually, during starting of the PSW conveyor its electrical motor is subjected to the maximum load. For this reasons, the use of the "star-delta" layouts, "soft start" devices and other solutions of this kind, preventing the electric motor from reaching its full nominal capacity during its start is forbidden.

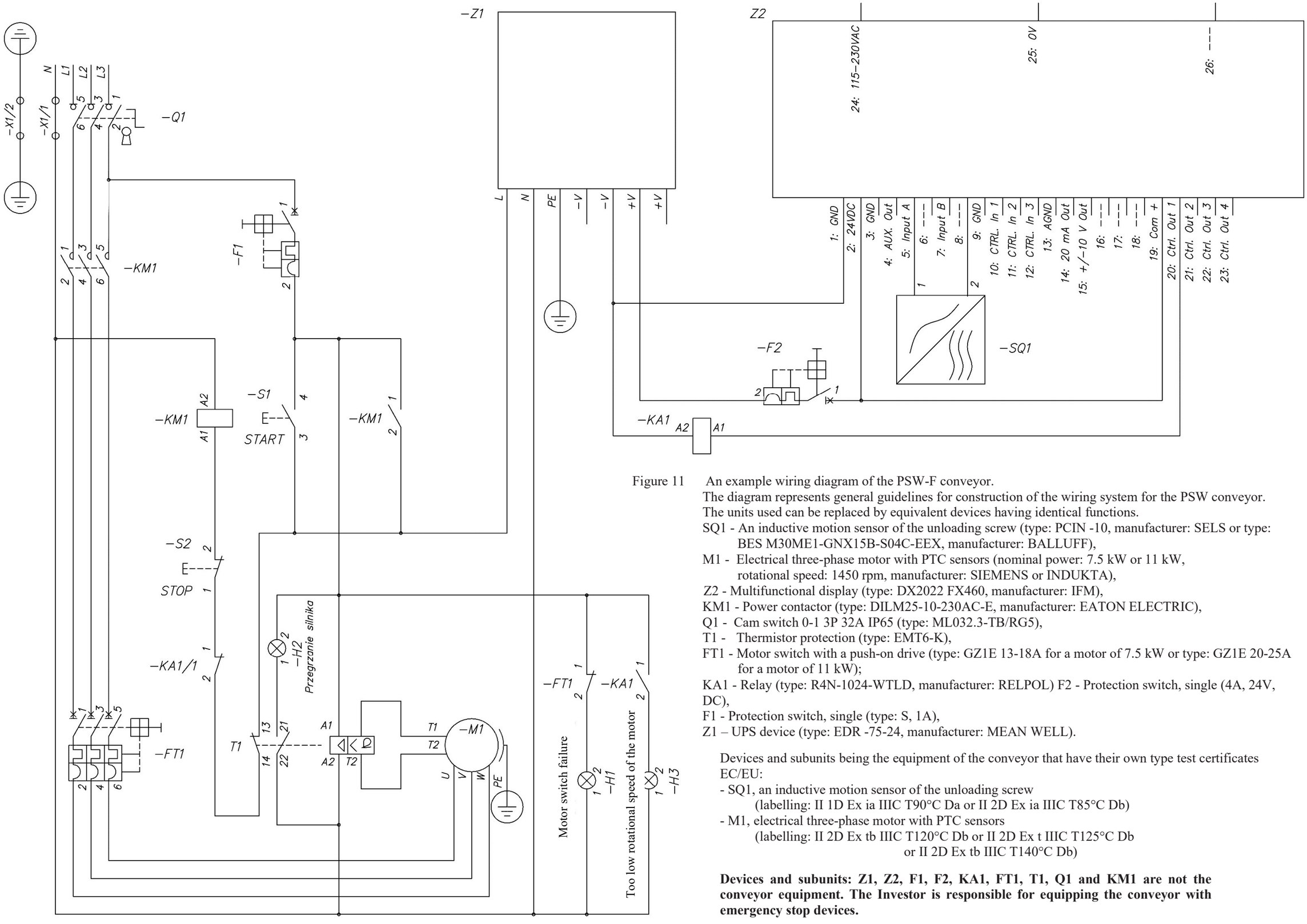


Figure 11 An example wiring diagram of the PSW-F conveyor.
The diagram represents general guidelines for construction of the wiring system for the PSW conveyor.
The units used can be replaced by equivalent devices having identical functions.
SQ1 - An inductive motion sensor of the unloading screw (type: PCIN -10, manufacturer: SELS or type: BES M30ME1-GNX15B-S04C-EEX, manufacturer: BALLUFF),
M1 - Electrical three-phase motor with PTC sensors (nominal power: 7.5 kW or 11 kW, rotational speed: 1450 rpm, manufacturer: SIEMENS or INDUKTA),
Z2 - Multifunctional display (type: DX2022 FX460, manufacturer: IFM),
KM1 - Power contactor (type: DILM25-10-230AC-E, manufacturer: EATON ELECTRIC),
Q1 - Cam switch 0-1 3P 32A IP65 (type: ML032.3-TB/RG5),
T1 - Thermistor protection (type: EMT6-K),
FT1 - Motor switch with a push-on drive (type: GZ1E 13-18A for a motor of 7.5 kW or type: GZ1E 20-25A for a motor of 11 kW);
KA1 - Relay (type: R4N-1024-WTLD, manufacturer: RELPOL) F2 - Protection switch, single (4A, 24V, DC),
F1 - Protection switch, single (type: S, 1A),
Z1 – UPS device (type: EDR -75-24, manufacturer: MEAN WELL).

Devices and subunits being the equipment of the conveyor that have their own type test certificates EC/EU:
- SQ1, an inductive motion sensor of the unloading screw
  (labelling: II 1D Ex ia IIIC T90°C Da or II 2D Ex ia IIIC T85°C Db)
- M1, electrical three-phase motor with PTC sensors
  (labelling: II 2D Ex tb IIIC T120°C Db or II 2D Ex t IIIC T125°C Db
  or II 2D Ex tb IIIC T140°C Db)

Devices and subunits: Z1, Z2, F1, F2, KA1, FT1, T1, Q1 and KM1 are not the conveyor equipment. The Investor is responsible for equipping the conveyor with emergency stop devices.

4. Operation

4.1. Conveyor operation

Before the conveyor is 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 the PSW conveyor operation.

Before each loading of the silo, the PSW conveyor must be set in the start-up position (Figure 1: flanges of intermediate bearings, Item 8, should be above the body supports, Item 9.
If the PSW is not set in a correct start-up position, it can be damaged.

It is strictly forbidden to start the PSW conveyor that is completely covered with grain. Before each start of the PSW, check if the conveyor turntable (Figure 1: Item 14) is not covered with grain. Starting the PSW above which there is so much grain that the conveyor turntable is covered may damage the silo and the conveyor.

The PSW conveyor cannot be used for transport of material contaminated or locally aggregated. Grain intended to be transported cannot contain stones, bolts, nuts, and other contamination of this kind. Any attempt to transport such grain may result in overload or damage, and in consequence, stopping of the device.

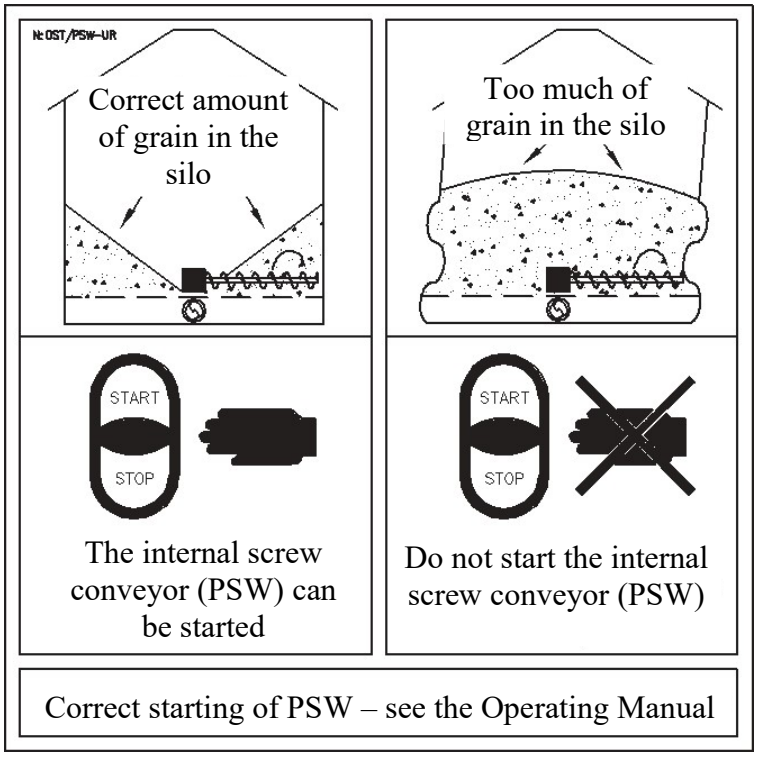


Figure 12 Correct start-up of the PSW conveyor - warning sign

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.

To unload the silo using the PSW conveyor:

1.1 Make sure there are no people or animals in the silo;
1.2 Check if the door in the cover of the external ladder and the bottom manhole of the silo are closed. Close, when necessary.
1.3 Start the underfloor conveyor and other equipment for grain transport cooperating with it.

NOTE: At this moment, you must not start the PSW conveyor.

1.4 Gradually, slowly open the shutter of the central unloading inlet.
1.5 Leave the central inlet shutter open for even and stable work of the underfloor conveyor.
1.6 The underfloor conveyor can be kept working until the gravitational feeding to the central inlet is completed.

To remove the grain remaining in the silo:

1.7 If the underfloor conveyor has been stopped, restart it and other equipment for grain transport cooperating with it.
1.8 Gradually, slowly open shutters of the relief inlets for the PSW conveyor start-up.

NOTE: At this moment, you must not start the PSW conveyor.

1.9 Leave the relief inlet shutters open for even and stable work of the underfloor conveyor.
1.10 The underfloor conveyor can be kept working until the gravitational feeding to the relief inlets is completed.

To start the PSW conveyor:

1.11 Gradually, slowly close shutters of the relief inlets for the PSW conveyor start-up.
1.12 Check if the conveyor turntable (Figure 1: Item 14) and the unloading screw (Figure 1: Item 2) are not covered with grain.
1.13 If the underfloor conveyor has been stopped, restart it and other equipment for grain transport cooperating with it.
1.14 Open the shutter of the central unloading inlet.
1.15 Start the PSW conveyor.
1.16 Underfloor and PSW conveyors can be kept running until the silo is completely unloaded (one or more full PSW turns around the silo vertical axis).
1.17 When the silo is completely emptied, stop the PSW conveyor.
1.18 Stop the underfloor conveyor and possible other equipment.
1.19 Manually remove the remaining grain from the silo floor.

4.2. Conveyor operation

Correct and punctual maintenance inspections, maintenance and possible repairs guarantee availability of the full operational capacity of the conveyors, and prevent their premature and excessive wear and development of situations posing a hazard to health and life.

1) Each time, before grain is poured into the conveyor, check its control devices, i.e., the motor switch, the delta-star switch, and possible other devices, if they were installed (normal operation, no mechanical damage, etc.).
   If any anomalies are found, perform necessary repairs or replace damaged subunits.

2) After each 25 hours of the conveyor operation, measure the thickness of the rubber coating on each support of the conveyor castor wheel - Figure 13. A support of the castor wheel must be replaced with a new one when the total thickness of the support with a rubber coating is below 14 mm.

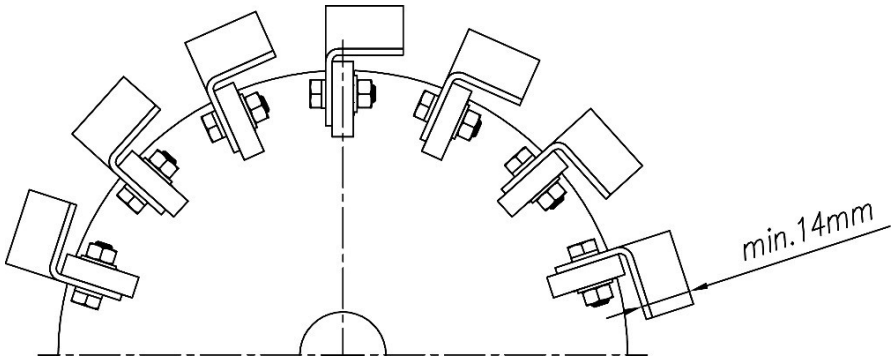


Figure 13 Measurement method for thickness of the rubber coating on the conveyor castor wheel.

3) The electrical wiring system must be inspected by an authorised electrician, including effectiveness of the conveyor earthing and effectiveness of the electric motor earthing.

At least once a year, the Investor should order a qualified electrician holding relevant licences to inspect all electric equipment components, including measurements of earthing effectiveness.

If any anomalies are found, perform necessary repairs or replace damaged subunits.

4) The bevel drive of the driving system (Figure 14) contains oil, which must be
   - checked and refilled, if necessary, each time before grain is poured into the conveyor,
   - replace on a regular basis every 2500 of the conveyor operation.
   Any damages of the drive, including its sealing system, resulting in oil leaks, should be repaired immediately. For replacement or refill, use oils adopted to the ambient temperature and recommended by the bevel drive manufacturer (TRAMEC S.R.L.) - *Table 5.*

Table 5 - Oils recommended and used by the bevel drive manufacturer - (TRAMEC S.R.L.

SHELL	Omala S4 WE 460	Omala S4 WE 320	Omala S4 WE 220	Omala S4 WE 150
	Omala Oil RL/HD 460	Omala Oil RL/HD 320	Omala Oil RL/HD 220	Omala Oil RL/HD 150
BP	Energol SGXP460	Energol SGXP320	Energol SGXP220	Enersyn SG 150
TEXACO	Synlube CLP 460	Synlube CLP 320	Synlube CLP 220	-
AGIP	-	Agip Blasia S 320	Agip Blasia S 220	Agip Blasia S 150
CASTROL	Alpha Synt 460	Alpha Synt 320	Alpha Synt 220	Alpha Synt 150
MOBIL	SHC 634	SHC 632	SHC 630	SHC 629
Ambient temperature	-15°C to +100°C	-20°C to +90°C	-25°C to +80°C	-30°C to +70°C

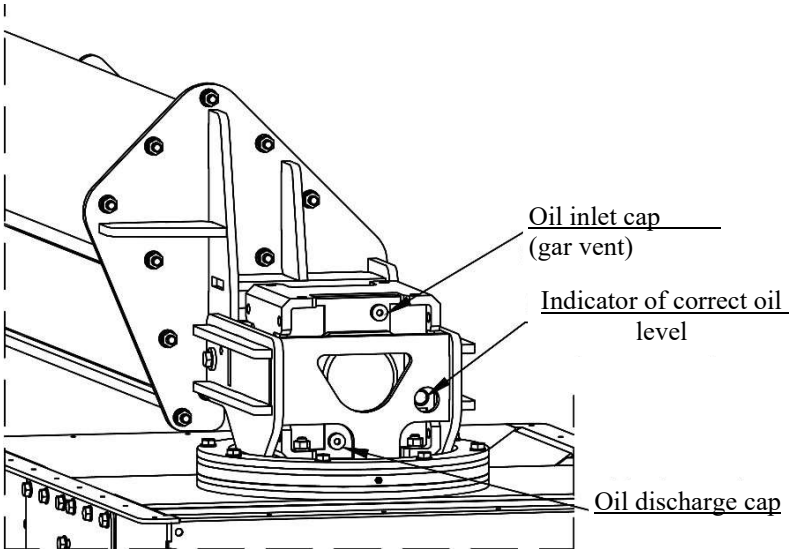


Figure 14 The conveyor bevel drive - a place for inspecting, refilling and replacement of oil.

5) At least once a year, perform a visual inspection of:
   - a technical condition of welded, screwed and other connections;
   - anti-corrosion coatings;
   - condition of an elastic joint of the screw;
   - the chain drive condition;
   - condition of roller and sliding bearings;
   - other moving and fixed components.

   If any anomalies are found, perform necessary repairs or replace damaged subunits.

6) Anti-corrosion coating of screws can be damaged during installation (tightening).
   In such case, anti-corrosion coatings on damaged surfaces must be repaired.
7) Every 25 hours of the conveyor work, refill solid grease in:
   - the screw sliding bearings (Figure 16);
   - the pusher bearing (Figure 15).
8) Every 50 hours of the conveyor work, refill solid grease in:
   - all roller bearings in cast iron housings (Figure 15);
   - the conveyor turntable (Figure 17).

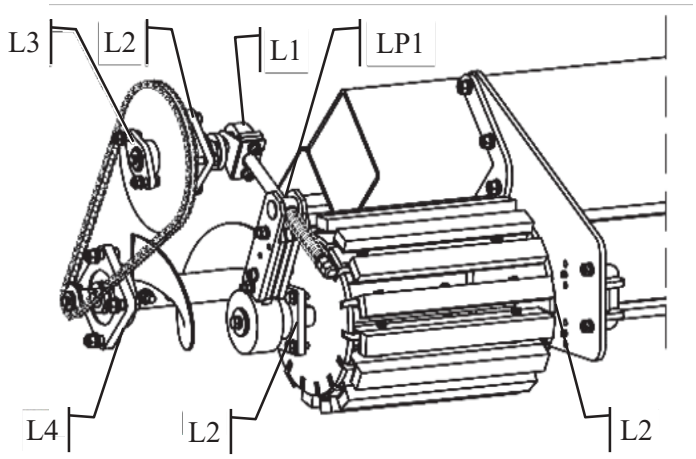


Figure 15 Roller bearings of the PSW conveyor - greasing points.
L1 – UCPA204 type bearing (1), L2 – UCF206 type bearing (3),
L3 – UCFL204 type bearing (1), L4 –UCF208 type bearing (1),
LP1 – pusher bearing (1)

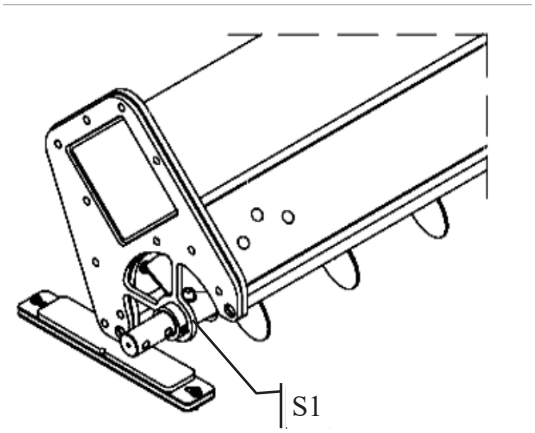


Figure 16 Roller bearings of the unloading screw - greasing point.
S1 – A sliding bearing of the unloading screw (3 for PSW-F19 i PSW-F17, 2 for PSW-F14 i PSW-F11)

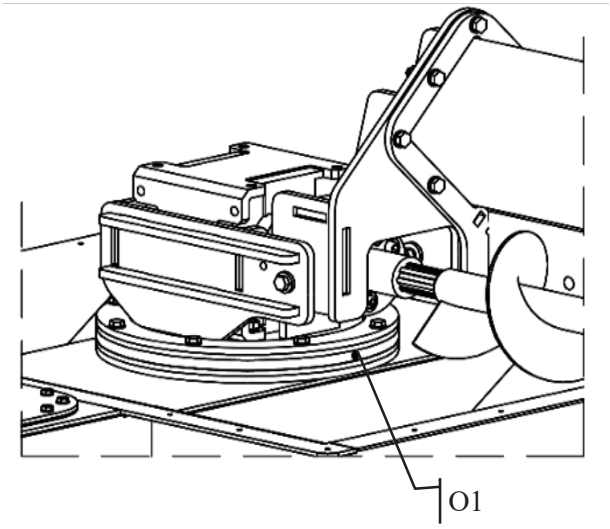


Figure 17 Conveyor turntable - greasing point.
O1 – conveyor turntable (1)

To grease roller and sliding bearing, use solely listed solid grease - *Table 6* or replacement grease not specified in this operating manual.

Table 6 Solid greases recommended for roller and sliding bearings.

TOTAL	CASTROL	MOBIL
Lical EP2	Sheeprol EPL-2	Mobilux EP2
Nevastane HD2T	-	MobilGrease FM222

9) Every 50 hours of the conveyor operation, replace all roller bearings of the unloading screw with sealing rings (Figure 16).
10) Every 150 of the conveyor operation replace:
- all roller bearings in cast iron housings (Figure 15);
- subunits of the chain drive (the chain and chain sprockets);
- subunits of the belt drive (the timing belt, pulleys and the tensioner pulley).
11) If necessary, make new anti-corrosion conveyor coatings and other required repairs.

All damages should be removed immediately, and damaged or worn parts should be repaired or replaced with new ones.

4.3. Spare parts

When any conveyor components are worn, damaged or lost, they can be purchased from BIN. The manufacturer does not provide for the use of spare parts from manufacturers other than BIN. To purchase spare parts, contact BIN in writing, specifying the following details:

- Equipment name
- Purchase document number
- Device model
- The year of production
- Serial No.

Before placing an order, define precisely (on phone) types of spare parts ordered.
A visit from a BIN representative may be necessary to correctly identify the part.
The manufacturer does not provide the conveyor with spare parts.

4.4. Disassembling and disposal

When the device is found to be unsuitable for further use:

- 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 their adverse effects on humans, animals, and the environment.

Disassembling and disposal should be ordered at a specialist company.

As of 30/08/2021 I approve for use the Operating Manual
- Internal Screw Conveyors PSW-F",
revision - 1 for use,
issued on - 25/08/2021

Chief Constructor
Mieczysław Laskowski

.....
(signature)

5. 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 warranty covers free of charge removal of defects significantly affecting product performance. Therefore, application of warranty provisions of Article 558.1 of the Civil Code is explicitly excluded.

General warranty terms and conditions.

1. Warranty territory
   The warranty covers the whole 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:
   - the product is used in a way contrary to its intended use;
   - installation was incorrect or any unapproved changes are made;
   - works requiring specialist licences are performed by unauthorised persons.

Special warranty terms and conditions.

1. For products:
   - with electrical motors, warranty 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, this results in formation of irremovable spots even during a short 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.

Exercising of warranty 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)*

Appendix 1. Anomalies (including problems and faults) during operation of the PSW-F type screw conveyor.

Conveyor malfunction	Possible malfunction cause brand	Way to remove the anomaly
The electric motor can not be started when starting the conveyor	- no power supply to the electric motor - damaged electric motor - aggregated grain around the unloading conveyor	Check, repair or replace subunits of the electrical system supplying the conveyor. Remove the aggregated grain from the space around the unloading screw, along its entire length.
When the conveyor is started, the electric motor works. However, the unloading screw and the castor wheels do not work.	- damaged belt drive (broken timing belt, the belt not tensioned, etc.) - damaged bevel drive - damaged flexible joint of the drive	Repair or replace the belt or bevel drive, or the flexible joint.
When the conveyor is started, the electric motor and the unloading screw work, but the castor wheel does not operate.	- damaged chain drive (broken chain, damaged chain sprockets, etc.) - damaged castor wheel pusher drive - the pusher spring not tensioned or damaged - damaged one-way clutch of the castor wheel	Repair the chain drive or the pusher drive. Tension the pusher spring correctly. Replace the damaged one-way clutch.
Conveyor subunits (including parts of its body, unloading screw, etc.) hit the floor or other parts of the silo.	- incorrect installation and operating height of the conveyor body - silo incorrectly installed (uneven silo floor or shell)	Adjust the conveyor body height or amend the silo installation.
During normal operation of the conveyor, the electric motor suddenly stops and the conveyor operation ends.	- no power supply to the electric motor - an increase in the current supplying the motor above the motor nominal value (triggered thermal switch) - an increase in a temperature of the motor coils above the acceptable value (triggered PTC sensors of the motor) - a decrease or disappearance of the rotational speed of the unloading screw during operation (triggered motion sensor of the unloading screw)	Restore power supply to the motor Remove the cause of the current increase (long-term overload of the conveyor, incorrect setting or damage to the thermal switch, etc.). Remove the cause of the increase in the temperature of the motor coils (long-term overload of the conveyor, no ventilation of the motor, damaged motor, etc.). Remove the cause of the decrease or disappearance of the rotational speed of the screw (damaged belt or bevel drive, or the motion sensor, the unloading screw blocked mechanically, etc.). When the above causes of the motor stopping are removed, re-start the conveyor.
Uneven and unnatural sounds from the belt drive during the conveyor operation.	- incorrect tensioning of the timing belt of the belt conveyor - damaged automatic tensioner of the belt drive	Inspect and, if necessary, install the automatic drive tensioner correctly. Replace the damaged automatic tensioner of the belt drive.
Uneven and unnatural sounds from the chain drive during the conveyor operation.	- damaged or worn chain and/or chain sprockets of the drive	Replace the chain and/or the chain sprockets of the drive.
The bevel drive housing heats to the temperature above 95°C.	- no oil in the drive or incorrect or used oil in the drive - drive damaged	Inspect and, if necessary, correctly fill the drive with the relevant oil. Repair or replace the bevel drive.
Mechanical damage to the conveyor body, its subunits or the unloading screw after the silo is filled with grain.	- the conveyor started when there is still too much grain in the silo - the body is not correctly supported when the silo is filled with the grain	Repair or replace the damaged conveyor subunits. Do not start the conveyor when there is so much grain above it that the conveyor turntable is covered with grain. Before the silo is filled with grain, always put the conveyor into the start-up position (above supports).