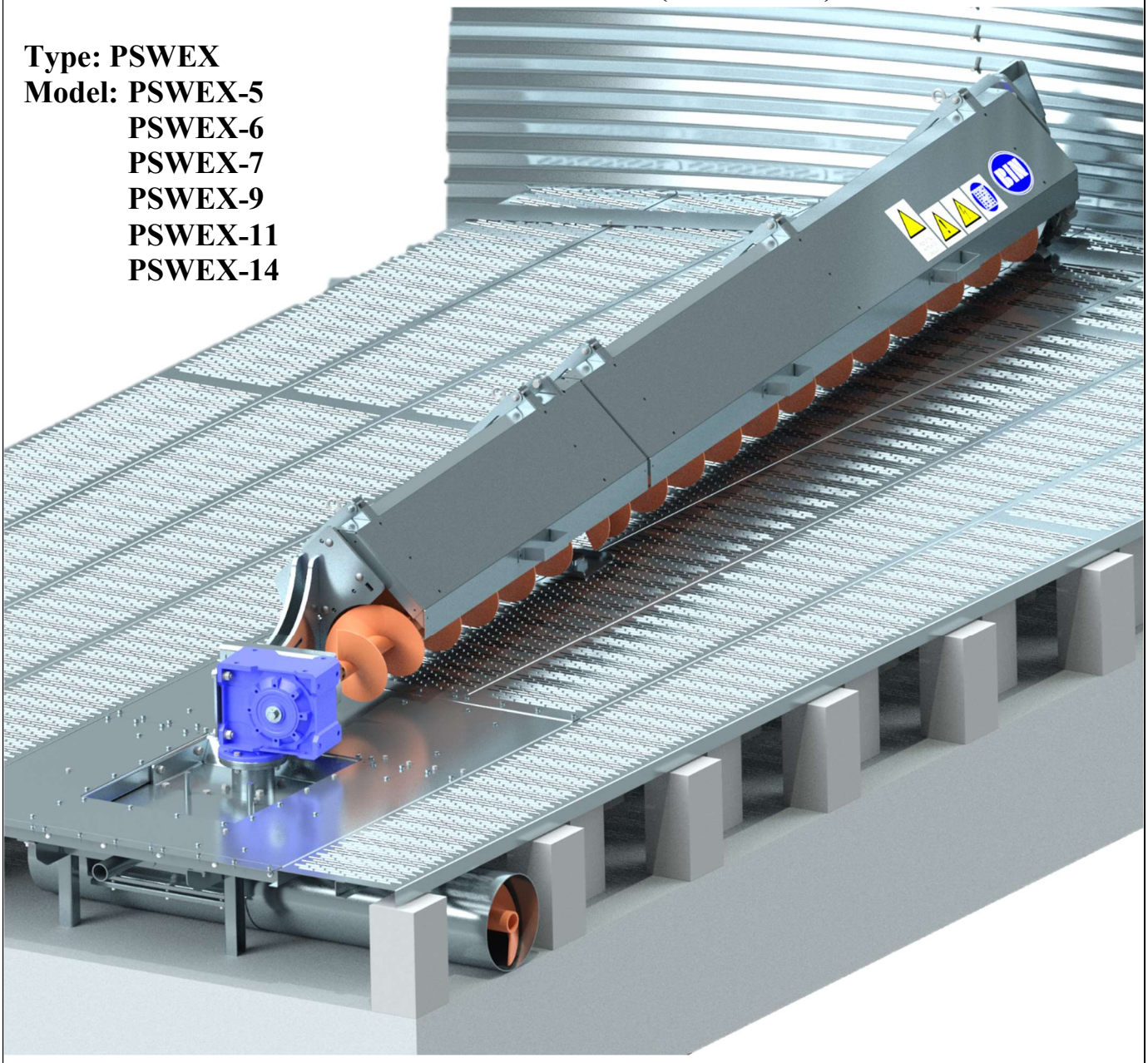
BIN Sp. z o.o.
87-700 Aleksandrów Kujawski, ul. Narutowicza 12
Phone (0-54) 282 22 55; (0-54) 282 88 00;
(0-54) 282 88 25; (0-54) 282 88 27
Fax (0-54) 282 88 63
www.bin.agro.pl e-mail bin@bin.agro.pl

INTERNAL SCREW CONVEYORS PSWEX

FOR UNLOADING OF FLAT BOTTOM SILOS OF BIN AND FBIN TYPE
OPERATING MANUAL (IO:PSWEX)

Type: PSWEX
Model: PSWEX-5
PSWEX-6
PSWEX-7
PSWEX-9
PSWEX-11
PSWEX-14



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Aleksandrów Kujawski/A4 format

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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 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 manufacturer or its representative.

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

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

It is strictly forbidden for people and animals to remain in a silo while the PSWEX conveyor or the underfloor conveyor is in operation.

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.

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.

It is strictly forbidden to start the conveyor when there is too much grain in the silo, enough to cover the central inlet opening so it is not clearly visible. Starting the conveyor 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

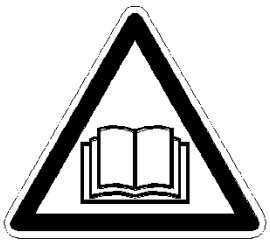
1. People employed to use or operate the PSW conveyors, as well as people within the area of their operation are obliged to adhere to general OHS regulations.
2. The user is obliged to read and understand this operating manual for the screw conveyors and manuals for all other auxiliary equipment, and 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, it is forbidden to:
   - 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 an unloading inlet 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 elevator is operated should be equipped with additional general lighting.
10. During its operation, the PSWEX 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. Ignoring this recommendation may result in motor overheating or 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 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.
17. Descriptions and diagrams of the wiring system provided in this operating manual represent general guidelines for development of a design for the wiring system by authorised people.
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 power supply cable should not be twisted or at risk of being cut. 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. It is forbidden to extinguishing fires of power supply systems with water or a foam extinguisher.
26. Before commencing installation, checked 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 supplied together with the PSWEX 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. A BIN or FBIN type silo, with which the PSWEX conveyor works, must be equipped with an emergency duct (if it is not provided as a standard feature of the said silo) for unloading the silo in the event of the conveyor failure or grain aggregation over the PSWEX inlet.
32. It is strictly forbidden to start the PSWEX screw conveyor in a silo with a central grain inlet to the underfloor 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.
33. The conveyors are labelled with safety marks. Each user is obliged to become acquainted with their meaning.
34. 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.
35. 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.
36. 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.
37. 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

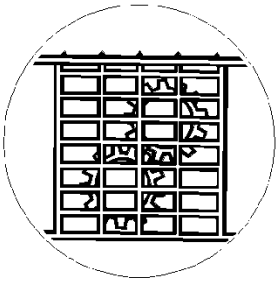
Information and warning signs are installed on the conveyor body. A correct motor rotational direction is marked on the motor cover near its fan. The nominal plate with a CE mark and the plate "normal start-up of the PSW conveyor" are placed on the silo shell near the bottom manhole.

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.

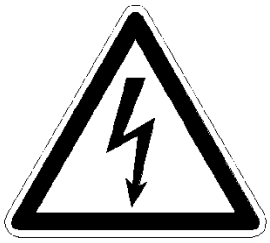


READ OPERATING MANUAL

ATTENTION! DANGER

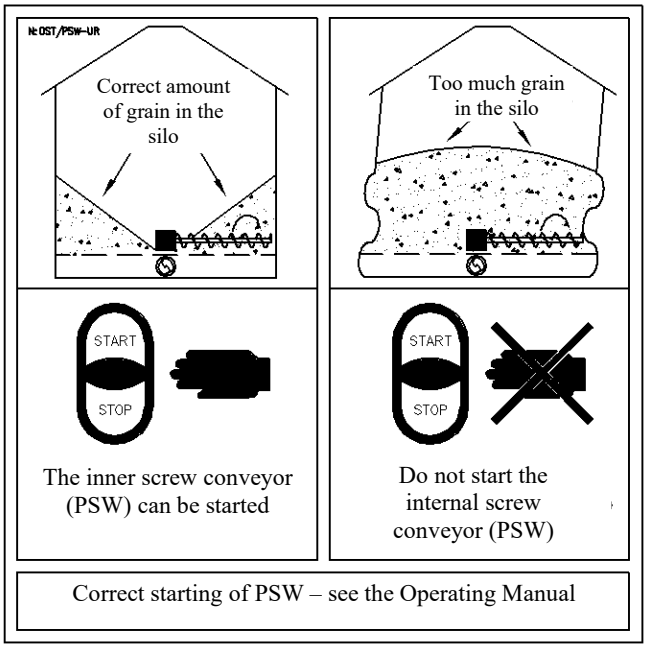


USE GUARDS

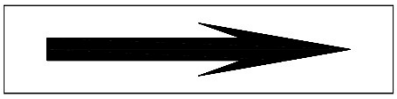


RISK OF ELECTRIC SHOCK

Correct start-up of the PSW conveyor



Correct direction of the electrical motor rotations



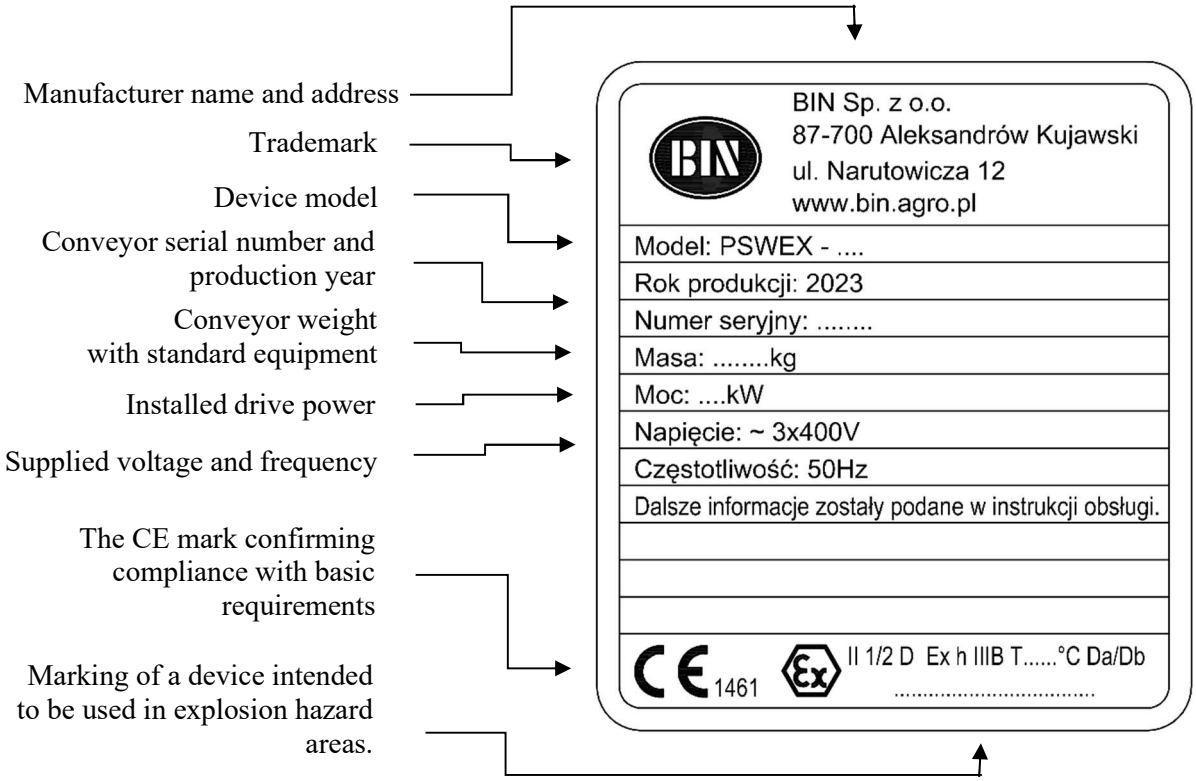
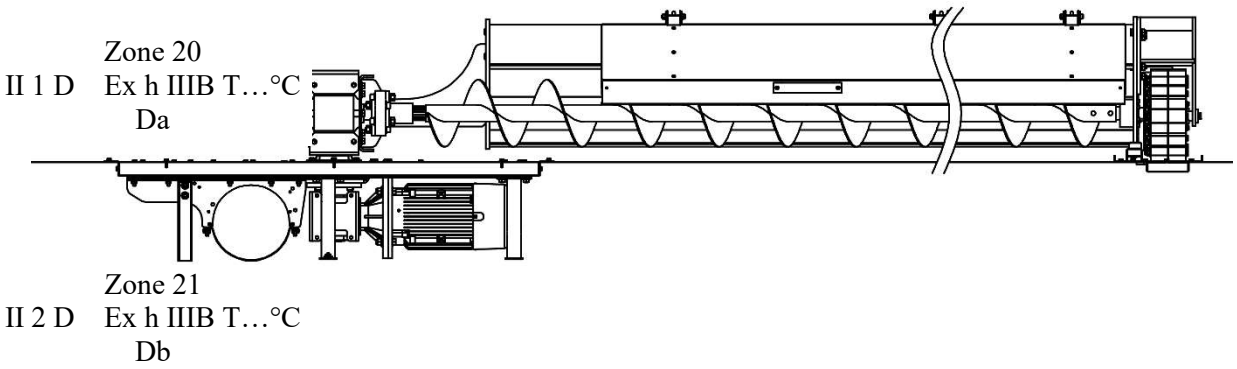


Table 1. Marking of a device intended to be used in explosion hazard areas.

	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 20, 21 and 22 **2** in zones 21 and 22
D	**D** - dust explosive atmospheres
Ex	A symbol indicating that a device corresponds to one or several types of the explosion-proof designs
h	Non-electrical equipment for explosive atmospheres - symbol
IIIB	Marking of the non-electrical equipment group: **IIIB** - devices are designated 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 of the PSWEX type is used to transport grain of cereals and maize, and oil seeds, stored in flat bottom silos of BIN or FBIN type, manufactured by BIN Sp. z o.o. The device is intended to transport grain of specified parameters, where the minimum dust cloud ignition temperature (T_{CL}) cannot be lower than 500°C, and the minimum ignition temperature of a 5 mm thick dust layer (T_{5mm}) cannot be lower than 200°C [1)]. PSWEX is an auxiliary device for unloading the remaining grain that did not get gravitationally into an underfloor unloading conveyor. The internal screw conveyor cannot work alone in the silo - it should 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 PSWEX type conveyors.

		BIN and FBIN type silo					
		BIN60	BIN100	BIN200 FBIN7	BIN500 FBIN9	BIN1000 FBIN11	BIN1500 FBIN14
	Internal screw conveyor of PSWEX type	**PSWEX-5**	**PSWEX-6**	**PSWEX-7**	**PSWEX-9**	**PSWEX-11**	**PSWEX-14**
Not a standard PSWEX equipment	The central inlet to silo with a steel floor on blocks and an underfloor conveyor of the PS160/PS220 type	**PSWEX-WLC-BL** A central inlet with a shutter for the PSWEX conveyor. It has a connection to conveyors of PS160/PS220 type					
	The central inlet to silos with a steel floor on blocks	**PSWEX-WLC-BL-UNI** A central inlet with a shutter for the PSWEX conveyor. It is equipped with a universal spigot, without a connection to an underfloor conveyor. (it is necessary to construct such a connection – adapted to a relevant conveyor)					
	The central inlet to silos with a steel floor on steel trusses	**PSWEX-WLC-RS-UNI** A central inlet with a shutter for the PSWEX conveyor. It is equipped with a universal spigot, without a connection to an underfloor conveyor. (it is necessary to construct such a connection – adapted to a relevant conveyor)					
	NOTE! **The PSWEX type conveyor is not suitable for installation in a silo with a concrete floor 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.**						

A correctly selected internal screw conveyor for a given BIN or FBIN type silo consists of a relevant PSWEX - …. + PSWEX – WLC -…. The underfloor conveyor working with PSWEX should be selected in such a way that its nominal capacity is equal to or exceeds the nominal capacity of the PSWEX conveyor. When a PSWEX 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 (PSWEX-WLC-BL-UNI or PSWEX- WLC-RS-UNI) with the underfloor conveyor is not a part of any PSWEX unit. A connection between the PSWEX conveyor and the underfloor conveyor must be custom designed and constructed depending on the underfloor conveyor design.

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1) Source: "Bezpieczeństwo pracy - Wybuchy przestrzenne" 11/2005/
(translation of the original title: *Occupational safety - Spatial explosions,* 11/2005/),
" Inżynier budownictwa - Przeciwdziałanie wybuchom pyłów materiałów sypkich składowanych w silosach" 2/2012 /
(translation of the original title: *Civil engineer - Counteracting explosions of dust of bulk materials stored in silos,* 2/2012 /),
„Centralny Instytut Ochrony Pracy i Państwowy Instytut Badawczy – Parametry charakteryzujące wybuchowość pyłów mieszanek paszowych i ich komponentów" 2019
(translation of the original title: Central Institute for Labor Protection and National Research Institute - *Parameters characterizing the explosiveness of dust of feed mixtures and their components*, 2019).

An operating cycle of the PSWEX conveyor ends with its full turn around a vertical axis of a silo in which it was installed. If the silo is equipped with internal devices (an internal ladder, an on-floor emergency duct, etc.) preventing the device from making a full circle, the conveyor can return to its initial position by changing a direction of the electric motor rotations.
If necessary (when a layer of grain remaining on the silo floor is too thick), the conveyor can perform the second and successive operating cycles (in silos in which a full turn of 360° is possible).

When the PSW operation ends, a layer of grain of 4 to 8 cm thick remains on the silo floor, to be removed manually by the user. The grain accumulating at locations where the silo internal equipment is installed, preventing the conveyor from making a full turn, also needs to be removed manually.

2.2. Technical specification

Table 3. Product technical parameters.

		PSWEX-5	PSWEX-6	PSWEX-7	PSWEX-9	PSWEX-11	PSWEX-14
Drive type		Electrical motor					
Nominal motor power	kW	1.5	1.5	2.2	2.2	3.0	3.0
Conveyor installation length [1)]	mm	2160	2600	3270	4180	5610	7040
Device weight [2)]	kg	283	303	357	416	516	622
Screw rotational speed	rpm	72		98			
Volumetric capacity	m^3/h	up to 21		up to 28			
Conveyor nominal capacity [3)]	tonnes/h	up to 16		up to 21			
Power supply	V	3x400					
Engine rotational speed	rpm	1450					
Types of transmissions used		Toothed gear (bevel and worm).					
Screw diameter	mm	200					
Ambient temperature	°C	-20 to +40					
Conveyor installation height [4)]	mm	455					

1. The conveyor installation length represents a length measured from the silo vertical axis to the furthest part of the device in the silo shell direction.
2. The device weight with standard equipment (excluding the weight of optional equipment, such as a central inlet, etc.)
3. The conveyor nominal capacity is determined by the material bulk density, depending on its type, size, moisture content, contamination level, etc.:
   16 or 21 t/h, respectively (for wheat of bulk density of 750 kg/m^3),
   12 or 17 t/h, respectively (for oats of bulk density of 600 kg/m^3).
4. The conveyor installation height represents a height measured from the silo floor surface to the highest part of the conveyor.
5. In no device shown in the manual, the level of noise exceeds 70 dB(A).

2.3. Design description

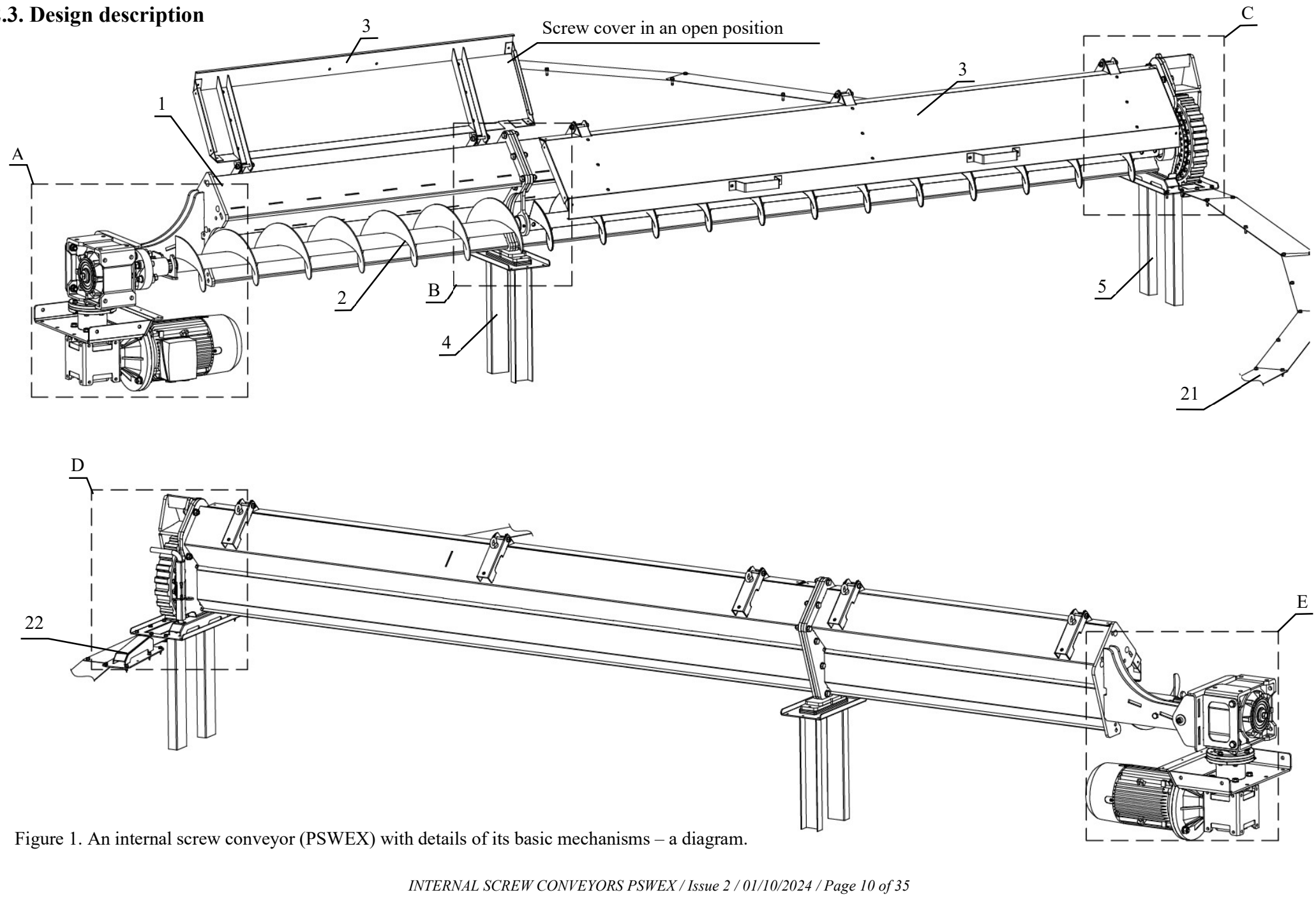
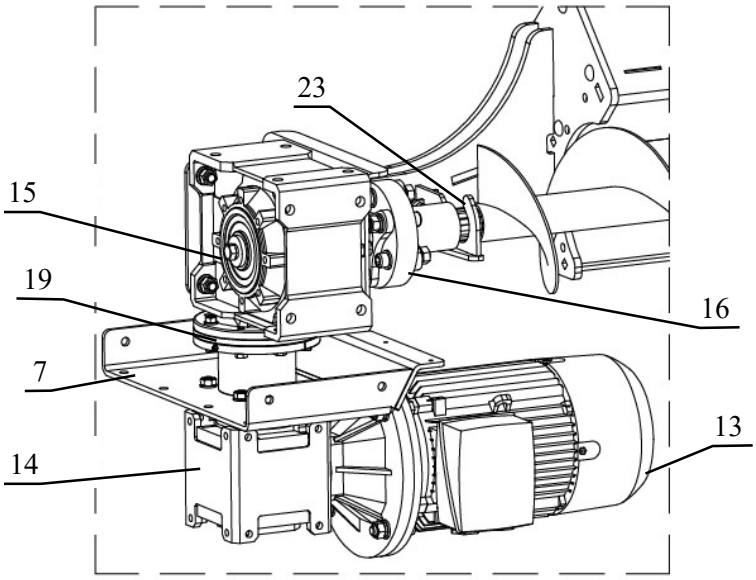
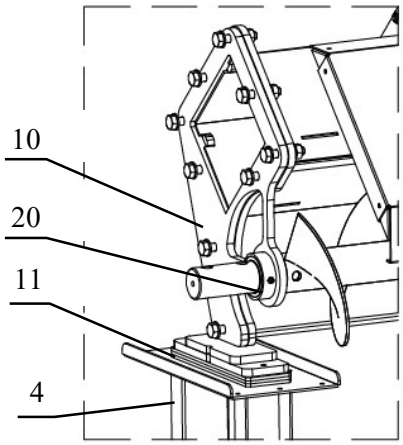


Figure 1. An internal screw conveyor (PSWEX) with details of its basic mechanisms – a diagram.

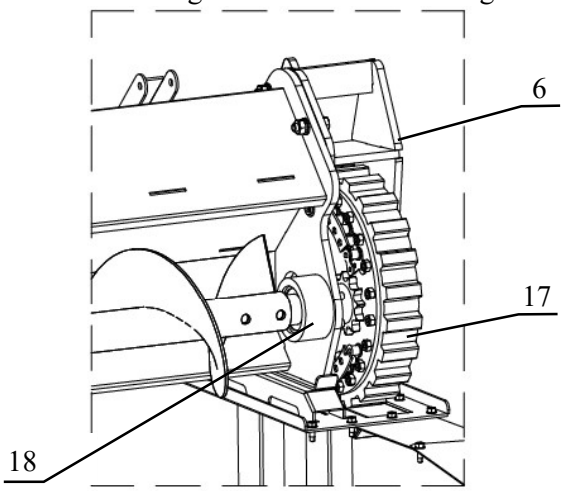
Detail A
A conveyor drive unit



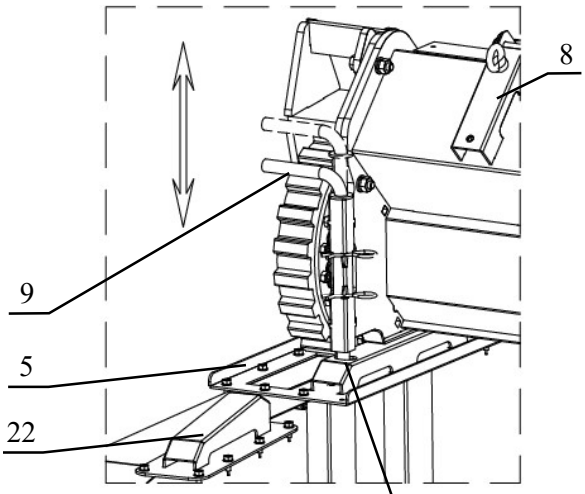
Detail B
Intermediate bearing



Detail C
A driving mechanism of a running wheel



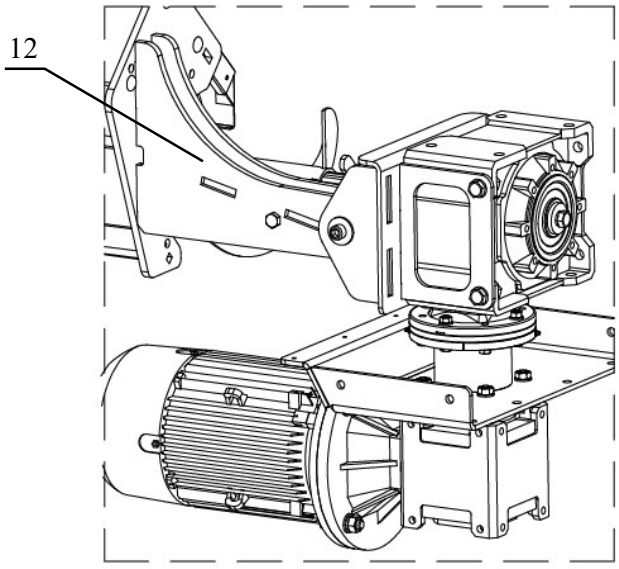
Detail D
A conveyor lock in an initial position



An opening for PSWEX locking

Item 1. Conveyor body
Item 2. Unloading screw conveyor
Item 3. Unloading screw guards
Item 4. Body support
Item 5. Running wheel support
Item 6. Running wheel bracket
Item 7. Conveyor fixing plate
Item 8. Unloading screw guard hinge
Item 9. Conveyor blocking lock
Item 10. Intermediate bearing bracket
Item 11. Spacers
Item 12. Body fixing bracket
Item 13. Electric motor
Item 14. Toothed gear (bevel)
Item 15. Toothed gear (worm)
Item 16. Unloading screw joint
Item 17. Conveyor running wheel
Item 18. Screw end bearing (ball)
Item 19. Conveyor turntable
Item 20. Intermediate bearing (slide)
Item 21. Conveyor track
Item 22. Braking wedge
Item 23. Transport (temporary) bracket, to be removed after installation of the screw body with a drive.

Detail E
Conveyor body fitting



Silos of BIN and FBIN type are unloaded in two stages:

- At the first stage, the unloading underfloor conveyor enables unloading of grain that gravitationally (under its own weight) pours into the central inlet installed in the centre of the floor. Because the silo floor is horizontal, some amount of grain cannot freely enter the central inlet. For example, about 270 tonnes of grain remains in BIN1500 silos.

- At the second stage, the remaining amount of grain can be removed from the silo by installing the internal screw conveyor PSWEX, which will mechanically rake most of that grain into the central inlet. The internal screw conveyor (PSWEX) 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 (PSWEX) with details of its basic mechanisms is shown in Figure 1. The conveyor consists of a body - Item 1, which enables installation of the unloading screw - Item 2 , forming a basic working unit of the conveyor. Furthermore, the body includes the unloading screw guard - Item 3, and supports Item 4 and Item 5, used to support the conveyor in the initial position during the grain storage. The unloading screw is fixed to the body with, among others, bearings Item 18 and Item 20, and a joint - Item 16. The screw of Ø200 mm in diameter is driven by an electric motor - Item 13, through a bevel gear - Item 14 and a worm gear - Item 15. The conveyor turntable - Item 19, enables rotational movement of the PSWEX conveyor around the silo vertical axis. The PSWEX rotating movement is performed with a running wheel - Item 17, driven by the unloading screw - Item 2. The track - Item 21 forms a working surface for a driving wheel.

The braking wedge - Item 22 stops the PSWEX rotating movement around the silo vertical axis at the specific location. It is installed in silos with internal equipment, e.g. an internal ladder, etc.

Transport bracket - Item 23 is found in PSWEX-5/6/7, it supports the screw during transport. The bracket needs to be removed after installation of the screw with a drive.

Furthermore, the PSWEX conveyor is equipped with a cable shielding pipe with a handle, and information and warning signs.

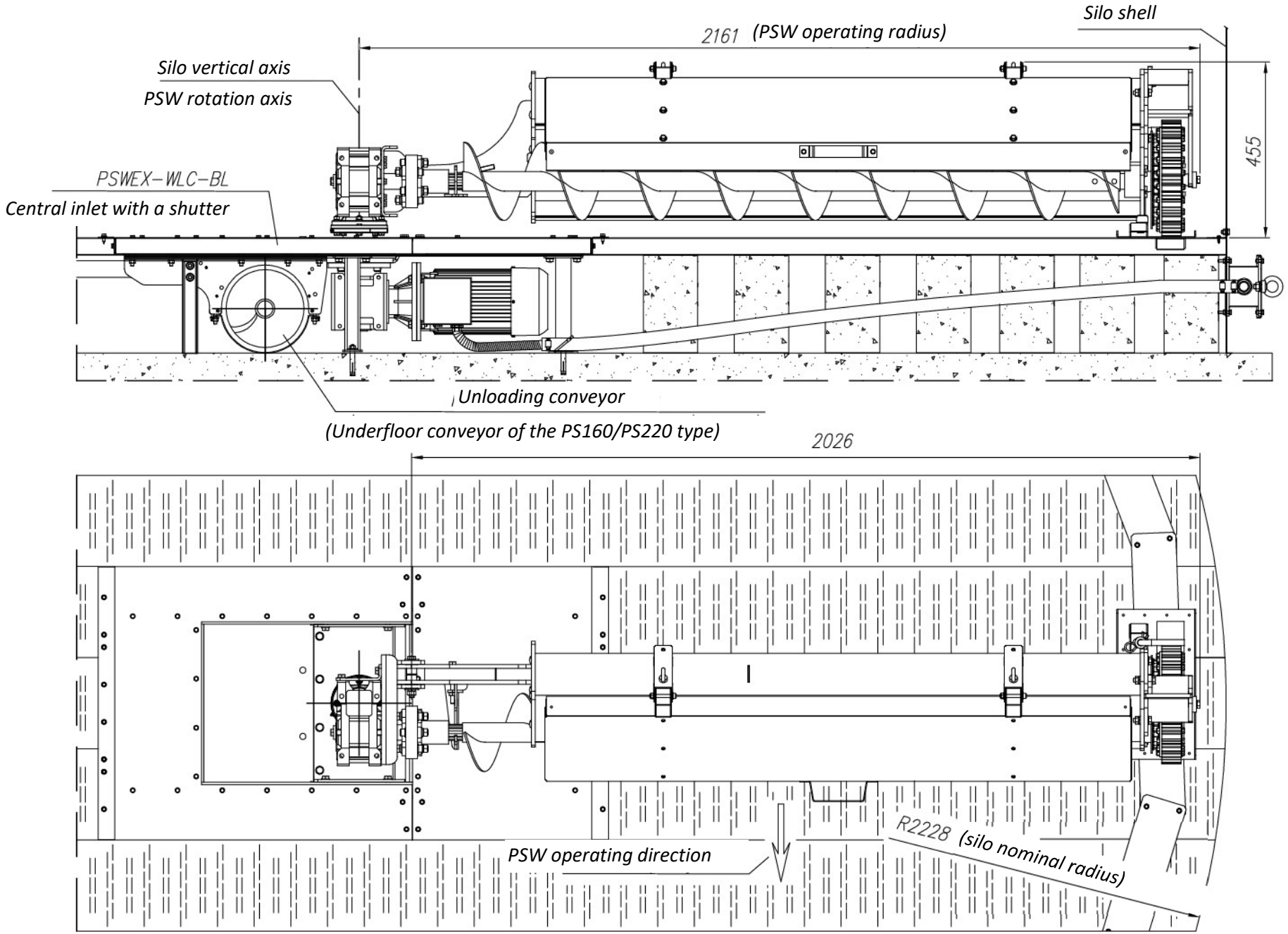


Figure 2. Basic installation dimensions of the internal screw conveyor, of the PSWEX-5 type (dimensions as mm).

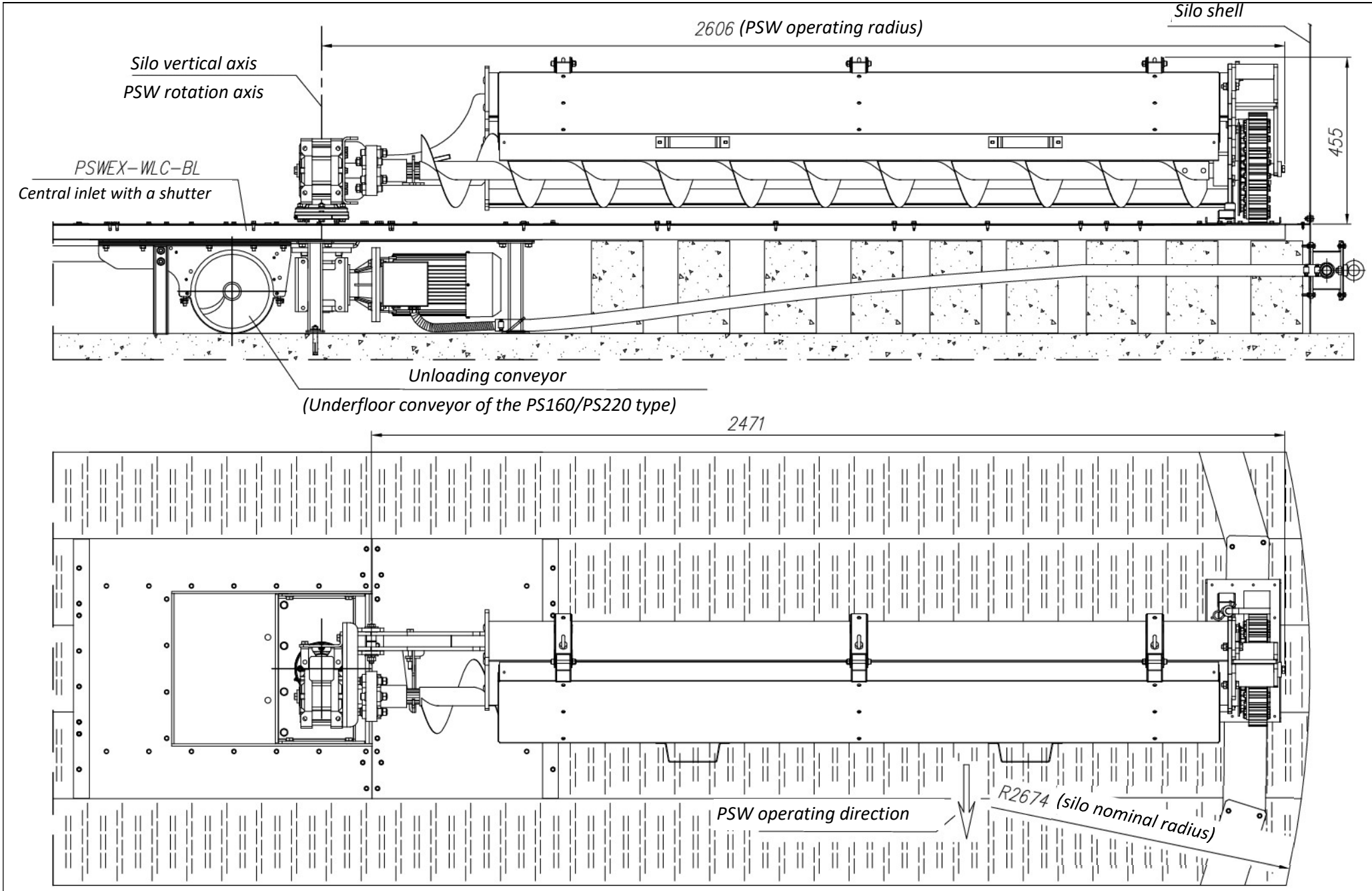


Figure 3. Basic installation dimensions of the internal screw conveyor, of the PSWEX-6 type (dimensions as mm).

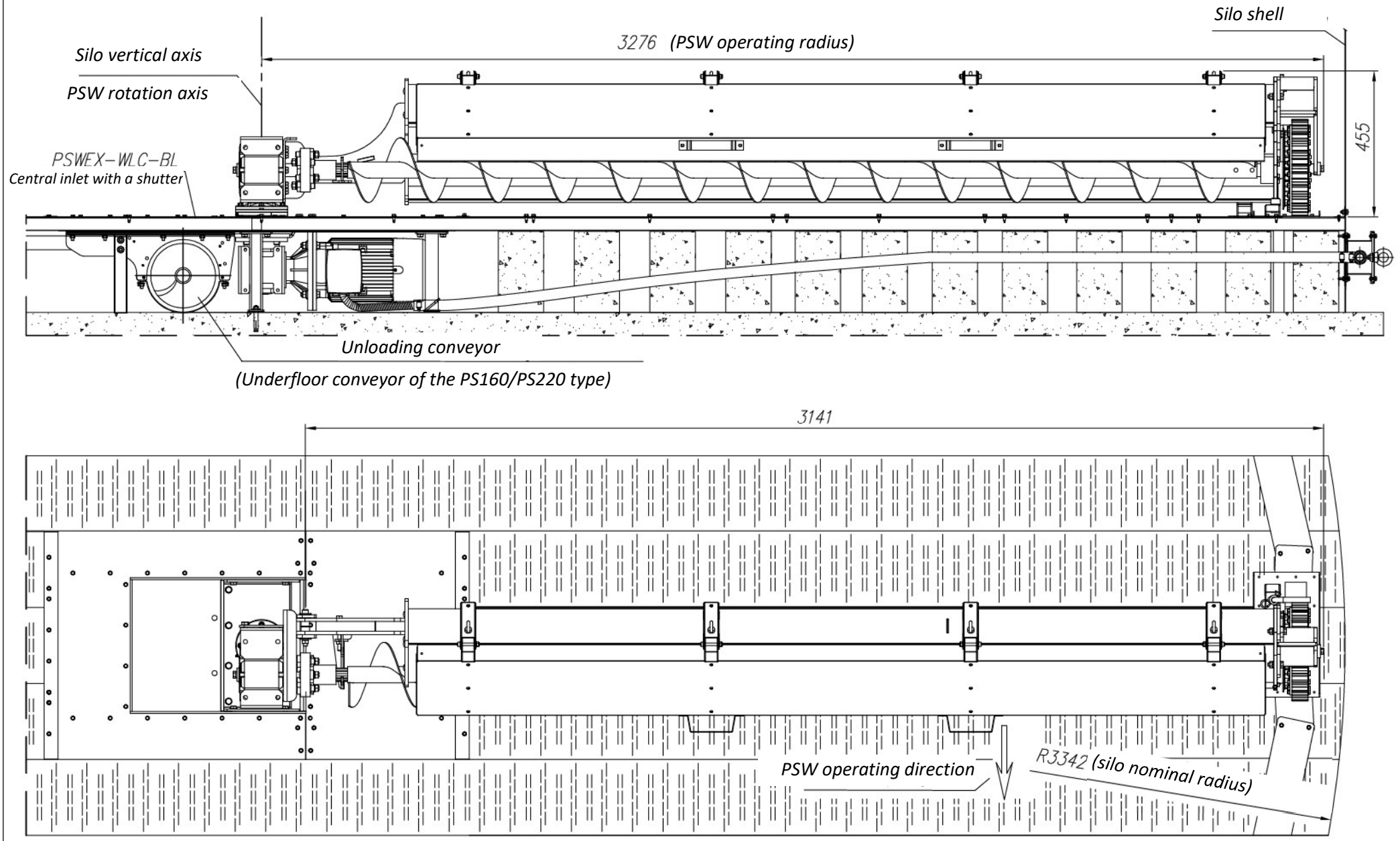


Figure 4. Basic installation dimensions of the internal screw conveyor, of the PSWEX-7 type (dimensions as mm).

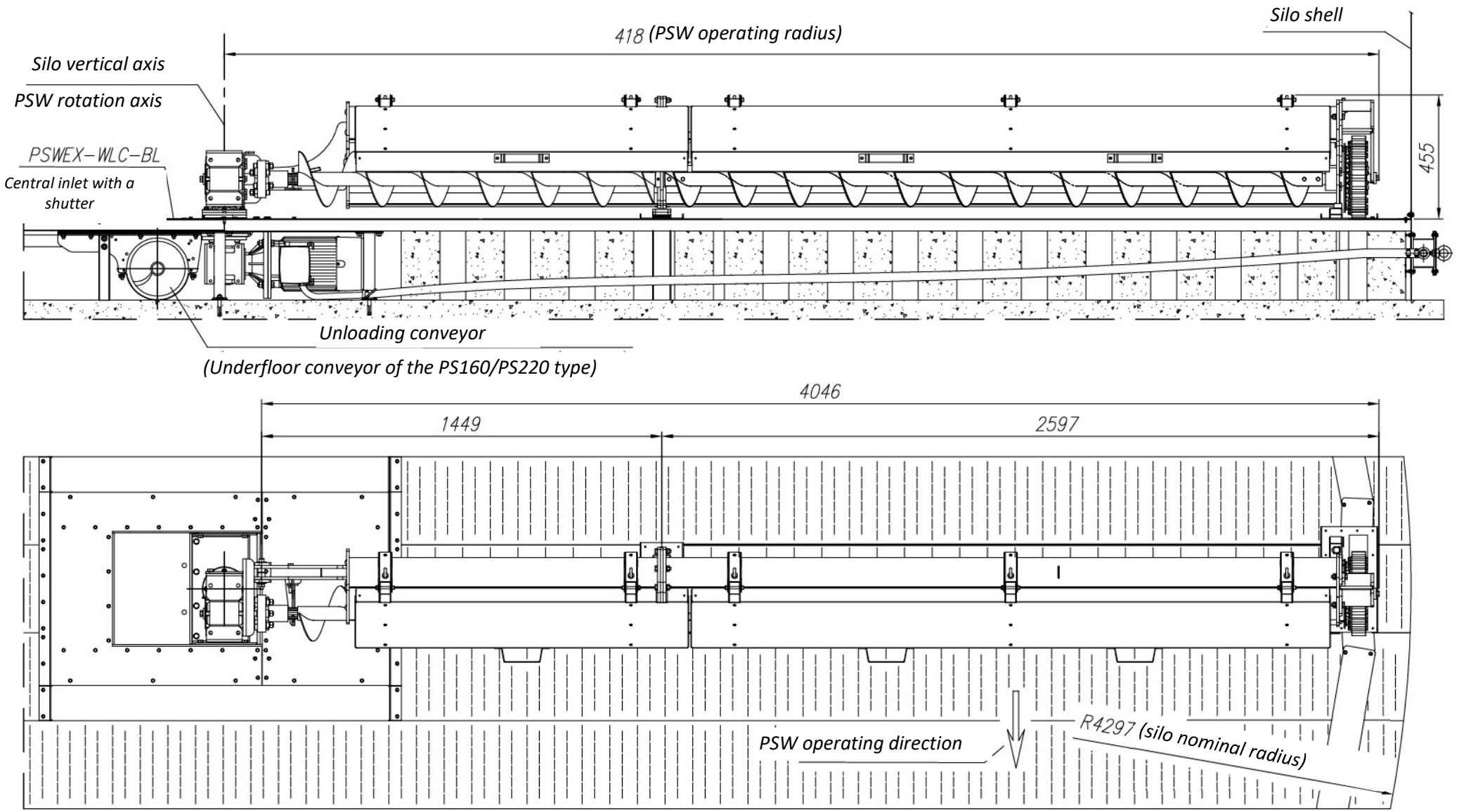


Figure 5. Basic installation dimensions of the internal screw conveyor, of the PSWEX-9 type (dimensions as mm).

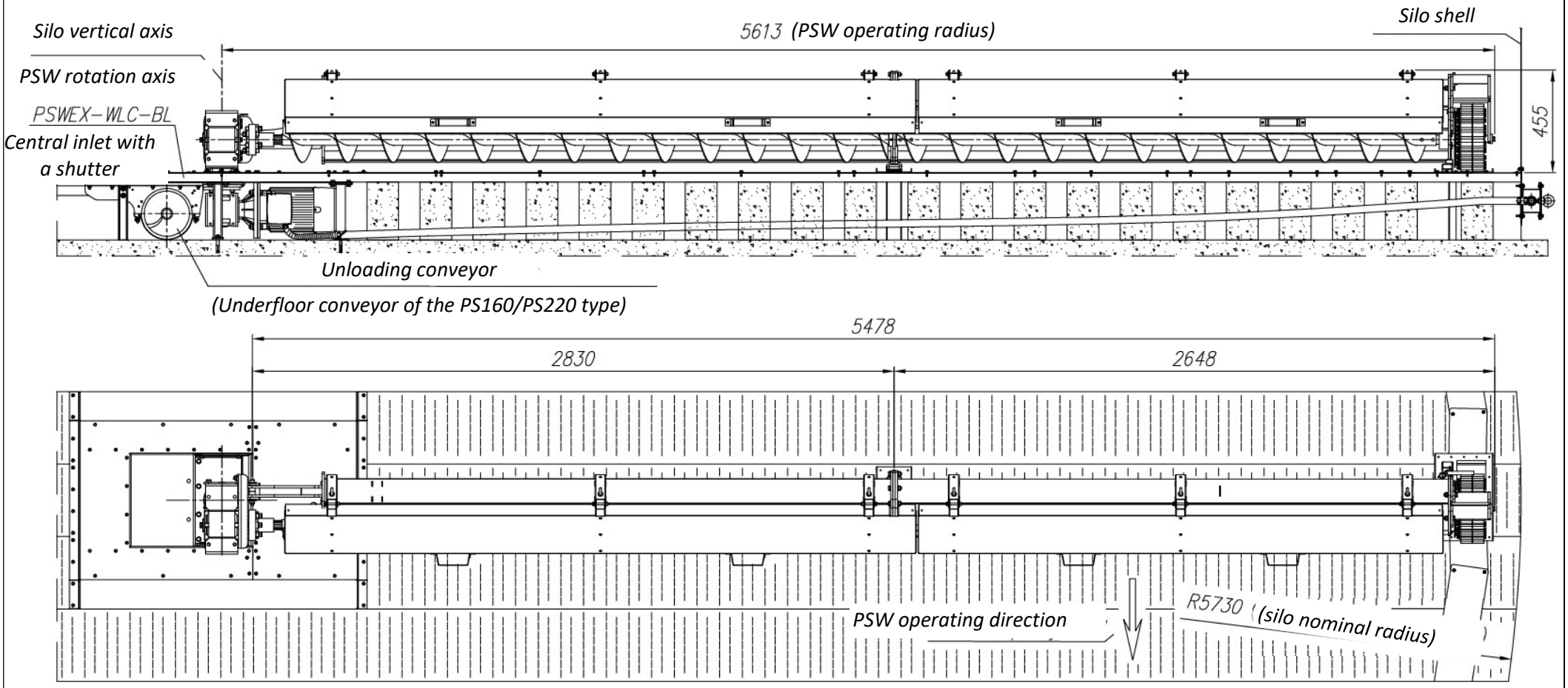


Figure 6. Basic installation dimensions of the internal screw conveyor, of the PSWEX-11 type (dimensions as mm).

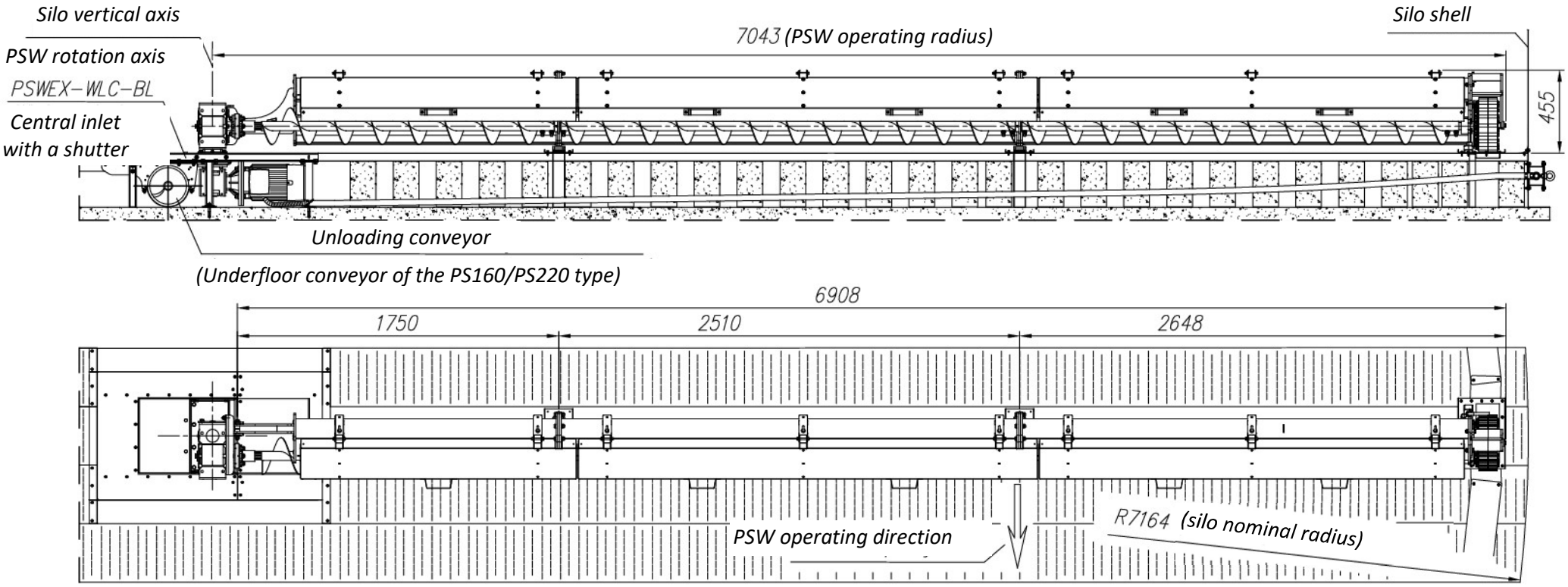


Figure 7. Basic installation dimensions of the internal screw conveyor, of the PSWEX-14 type (dimensions as mm).

3. Initial operations and preparing the elevator 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 transport vehicle of dimensions and capacity resulting from data - Table 4. The cargo body of the vehicle must be provided with a 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. An internal screw conveyor packed for transport - weight and dimensions.

Article code	Number of packages	Package dimensions	Product weight with packaging
	pcs.	cm	kg
PSWEX-5	1	210x110x80	344
PSWEX-6	1	270x110x65	389
PSWEX-7	1	315x110x65	448
PSWEX-9	1	315x110x65	514
PSWEX-11	1	315x110x110	614
PSWEX-14	1	315x115x90	730
PSWEX-WLC-BL	2	135x85x50	163
		370x15x10	
PSWEX-WLC-BL-UNI	2	170x90x45	190
		370x15x10	
PSWEX-WLC-RS-UNI	2	220x80x55	205
		370x15x10	

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.

3.3. Conveyor installation

The internal screw conveyor cannot work alone in the silo - it must always works 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 themselves 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 PSWEX conveyor:

- PSWEX-… install upstream of the bottom manhole. After being started at the first stage of operation, the conveyor is to remove the grain from the bottom manhole and enable its opening.
- Conveyors of the PSWEX type-… can make any number of full turns around the vertical silo axis (n x 360°) in a direction of its operation (Figure 8 – if there is no emergency duct, internal ladder, etc. in the silo). The conveyor does not need to move back.
- In silos equipped with an internal ladder, an emergency duct, or similar equipment, the conveyor performs the incomplete rotation in the silo (Figure *9*). PSWEX stops to operate before devices installed in the silo, after driving onto the braking wedge (Figure 1, Item 22). The reverse movement of the PSWEX conveyor is necessary for it to return to its initial position.
- After installation and correct setting of the PSWEX conveyor in the silo, body supports (Figure 1, Item 4 and Item 5) need to be installed, with their location and distance to the body flanges (Figure 10) maintained.
- The driving wheel of the conveyor is equipped with the drive backlash adjustment. The conveyor is delivered with the play adjusted. Before the bodies are installed, check and adjust, if necessary, the drive backlash. To facilitate adjustments, perform this activity before connecting the screw body with the drive. Perform adjustments only when the screw is supported at its ends with bearings; the sole exception are PSWEX -5/6/7 conveyors, in which the screw is supported on a temporary transport bracket. Loosen 4 M10 screws fixing the wheel bracket. Reduce the backlash by hitting on a protruding adjusting plate. Check the backlash by turning the wheel (a full turn of the wheel). The correctly set wheel should turn freely, without any jams. In each wheel position, a slight backlash between a chain and a gear, of 1 mm should be noticeable (measured on the wheel circumference, Figure 11).
- After installation and possible adjustments, perform a test rotation of PSW around the silo vertical axis. No part of the conveyor (screws, bodies, supports, etc., apart from the running wheel) should be in contact with the floor and the silo shell.

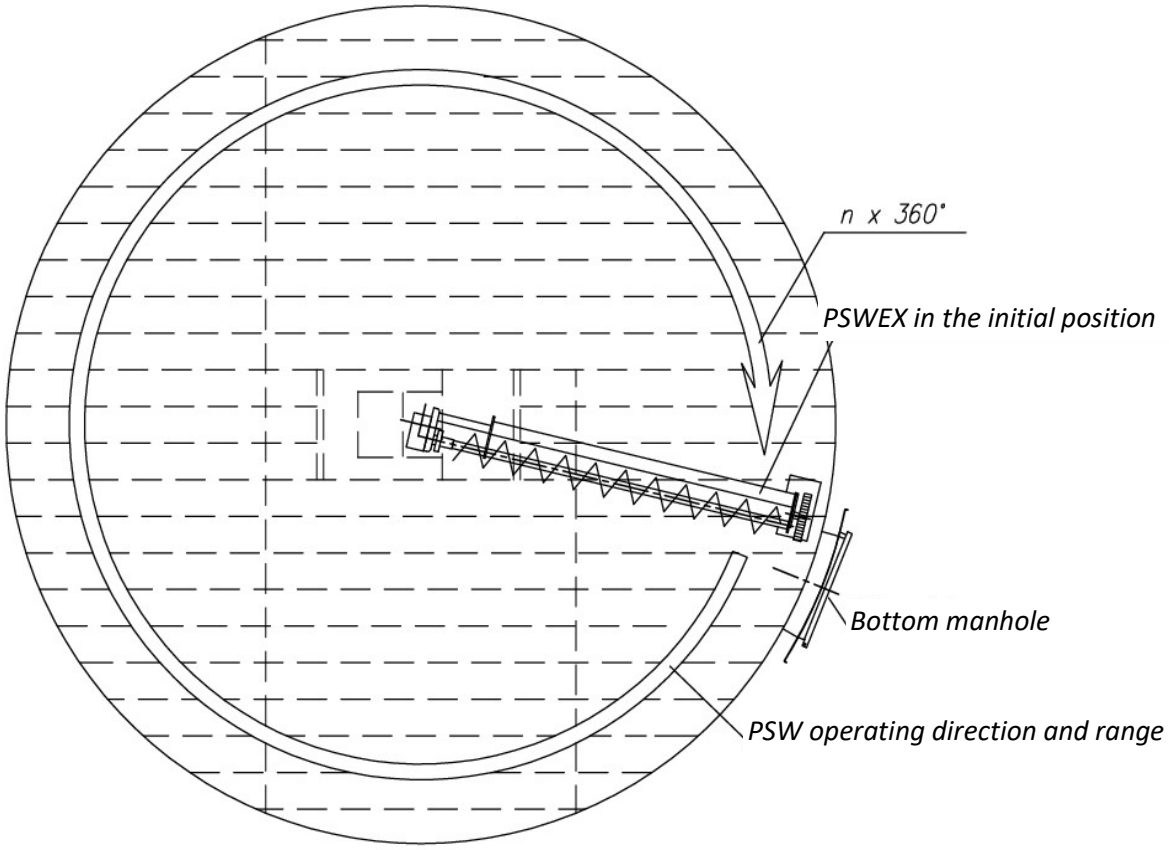


Figure 8. A diagram showing the PSWEX conveyor setting in a silo without an internal ladder and other equipment above the floor.
n - any number of conveyor rotations.

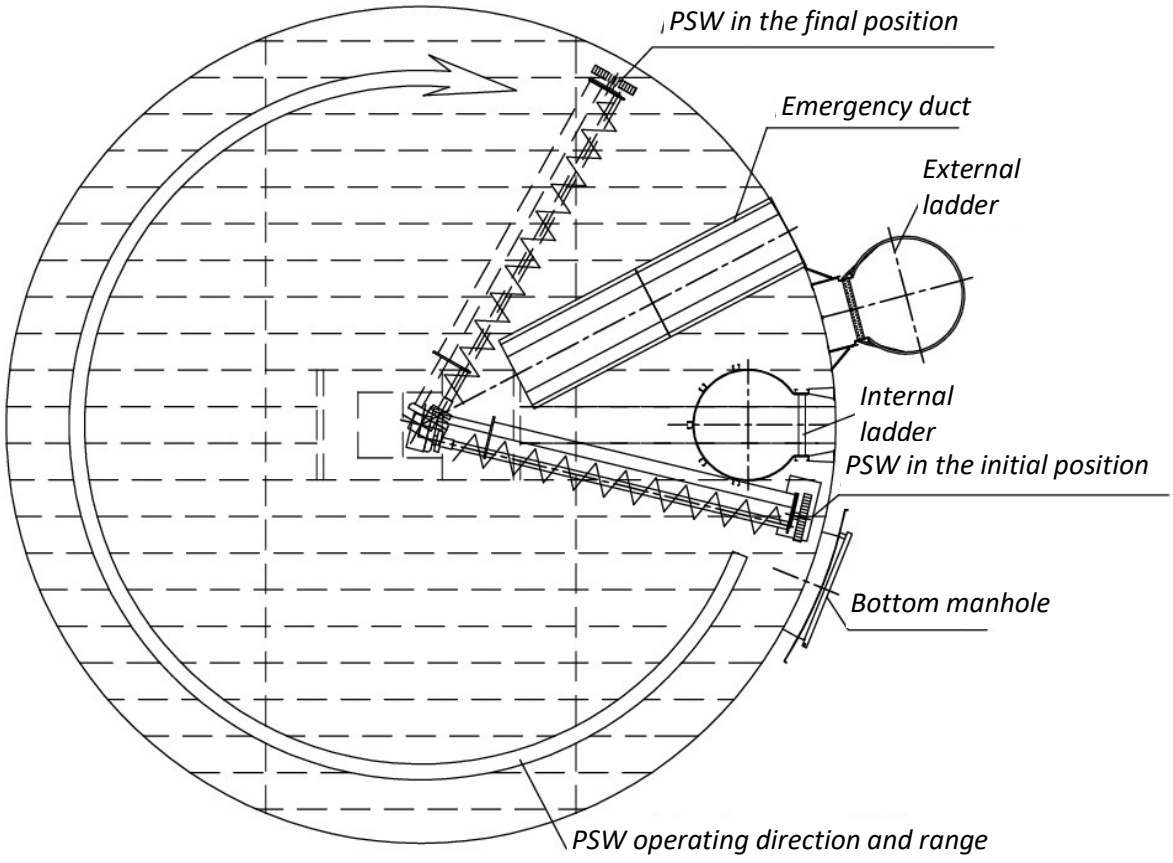


Figure 9. A diagram showing the PSWEX conveyor setting in a silo equipped with an internal ladder and an on-floor emergency duct.

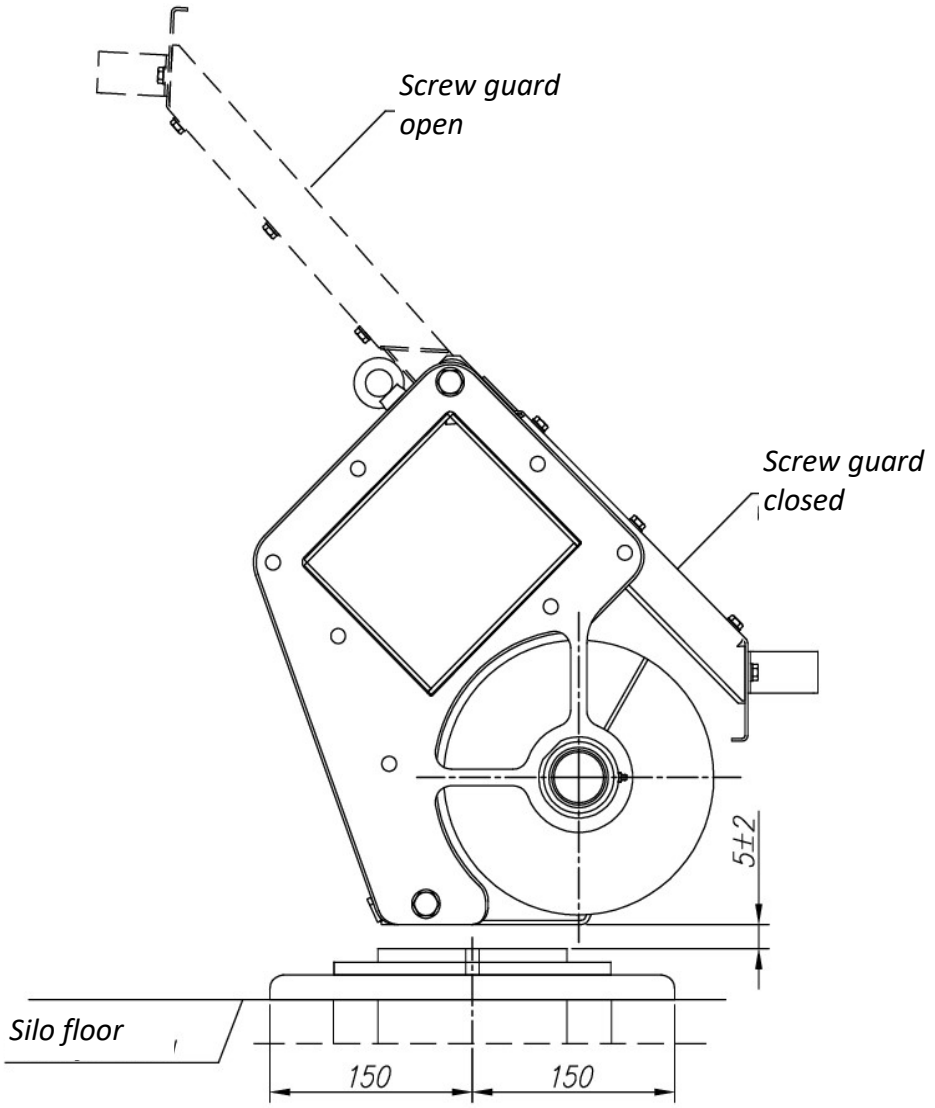


Figure 10. The body support setup. The screw guard position.

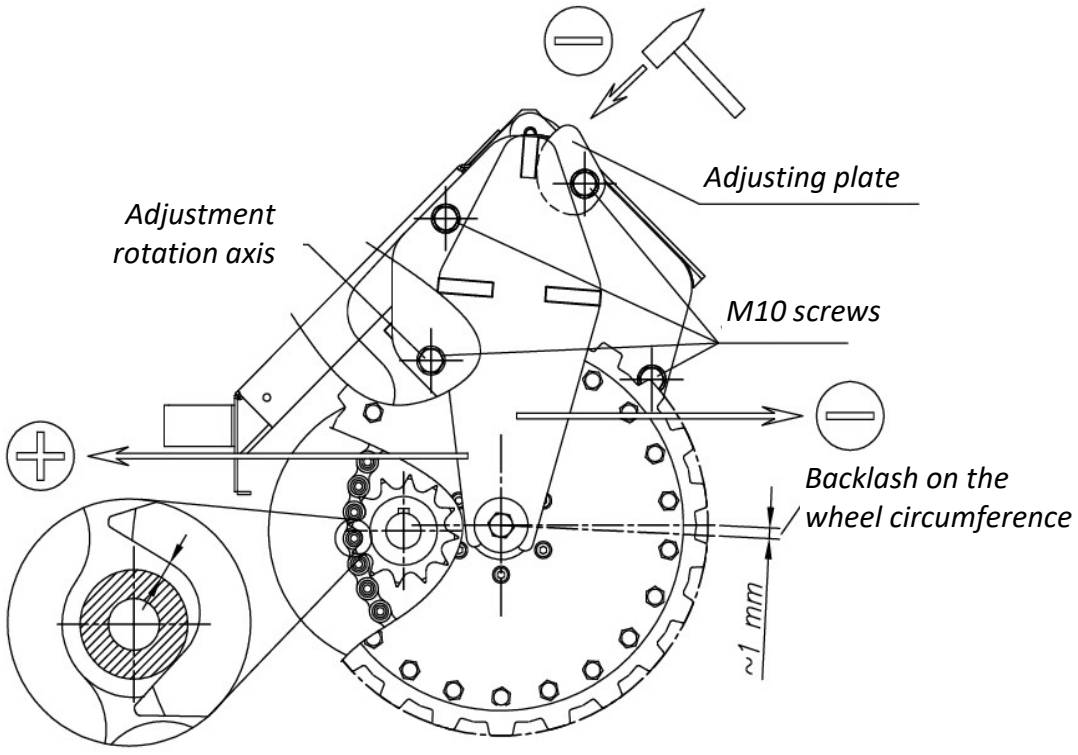


Figure 11. Adjustment of the drive of the running wheel of the PSWEX conveyor

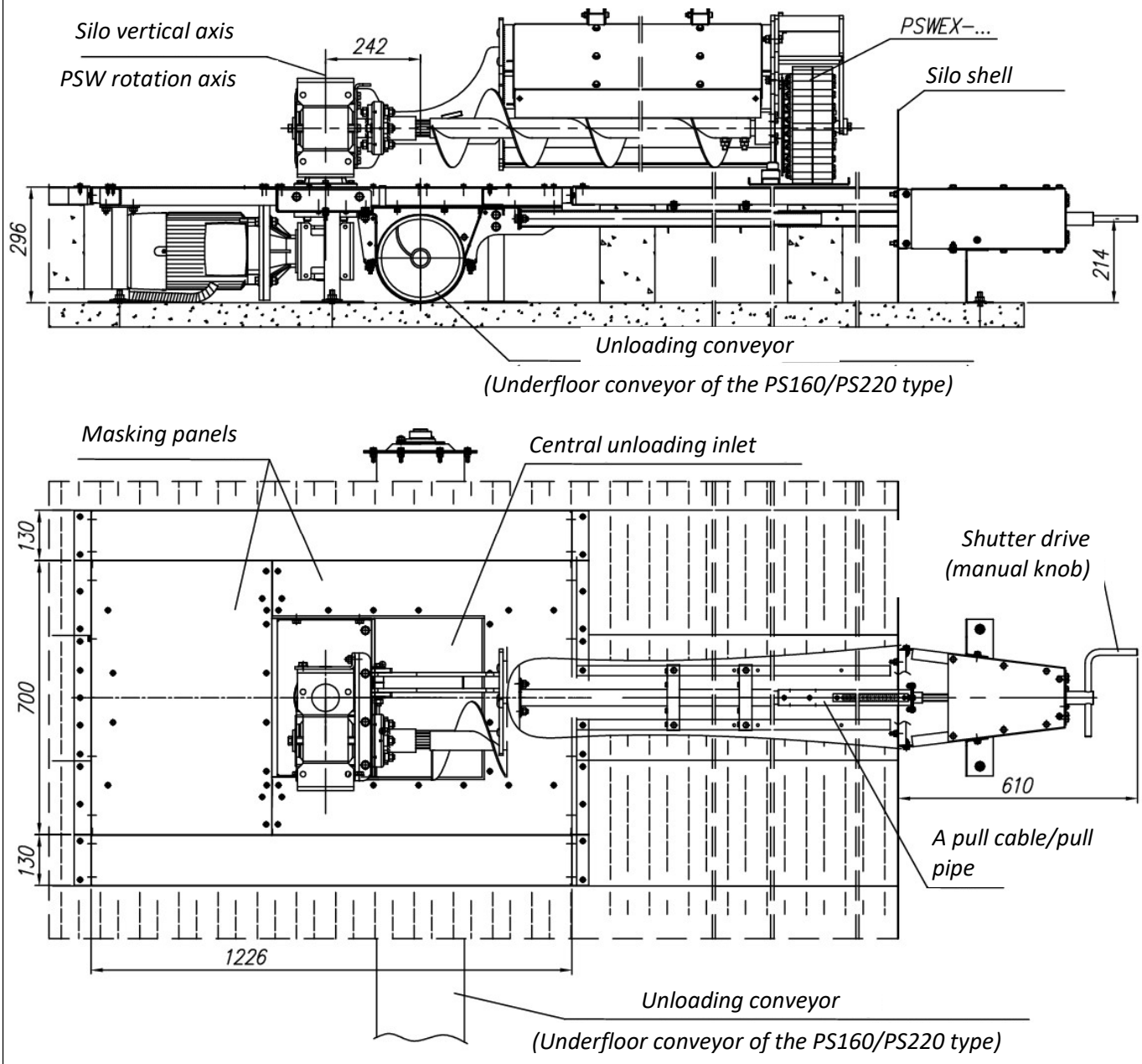


Figure 12. The way for installing PSWEX equipped with accessories of the PSWEX-WLC-BL type: The central inlet of the PSWEX conveyor to silos with a steel floor on blocks and underfloor conveyors of the PS160/PS220 type.

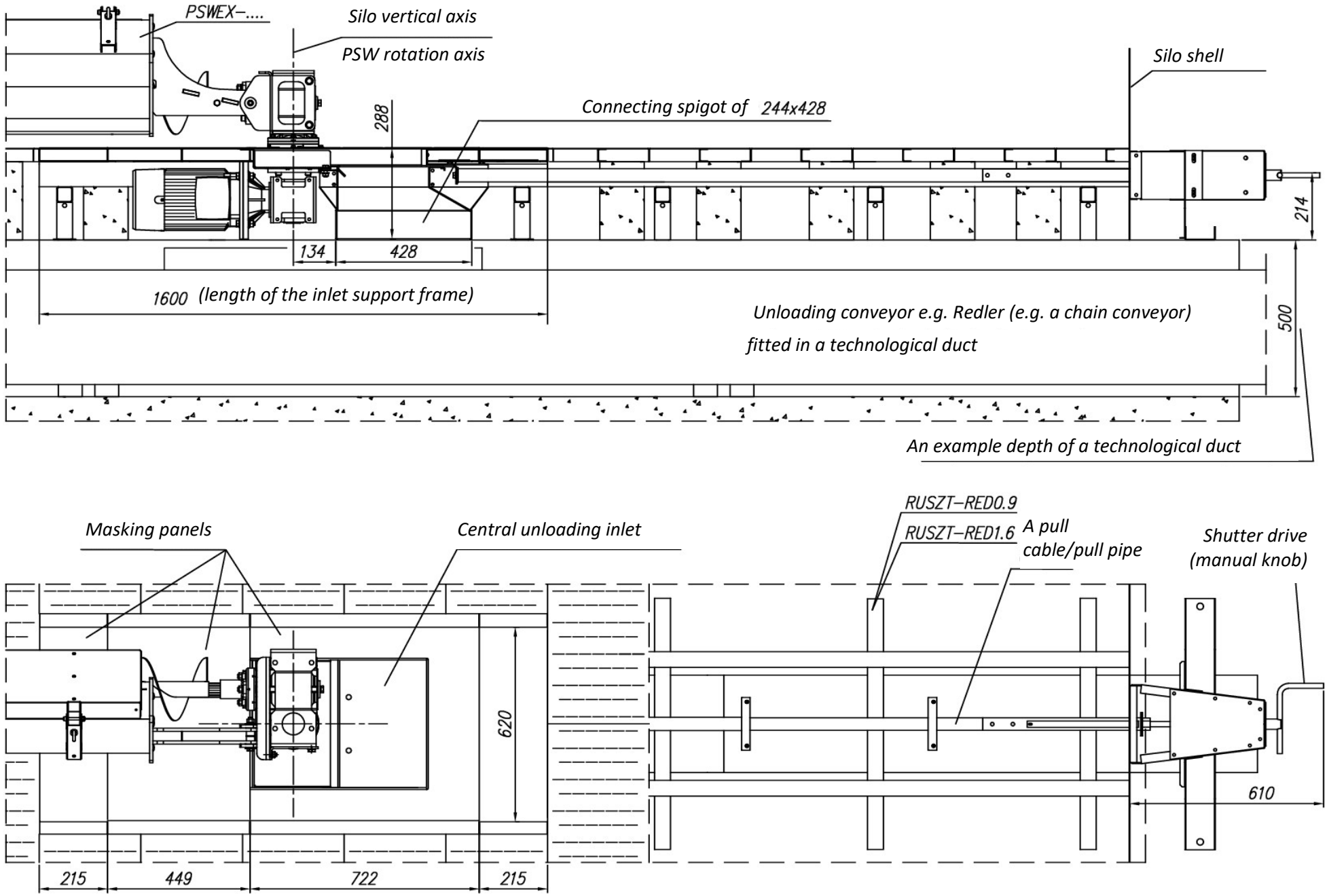


Figure 13. The way for installing PSW equipped with accessories of the PSWEX-WLC-BL-UNI type - The central inlet of the PSWEX conveyor to silos with a steel floor on blocks (dimensions as mm).

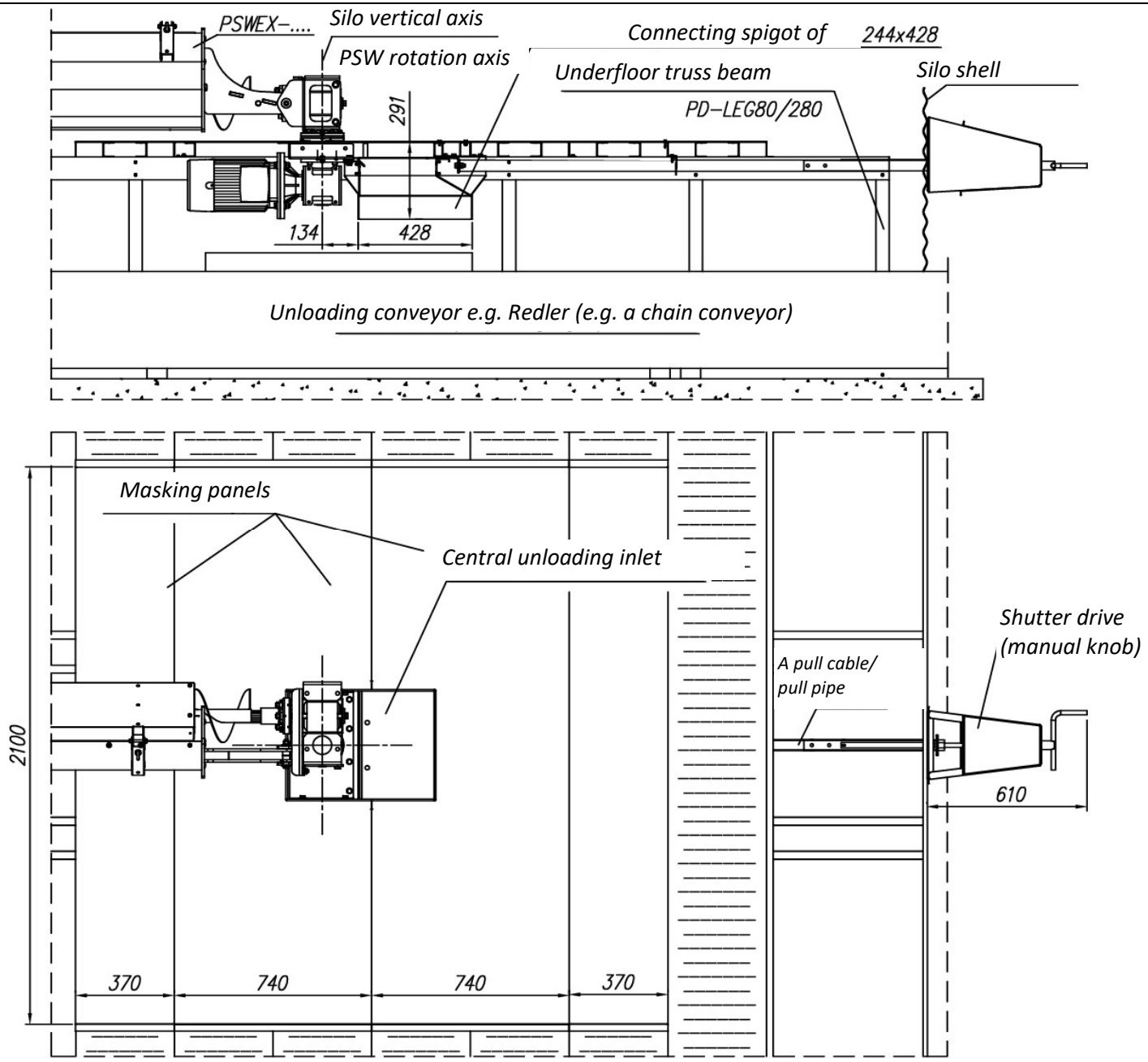


Figure 14. The way for installing PSW equipped with accessories of the PSWEX-WLC-RS-UNI type - the central inlet of the PSWEX conveyor to silos with a steel floor on steel trusses (dimensions as mm).

3.4. Electric systems and start-up

The manufacturer equips the PSWEX conveyors with:
- (M1) three-phase electric motor with PTC temperature sensors and a shielding pipe for the cable (installed under the floor),
- (B1) thermistor protection (type: EMT6 230V, EATON),
- (Q2) motor switch with a push-on drive (type: GZ1E 2.2-4A, for a motor of 1.5 kW, 4-6.3 A for a motor of 2.2 kW or 6-9A for a motor of 3.0 kW) with 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 ensuring that this design study is drawn up by a person holding relevant licences in accordance with current legislation.
An example of the wiring diagram is shown in Figure 15.

The electrical system must meet the following requirements:
- a motor correctly connected (as required by a motor manufacturer), including its effective earthing;
- a motor secured by a correct connection and adjustment of the thermal switch (Figure 15, switch Q2);
- securing against unintended starting of the conveyor after power outage (Q2) < U;
- an option of securing against unexpected switching of the conveyor on (Q1);
- voltage supplied to all units should be within ranges specified by manufacturers of those units;
- the function for automatic stop of the conveyor work in the event of any abnormal work of auxiliary equipment (K) (e.g. failure of another conveyor) or people entering areas in a silo in which the conveyor works - switches and/or sensors are not included as the conveyor equipment;
- a function for stopping the electric motor operation after its acceptable temperature (B1) is exceeded (PTC sensors of the electric motor);
- the operating time counter (L1), electric with a roller type counter (analogue). It counts the operating hours of the device, to plan maintenance;
- all devices and subunits of the electrical system (Figure 15), except for the electric motor (M1), should be installed outside the explosion hazard zone.

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 the 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 manufacturer 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 PSWEX is necessary, preventing starting of the PSW conveyor when the underfloor conveyor is not working.

NOTE:

Devices and subunits - Figure 15: Q1, Q3, K i L1 - are not provided as the conveyor equipment.

Usually, during starting of the PSWEX conveyor its electrical motor is subjected to the maximum load. For these 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.

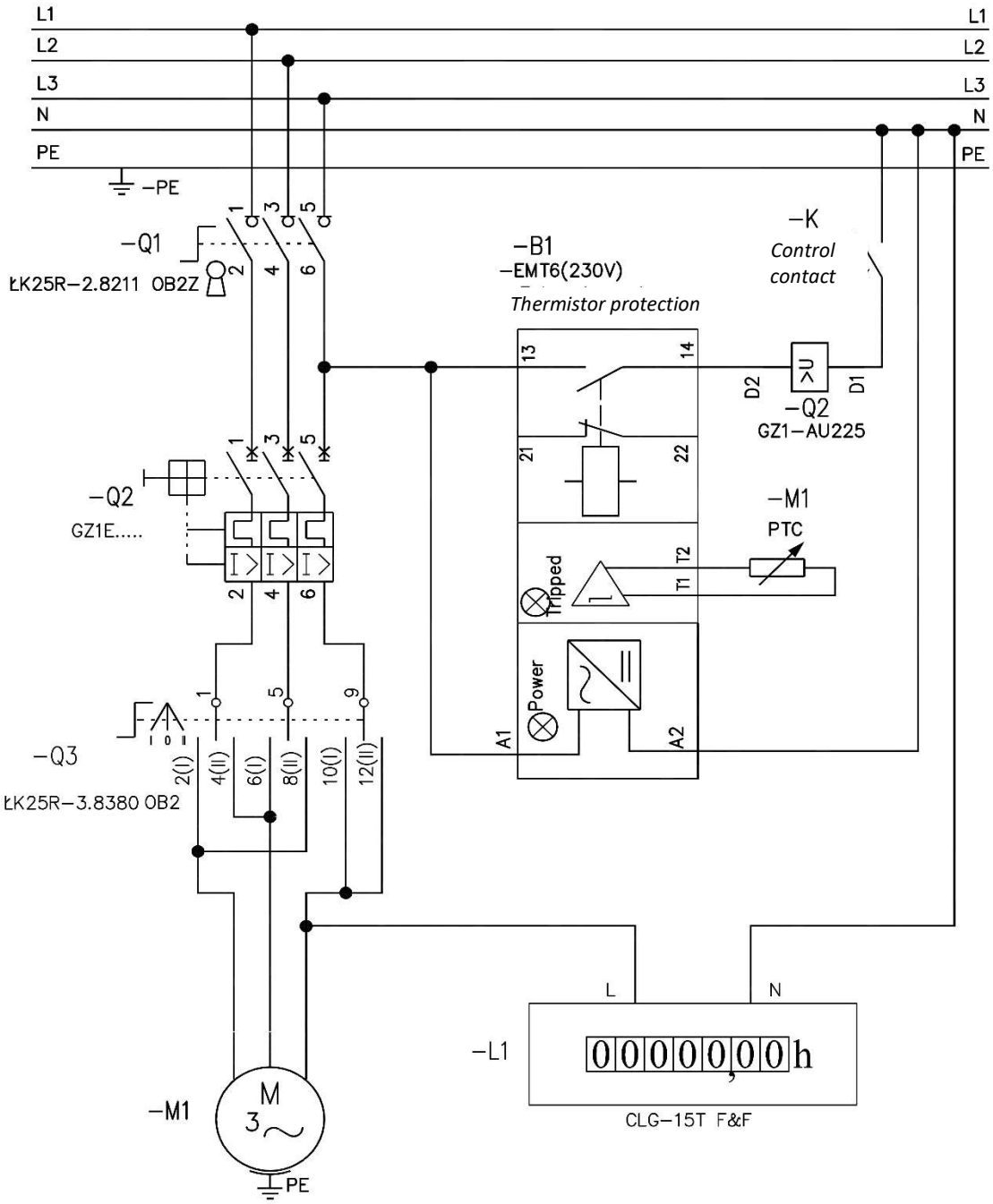


Figure 15. An example of the wiring diagram for conveyors of the PSWEX type

The diagram represents general guidelines for construction of the wiring system for the conveyor.

The units used can be replaced by equivalent devices having identical functions.

M1 - An electrical three-phase motor with PTC sensors, manufactured by SIEMENS or INDUKTA, 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

Q1 - A lockable main switch 0-1;

Q2 - A motor switch with a push-on drive (type: GZ1E 2.2-4A, for a motor of 1.5 kW, 4-6.3 A for a motor of 2.2 kW or 6-9A for a motor of 3.0 kW) with undervoltage release.

Q3 - A 1-0-2 switch for changing motor rotations (not required if PSWEX rotates freely around the silo axis)

B1 - Thermistor protection (type: EMT6 230V, EATON),

K - A control contact. When closed, it enables PSW operation, when open, the conveyor cannot be operated, the contact should open following:

- 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.

L1 - An operating time counter (L1), electric with a roller type counter.

4. Operation

4.1. Operation of conveyors

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 work of the PSWEX conveyor and any equipment working with the silo.

Before each loading of the silo, PSWEX needs to be placed in an initial position (Figure 1): Place the conveyor wheel on a base Item 5. Move the lock Item 9 down and lock in an opening in the base. Flanges of the body should be above supports Item 4. Lower the screw guards Item 3.
If the PSWEX is not set in a correct initial position, it can be damaged.

It is strictly forbidden to start the PSWEX conveyor that is completely covered with grain. Before each starting of the conveyor, check if the silo central inlet is uncovered (not covered with grain). Starting the PSWEX above which there is so much grain that the silo central inlet is completely covered, may damage the silo and the conveyor (Figure 16).

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.

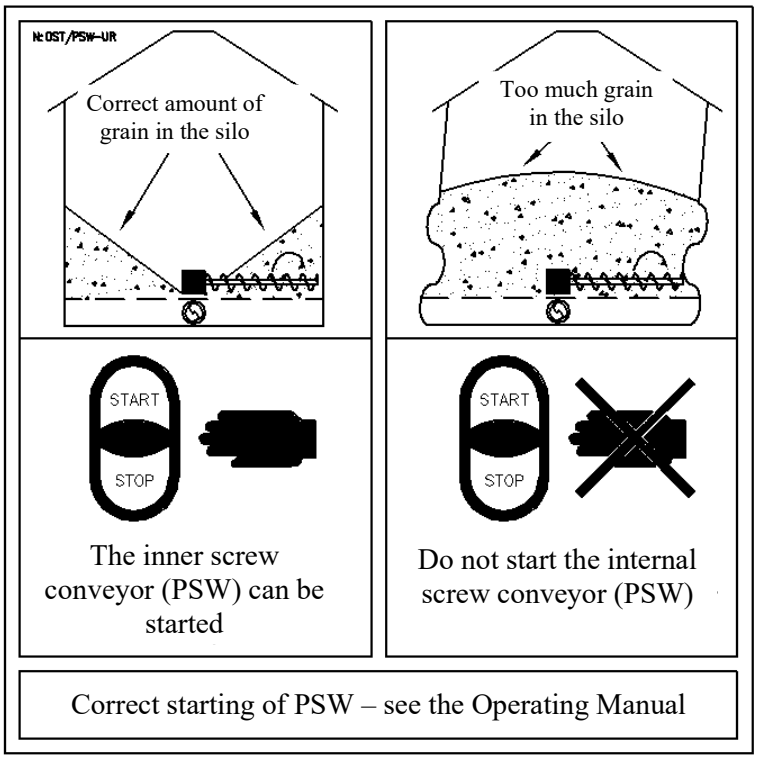


Figure 16. Correct start-up of the PSW conveyor - a warning sign

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 electric units (mainly control devices) differ from those proposed by the conveyor manufacturer.

To unload the silo using the PSWEX 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.
1.3 Close, if necessary.
1.4 Start the underfloor conveyor and other equipment for grain transport cooperating with it.

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

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

To start the PSWEX conveyor:

1.8 If the underfloor conveyor has been stopped earlier, restart it and other equipment for grain transport cooperating with it.
1.9 Open the shutter of the central unloading inlet.
1.10 Start the PSWEX conveyor.
1.11 The PSW conveyor can be kept working until the grain accumulated above it is completely unloaded. When this stage of unloading is over, the bottom manhole can be opened, if it is included in the silo equipment.
1.12 Stop all devices and secure the main switch against unintended activation. Close the central inlet. Enter the silo, lift the screw guards Figure 10. Unlock the lock (Figure 1, detail "D") installed at the wheel. If necessary, move the conveyor to place the wheel on the track.

NOTE:
Is strictly forbidden for people and animals to be present in front of the PSWEX screw when the lock of the conveyor is unlocked. The pressure of grain accumulated upstream from the PSWEX may result in the sudden movement of the conveyor in the direction of its operation.

1.13 Restart the conveyors following the items 1.1 to 1.4.
1.14 Open the shutter of the central unloading inlet.
1.15 Start the PSWEX conveyor.
1.16 In silos without internal equipment Figure 8 the conveyor should be kept moving until the silo is completely unloaded. One or more full PSWEX turns around the silo vertical axis.
1.17 In silos with internal equipment Figure *9* the PSWEX conveyor can be kept moving until its rotation is stopped by the braking wedge (Figure 1, Item 22) installed on the silo floor.
1.18 When the silo is completely emptied, stop the PSW conveyor.
1.19 Stop the underfloor conveyor and possible other equipment.
1.20 Manually remove the remaining grain from the silo floor.
1.21 Set the PSWEX conveyor in the initial position.

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 and possible other devices, if they were installed (normal operation, a direction of motor rotations, no mechanical damage, etc.). If any anomalies are found, perform necessary repairs or replace damaged subunits.
2. Perform inspections and maintenance of the electric motor in accordance with guidelines provided in the electric motor operating manual. The manual is included with the product or available on the manufacturer's website.

3. After each 20 hours of the conveyor operation, measure the thickness of the rubber coating on the conveyor running wheel Figure 17. The rubber coating must be replaced when the total coating thickness is below 12 mm (when measured from the external edge of the wheel disc).

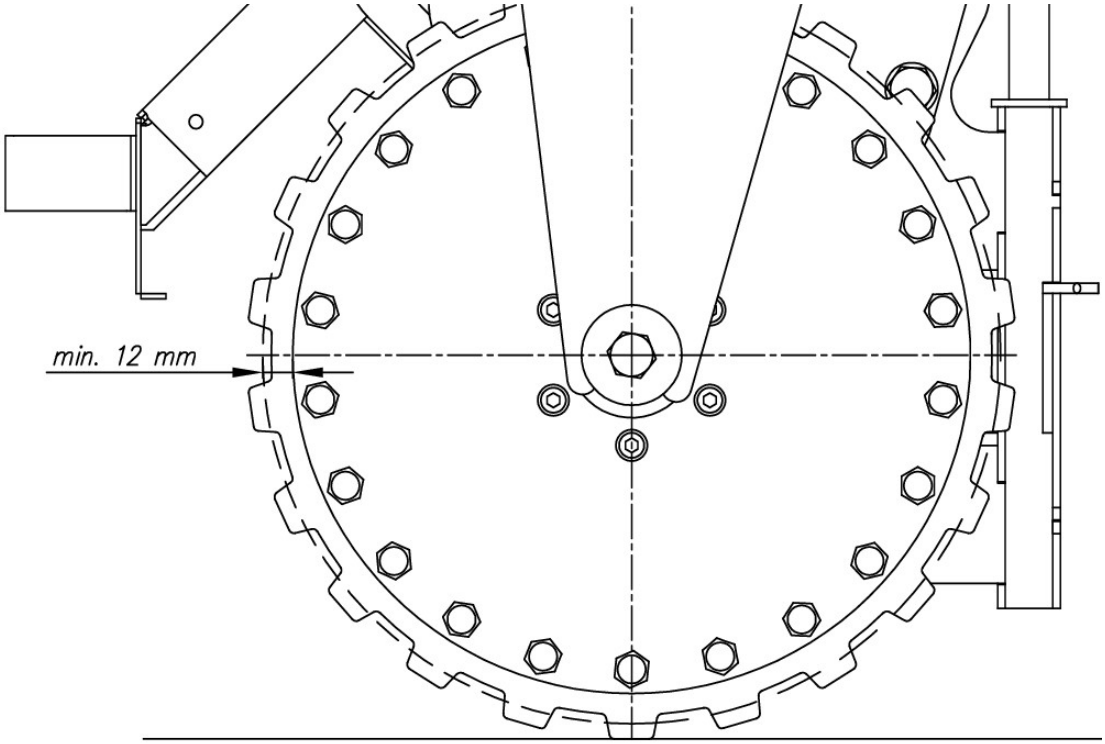


Figure 17. A method for measuring thickness of the rubber coating on the conveyor running wheel.

4. 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.

5. In the conveyor, the drive is provided by the electric motor installed under the floor, which drives the bevel gear (of the RC type, installed under the silo floor) and the worm gear (of the XC type); both gears are manufactured by TRAMEC S.R.L. (Figure 18).
   During operation:
   - each time before pouring grain into the silo, check the oil level in the worm gear (of the XC type), and replenish if necessary.
   - every 2500 of the conveyor operation replace oil in the bevel (RC) and worm (XC) gears.
   - monitor and remove immediately any damage to the gears.

   For replacement or refill, use oils adopted to the ambient temperature and recommended by the bevel gear manufacturer (TRAMEC S.R.L.) – see Table 5.

Table 5. Examples of oils recommended and used by the bevel gear manufacturer - TRAMEC S.R.L. (more information can be found on the gear manufacturer website).

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

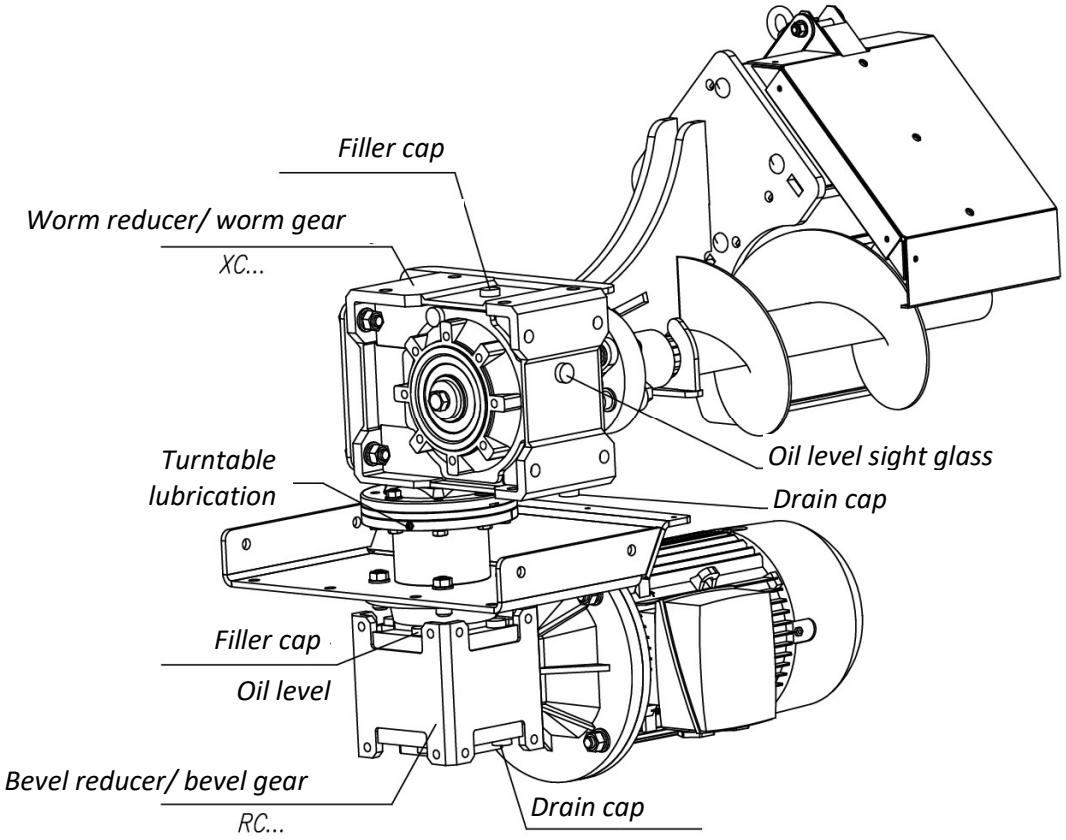


Figure 18. The conveyor bevel and worm gears (gearboxes) - points for inspecting, refilling and replacement of oil.

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

   If any anomalies are found, perform necessary repairs or replace damaged subunits.
7. Anti-corrosion coating of screws can be damaged during installation (tightening). In such case, anti-corrosion coatings on damaged surfaces must be repaired.
8. Each time before pouring grain into a silo or every 20 hours of the conveyor work at the most, refill solid grease in slide bearings of the screw (Figure 19).
   - PSWEX-9 and PSWEX-11 – one bearing each.
   - PSWEX-14 – two bearings.
9. Each time before pouring grain into a silo or every 20 hours of the conveyor work at the most, refill solid grease in:
   - conveyor turntable (Figure 18). Two greasing points.

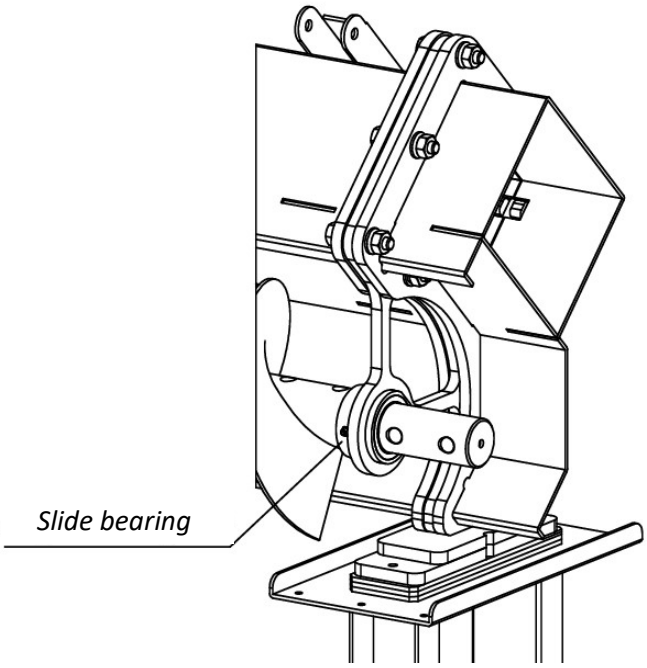


Figure 19. A slide bearing of the unloading screw - the greasing point.

To grease roller and slide bearings use only the listed solid greases - *Table* 6 or replacement greases not listed in this operating manual.

Table 6. *Solid greases recommended for roller and slide bearings.*

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

10. Every 60 hours of the conveyor operation, replace all roller bearings of the unloading screw together with sealing rings (Figure 19).
    The bearing manufactured by BIN, sealings of Simmering Ø42x52x4 type – 2 pieces per bearing.
11. Every 150 of the conveyor operation replace:
    - the end bearing of the screw and sealings (Figure 1, Item 18)
    The ball bearing 6007 2RS (35x62x14) – 1 piece, sealings of Simmering Ø35x58x8 type – 1 piece and Simmering Ø40x62x8 – 1 piece
12. Every 300 of the conveyor operation replace:
    - roller bearings and sealing of the wheel (Figure 1,Item 17).
    The ball bearing 6007 2RS (35x62x14) – 2 pieces, sealings of Simmering: Ø 35x62x7 – 2 pieces
13. If necessary, make new anti-corrosion conveyor coatings and other required repairs.

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

Anomalies (including problems and faults) during operation of the PSWEX type conveyor.

Conveyor malfunction	Possible conveyor malfunction cause	Way to remove the anomaly
The electric motor cannot 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 running wheel do not work.	- damaged bevel or worm gear (gearbox) of the drive - damaged flexible joint of the drive	Repair or replace the bevel or worm gear, or flexible joint.
When the conveyor is started, the electric motor and the unloading screw work, but the running wheel does not operate.	- a damaged chain drive transmission at the drive wheel (chain rollers broken from the wheel disc, etc.) - too large backlash on the transmission - worn subunits	Replace the damaged components. Adjust the transmission backlash.
Conveyor subunits (including parts of its body or of unloading screw, etc.) hit the floor or other parts of the silo.	- the silo incorrectly installed (uneven silo floor or shell) - collapsed floor	Correct the silo installation. Repair the floor
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) - temporary power outage (triggered undervoltage release)	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, lack of 1 phase, 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., damaged bevel or worm gear, mechanical stopping of the unloading screw, etc.). When the above causes of the motor stopping are removed, re-start the conveyor.
Uneven and unnatural sounds from the toothed gear during the conveyor operation.	- the gear damaged	Replace the gear (gearbox)
Uneven and unnatural sounds from the chain drive transmission of the wheel during the conveyor operation.	- a damaged chain drive transmission at the drive wheel (chain rollers broken from the wheel disc, etc.) - too large backlash on the transmission - worn subunits	Replace the damaged components. Adjust the transmission backlash.
The bevel gear housing heats to the temperature above 95°C.	- no oil in the gear or incorrect or used oil in the gear - the gear damaged	Inspect and, if necessary, correctly fill the drive with the relevant oil. Repair or replace the gear (gearbox).
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 - “start-up position”.	Repair or replace the damaged conveyor subunits. Do not start the conveyor when there is so much grain above it that the outlet and the worm gear are covered with grain. Before the silo is filled with grain, always put the conveyor into the start-up position (above supports).

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:

- Device name
- Proof of purchase number;
- Device model
- Year of production
- Serial number.

Before the order is placed, the type of ordered spare parts must be precisely specified. A need for BIN representative's visit to correctly identify a part cannot be excluded.

The manufacturer does not provide the conveyor with spare parts.

4.4. 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.

Disassembling and disposal should be ordered at a specialist company.

As of 01/10/2024, I approve for use the Operating Manual:
Title - "Internal screw conveyors PSWEX",
Revision - 2,
issued on - 01/10/2024

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 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 not specified above, especially costs being a consequence of the equipment stoppage.
4. The warranty becomes invalid 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 are performed by unauthorised persons.

Specific Guarantee Terms And Conditions.

1. In the case of products:
   - with electric 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

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

Manufacturer:

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

.....
Seller:

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