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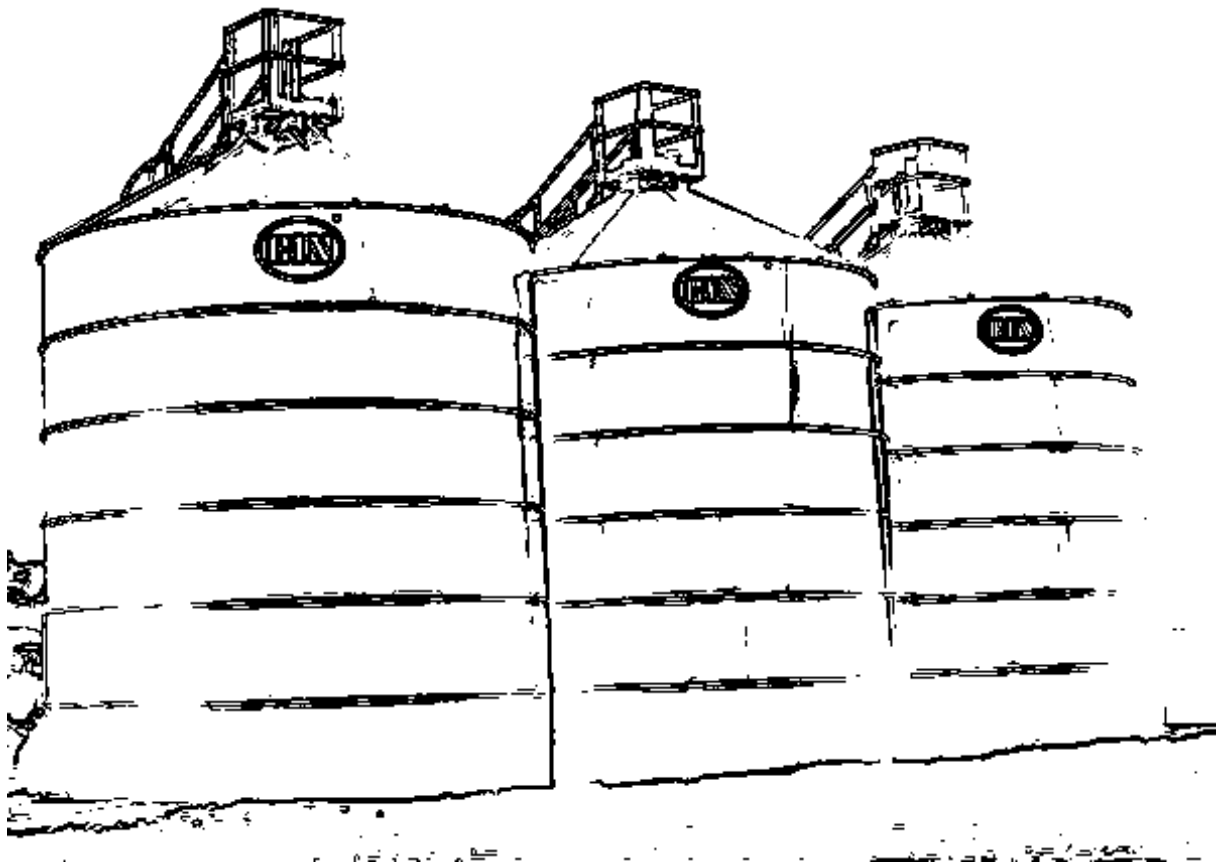
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FLAT BOTTOM BIN SILOS

FOR STORAGE OF CEREAL GRAIN, MAIZE AND OILSEEDS DRIED BY ACTIVE VENTILATION SYSTEMS

TYPE: BIN10, BIN20, BIN60, BIN100, BIN200, BIN500, BIN1000, BIN1500

OPERATING MANUAL (IO:SIL)



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



Aleksandrów Kujawski/A4 format



INTRODUCTION

Thank you for purchasing a silo from BIN. This equipment is provided with safety devices to protect operators and the silo during its normal use and operation. However, these devices cannot ensure safety in all circumstances, and, therefore, before operators start to use it, they must thoroughly read this Operating Manual and understand it. This way errors during the machine installation, and during operation itself can be avoided. Please, do not attempt to use the machine before you get acquainted with all sections of this manual, and not understand each of its functions and all procedures.

The aim of this operating manual is to acquaint the user with proper operation of the purchased product. It contains practical guidelines that must be known to a user during silo operation.

If any content of this OPERATING MANUAL is not understood by or 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 future use.



Before starting to operate the silo, read this operating manual, and, in particular, the chapter concerning safety at work.



Each use of the equipment 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



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 make additional openings and holes in the silo shell (walls) for unloading or installation of additional unloading equipment. It is forbidden to make non-central unloading openings in the silo floor. Making of such openings and holes in the silo shell or floor may result in deformation or even bursting of the silo shell during unloading.

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1. Safety

1.1 Basic safety rules

1. People operating, performing maintenance or overhauls of silos are obliged to adhere to general occupational safety regulations.
2. The user is obliged to read and understand operating manuals for silos and for all other auxiliary equipment, and to strictly adhere to them.
3. The silo can only be operated by able-bodied adults. These people must be fully aware of conducted operations.
4. In particular, the following is forbidden:
 - operation by any "third" persons, who are not familiar with the Operating Manual,
 - operation by people who are ill, or under influence of alcohol or narcotic drugs, and operation by minors.
5. The silo should be secured against access of children.
6. A silo owner is obliged to provide the silo with detailed occupational health and safety instructions.
7. It is recommended for people operating and using silos to be equipped with antistatic tools (spades, brooms, hammers, spanners, etc.), clothes and footwear.
8. Each time before entering a silo, an instruction from an employer or a person authorised by it must be given.
9. Always keep the silo and its surroundings tidy and clean.
10. It is forbidden to leave any tools, items, etc., on the silo or its structure due to a risk of an operator or any third persons being hit by objects falling from height.
11. It is strictly forbidden to climb onto a layer of grain in the silo, except when only a small amount of grain remained in the silo, and the inlet opening to the unloading device is not covered and clearly visible. Then it is necessary to enter to shovel grain into that opening or to start the shovelling device.
12. Repair works in the silo can only be performed when the silo has been emptied and grain remains removed, with feeding and unloading equipment locked and disconnected from power supply, and with a plate "Attention: do not start - repairs in progress" displayed.
13. A worker working in the silo should be assisted by another person and provided with relevant personal protection equipment.
14. A person entering the silo through a roof manhole should be assisted by two people and provided with equipment protecting against falling from heights, including an automatic fall arrest system.
15. It is strictly forbidden to disconnect a lifeline protecting against a fall from height while working in the silo.
16. While workers are present in the silo, the roof (top) manhole and, whenever possible, a bottom manhole should be kept open, with a shutter of the underfloor conveyor closed.
17. When there are hazards related to noise, causing problems in communication, then special equipment for smooth communication between workers is required.
18. It is forbidden for people to stay near the silo while any works at height are in progress, and the area around the silo should be secured against any access of third parties.
19. Ban on use of naked flame, smoking, and conducting welding works or similar in the silo and within 10m radius of the silo or the unloading outlet should be strictly adhered to.
20. Before entering the silo, disconnect power supply to all electrical accessories of the silo and secure them against an accidental starting by any third persons.
21. It is strictly forbidden for people to be present in the silo during its loading or unloading, or when grain is ventilated.
22. Before loading or unloading equipment, or a grain ventilation fan is started, make sure there are no people in the silo.
23. When BIN loading or unloading equipment is installed in the silo, provided with limit switches on an external ladder and near the bottom manhole, then it is forbidden to:
 - remove the limit switches;
 - block the switches;
 - attempt to bypass them.
24. When loading or unloading equipment from other manufacturers is installed in the silo, then the silo owner is obliged to construct the electrical wiring of these devices in such way that any attempt to access the silo through the bottom manhole or the ladder automatically stops their work immediately.
25. When loading or unloading equipment from other manufacturers is installed in the silo, then the silo owner is obliged to provide these devices with a main switch with a padlock, so before the silo is entered, power supply to these devices can be effectively disconnected.
26. Manual shovelling of grain into the silo unloading sleeve or to the discharge opening in the floor requires all silo auxiliary equipment to be stopped first.
27. It is strictly forbidden to put hands into inlets of conveyors installed in the silo.
28. It is strictly forbidden to enter the space under the silo floor.
29. Temperature measurements with a manual probe should be made while standing on the internal ladder.

30. All guards and security devices representing the factory equipment of the silo must be installed.
31. When all works in the silo are completed, close and padlock the guard of the external ladder. Before attaching the padlock, make sure there are no people in the silo.
32. Lock the bottom manhole of the silo.
33. The keys for access to the silo (the key to the ladder with the guard and the key to the bottom manhole) must be kept by an authorised person.
34. When any operations are conducted in the silo, use safe voltage portable lighting. During work, components of the portable lighting cannot heat up to a temperature that may cause grain dust fire or explosion.
35. Grain that is contaminated or of excessive moisture content should not be stored in the silo (Table 7).
36. The user is responsible for construction and operational condition of the lightning system and the protective grounding of the silo.
37. The user is responsible for correct connection of power delivery points and their correct operation.
38. In the event of any power outage, switch off all silo auxiliary equipment.
39. The silo and its surroundings must be used and maintained in a way preventing fire, and it should be provided with manual fire extinguishing equipment, including a dry powder or carbon-dioxide extinguisher.
40. In the event of the fire:
 - - evacuate people from the danger zone;
 - - call the fire brigade;
 - - disconnect the equipment from the power supply;
 - start extinguishing fire.
41. Extinguishing electrical systems fires with a water or a foam extinguisher is forbidden.
42. When any situation hazardous to human life or health is discovered, the equipment must be stopped immediately and switch power supply to the equipment with the main switch.
43. When any defects or damages to the silo are found, which may affect human safety or safety of materials stored in the silo, the investor is obliged to immediately notify them in writing to the silo manufacturer.
44. The repair and maintenance operations can only be conducted by able-bodied adults holding relevant qualifications.
45. Do not attempt any works in adverse weather conditions (rain, heavy frost, ice, strong wind, lightnings, poor visibility).
46. Fumigation, pest control, and similar operations in the silo or on the stored grain should be ordered at specialist companies. After these activities, relevant OHS regulations concerning use of chemicals in confined spaces should be strictly adhered to.
47. People working in the silo, manually shovelling the grain or cleaning the silo, must be equipped with protective goggles and respiratory protection.
48. Adhere to principles of complete control over auxiliary equipment connected to the mains.
49. In the event of the unloading equipment failure, when it cannot be repaired due to large quantities of grain stored in the silo, unload the grain through a sack-filling device or through an emergency duct in the silo, at the speed not exceeding 20 tonnes per hour. Higher rates may cause permanent deformation of the silo.
50. 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.
51. Any design changes in the finished product require the new technical acceptance by the manufacturer or its authorised representative.
52. The owner/user is strictly forbidden to make itself additional openings and holes in the silo shell (walls) for unloading or installation of additional unloading equipment. It is forbidden to make non-central unloading openings in the silo floor. Making of such openings and holes in the silo shell or floor may result in deformation or even bursting of the silo shell during unloading.
53. All equipment and systems connected to the silo (e.g., feeding pipes of bucket or vertical conveyors) must be constructed in such way that they do not damage the silo equipment.
54. Silo loading and unloading should be carried out so as not to exceed the output of 60 tons per hour for silos of the type ranging from BIN10 to BIN200, and of 150 tons per hour for silos of the BIN500 type and larger. A higher output may result in the permanent deformation of the silo and, in consequence, its damage.
55. Do not start the fan in the silo without grain.
56. When the silo is equipped in any BIN equipment or sets of devices (loading, unloading, active ventilation, and similar equipment), then necessary information on their operation, including control, switching on/off, lubrication, operation of electrical equipment, and other, can be found in relevant operating manuals for that equipment. The manufacturer accepts an option for equipping the silo with equipment or sets of devices from other manufacturers provided they are "CE" marked and have the "EC declaration of

conformity". This forms a basis for use of relevant operating manuals of this equipment as a part of their correct operation.

57. Each silo with a roof manhole must be provided with an external access to it.

The external access to the roof manhole is understood as a possibility to enter through an external ladder or an external spiral staircase, and/or indirectly through roof stairs from a service catwalk.

58. Each silo loaded through an inlet in a roof collar must be provided with an external access to it. The access to the collar is understood as a possibility to access it using appropriate lifting equipment, through roof stairs with a collar platform, and/or through a service catwalk.



59. When the silo owner does not purchase and install (manufactured by BIN) equipment ensuring access to the roof manhole and the collar with the loading inlet, it is obliged to construct itself (in accordance with relevant current legislation) equipment for using and operating the above units. When these conditions are not met, then the CE declaration of conformity attached by BIN to this Operating Manual becomes invalid.

60. The silos are marked with safety marks. Each user is obliged to become acquainted with their meaning.

61. In no device included in this Operating Manual the equivalent acoustic pressure level exceeds 70dB(A), measured in accordance with PN-EN ISO 11201:1999 and PN-N-01307:1994.

1.2 Information and warning signs

Warning signs





DO NOT ENTER THE SILO DURING LOADING AND UNLOADING BECAUSE OF DANGER OF BEING BURIED IN MATERIAL!

Ⓢ Do not enter the silo during loading and unloading because of danger of being buried! Ⓢ Grūdų pakrovimo arba iškrovimo metu draudžiama eiti į bokšto vidų! Ⓢ Neienākt graudu uzglabāšanas tīrni iekrāvāšanas laikā bistamības būt apglabātam zem graudiem dēļ!

Ⓢ Не входить в зернохранилище во время загрузки и выгрузки из-за опасности быть засыпанным зерном! Ⓢ Забороняцца перебувати в середині зернохосовища під час завантаження та розвантаження, так як існує небезпека бути повністю засипаним зерном! Ⓢ Nevstūpiete do sila během naskladování a vyskladování, hrozí nebezpečí smrti zasypáním! Ⓢ Bei Verladung oder Entladung darf man in den Silo eintreten, Gefahr des Zuschüttens! Ⓢ Gå ikke ind i siloen under dens påfyldning og tørrning – risiko for kvælning med kornmasse! Ⓢ Verboden de silo te betreden tijdens vullen en legen. Begravningsgevaar! Ⓢ Arge sisenege punkrisse sisseaadimise või väljaladimise ajal. Oht mattuda teravilja all! Ⓢ Gå ej i silos vid fyllning och tömning risk för att begravas! Ⓢ Ποčas naskladnenie a vyskladnenie nevstupuje do sila kvoli nebezpečnosti smrti zasypáním! Ⓢ Μη εισέρχεστε στο σιλό κατά την διάρκεια της φόρτωσης ή της εκφόρτωσης καθώς υπάρχει ο κίνδυνος να καταπνικθείτε!

DO NOT STEP ONTO THE GRAIN LAYER BECAUSE OF DANGER OF BEING BURIED IN MATERIAL!

Ⓢ Do not enter the grain layer because of danger of being buried! Ⓢ Draudžiama vaikšioti ant grūdų sluoksnio bokšto viduje! Ⓢ Neienākt graudu slāni bistamības būt apglabātam zem graudiem dēļ! Ⓢ Не заходить на слой зерна в зернохранилище из-за опасности оказаться в глубине зерна. Грoсит засыпанием! Ⓢ Забороняцца заходзіць на паверхню зберігання зерна, так як існуе небезпека проваліцца а шар зерна! Ⓢ Nevstūpiete na vrstvu zrna v silo, hrozí nebezpečí smrti zasypáním! Ⓢ Es darf man nicht auf die Kornschichte eintreten, Gefahr des Zuschüttens! Ⓢ Den må ikke trædes op på kornmasse i siloen - risiko for kvælning! Ⓢ Verboden in de silo te komen als deze gevuld is. Begravningsgevaar! Ⓢ Arge sisenege punkrisse teraviljakihni peale. Oht mattuda teravilja sisse! Ⓢ Gå ej i spanmålens risk för att begravas! Ⓢ Nevstūpiete na hladnu zrna v silo kvoli nebezpečnosti smrti zasypáním! Ⓢ Μη εισέρχεστε σε γεμάτο σιλό καθώς υπάρχει κίνδυνος να θωπείρε!

DO ENTER AND DO NOT REACH INTO THE CRUSH ZONE WHEN PART SCAN ROTATE

Other warning signs



READ OPERATING MANUAL



ATTENTION! DANGER



RISK OF FALL FROM HEIGHT



NO ENTRY – NO TRAMPLING OVER



NO ENTRY FOR UNAUTHORISED PERSONS



USE PROTECTIVE GLOVES



USE PROTECTIVE FOOTWEAR



NO USE OF NAKED FLAME OR SMOKING



USE LIFELINE WHEN ENTERING THE SILO



USE RESPIRATORY PROTECTION WHEN ENTERING THE SILO

All warning and safety signs are installed on the silo shell, at the height of ca. 1.6m, near the silo ladder or bottom manhole.

Additional warning signs: "do not enter or reach into the crushing zone when the parts can move", "use of a lifeline is obligatory when entering the silo", "no entry - no trampling over" and "no entry to unauthorised persons" signs are installed on the cover of the silo top manhole.

The nominal plate is installed on the silo shell, at the height of ca. 1.6 m from the foundation surface.

Model: NBIN XXX
Year of production: 20XX
Serial number: XXXX-XXX
Weight: XXXX kg
Usable properties declaration No.: SZJ/029/XXXXX
Harmonised standard: PN-EN 1090-1
ZKP certificate No.: XXXX-CRP-XXXX
ZKP certifying body No.: XXXX
Further information: Operating Manual and declaration
Year of the first-time product labelling: XX
Construction class: XXXX

	BIN Sp. z o.o. 87-700 Aleksandrów Kujawski ul. Narutowicza 12 POLSKA www.bin.agro.pl
Model: NBIN XXXX	
Rok produkcji: 20XX	
Nr seryjny: XXXX - XXX	
Masa: XXXX kg	
Nr deklaracji właściwości użytkowych: SZJ/029/XXXXX	
Norma zharmonizowana: PN-EN 1090-1	
Nr certyfikatu ZKP: XXXX-CRP-XXXX	
Nr jednostki certyfikującej ZKP: XXXX	
Dalsze informacje: instrukcja obsługi i deklaracja	
Rok oznakowania wyrobu po raz pierwszy: XX	
Klasa wykonania: XXXX	
	



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

2. General product description

2.1. Product intended use

- storage of corn and maize grain, and oilseeds;
- cooling of grain or seed mass;
- additional drying by active ventilation.

Stored grain and seeds must have appropriate moisture content (Table 7) and free of contamination. Material of such optimum parameters can be stored in high layers for a long time without deterioration in its quality. When grain deviates from the parameters provided above, it should be dried by active ventilation. This drying method can be used in NBIN10 to NBIN100W silos. For larger silos, it is recommended to store material only of optimal parameters. The silos are not designed for preservation of grain and seeds that are strongly contaminated, or of moisture content that cannot be reduced by active ventilation. It is forbidden to store in the silo materials other than listed, and in particular, materials of density exceeding 800 kg/m³. When the silo is used contrary to its intended use, the manufacturer shall not be held responsible for any resultant damage.

Note!!! A special sealing kit should be used for storage of small seeds, smaller than cereal grain (e.g., for rapeseed). **Information that silo will be used for storage of small grain or seeds should be provided when ordering the silo.**

2.2. Basic silo technical data

Table 1. Technical specification of BIN silos

Silo type	Silo model	Usable volume ¹⁾ m ³	Loading capacity for wheat ²⁾ t	Diameter m	Total height m	Wall height m	Number of anchors, pieces	Weight kg ⁵⁾	
								Silo components	Concrete blocks
BIN 10	NBIN10	15.6	10.5	2.29	5.10	3.85	4	581	260
	NBIN10W	19.5	13.5		6.05	4.80		739	
BIN 20	NBIN20N	26.3	19.7	3.18	4.60	3.35	4(+4) ³⁾	837	698
	NBIN20	29.9	22.4		5.10	3.85		879	
	NBIN20R				912				
	NBIN20W	37.4	28.1		6.05	4.80		1006	
	NBIN20WR				1039				
	NBIN20WW	45	33.8		7.00	5.75		1191	
BIN 60	NBIN60	76.9	57.7	4.46	6.12	4.80	8(+8) ³⁾	1503	1339
	NBIN60R							1546	
	NBIN60W	91.7	68.8		7.07	5.75		1734	
	NBIN60WR				1776				
	NBIN60WW	121.3	91.0		8.97	7.65		2185	
BIN 100	NBIN100U	133	99.8	5.35	8.18	5.75	12	2472	1860
	NBIN101U							2607	
	NBIN100RU							2498	
	NBIN100WU	176	132		10.08	7.65	18(+6) ⁴⁾	2966	
	NBIN101WU							3134	
	NBIN100WRU							2991	
BIN 200	NBIN200NU	247	185	6.69	9.65	6.70	7	4023	3720
	NBIN200U	281	211		10.60	7.65		4339	
	NBIN200WU	348	261		12.50	9.55		4978	
BIN 500	NBIN500	695	521	8.59	15.33	11.45	18	9363	7440
	NBIN501							10338	
	NBIN501W	805	604		17.23	13.35		11775	
BIN 1000	NBIN1001	1264	948	11.46	16.18	11.45	24	14990	14880
	NBIN1001W	1460	1095		18.08	13.35		16805	
	NBIN1500_N	1560	1170		14.32	14.15		8.60	
NBIN1500_P	1713	1285	15.10	9.55		18950			
NBIN1500	2019	1514	17.00	11.45		20931			
NBIN1500_W	2325	1744	18.90	13.35		23494			

1) – total volume of the silo inner space (above the floor);

– an actual volume of grain stored in the silo depends on the following factors: loading method, equipment installed in the silo, grain pour parameters, etc.

2) – in relation to the usable capacity, for wheat of bulk density of 750 kg/m³

3) – additional anchors required when the silo is installed in the 2nd wind zone, and 1 and 3 wind load zones for the height of 300 ≤ A ≤ 600m amsl according to PN-EN1991-1-4:2005 (not included in the standard silo equipment - include in the silo order)

4) – additional anchors required for assembling of the silo with the POM100 service catwalk (standard catwalk equipment)

5) – net weight of the silo elements (without packaging, etc.), silo weight and blocks weight rounded to the nearest 1 kg.

2.3 Recommended methods for silo loading and unloading

Table 2. Recommended methods for BIN silo loading and unloading

Silo	Loading/ Unloading	Recommended equipment system
NBIN10 NBIN10W	Loading	grain blower PPZ-7.5-WNT
		inclined screw conveyor
		vertical screw conveyor PS220-PN
	Unloading	underfloor PS screw conveyor
sack-filling device		
NBIN20N NBIN20 NBIN20R NBIN20W NBIN20WR NBIN20WW	Loading	grain blower PPZ-7.5-WNT
		vertical screw conveyor PS220-PN
	Unloading	sack-filling device
		underfloor PS screw conveyor
		universal screw conveyor, through an unloading sleeve
NBIN60 NBIN60R NBIN60W NBIN60WR	Loading	grain blower PPZ-7.5-WNT
		vertical screw conveyor PS220-PN
	Unloading	sack-filling device
		universal screw conveyor, through an unloading sleeve
NBIN60WW	Loading	grain blower PPZ-7.5-WNT
		bucket elevator (scoop conveyor)
		vertical screw conveyor PS220-PN
	Unloading	sack-filling device
BIN PS/PSW conveyor system		
NBIN100 NBIN101U NBIN100RU NBIN100WU NBIN101WU NBIN100WRU	Loading	grain blower PPZ-7.5-WNT
		bucket elevator (scoop conveyor)
		vertical screw conveyor PS220-PN
	Unloading	sack-filling device
		universal screw conveyor, through an unloading sleeve
		BIN PS/PSW conveyors system
NBIN200NU NBIN200U	Loading	bucket elevator (scoop conveyor)
		grain blower PPZ-7.5-WNT
	Unloading	vertical screw conveyor PS220-PN
NBIN200WU NBIN500 NBIN501 NBIN501W NBIN1001 NBIN1001W BIN1500_N NBIN1500_P NBIN1500 NBIN1500_W	Loading	vertical screw conveyor PS220-PN
		BIN PS/PSW conveyors system
	Unloading	bucket elevator (scoop conveyor)
		BIN PS/PSW conveyors system

2.4 Design description

Fig. 1 shows a silo in form of a cylindrical tank with a flat perforated bottom, a shell made of flat galvanised metal, and a self-supported roof with a manhole. Multi-row screw joints of the shell are sealed with self-adhesive seals of polyurethane foam. Rings strengthening the shell structure are installed in all silos, except for BIN10 and BIN20. The perforated floor is assembled of trays supported on concrete supports installed on the foundation slab.

During installation, the whole structure is bound with the foundation slab with anchors and steel rawlplugs. A brief characteristic of the most important units and devices installed in BIN silos is presented below. Views and basic silo dimensions are presented in Figures from 11 to 21.

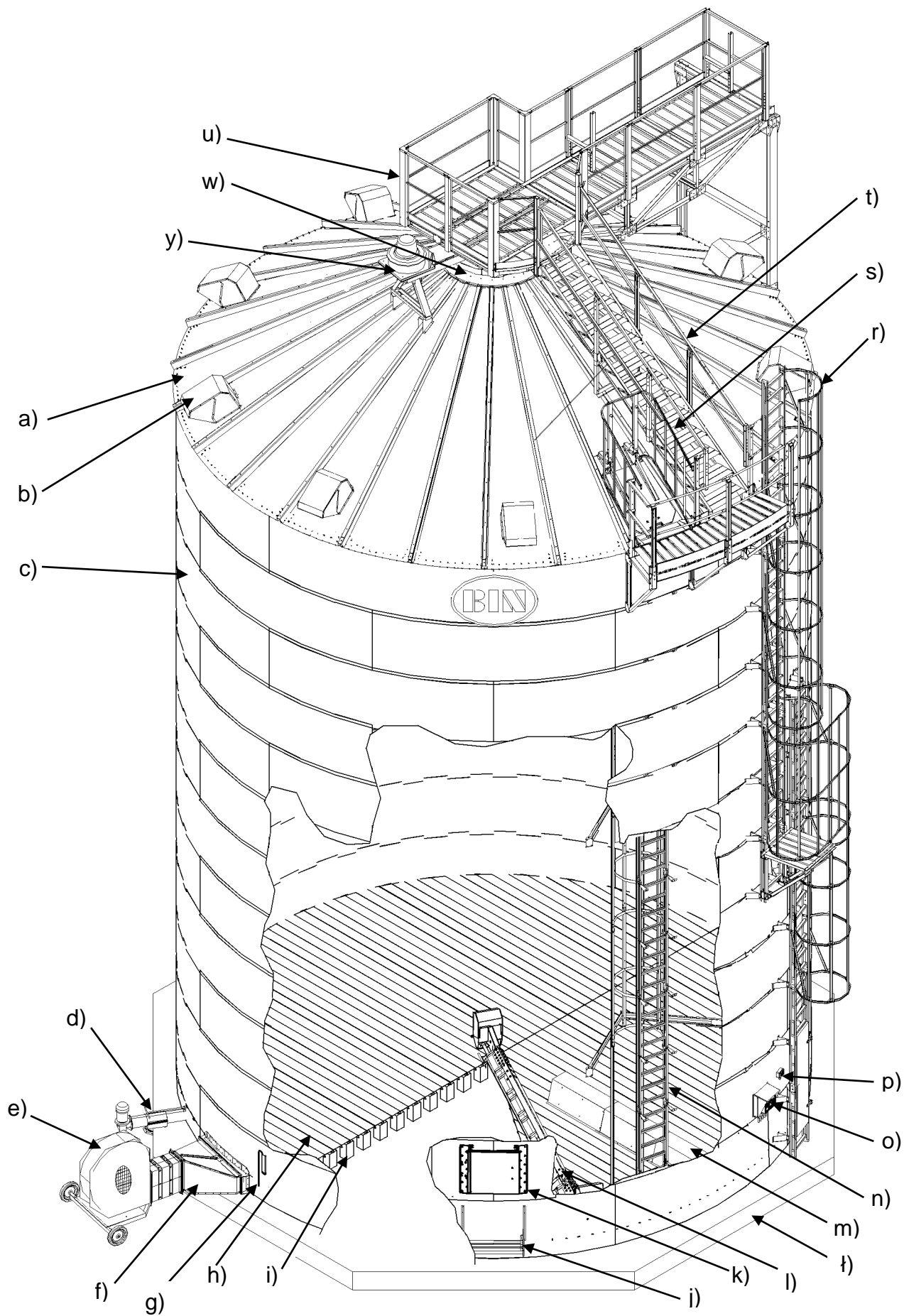


Figure 1. BIN silo design - diagram

a) SILO ROOF

Roofs in all BIN silos are conical, of hot-dip galvanised steel. Individual roof components (sections) are joined with steel screws with anti-corrosion coating. At the joints, roof sections are appropriately shaped, additionally strengthening the structure and ensuring its tightness. A special internal strengthening system has been implemented in silos of larger diameter, BIN500, BIN1000, BIN1500. All prefabricated roof components (vent openings, roof manhole, and similar) are provided with special external embossing preventing precipitation (rain, snow, etc.) penetration into the silo.

b) VENT

A roof vent is a device installed on the silo roof. It is made of hot-dip galvanised steel and ensures appropriate ventilation of grain. The vent design prevents penetration into the silo of precipitation or strong wind. Additional sealing is installed at a connection between the vent and the roof. Vents are installed in BIN60, BIN100, BIN200, BIN500, BIN1000, BIN1500.

c) SILO SHELL

The silo shell means its side cylindrical side walls, of hot-dip galvanised steel. The shell consists of components (sheets) joined with steel screws with anti-corrosion coating or of stainless steel. The shell sheets are joined with an overlap, and additional seals are installed on joints, to ensure the highest possible tightness of the structure. A special internal strengthening system of components called stringers has been implemented in silos of larger diameter, like silos of the BIN500, BIN1000, or BIN1500 type. Special strengthening rings of triangular cross-section are installed outside, maintaining the cylindrical shape of the shell (except for BIN10 and BIN20 silos). In its upper part, the shell is connected to the silo roof with a roof connector. In its bottom part, it is supported on the foundation slab, to which it is connected with special connectors and expansion anchors or chemical anchors. On the foundation slab side, the silo shell must be sealed, usually with concrete overlay additionally secured with bitumen mass along the complete circumference of the silo shell base. More information is provided in section 3.4.4 of this Operating Manual.

d) SILO UNLOADING

BIN silos are provided with components and equipment for their unloading. Furthermore, installation of various unloading machines, such as screw, scrapping, or belt conveyors, and similar.

UNLOADING SLEEVE

A rectangular duct installed in the silo. It's one end rests on the silo floor, while the other is connected to the silo shell. With the unloading sleeve, a conveyor, usually a screw conveyor, can be introduced into the silo to unload the silo through the sleeve outlet. The unloading sleeve is made of hot-dip galvanised steel, and it can only be installed in smaller silos, such as BIN20, BIN60 and BIN100.

UNLOADING SACK-FILLING DEVICE AND AN ANTI-DYNAMIC PIPE OF A SACK-FILLING DEVICE

The sack-filling device is a discharge trough installed in the lower part of the silo shell. It is equipped with a shutter for adjustment of an outlet gap, which can be padlocked. With the sack-filling device the silo can be unloaded through an opening in its shell. It can be installed in BIN10, BIN20, BIN60 and BIN100 silos. In NBIN60W, NBIN60WW and BIN100 silos an anti-dynamic pipe must be installed together with the sack-filling device. The anti-dynamic pipe is a device installed in the silo. It prevents too fast outpour of the stored material (grain) from the silo, because otherwise the silo could be damaged. Both the sack-filling device and the anti-dynamic pipe are made of hot-dip galvanised steel.

UNLOADING CONVEYORS

Various underfloor unloading conveyors can be installed in the silos. BIN manufactures two types of universal screw conveyors that can be used for underfloor unloading of the silos. The screw conveyors of the nominal diameter of 160mm and the screw conveyors of the nominal diameter of 220mm. They are provided with a special central inlet with a control shutter for connection to the silo floor. The conveyors transport the unloaded material (grain) outside the silo, and they can also be connected with other transport equipment, including bucket, scrapping, or belt conveyors, using special connectors. Detailed information on BIN conveyors and possibilities to use them in silos is provided in the operating manual "SCREW CONVEYORS".

e) ACTIVE VENTILATION EQUIPMENT - FANS/HEATERS

The air passes through perforated floor and then through the material (grain) in the silo, and this way the material is ventilated. Issues related to correct ventilation and storage of material in the silo are described in further chapters of this Operating Manual. BIN provides for use of various types of fans, depending on the silo type and technical parameters of the fan. Below the examples for using commercially available fans with specific BIN silos are provided.

- BIN500, BIN1000 and BIN1500 – WPS-40-type fan with an 18.5kW motor,
- BIN500 - WPR11-type fan with 11kW motor,
- BIN1000 and BIN1500 –WPR15-type fan with a 15kW motor,
- BIN10 to BIN200 – PPZ-7.5-WNT -type fan with a 7.5kW motor.

Information on selection of appropriate fan for a specific silo are provided in further chapters of this instruction. Information concerning the PPZ-7.5-WNT fan can be found in the operating manual "FAN/BLOWER FOR GRAIN".

When the material for storage has too high moisture content, temperature, or other parameters, then it must be dried additionally by active ventilation. This drying method can be used in NBIN10 to NBIN100W silos. For larger silos, it is recommended to store material only of optimal parameters.

To increase intensity of the active ventilation process, an electrical heater is used, heating air supplied by the fan. The heater is a flow-through electrical device installed between the fan and the air inlet into the silo.

The following heaters are manufactured:

- NG-310-4.5 heater, of 310mm in diameter and 4.5kW power,
- NG-310-9.0 heater, of 310mm in diameter and 9kW power.

Detailed information on BIN heaters and possibilities to use them in silos is provided in the operating manual "ELECTRICAL AIR HEATER".

f) AIR INLET

The air inlet can be used for connecting an appropriate fan (see e) to the silo. BIN manufactures and equips its silos with the following air inlets:

- air inlet of 180mm in diameter for BIN10 and BIN 20 silos (with a plastic confuser for the PZZ fan, the PPZ-7.5-WNT-type fan can be connected);
- air inlet of 310mm in diameter for BIN60, BIN 100 and BIN 200 silos (with a plastic confuser for the PZZ fan, the PPZ-7.5-WNT-type fan can be connected);
- air inlet of 400mm in diameter for BIN500, BIN 1000 and BIN 1500 silos (with a plastic confuser for the WPS fan, the WPS-40-type fan can be connected);
- universal air inlet for BIN200, BIN500, BIN1000 and BIN1500 silos (with a suitable confuser a WPR11, WPR15 or WPS-40 fan can be connected).

All air inlets are made of hot-dip galvanised steel.

Furthermore, one fan can be installed for two adjoining silos, when a special air splitter is used. BIN manufactures the following types of air splitters:

- a splitter for a universal air inlet, for the WPR or WPS fan.

g) MANOMETER

The water manometer is a simple device for determining pressure of air flowing through a layer of material (grain) stored in the silo. Its use is described in further chapters of this Operating Manual, using a special diagram. The manometer is always installed near the air inlet.

h) SILO FLOOR

The floor is a structural component of the silo, on which the material (grain) is stored). In all BIN silos, the floor is installed at a certain height above the foundations, to facilitate active ventilation. It is made of hot-dip galvanised steel and its whole surface is perforated (with openings for air flow). BIN manufactures a special system for additional sealing of the floor for oilseeds (rapeseed) and other fine materials, to ensure the best ventilation results and safe storage.

i) PERFORATED FLOOR SUPPORTS

Installation of silos from the BIN10 to BIN1500 range requires concrete floor supports (concrete blocks) in quantities specified below (Table 3). They have a form of:

- cuboids of 14cm x 12cm x 25cm.

Supports must be made of at least C16/20 concrete.

Concrete floor supports should be purchased from BIN.



It is forbidden to use other than concrete supports, including lime and sand ones. It is forbidden to use supports of other dimensions.

Table 3. Concrete blocks - technological quantity (quantity of blocks in the construction design, required for the silo assembling) The commercial quantity includes additional reserve.

<i>Silo type</i>	<i>Silo model</i>	<i>Technological quantity of concrete blocks [pcs.]</i>	<i>Commercial quantity of concrete blocks [pcs.]</i>
BIN 10	NBIN10, NBIN10W	26	28
BIN 20	NBIN20N, NBIN20, NBIN20R, NBIN20W, NBIN20WR, NBIN20WW	71	75
BIN 60	NBIN60, NBIN60R, NBIN60W, NBIN60WR, NBIN60WW	134	144
BIN 100	NBIN100U, NBIN100RU, NBIN100WU, NBIN100WRU, NBIN101U, NBIN101WU	176	200
BIN 200	NBIN200U, NBIN200WU	378	400
BIN 500	NBIN500, NBIN501, NBIN500W, NBIN501W	752	800
BIN 1000	NBIN1001, NBIN1001W	1536	1600
BIN 1500	NBIN1500_N, NBIN1500_P	1617	1800
	NBIN1500, NBIN1500_W	2144	2200

j) BOTTOM PLATFORM

The bottom platform is a component facilitating access to the silo through the bottom manhole. It is made of hot-dip galvanised steel, with an anti-slip surface to ensure safety of its use. It is screwed to the silo shell with M8 screws, below the bottom manhole and is a standard equipment for all silos with the bottom manhole.

k) BOTTOM MANHOLE

The double-door bottom manhole provides access into the silo and equipment installed inside. The inner door with a lock opens into the silo. The outer door acts as a cover and opens to the outside. The manhole is made of hot-dip galvanised steel and installed at ca. 95 cm above the foundations surface. In the body, a special connection is made for installation of the limit switch stopping the equipment in the event the manhole is opened accidentally. BIN Sp. z o.o. designed installation of the bottom manhole in silos from the BIN20 to BIN1500 range (Table 4). List of equipment for silos from the BIN10 to BIN1500 range.

l) INTERNAL SCREW CONVEYOR

The internal screw conveyor - PSW, is a device installed in the silo and supports unloading. It allows unloading of that part of grain (Table 8) that did not get gravitationally into the unloading underfloor conveyor. Cooperating underfloor and internal conveyors allow to unload the silo practically completely. 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 nearly full circle is made.

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

The following PSW conveyors are manufactured:

- PSW60 for BIN60 silos;
- PSW220-BIN100 for BIN100 silos;
- PSW220-BIN200 for BIN200 silos;
- PSW500 for BIN500 silos;
- PSW1000 for BIN1000 silos;
- PSW1500 for BIN1500 silos;

Detailed information on BIN conveyors and possibilities to use them in silos is provided in the operating manual "SCREW CONVEYORS".

f) FOUNDATION SLAB

A correctly designed and constructed foundation slabs is one of preconditions for correct installation, and safe and failure-free operation of a silo.

- guidelines for designing foundation slabs

- geotechnical conditions - when designing foundation slabs for BIN silos, local geotechnical conditions should be considered;

- minimum thickness and shape of the slab:

for BIN10 silos – a 200mm-thick, rectangular slab;

for the BIN20–BIN1000 silo range – a 300mm (350mm for BIN200) thick, octagonal slab;

for BIN1500 silos – a 300mm-thick, circular or octagonal slab;

- foundation load (grain in the silo plus the silo with the standard equipment):

for the BIN10–BIN100 silo range – up to 65 kPa;

for the BIN200–BIN1500 silo range – up to 135 kPa;

- minimum concrete class:

for the BIN10–BIN100 silo range – C16/20 (B20);

for the BIN200– BIN1500 silo range – C20/25 (B25);

- reinforcement:

Reinforcement is a necessary component of the foundation slab and must be constructed in accordance with the guidelines provided in the construction design for a relevant silo.

The investor is responsible for development of the construction design. The construction design, considering the geotechnical conditions and geometrical guidelines from the BIN company (according to Figures 2, 3 and 4), must be developed by a designer holding relevant licences.

- Conditions for foundation slab construction and acceptance

- a topsoil layer and non-load bearing layers under the foundation slab must be removed;
- backfill the dug pit with sand laid in layers of ca. 30cm and compacted to $I_d=0.6 - 0.7$;
- construct sand and cement bedding, class 7.5–10 MPa (substrate of B7.5–B10 lean concrete), 150 mm thick;
- draining holes must be drilled in the foundation slab, to drain water that may accumulated under the silo floor;
- for silos installed in a row or in a cluster, foundations of individual silos must be separated with expansion joints;
- when pouring concrete for foundation slabs, it is important to maintain the slab dimensions and to correctly (horizontally) trowel the upper slab surface (a difference between the lowest and the highest point on the foundation slab cannot exceed 10mm), it is obligatory to vibrate the concrete;
- acceptance of the foundation slabs in a presence of the installing team manager and an investor representative is a prerequisite for starting silo installation;
- when the foundation slab is not constructed correctly, installation of the silo may be cancelled;
- foundation slabs must be constructed in such way that a difference between the slab surface and the surrounding ground does not exceed 10cm. When the difference between the slab surface and the surrounding ground exceeds 10 cm, the investor is obliged to ensure an appropriate access level for the side manhole, an external ladder, or stairs and other equipment installed on the silo. An appropriate access level must be constructed in accordance with current legislation.
- when a difference between the slab surface and the surface of the ground surrounding the slab exceeds 40cm, the investor must ensure a temporary installation platform on the whole slab circumference;
- the platform must be constructed in accordance with current legislation and be at least 60 cm wide;
- when this platform is not provided, installation of the silo is not possible for safety reasons and technical conditions;
- BIN Sp. z o.o. shall not be held responsible for any silo damage and other damage resulting from incorrect design and construction of the foundation slab.

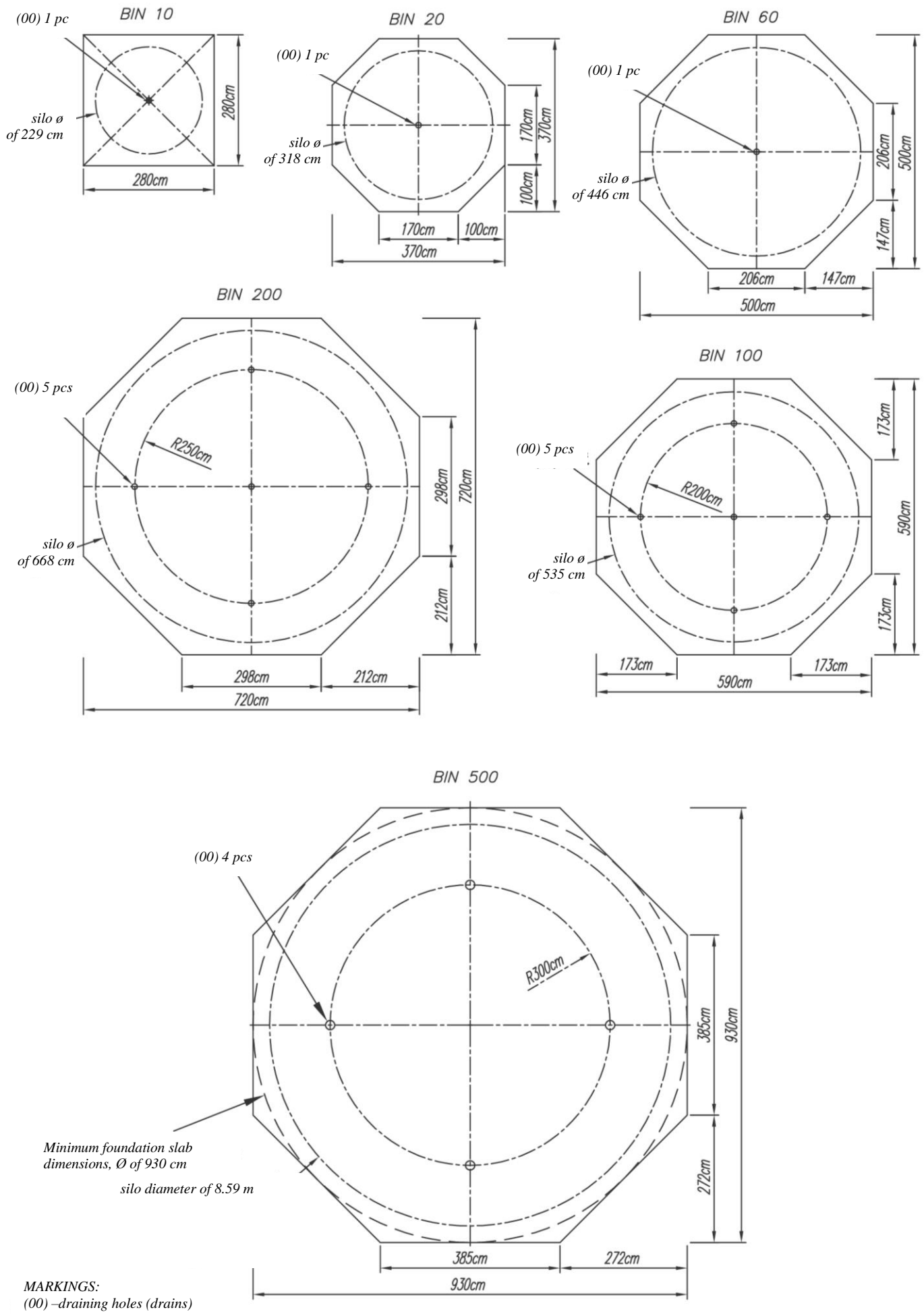


Figure 2. Foundation slab characteristics for the BIN10 to BIN500 silo range.

MARKINGS:
(00) –draining holes (drains)

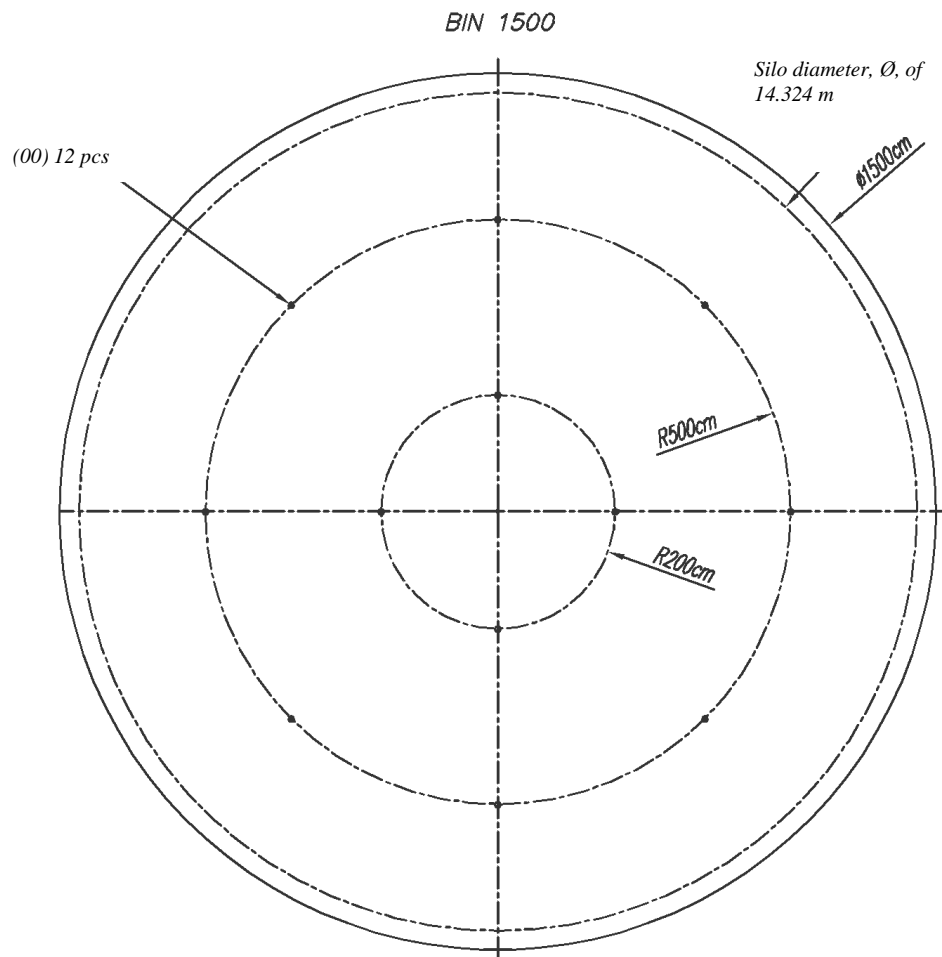
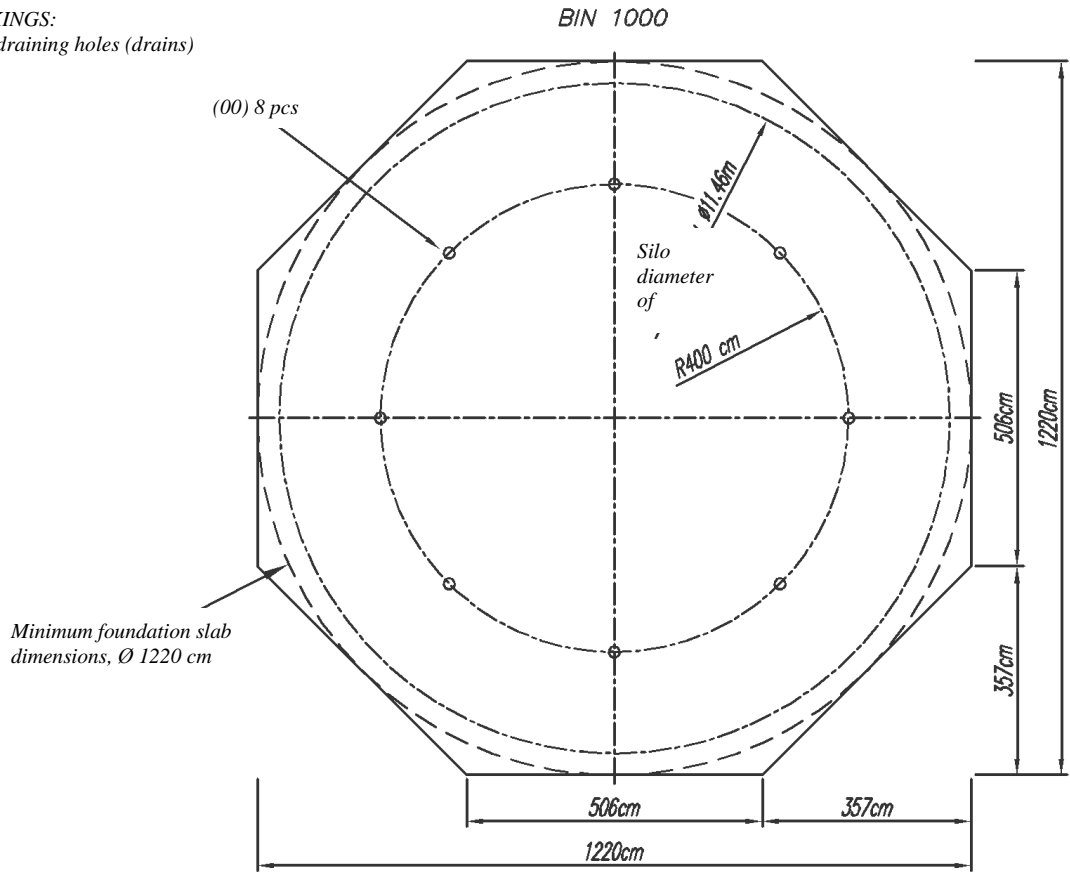


Figure 3. Foundation slab characteristics for the BIN1000 and BIN1500 silos.

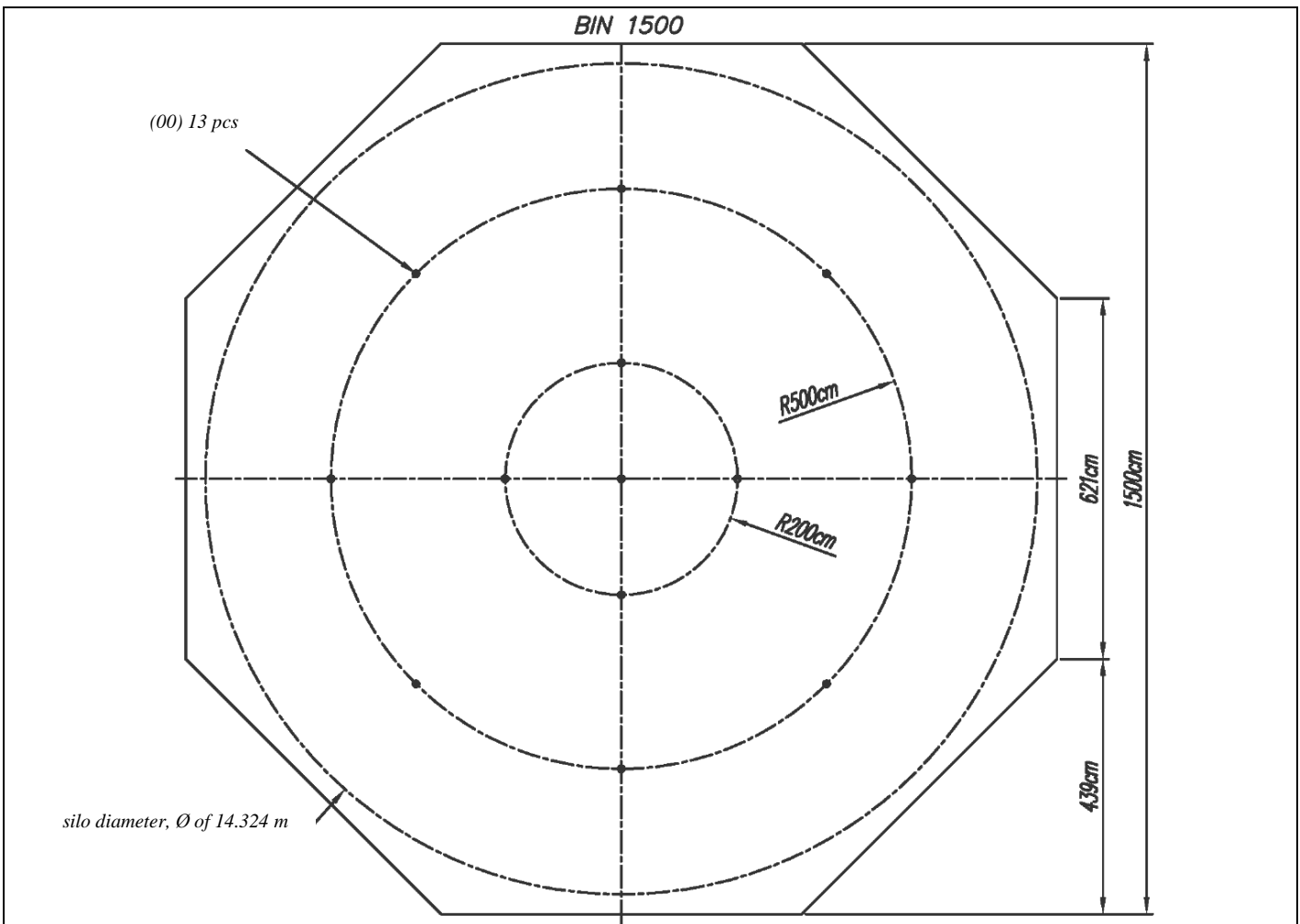


Figure 4. Foundation slab characteristics for the BIN1500 silos.

m) EMERGENCY DUCT

In silos from the BIN60 to BIN1500 range an option for the emergency unloading is foreseen, through a special emergency unloading duct. It is necessary when the inlet into the underfloor unloading device is blocked or in the event of the failure of that device, when it is not possible to repair it in the loaded silo. The duct can be used for inserting into the silo a conveyor to transport the material outside the silo. It should be installed on the silo floor, near the internal ladder. All emergency ducts are made of hot-dip galvanised steel. The emergency duct is not designed for normal unloading of the silo.

n) INTERNAL LADDER

The internal silo ladder is a vertical ladder with a fixed safety cage. It is attached to the silo shell with special supports. All silos equipped with the internal vertical ladder, must also have a roof manhole. The internal ladder provides access to the material (grain) in the silo through the roof manhole. Access is possible using a special harness protecting from a fall from height, and when special precautions are observed.

o) SILO CONTROL MODULE MKS-100/2

The Silo Control Module is a device designated for BIN silos and having a control and protective function. MKS-100/2 may control and inform a user about a maximum acceptable filling of the silo with stored material and whether access manholes to the silo are closed. The silo control module can be used to connect machines, unloading/loading equipment or active ventilation, with a function for their control and switch off to:

- secure against access to the silo interior during loading, unloading or active ventilation;
- prevent silo overfilling by switching the loading devices off at an appropriate time.

Stopping of the loading equipment after loading the silo does not prevent starting the silo unloading equipment.

p) MEASUREMENTS OF GRAIN TEMPERATURE IN THE SILO

The temperature of grain in the silo is one of the most important parameters informing about the grain condition. An increase in the grain temperature indicates high intensity of biological processes, usually caused by too high moisture content of grain.

The temperature should be measured:

- with a special probe that can be pushed into grain to ca. 1.5m;
- with an electronic thermometer STW-100 (Fig. 5) with a multi-point probe for temperature measurements of grain stored in the silo (in its whole volume).

The STW-100 thermometer is made of two basic units: a temperature reader and a measuring probe. Regardless of the type and the number of measuring probes, one reader is sufficient for all of them. The reader is a device with a display on which the user reads the temperature on individual sensors of the measuring probe. The measuring probe consists of temperature sensors spaced along it every 1m. All sensors are connected with an electrical cable routed outside the silo and ending with a connecting plug for connection of the temperature reader.

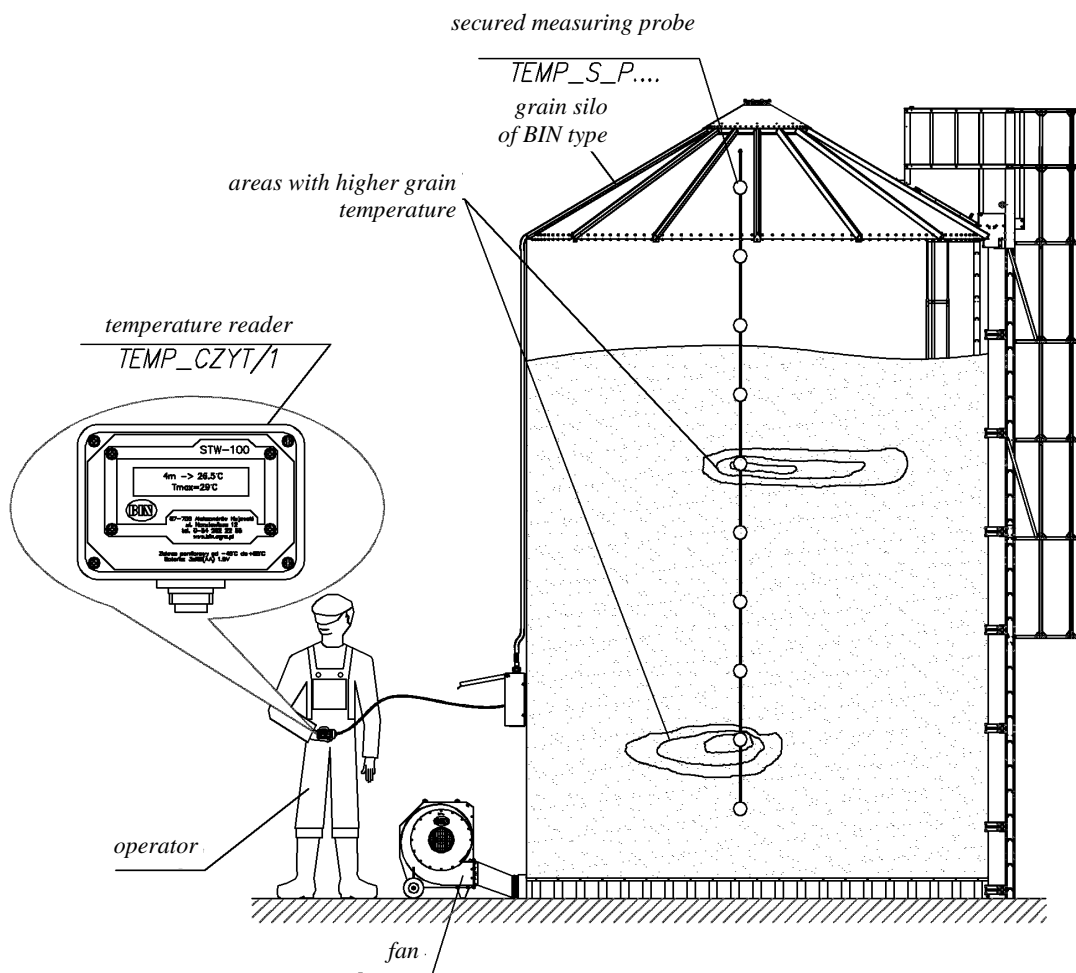


Figure 5. Design and a principle of operation for the STW-100 thermometer.

Regardless of the measuring method, when the temperature is found to be too high, immediately start airing grain to reduce its temperature.



During temperature measurements stay on the internal ladder of the silo. It is forbidden to climb onto the grain pile in the silo.

r) EXTERNAL LADDER/SPIRAL STAIRS

Access to places of use and operation in upper parts of BIN silos is provided by installation of an external ladder or a spiral staircase. The external ladder is a vertical ladder with a fixed safety cage, and provided with a door preventing an accidental access to the ladder by unauthorised persons. The door securing the ladder is adapted to installation of the limit switch stopping the equipment in the event the door is opened accidentally. Higher silos are equipped with ladders with a landing. All ladder components are hot-dip galvanised.

The spiral staircase is a solution alternative to the external ladder, ensuring access to places of use and operation in upper parts of the silo. This is a ladder-type staircase, with two security railing, available for BIN200, BIN500, BIN1000 and BIN1500 silos. The staircase is provided with a security door, having an identical function as in a case of ladders.

s) ROOF MANHOLE

The roof manhole with a platform and a security cover provides access to the upper part of the silo. The manhole is a standard silo equipment. It is not allowed to install a roof manhole without an internal ladder. When a roof manhole is installed in the silo, it must be provided with an external access. This access can be ensured through an external ladder, a spiral staircase or indirectly through a service catwalk and roof stairs. All silos manufactured by BIN are provided with an access to the inside in their upper part. All components of the roof manhole and the silo cover are hot-dip galvanised.

t) ROOF STAIRS

Roof stairs are used to provide access from outside to devices and units in the top part of the silo roof. When access to these places is ensured in other way, e.g., through a service catwalk or a relevant lifting equipment, then installation of roof stairs is not required. Roof stairs can be installed on BIN silos, except BIN10, BIN20 and BIN60. BIN1500 silos are equipped with roof stairs with a landing. All stair components are made of hot-dip galvanised steel.

u) SERVICE CATWALK/COLLAR PLATFORM

Service catwalks enable correct use and maintenance of silos, particularly when several silos are arranged in a row. They belong to additional silo accessories. They ensure safe and easy installation and operation of various equipment for grain transport. The catwalk design is based on a system of profiles made of hot-dip galvanised steel. Service catwalks are intended to be installed on BIN60, BIN100, BIN200, BIN500, BIN1000 and BIN1500 silos.

When installation of the service catwalk is not necessary then the collar platform can be used as a unit ensuring access to equipment located in the top part of the roof. Collar platforms are intended to be installed on BIN100, BIN200, BIN500, BIN1000 and BIN1500 silos. Detailed information on BIN service catwalks and possibilities to use them in silos is provided in the operating manual "BIN SERVICE CATWALKS".

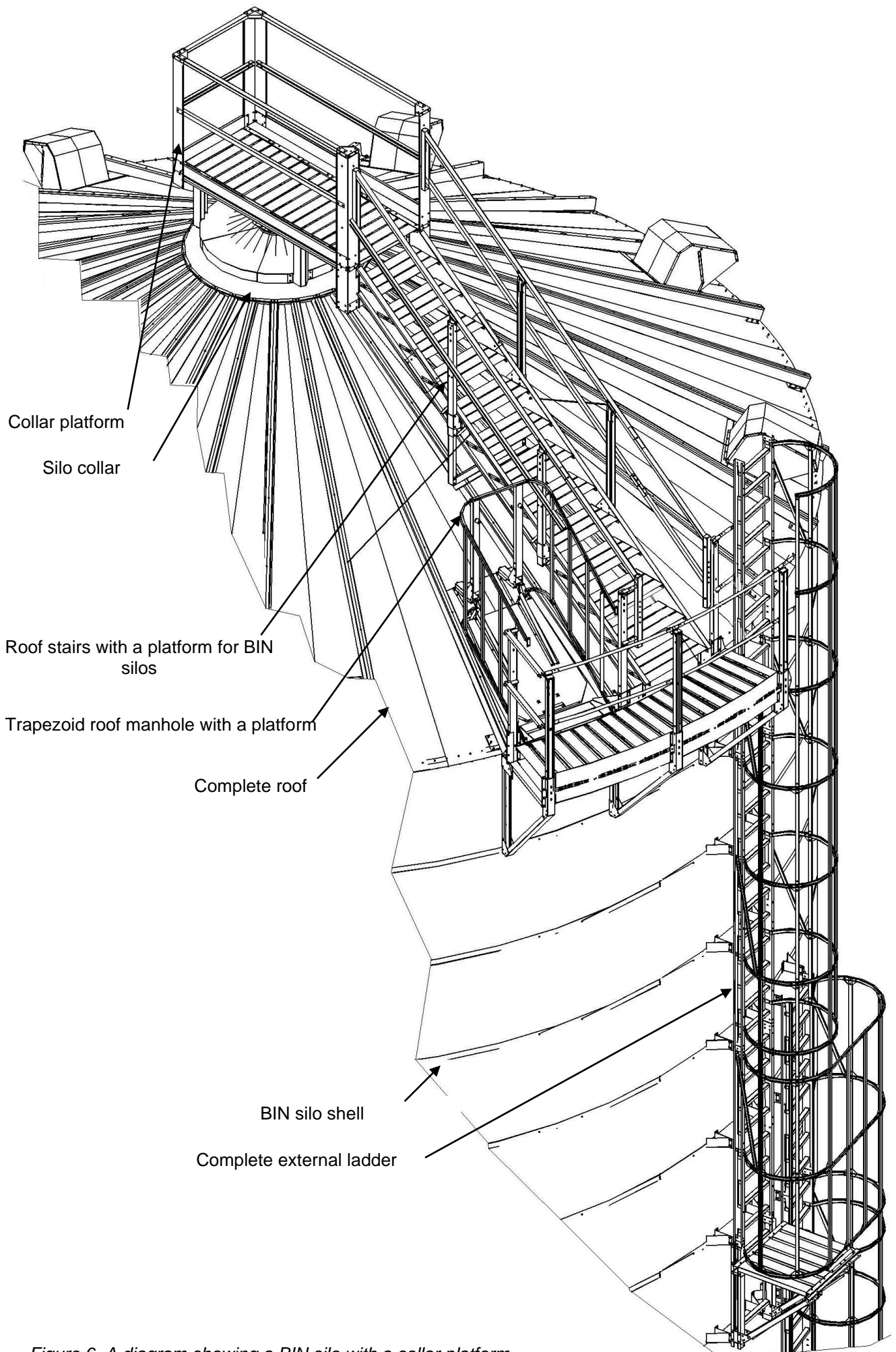


Figure 6. A diagram showing a BIN silo with a collar platform.

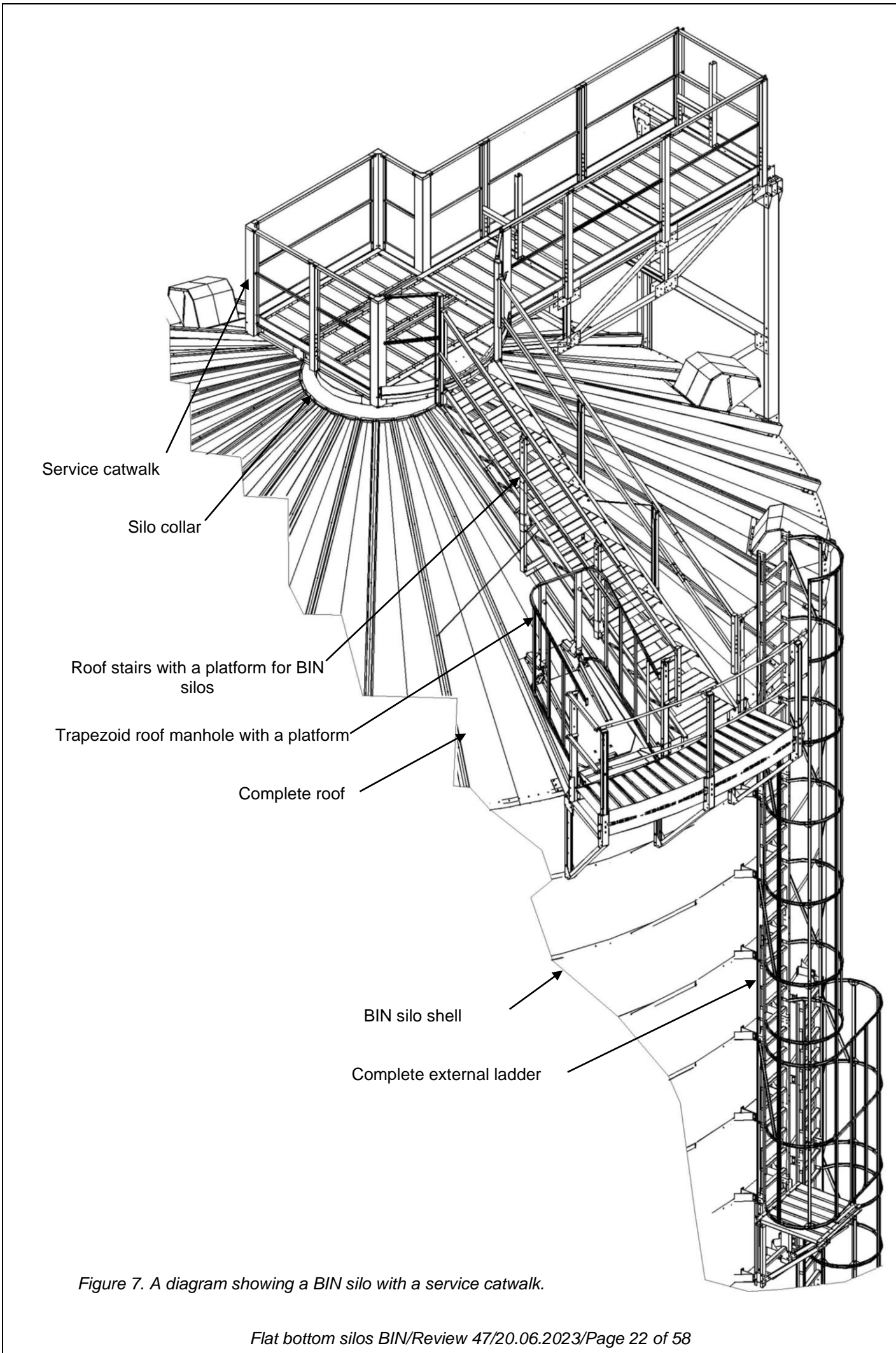


Figure 7. A diagram showing a BIN silo with a service catwalk.

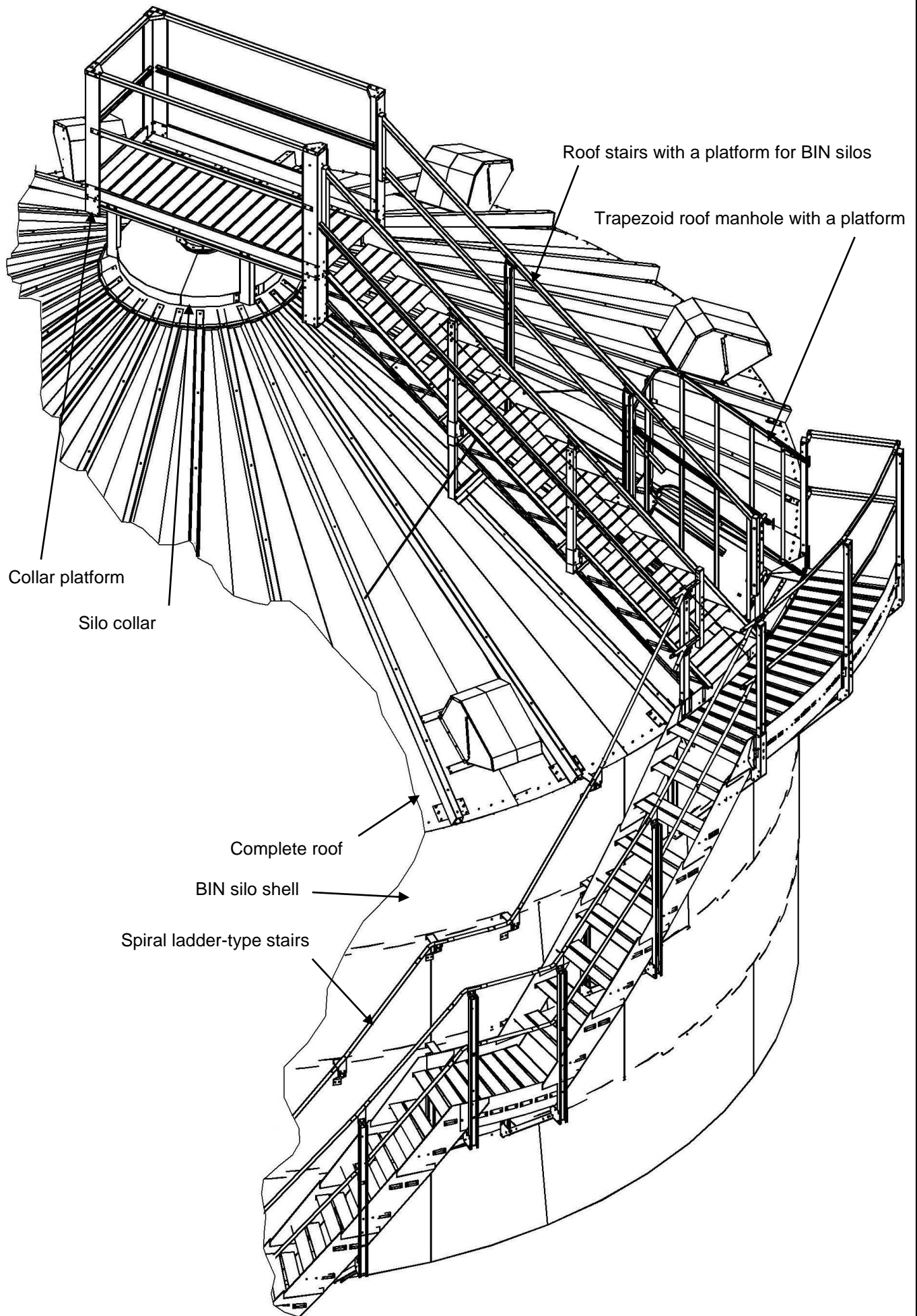
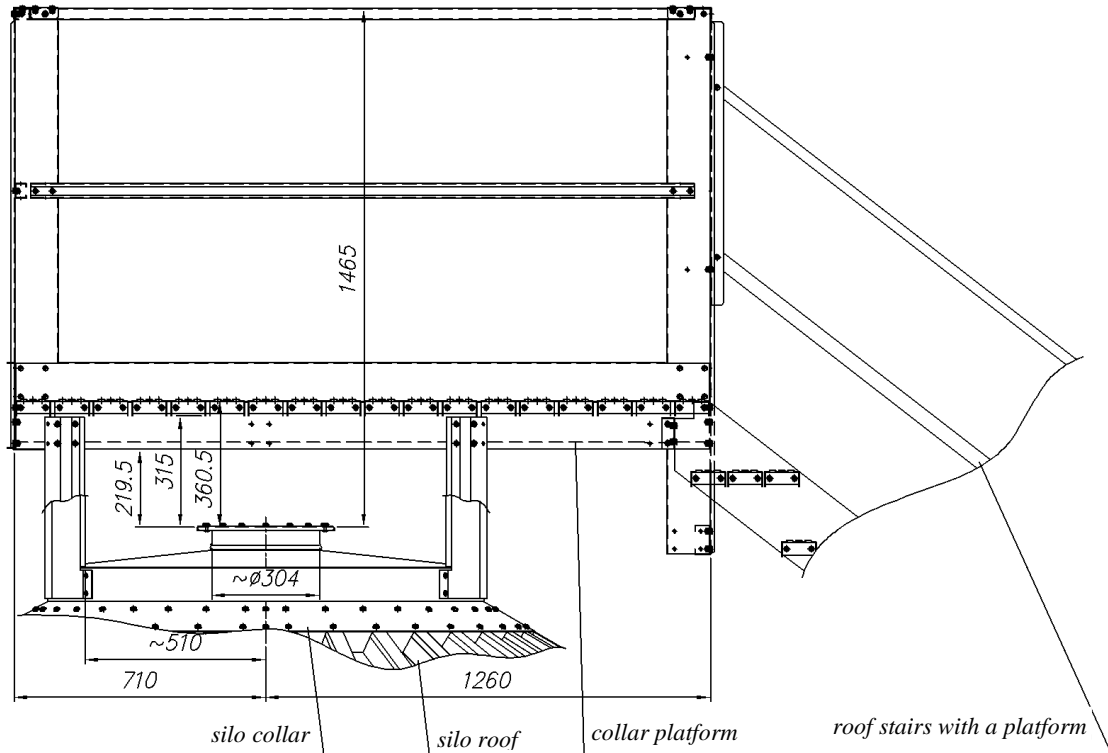


Figure 8. A diagram showing a BIN silo with spiral ladder-type stairs.

w) LOADING INLET

All BIN silos are adapted to loading through special loading inlets. In larger silos, such as BIN1500, BIN1000, BIN500 and NBIN200W, loading can be done only through a central loading inlet (of ca. 300mm in diameter) installed in the silo collar. In smaller silos, such as BIN10, BIN20, BIN60, BIN100 and NBIN200U, pneumatic loading through a side loading inlet installed in the silo shell is acceptable. In the BIN10, BIN20, BIN60, BIN100 and NBIN200U silos, the central loading inlet (of ca. 200mm in diameter) installed in the silo collar, or a side loading inlet installed in the silo shell can be used.

CENTRAL LOADING INLET IN THE SILOS TYPE BIN500, TYPE BIN1000, TYPE BIN1500



CENTRAL LOADING INLET IN THE SILOS TYPE BIN100 AND TYPE BIN200

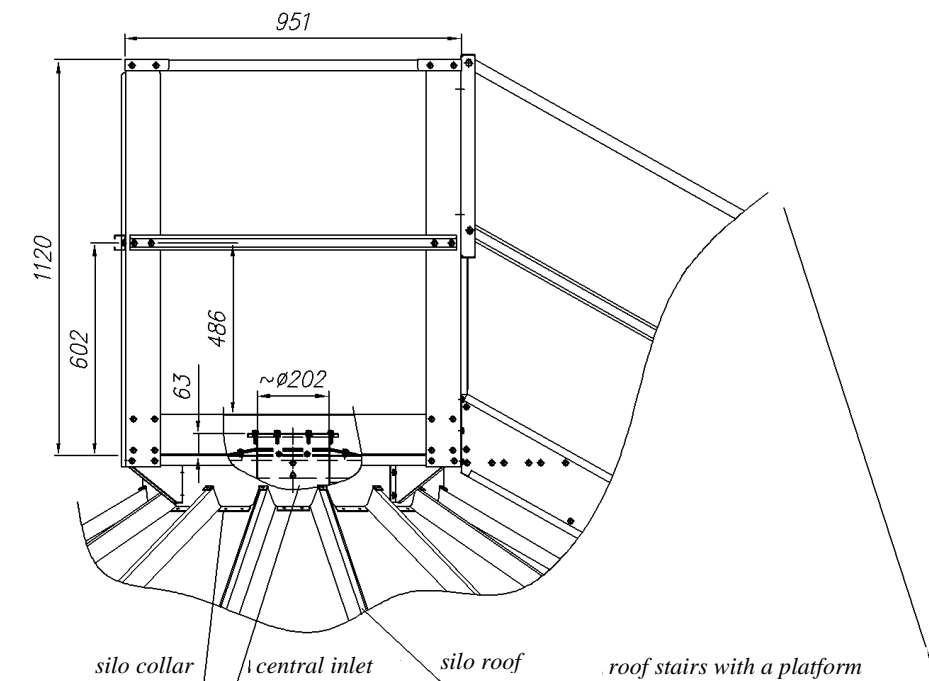


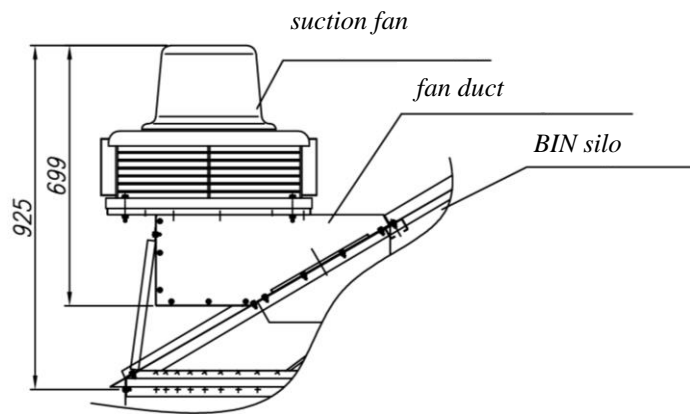
Figure 9. A diagram showing a central loading inlet together with conditions and options for connecting loading equipment to the silo collar with the collar platform installed.

y) SUCTION FAN

A radial suction fan with a side outlet is an additional equipment in the BIN type silos. It is designed to ventilate the space above grain stored in the silo. Contaminations of air directly in contact with stored material are formed in the technological process for storing of cereal and maize grain, and oilseeds. Usually, the air is contaminated with excessive water, various dust, and similar. To improve safe storage conditions in the silos the contaminated air must be removed. Silo ventilation is also recommended during loading and unloading, and cleaning of the silo. The fan is attached to the special duct in the upper part of the silo. It is recommended to construct the electrical wiring in such way that starting of equipment for grain loading, unloading or active ventilation also starts the suction fan. Ventilation should be conducted throughout the grain loading, unloading or active ventilation. When the suction fan is used this way, accumulation of large dust quantities in the silo is prevented.

Basic technical characteristics of the suction fan: type: WVPKH-250, power supply: 3~, motor power: 0.55 kW, motor rotations: 1380 rpm, motor current: 1.5 A, max. capacity: 4040 m³/h, weight: 25 kg.

SUCTION FAN IN SILOS OF THE BIN10, BIN20, BIN60, BIN100 AND BIN200 TYPE



SUCTION FAN IN SILOS OF THE BIN500 TYPE AND LARGER

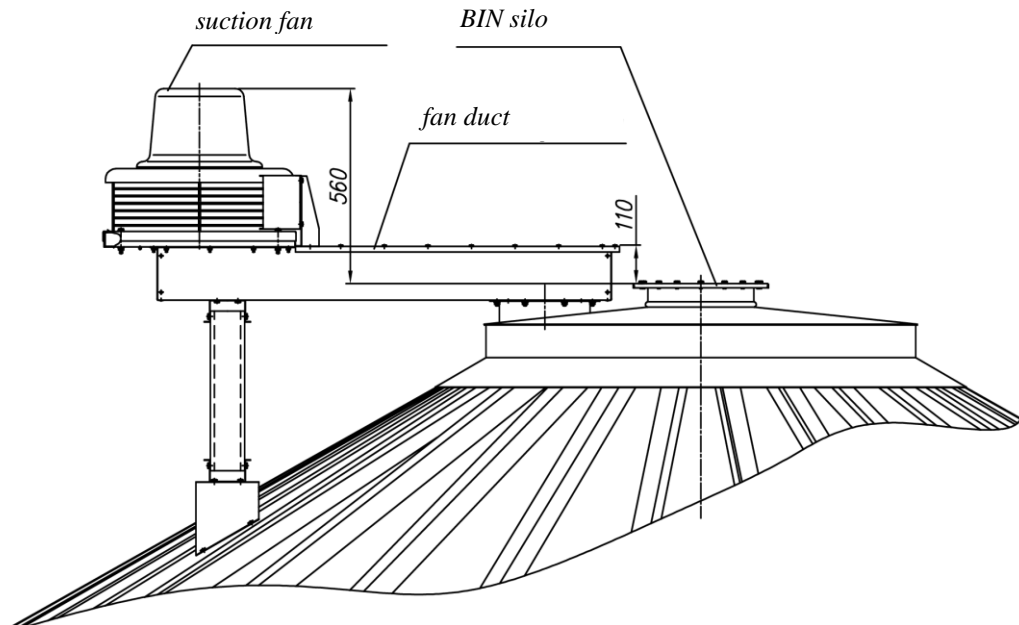


Figure 10. Suction fan installed on a silo of the BIN type

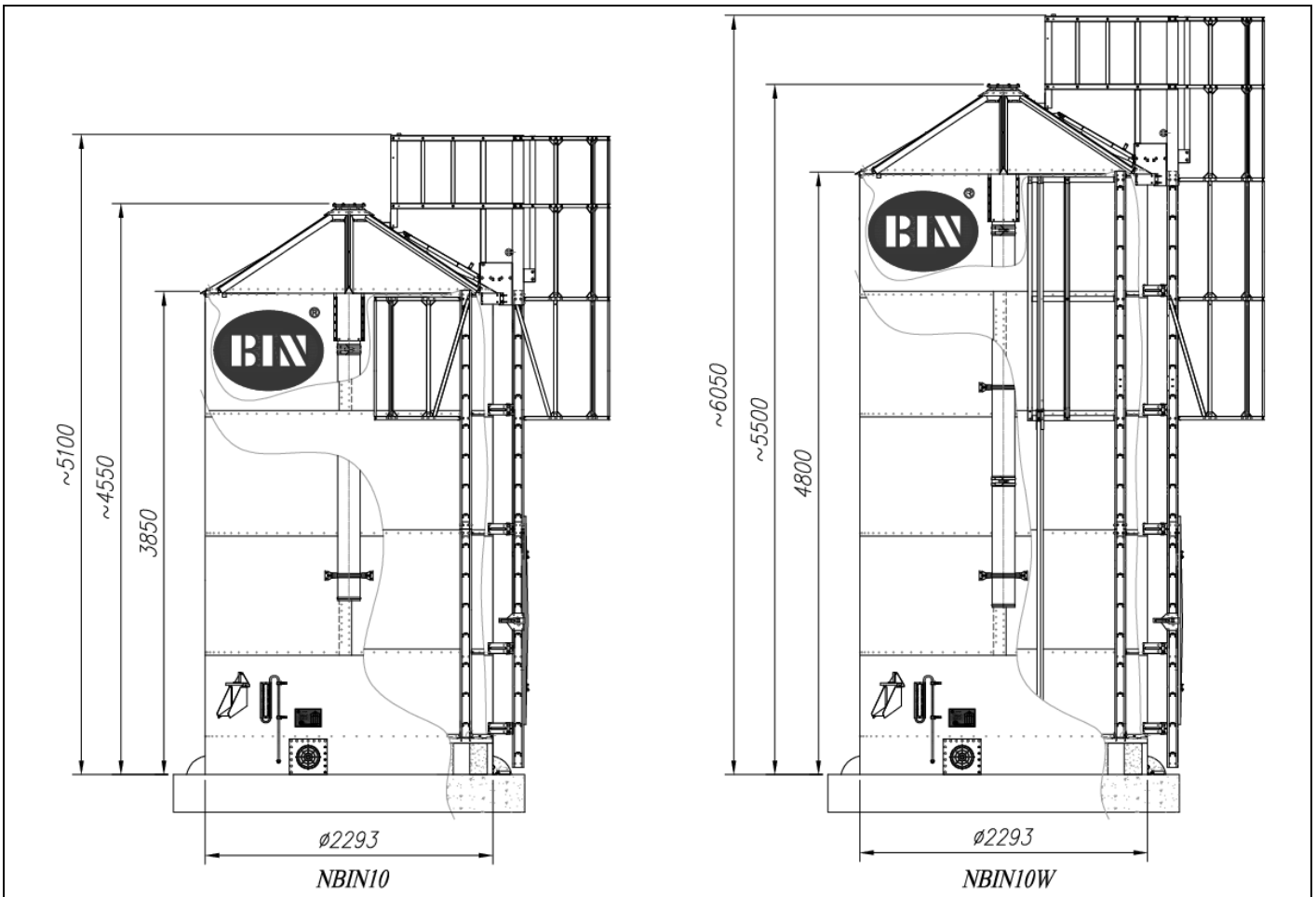


Figure 11. Construction diagram for silos of the BIN10 type

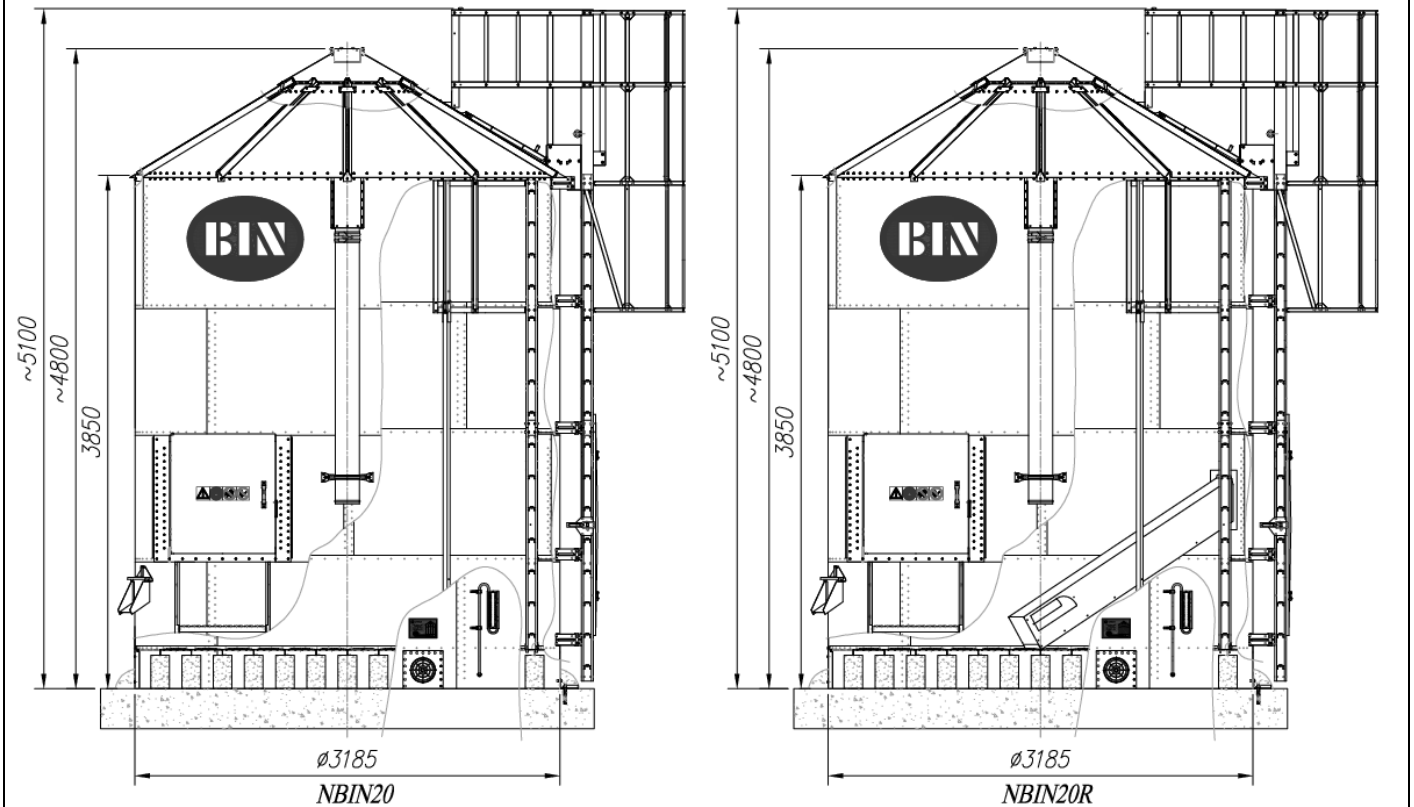


Figure 12a. Construction diagram for silos of the BIN20 type

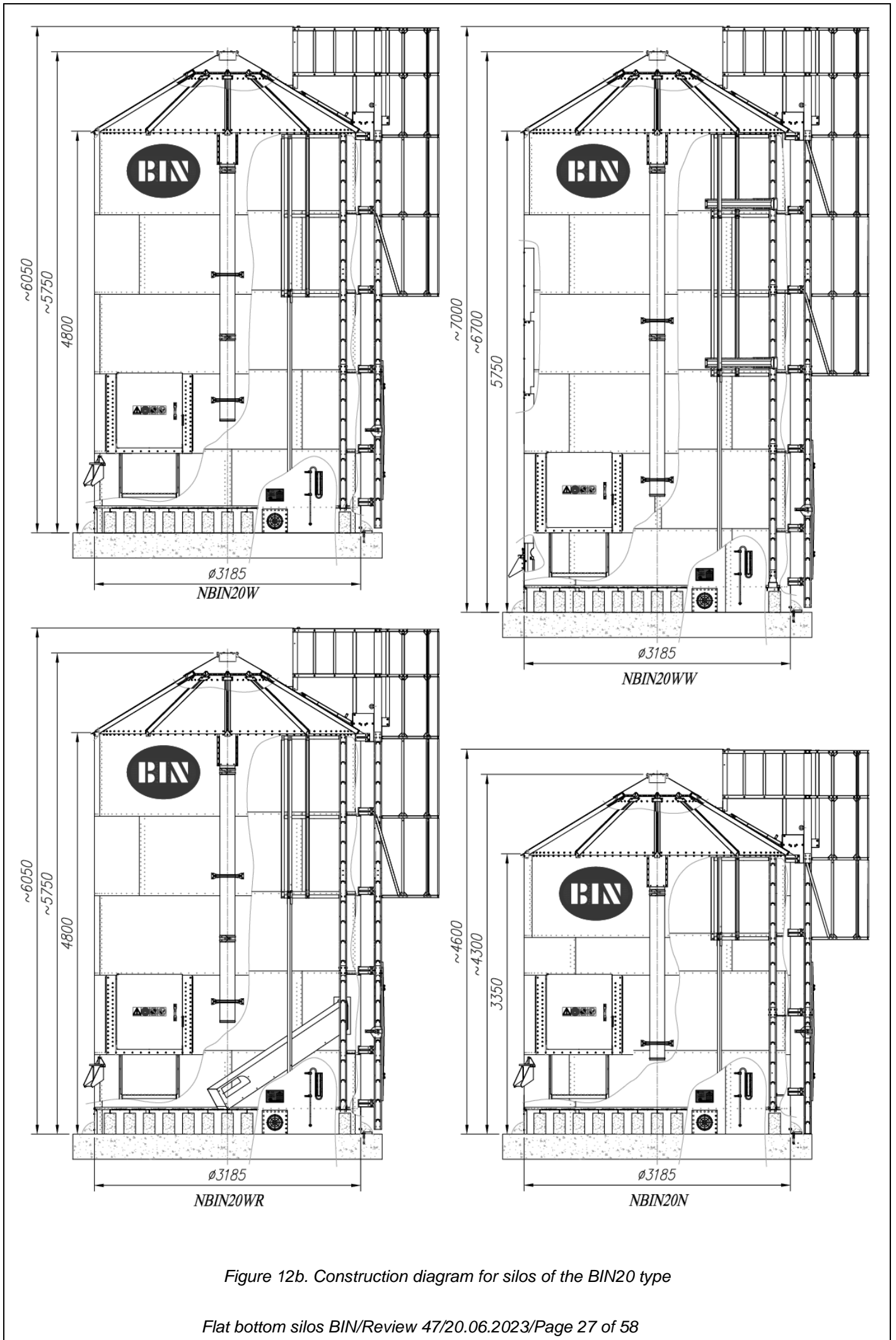


Figure 12b. Construction diagram for silos of the BIN20 type

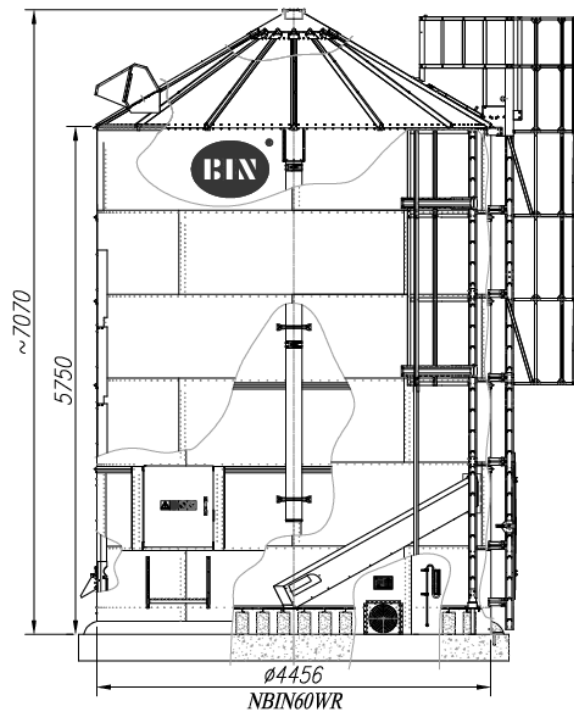
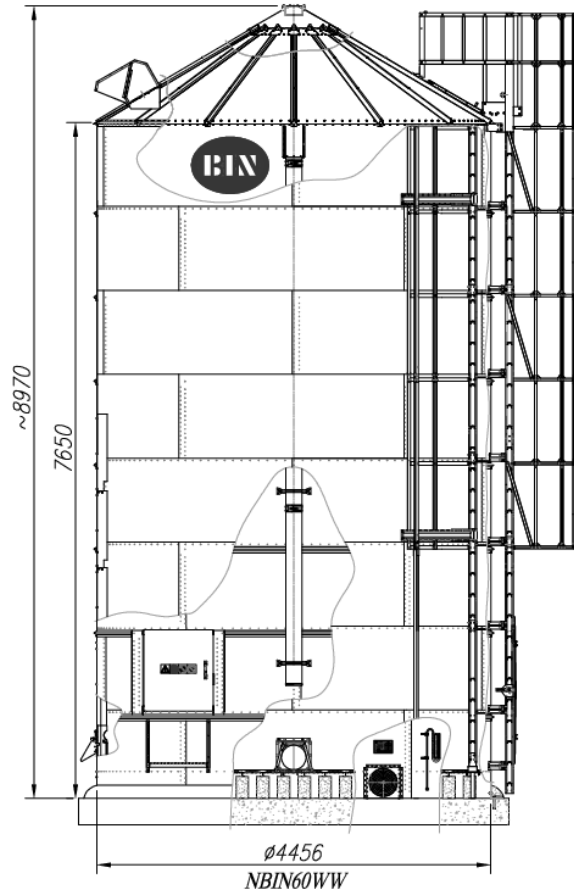
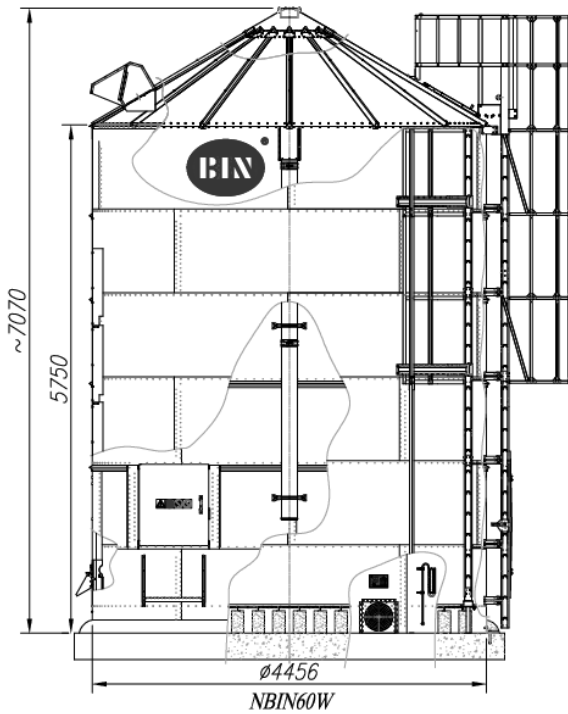
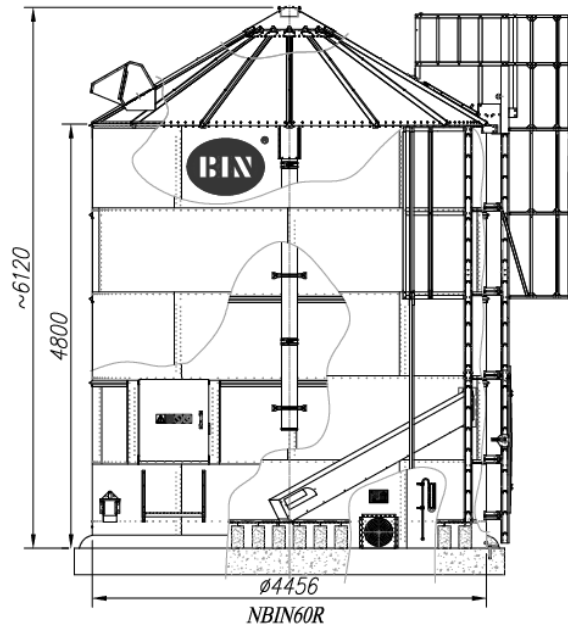
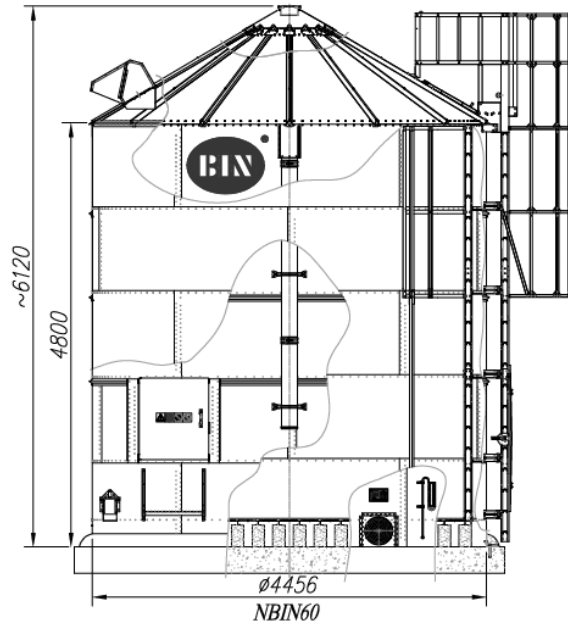


Figure 13. Construction diagram for silos of the BIN60 type

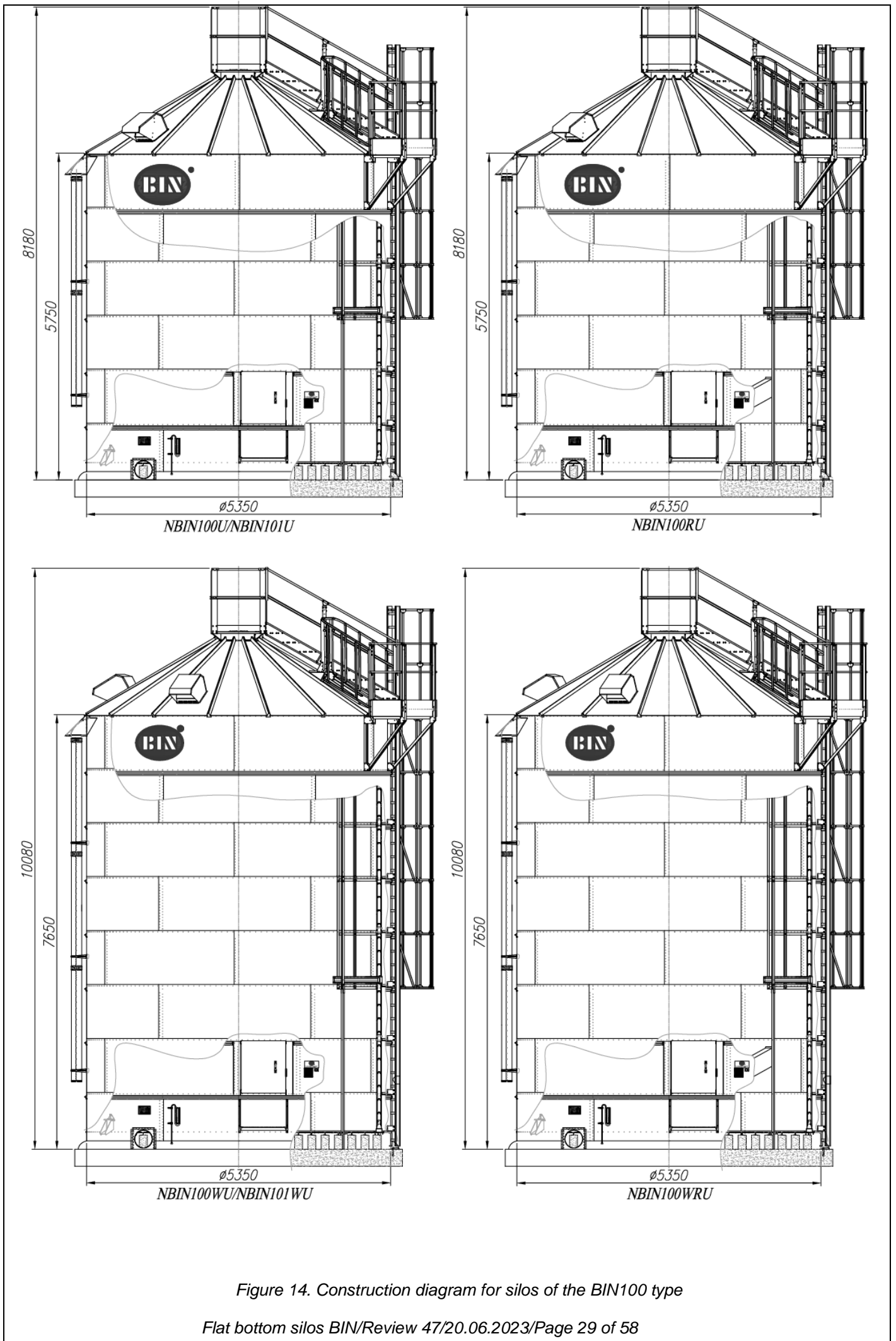


Figure 14. Construction diagram for silos of the BIN100 type

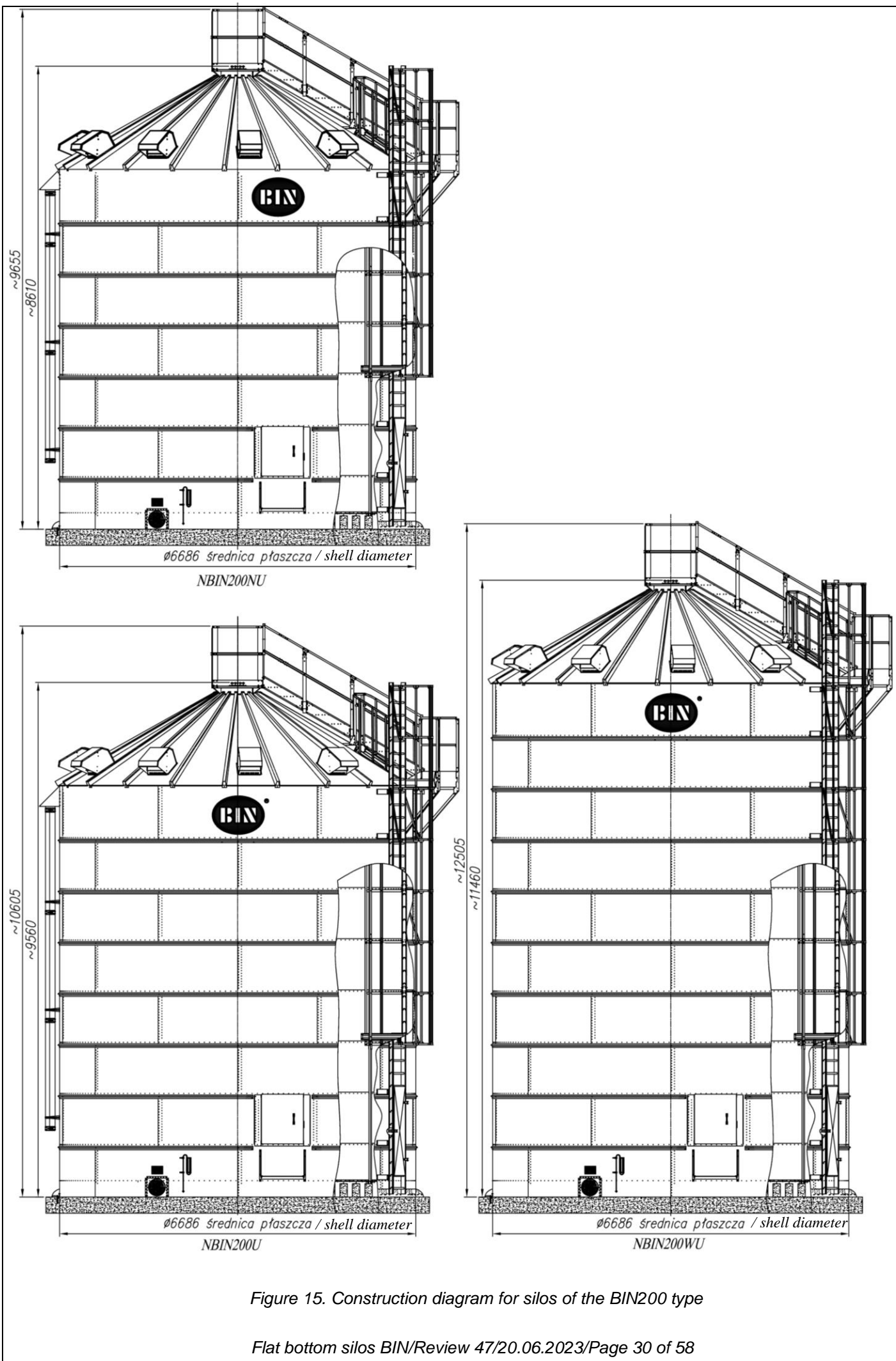


Figure 15. Construction diagram for silos of the BIN200 type

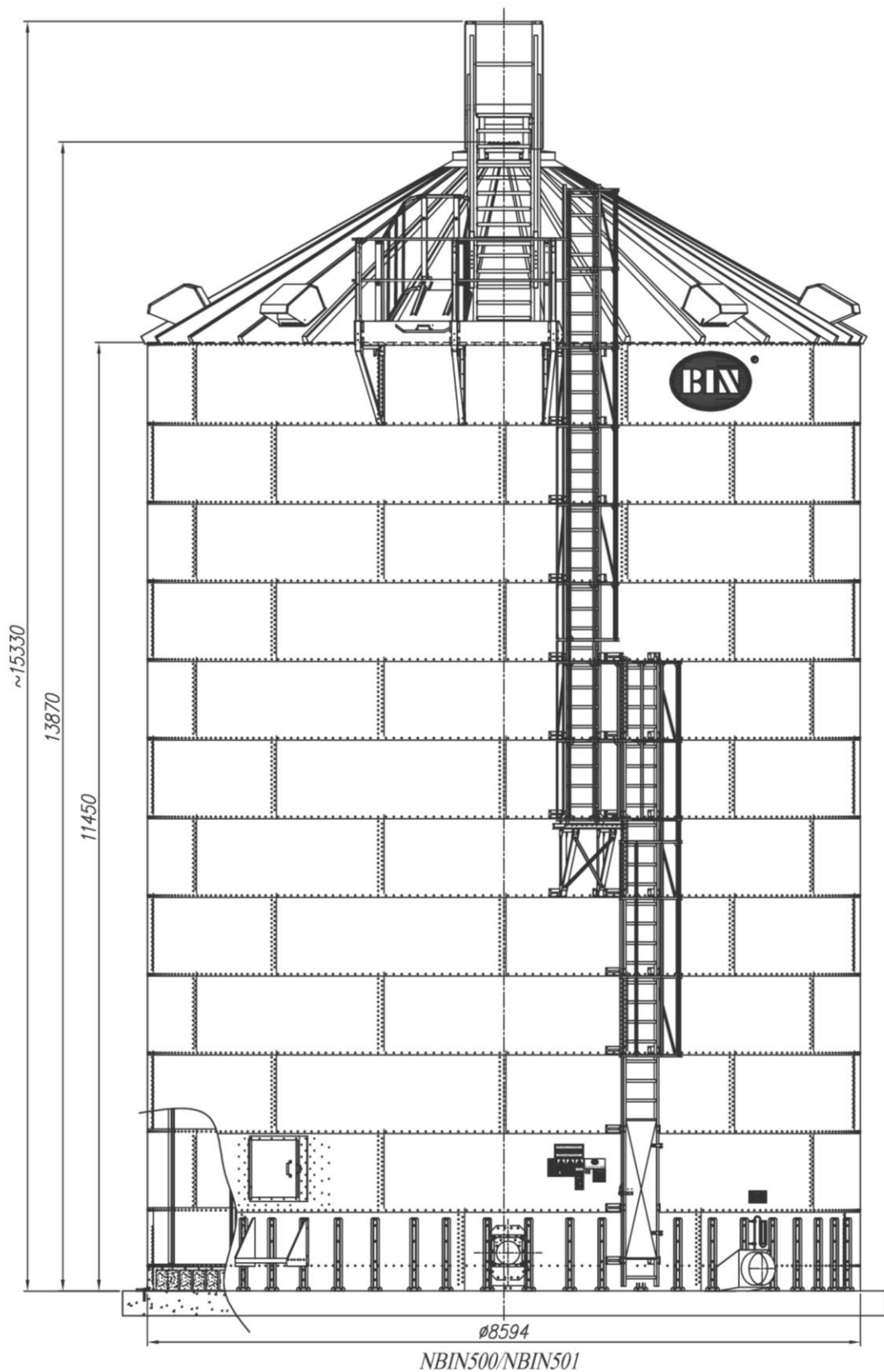


Figure 16a. Construction diagram for silos of the BIN500 type

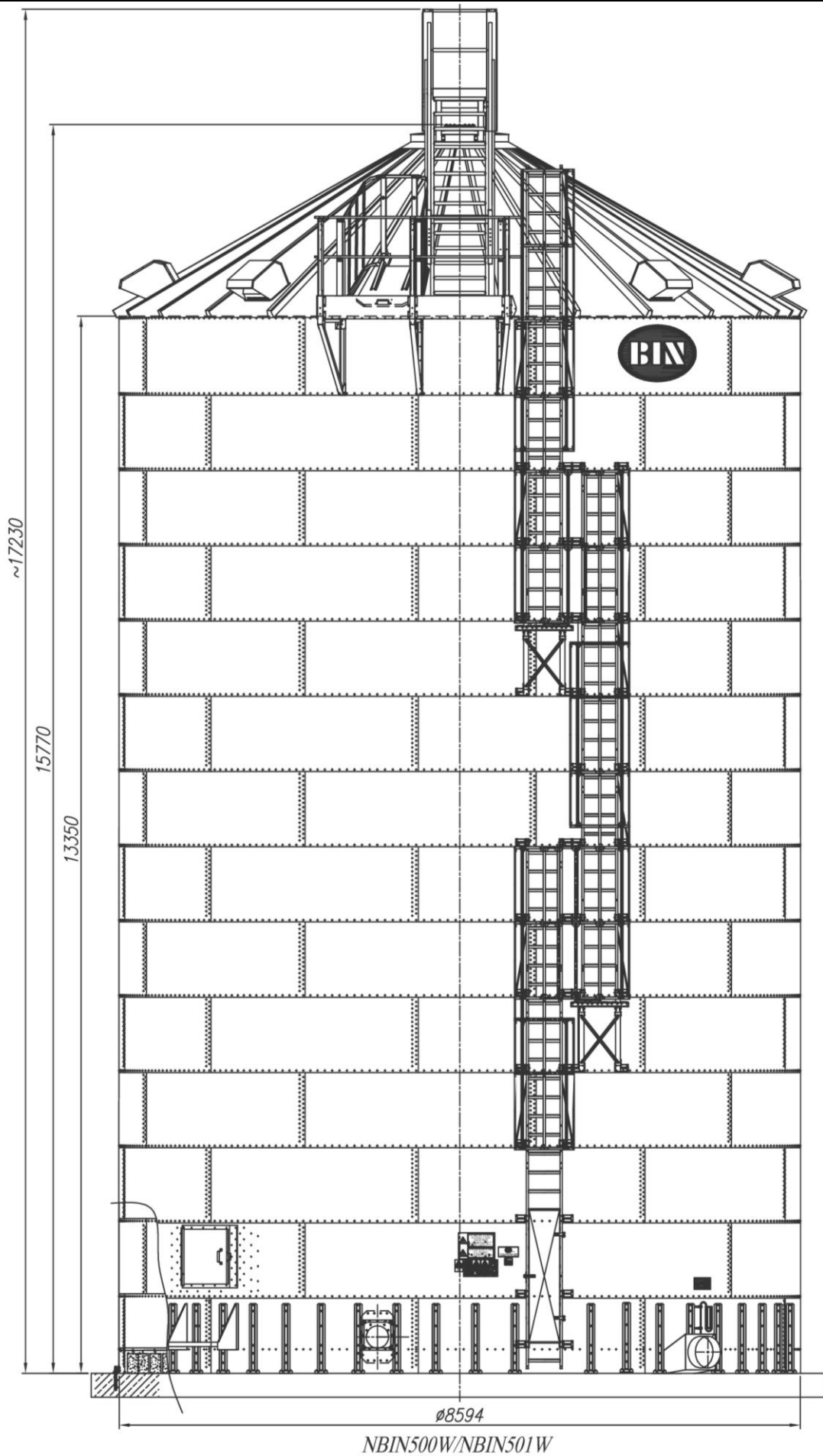


Figure 16b. Construction diagram for silos of the BIN500 type

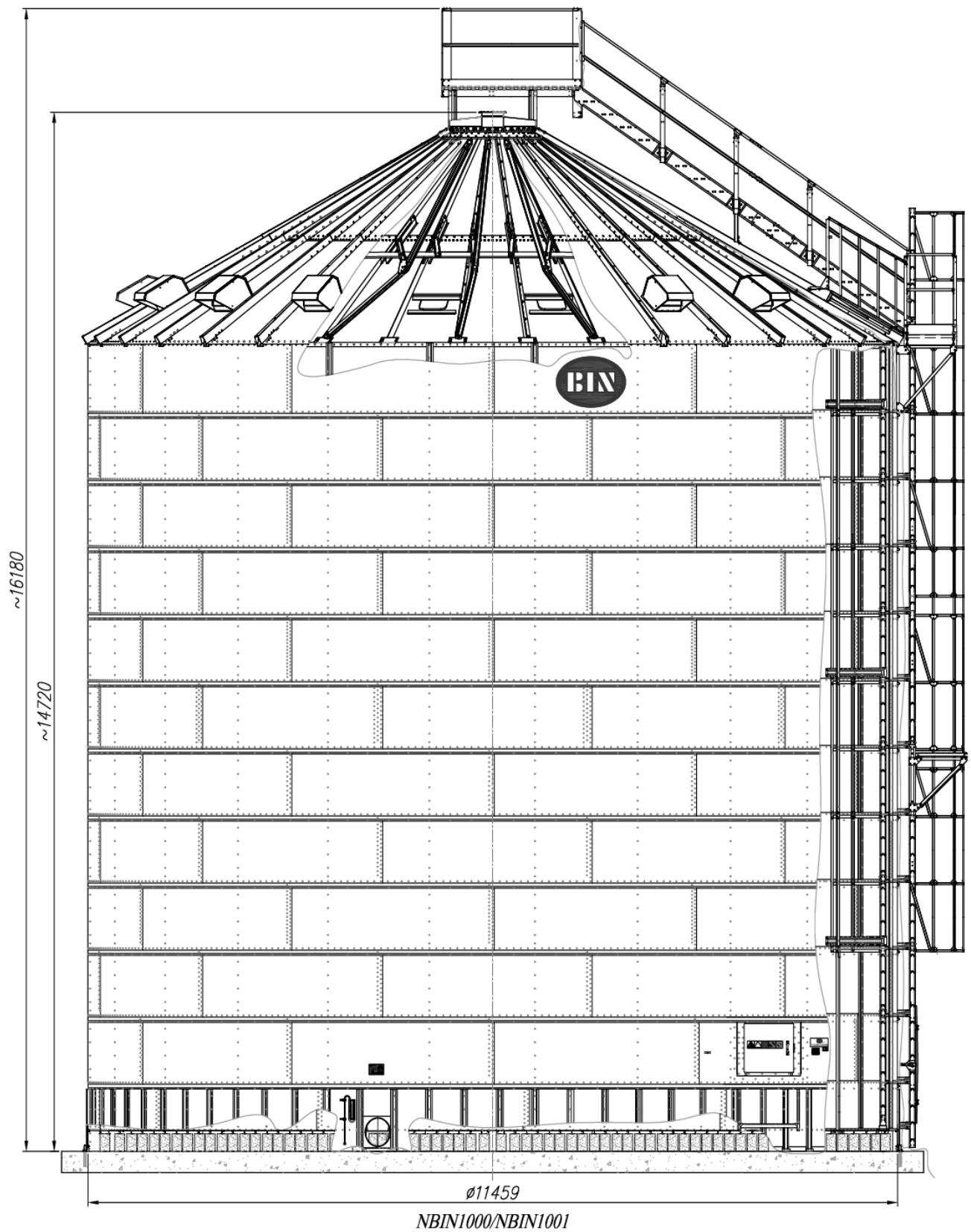


Figure 17a. Construction diagram for silos of the BIN1000 type

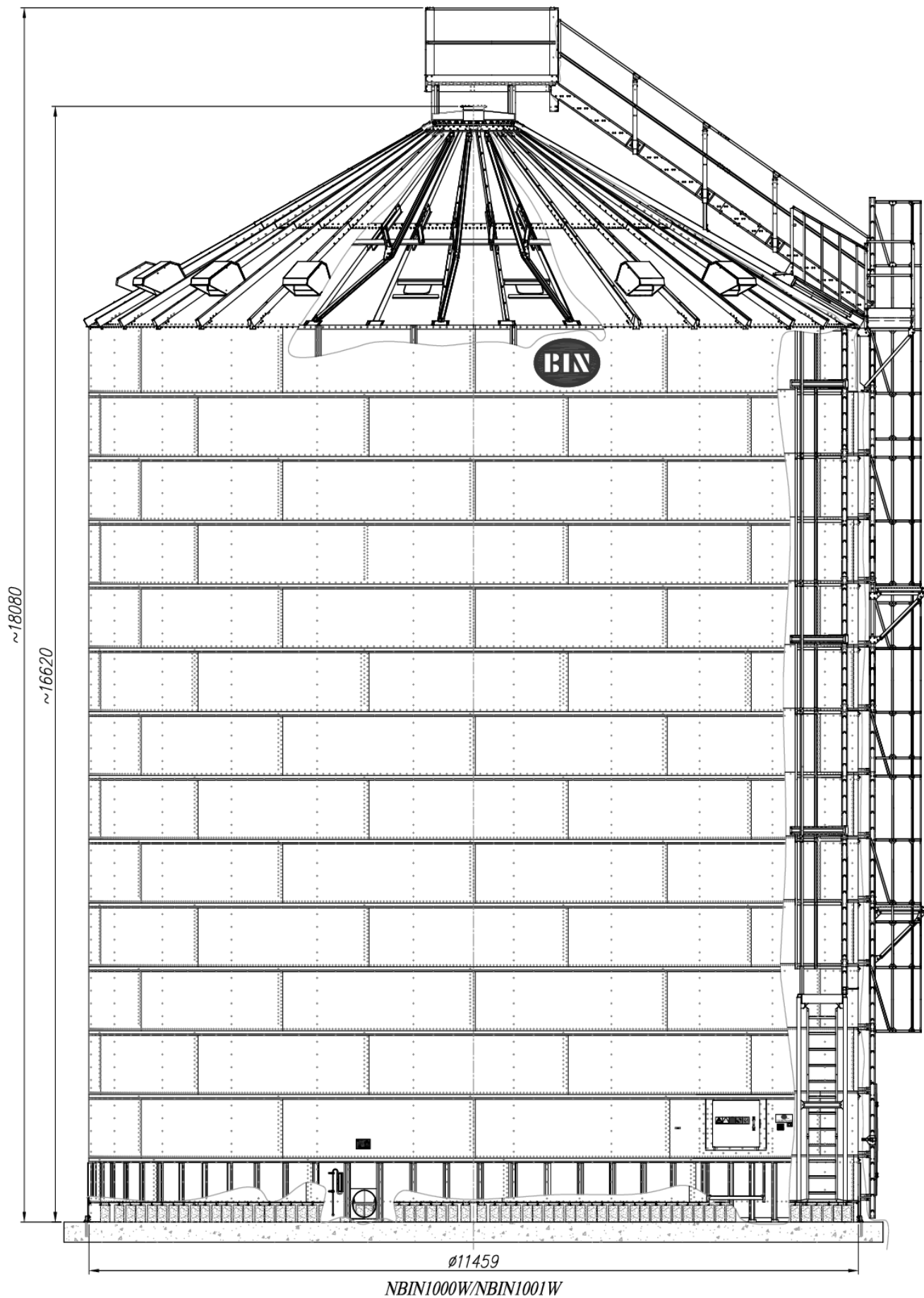


Figure 17b. Construction diagram for silos of the BIN1000 type

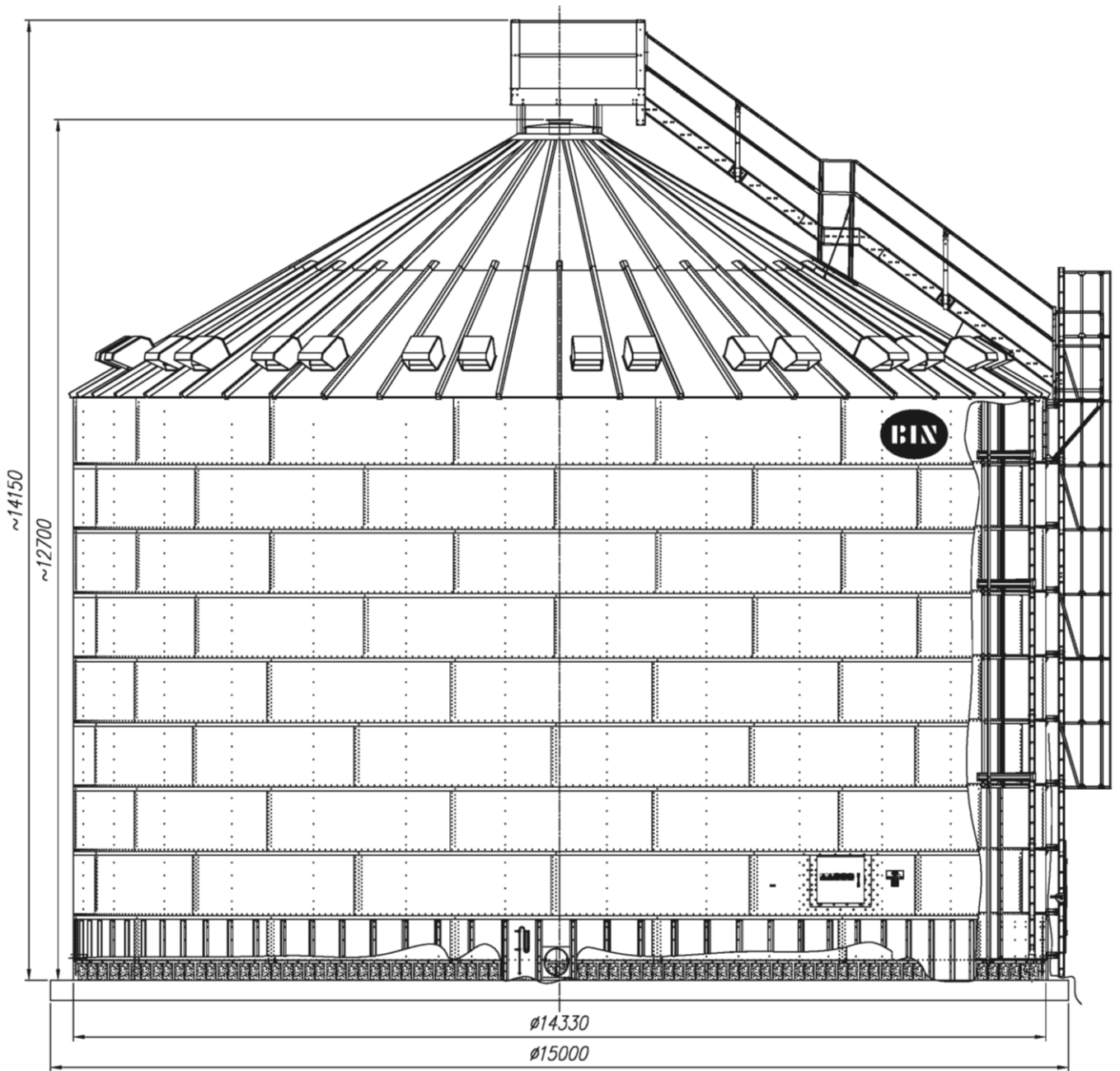


Figure 18. Construction diagram for the NBIN1500_N silos

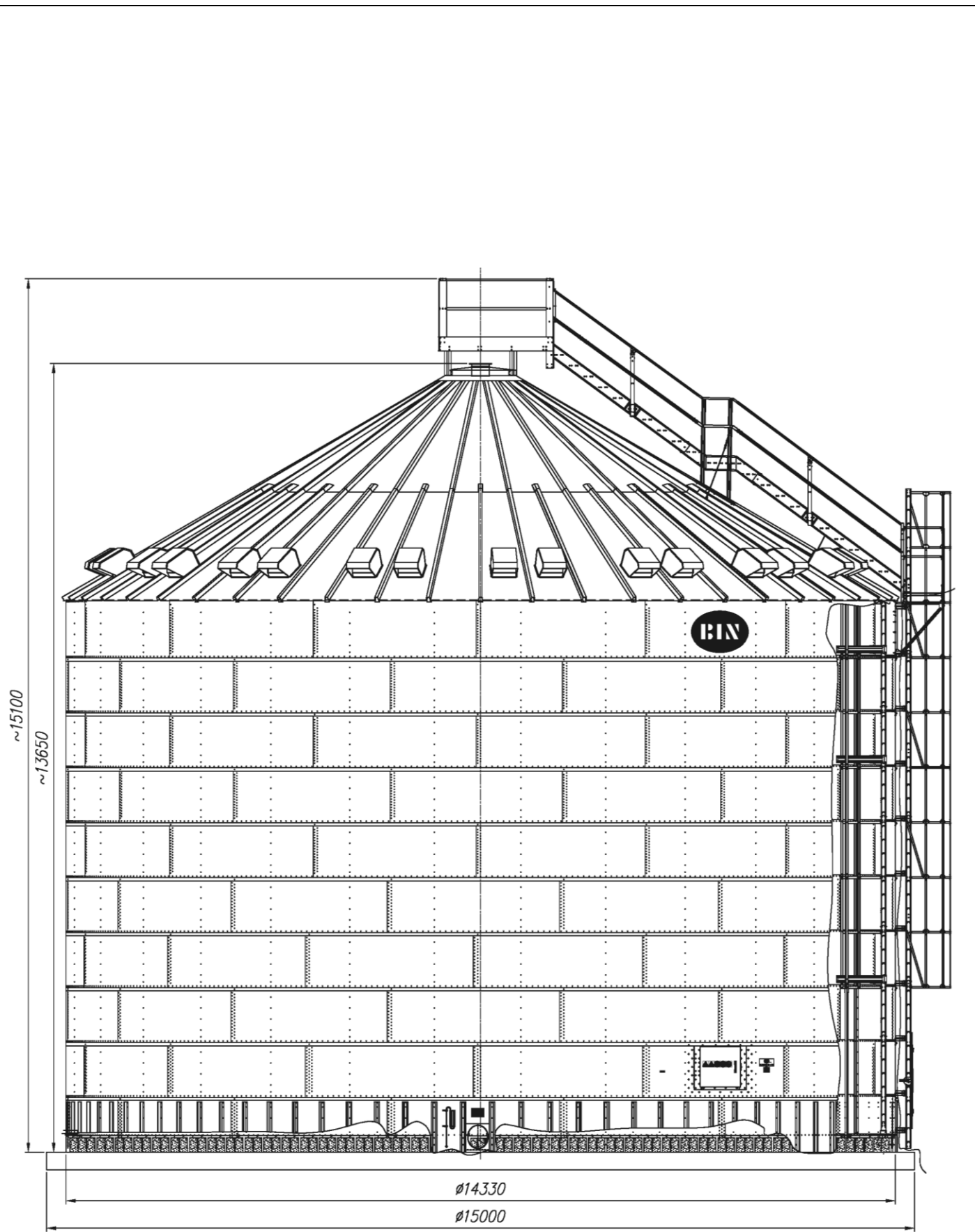


Figure 19. Construction diagram for the NBIN1500_P silos

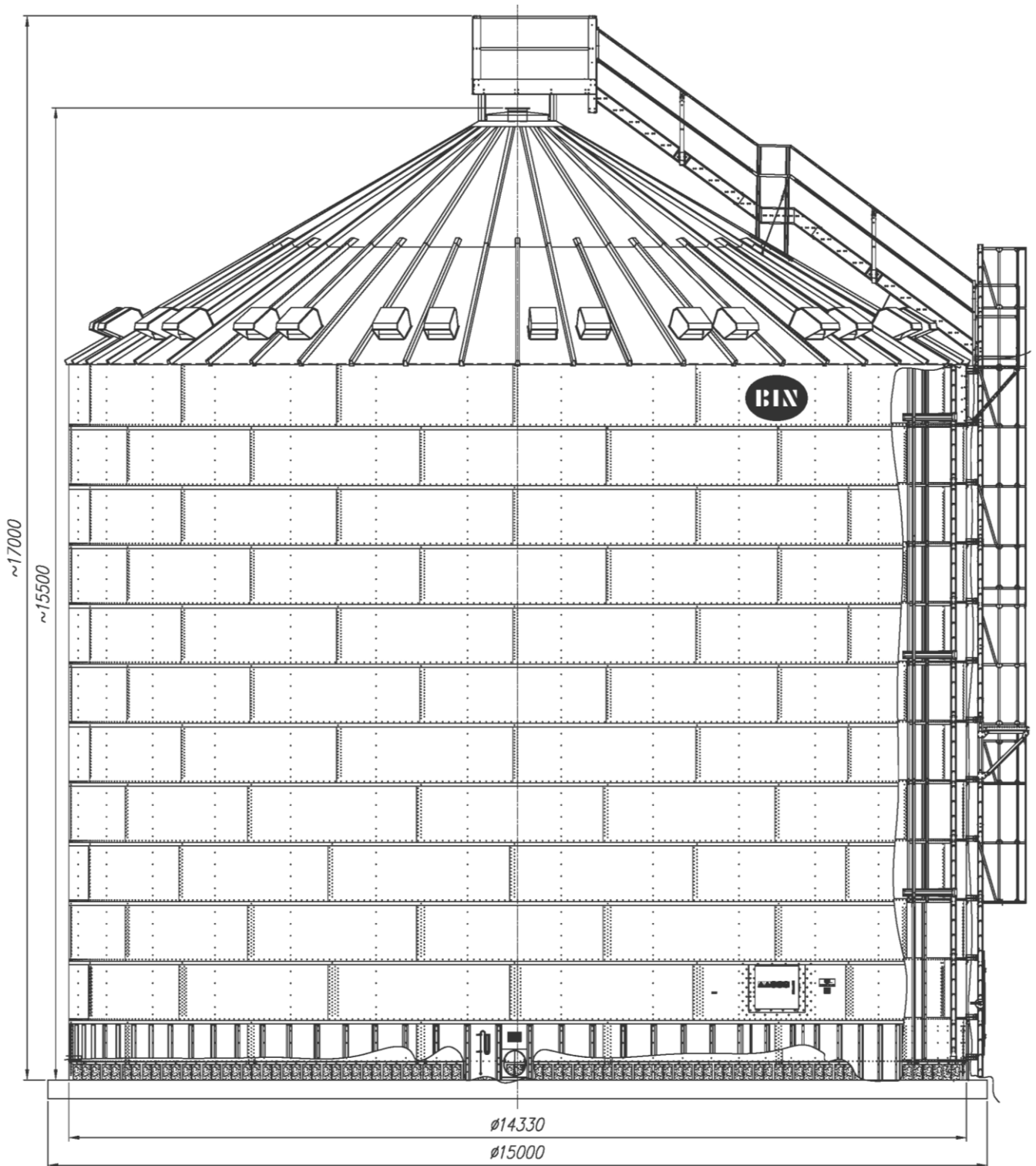


Figure 20. Construction diagram for the NBIN1500 silos

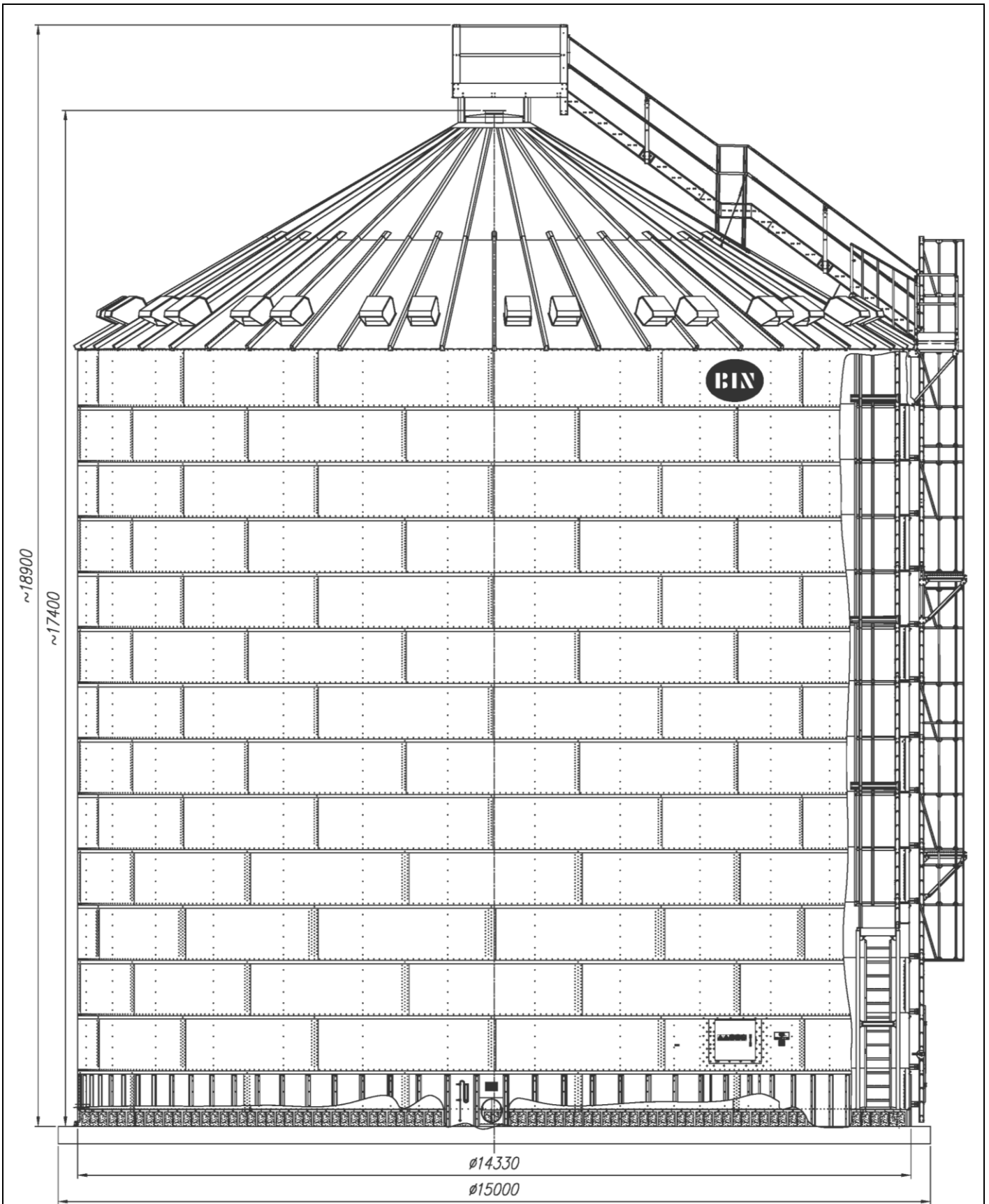


Figure 21. Construction diagram for the NBIN1500_W silos

2.5. Standard and additional silo accessories.

S – standard (included in the silo price), O – optional (available for additional payment), NA -not available/not acceptable

Table 4. List of equipment for silos from the BIN10 to BIN1500 range.

SILO TYPE	BIN10	BIN20	BIN60			BIN100		BIN200		BIN500	BIN1000	BIN1500
SILO MODEL	NBIN10 NBIN10W	NBIN20N NBIN20 NBIN20R NBIN20W NBIN20WR NBIN20WW	NBIN60 NBIN60R	NBIN60W NBIN60WR	NBIN60WW	NBIN100U NBIN101U NBIN100RU	NBIN100WU NBIN101WU NBIN100WRU	NBIN200NU NBIN200U	NBIN200WU	NBIN500 NBIN501 NBIN501W	NBIN1001 NBIN1001W	NBIN1500_N NBIN1500_P NBIN1500 NBIN1500_W
1.	2	3	4	5	6	7	8	9	10	11	12	13
VENT	NA	NA	S 1piece	S 1piece	S 1piece	S 2pcs	S 3pcs	S 10pcs	S 10pcs	S 12pcs	S 18pcs	S 32pcs
UNLOADING SACK-FILLING DEVICE	S	S	S	S	O	O	O	NA	NA	NA	NA	NA
ANTI-DYNAMIC PIPE OF THE SACK-FILLING DEVICE	NA	S NBIN20WW NA other	NA	S	O	O	O	NA	NA	NA	NA	NA
AIR INLET	S Ø180	S Ø180	S Ø310	S Ø310	S Ø310	S Ø310	S Ø310	S Ø310	S Ø310	S Ø400	S Ø400	S Ø400
UNIVERSAL AIR INLET	NA	NA	NA	NA	NA	NA	NA	O	O	O	O	O
AIR DIVERTER VALVE	NA	NA	NA	NA	NA	NA	NA	O	O	O	O	O
UNLOADING SLEEVE	NA	S NBIN20R NBIN20WR O other	S NBIN 60R O other	S NBIN 60WR O other	NA	S NBIN 100RU O other	S NBIN 100WRU O other	NA	NA	NA	NA	NA
CENTRAL LOADING INLET	S	S	S	S	S	S	S	S	S	S	S	S
SIDE LOADING INLET	S	S	S	S	O	S	S	O	NA	NA	NA	NA
EMERGENCY DUCT	NA	NA	O NA NBIN60R	O NA NBIN60WR	S	S NA NBIN100RU	S NA NBIN100WRU	S	S	S	S	S
WATER MANOMETER	S	S	S	S	S	S	S	S	S	S	S	S
EXTERNAL LADDER	S	S	S	S	S	S	S	O	O	O	O	O
INTERNAL LADDER	S	S	S	S	S	S	S	S	S	S	S	S
SPIRAL STAIRS	NA	NA	NA	NA	NA	NA	NA	O	O	O	O	O
ROOF STAIRS	NA	NA	NA	NA	NA	O	O	O	O	O	O	O
COLLAR PLATFORM	NA	NA	NA	NA	NA	O	O	O	O	O	O	O
SERVICE CATWALK	NA	NA	O	O	O	O	O	O	O	O	O	O

TABLE 4, contd.

TYP SILOSU	BIN10	BIN20	BIN60			BIN100		BIN200		BIN500	BIN1000	BIN1500
MODEL SILOSU	NBIN10 NBIN10W	NBIN20N NBIN20 NBIN20R NBIN20W NBIN20WR NBIN20WW	NBIN60 NBIN60R	NBIN60W NBIN60WR	NBIN60WW	NBIN100U NBIN101U NBIN100RU	NBIN100WU NBIN101WU NBIN00WRU	NBIN200NU NBIN200U	NBIN200WU	NBIN500 NBIN501 NBIN501W	NBIN1001 NBIN1001W	NBIN1500_N NBIN1500_P NBIN1500 NBIN1500_W
1	2	3	4	5	6	7	8	9	10	11	12	13
THERMOMETER STW-100	O	O	O	O	O	O	O	O	O	O	O	O
SILO CONTROL MODULE	O	O	O	O	O	O	O	O	O	O	O	O
FAN	O PPZ	O PPZ	O PPZ	O PPZ	O PPZ	O PPZ	O PPZ	O PPZ	O PPZ	O WPR/WPS	O WPR/WPS	O WPR/WPS
SUCTION FAN	O	O	O	O	O	O	O	O	O	O	O	O
ELECTRIC HEATER	O 4.5kW	O 4.5kW	O 4.5kW	O 4.5kW	O 4.5kW	O 4.5kW	O 4.5kW	O 9kW	O 9kW	NA	NA	NA
BOTTOM MANHOLE	ND	O	O	O	S	S	S	S	S	S	S	S
BOTTOM PLATFORM	ND	O	O	O	S	S	S	S	S	S	S	S
ROOF MANHOLE	S	S	S	S	S	S	S	S	S	S	S	S
UNDERFLOOR UNLOADING CONVEYOR	O PS160	O PS160	O PS160	O PS160	O PS160 or PS220	O PS160 or PS220	O PS160 or PS220	O PS160 or PS220	O PS160 or PS220	O PS220	O PS220	O PS220
INTERNAL SCREW CONVEYOR PSW	NA	NA	O PSW60	O PSW60	O PSW60	O PSW220- BIN100	O PSW220- BIN100	O PSW220- BIN200	O PSW220- BIN200	O PSW500	O PSW1000	O PSW1500
SET OF STEEL SCREWS WITH ANTI-CORROSION COATING	S	S	S	S	S	S	S	S	S	S	S	S



A fan is a necessary accessory in each silo.



It is forbidden to install the sack-filling device without an aerodynamic pipe in BIN100, NBIN60WW and NBIN20WW silos.



When an unloading sleeve is not included in a design of BIN60 and BIN100 silos, an appropriate emergency duct should be installed.

3. Initial operations and preparing the conveyor for operation

3.1. Investor initial activities

3.1.1. Formal and legal arrangements for the investment

Silos should be erected in accordance with the current Construction Law:

- the Construction Law of 7 July 1994 (Journal of Laws No. 89, item 414, as amended),
- the Regulation of the Minister of Agriculture and Rural Development of 13 January 2023 concerning technical requirements that should be met by agricultural constructions and their location (Journal of Laws 2023, item 297, as amended).

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

A building permit is required for the silo construction (excluding all silo models of the BIN10, BIN20, BIN60, and BIN100 type and NBIN200NU silos)¹. Before construction of the silos listed above, a relevant body should be notified. The investor is responsible for meeting all formal and legal issues, together with a building design. The designer is responsible for designing the foundations for silos and other equipment (when used) and for drawing up a land development plan. Guidelines for design of foundations and silo dimensions are specified in this Operating Manual. The whole silo design documentation was drawn up at BIN spółka z o.o.

The silos were designed in accordance with current standards and legislation, and are intended to be used in climate conditions of Poland for:

a) wind load

The II terrain category was selected, defined in the standard PN-EN 1991-1-4 as terrains with low vegetation and with low isolated obstacles with separations of at least 20 obstacle heights. II, III and IV terrain categories are also accepted, but the design does not provide for construction of silos with catwalks at the sea and shore terrains, lakes and terrains without terrain obstacles, belonging to more stringent terrain categories.

In 1 and 3 wind zones, for the height $A \leq$ of 300m amsl, construction of NBIN20W and NBIN20WR silos without additional anchoring is permitted (basic wind velocity, $v_{b,0} = 22$ m/s).

In 1 and 3 wind zones, for the height A of ≤ 600 m amsl, and in the 2 wind zone regardless of the height, construction of the following silos is permitted (basic wind velocity, $v_{b,0} = 26$ m/s):

- silos of BIN10, BIN60, BIN200, BIN500, BIN1000 and BIN1500 type,
- NBIN20W silos, provided additional anchoring is ensured.
- BIN100 silos without a service catwalk;
- NBIN100U, NBIN100RU and NBIN101U silos with a service catwalk;
- NBIN100WU, NBIN100WRU and NBIN101WU silos with a service catwalk, provided additional anchoring is ensured;

b) Snow load

For all BIN silos, assumptions for snow load zones correspond to the snow load on the ground of a specific value of $s_k = 1.6$ kN/m². This value corresponds to 2 and 4 zones, and zone 1 to the height of 428m amsl, and zone 3 to the height of 366m amsl (according to PN-EN 1991-1-3).

3.1.2. Silo location

Silos are installed outdoors. Silo installation inside is permitted provided sufficient space is ensured. A design provides for silo installation on a slope of an incline not exceeding 5%.

Due to the installation technology and operational activities in the future, as well as the silo maintenance, it is required for all structures and machines to be located at least 1.0m away from the silo shell. It is forbidden to install a silo near or under power lines.

Silos can be erected at a minimum distance of 15m away from storage of organic fertilisers: manure, liquid manure, and similar.

¹ On a basis of Article 29.1.c - Construction Law

3.1.3. Ordering a silo

Orders for silos 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 customer should consult the manufacturer or a sales representative in detail about planned investment.

The manufacturer prepares the silo before shipment in accordance with a specification. The specification is attached to the shipped components.

3.2.3. Transport of silo components

Silos are delivered as components packed on pallets. Transport of the components is arranged by a seller or a customer, under an additional agreement. The components require a vehicle of dimensions and load capacity resulting from data provided in Table 5. 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 provided in Table 5. During a delivery acceptance, a silo buyer is obliged to check the delivery completeness against the specification attached to the components.



SILO COMPONENTS MUST BE SECURED AGAINST MOISTURE DURING THEIR TRANSPORT AND STORAGE.

When the components become wet, they must be dried thoroughly. This applies, in particular, to silo shell and roof components. Storage of wet components may result in forming of permanent white spots on a surface of metal of which the silo is constructed. The producer shall not be held responsible for the above-mentioned defects resulting from non-adherence to the recommendations.

Table 5. Dimensions of the longest and the heaviest pallets with silo components prepared for transport

SILO	Length of the longest pallet [m]	Weight of the longest pallet [tonne]
NBIN10	2.1	0.41
NBIN10W	2.1	0.55
NBIN20N	2.1	0.76
NBIN20	2.1	0.81
NBIN20W	2.1	0.92
NBIN20WW	2.1	1.03
NBIN60	3.15	1.41
NBIN60W	3.15	1.58
NBIN60WW	3.15	1.80
NBIN100U	3.15	2.21
NBIN100WU	3.15	2.69
NBIN101U	3.15	2.35
NBIN101WU	3.15	2.86
NBIN200NU	3.15	2.10
NBIN200U	3.15	2.10
NBIN200WU	3.5	2.50
NBIN500	4.0	2.40
NBIN501	4.0	2.70
NBIN500W	4.0	2.10
NBIN501W	4.0	2.60
NBIN1001	4.0	2.45
NBIN1001W	4.0	2.15
NBIN1500_N	4.0	2.44
NBIN1500_P	4.0	2.68
NBIN1500	4.0	2.45
NBIN1500_W	4.0	2.45

Concrete floor supports are delivered on pallets - weight of a pallet with concrete supports does not exceed 2000kg.



IT IS FORBIDDEN TO CARRY THE PALLETS ABOVE PEOPLE AND ANIMALS

3.3. Information on installation

Installation of the silo requires use of special equipment, and relevant know-how. Therefore, the silo can only be installed by an installation company authorised by BIN. The installation company should cooperate with an entity ordering installation, in terms of works organisation, financial settlements, and acceptance of installation works. Due to risks related to the installation works, it is forbidden for the investor or other companies not authorised by BIN to perform these works. The installation works can be started when a correct foundation slab is constructed and all silo components, including concrete floor supports and machines working with the silo (such as unloading conveyors PS/PSW) are gathered in a relevant location.

In addition, the installation company authorized by BIN should install the provided equipment of the silo during assembly, except for the execution and connection to the wiring.

The investor is responsible for construction of the required wiring. The investor should order performance of the above activities from a licensed electrician, in accordance with current legislation and an individual design of the facilities.

3.4. Investor final activities



LACK OF THE REQUIRED ANCHORING FOR THE SILO MAY RESULT IN ITS DESTRUCTION AND IN A THREAT TO HUMAN HEALTH OR LIFE.

3.4.1. Silo anchoring with rawlplugs

Steel anchors are screwed with steel rawlplugs to the foundation slab. A torque required for the steel rawlplugs is 70Nm. The rawlplug should be installed at least 120mm from the foundation slab edge. The number of rawlplugs installed for the silo depending on its type is specified in Table 1. The silo is installed by an installation company according to a direct order from the investor. During the installation works the investor is obliged to check and ensure itself that all above activities are performed correctly.

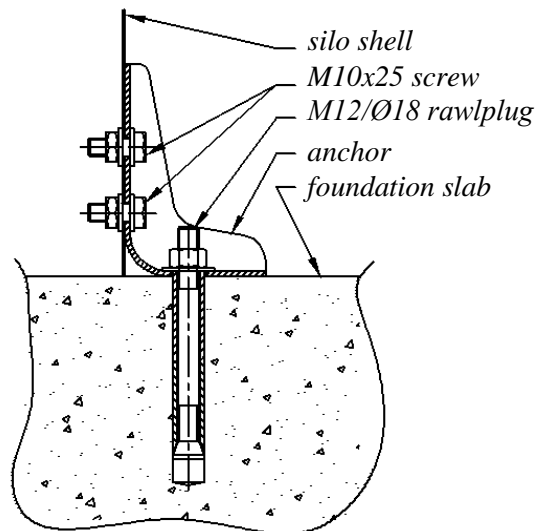


Figure 22. A diagram for silo anchoring with rawlplugs

3.4.2. Silo anchoring with chemical anchors

The action consists in connecting 8 mm-thick steel anchor sheets the foundation slab, using M20 or M24 steel glued-in anchors with a resin ampoule. The works related to silo anchoring should be performed while adhering to the rules and conditions for the installation of glued-in anchors specified by their manufacturer in a relevant installation manual. The installation of the silo is carried out by an installation company under the investor's direct order. During the installation works, the investor is obliged to check and ensure itself that all above activities are performed correctly.

Table 6. Data for gluing in chemical anchors

Chemical anchor	Effective anchoring depth h_{ef} [mm]	Torque for Fisher anchor [Nm]	Torque for Hilti anchor [Nm]	Drilled hole diameter d_o [mm]	Wire brush diameter d_b [mm]
M20	170	120	150	24	27
M24	210	150	200	28	30

The minimum distance from the concrete edge, as specified by the manufacturer of chemical anchors is 120 mm; however, the required minimum distance is specified in the building design of a specific silo.

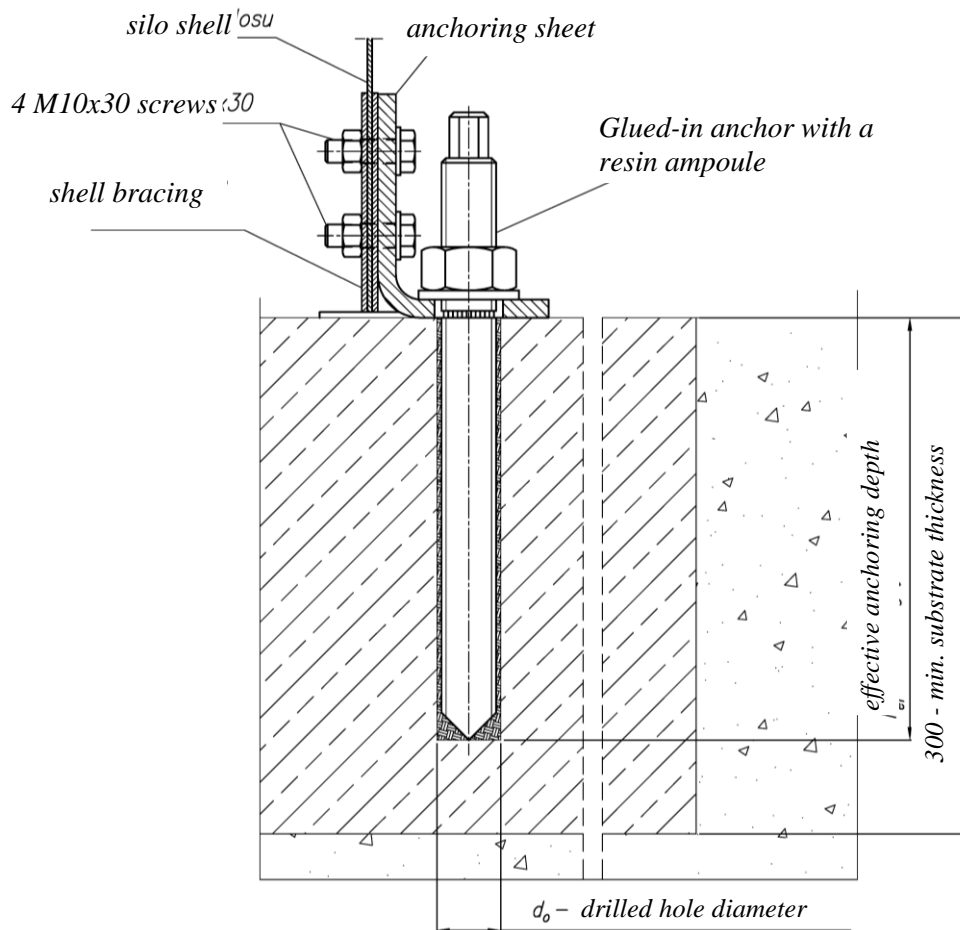


Figure 23. A diagram for silo anchoring with chemical anchors

3.4.3. Electric shock protection - lightning arrestor system

The silos should be protected against consequences of a lightning stroke. A system must be provided, protecting people and animals against the electric shock, associated with devices and machines installed in the silo. The investor is obliged to provide the electric shock protection for people and animals, and to construct the lightning arrestor system and the protective earthing of the silo. An order for construction and performance verification of the silo lightning arrestor system and protective earthing should be placed with a person holding required qualifications.

3.4.4. Fire prevention measures

The investor is responsible for meeting all requirements related to fire prevention. They include ensuring of: access and emergency escape routes, access to sources of water for extinguishing, distribution of extinguishing equipment and fire safety instructions. Fire prevention issues are governed by the Minister of Interior and Administration Regulation of 7 June 2010 concerning fire prevention in buildings, other structures, and terrains (Journal of Laws, 2010, No. 109, item 719) and the Minister of Interior and Administration Regulation of 24 July 2009 concerning supplies of water for extinguishing purposes and fire department access roads (Journal of Laws 2009, No. 124, Item 1030).

3.4.5. Shell sealing at the base edge

The investor installs the shell sealing at the edge base after the silo is anchored.

The sealing is installed to:

1. Level the foundation slab when necessary, so the silo shell rests on the foundations along its complete circumference.
2. Prevent penetration of precipitation water flowing down the silo under the floor.
3. Prevent air losses during grain drying with a fan.

The sealing has a form of a concrete overlay along the whole circumference of the silo shell base. When concrete hardens, the overlay should be additionally sealed with sealant (trade name - BOLL brushable sealant) along the whole silo circumference, where the overlay joins the foundation slab and the silo shell

"BOLL brushable sealant" is a rubber-based one-component sealant that hardens at a room temperature through solvent evaporation.

The sealant can be purchased at BIN Sp. z o.o. (not a standard silo accessory). The sealant can be used on silos constructed in previous years. Defects or damages in the sealing coating must be repaired with the same sealant.



The overlay dimensions must conform to a description in the diagram below.

Failure to construct the overlay results in loss of the warranty.

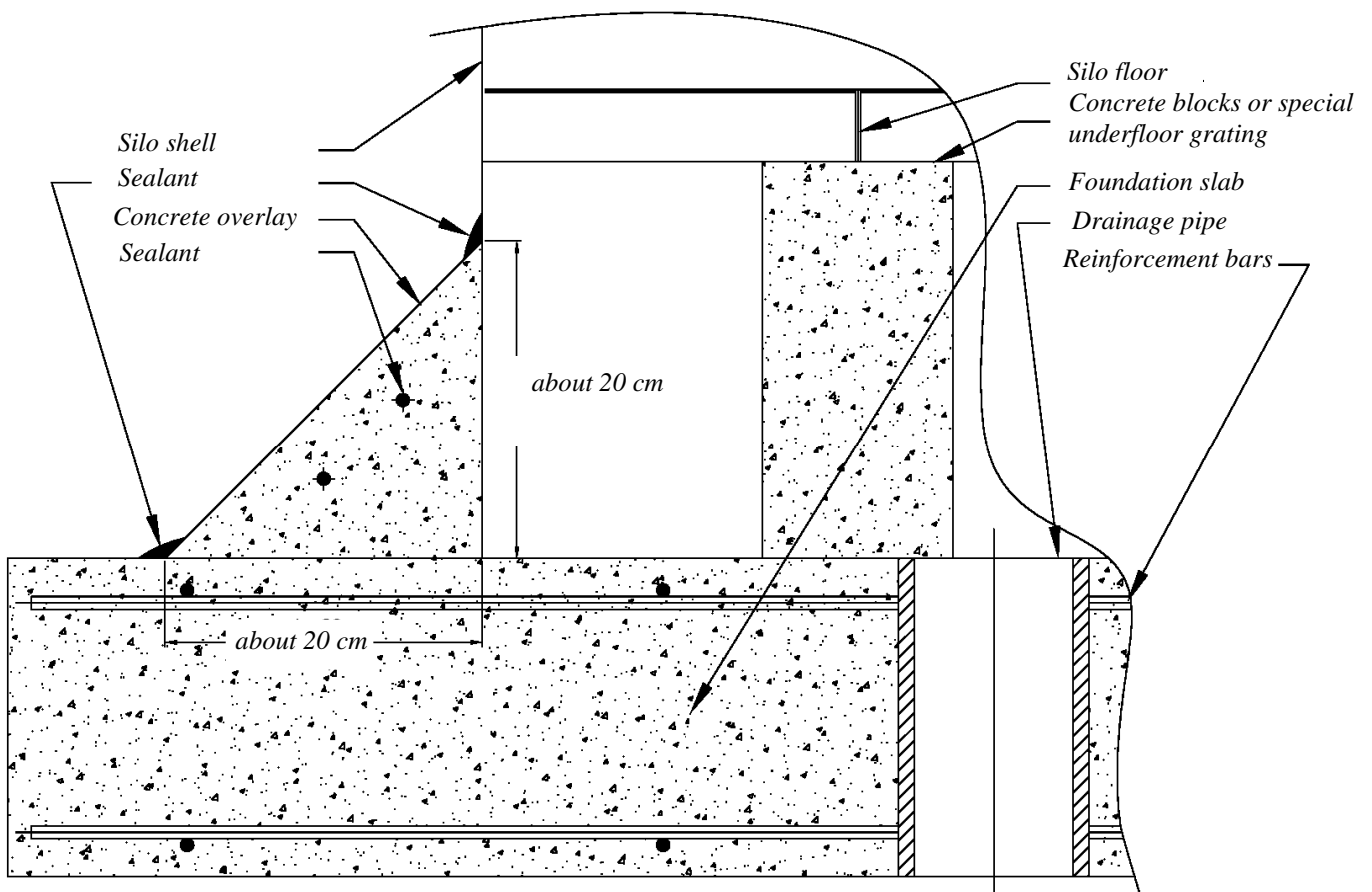


Figure 24. Diagram of shell sealing at the base edge

3.4.6. Installation of power delivery points

Power delivery points and power supply for accessories should be installed by an authorised electrician, in accordance with current legislation and an individual design of a structure.

4. Operation

4.1. Silo operation

A sequence of operations during silo loading (Fig. 25) - Example:

- 1) close the unloading shutter Z2;
- 2) open the loading shutter Z1;
- 3) set the five-way separator, R5, in a position to the loading conveyor PZ;
- 4) start the grain spreader, RZ;
- 5) start the loading conveyor, PZ;
- 6) start the bucket conveyor, PK;
- 7) start the inlet hopper, KP;
- 8) unload the transport vehicle, PT.

When the silo loading is completed, stop the specified equipment in the order reverse to the described above.

A sequence of operations during silo unloading (Fig. 26) - Example:

- 1) set the five-way separator, R5, in a position to a transport vehicle, PT;
- 2) check, and when necessary, close the unloading shutter, Z2,
- 3) start the bucket conveyor, PK;
- 4) start the underfloor conveyor, PP;
- 5) gradually and slowly open the unloading shutter Z2 (open the shutter Z2 so the PP, PK or other conveyors are not blocked); the silo unloading process can be stopped by performing in reverse the actions described above.

When the transported material stops to flow gravitationally to the shutter Z2, stop the unloading (as specified in item 5). Check if an opening of the shutter Z2 and the internal conveyor PW (in the silo axis) are not covered with material stored in the silo.

When the above conditions are met, the unloading may proceed as follows:

- 6) check and, whenever necessary, set the five-way separator, R5, in a position to a transport vehicle, PT;
- 7) start the bucket conveyor, PK;
- 8) start the underfloor conveyor, PP;
- 9) start the internal conveyor, PW;

When the transported material stops to flow to the shutter Z2, stop the unloading (as specified in item 5). The internal conveyor PW must be removed from a special support, the guards must be opened, etc. (depending on a model of the silo and the internal conveyor).

When the above conditions are met, the unloading may proceed as follows:

- 10) check and, whenever necessary, set the five-way separator, R5, in a position to a transport vehicle, PT;
- 11) start the bucket conveyor, PK;
- 12) start the underfloor conveyor, PP;
- 13) start the internal conveyor, PW

The unloading can be conducted until the transported material stops to flow to the shutter Z2, then stop the unloading (as specified in item 5).

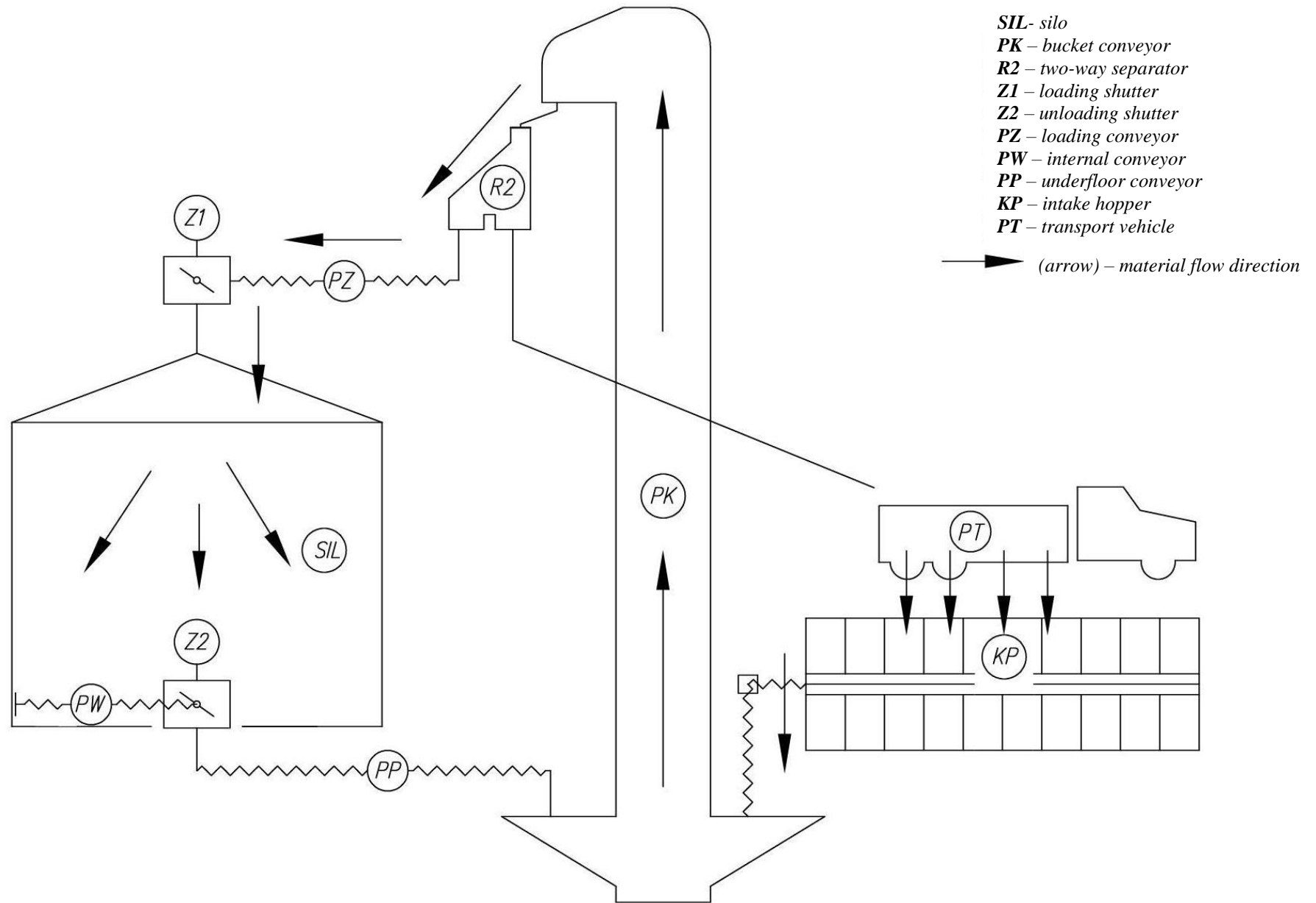
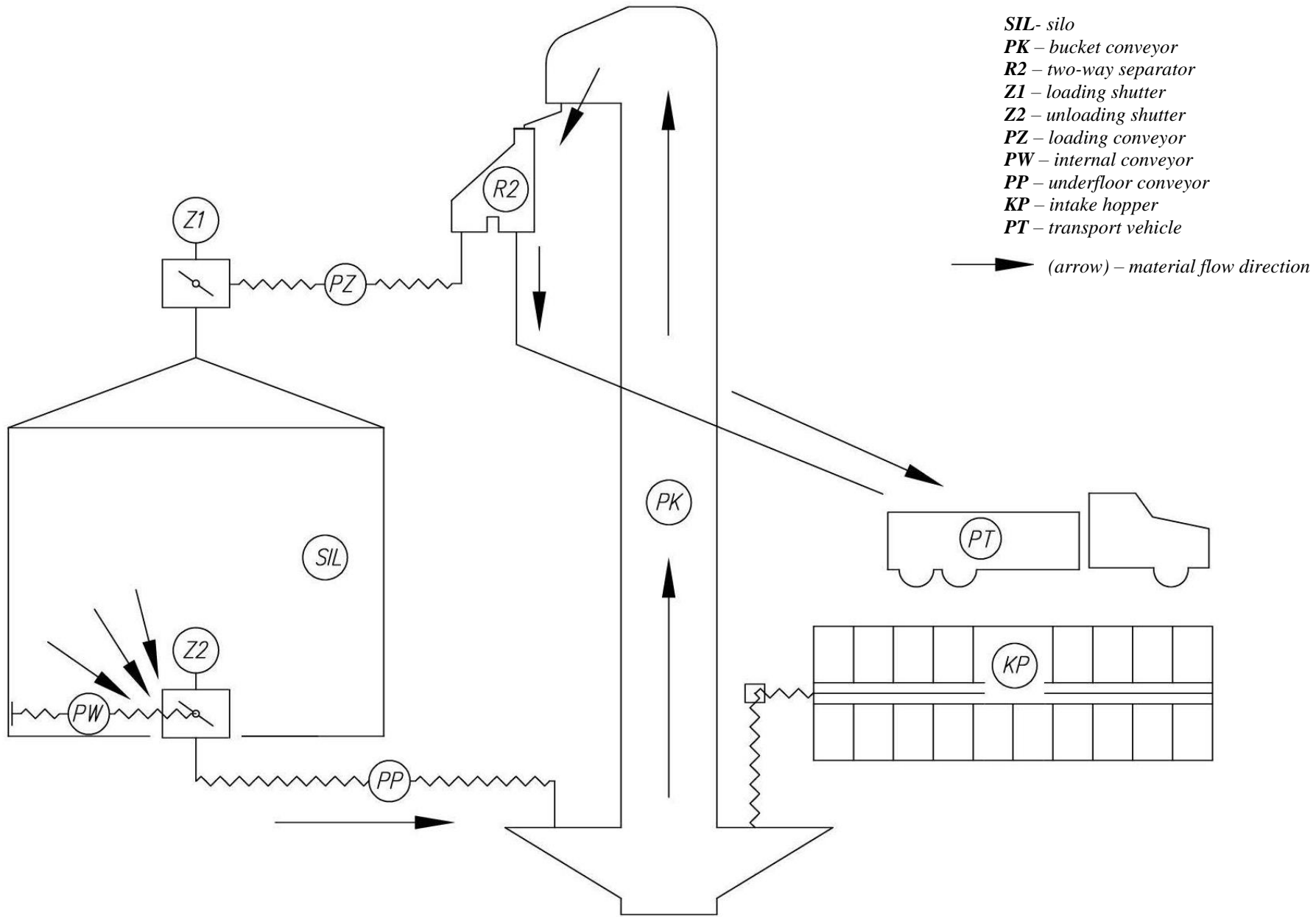


Figure 25. A diagram for loading of BIN silos with most common sets of equipment.



4.1.1. Grain loading into a silo

Each silo should be equipped with devices for loading of grain. Loading can be performed with pneumatic transport or with a screw or a bucket conveyor. Recommended loading methods, depending on needs and silo equipment, are provided in Table 2.

All silos have the grain inlet installed in the silo axis (centrally). This location of the silo ensures the silo walls are loaded evenly (equal grain pressure on the walls along the whole circumference).

In silos of the BIN10, BIN20, BIN60, and BIN100 type and in NBIN200NU and NBIN200U silos, a side inlet for pneumatic loading can also be used. All loading equipment attached to the silo should be installed in a way not damaging the silo (Fig. 27). This applies, in particular, to loading pipes of bucket conveyors supported on the silo roof. These pipes should only be connected to special spigots in the silo collar. A downpipe of a lift must be connected to an inlet spigot in a way preventing load transfer from the lift onto the silo roof.

The producer shall not be held responsible for any silo defects resulting from non-adherence to the above recommendations.

1. The pneumatic loading is conducted through an inlet pipe of $\phi 180\text{mm}$ in diameter, installed in the silo. This loading method is recommended for smaller silos, i.e., when a rate of a few tonnes per hour can be considered satisfying. It should be noted that the blower efficiency to a large extent depends on the silo height. During the pneumatic loading, the silo manhole should be kept open.
2. Loading with a vertical screw conveyor is intended for small silos (from BIN10 to BIN200) or small groups of silos.
3. Loading with a bucket conveyor usually is used for large silos (NBIN200U, NBIN200WU, BIN500, BIN1000, and BIN1500) or sets of silos.

Loading of silos should be carried out so as not to exceed output of 60 tons per hour for the silos of the type ranging from BIN10 to BIN200, and 150 tons per hour for the silos of the BIN500 type and larger. A higher output may result in the permanent deformation of the silo and, in consequence, its damage.

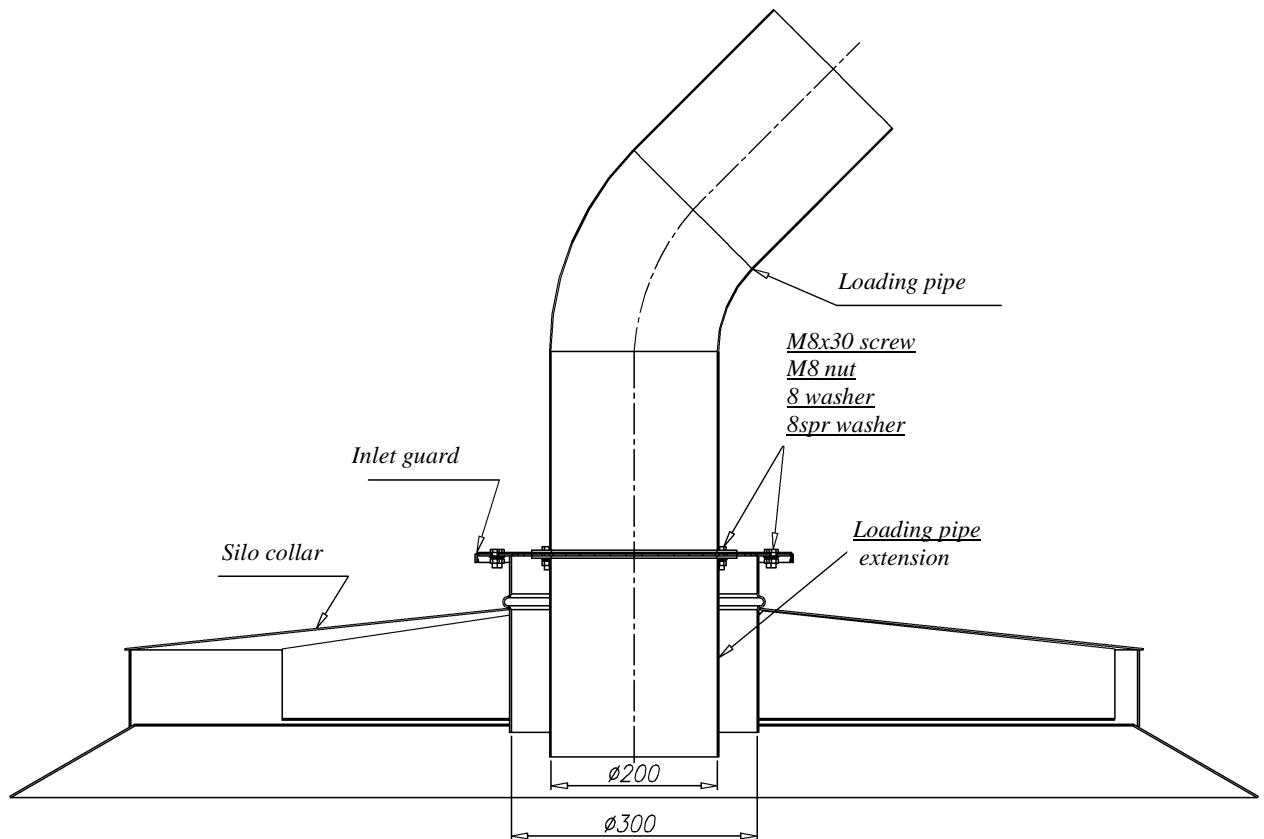


Figure 27. Correct installation of loading pipes in the roof collar of BIN500, BIN1000 and BIN1500 silos.

Before starting to load the silo:

- 1) check the operational condition of the silo and its accessories;
- 2) make sure there are no people in the silo;
- 3) close the bottom manhole of the silo (if installed);
- 4) close openings for grain unloading.

During loading continuously monitor the level of silo filling.

For loading equipment, strictly adhere to rules of their operation as described in the relevant Operating Manual.

4.1.2. Grain storage

Grain in the silo can be stored for a long time without losing its quality, provided the following rules are observed:

1. grain cannot be contaminated;
2. it should have a specified moisture content (Table 7);
3. a user should continuously monitor temperature of the stored grain;
4. freshly poured grain must be cooled thoroughly;
5. regardless of its moisture content, grain should be regularly ventilated with an appropriate fan;
6. when grain is affected by pest, conduct fumigation;
7. always remember to secure the silo against penetration of precipitation water;
8. when grain becomes wet, remove it from the silo immediately and dry.

Grain stored in the silo must be inspected at least once a week.

More detailed information on grain storage can be found in a textbook by A. Ryniecki "Dobrze przechowane zboże" ("Correctly stored grain"). This textbook can be purchased from BIN.

Note: Failure to follow rules for grain storage may result in significant deterioration in its quality or destruction of the whole silo load, as well as in numerous situations that can affect safety of the silo and its operators.

The worst hazard is so-called grain bridging. This situation can:

- completely prevent silo unloading;
- destroy the silo due to "bump" of the bridged mass after the silo is partly emptied;
- result in formation of empty cavities in the mass of grain during its unloading.



Due to the above-mentioned hazards, it is strictly forbidden to climb onto a layer of grain.

Table 7. Safe moisture content for grain (for the Polish climate, Data prepared on a basis of the study "Dobrze przechowane zboże" by A. Ryniecki)

Grain type and storage duration	Safe moisture content of the grain [%]
Wheat, rye, triticale, barley, and oats: stored for up to 6 months	14
stored for longer than 6 months	13
Rapeseed: stored for up to 6 months	8
stored for longer than 6 months	7
Maize: fodder, used by spring	15.5
stored for 6–12 months	14
stored for longer than 12 months	13

Cereal and maize grain, and oilseeds are nearly always stored in the silo with some contaminations, pests and microorganisms, therefore, they are a very difficult material for storage. Their physical and biological parameters may change within a relatively extensive range, and during various periods of storage. Basic parameters decisive for the condition of the stored material, and relatively easy to monitor during storage are temperature and moisture content of the stored material. Temperature and moisture content have a crucial influence on a length of a period for which grain or seed can be (safely) stored, as shown in diagrams in Figs. 28 and 29.

BIN silos and other machines and devices working with them do not have any design limitations concerning temperature and moisture content of materials stored in them within the scopes presented in Figs. 28 and 29. However, acceptable periods for safe storage must be strictly adhered to due to a risk of deterioration in the material quality which may lead to bridging of grain or seeds, and in consequence, prevent the silo unloading or loading, create empty spaces in the material, etc. Bridging or forming of empty spaces (cavities) in the stored material may result in complete deformation of the silo and thus its irreversible damage requiring its withdrawal from operation.

For example: the chart shows that cereal grain of 5°C and moisture content of ca. 14% can be stored safely for ca. 2.5 years, while cereal grain of 15°C and moisture content of ca. 16% can be stored safely for only ca. 3 months.

Maintaining required temperature and moisture content throughout the material storage is equally important as achieving these parameters. For this purpose, BIN silos were equipped with active ventilation devices that must be used regularly to ventilate grain and seeds. When the temperature or moisture content increases despite ventilation, then:

- shorten the storage period appropriately;
- when technically feasible, use unloading/loading equipment for grain circulation in a closed flow circuit, that is, unload the silo directly into its loading equipment (simultaneous unloading and loading of the same silo);
- unload the silo and dry grain in a continuous, batch, mobile or other dryer.

The examples presented above are most common methods for bringing the stored material to required storage parameters.

Grain stored in the silo should be inspected periodically, by collecting samples and determining their moisture content. When necessary and possible, also test other parameters important for storage conditions in the silo.

Sampling frequency should depend on a condition of the stored material. Grain temperature is another important parameter besides the moisture content, and it can be measured, e.g., with the STW-100 thermometer from BIN (described in section 2.4 of this Operating Manual).

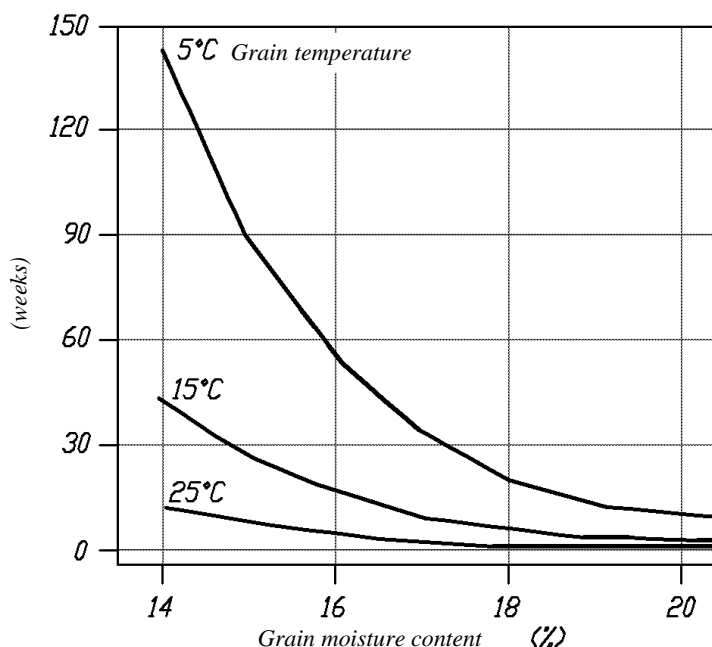


Figure 28. A time of safe grain storage depending on visible mould development (sometimes called an acceptable storage time); this time strongly depends on grain moisture content and temperature [after "Dobre Przechowywane Zboże" A.Ryniecki and P.Szymański].

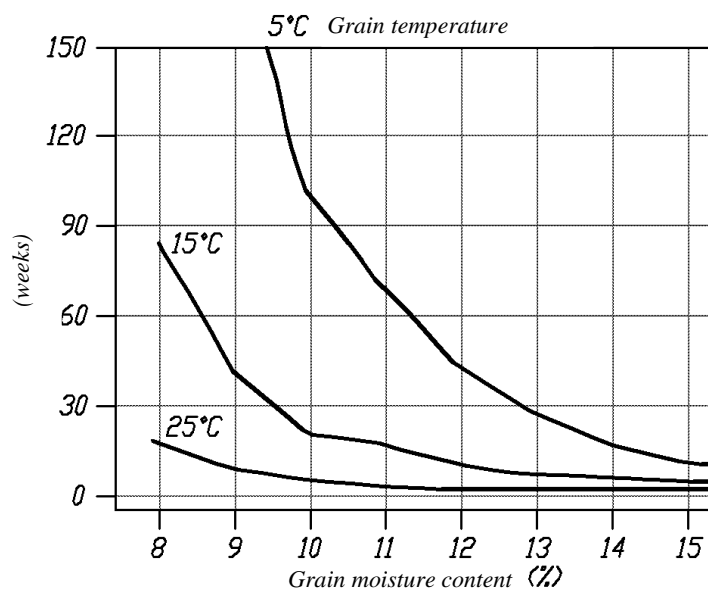


Figure 29. A time of safe rapeseed storage depending on visible mould development (sometimes called an acceptable storage time); this time strongly depends on grain moisture content and temperature [after "Dobrze Przechowywane Zboże" A. Ryniecki and P. Szymański].

4.1.3. Fan selection

A standard feature of each silo is a perforated floor facilitating even flow of air through a whole layer of grain stored in the silo when using an appropriate fan.

A correctly selected fan ensures a correct dose of air flowing through a grain layer. The dose here is understood as an amount of air flowing through 1 tonne of grain during one hour. E.g., when a capacity of the fan connected to the silo containing 60 tonnes of grain is 6000m³/h then the hourly dose is 100m³/tonne. It should be remembered that when grain is dried in a silo with air of relatively low moisture content, then the larger the air dose, the better the results of drying. When planning to purchase a new fan the user should consult the silo manufacturer about its usefulness, or can itself establish its required capacity and fan pressure using the provided chart and the description below:

1. Determine the loading capacity of a silo: e.g., NBIN60 - 60 ton (Wall height of 4.75m).
2. Determine the required air dose: e.g. 55m³/tonne.
3. Calculate the fan capacity: Capacity = Load capacity x Dose; Capacity = 60 tonnes x 55m³/tonne = 3300 m³/hour
4. In the chart, draw a vertical line representing the height of the grain layer in the silo. Example: Line 1.
5. In the chart, draw a horizontal line at a point where the vertical line crosses the line for the required dose. Example: Line 2.
6. Where the horizontal line crosses the vertical axis of the chart read the required fan pressure. Example: Pressure = 8cm of the water column = 8cm x 100 = 800Pa.

The above calculations show that to provide a dose of 55 m³/tonne of air in the NBIN60 silo, a fan of 3300 m³/h capacity and pressure of 800Pa must be used.

For BIN silos of load capacity ranging from 10 tonnes (NBIN10) to 250 tonnes (NBIN200WU), it is recommended to use a fan of the PPZ-7.5-WNT type with a 7.5kW motor, manufactured by BIN. (This fan is a part of the grain blower). For BIN500, BIN1000 and BIN1500 silos a fan of the WPR11, WPR15, or WPS-40 type is recommended.



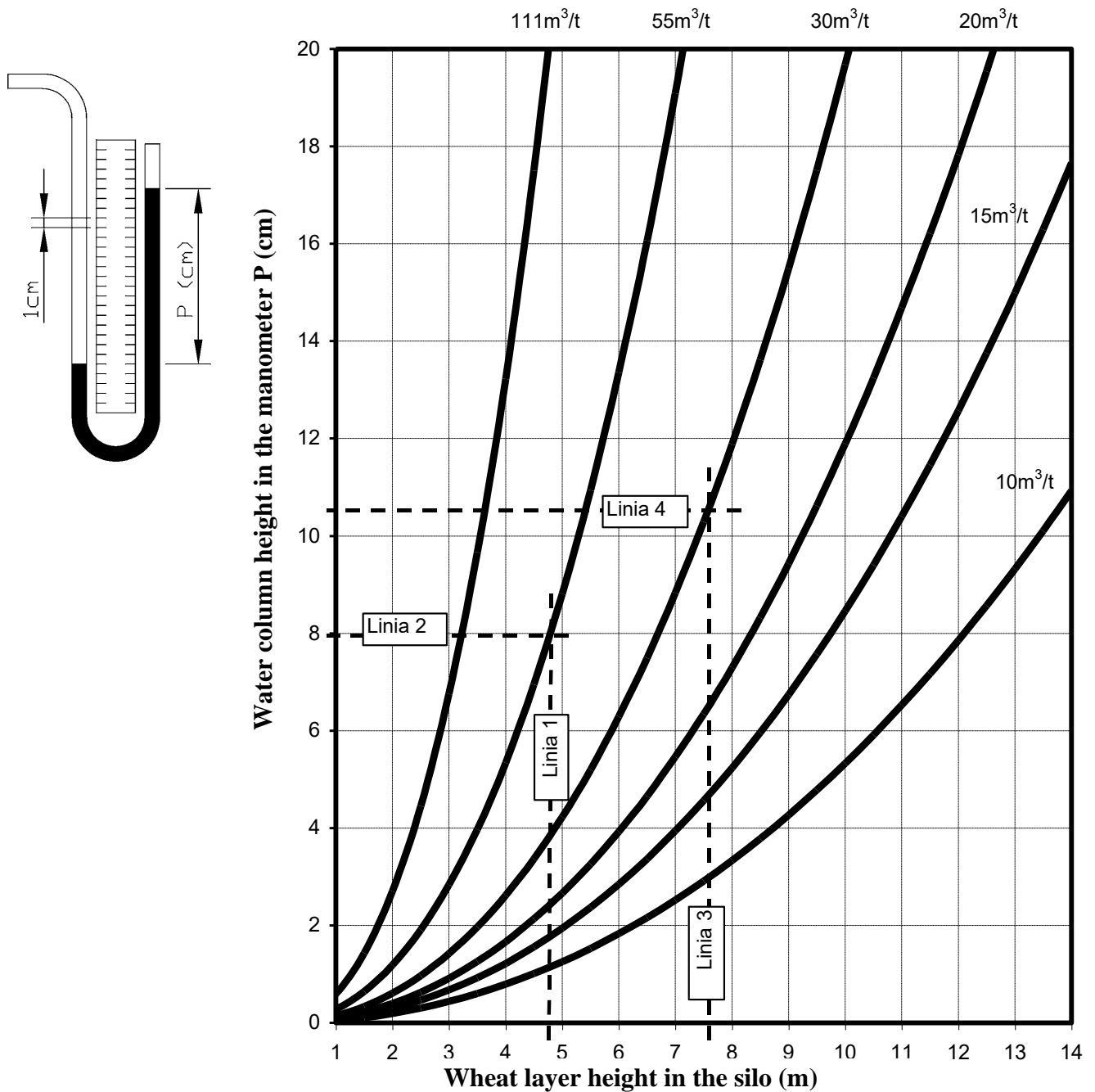
The WPR fan requires construction of a special connection at the silo installation stage, so the fan can be used in one or in two adjoining silos. Therefore, installation of the WPR fan silo should be provided for at the design and the construction of silo foundation slabs stages. Guidelines for construction of appropriate foundation slabs should be obtained from BIN Sp. z o.o.

4.1.4. Measurements of an air dose flowing through a silo

When a user has its own fan, it can be connected to the silo, and the dose of air flowing through a grain layer in the silo can be determined using the installed manometer and the provided chart, as follows:

1. Fill the manometer tube with clean water to the half of the tube height.
2. Level the layer of grain in the silo and determine the layer height as m.
3. Start the fan.
4. Read a distance between the water surfaces in both manometer tubes using a scale on its casing. Scale notches are spaced every 1 cm. Example: 10cm, 5cm.
5. In the chart, draw a vertical line representing the height of the grain layer in the silo. Example: Line 3.–7.5m
6. In the chart, draw a vertical line representing the height of the water column in the manometer. Example: Line 4.
7. Read the obtained air dose in the chart. In the example shown in the chart a dose of 30 m³/tonne was obtained.

A chart for calculation of an hourly dose of air flowing through wheat



The chart shown above is indicative only. The actual air flow parameters depend on the grain type, moisture content, contamination level, loading method, storage time, type of the fan connection and other factors.

4.1.5. Grain sampling for moisture content measurements

To measure grain moisture content its samples must be collected. Samples can either collected from a top layer, entering the silo on the internal ladder or by starting the unloading equipment and unloading certain amount of grain from the silo. The second method is considered to be more reliable because grain from various layers is mixed.

4.1.6. Grain unloading

Each silo should be equipped with devices for unloading of grain.

The following unloading methods are acceptable:

- unloading through a factory-installed sack-filling device;
- unloading with an universal screw conveyor inserted into the unloading sleeve;
- unloading with a system of BIN PS/PSW conveyors.

Recommended unloading methods, depending on a silo type, needs and silo equipment, are provided in Table 2.

Because the silo bottom is flat, some grain (Table 8) cannot be get into the outlet automatically. Therefore, regardless of the unloading method, it always has two stages:

- stage 1 - when grain automatically (gravitationally) flows to the unloading device.
- stage 2 - at the end of unloading, when grain remaining in the silo (Table 8) must be shovelled (manually or mechanically) to the inlet of the unloading device.

For smaller BIN10 and BIN20 silos unloading with an in-built sack-filling device or the universal conveyor through an unloading duct is foreseen. For BIN60 and larger silos it is recommended to use a system of PW/PSW screw conveyors manufactured by BIN, allowing completely mechanical unloading of grain from the silo.

Before starting the unloading equipment:

- check the operational condition of the unloading equipment;
- make sure there are no people in the silo.

The following rules must be followed during unloading:

- Silo unloading requires continuous supervision.
- For unloading equipment, strictly adhere to rules of their operation as described in the relevant Operating Manual.
- Manual shovelling of grain into the silo unloading sleeve or to the discharge opening in the floor requires all silo auxiliary equipment to be stopped first.
- In the event of the unloading equipment failure, when it cannot be repaired due to large quantities of grain stored in the silo, unload the grain through a sack-filling device or through an emergency duct in the silo, at the speed not exceeding 20 tonnes per hour. Higher speed may cause permanent silo deformation and, in consequence, its damage.
- It is forbidden to cut any holes in the silo shell or floor, for an emergency silo unloading.
- During silo unloading, the output of 60 tons per hour for the silo of the type ranging from BIN10 to BIN200, and 150 tonnes per hour for the silos of the BIN500 type and larger should not be exceeded. A higher output may result in the permanent deformation of the silo and, in consequence, its damage.

Silos from the BIN20 to BIN100 range can also be unloaded through an inclined unloading sleeve - Table 4. In silos from the BIN200 to BIN1500 range an option for the emergency unloading is foreseen, through a special emergency unloading duct - Table 4. These ducts can be used for inserting into the silo a conveyor to transport the stored material outside the silo. The unloading conveyors are not standard silo equipment.

Basic parameters for a conveyor for unloading silos from the BIN20 to BIN100 range:

- conveyor type - screw (recommended);
- outer diameter – Ø250mm (maximum outer diameter);
- capacity – 20 tonnes/h (maximum)
- length (minimum) – BIN20 – ca.3m, BIN60 – ca.3.8m, BIN100 – ca.4m

Basic parameters for a conveyor for emergency unloading silos from the BIN200 to BIN1500 range:

- conveyor type - screw (recommended);
- outer diameter – Ø250mm (maximum outer diameter);
- capacity – 20 tonnes/h (maximum)
- length (minimum) – BIN200 – ca.3m, BIN500 – ca.4m, BIN1000 – ca.5m, BIN1500 – ca.6m

Table 8. An indicative quantity of stored material (grain) that will remain in the silo after gravitational unloading through a central inlet is completed.

Silo type	Silo model	Remaining quantity of grain [t]*
BIN 10	NBIN10, NBIN10W	1.1
BIN 20	NBIN20N, NBIN20, NBIN20R, NBIN20W, NBIN20WR, NBIN20WW	3
BIN 60	NBIN60, NBIN60R, NBIN60W, NBIN60WR, NBIN60WW	8.5
BIN 100	NBIN100U, NBIN101U, NBIN100RU, NBIN100WU, NBIN100WRU	14.5
BIN 200	NBIN200U, NBIN200WU	28
BIN 500	NBIN500, NBIN501, NBIN500W, NBIN501W	59
BIN 1000	NBIN1001, NBIN1001W	138
BIN 1500	NBIN1500_N, NBIN1500_P, NBIN1500, NBIN1500_W	270

4.2. Silo maintenance

Correct and punctual maintenance inspections, maintenance and possible repairs guarantee availability of the full storage capacity of the silo and prevent its premature and excessive wear.

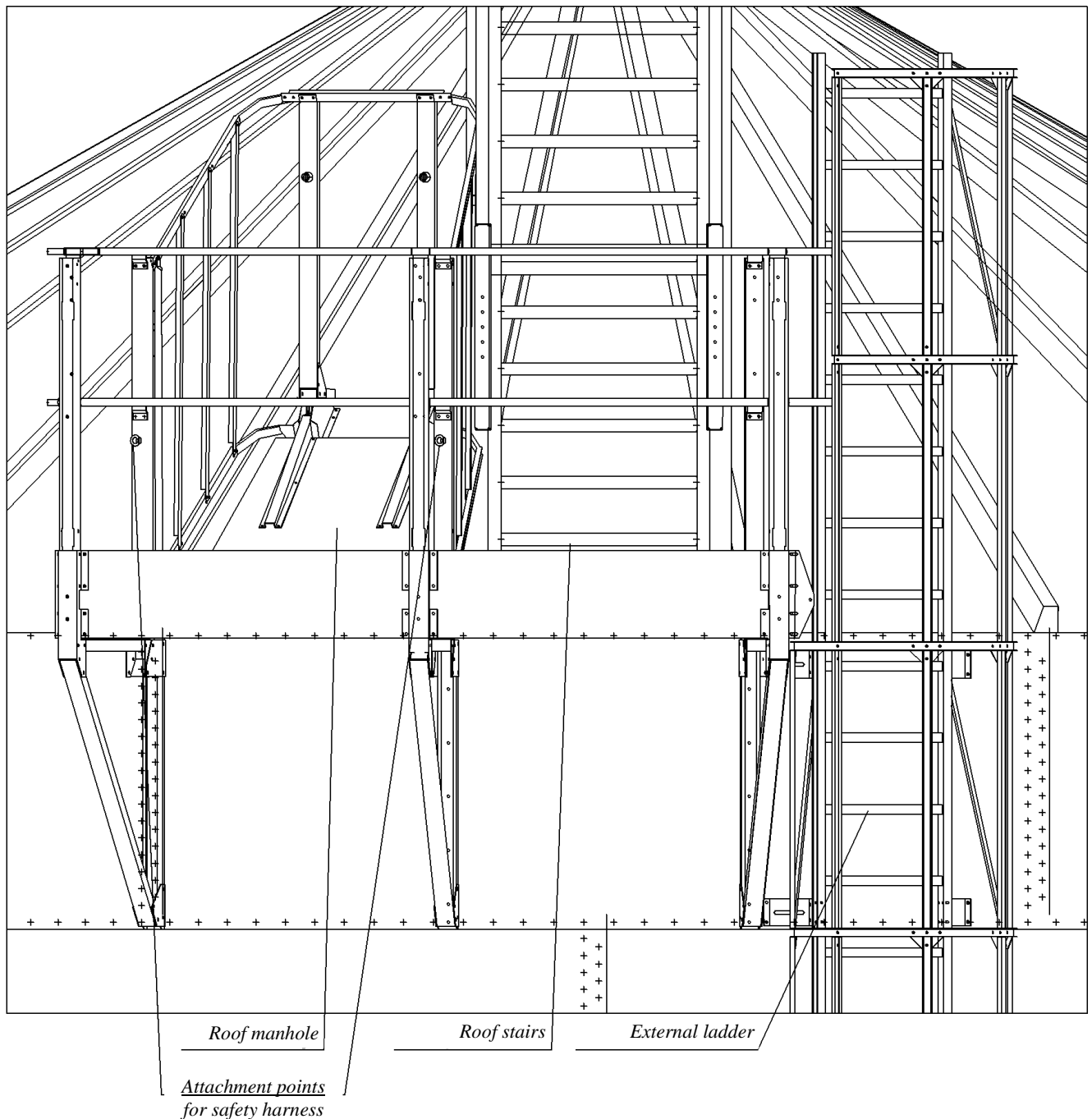


Figure 30. Access through an upper manhole to BIN100, BIN200, BIN500, BIN1000, and BIN1500

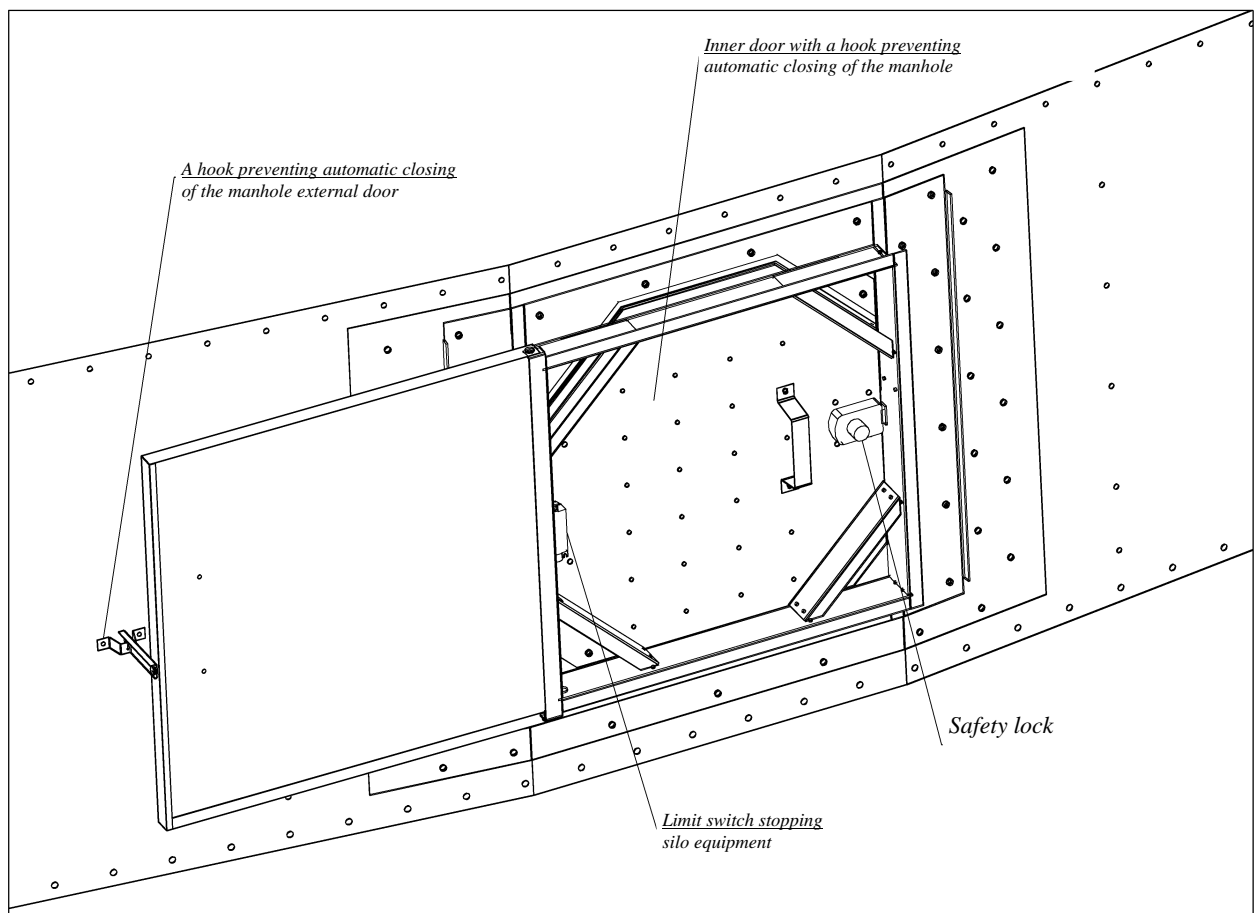


Figure 31. Access to a silo through a bottom manhole.

4.2.1. Periodic maintenance and regular repairs

Periodic maintenance covers:

- inspection of ladders and safety devices (secure fixing);
- inspection of a technical condition of a silo shell and bolted joints;
- inspection of fixing of covers, manholes, hinges, locks and devices securing against their automatic closure, as well as handles for their opening;
- inspection of closures of unloading openings;
- inspection of anti-corrosion coatings.

The technical condition of the bottom manhole must be checked after each unloading of the silo and before its each loading.

Before each loading of the silo, check the technical condition of the loading and unloading equipment, i.e., the conveyors installed in the silo (internal, underfloor, and other).

All safety devices, i.e., ladder covers, ladder safety equipment, safety railings, ladder fixing, and fixing of covers must be inspected at least once a month.

Other silo components must be inspected at least once every 12 months.

The regular repairs include small repairs, applying solid lubricant onto hinges and possible repairs of paint coats.

At least once every two years anti-corrosion coating of the shell below the floor level should be checked. When any corrosion foci are found, they should be removed, and anti-corrosion coating applied.

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

A person authorised to conduct inspections of construction facilities should participate in the annual inspection of the silo. The person conducting the inspection should draw up a report on verification of the silo operational condition.

A silo user should keep a logbook of silo maintenance records.

4.2.2. Overhaul

An overhaul is conducted at least once every 8 years. Its scope covers the regular repairs plus:

- painting of steel components;
- maintenance of the lightning system by an authorised electrician with drawing up of a relevant report;
- tests of fixing and security measures, with their possible strengthening;
- other relevant repairs.



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

4.2.3. Spare parts

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

- Device name
- Purchase document number
- Device model
- Year of production
- Serial number

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 equip the silo with spare parts.

4.2.4. Pest control

Pest control activities should be performed each time any grain pests are found. A general principle should be applied that no fresh grain is poured into the silo after grain affected by pests was unloaded before conducting necessary pest control activities. Pest control should be ordered at specialist companies, as there is a high risk of poisoning with chemical agents.

4.2.5. Disassembling and liquidation

Silos are devices made of materials not harmful to the environment and can be scrapped, and all their components can be recycled. During disassembling, particular attention should be paid to safety, due to their large dimensions and height. Disassembling should be ordered at a specialist company.

As of 23.06.2023 I approve for use the Operating Manual:

title - "Flat bottom silos BIN"

review - 47,

Issued on - 20.06.2023.

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 warranty becomes invalid when:
 - 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. BIN Sp. z o.o. guarantees correct anti-corrosion protection for manufactured hot-dip galvanised products. A minimum weight of zinc coating of 200 g/m² for all products made of hot-dip galvanised steel is required.
Furthermore, products can have parameters of no importance from an anti-corrosion protection point of view, and thus not covered by a warranty, such as:
 - different colouring, zinc coat shade, etc., on individual product components (depending on a material supplier);
 - visible cracks and scratches created in the metal sheet production process with a minimum zinc coating weight maintained.
3. 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.
4. 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

A customer notifies any defects found to the seller in writing.

No later than within 14 days, the seller shall notify the customer about a way of handling its complaint, a place and a time of warranty repair.

Manufacturer:

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

.....
Seller

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