



Technologies & Equipment for Wastewater Treatment

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# **OPERATION MANUAL**

# RAKE BAR SCREEN RKE







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# 1. INTRODUCTION

## 1.1. How to Use This Manual

This Operating Manual (hereinafter referred to as the Manual, OM) has been developed for the RKE Rake Bar Screen (hereinafter referred to as the screen) and applies to all modifications and standard typesizes of RKE screens.

This Manual is part of the technical documentation supplied with the screen, and is intended to provide all the information necessary for the correct and safe use of the equipment.

This Manual uses **DANGER!** and **ATTENTION!** symbols to remind you of the need to take all safety measures during installation, adjustment, operation and repair of the screen.



"DANGER!" symbol indicates danger to life and risk of injury to people if the recommendations are ignored.

"ATTENTION!" symbol indicates potential damage to equipment if recommendations are ignored.



**ATTENTION!** Before using the screen, maintenance personnel should carefully read this Manual and its annexes.

**ATTENTION!** This Operating Manual must be kept in a place accessible to maintenance personnel in the immediate vicinity of the equipment.

In cases where clarification of the information contained in this Manual is required, please contact the manufacturer.

# 1.2. Copyright

This Manual is copyright protected. All rights belong to PRODEKO-EŁK Sp. z o.o. Distribution or translation of this documentation into other languages, in whole or in parts, is only permitted with written agreement from PRODEKO-EŁK Sp. z o.o.

This Manual cannot be sold or transferred to third parties without the written permission of PRODEKO-EŁK Sp. z o.o.

#### **1.3.** Information Contained in the Manual

This Manual contains all the necessary information on transportation, installation, adjustment, operation, maintenance, equipment repair and personnel safety.

Due to the constant work to improve the equipment, design changes may be introduced that are not reflected in this Manual.

Data, images and descriptions cannot be used as a basis for making claims for the screens that are already supplied.

# 1.4. Manufacturer's Liability

#### Liability

- The manufacturer declines any liability for actions that the customer takes without following the instructions in this Manual.
- The manufacturer is not liable for direct or indirect damage caused by the following reasons:
- Use of equipment for purposes other than its intended use;
- Incorrect installation of equipment or its parts;
- Unauthorized changes in the design of the mechanical and electrical parts of the equipment;
- Repair works using non-original spare parts, with the exception of standardized, equivalent and standard spare parts;
- Maintenance and repair of equipment by unqualified and untrained personnel;
- Improper performance of work on the operation, maintenance and repair of equipment;



- Incorrect connection of power supply to the equipment;
- Improper transportation and storage of equipment;
- Non-compliance with the requirements of the Operation Manual;
- Non-observance of the safety instructions.

#### 1.5. Warranty

- Warranty conditions are specified in the contract and the equipment passport.
- Claims for the operation of the equipment during the warranty period must be submitted by the Customer in writing (by attaching a photo, video material) immediately after the discovery of a defect or non-compliance of the equipment with the requirements set out in this Manual.



**ATTENTION!** The warranty does not apply to components that are out of order due to non-compliance with the manufacturer's operating manuals.

ATTENTION! The warranty does not cover fast wearing parts.

Warranty obligations lose their validity in cases of the use of the screen for other purposes, changes in the original screen design without agreement with the manufacturer, the use of non-original spare parts and operation deficiency.

When performing maintenance or repairs, ALWAYS complete the Operation and maintenance log (ANNEX C). The presence of a completed Operation and maintenance log is a prerequisite for filing complaints.



### 2. SAFETY MEASURES

#### 2.1. General Safety Instructions

The equipment is designed and manufactured taking into account safety requirements and provides the maximum degree of safety for operating personnel when using it for its intended purpose and following the requirements of this Manual.

This Operating Manual contains basic safety instructions that should be followed during the installation, operation and maintenance of the equipment. The personnel responsible for the installation, operation and maintenance of the equipment shall have the relevant qualification.

Maintenance personnel should be tested at least twice a year for their knowledge of the basic safety requirements outlined in this Manual. Personnel who have not been tested for knowledge of the safety requirements set out in this Manual must not be allowed to operate the equipment.

In addition to the general safety precautions mentioned in this chapter, the requirements in the main sections of this Manual, the manuals for spare parts and the specialized safety instructions applicable at the site where the equipment is operated should be followed.

The equipment is subject to all safety requirements for the operation of electrical equipment.

# 2.2. Definition of Safety Signs on the Unit



# 2.3. Instructions for Safety Measures During the Work

Transport, storage, electrical connection, commissioning, maintenance and repair of the equipment shall be carried out by qualified personnel.

The installation of the screen should be carried out by qualified personnel using electrical equipment and materials provided for in the project documentation and instructions for conducting electrical installation work. Electrical installation must be carried out in accordance with the equipment manufacturer's instructions.



**DANGER!** Installation and maintenance work must only be carried out on a shutdown unit. The screen drive must be de-energized and protected against accidental activation.



#### Shutting off the screen:

Disconnect the power supply to the screen control panel and lock the main switch.

Each employee performing maintenance of the screen must have a personal padlock.

The screen can only be switched on after all padlocks have been removed from the main switch.





**DANGER!** Do not turn on the equipment during troubleshooting when performing repair work and maintenance. Unexpected start-up of equipment can result in serious injury to personnel.



**DANGER!** The presence of deviations from the normal operating mode (increased power consumption, temperature, vibration, noise, protection equipment operation, etc.) can lead to failure. In such a case, the personnel responsible for the maintenance must be notified immediately in order to avoid failures that, directly or indirectly, could lead to serious personal injury or material damage. If in doubt, turn off the equipment immediately.



**ATTENTION!** It is forbidden to mix mineral and synthetic lubricants used in different parts of the equipment.

**DANGER!** Use only the lifting lugs provided for the transport and installation of the equipment. It is forbidden to hook the slings onto the equipment units.



Figure 2.1 – Correct and incorrect slinging of the screen

A – Correct; B – Incorrect



**DANGER!** When moving the equipment with lifting and transport means, it is strictly forbidden to stand on the unit or in the area of its possible fall. It is forbidden to stay between the transported unit and the wall if there is a danger of crushing.



**DANGER!** It is forbidden to start up the equipment while people are in the channel.



**DANGER!** It is forbidden to carry out repair work on the working equipment.



**ATTENTION!** It is forbidden to continue the operation of the equipment when a failure is detected.



**DANGER!** It is forbidden to put your head, limbs and various objects into the area for unloading waste from the screen.



**ATTENTION!** It is prohibited to operate the gear motor if the mains voltage deviates for more than  $\pm$  5% and the alternating current voltage frequency deviates for more than  $\pm$  0.2 Hz.





**ATTENTION!** It is forbidden to change the factory settings of the safety device without the consent of the representatives of the manufacturer.

**DANGER!** It is forbidden to operate equipment with removed interlock units manufactured and installed by the manufacturer.

When servicing the equipment, it is necessary to comply with the safety regulations existing in the given enterprise.

When carrying out maintenance work on equipment associated with the need to dismantle the gate plate covering the free surface of the channel, the place of work must be fenced off and marked according to the safety rules in force at the facility (the place of work must be marked with bright actuators or a signal tape with the installation of signs signaling the risk of a person getting into an open channel, etc.).

Use special work clothing: headgear, gloves, personal protective equipment for respiratory organs and mucous membranes to perform maintenance of equipment. After carrying out any maintenance work on the equipment, personnel should wash their hands with special disinfectant detergents.



Figure 2.2 - Correct and incorrect operation of the

A – Correct; B – Incorrect



**DANGER!** Fire extinguishing means should be kept in the room where the equipment is installed. In the event of a fire, the equipment must be de-energized and the emergency situation must be immediately reported to the nearest fire department. Extinguishing an ignition source must be carried out with non-conductive fire extinguishing means.



**DANGER!** It is strictly forbidden to carry out work and be near the equipment to persons under the influence of alcohol and persons with poor health.

# 2.4. Electrical Connection



**DANGER!** Perform electrical installation work with strict observance of safety rules when working with electrical equipment.

ATTENTION! P

**ATTENTION!** Perform electrical installation work strictly in accordance with the wiring diagram of the connection of the equipment to the control panel.





DANGER! Before starting work, make sure that there is no voltage in the mains!



**DANGER!** Provide that there is no accidental power supply by turning off the main switch and locking it with a padlock.



**DANGER!** The metal structure of the equipment must be grounded before connecting to the mains.

# 2.5. Unauthorized Changes to Equipment and Spare Parts

Original spare parts from the manufacturer meet all safety requirements. The use of non-original parts and accessories, or modifications to the original design of the equipment may result in damage or injury. The manufacturer is not responsible for direct or indirect damage resulting from the above actions.

Retrofitting the equipment and/or changing its design without written approval from the manufacturer is prohibited.

The use of the equipment for purposes other than its intended use is prohibited.

# 2.6. Customer's Obligations

Obtaining permits required for the operation of the equipment not specified in the contract is carried out by the Customer on their own account and at their own expense. Moreover, the consumer must comply with local laws regarding the following:

- Ensuring the safety of personnel;
- Ensuring the safety of production equipment;
- Disposal of products;
- Disposal of materials;
- Sweep-up and cleaning (cleaning agents and their removal);
- Environmental protection.



- Instructing the maintenance personnel;
- Timely maintenance of equipment.

Before starting up the equipment, the customer must provide that the requirements of local standards and regulations that provide the operability of the equipment (for example, standards for electrical connection) are met.



# 3. SPECIFICATION DATA

#### 3.1. Scope and Purpose

The screen is designed to extract coarse and middle waste from industrial and domestic wastewater with their subsequent mechanized unloading onto a transport device or a waste disposal tank. In the standard option, the equipment can be installed in sewage pumping stations (SPS), in screens buildings at the site of treatment facilities.

The screen is designed for use in wastewater with a pH of 6 to 9. The equipment in the standard option is not intended for use in an explosive environment. Intended use also includes:

- adherence to the conditions prescribed by the manufacturer for commissioning, maintenance, repair, as described in this Operating Manual;
- Taking into account projected professional negligence;
- Operation of the equipment only by qualified personnel which are trained in the correct operation and aware of the risks.

The equipment is intended for use exclusively in the area specified above. To avoid damage to the equipment and its failure, it is forbidden to use this type of screen for the treatment of wastewater with a significant content of large construction waste (fragments of concrete, stones, fittings, cuttings of pipes, metal, etc.). When, nevertheless, there is a likelihood of the above-mentioned waste falling on the screen, it is recommended to provide for the installation before the screen of a manual or mechanized screen with a gap 5-10 times larger than the gap of the specific step screen.



**ATTENTION!** The manufacturer is not responsible for damage resulting from the use of the equipment for other purposes and from unauthorized design changes not agreed with the manufacturer.

# 3.2. Equipment Labelling

A metal plate called a nameplate is used to mark and identify the product. The nameplate contains information about the equipment and its manufacturer:

- 1 name/logo of the manufacturer and his contacts;
- 2 name of the product;
- 3 product type/model;
- 4 power consumption;
- 5 serial number;
- 6 weight.

When requesting or ordering spare parts, it is necessary to indicate the type of screen, its year of manufacture and the serial number in order to expedite the execution of the request or order.



# **3.3. Equipment Acceptance Information**

Before delivery, the manufacturer carries out technical control and acceptance of equipment, namely:

- 1) General inspection of the screen;
- 2) Tightening of all bolted connections;
- 3) Checking the presence and condition of the nameplate;
- 4) Checking the availability of all items in the supply package;
- 5) Checking the operation of the control panel;
- 6) Run-in test of product on the no-load operation;
- 7) Checking of package used for product delivery.

The equipment acceptance certificate is indicated in the product passport.

#### 3.4. Technical characteristics of the screen

The screens are made of corrosion-resistant steel or carbon painted steel and polymer materials. The typesize of the screen is selected depending on the required throughput, the composition of the wastewater and the geometric dimensions of the channel at the installation site. The data for the selection of equipment are indicated by the Customer or the design organization in the questionnaire.

The screen is manufactured for use in the following environmental conditions:

- For operation in rooms with artificially regulated climatic conditions, for example, in closed heated or cooled and ventilated production facilities and other, including well-ventilated underground premises (no exposure to direct sunlight, an atmospheric precipitation, wind, sand and a dust of external air; no or significant reduction of the impact of scattered sunlight and condensation);
- 2) The range of limiting operating air temperature during operation is +1...+40°C;
- 3) The standard screen is not intended for operation in winter outdoors at temperatures below 0°C, because there is a risk of icing and freezing.
- 4) Optionally, the screen can be equipped with a set for outdoor work in winter; the presence of this option is indicated in the equipment passport.

Equipment conventional designation structure:



Rake bar screen with an electric drive

Standard size for RKE (digital designation of the screen of a specific overall size - 0506...2030) see Table 3.2.

The technical parameters of the screens manufactured in the standard design are presented in Table 3.1. A number of standard screen designs are formed for the most commonly used channel size combinations in typical wastewater treatment plant projects, as well as in accordance with the transportation capabilities. The screens can be made with non-standard sizes and technical specifications according to the individual requirements of the customer.



No.	Parameter Description	Units of Measurement	Val	ues
1	Nominal channel width	mm	600-1000	800-2100
2	Nominal channel depth	mm	700-1300	1300-3400
3	Inclination angle of the screen to the horizon	degree	8	0
4	Nominal openings between bars	mm	5, 6, 8, 10, 20,	40, 50, 70, 100
5	Chain pitch	mm	63	100
6	Number of rakes	pcs.	46	not less than 5
7	Electric drive	-	NORD o	or analog
8	Rated drive power	kW	0.37; 0	.75; 1.1
9	Supply voltage	V	380	- 420
10	Supply frequency	Hz	5	0
11	Drive ingress protection*	-	IP	55
12	Control panel ingress protection	-	IP	65
13	Sensor supply voltage	V	2	4
14	Overall dimensions of the screen	mm	See Ta	able 3.2
15	Screen weight with gear motor	kg	See pa	assport

Table 3.1 - Technical parameters of screens in the standard design

\*- can be upgraded to IP68 by agreement.

Specific values of characteristics, overall dimensions and total weight are indicated in the product passport.



# 3.5. Standard Sizes of RKE Screens in the Standard Design

Standard sizes and main dimensions of the screens are presented in table 3.2 and in fig. 3.2.

Table 3.2 –	Standard sizes	of RKE	screens
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Standard	Dimensions of RKE					Channel dimensions	
size XXXXX	K, mm	N, mm	h, mm (±1)	B, mm (±1)	R, mm (±1)	width, mm	depth, mm
05060906	506-906	2088	1339	400-800	1470	600-1000	700-1000
05070907	506-906	2397	1649	400-800	1780	600-1000	700-1000
05090909	506-906	2646	1890	400-800	2015	600-1000	1000-1300
07120912	700-900	2999	2141	600-800	2394	800-1000	1300-1600
09151415	900-1400	3294	2436	800-1300	2687	1000-1500	1600-1900
09182018	900-2000	3590	2732	800-1900	2980	1000-2100	1900-2200
11212021	1100-2000	3885	3027	1000-1900	3278	1200-2100	2200-2500
16242024	1600-2000	4181	3323	1500-1900	3580	1700-2100	2500-2800
17272027	1700-2000	4476	3619	1600-1900	3870	1800-2100	2800-3100
18302030	1800-2000	4771	3915	1700-1900	4170	1900-2100	2900-3400



Figure 3.1– Overall dimensions of the screen

K – screen width; R – rotation radius of the screen; H – height of the screen; B – width of screen filtering mesh; h – discharge height from channel bottom.



# 3.6. Supply Package

The standard supply package of the screen is shown in Table 3.3. The supply package of a specific product is given in the form or passport for the equipment. Optional items are not included in the standard supply package.

No.	Name	Units of Measurement	Amount
1	Screen RKE XXXX (AISI304)	pc.	1
2	Support for installing the screen on the side of the channel	pcs.	2
3.1	CP RKE control panel	pc.	1
3.2	Remote control panel RCP	pc.	1
4	Emergency stop console with stand	pc.	1
5	Conductometric level sensor	pc.	1
	Fasteners for installation:		
6	screen anchoring	set	1
	CP fasteners	set	1
	Set of documents:		
	Operation Manual for the screen	pc.	1
7	Operation Manual for the CP control panel	pc.	1
	Operation Manual for the gear motor	pc.	1
	Passport on the screen	pc.	1
	Product quality certificate	pc.	1
	OPTIONAL:		
8	Manufacture of housing and screen filtering mesh from AISI 316	+	+
9	The material of screen chain is AISI 316 + plastic	pc.	1
10	Screen protection set for outdoor operation	set	1
11	Electric drive with ingress protection higher than IP 55	pc.	1
12	Flange for connecting exhaust ventilation	pc.	1
13	Advanced control panel	pc.	1
14	Stand for installing the screen on the bottom of the channel	pc.	1
15	Stand for CP RKE	pc.	1
16	Control CP buttons	set	1
17	Fasteners for installation - chemical anchors	set	1
18	Rake positioning systems	set	1
19	Light and sound column	pc.	1
20	Cable products for connecting electrical equipment from CP	set	1
21	Level sensor hydrostatic / ultrasonic / radar	pcs.	2
22	Stand of the remote control panel	pc.	1
23	Explosion-protection electrical equipment	+	+
24	Data transfer protocols to the dispatching system using Modbus TCP, Modbus RTU, Profibus DP, Profinet	+	+
25	Heating of the CP (allows to operate the CP at an outdoor temperature of -30+40°C), the CP enclosure material - plastic or stainless steel	set	1
26	Drive frequency converter	pc.	1
27	External emergency sound signalization	+	+
28	RCP, the Emergency stop console, sensors in Ex explosion- protection design	+	+
29	Spare parts	set	1

Table3.3 –	Supply	package
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ATTENTION! When ordering cable products, you should specify the required length.

# 3.7. Design

The screen for mechanical wastewater treatment is a completely finished product and includes components that must be connected to each other with electrical cables.

The manufacturer reserves the right to make design changes when improving the equipment.

## 3.7.1. Location of main zones and elements

Screen nodes (Fig. 3.3) are installed on a frame (Fig. 3.3, item 8) formed by inclined sidewalls and transverse beams.



Figure 3.2– Arrangement of screen elements:

1 – gear motor; 2 – safety device; 3 – slip; 4 – window; 5 – terminal box; 6 – support on the side of the channel; 7 – eyes for starting slings; 8 – rectangular frame; 9 – gutter; 10 – sloth;

- 11 rubber sealing; 12 rakes; 13 filtering mesh; 14 flexible chain;
- 15 leading sprocket; 16 debris blade; 17 drive shaft; 18 cover; 19 table; 20 level sensor (conductometric) – stainless steel rod; 21 – rack with an emergency stop button

Between the sidewalls there is insert filtering mesh, made of shaped rolled rods of a drop-shaped or rectangular profile with a specified opening (Fig. 3.3, item 13).

The chains are driven by the sprockets (Fig. 3.3, item 15) of the drive shaft (Fig. 3.3, item 17) with the help of a gear motor (Fig. 3.3, item 1).

In the immersed part of the screen, there are immovably fixed idlers (Fig. 3.3, item 10), which perform the function of a driven sprocket.

Transverse movable rakes are fixed between the chains (Fig. 3.3, item 12), which cover the rods of the insert filtering mesh with the depressions of the teeth.



A debris blade (Fig. 3.3, item 16) is attached to the upper edge of the screen frame, which removes waste from the surface of the rakes, and slides with a discharge cover (Fig. 3.3, item 3) that direct the waste to the hopper.

A safety device (Fig. 3.3, item 2) based on a jet arm is provided to prevent the screen from failureing when the rake is overloaded or jammed.

To seal the screen in the channel from the sides and bottom, it is equipped with rubber sealings (Fig. 3.3, item 11) and a gutter (Fig. 3.3, item 9) to direct the flow of wastewater strictly through the filtering mesh.

The screen is installed on supports on the side of the channel (Fig. 3.3, item 6) or on a special stand on the bottom of the channel (the shape of the support / supports may differ from the image in the picture).

For loading and unloading operations, lifting the screen from the channel and carrying out technical maintenance, there are eyes for starting the slings (Fig. 3.3, item 7).

There are windows on the screen frame on both sides (Fig. 3.4, item 4) for installing the latter in the links when replacing the chains.

A terminal box (Fig. 3.3, item 5) is installed on the side of the gear motor for connecting the overload sensor and the emergency shutdown button (the location of the terminal box and the emergency shutdown button may differ from the one shown in Fig. 3.3, see assembly and assembly drawings).

The conductometric level sensor (Fig. 3.3, item 20) - a Ø8 mm stainless steel rod - is installed in a bracket on the screen frame. The level sensor monitors the level of wastewater in the channel.

#### 3.7.2. Frame

The details of the screen frame (Fig. 3.4) are made of stainless sheet metal and are connected by bolted joints. All fasteners are made of stainless steel.



Figure 3.3 - Frame

#### 3.7.3. Drive shaft

A gear motor (fig. 3.5, item 4) and drive sprockets (fig. 3.5, item 3) are installed on the drive shaft (Fig. 3.5, item 2). Sprockets move flexible chains. The shaft is installed on the frame with the help of a small (Fig. 3.5, item 1) and a large slider in the frame guides. A safety device is installed on the large slider on the drive side (Fig. 3.5, item 5).





Figure 3.4– Drive shaft

1 - slider; 2 - drive shaft; 3 - leading sprocket; 4 - gear motor; 5 - safety device.

#### 3.7.4. Flexible chain

The flexible chain is made of corrosion-resistant materials and consists of plates (Fig. 3.6, item 1), connecting plates (Fig. 3.6, item 2) and plastic rollers (Fig. 3.6, item 3).



Figure 3.5– Flexible chain 1 – plate; 2 – connecting plate; 3 – roller.

#### 3.7.5. Rakes

Rakes (Fig. 3.7) are intended for cleaning the filtering mesh from retained waste. The rakes are attached to the flexible chains using a bolted connection with self-locking nuts.



Figure 3.6- Rake

The rake moves the waste along the working surface of the screen until it stops in the debris blade, after which the debris blade, sliding along the rake, removes the waste from its surface.

The rake has 2 positions: lower (working) and upper. The rake is in the working position after passing the gutter, in the upper position - after passing the dumper.

#### 3.7.6. Filtering mesh

The filtering mesh (Fig. 3.8) intended for waste retention. The filtering mesh consists of stainless steel rods with a drop-shaped or rectangular cross-section and a beam. Rods are attached to the beam by welding or tension. The filtering mesh can be inserted or welded.





Figure 3.7- Filtering mesh

#### 3.7.7. Debris blade

To remove waste from the rakes, a debris blade is installed in the upper part of the screen (Fig. 3.9, item 2). The debris blade is hinged to the screen frame and intended for removing the trapped waste from the surface of the rake (Fig. 3.9, item 3), sliding on it during the raising of the rake. On the rear side of the screen, a slide is installed on the frame (Fig. 3.9, item 4), connected to the discharge casing.



Figure 3.8- Debris blade

1 – drive shaft; 2 – debris blade; 3 – rake; 4 - slip.

The rake rises to the dumper, with the help of which the waste is shifted onto the slide. The gutter is located at an angle to the frame and directs the waste into the hopper of the garbage collector or onto the transport device. Next, the rake turns in the direction of movement of the chain on the sprockets of the drive shaft (Fig. 3.9, item 1), becomes in the upper position, and the dumper lowers to the stop.



#### 3.7.8. Safety device



Figure 3.9- Safety device

1 – drive shaft; 2 – bearing support; 3 – jet arm; 4 – gear motor; 5 – spring; 6 – inductive sensor; 7 – control nuts; 8 – wedge key; 9 – control plate.

The safety device (Fig. 3.10) is designed to prevent deformation of the screen, stretching and breaking of the chain due to jamming of the rake.

#### The safety device works as follows:

The jet arm (Fig. 3.10, item 3) is attached to the gear motor housing (Fig. 3.10, item 4). An inductive sensor is installed in the hole of the jet arm (Fig. 3.10, item 6). With the help of control nuts (Fig. 3.10, item 7), the distance to the control plate (Fig. 3.10, item 9) is set, which is equal to 1-2 mm. In the upper part, the safety device is attached by a support to the shaft of the gear motor (Fig. 3.10, item 1).

The safety device is activated when the rake jams or other mechanical damage prevents the free movement of the chain. When the chain jams, the shaft rotation force is transmitted to the gear motor housing. At the same time, the housing of the gear motor rotates around the axis of the drive shaft in the opposite direction of rotation of the shaft.

The jet arm attached to the gear motor housing rises by compressing the spring (Fig. 3.10, item 5), the inductive sensor moves up relative to the control plate (Fig. 3.10, item 9). Having reached the edge of the control plate, the sensor activates the break in the electrical circuit and turns off the gear motor. At the same time, the sound and light alarm is activated.



**ATTENTION!** The equipment is delivered with the safety device tripping settings set at the factory. It is allowed to adjust the factory settings of the safety device for specific operating conditions at the facility at the stage of commissioning works, subject to agreement with the representative of the manufacturer. Information about the changes made to the factory settings must be indicated in the act of commissioning the equipment.



**ATTENTION!** The effectiveness of the safety device depends on the correct setting of the trigger moment of the inductive sensor.

- **ATTENTION!** The safety device must be adjusted properly, otherwise it does not provide full protection of the screen from damage when the rake is jammed.
- **ATTENTION!** It is forbidden to operate the screen with a faulty or NOT adjusted safety device.

**ATTENTION!** Excessive deepening of the safety device can lead to the failure of the screen during overloads due to failure of the mechanical protection.

#### 3.7.9. Chain tension node

The chain tension node (Fig. 3.11) allows you to achieve the optimal tension of the flexible chain of the screen between the leading sprocket and the idler.





Figure 3.10- Chain tension node

1 – nut; 2 – tension screw; 3 – drive shaft; 4 – guides; 5 – slider.

Movable elements of the chain tension unit - sliders (Fig. 3.11, item 5) assembled with the drive shaft (Fig. 3.11, item 3) are located on the sides of the screen. Their position determines the position of the shaft with the leading sprockets and, as a result, the degree of chain tension. The sliders are moved relative to the sides of the screen in the guides (Fig. 3.11, item 4) using tension screws and nuts with a trapezoidal thread (Fig. 3.11, items 2 and 1).

#### 3.7.10. Supports on the side of the channel

The supports (Fig. 3.12) are intended for installing the screen on the side of the channel. The support consists of a rod with a branch for the axis of rotation (Fig. 3.12, item 1), which guides the racks (Fig. 3.12, item 2), a prop stay (Fig. 3.12, item 3) and anchor bolts (Fig. 3.12, item 5) for fixing in the floor.



Figure 3.11 – Support on the side of the channel

1 - rod; 2 - guide rack; 3 - prop stay; 4 - anchor bolts; 5 - channel side.



# 3.7.11. Stand on the bottom of the channel (option)

The stand (Fig. 3.13) is intended for installing the screen on the bottom of the channel. It consists of a rod (Fig. 3.13, item 1), which guides the racks (Fig. 3.13, item 2), supports (Fig. 3.13, item 3).



Figure 3.12 – Stand on the bottom of the channel

1 – rod; 2- guide rack; 3- support.

# 3.8. Screen Operation Principle

The flow of wastewater passes through the filtering mesh of the screen (Fig. 3.3, item 13). Rubber sealings (Fig. 3.3, item 11) and a gutter (Fig. 3.3, item 9) direct the flow of wastewater into the working area of the screen, preventing the passage of large mechanical impurities under the screen and in the space between the screens and channel walls. Mechanical impurities are retained on the filtering mesh and removed by rakes (Fig. 3.3, item 12), which are attached symmetrically on both sides to flexible chains (Fig. 3.3, item 14). When turning the chain along the idler (Fig. 3.3, item 10), the working part of the rake smoothly enters the gutter (Fig. 3.3, item 9).

When moving the rake along the gutter, the waste that settles below the filtering mesh is collected by the rakes and, together with the waste removed from the surface of the filtering mesh, is moved to the upper part of the screen.

In the working position, the rake enters the openings of the screen.

The shape of the rake and the design features of the connection with the bars of the filtering mesh exclude the pressing of waste and provide their effective removal over the entire area of the filtering mesh.

To remove waste in the upper part of the screen, a debris blade is provided (Fig. 3.3, item 2). The debris blade is attached to the frame and intended for removing retained waste from the surface of the rake (Fig. 3.3, item 3) without stopping the operation of the screen. The rake moves the waste along the working surface of the screen to the stop in the debris blade, which moves the waste onto the slide (Fig. 3.3, item 4).

The slide is located at an angle to the frame, which provides free removal of waste into the garbage can or onto the transport device.

Next, the rake rotates in the direction of movement of the chain on the sprockets of the drive shaft, becomes in the upper position, and the dumper lowers to the stop.

The used method of waste removal provides constant cleaning of the working surface of the screen from new incoming large mechanical impurities.



# 4. CONTROL SYSTEM

# 4.1. Modes and Principles of Equipment Operation

#### **Basic configuration**

The basic control panel included in the supply package has one mode of operation - continuous operation.

The control panel provides control of the operation of the equipment in a constant mode of operation, protection of the screen from emergency modes of operation, light signaling of the status of the screen (OPERATION or EMERGENCY). To reduce the impact of an aggressive environment, the CP must be placed outside the room where the equipment is installed (for example, an electrical panel or operator's room).

The control panel is designed to control the operation of mechanized sewage screens RKE of all standard sizes, equipped with a jet arm.

The control panel provides:

- modes of operation continuous operation;
- comprehensive protection of the gear motor against current overload;
- indication of normal and emergency states of equipment and control panel.

Light signal indicators and controls are located on the front panel of the control panel.

#### Standard equipment

The standard control panel included in the supply package has 3 main modes of operation:

- 1. "Manual" mode;
- 2. "Automatic" mode;
- 3. "Remote" mode.

The control panel provides control of equipment operation in manual and automatic modes, protection of the screen from emergency modes of operation, light and sound signaling of the status of the screen (OPERATION or EMERGENCY). To reduce the impact of an aggressive environment, the CP must be placed outside the room where the equipment is installed (for example, an electrical panel or operator's room).

The CP control panel is designed to control the operation of mechanized sewage screens RKE of all standard sizes, equipped with a jet arm.

The control panel provides:

- three modes of operation: remote, automatic and manual;
- control modes: local (from a control panel or a remote control panel), remote (from an external discrete signal);
- comprehensive protection of power chains and gear motor (overload, interruption and overvoltage) in both automatic and manual mode;
- the possibility of screen operation by time and level;
- indication of normal and emergency states of the screen and control panel;
- the built-in dispatching function allows you to remotely monitor the state of the control panel as a whole (dry contacts).

A remote control panel with START / STOP / REVERSE buttons with backlight is delivered complete with the control panel. Light indicators and controls are located on the front panel of the CP and RCP.

The "REMOTE/AUTO/MANUAL" mode is selected by the mode selection switch on the front panel of the control panel. To switch between operating modes, press the "STOP" button on the remote control and move the switch to the desired operating mode on the front panel of the CP. A signal of the position of the grating operation mode switch is sent to the external alarm circuits. Screen protection against emergency situations is provided in all operating modes. At any switching of the mode, the screen is turned off, if it was turned on. The automatic mode allows you to reduce the wear and tear of parts, which means to increase the service life of the screen, as well as to reduce energy consumption.

The choice of screen operation mode is determined by the technologist depending on the amount and composition of impurities in the wastewater fed to the screen.



**ATTENTION!** With a significant amount of sewage pollution, especially fibrous waste, it is recommended to use continuous operation of the screen in manual mode.



#### The principle of operation of the screen in automatic mode (time and level relay):

After switching on the screen, the automatic switching on and off of the gear motor of the screen is carried out cyclically according to the time relay - work / pause. When the level in front of the screen in the channel increases above the set value (the water level is monitored by a conductometric type level sensor - a rod), the screen begins to work continuously until the level decreases. When the level drops (less than the sensor drops), the array returns to timed cycling.

The time intervals are selected practically and depend on the flow rate, the degree of pollution and the composition of the wastewater.

Detailed information on the characteristics of the control panel, its preparation for operation, and the procedure for operation are specified in the operating manual "CP control panel for the catenary screen with electric drive" supplied complete with the equipment.



# 5. TRANSPORTATION AND STORAGE

#### 5.1. Storage

It is necessary to provide the following storage conditions for the electrical part of the supply package (CP with accessories):

- storage in dry rooms;
- temperature without large fluctuations in the range from 0°C to +40°C;
- relative air humidity above 60%;
- do not allow exposure to ultraviolet radiation (under direct rays);
- absence of aggressive, corrosion-causing substances in the environment (polluted air, ozone, gases, solvents, acids, alkalis, salts, radioactivity, etc.);
- absence of shocks and vibrations.

Storage conditions and shelf life of gear motors shall comply with the recommendations of the gear motor manufacturer.

In case of long-term storage or non-use of the screen (6 months or more), it is recommended to order an additional set for long-term storage of gear motors from the gear motors manufacturer.

- Stacking of screens during transportation and storage is not allowed.
- The shelf life of the screen before commissioning is no more than one year.
- Technical documentation must be kept together with the screen.
- Documentation for the control panel must be kept in the control panel itself.
- Maintenance for the storage period should include periodic inspection of the packaging.

#### 5.2. Transportation

Transportation of equipment is allowed by all types of transport in covered vehicles, subject to the standards and requirements applicable to these types of transport. During transportation, the components of the equipment must be securely fastened to the vehicle.

Slinging of the screen must be carried out in accordance with the slinging scheme (Fig. 5.1).



Figure 5.1 – Screen slinging scheme

Equipment should only be transported and unloaded by experienced personnel. Lifting equipment is always required to transport the equipment to the assembly site due to its significant weight.

Various lifting mechanisms can be used as lifting equipment depending on the available access roads. In most cases, the following devices are used indoors: slings, tripods, chains, cables, forklifts, rollers.





Figure 5.2 - Safety measures during loading and unloading operations



#### DANGER!

- Wear safety footwear (with protective toe cap) to avoid injury.
- Always clean off dirt!
- Carry out work in a protective helmet and protective gloves!



**DANGER!** It is forbidden for unauthorized persons to stay in the area of loading and unloading operations.

**DANGER!** When performing loading and unloading operations, it is prohibited to carry out any other work in dangerous proximity to the loading and unloading area.

**ATTENTION!** The lifting capacity of the transport and lifting device must exceed the weight of the equipment. The weight of the equipment is indicated in the product passport.

**ATTENTION!** Use slings with a weight that exceeds the weight of the equipment.

When lifting the equipment, avoid jerking or swaying the load. Raise and lower the load slowly, with no jumping or jolting.

After transportation, it is necessary to check the tightness of the screws and all contacts in the CP.



Figure 5.3 – Example of designation of attachment points for hooks of lifting mechanisms



# 6. INSTALLATION

## 6.1. Key Safety Measures

Installation of the screen must be carried out by qualified personnel using electrical equipment and materials provided for in the project documentation and manual for conducting electrical installation work.

Observe the following safety precautions before starting installation work:

- The screen installation work should be carried out only by qualified personnel observing all safety rules.
- Check the equipment for any damage before carrying out installation work.
- Ensure that only authorized personnel have access to the site and that no one is at any risk during installation work.
- When making wire routing and connections, make sure that no one trips over the cables, hoses, pipes, etc. to be installed.
- Check the bending radii of the cables/hoses/pipes for compliance with building codes.
- Pay attention to the instructions for working fluids, lubricants, used auxiliary materials.
- Additionally, read the "Safety Measures" chapter.



**DANGER!** Installation work must be performed using personal protective equipment: helmet, work gloves; welding mask, special clothing and gloves when welding; a respirator and safety glasses when working with a hammer drill and an angle grinder.



**DANGER!** It is forbidden for unauthorized persons to stay in the area of installation work.

**ATTENTION!** Avoid jerking or swaying the load when lifting or moving the equipment. Raise and lower the load slowly, with no jumping or jolting.

## 6.2. Requirements for the Screen Installation Site

Before starting work, it is necessary to block the channel where the screen shall be installed and fence the open areas of the stand-by channels. Additionally, sufficient space for installation work shall be provided. The channel in which the equipment is installed should meet the following requirements:

- There must be no water or wastes in the channel;
- The dimensions of the channel must correspond to the dimensions indicated in the installation drawings of this equipment;
- A removable cover must be provided above the channel in front of the screen to raise the equipment to the repair position.

The dimensions of the building doors/gates must be large enough to transport the screen to the installation site.

For installation, maintenance and repairs, slide gates or stop gates must be installed before and after the screen. The gate before the screen must be at such a distance that the screen can be lifted out of the channel to the repair position.

A hoisting device is recommended in the service area of the screen.

The platform in the service area of the screen should be large enough to allow inspection and adjustment of the screen.



**ATTENTION!** The angle between the bottom and the walls of the channel should be 90°.

**ATTENTION!** The installation and fastening of the screen in the channel must be carried out after the concrete base and channel walls have completely solidified.

#### 6.3. Preparatory Work Before Starting the Installation

Before starting the installation, it is necessary to unpack the screen, inspect and clean the screen from foreign objects.



#### Works to be carried out by the Customer:

- Inspection and repair (if necessary) of lifting equipment, lighting systems, heating and ventilation of the screen room.
- Electricity supply for electric welding and other works using power tools.
- Solving issues related to the disposal of waste trapped by the screen.
- Study of technical documentation, preparation of the necessary materials and equipment, development and approval of a work schedule.
- Checking the completeness and preparation of assembly and fixing materials if necessary.
- Preparation of cable products according to the external connection scheme.
- Selection of a circuit breaker for supplying power to the CP based on the characteristics of the CP.
- Emptying the channel where the screen will be installed, cleaning it from wastes, checking the condition of its bottom and walls, especially in the places where the rubber sealing of the screen adjoin (if necessary, the walls and bottom of the channel must be repaired, as well as other construction, installation and repair work provided by the project must be performed).

#### 6.4. Installation of Mechanical Equipment

#### 6.4.1. Installation of the screen on supports on the side of the channel

The screen is slung as shown in fig. 5.1, and rises above the floor to a height sufficient to install supports. The supports on the side of the channel (with the terminal box on the side of the engine) are put on the corresponding axes of rotation of the screen (item 4, Fig. 6.1) until the stop of the rod nozzle (item 2) in the washer on the axis of rotation. The screen is lowered into the channel and installed strictly at the bottom of the channel at an angle of 78 ... 85 degrees. to the horizon and is located at the same distance from the sides of the channel (symmetrically). After installing the screen on the bottom of the channel at an angle of 80 degrees. the protrusion of the rod (size B) is fixed by the fastener (pos. 7-9) in two places on the corner of the support (pos. 3), which is also exposed along the height of the support post (pos. 1). With the help of a construction level applied to the rack, the strictly vertical position of the supports is set.



Figure 6.1 - Installation of the screen on supports on the side of the channel

1 – bearing rack of the support; 2 – retractable support bar; 3 – prop stay; 4 – screen rotation axis;
5-6 – bolt and locknut for fixing the rod on the axis of rotation of the screen; 10 – anchor bolts for fastening the support on the side of the channel (in the floor); L1 – channel board; L0 – channel bottom; A – depth of the channel.





Figure 6.2– The sequence of installing the screen on the side of the channel

#### 6.4.2. Installation of the screen on the stand at the bottom of the channel

Installation of the stand in the channel:

The inclination of the guide supports of the stand to the horizon is 80 °.

- 1) It is lowered into the channel and centered along the axis of the channel. Inclined guide stands must be directed towards the flow.
- 2) With the help of a construction level attached to the rack, the strictly vertical position of the stand is displayed.
- 3) With the help of a construction level applied to the mounts of the stand, the strictly horizontal position of the stand is displayed;
- 4) It is attached to the walls of the channel, indicated in fig. 6.3. places, with pins or fittings and a corner with anchor bolts at the ends (for fixing in the walls of the channel), which is placed on the floor close to the stand posts and welded to them. The fastening elements are hammered into the made holes to a depth of at least 100 mm and welded to the racks and guides of the screen in the appropriate places.
- 5) If the racks of the screen do not rest against the channel overlap (there is no overlap after the screen), it is necessary to put a stainless corner with anchor bolts at the ends (for fixing in the floor) or a channel across the channel so that they fit closely to the racks of the stand and weld to the racks. If a corner or channel made of carbon steel is used, it is necessary to provide for laying between the channel and the posts of insulating material to exclude the contact of stainless steel with carbon steel.

The described method determines the basic principle of fixing the stand in the channel. Mounting may vary if specific conditions require it.

To increase the stability and reliability of the structure, each of the supporting elements of the stand is attached to the channel wall in at least two places.





Figure 6.3- Installation of the stand in the channel

1- support rack of the stand; 2 – element of fastening the stand to the screen during transportation;
3- blocking of the channel; 4 – metal pin; 5 – channel wall; 6 – hole for fastening the stand;
7- place of welding of the metal pin to the stand; 8 – guide of the stand.

Installation of the screen on the stand in the channel



ATTENTION! Installation of the screen on the stand is carried out only after fixing the stand in the channel.

DANGER! For transportation and installation of the equipment, use only the lifting lugs provided for this purpose. It is forbidden to hook the slings to the screen nodes.

Installation is carried out using a lifting mechanism and slings. The load capacity of the lifting mechanism must be greater than the weight of the equipment.



Figure 6.4 – The sequence of installation of the screen on the stand in the channel

The slinging scheme is shown in fig. 5.1. It is allowed to use chain slings, steel rope slings and textile ribbon slings that correspond to the weight of the equipment.





Figure 6.5 – Installation of the screen on the stand in the channel

1 – slings; 2 – screen; 3 – stand; 4 – screen bracket plate; 5 – plate for fixing the stand.

The sequence of installing the screen on the stand:

- 1. Place the screen in a horizontal position in the center of the channel above the stand at the required height;
- 2. Lower the screen until the holes of the screen bracket plate align with the holes of the stand plate;
- 3. Use fastening bolts, washers and nuts to fasten the screen brackets and stand plates;
- 4. Lower the screen on the guides (in the working position);
- 5. Check that, when lowering, the screen does not touch the walls of the channel and the ceiling anywhere, and that there is an equal gap between the screen and the walls of the channel on both sides;
- 6. Check the tightness of the grating to the bottom of the channel. Ski screens should fit tightly to the bottom of the channel;
- 7. Check the tightness of the protective rubber sealings against the walls of the channel, the screens must fit tightly;
- 8. Unhook the slings from the eyelets;
- 9. Install the discharge cover with a slide on the screen (see Chapter 10);
- 10. Tighten all bolted connections.



# 6.5. Installation of Electrical Equipment

This section provides general information on electrical equipment installation.



**ATTENTION!** Perform electrical installation work strictly in accordance with the wiring diagram of the connection of the screen to the control panel.



DANGER! Before starting work, make sure that there is no voltage in the mains!



**DANGER!** Ensure that there is no accidental power supply by turning off the main switch and locking it with a padlock.

#### 6.5.1. Requirements for the Placement of Electrical Equipment and Power Supply Parameters

#### Placement of electrical equipment components:

- Place the control panel outside the room where the screen is installed (for example, control room, switchboard) to reduce the impact of aggressive waste. The panel is wall-mounted with a front door, the cable entry is performed below through sealed lead-ins. Operating temperature is +1...+40°C. Ambient humidity shall not exceed 95% (93% without condensation and dripping water according to IEC 60068-2-78):
  - a. Easy access during work and maintenance;
  - b. Assembled so as to minimize the possibility of damage to it when servicing or moving any other mobile equipment;
  - c. Mounted so that the input switch is at a height of 0.6...1.7 m above the floor level;
  - d. Shall not create dangerous situations for the operator during movement and shall have minimal possibility of unintended movement.
- Remote control panel (RCP) to be placed near the screen on the side of the gear motor at a distance of 0.3-0.5 m from the gear motor. Bringing the cable to the RCP from below through the hermetic duct.
- 3) The screen overload sensor is installed in the designated hole in the jet arm on the screen gear motor.

#### Requirements for screen power supply parameters

- 1) Supply voltage 400V±5%;
- 2) Supply voltage frequency 50Hz±0.2Hz;
- 3) Power connection diagram five-wire (3x400V +N+PE);
- 4) Rated power consumption see product data sheet (passport);
- 5) Rated consumption current see the product data sheet (passport);
- 6) Insert the supply cable with a cross-section of at least 1.5 mm2 into the control panel from below through the pressure seals and connect according to the external connection diagram of the control panel.
- 7) To protect the supply lines from overcurrents, provide for the connection of the supply lines to the power supply network through fuses with gG or gM characteristics or a three-pole circuit breaker with characteristics B or C with a rated current of 10A.

#### 6.5.2. Recommendations for the Selection of Cable and Cable Protector

- 1. The cable for supplying power to the control panel is a cable with copper cores, the number of cores is not less than five  $(3 \times 400V + N + PE)$ , the cross-section is not less than 1.5 mm<sup>2</sup>.
- 2. The cable for connecting the gear motor is a flexible cable with copper cores, the number of cores is at least five (the blue core is not used), the cross-section is at least 1.5 mm<sup>2</sup>.
- 3. Cable for connecting a remote control panel a control cable with copper cores, the number of cores is not less than eleven, the cross-section is not less than 0.75 mm<sup>2</sup>.
- 4. The cable for connecting the overload sensor is a control cable with copper cores, the number of cores is at least four, the cross-section is at least 1 mm<sup>2</sup>.
- 5. It is recommended to lay the cable along the wall in cable channels (steel or plastic) measuring 80x80 mm. It is recommended to lay the cable from the cable channel to the gear motor, sensor and remote control in a DN40 mm steel pipe. It is recommended to lay the cable from the pipe to the connected device in a corrugated PVC pipe DN 20 mm





**ATTENTION!** Color coding of cables should be carried out according to the external connection diagram of the CP.

#### 6.5.3. Installation procedure

Install the electrical part in the following order:

- 1. Installation of the control panel in a control room or electrical room;
- 2. Installation of a remote control panel near the screen;
- 3. Installation of the overload sensor on the safety device (Fig. 6.6, item 2);
- 4. Installing the terminal box on the screen and connecting the overload sensor to the box (Fig. 6.6, item 3);
- 5. Laying of protective pipes or cable channels from the control panel to the gear motor, remote control panel, terminal box.
- 6. Laying and connecting cables from the control panel to the gear motor (Fig. 6.6, item 1), remote control panel, terminal box. To prevent interference with control circuits, power and control cables must be laid separately. Insert the cable into the CP through the hermetic ducts. The 400V gear motor connection diagram (delta or star) is indicated on the gear motor nameplate.
- 7. Tightening of all screw contacts inside the CP;
- 8. Grounding of the screen hosing and the control panel;
- 9. Power supply and connection to the control panel.



Figure 6.6 – Connection of gear motor, overload sensor and terminal box

1 – connection of the gear motor; 2 – installation and connection of the overload sensor; 3 – installation and connection of the terminal box.



**ATTENTION!** Conductors of flexible stranded copper cable must be crimped with ferrules when connected.

**DANGER!** The metal structure of the screen must be grounded before connecting to the power screen.





Figure 6.7 – Screen hosing grounding

A - correct; B - not correct.



**ATTENTION!** Connect the conductors of the supply cables using the screwdriver included in the CP supply package.

Grounding of the screen hosing and the control panel should be performed with a flexible yellow-green insulated copper conductor with a cross-section of at least 2.5 mm<sup>2</sup>. Grounding the screen is a mandatory protective measure. Grounding is carried out in order to avoid damage to service personnel by electric current due to a breakdown or a short circuit to the enclosure.

The external connection diagram is given in the Operation Manual of the CP included in the supply package along with the CP.





# 7. COMMISSIONING

# 7.1. Pre-starting Check

Before starting operation, it is necessary to check the correct installation of the screen. The inspection is carried out to identify and correct errors and inconsistencies that occurred at the stage of installation of the screen, which may affect the functioning of the screen.

During the inspection, the following provisions are evaluated:

- 1) The absence of distortions of the screen relative to the channel in all functional positions, namely in the working (screen in the channel) and repair position (screen above the channel), see Fig. 10.1. Free movement of the screen when turning along the axis of rotation. The free movement when turning along the axis of rotation allows you to freely immerse it in the channel and pull it out of the channel for maintenance, without clinging to the walls and edges of the channel sides with the hosing of the screen. In the absence of the possibility of free immersion and extraction of the screen from the channel, it is necessary to determine and eliminate the causes of the discrepancy. In the event that, based on the specifics of the installation site or project features, it is not possible to turn the screen in the channel if the length of the straight section of the channel is insufficient, this information must be indicated in the act of commissioning, and the possibility of vertically lifting the screen for maintenance and repair.
- 2) The position of the screen in the channel:
  - a. the angle of inclination of the screen on the supports/stand to the horizon is 80°;
  - b. the rubber sealings of the screen should fit tightly to the walls of the channel;
  - c. there should be no free space between the bottom of the channel and the groove of the screen (the lower part of the screen should rest on the bottom of the channel).

If the position of the screen in the channel does not meet the above conditions, it is necessary to determine and eliminate the causes of these discrepancies.

It is recommended to carry out the following measures in relation to the elimination of installation inconsistencies:

- expansion of the dimensions of the channel in the case of impossibility of free immersion and lifting of the screen from the channel;
- replacement with wider rubber sealings or expansion of rubber sealings when they do not completely cover the openings between the screen and the channel walls;
- concreting the bottom of the channel if there is a clearance and incomplete fit of the screen to the bottom of the channel.
- 3) The presence of grounding on the metal hosing of the screen.



**ATTENTION!** If the reason for the non-conformity according to clauses 2 and 3 is a skew of the screen or support/stand due to improper fastening, mechanical damage or deformation, it is necessary to take measures to eliminate this damage.



**DANGER!** The metal structure of the screen must be grounded. Grounding the screen is a mandatory protective measure.

Before the first start, after checking the correct installation of the screen, the following actions must be performed:

- 1) Make sure there is no construction debris, tools, etc. in the channel.
- 2) Check and adjust the tension of the screen chains (paragraph 7.3).
- 3) Check the quality of bearing lubrication.
- 4) Check the oil level in the reducer according to the manual for the gear motor.
- 5) Check the correct connection of electrical equipment.
- 6) Check the correctness of the power supply connection to the gearmotor according to the plate (star or triangle).
- 7) Check the screen power supply parameters according to the technical specifications.
- Check the value of the thermal protection setting on the screen gear motor protection machine in the CP (the setting value must be equal to the value of the rated current indicated on the gear motor nameplate).
- 9) Check the setting of the time relay in the control panel (see the control panel's operation manual).
- 10) Check the presence of ATTENTION signs of danger on the screen.





**DANGER!** Checking the correctness of the connection of electrical equipment, setting the time relay, setting the thermal protection on the gear motor protection machine should be carried out only by qualified personnel who have permission to work with electrical equipment.



**DANGER!** Checking the correctness of the connection and, if necessary, changing the connection scheme of the gear motor should be carried out only by qualified personnel who have access to work with electrical equipment. At the same time, it is necessary to provide the impossibility of accidental supply of voltage by turning off the input circuit breaker and blocking its inclusion with a padlock.



**ATTENTION!** It is necessary to carefully familiarize yourself with the operation manual of the gear motor, which is included in the supply package.

# 7.2. Preparation of the CP for Operation

- 1) Connect the CP to the three-phase alternating current network with voltage.
- 2) Make sure the phasing is correct (indicators on the phase control relay).
- 3) Connect the grounding conductor to the PE1 clamp of the XT1 terminal box (Fig. 6.6).
- 4) Apply the mains voltage to the control panel.
- 5) Turn on the automatic switches in the CP.
- 6) Turn on the automatic switch for the protection of the screen gear motor.
- 7) Close the CP.
- 8) Turn on input switch QS1.
- 9) Check that the "NETWORK" indicator on the front panel of the CP is on.



**DANGER!** The preparation of the control panel CP for operation should be carried out only by qualified personnel who have permission to work with electrical equipment.

# 7.3. Chain tension



**DANGER!** Chain tension should be performed when the input switch on the control panel is turned off. The inserted switch must be blocked from turning on with a padlock.

**Chain tension** is carried out to optimize the functioning of the equipment. The level of chain tension determines the operation conditions of the equipment. If the tension is insufficient, there is a risk of the chain coming off.

# Excessive chain tension increases the load on the working mechanisms of the screen. This leads to increased forces on the shaft, increased wear of drive sprockets, chains and idlers.

When the forces on the shaft are increased, frequent unauthorized activation of the jet arm may occur under normal conditions. The chains are tensioned independently of each other by changing the location of the sliders with tension bolts (Fig. 3.11, pos. 5 and 2) relative to the screen frame. To do this, it is necessary to tighten or loosen tension nuts. When tightening the tension nut (Fig. 3.11, item 1), the chain is tightened, when it is unscrewed, it is loosened. The chains must be tensioned equally to avoid skewing and jamming of the rake. For this purpose, it is recommended to tension the chain by simultaneously or alternately screwing the tension nuts at equal distances from both sides.



**ATTENTION!** Chain tension should be carried out with simultaneous control of the location of the rake. For control, the rake is brought to the dividing line of the filtering mesh and the table. The rake should be parallel to this line. It is not allowed to skew the rake relative to the filtering mesh.





Figure 7.1– Checking the location of the rake

A is the dividing line of the table filtering mesh, B is the rake line.

Check the chain tension in the following order:

- 1) remove the lining in the operating position of the screen;
- 2) set the rake going down in a position at a distance of 500 mm from the drive shaft;
- 3) turn off and block the power supply to the screen;

turn the rake around its axis by the middle part, applying an effort of 10-12 kg. At the same time, the chain tension is considered normal if, on both sides of the rake, the upper roller of the chain link, on which the rake is fixed, touches the side of the screen, and the lower one touches the guide.



Figure 7.2 – Checking the chain tension

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**ATTENTION!** The chain is a wearing product and must be replaced, depending on the degree of its wear. Excessive chain tension is not allowed.

# 7.4. Checking the setting of the safety device



Figure 7.3 – Correct location of the inductive sensor relative to the control plate

1 – jet arm; 2 – inductive sensor; 3 – sensor control nuts; 4 – control plate; 5 – fastening of the control plate; 6 – spring; 7 – spring control nuts.





Figure 7.4 – The position of the inductive sensor

A – working position of the inductive sensor; B – emergency position of the inductive sensor; 1 – fixed part; 2 – moving part; 3 – direction of movement of the jet arm



Figure 7.5 – The front and back side of the sensor

A – the front side of the sensor; B – rear part of the sensor; 1 – working surface of the sensor; 2 – red sensor operation indicator; 3 – sensor cable.



Figure 7.6 – The direction of movement of the shaft and the jet arm

1 – shaft movement direction; 2 – direction of movement of the jet arm.



**ATTENTION!** The equipment is delivered with the safety device tripping settings set at the factory. It is allowed to adjust the factory settings of the safety device for specific operation conditions at the facility at the stage of commissioning operations, subject to agreement with the representative of the manufacture. Information about the changes made to the factory settings must be indicated in the act of commissioning the equipment.



**ATTENTION!** Checking the settings of the safety device is carried out strictly after the chain tensioning operation is completed.

**ATTENTION!** Excessive deepening of the safety device can lead to the failure of the screen during overloads due to failure of the mechanical protection.



#### Before checking the settings of the safety device, carefully study 8.6 "Operator's Procedure".

It is necessary to check the following settings of the safety device:

- 1) When unscrewing the control nuts (Fig. 7.3, item 3) and removing the overload sensor (Fig. 7.3, item 2) from the control plate (Fig. 7.3, item 4), the "EMERGENCY" should be activated;
- The control plate (Fig. 7.3, item 4) must be fixed symmetrically in relation to the overload sensor (Fig. 7.3, item 2) (the working part of the sensor should not extend beyond the plane of the control plate);
- 3) The overload sensor must be fixed at a distance of 1.5-2 mm from the plane of the control plate (Fig. 7.3 item 3);
- 4) When the overload voltage is applied to the sensor, the LED indicator should light up on its back side (Fig. 7.3 item 2);
- 5) The spring (Fig. 7.3, item 6) with the help of control nuts (Fig. 7.3, item 7) must be compressed in such a way that at the moment of switching on the screen, the gear motor, in the absence of jamming, works without oscillations on the shaft, but between the turns the spring had a gap for its compression during jamming and overloading of the equipment, which provides an exit from the zone of action of the inductive overload sensor (Fig. 7.3, item 2).



**DANGER!** Changing the setting parameters of the safety device must be done with the input switch on the control panel turned off, blocking it from turning on with a padlock.

ATTENTION! Full compression of the spring is not allowed.

**ATTENTION!** It is forbidden to change the setting of the safety device after checking the settings of the safety device during commissioning.

ATTENTION! Only qualified personnel who follow safety rules are allowed to start.

# 7.5. Debris blade adjustment

For uniform removal of waste from the rake, it is necessary to periodically adjust the scraper of the dumper with the help of adjustment bolts. Adjustment must be made so that the scraper is pressed against the rake along its entire length.





1 – adjustment bolts; 2 – scraper debris blade



# 7.6. Level Sensor (conductometric)

The level sensor (conductometric) is a stainless steel rod mounted on a screen.



Figure 7.8– Level sensor (conductometric)

1 – bracket; 2 – rod; 3 – puck; 4 – nut; 5 – hermovod; 6 – heat-shrink tube.

# 7.7. Measures to Reduce Noise and Vibration

With proper installation and adjustment before start-up, the screen works very quietly (no more than 60 dB). Nevertheless, in order to exclude the occurrence of vibration and noise factors beyond the specified, it is necessary to perform the following points during installation and check before start-up:

- 1. The screen support/stand must be securely fixed;
- 2. All bolted and screw connections on the equipment must be securely tightened;
- 3. The chains must be evenly tensioned, the chains must not be stretched and the rakes must not be skewed;
- 4. There should be no mechanical damage on the equipment parts;
- 5. The bearings of the screen drive shaft must be lubricated.

# 7.8. Starting the Screen in Idle Mode



**ATTENTION!** The start of the screen in idle mode is carried out dry in an empty channel in the operating position of the screen.

Before turning on the screen gear motor, it is necessary to check:

- correct chain tension;
- correct attachment of the rake;
- the presence of grounding on the metal hosing of the screen.



**ATTENTION!** Turning on the gear motor must be carried out with simultaneous control of the operation of the screen.

**ATTENTION!** In the event of a failure of the equipment mechanisms immediately after switching on, it is necessary to immediately turn off the power to the gear motor, eliminate the problems and perform the switch-on procedure again.

#### Before turning on the screen, carefully study item 8.6 "Operator's Procedure".

When turning on the screen for the first time, it is necessary to check the correctness of the direction of movement of the rake along the web. With the correct direction of movement, the rakes should move in a straight (working) direction (Fig. 7.9) - along the filtering mesh from bottom to top. At the same time, the drive



shaft of the screen on the side of the gear motor rotates counterclockwise. The arrow of the correct direction of rotation of the drive shaft is marked on the screen gear motor.



Figure 7.9– Directions of movement of rakes and rotation of the drive shaft

- 1 correct (straight) direction of rake movement and drive rotation; 2 reversible direction of rake movement and drive rotation.
  - 1. The course of the chain. The chains on both sides of the screen should move along the guides at the same time, breaking smoothly when turning on the leading sprockets and sliders. In the case of a delay when turning the chain, there is an increase in the effort of the gear motor to

turn the sprocket, which negatively affects the operation of the equipment. The main reasons in this case can be: jamming of the chain rollers or mechanical damage to the

The main reasons in this case can be: jamming of the chain rollers or mechanical damage to the chain plates.

2. Free movement of the rake. The rake, attached on both sides to the flexible chains, must move freely in the upper position and in the working position in the grooves of the profile of the filtering mesh.

In case of violation of the free movement of the rake, a delay in the movement of the chain can be observed with an increase in the load on the shaft, which will lead to the activation of the safety device.

The reasons for the violation of the free movement of the rake can be: improper attachment of the rake to flexible chains or mechanical damage to the profile or the rake.

- 3. The moment the rake enters the gutter. When turning the rake along the slider, the rake must freely enter and move along the gutter. Disruption of the movement of the rake when turning in the gutter can be caused by improper attachment of the rake to flexible chains, mechanical damage to the rake or gutter, insufficient chain tension.
- 4. The entrance of the rake into the openings of the drop-shaped or rectangular profile of the filtering mesh.

After passing through the gutter, the rake in the working position under its own weight enters the openings of the profile of the filtering mesh. This provides a tight connection with the bars of the filtering mesh and effective removal of waste over the entire area of the filtering mesh.

If the entrance of the rake into the openings is disturbed, the efficiency of the screen is reduced, which can lead to partial or complete clogging of the openings of filtering mesh.

The reasons may be: improper attachment of the rake to flexible chains, mechanical deformation of the structure.

#### 5. The work of the debris blade.

The debris blade is provided for cleaning the rake from waste removed from the filtering mesh. The debris blade must clean the entire working surface of the rake, preventing waste from returning to the channel. Therefore, its working part must completely cover the working part of the rake to the fastening bolts. Failure to meet this condition reduces the efficiency of waste removal from the rake and the overall efficiency of the screen. The reasons may be: insufficient length of the working hosing of the debris blade, deformation of the debris blade or weakening of the fastening of the



polyethylene scraper in the longitudinal grooves of the corner in its central part (the scraper becomes an arc along its length in relation to the corner).



**ATTENTION!** The assessment of these parameters is carried out when all rakes pass through a full cycle.

# After that, it is necessary to correctly adjust the safety device of the screen according to chapter 7.4 "Checking the safety device setting".

If failures and inconsistencies in the operation of the mechanisms were detected when checking the operation of the screen in the working position, it is necessary to determine the possible causes of the failure and eliminate the failures until the lost functionality is completely restored.

If the results of the preliminary inspection are satisfactory, you can proceed to the final stage of preparing the screen before work - start-up and debugging under load.



**ATTENTION!** It is necessary to notify the manufacturer of the grating as soon as possible, if defects in the structure of the grating were discovered during the inspection.

**ATTENTION!** Commissioning work under load is carried out only after the elimination of observations found during the check of the operation of the screen.

# 7.9. Commissioning under Load

Start-up and adjustment work under load in a filled channel is carried out after a preliminary check and ascertainment of the regulated operation of the screen.

At this stage, changes in the operation of individual mechanisms of the equipment at full load in the channel are eliminated.

When working in conditions of a filled channel, the working load applied to the main mechanisms and the screen frame exceeds the load at which the safety device is set. At the same time, in working conditions, the safety device can be activated to turn off the gear motor.

Thus, at the final stage, the evaluation of the operation of the equipment under the conditions of the workload and the adjustment of its mechanisms for individual conditions are carried out.

If an unauthorized disconnection of the gear motor occurs during the working load, it means that it is necessary to readjust the safety device for individual conditions.



**DANGER!** Changing the setting parameters of the safety device must be done with the input switch on the control panel turned off, blocking it from turning on with a padlock.

Also at this stage, the automatic operation of the equipment is set by setting the time relay (see the manual for the operation of the control system).

If no changes are detected during operation of the screen under load, the screen is considered prepared for operation in specific conditions.



**ATTENTION!** In all cases of failures of the normal operation of the screen, the gear motor should be immediately disconnected.



# 8. OPERATION

#### 8.1. Requirements for Operation

The customer must obtain a local license to operate the screen and act in accordance with directives

89/391 / EEC and 2009/104 / EU (in EU countries) or local legislation.

Moreover, the customer must comply with local laws regarding the following:

- Ensuring the safety of personnel;
- Ensuring the safety of production equipment;
- Disposal of products;
- Disposal of materials;
- Sweep-up and cleaning;
- Environmental protection.



**ATTENTION!** The customer shall be responsible for the following:

- Instructing the maintenance personnel;

- Timely maintenance.

Before starting up the screen, the customer must make sure that the requirements of local standards (such as those for electrical connection) are met.



**ATTENTION!** Correct operation of the screen in accordance with the recommendations of this Operation Manual guarantees long-term trouble-free operation of the screen and the efficiency of wastewater treatment.

# 8.2. Ventilation System

The ventilation system of industrial and other premises, including underground ones, provided for the operation of the equipment must ensure the required volume of fresh air and the rate of air exchange in the room according to the established regulatory requirements.



**ATTENTION!** Inefficient operation of the ventilation system in the production premises intended for the operation of the equipment can lead to the formation of corrosion and a decrease in the service life of parts subject to corrosion.

# 8.3. Safety Instructions

The screen is subject to all safety requirements for the operation of electrical equipment.

The screen must be reliably grounded.

In case of fire, the screen must be disconnected from the power supply. Extinguishing an ignition source shall be carried out with non-conductive fire extinguishing means.

You should take into account the additional safety instructions set out in separate sections of the Manual.

To avoid any incidents, please read the following information carefully:

- The screen may only be used by trained personnel.
- The screen cannot be used for purposes other than the intended use.
- Before starting the screen, carefully check that all safety devices are connected.
- If the defect prevents the unit from working correctly, it must be stopped.
- Do not remove guards and safety devices near the unit.
- Maintenance personnel must wear protective clothes (shoes, gloves, etc.).
- To avoid accidental starting of the screen during the inspection, cleaning or maintenance, set the switch to the OFF position and press the emergency button.
- Before turning on the screen, make sure that all safety devices work correctly.
- Switch off the device in the event of a failure, as this may constitute a threat to your safety and the safety at the site.
- Make sure the nameplate is easy to read.
- The screen must be grounded.
- Do not remove ATTENTION signs near the screen.
- It is forbidden to remove or open the safety devices while the screen is in operation.





**DANGER!** To avoid personal injury, do not touch the rotating and moving parts of the screen.



**DANGER!** Before carrying out installation, repair, maintenance, or any other work, it is mandatory to disconnect the power supply to the unit control panel!



**DANGER!** It is forbidden to start the screen into operation when people are in the hazard zone.



**DANGER!** It is forbidden to operate the screen with the removed coverings, fences, protective parts, blocking devices, that were manufactured and installed by the manufacturer.



**ATTENTION!** It is forbidden to continue the operation of the screen if a failure is detected.



**DANGER!** Before turning on the screen, the operator must make sure that all safety requirements have been complied with!

**ATTENTION!** A detailed description of the control modes, the procedure for the operator's work with the equipment is given in the operating manual for the screen control panel.

# 8.4. Screen Protection Systems

Each unit should be provided with an emergency button to stop the equipment in the event of an emergency. In the event of dangerous situations related to the equipment, the screen stops when you press this button.

The emergency button must always be in the immediate vicinity of the screen and must always be easily accessible. It is the installer's job to ensure that all necessary protective devices are available and to ensure the safety of the equipment.

# 8.5. Equipment Operation

#### The following shall be performed before operation:

- 1) Read all paragraphs of this Operation Manual.
- 2) Carry out installation and preparatory work with a mandatory check of the screen operation and elimination of possible failures according to the paragraphs of this Operation Manual.
- 3) Carry out commissioning works according to Chapter 7, with the adjustment of the screen mechanisms for specific working conditions and adjustment of additional equipment.

#### The following should be performed during operation:

- 1) Adhere to the safety regulations when servicing the screen.
- 2) Carry out mandatory maintenance according to the maintenance schedule (Chapter 9).
- 3) Record all performed maintenance operations in the maintenance log (ANNEX B).
- 4) Inform the experts of the screen manufacturer in the event of fatal breakdowns or breakdowns not described in this Manual.

Additionally, when operating the equipment, it is necessary to follow the recommendations of the Operation Manual for the gear motor and the manual for the control panel.



**ATTENTION!** The operator responsible for operating the equipment must have all protective equipment (gloves, shoes, etc.).

# 8.6. Operator's Procedure

This section provides information that is necessary and sufficient for operators to operate the screen safely and correctly.



The screen is controlled by the operator using a remote control panel (RCP). The RCP must be placed near the screen in a place convenient for operation. The work of the operator with the RCP is safe, because the following safety measures are provided by the manufacturer:

- 1) The RCP hosing is made of plastic that does not conduct electric current and is resistant to aggressive environments. RCP is completely protected from dust and moisture;
- 2) Only a constant voltage of 24 V is supplied to the RCP.



**DANGER!** Before turning on the equipment, the operator must make sure that all safety requirements have been complied with!

#### Introducing the screen into operation

- 1) Turn on the screen in manual mode.
- 2) Open the slide gate after the screen.
- 3) Gradually opening the gate in front of the screen, feed the wastewater to the screen.
- 4) Wait for the moment when the amount of garbage thrown from the discharge window of the screen decreases, put the screen into automatic mode.
- 5) If the amount of wastes does not decrease, it is recommended to leave the screen in manual mode.



**ATTENTION!** When the screen is put into operation, wastewater must be fed gradually. Do not allow sudden full opening of the slide gate in front of the screen. A sudden supply of a large amount of waste accumulated in front of the screen can lead to rapid clogging of the filtering mesh and activation of the safety device of the screen.

#### Taking equipment out of service

- 1) Close the slide gate before the screen.
- 2) Close the slide gate behind the screen.
- 3) Turn off the screen.

#### Selecting the screen operating mode

To turn on the screen, the operator must:

- 1) check by turning the "Emergency stop" mushroom button to the right that the button is not locked when pressed;
- 2) select the required screen operation mode with the "MANUAL / AUTO" switch;
- 3) briefly press the green "START" button;
- 4) check that the backlight of the "START" button has turned on;
- 5) check that the rake moves in the correct (straight) direction (the direction of rotation of the drive shaft on the side of the gear motor must coincide with the arrow indicated on the gear motor, i.e. counterclockwise).



**ATTENTION!** When the rakes of the screen move down - immediately disconnect the screen and change the direction of movement of the rakes by replacing the places of any two phase conductors in the terminal box of the gear motor.



**ATTENTION!** Highlight of the "START" button on the control panel indicates that the screen is in operation. The screen gear motor in manual mode turns on immediately after turning on the "START" button. The screen gear motor in automatic mode is switched on cyclically by the time relay.

#### Switching off the equipment

Depending on the situation in which it is necessary to turn off the screen, the operator should perform:

**Scheduled shutdown** - shortly press the red STOP button (see Operation manual of the CP). In this case, the screen is turned off, and its subsequent activation is carried out only after pressing the "START" button, which prevents self-starting of the equipment.

**Emergency stop** - press the red EMERGENCY STOP mushroom shaped button (see Operation manual of the CP). In this case, the screen is turned off, and the button is fixed in the pressed position and blocks the screen activation with the START button. Subsequent switching on of the screen is performed only after unlocking the EMERGENCY STOP button by turning it to the right and after pressing the START button, which prevents the screen from starting up.

The emergency stop is used to turn off the screen gear motor in order to eliminate the danger.



**Emergency shutdown- switching** of the power supply to the CP. The emergency shutdown is performed using a local switch, which is located on the side wall of the CP.

# 8.7. Emergency Conditions



**DANGER!** The search and elimination of the cause of emergency situations must be carried out with the power off (the local switch must be turned off and locked with a padlock).

Types of Emergency Situations	Protection Device Tripping
- jamming of rakes;	overload sensor
- breakage of the cable of the overload sensor.	
- gear motor overload;	gear motor protection circuit breaker
-short circuit in the power supply circuits of the gear	
motor;	
- interruption of the power supply phase of the gear	
motor	

In case of emergency situations during operation of the screen, emergency protection of the screen is provided. In this case, the equipment is immediately turned off. The illumination of the green "START" button on the control panel turns off. The illumination of the red "STOP" button turns on, which signals that the screen is in the "EMERGENCY" state. On the front panel of the CP, the red "EMERGENCY" indicator and a sound alarm (when connecting a call) are turned on.

Protective shutdown of the screen in emergency situations and activation of the emergency alarm is carried out in both manual and automatic modes.

# A detailed description of emergency situations and their elimination is indicated in the Operation manual for the CP.

# 8.8. Actions in emergency situations



**DANGER!** The search and elimination of the cause of emergency situations must be carried out with the power off (the input switch must be turned off and locked with a padlock).

# This section provides a general procedure for personnel actions in emergency situations. A detailed description of the procedure for actions in specific emergency situations is indicated in the operation manual for the CP!

When the emergency protection and alarm are activated, you should perform:

- 1) Turn off the call (if available) by pressing the "STOP" button on the control panel or the "EMERGENCY DISCHARGE" button on the front panel of the CP.
- 2) Stop the supply of wastewater to the screen by closing the slide gate in front of it. Put the backup screen into operation.
- 3) Press the "REVERSE" button once.



**ATTENTION**! Turn on the screen in the reverse direction only to eliminate jamming of the chains and rakes of the screen. The inclusion must be one time.

- 4) Press the "STOP" button on the RCP. If the illumination of the red "STOP" button on the control panel and the "EMERGENCY" indicator on the front panel of the control panel are turned off, the protective shutdown of the screen occurred due to the activation of the overload sensor. If the illumination of the "STOP" button and the "EMERGENCY" indicator on the front panel of the CP did not turn on, the protective shutdown of the screen occurred due to the activation of the automatic switch for the protection of the FS1 screen gear motor.
- 5) Turn off the screen power supply by setting the input switch on the control panel to the "0" position.
- 6) If the screen has tripped due to an overload sensor, move it to the repair position (Chapter 8, 9). Carefully inspect the filtering mesh and eliminate the cause of jamming of the rakes. Move the screen to the working position.





**ATTENTION!** The load capacity of the lifting device must exceed the weight of the screen. The weight of the screen is indicated on the plate of the screen.

**ATTENTION!** Slings must be used designed for a weight that exceeds the weight of the screen.



**DANGER!** Provide the impossibility of accidental voltage supply by turning off the input switch and blocking its activation with a padlock.



**DANGER!** It is forbidden to carry out operations to eliminate jamming of rakes without fixing the grating above the channel.

7) If the screen is disconnected due to the activation of the automatic switch for protection of the gear motor - check the serviceability of the gear motor itself and its power supply circuits. These works must be performed by qualified personnel who have a permit to work on power supply. After determining and eliminating the cause of the tripping of the automatic gear motor protection switch, it must be brought to the working position by pressing the black "START" button located on it.



**DANGER!** Work to determine and eliminate the cause of the tripping of the automatic switch should be carried out only by qualified personnel who have permission to work with electrical equipment.

- 8) Turn on the power supply of the screen by setting the input switch on the control panel to the "I" position.
- 9) Check that the screen overload sensor is in the working position (the red indicator in the sensor lights up), there is no indication of an accident on the RCP and the front panel of the CP.
- 10) Switch the screen to the "MANUAL" control mode, press the "START" button on the remote remote control of the screen and check the operation of the screen in the "MANUAL" mode. Make sure the screen is working properly.
- 11) If necessary, switch the screen to AUTOMATIC mode.



**ATTENTION!** Screen lubrication points on the motor side are similar to those shown in Figure 9.1.

# 8.9. Measures to prevent steel corrosion

Products and equipment operated at waste water treatment plants have an increased risk of steel corrosion. To prevent the occurrence of corrosion, it is necessary to observe the rules of storage, installation and operation of the equipment given in the operation manual. The main causes of corrosion include the following:

#### 1) The quality of the water used for equipment flushing and washing

High salt content as well as presence of sulfides and hydrogen sulfide in water lead to corrosion of the surface of equipment; the use of chlorinated water poses a threat of surface damage in the presence of a high concentration of free chlorine; the presence of bacteria can also lead to biocorrosion. Therefore, it is necessary to monitor the quality of the rinsing water and not to exceed the values of the parameters:

- a. Chloride ions: 200 mg/l,
- b. Sulfide ions and hydrogen sulfide: 100 mg/l,
- c. TDS: 2000 mg/l,
- d. Free chlorine: 0.5 mg/l,
- e. Coliform organisms: 10/100 ml.

#### 2) Quality of washing and cleaning procedures

The presence of microorganisms in the waste water, as well as the course of their vital processes, lead to the formation of corrosive compounds. To prevent the occurrence of biocorrosion, the equipment must undergo appropriate cleaning and washing procedures in accordance with the operating regulations; any work performed regarding cleaning must be indicated in the equipment operation log.

#### 3) Violation of recommendations for cleaning equipment

The use of high-pressure washers for cleaning equipment with a water jet pressure above 27.5 MPa and a spray pattern angle less than 25° can damage not only the technological elements of the equipment, but also



the protective layer of the surface of the stainless steel. Do not use ultra-high pressure washers to clean the equipment; carry out cleaning procedures using recommended spray pattern angle of 40°.

#### 4) Air quality

The presence of moisture, hydrogen sulfide and salt (in the form of an aerosol) in the air leads to electrolysis and surface oxidation. Ensure effective ventilation of the facilities in order to prevent the accumulation of hydrogen sulfide and corrosive substances in the air.

#### 5) Physical contact of stainless steel with other metal products

Physical contact of stainless steel with other conductive materials (e.g., carbon steel) can create an electrochemical cell that will lead to corrosion. It is necessary to insulate the elements with special gaskets and uniform painting of the carbon steel elements.

#### 6) Mechanical damage

Any scratch or damage to the surface of stainless-steel products, or even the presence of metal dust on it can lead to corrosion. Therefore, you should not allow mechanical damage to the equipment and do not carry out any welding or cutting work near it.

#### 7) Sewage/sludge decay

Direct contact of steel with fluids containing high concentration of sulfides, hydrogen sulfide and other decay gases, causes rapid corrosion development. Therefore, it is important to prevent rotting of wastewater / sludge, and to carry out their conditioning if needed; after working with such fluids to perform a thorough washing of the equipment.



**ATTENTION!** Failure to comply with the operating conditions of equipment and stainless steel products will void the warranty.



# 9. MAINTENANCE

The complex of technical maintenance operations should be performed only by qualified specialists who have studied the structure and principle of operation of the screen and have received instruction and training from representatives of the manufacturer's company.

In the event that, based on the specifics of the installation site or project features, it is not possible to rotate the screen in the channel if the length of the straight section of the channel is insufficient, it is necessary to provide for the possibility of vertically lifting the screen from the channel for maintenance and repair.



**ATTENTION!** When maintaining the screen, it is necessary to strictly follow the safety rules and follow the recommendations of this manual.



**DANGER!** Work to determine and eliminate the cause of the tripping of the automatic switch should be carried out only by qualified personnel who have permission to work with electrical equipment.



**DANGER!** Maintenance is carried out only after disconnecting the equipment from the network by turning off and locking the input switch with a padlock, as well as posting the sign "Do not turn on, people are working" on the control panel.



**ATTENTION!** Screen maintenance must be carried out strictly within the terms determined by the maintenance regulations. It is MANDATORY to make a note about all performed routine work in the maintenance log using the attached form (ANNEX B).

Use the oils specified in the passport of the gear motor as a working fluid.



Figure 9.1- Screen lubrication points



**ATTENTION!** The screen lubrication points on the motor side are similar to those shown in fig. 9.1.

To carry out maintenance of the screen, it is necessary to raise and fix the screen above the channel. The screen is lifted above the channel using standard two-strand slings and a lifting mechanism.



**ATTENTION!** In case of non-performance of preventive works in accordance with the recommended scope and terms of technical maintenance of the screen, the manufacturer removes responsibility for warranty obligations.

**ATTENTION!** Before moving the screen to the repair position, it is necessary to remove the discharge cover (see Chapter 10).

The screen is lifted from the channel using special slinging eyes or by eyes in the lifting frame (Fig. 9.2).





Figure 9.2– Transferring the screen to the repair position

When lifting from the channel, the screen rotates around the axes on the screen hosing, connected to the supports/stand in the channel or on the side of the channel. To rotate the screen installed on the supports/stand on the side of the channel and bring it to a horizontal position for maintenance, the control bolts and nuts must be unscrewed until the axis of the screen can rotate freely in the spigot of the rod of the supports/stand.



**ATTENTION!** Before carrying out the operation, it is necessary to check the serviceability of the lifting mechanism and the integrity of the slings.

**ATTENTION!** The load capacity of the lifting device must exceed the weight of the screen. The weight of the screen is indicated on the screen's nameplate.





**DANGER!** Provide the impossibility of accidental voltage supply by turning off the input switch and blocking its activation with a padlock.

After lifting, the screens are installed on a stop for fixation above the channel.

Maintenance is carried out strictly after fixing the screen over the channel.



**DANGER!** It is forbidden to carry out maintenance operations of the screen without fixing it above the channel. Before installing the screen in the repair position, it must be disconnected and the slide connected to the discharge casing must be removed from the hinges.

Openings cleaning of the filtering mesh from foreign objects is carried out to prevent jamming of the rakes, damage to the structure and, as a result, failure of the screen. After the maintenance is completed, the screen slowly lowers into the channel.

The periodicity of the operation is determined by the degree of clogging of the filtering mesh.



**ATTENTION!** If during the external examination, equipment failures were revealed associated with filtering mesh clogging, it is necessary to clean the mesh openings from foreign objects.



Cleaning of filtering mesh transparencies is carried out with a sharp object with a diameter (thickness) smaller than the size of the transparencies.



**ATTENTION!** Removal of foreign objects must be carried out without deformation and damage to the filtering mesh, rakes and other elements of the screen.

The openings of the screen after cleaning must be completely free of foreign objects.

The tines of the rake should freely pass into the openings between the rods along the entire length of the filtering mesh.

Table 9.1 -	Maintenance	schedule
-------------	-------------	----------

Type of works	Periodicity	Note
Checking the operability of the control panel	Daily at the beginning of the shift	Check the switching on/off of the screen from the control panel, check the "OPERATION" status indication on the control panel.
External inspection	Daily at the end of the shift	<ol> <li>The screen is in the operating position in the channel.</li> <li>Inspect the visible parts and nodes of the screen.</li> <li>Check the operation of the screen for jamming, wedging, knocking, creaks, extraneous noises.</li> </ol>
Checking the chain tension	Once per month	<ol> <li>Move the screen to the repair position above the channel.</li> <li>If necessary, tighten the chains (see chapter 7.4)</li> </ol>
Cleaning and checking of the filtering mesh	Once a week or as it gets clogged	<ol> <li>Inspect the filtering mesh for mechanical damage.</li> <li>Clean the filtering mesh from wastes.</li> </ol>
Inspection of the submerged part of the screen for mechanical damage	Once per month	<ol> <li>Move the screen to the repair position above the channel.</li> <li>Inspect the submersible parts and screen nodes.</li> <li>Check the free rotation of the chain rollers</li> </ol>
Checking the integrity of rubber sealings	Once per month	<ol> <li>Move the screen to the repair position above the channel.</li> <li>Inspect the rubber sealings, if necessary, replace them.</li> </ol>
Lubrication of main shaft bearings	Once per month	Lubricate the bearings with LITOL-24 grease using a syringe (Fig. 9.1).
Lubrication of the screen attachment unit to the supports/stand	Once per month	Lubricate the fastening unit with LITOL-24 grease
Adjustment of the debris blade scraper	Once per 6 months	Adjust with the help of bolts (chapter 7.6).
Checking the attachment of the rakes to the chains	Once per month	
Functional tests of safety devices	-	The periodicity and order of conducting functional tests is carried out in accordance with the operation manual of the CP.
Tightening of screw connections in CP and RCP	Once per 6 months	
Cleaning the CP from dust	Once per 6 months	
Replacement of broken elements of CP and RCP, overload sensor	In case of failure	
Measurement of the voltage and current consumption of the CP and the gear motor	Once per 6 months	Measurements should be made with a multimeter with current clamps.





**ATTENTION!** Functional tests should be performed only by qualified and trained personnel!

**ATTENTION!** Lack of maintenance entails automatic termination of warranty obligations.



# **10. REPAIR WORKS**

All repair work, replacement of chains, rakes, cleaning of the filtering mesh must be carried out only after installing the screen in the repair position (Fig. 10.1). The screen is lifted into the repair position using slings tied to the lower lugs or lugs in the lifting frame. To rotate the screen installed on the supports on the side of the channel and bring it to a horizontal position, the locking bolts and nuts (Fig. 6.1, items 5 and 6) must be unscrewed until the axis of the screen can rotate freely in the spigot of the support rod.



Figure 10.1– Working and repair position of the screen A – operating position, B – repair position, 1 – discharge cover



Figure 10.2– Removing the discharge cover A – step №1, B – step №2.





**ATTENTION!** Before lifting the screens into the repair position, it is necessary to remove the discharge cover (Fig. 10.2).

## The sequence of removing the discharge cover:

- 1) Loosen the bolt connection (4 pcs.), by means of which the casing is fixed to the screen frame;
- 2) Using the handles, lift the casing so that the casing can be dismantled through the removable holes;
- 3) Pull the discharge cover on yourself and dismantle.

Installation of the discharge cover is carried out in the reverse order.



**DANGER!** All repair work should be carried out only by qualified personnel, observing all safety rules.



**DANGER!** Repair work is carried out only after disconnecting the screen from the network by turning off and locking the input switch with a padlock, as well as posting the sign "Do not turn on, people are working" on the control panel.



**DANGER!** It is forbidden to carry out operations on the repair work of the screen without fixing it above the channel.

**ATTENTION!** For transportation and installation of the screen, use only the lifting lugs provided for this purpose. It is forbidden to hook the slings to the screen nodes.



DANGER! It is strictly forbidden to be on or under suspended equipment.

- **ATTENTION!** Before carrying out the operation, it is necessary to check the serviceability of the lifting mechanism and the integrity of the slings.
  - **ATTENTION!** The load capacity of the lifting device must exceed the weight of the screen. The weight of the screen is indicated on the plate of the screen.



**ATTENTION!** Slings must be used designed for a weight that exceeds the weight of the screen, indicated on the plate of the screen.



**DANGER!** When raising/lowering the grating, it is necessary to strictly follow the safety rules when working with lifting devices.

# 10.1. Replacement of chains

Chains are consumables.

When replacing the chain, it is necessary to set the screen in the repair position (Fig. 10.2) and loosen the chain tension node to a minimum. After that, it is necessary to remove the cover of the side window (Fig. 3.3, item 4), turn on the screen and adjust the chain so that the chain link with the lock appears in the window (Fig. 10.3, item 2). Next, it is necessary to stop the screen, unpin the finger (Fig. 10.3, item 1), pull it out of the lock, remove the locking plates and washers, and remove the chain.

After that, you need to put a new chain on the sprockets and pull it so that the chain lock appears in the window. Insert a finger into the closing link (Fig. 10.3, pos. 1), put washers and cotter pins (Fig. 10.3, pos. 3, 4) and tighten the chain. Put the cover of the side window, set the screen in the working position and start it.





Figure 10.3– Chain lock

1 – finger; 2 – connecting plate; 3 – puck; 4 - cotter pin.

**ATTENTION!** After replacing the chain, it is necessary to tension the chain (chapter 7.3).

# 10.2. Replacement of rakes



**DANGER!** Replacement of rakes is carried out only after disconnecting the screen from the network by turning off and locking the input switch with a padlock, as well as hanging the sign "Do not turn on, people are working" on the control panel.

The rake has cheeks on both sides (Fig. 10.4, item 1). With the help of bolts and screws (Fig. 10.4, pos. 3 and 4), which pass through holes in the cheeks and in the chain, and self-locking nuts (Fig. 10.4, pos. 6), the rake is attached to the flexible chain (pos. 5).

The sequence of attachment of the rake:

- 1. Set the rake so that the holes in the cheek of the rake coincide with the holes in the chain.
- 2. Insert the bolts and screws into the holes of the chains and cheeks, first thread the limiters onto the bolts.
- 3. Tighten the rake with self-locking nuts. The screw (item 4) should not protrude beyond the limiter (if necessary, cut the screw).



Figure 10.4- Replacement of the rake

1 - cheek; 2 - rake; 3 - bolt; 4 - screw; 5 - chain; 6 - self-locking nut; 7 - limiter.



# 11. POSSIBLE FAILURES AND TROUBLESHOOTING

The main failures that may arise during the operation of the screen and the ways to eliminate them are given in Table 11.1.

Table11 1- Pos	sible failures in the one	ration of the equipmen	t and methods of their	r elimination
		radon of the equipment		Chinadon

Failure	Probable cause	Method of elimination
	Improper attachment of rakes to flexible chains	Install the rake correctly
	Mechanical damage to the bars	Repair the damage
Activation of the safety device	Falling under the rake of large foreign objects (board, rag, etc.)	<ol> <li>Turn on the reverse and try to remove the object.</li> <li>Remove the rake and remove the object</li> </ol>
	Mechanical damage to the rake	Replace the rake
	A large gap between the working surface of the sensor and the control plate	Adjust the gap
	Overload sensor failure	Replace the sensor
	Improper attachment of the rake	Install the rake correctly
Tight entry of the rake into	Mechanical damage to the rake	Replace the rake
the gutter	Gutter damage	Repair the damage
	Insufficient chain tension	Pull the chain
Partial or complete clogging	Incorrect attachment of the rake to the flexible chains	Install the rake correctly
filtering mesh	Mechanical deformation of the profile structure	Eliminate deformation
Waste is inefficiently	Insufficient length of the working part of the debris blade	Adjust the working part of the debris blade
removed from the rakes	Deformation of the debris blade	Eliminate deformation
Gear motor does not rotate	No power supply	Check the network power
	An emergency sensor is included	Eliminate the cause of the accident



**ATTENTION!** If you identify unrecoverable failures or malfunctions that are not described in this Manual, please contact manufacturer's specialists as soon as possible.



# 12. SPARE PARTS AND CONSUMABLE PARTS THAT ARE NOT COVERED BY THE MANUFACTURER'S WARRANTY

## **Consumable parts**

Long service life and resistance to corrosion caused by municipal and industrial wastewater are achieved due to the fact that all components in contact with the wastewater are made entirely of corrosion-resistant materials (stainless steel, polymer materials, painted carbon steel), pickled and passivated. The construction contains parts, the degree of wear of which depends on the operating conditions and the duration of operation. Consumable parts are not covered by the warranty.

List of consumable parts that are not covered by the Manufacturer's warranty is given in Table 12.1.

Table 12.1 – List of consumable parts that are not covered by the Manufacturer's warranty

No	Name	Where does it includes	Frequency of replacement	Note
1	Chains	Raking mechanism		
2	Scraper of the debris blade	Debris blade	According to wear	
3	Cam of the debris blade	Debits blade		
4	Sloth	Screen housing		
5	Non-contact inductive load sensor	Safety device	In case of failure	



#### Figure 12.1 – Screen chains



Figure 12.2 - The scraper of the debris blade



Figure 12.3 - Cam of the debris blade



Figure 12.4 - Sloth

A list of screen spare parts is provided in ANNEX B.



To order spare parts, you must make a request to PRODEKO-EŁK Sp. z o.o by e-mail, specifying the following information about the screen:

- model;
- the serial number;
- graduation year;
- part code or product name (if it is specified/known).

Always use original replacement parts made by PRODEKO-EŁK Sp. z o.o.



# 13. DISPOSAL

Electrical and mechanical disconnection must only be carried out by qualified personnel authorized to perform such works.

Before final shutdown, drain the oil from the gearbox.

When disposing of used oil, appropriate safety precautions for lubricants handling must be observed.



**ATTENTION!** Disposal of used oil should only be carried out by specialized organizations.

This product contains:

- Steel;
- Polymer materials;
- Copper;
- Electronic components.

Material	Disposal Methods
Steel	<ul> <li>Recycling;</li> <li>Burial (performed by a specialized organization).</li> </ul>
Polymer materials	<ul> <li>Recycling;</li> <li>Burial (performed by a specialized organization);</li> <li>Recovery of materials.</li> </ul>
Copper	<ul> <li>Recycling;</li> <li>Burial (performed by a specialized organization).</li> </ul>
Electronic	- Recycling;
components	- Recovery of materials.

Dispose of parts of the product according to applicable standards.



**ATTENTION!** The equipment must be disposed of according to the sanitary and epidemiological standards of the country of application. The Customer is responsible for compliance with this requirement!



# ANNEX A. CONTACTS

# Contacts PRODEKO-EŁK Sp. z o. o.

Poland

19-300 Ełk, Strefowa str. 9 tel. +48 87 620 06 02 e-mail: prodeko@esmil.eu



# ANNEX B. CATALOG OF SPARE PARTS AND ACCESSORIES

# CATALOG OF SPARE PARTS AND ACCESSORIES OF RKE SCREEN

Pos.	Name	Quantity, units	Note
1	Rake assembled	from 4 to 11*	
2	Flexible chain	set	
3	Discharge cover with a slide	1	
4	Front cover	from 2 to 4	
5	Top cover	1	
6	Debris blade	1	
7	Sprocket	2	
8	Shaft	1	
9	Safety device	1	
10	Gear motor	1	Manufacturer's warranty
11	Supports on the side of the channel	set	
12	Terminal box	1	
13	Sloth	2	
14	Gutter	1	
15	Filtering mesh	1	
16	Rubber sealings	1	
17	Frame	1	

\* – The range corresponds to the standard series of standard sizes (up to xx30). For higher screens, the number of rakes will be increased, keeping the step of 800 mm.



#### ANNEX C. OPERATION AND MAINTENANCE LOG

(The log is kept at the place of operation of the equipment by maintenance personnel)

#### OPERATION AND MAINTENANCE LOG (example)

Model: \_\_\_\_\_

Serial number: \_\_\_\_\_

Commissioning date: \_\_\_\_\_

Na	Type of work (maintenance, repair) notes on equipment operation	Date	Performed by		Comment
NO			Signature	Full name	Comment
1					
2					
3					
4					
5					



ATTENTION! Lack of notes in the OPERATION AND MAINTENANCE LOG (ANNEX C) will automatically void the Warranty.