



**DNEPROTECHSERVICE**  
SCIENTIFIC PRODUCTION FIRM



# BULK MATERIALS HANDLING EQUIPMENT



PUBLIC JOINT STOCK COMPANY  
**ДНЕПРОТЯЗМАНШ**



# DNEPROTECHSERVICE

SCIENTIFIC PRODUCTION FIRM

"DNEPROTECHSERVICE" scientific and production firm comprises a group of Ukrainian machine-building enterprises. Specialization of the firm is: development, production, selling and maintenance of equipment, machines and facilities, creation of technologies for enterprises of cosmic and aviation branch, for enterprises of ore-dressing, metallurgic, coke-chemical, oil and gas, electro technical, automobile industry, energy and building industry, underground and mines, railroad and marine terminals.

## MANAGING COMPANY



# DNEPROTECHSERVICE

PRODUCTION GROUP

## PRODUCTION UNIT



### Dneprotymash

Heavy engineering equipment for metallurgical and mining industries



### Mill Rolls Plant

Cast Iron Roll Forming



### RDE NIKE

Cellular constructions for Space industry



### Svetofor

Electrical products for rail industry

## DESIGN UNIT



Metallurgical Equipment  
Designing and Technical institute



### Metallurgavtomatika PJSC



Ukrainian Research Institute  
of Manufacturing Engineering PJSC

## Sales & marketing unit

Trade House  
Dneprotechservice  
Russia, Moscow



DTS Equipment Ltd.  
London, United Kingdom



**DNEPROTYAZHMASH PUBLIC JOINT-STOCK COMPANY** (former name – Dnepropetrovsk plant of metallurgical equipment – DPME – until 1990) is one of the leading heavy engineering enterprises possessing century-long history, experience and traditions. Since 2001 Dneprotiyazhmash Public Joint-Stock Company has been a part of Dneprotechservice Scientific and Production Group.

The company is a leading supplier of process equipment for the mining and metallurgical complexes, coke and energy industry, space industry, cast-iron tubing for the construction of underground and mine railways, and is the supplier of the wide nomenclature of the transport and unloading equipment.

The enterprise has implemented a full technological cycle of production, combining metallurgical, welding and mechanical assembly production. The quality management system complies with the requirements of the international standard ENISO 9001:2008.

PJSC "Dneprotiyazhmash" is one of the leading developers of handling complexes (HC) for unloading of bulk materials from rail, and is manufacturer of process equipment, which is part of the handling complex.

The first car dumper made by Dnepropetrovsk plant of the Machine-Building Equipment, was produced in July 1948.

Since then and until today this production became a peculiar card of the enterprise "Dneprotiyazhmash". In this time, more than 400 car dumpers of most various types – rope and gear, stationary and mobile, rotor and lateral – were produced. Unloading production complexes of PJSC "Dneprotiyazhmash" are broadly applied at the enterprises of mining and metallurgical branches, power and building industries, and on sea unloading terminals.

Large experience in the production of high-performance, reliable, easy-to-use handling complexes, as well as a high level of design development and technological capabilities of the enterprise ensures timely and accurate manufacture of equipment for the customer.

PJSC "Dneprotiyazhmash" develops projects of placement and alignment of HC process equipment (mechanical, electrical and building parts), including such projects as:

- projects of buildings, facilities and structures;
- projects of engineering life-support systems of HC (lighting, welding stations, water supply, sewerage, fire extinguishing systems, ventilation, air conditioning, grounding, lightning protection, etc.);
- railway access roads, catenary carriage pushers, conveyor galleries, as well as the development of private technical specifications for process equipment of HC.

PJSC "Dneprotiyazhmash" is ready to participate in the implementation of complex projects, and in the execution of certain types of design works. The capabilities of our enterprise allow carrying out these works on our own forces, as well as with attraction of a wide range of specialized subcontract organizations.

Relying on long-term experience of our experts, we have created the unique scheme of work on objects, which allows considering completely individual interests and requirements of the Customer, to develop optimum design decisions, to offer the most effective equipment, to organize professional installation and commissioning, and to provide the qualified service.

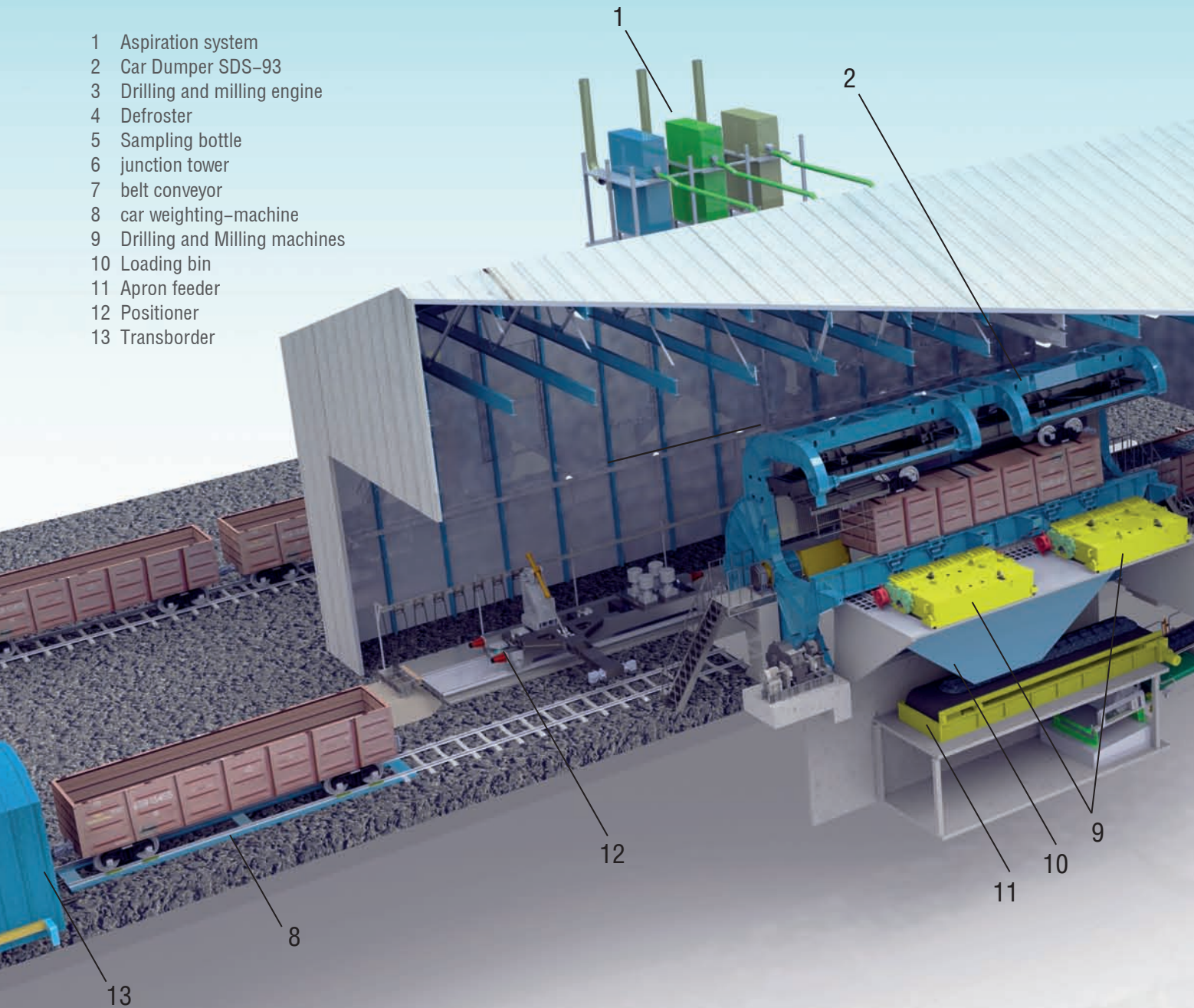


**WE LOOK FORWARD TO COLLABORATION POSSIBILITIES AND HOPE TO ESTABLISH LONG-TERM BUSINESS CONTACTS, AS WELL AS FOR DEVELOPING OF JOINT PROJECTS.**



# LAYOUT OPTION OF UNLOADING COMPLEX PROCESSING EQUIPMENT

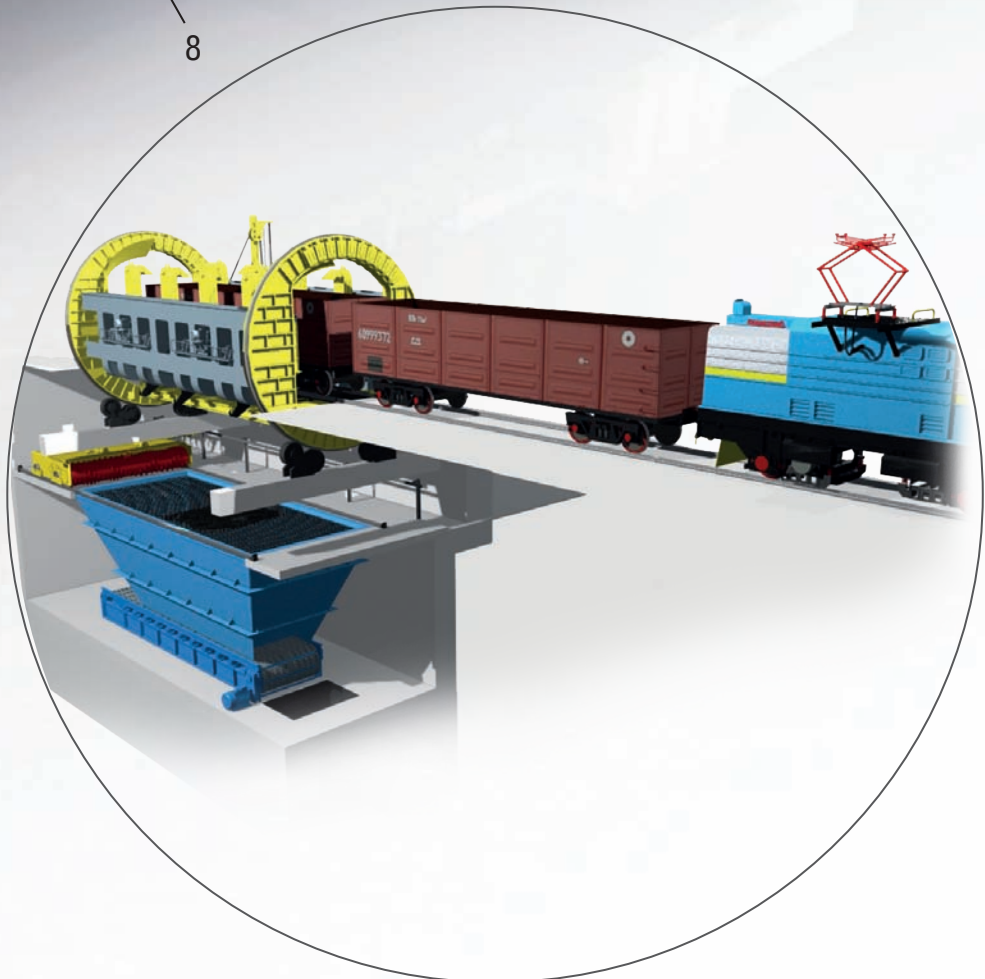
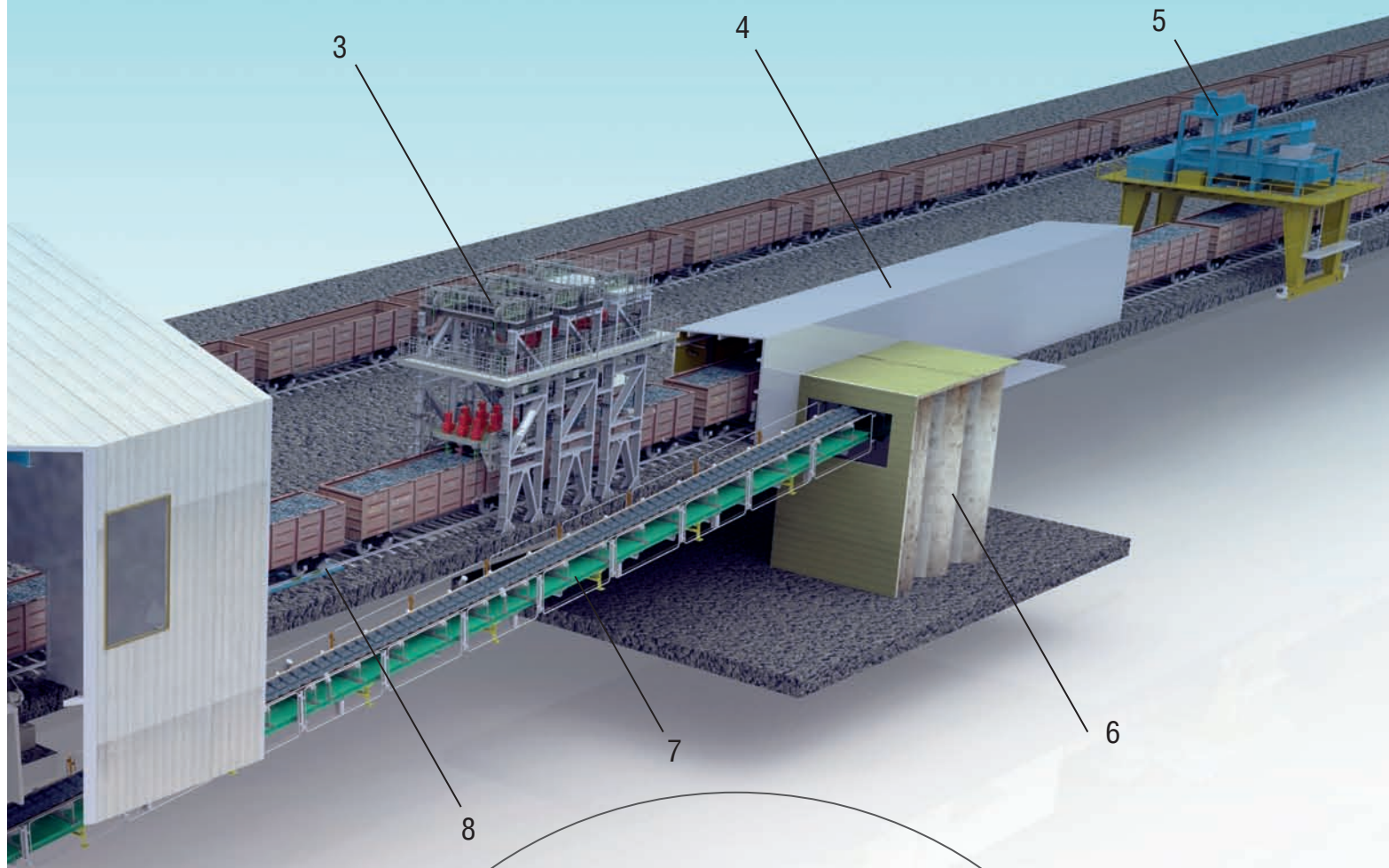
- 1 Aspiration system
- 2 Car Dumper SDS-93
- 3 Drilling and milling engine
- 4 Defroster
- 5 Sampling bottle
- 6 junction tower
- 7 belt conveyor
- 8 car weighting-machine
- 9 Drilling and Milling machines
- 10 Loading bin
- 11 Apron feeder
- 12 Positioner
- 13 Transborder



## THE FOLLOWING TECHNOLOGICAL EQUIPMENT IS SUPPLIED FOR UNLOADING COMPLEX CONFIGURATION:

- car pushers – different models with different configuration;
- positioners;
- car dumpers – different models with different configuration;
- drilling and ripping devices;
- drilling and milling machines;
- bin netting with bays of different size;
- loading bins;
- various types of feed boxes;
- conveyors with pin catcher and metal detector;
- discharging chutes;
- travelling cranes with load-carrying ability of 15–30 t;
- aspiration system;
- unloading complex operation system;
- auxiliary equipment;
- process CCTV system.

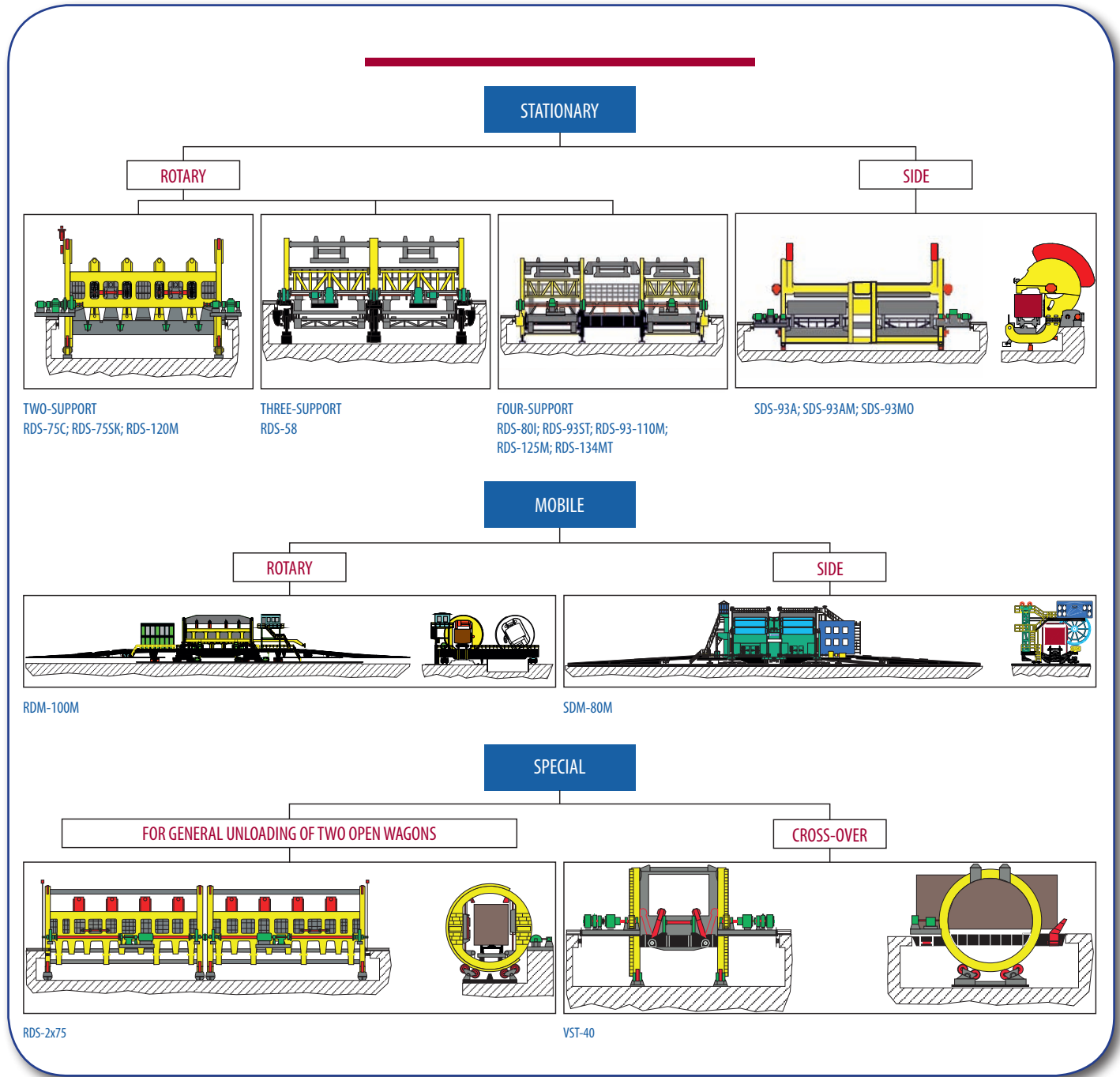




OPTION OF UNLOADING COMPLEX OPERATION WITH CAR PUSHER

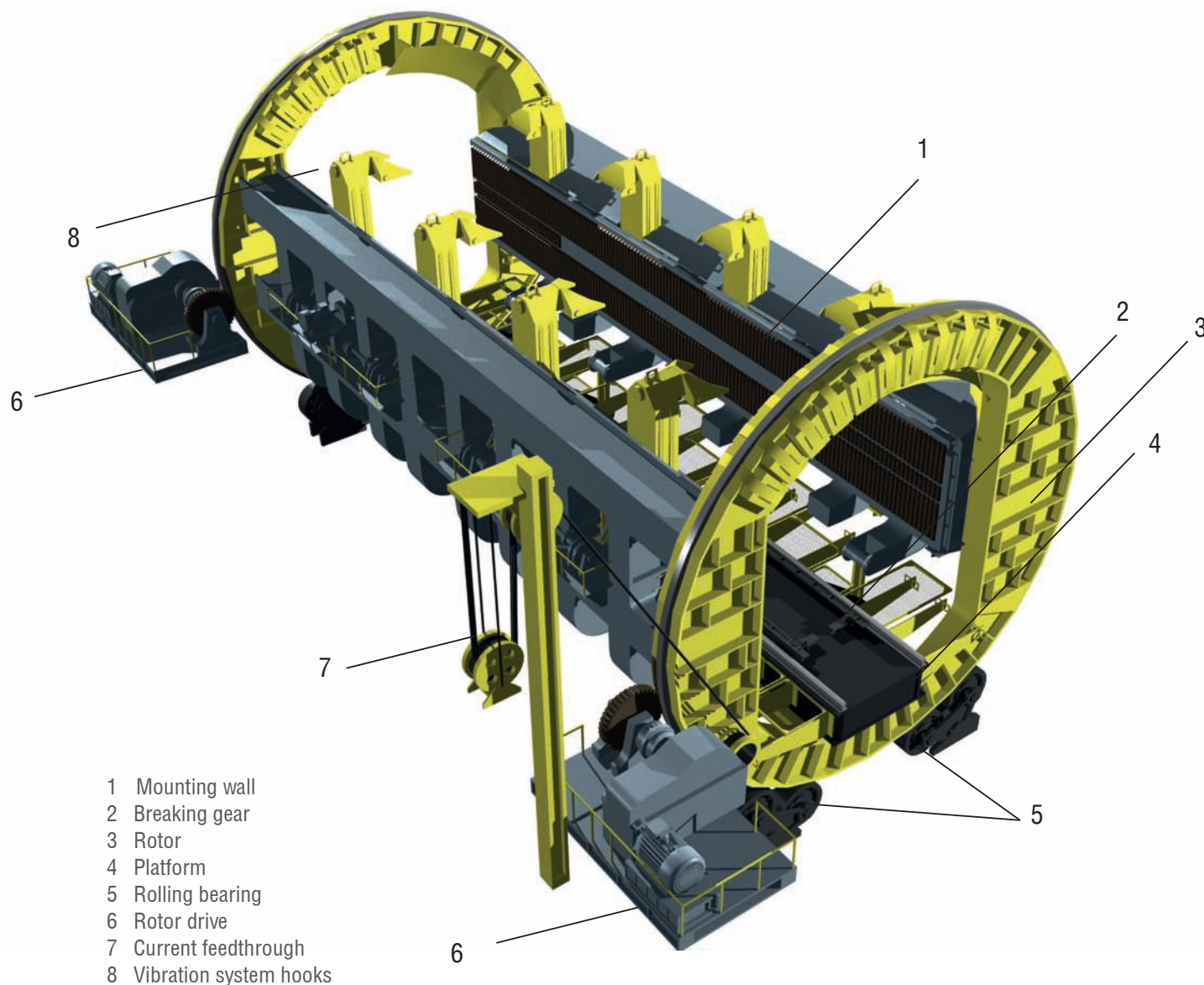
# CAR DUMPERS

## CAR DUMPER MODELS





## ROTARY CAR DUMPERS



3D-model of Rotary Dumper mounted on RDS-75

TYPE	WAGONS PER HOUR	CAPACITY, T	MEASURES, MM WEIGHT * HEIGHT * LENGTH	WEIGHT, T
RDS-75	20-25	60-100	8593*9678*19350	216
RDS -120	20-25	60-120	8593*9678*19350	220
RDS -93	20-22	93	8748*9634*16770	188
RDS-93-110	20-22	110	8748*9634*17470	188
RDS -125	25	125	8445*9184*22760	228
RDS -134	22	134	9038*9634*22770	226
RDS -75x2	50	up to 200	8593*9688*30220	425

# CAR DUMPERS

## STATIONARY ROTARY DUMPER RDS-75, RDS-120



The two-support RDS-75 Rotary Dumper is designed to unload bulk material from eight-wheel open cars with a capacity of 60 to 100 t by tilting the wagon in the rotating rotor. The open top of the cars allows unloading of partially frozen bulk material. It reduces load impact on dumper metal structures. The RDS-120 Rotary Dumper is designed to unload bulk material from special open cars with a 120 t capacity.

SPECIFICATIONS	VALUE	
Rotary Dumper model	RDS-120	RDS-75
Capacity, t/y	up to 6 million	
Swing angle, deg	170...175	170...175
Unloading time, forward and return stroke, s	57...60	
Power supply, kW	166	156
Energy consumption (average), kW*h/t	0,04	
Unloading open car dimension, mm:		
– height from railhead	3100...3800	3274...3800
– width	3100...3220	3130...3220
– length	13920...15800	13920
Carrying capacity, t	60...120	60...100
Dimensional specifications, mm	9678*8593*19350	
Weight, t	220	216

### ADVANTAGES:

- ✓ open car provides the ability to unload bulk materials, including partially frozen ones;
- ✓ firm fixation of the car on platform by means of specially designed breaking gear;
- ✓ electrical heating system of the hooks for operation in the conditions of low temperatures;
- ✓ automatical central lubrication system (ACLS);
- ✓ automatical control system for unloading complex (UCCS), which allows to combine discharge end subassembly machines into a single complex;
- ✓ open car vibratory cleaning system;
- ✓ increase of the service life of the reduction gears as well as the entire structure due to smooth regulation of the rotor rotation speed.



## STATIONARY ROTARY DUMPER RDS-93, RDS-93-110



Stationary Rotary Dumpers are designed for unloading bulk material from open cars with a capacity of 60 to 110 t by tilting the wagon in the rotating rotor. The dumper is designed to operate at temperatures of from  $-40^{\circ}\text{C}$  to  $+45^{\circ}\text{C}$ .

Rotary Dumpers are equipped with a braking gear to fix the open cars on the platform. Open car vibration cleaning can be conducted during unloading process. Lubrication is centralized and grease-packed. Operators control the machine via control pannel.

SPECIFICATIONS	VALUE	
Dumper model	RDS-93	RDS-93-110
Capacity, t/y	up to 6 million	
Unloading rate, wagons/h	22	
Open car capacity, t:	up to 93	up to 110
Energy consumption (average), kW*h/t	0,04	
Power supply	380 V; 116...144 kW	
Personnel, men/shift	2	
Dimension, mm:		
– height	8 748	
– width	9 634	
– length	16 770	17 470
Weight, t	188	

### ADVANTAGES:

- ✓ firm fixation of the car on platform by means of specially designed breaking gear;
- ✓ automatical central lubrication system (ACLS);
- ✓ automatical control system for unloading complex (UCCS), which allows to combine discharge end subassembly machines into a single complex;
- ✓ might have freight electronic weight system.

## STATIONARY ROTARY DUMPER RDS-125, RDS-134



Stationary Rotary Dumpers are designed for unloading bulk material from open cars with a capacity of 60 to 134 t by tilting the wagon in the rotating rotor.

### ADVANTAGES:

- ✓ firm fixation of the car on platform by means of specially designed breaking gear;
- ✓ automatical central lubrication system (ACLS);
- ✓ automatical control system for unloading complex (UCCS), which allows combining discharge end subassembly machines into a single complex.



SPECIFICATIONS	VALUE	
	RDS-125	RDS-134
Model	RDS-125	RDS-134
Capacity, t/y	up to 6 million.	
Unloading rate, wagons/h	22	22
Open car capacity, t	125	134
Energy consumption (average), kW*h/t	0,04	
Power supply	380V; 116...144 kW	
Personnel, men/shift	2	
Dimension, mm:		
– height	8 445	9 038
– width	9 184	9 634
– length	22 760	22 770
Weight, t	215	220



## STATIONARY ROTARY DUMPER DUPLEX RDS-75X2



The RDS-75x2 Rotary Dumper is designed for parallel unloading of loose and bulk materials from two open cars with a capacity of up to 100 t per wagon by tilting the wagon in the rotating rotor.

SPECIFICATIONS	VALUE
Capacity, t/y	up to 12 million
Unloading rate, wagons/h	up to 50
Open car capacity, t	up to 75
Power supply	380 V; 328 kW
Personnel, men/shift	2
Dimension, mm:	
– height	8 593
– width	9 688
– length	30 670
Weight, t	425

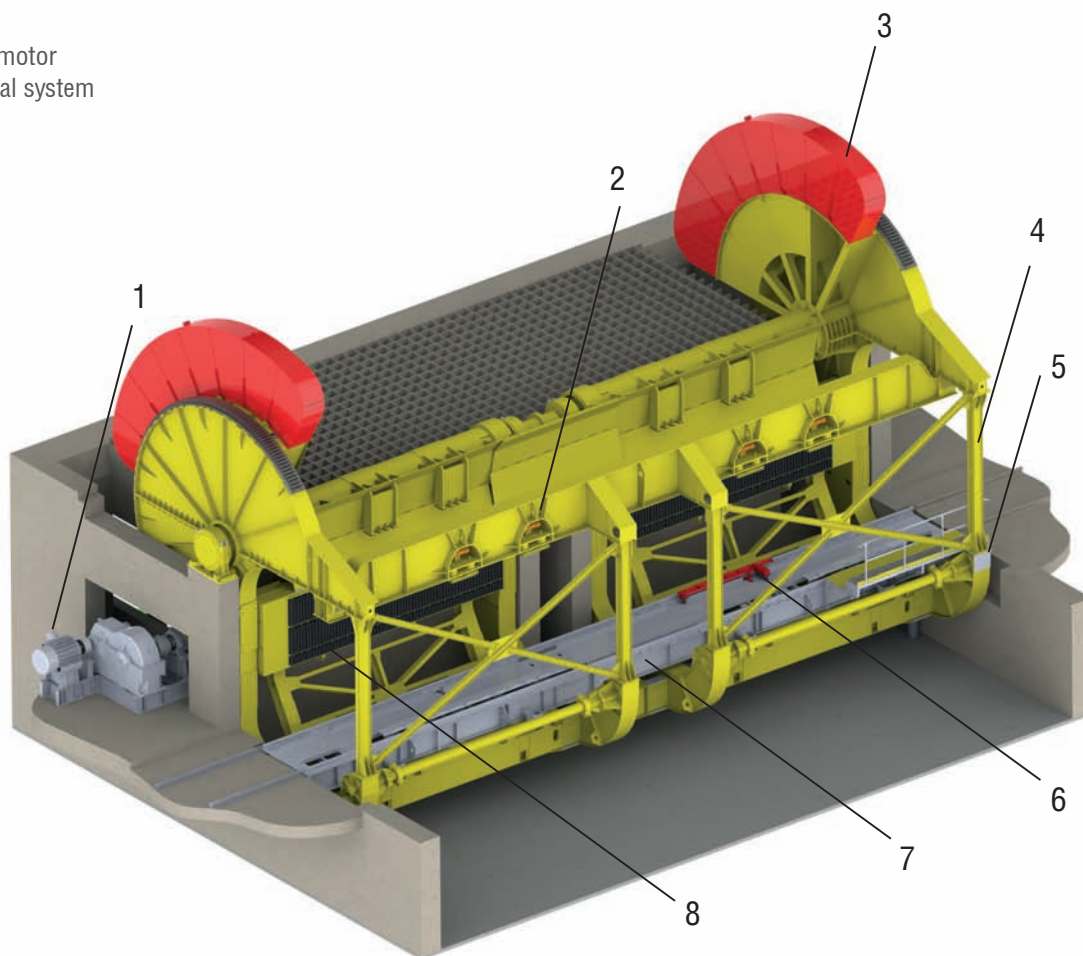
### ADVANTAGES:

- ✓ parallel unloading of two open cars;
- ✓ open car provides the ability to unload bulk materials, including partially frozen ones;
- ✓ firm fixation of the car on platform by means of specially designed breaking gear;
- ✓ electrical heating system of the hooks for operation in the conditions of low temperatures;
- ✓ automatical central lubrication system (ACLS);
- ✓ automatical control system for unloading complex (UCCS), which allows to combine discharge end subassembly machines into a single complex;
- ✓ new open car vibratory cleaning system.

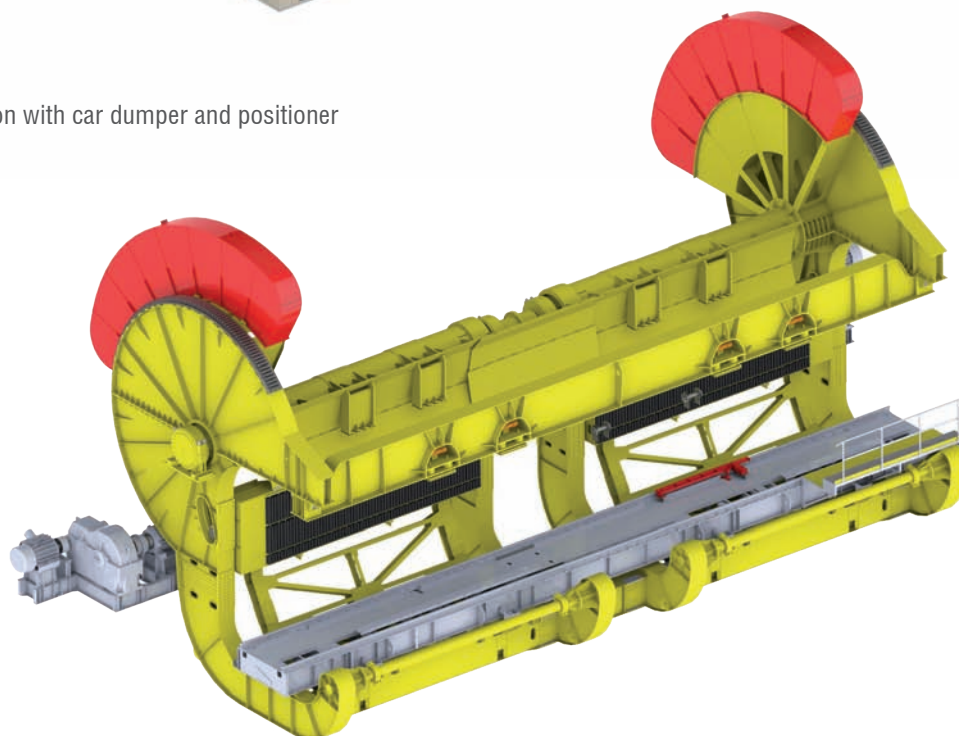
## STATIONARY SIDE DUMPER SDS-93

3D-model of SDS-93 for operation with car pusher

- 1 Frame swiveling motor
- 2 Bearing vibrational system
- 3 Balance
- 4 Forcing bars
- 5 Frame
- 6 Breaking gear
- 7 Platform
- 8 Mounting wall



3D-model of SDS-93 for operation with car dumper and positioner





## STATIONARY SIDE DUMPER SDS-93M



Car dumper is designed for unloading bulk cargo carrying capacity of the gondola 60 ... 93 tons is used primarily in the enterprises located in areas with high groundwater.

### ADVANTAGES:

- ✓ lower installation costs due to decrease of the depth of foundation;
- ✓ open car provides the ability to unload bulk materials, including partially frozen ones;
- ✓ firm fixation of the car on platform by means of specially designed breaking gear;
- ✓ new open car vibratory cleaning;
- ✓ automatical control system for unloading complex (UCCS), which allows combining discharge end subassembly machines into a single complex;
- ✓ automatical central lubrication system (ACLS);
- ✓ functionally it can be combined with open car positioner.

SPECIFICATIONS	VALUE
Capacity, t/y	Up to 6 million
Open car capacity, t	Up to 93
Unloading rate, wagons/h	Up to 20
Energy consumption (average), kW*h/t	0,04
Swing angle, deg.	170...175
Unloading time (forward and return stroke), s	90...100
Personnel, men/shift	2
Voltage, V	380
Power supply, kW	222
Rail gage, mm	1520
Dimension, mm:	
– height	12 530
– width	10 432
– length	25 364
Weight, t	353
Top unloading elevation above the bin level, m	+4

## MOBILE UNLOADING COMPLEX MUC (PRK)



The mobile unloading complex muC (prk) is designed to unload loose bulk material from open cars in specific unloading areas.



### ADVANTAGES:

- ✓ locomotiveness and high productivity;
- ✓ cleaning in the Dumper operation area;
- ✓ operational reliability in any weather conditions;
- ✓ low energy consumption;
- ✓ bridge-type pusher, which is in a part of the complex, is not inter-locked with car dumper.

### MAIN DESIGN FEATURES OF UNLOADING COMPLEX PRK:

- all units of the complex are highly productive;
- units are equipped with a complex system of control providing automatic process control of their functioning both independently and according to the algorithm;
- automatical control system for unloading complex (UCCS), which allows to combine discharge end subassembly machines into a single complex;
- in general complex is maintainable and does not require special skills and on-the methods of maintenance;
- the control cabs are equipped with the systems of air cleaning and conditioning.

SPECIFICATIONS	VALUE
Maximum allowable open car weight (gross), t	150
Unloading rate, wagons/h	20
COMPLEX COMPOSITION:	
Side Mobile Dumper SMD-80M	
Type	side mobile
Rotor rotation angle, deg	170-175
Traveling speed, m/s	0,58
Installed power, kW	641
Bridge-type car pusher BP (TP)-20M	
Pushing force, kN	205
Traveling speed, m/s:	
– operation	0,5
– road	1,86
Installed power, kW	500
MUP-14 Rotary Dumper rail cleaning machine	
Spillage removal	cylinder brush
Spillage transportation	conveyor
Installed power, kW	360
Weight, t	1 000

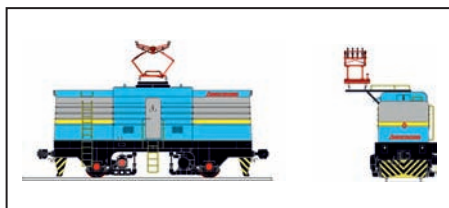


## TYPES OF CAR PUSHERS

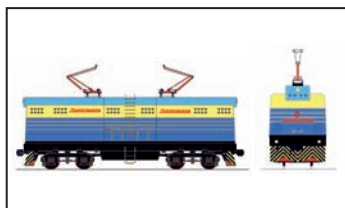
### RAIL CAR PUSHERS

FOR HUMPING OF THE OPEN CARS INTO STATIONARY CAR

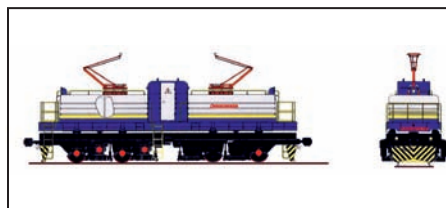
CAR PUSHER type T-20



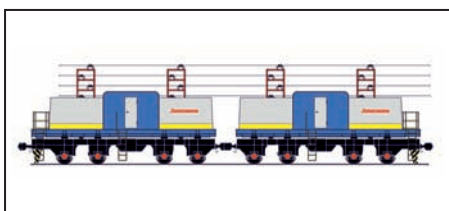
CAR PUSHER type VT-4



CAR PUSHER type VT-4L



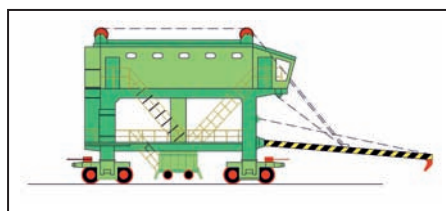
CAR PUSHER type VT-4Lx2



POSITIONER



CAR HUMPING SYSTEM type CHS (UNV)-30



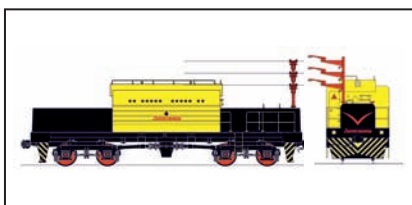
### SPECIAL PUSHERS

CAR SUPPLY FOR LOADING

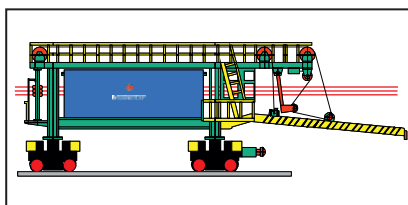
CAR HUMPING INTO MOBILE DUMPERS

DISPANSING OF EMPTY CARS FROM DUMPER

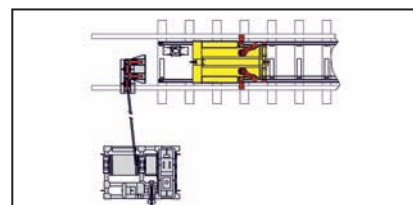
ELECTRIC TRACTOR type E-2B



BRIDGE-TYPE PUSHER type TP-20



MANEUVERING GEAR type MU-5



SPECIFICATIONS	T-20M	VT-4	VT-4L	VT-4LX2	E-2B
Number of cars to be moved, pcs	22	25	35	70	30
Weight of train to be moved, t, max	2200	2500	3500	7000	3000
Weight on driving axles, t, min	80	90	160	320	93
Minimum curvature radius, m	-	90	90	400	90

# CAR PUSHERS

## CAR PUSHER VT-4, VT-4L



CAR PUSHER VT-4



CAR PUSHER VT-4L

Car Pushers VT-4 and VT-4L are used for pushing and positioning the open rail cars in the dumpers of (RDS) VRS and (SRD) VBS types. These pushers are designed for unloading trains at rail track sections with a minimum radius of 90 m.

The VT-4L car pusher consists of: two four-wheel driving trucks interlinked by an articulated joint, platform bearing on the trucks through the eight sliding supports, electrical equipment cab, two pair of removable ballast boxes; and two pantographs.



### RAIL CAR PUSHER DESIGN FEATURES

#### VT-4

- ✓ Capability of operation on the curvilinear track section; 4 independently driven axes; operational safety; operational reliability in any weather conditions; removable ballast boxes; ease of control and operation

#### VT-4L

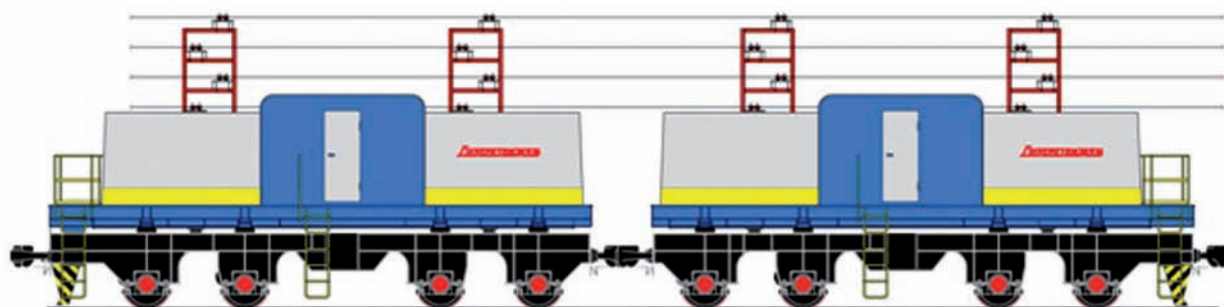
- ✓ Operational safety; operational reliability in any weather conditions; low energy consumption; ease of control and operation; heavy starting duty of engine and complete drive are excluded, thus operation life of reduction gearbox and auxiliary equipment is increased.

SPECIFICATIONS	VALUE	
Car pusher model	VT-4	VT-4L
Maximum tractive effort, kN, min	250	350
Axleload from each axle, kN, max	225	350
Number of cars to be moved, pcs	25	35
Weight of train to be moved, t, max	2500	3500
Operating (idling) speed, m/s	0...0,6 (1,2)	0...0,6 (1,0)
Control features *	remote**	remote**
Power supply, kW	190	300
Minimum track curvature radius, m	90	90
Rail gage, mm	1520	1435, 1520, 1676
Dimension, mm, width*height*length	3200*4040*14300	4060*3350*14300
Weight, t, max	90	140
Weight on driving axles, t, min	90	140

\*Wagon pusher drive control system can be configured based on customers' specifications: F/C – frequency converter; R/C – rheostatic control; \*\* with application of signal-dispatch traffic device



## CAR PUSHER VT-4Lx2



VT-4Lx2 car pusher is designed as for moving the train for loading, as for positioning loaded open cars into Stationary Car Dumpers for unloading on the sections of industrial railroad with a minimum radius of 90 m.

**CAR PUSHER VT-4Lx2 CONSISTS OF TWO SECTIONS, EACH OF WHICH CONSISTS OF:**

- platform;
- two four-wheel driving trucks with two drives and automatic coupling;
- electrical and hydraulic equipment cabs;
- ballast boxes;
- Platform that provides power supply from trolleys to electrical equipment, adjusted in car pusher cab.

SPECIFICATIONS	VALUE
Maximum starting tractive effort with coefficient of friction= 0,25 kN (ts), min	800 (80)
Number of pushed open cars, pcs, max	70
Carload weight, t	100
Maximal weight of pushed train, t	7000
Axleload from each axle, kN, max	400
Operating speed, m/s	0...0,5
Idling speed, m/s	1,0
Curves radius, m	400
Number of hydraulic motors, pcs	8
Number of driving axes, pcs	8
Control	remote
Dimension of car pusher, mm	
–length (over pulling faces of couplers)	14300*
–width (without pantagraph)	3500*
–height (without pantagraph)	4400*
Adhesion weight, t, min	320

\* Dimension is specified on the stage of detailed design.

# CAR PUSHERS

## CAR PUSHER T-20M, T-22P2



The T-20M and T-22P2 car pushers are part of the unloading complex and are used to push and position rail open cars in the Stationary Rotary Dumper and Side Rotary Dumper.

Car pusher consists of four-wheel driving truck including frame with mounted drives, electrical equipment cab, ballast box, current collector to use as the power supply from trolleys to the car pusher.

SPECIFICATIONS	VALUE	
Wagon pusher model	T-20M	T-22P2
Maximum tractive effort, kN, min	220	220
Number of cars to be moved, pcs	22	22
Weight of train to be moved, t, max	2200	2200
Weight per axle, t	40	40
Operating speed (idling), m/s	0,6 (1,2)	0...0,6 (1,2)
Kind of current	alternating	direct
Control features	remote	remote
Voltage, V	380	220/440
Rail gage, mm	1520, 1435, 1067	1520, 1435, 1067
Dimension, mm, width*height*length	3050*3965*10020	3050*3965*10020
Weight, t, max	33	32,5
Weight on driving axles, t, max	80	80

### CAR PUSHER DESIGN FEATURES

- ✓ operates on straight track sections;
- ✓ reliable operation in any weather conditions;
- ✓ smooth and effective braking while positioning the open car into car dumpers;
- ✓ low power consumption;
- ✓ ease and control and operation;
- ✓ mechanical brakes remote independent control without the excitation winding and deenergizing.





Bridge-Type TP-20M Car Pusher is used to push and position of rail open cars into the mobile side and mobile rotary dumpers (SDM and RDM).

Bridge-Type TP-20M Car Pusher consists of two bridges mounted on four-wheel driving trucks; four independent four-wheel driving trucks; swivel-mounted boom on the front bridge; mechanism to raise and lower the boom; control cab; two electrical equipment cabs; counterweights to partially counterbalance the boom; platforms with current collectors.

### ADVANTAGES:

- ✓ capability to push up a ramp;
- ✓ high performance;
- ✓ continuous control over the traveling speed;
- ✓ reliable operation in any weather conditions;
- ✓ energy efficient.

SPECIFICATIONS	VALUE
Maximum tractive effort, kN, min	205
Axleload from each axle, kN, max	200
Operating speed (idling), m/s	0,33...1,2 (1,9)
Number of cars to be moved, pcs	30
Weight of train to be moved, t, max	3000
Kind of current	alternating
Control features	operator, F/C, R/C
Power supply, kW	500
Minimal curves radius, m	straight-line
Rail gage, mm	as required
Dimension, mm, width*height*length	7510*10020*23150
Weight, t, max	160
Weight on driving axles, t, max	160

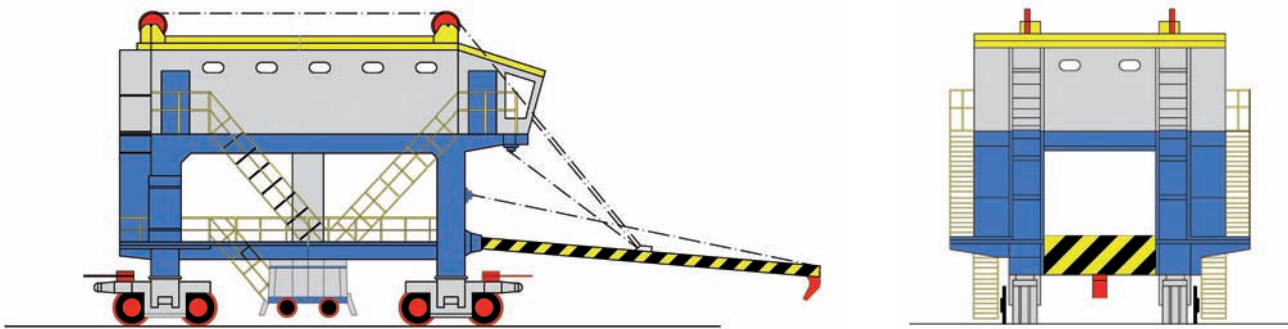
### MAIN DESIGN FEATURES OF MOBILE UNLOADING COMPLEX (MUC) (PRK):

- control system is designed to use with modern hardware components;
- control cabs are equipped with clean air filters and air conditioning;
- mechanical brakes remote independent control at the traction motor allow the car pusher to brake by "coasting" or dynamic braking;

\*Car pusher drive control system can be configured based on customers' specifications: F/C – frequency converter; R/C – rheostatic control.

# CAR PUSHERS

## RAIL CAR PUSHER UNV-30



### ADVANTAGES:

- ✓ improved accuracy of the open car positioning in the rotary dumper;
- ✓ capability for failure-free operation, excluding service breaks for travel to the starting position;
- ✓ chain drive for travel;
- ✓ continuous control over the traveling speed;
- ✓ reliable operation in any weather environment;
- ✓ low energy consumption.

Rail car pusher UNV-30 is intended for automatic push of loaded open cars in stationary rotary dumper for further unloading. UNV-30 is self-propelled machine of portal type with the boom fastening at the front posts of the portal.

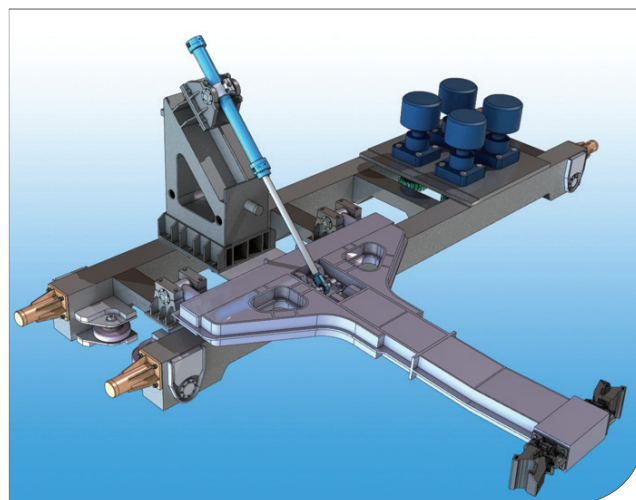
This design allows passing the loaded train under it without UNV removal to dedicated dead-end siding that greatly increases efficiency of unloading complex.

UNV-30 consists of: metal structure of portal type supported by four trolleys; mechanisms to raise and lower the boom; drive for travel; centralized lubrication system.

SPECIFICATIONS	VALUE
Maximum tractive effort, kN (tf)	300 (30)
Traveling speed, m/s:	
– operating speed	0,4
– idling speed	1,5
Tooth raise and lower speed, m/s	0,4
Quantity of loaded open cars to be travelled along level track, pcs	
68 t	44
94 t	30
130 t	21
Rail gage, mm	as required
Dimension, mm:	
– width	10330
– height	8555
– length	20930



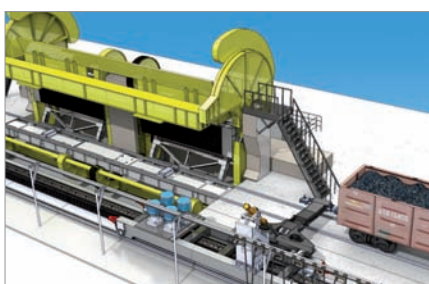
## POSITIONER P-30



The rail car positioners are intended for accurate positioning of loaded open cars in stationary rotary dumpers, pulling the loaded train and pushing empty open car when positioning the next one for unloading. Positioners are operated automatically and manually.

### ADVANTAGES:

- ✓ accurate positioning of the car in rotary dumper (up to 100mm);
- ✓ higher efficiency in comparison with rail car pusher.

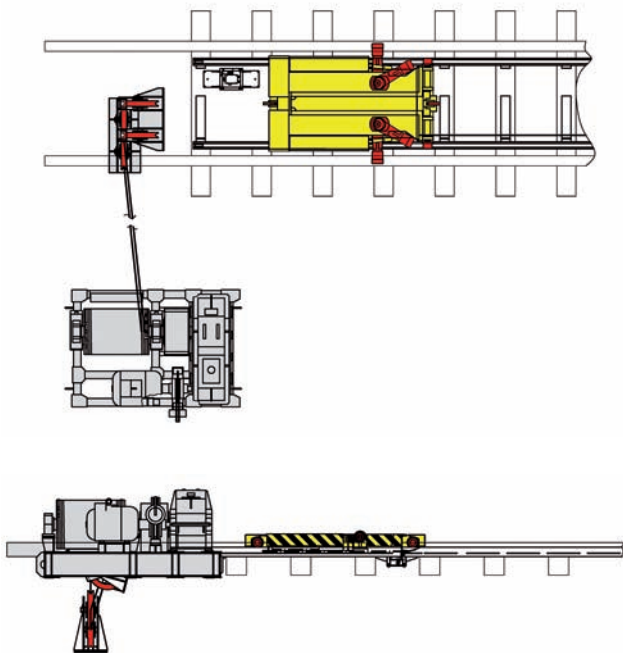


SPECIFICATIONS	VALUE
Maximum tractive effort, kN	300
Maximum weight of the train, t	2850
Maximum weight of the open car, t	95
Total length of track, m	44*
Operating length of track, m	27*
Operating speed, m/s	0,5
Idling speed, m/s	1,0
Number of travelling drives, pcs	4
Drive system	toothed rack /gear
Dimension of positioner, mm:	
– length	14300*
– width(without boom)	2500*
– height	3000*
Weight, t	100*

\*Dimensions and weight is to be specified while design documentation developing.

# CAR PUSHERS

## SHUNTING FACILITY MU-5



SPECIFICATIONS	VALUE
Tractive effort, N, not more	45700
Speed of forward and return travel of trolley, m/s, not more	0,95
Trolley travel, m, max	35
Diameter of rope, mm	20,5
Motor power, kW	43
Kind of current	alternating
Voltage, V	380
Frequency, Hz	50
Motor control	automatic
Weight, t	8
Rail gage, mm	1 050
Rail type of railway track	P50

The shunting facility is used for shunting out of the empty open cars from the rotary dumper and connection them into the train.

The shunting facility consists of: undercar trolley, winch and the system of sheave wheels. The undercar trolley comprises metal frame installed on rollers, and it is moved on special rails laid inside railway track of normal gauge. Folding roller levers are installed on the trolley. During operating and idling movements the trolley travel is performed by the winch. Opening of the roller levers occurs during operating motion, but during idling motion they are folded and removed inside the trolley frame.

## TRANSBORDER



The transborder including the unloading complex serves for transfer of the unloaded open car to parallel railway track. The car moves on the transborder and pulls off from it through sloping section in it. To pull and push the car the transborder has available electrical shunting winch and the system of sheave wheels. To prevent self-movement of the car positioned in the transborder the folding buffer stops with electromechanical drive are used. The transborder is used with the individual drive for travelling wheels. Smooth acceleration and braking is achieved by AC variable-frequency drive.

The lifting capacity of transborder is up to 160t.

Travelling (shunting) hump can be used as alternative to the transborder. The shunting hump is stationary facility allowing due to the slope of railway tracks to use the car gravity for its self-movement (rolling) on branching tracks of shunting yard.



## ELECTRICAL RAIL WAGON PUSHER E-2B



SPECIFICATIONS	VALUE
Starting tractive effort, kN (tf)	360 (36)
Axle load, t	22,5
Number of cars to be moved, pcs	30
Weight of train to be moved, t, max	3000
Operating (idling) speed, m/s	0...0,4(1,0)
Minimum track curvative radius, m	90
Control feature	remote
Kind of current	direct
Catenary voltage, V:	
– power	440
– control	220
Rail gage, m	1520
Adhesion weight (min), t	90
Weigh (with equipment installed outside of electrical rail wagon pusher), t	94,5

### ADVANTAGES:

- ✓ high tractive efficiency;
- ✓ low energy consumption;
- ✓ high reliability.

Electrical rail car pusher is designed for continuous movement with low speed of railway trains in the process of open cars loading.

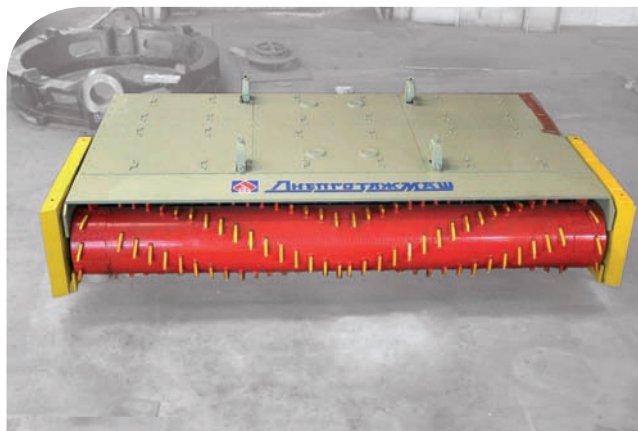
The electrical rail car pusher is a special electric locomotive consisting of four-wheel driving trucks with universal-joint drives, frame with drive, electrical equipment cab, two ballast boxes and pantographs.

The wheel pairs are driven by two electric motors using vertical gearbox of truck and two axle gearboxes of bogie.

It is most advantageous to use at highly efficient (2000...5000 t/h) coaling facilities of mines, concentrating mills and open-pit mines.

# CRUSHING MACHINE

## CRUSHING AND MILLING MACHINES



### ADVANTAGES:

- ✓ the machine is equipped with centrifugal clutches (torque limiting clutches);
- ✓ inclined screw tooth pattern on the milling cutter drum reduces the dynamic loads during coal crushing and the number of teeth simultaneously involved in operation;
- ✓ hard surfacing of tooth cutting head increases wear resistance of teeth and improves the machine performance.

Crushing and milling machines (DFM) are designed for crushing of large pieces and frozen blocks of unloading material on the bin-loading grates of receiving bins in stationary rotary and side-discharge dumpers.

### BASIC DESIGN FEATURES OF DFM:

- high efficiency;
- the control system is on the basis of programmable controllers;
- smooth control of traveling speed;
- easy to repair as a whole and they do not require the special skills and methods of maintenance;
- easy to control;

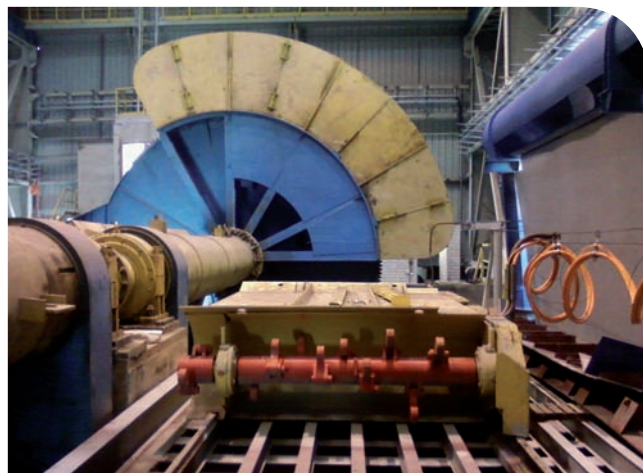
SPECIFICATIONS	VALUE			
	DFM-12M	DFM-14	DFM-20M	DFM-12x2
Modification	DFM-12M	DFM-14	DFM-20M	DFM-12x2
Power supply, kW	165	165	82	315
Machine stroke, mm	6200	6200	12000	36000
Rail gage (span), mm	5810	5810	3450	5810
Crusher width, mm	5560	6430	3685	5560
Height, mm	1280	1280	1057	1280
Width, mm	6075	6460	3995	6075
Length, mm	3460	3460	2625	5040
Weight, t, not more	31	32	16,8	40

Kind of current –alternating;  
 Current lead– cable;  
 Control system circuit for travel drives – variable speed drive;  
 Traveling speed: 3–15 m/min.



## HAMMER CRUSHING MACHINES

SPECIFICATIONS	VALUE
Power supply, kW	165
Machine stroke, mm	12000
Rail gage (span), mm	2610
Crusher width, mm	2410
Height, mm	1000
Width, mm	2900
Length, mm	4400
Weight, t, not more	18,5



At Customer's request for crushing of frozen and large-size material of higher hardness and abrasiveness it is possible to use hammer crushing machine (DFM). The material crushing is performed by hammers hinged on high-speed rotor in forward motion of the machine along rails installed on receiving bin grates. The hammer is made of wear-resistant and impact resistant material, of large weight and has high kinetic energy to crush the material into pieces of the optimal size. The crushed pieces of material fall into the bin through the holes in the bin-loading grate. The machine efficient application is provided by the replacement of the cutting process of material for the process of material destruction by hammer blows. The hammer crushing machine is operated with the bin-loading grates of the car rotary dumpers of any type.



BIN



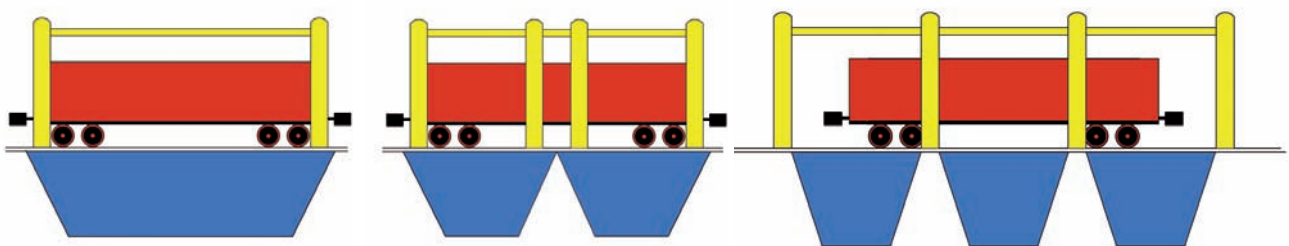
UNLOADING CHUTES

The bin is receiving facility and designed for reception of bulk solids directly from the car dumper with further transferring to different flows of material.

The bins can be lined with special wear-resistant materials increasing the service life.

Depending on the type and capacity of unloading complex declared by the Customer the different number of bins can be used.

Bin arrangement options



TYPE OF CAR DUMPER	NUMBER OF BINS
RDS-75	1-2
RDS-93	1-2
SDS-93	1-2
RDS-125	3
RDS-75x2	2-4

The unloading complex uses unloading chutes intended to transfer the unloading material from feeders to the conveyor or in transfer house.

The unloading chutes are facilities used for the material supply from the top down by gravity. The angle of slope in the unloading chute is selected so that to provide the material travels with the specified speed.



The feeders for unloading raw material and uniform feeding from bin to conveyor are designed for transportation and continuous loading (unloading) of different lump and bulk material from the bin to handling systems. The feeders can be of different types. The most frequently in unloading complex the following feeders are used, namely: of plate, belt, shaking, scraper and vibrating type.

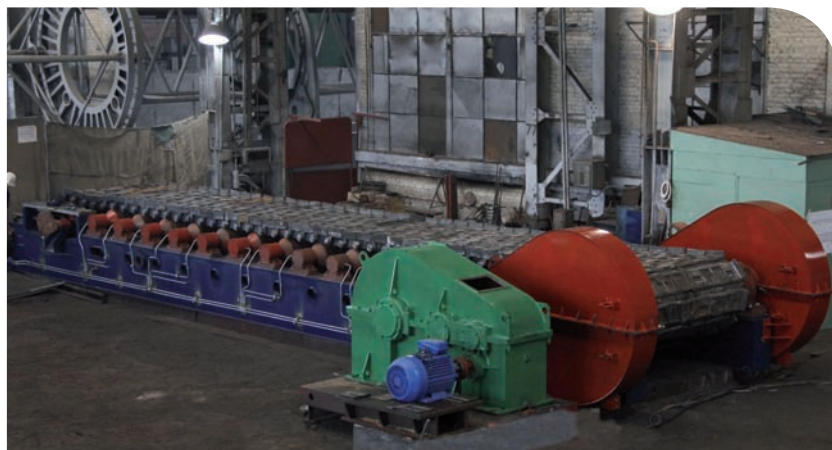
At Customer request it is possible to develop documentation for feeder of any capacity.

## PLATE FEEDERS

The plate type feeder is designed for uniform feeding of bulk material from the bin with the bulk weight up to 2.5t/m<sup>3</sup>. The durable metal plates serve as sliding belt. The feeder can be installed both horizontally and with the slope of no more than 15°. There are two types of plate feeders: heavy-duty (type I) and medium (type II). The feeder of type II excludes spilling of material between the plates. The plate feeder capacity is regulated by changing the traveling speed of the belt and by changing the height of filling layer of loaded material.

The feeder consists of the following:

- frame;
- upper and lower support rollers;
- apron;
- tensioning device with mechanism for cleaning of spillage;
- drive shaft with sprockets;
- drive of control device for apron position and centralized lubrication.



FEEDER TYPE & SIZE	LOADED FEEDER SIZE MATERIAL, MAX.,LENGTH, MM	LENGTH, MM	FEEDER WIDTH,, MM	SPEED, MAX, m/s	CAPACITY, MAX, M <sup>3</sup> /H	WEIGHT, KG
1-18-60	1200	6000	1800	0,06	350	53000
1-18-90		9000				66000
1-18-120		12000				80000
1-18-150		15000				93000
1-18-180		18000				106000
1-24-90	1500	9000	2400	0,06	600	76000
1-24-120		12000				92000
1-24-150		15000				108000
1-24-180		18000				125000
2-18-45	400	4500	1800	0,16	800	41000
2-18-60		6000				44000
2-18-90		9000				54000
2-18-120		12000				64000
2-18-150		15000				73000
2-18-180		18000				83000
2-24-45	400	4500	2400	0,16	1500	47000
2-24-60		6000				51000
2-24-90		9000				63000
2-24-120		12000				78000
2-24-150		15000				89000
2-24-180		18000				101000

# FEEDERS

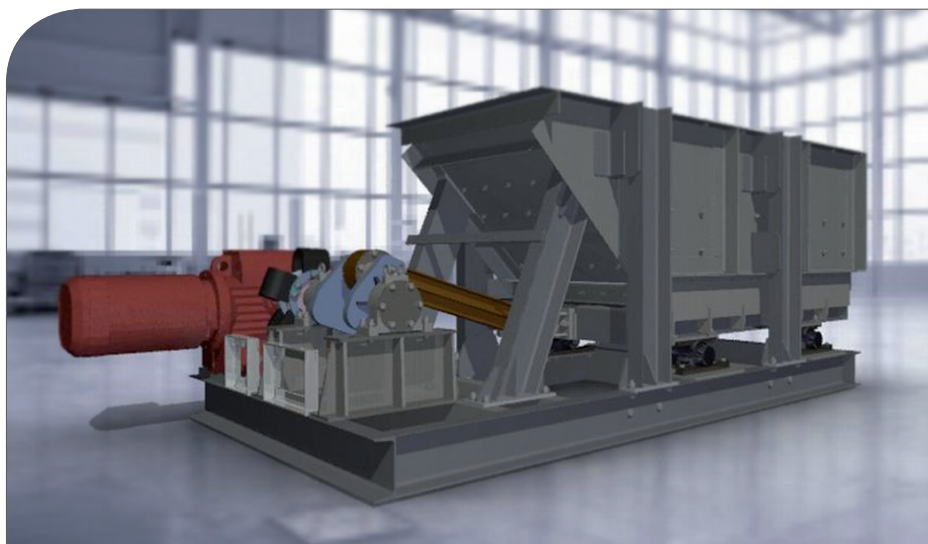
## BELT FEEDERS



SPECIFICATIONS	VALUE
Capacity, m <sup>3</sup> /h, no more	800
Traveling speed of conveyer belt, m/s	0,5...1
Width of conveyer belt, mm	500...1600
Feeder length, not more	12000
Operating voltage, V	380
Tensioning device	screw type
Angle of slope of feeder on line, degree, not more	10

It is intended for uniform feeding of bulk materials from bin or feeding funnel to conveyor. According to the design the belt feeder is a kind of belt conveyor and is a transporter or conveyor with longitudinal sides, in some cases with sliding gates. The feeder includes the drive pulley and tension drums, conveying belt, rollers and frames. The belt feeders have a wide range of performance which can be varied by speed of belt.

## SHAKING FEEDERS



The shaking feeder is designed for uniform feeding of bulk materials from bins or feeding funnels to handling systems. The main operating part of such machine is the tray of special design which performs reciprocating motions.

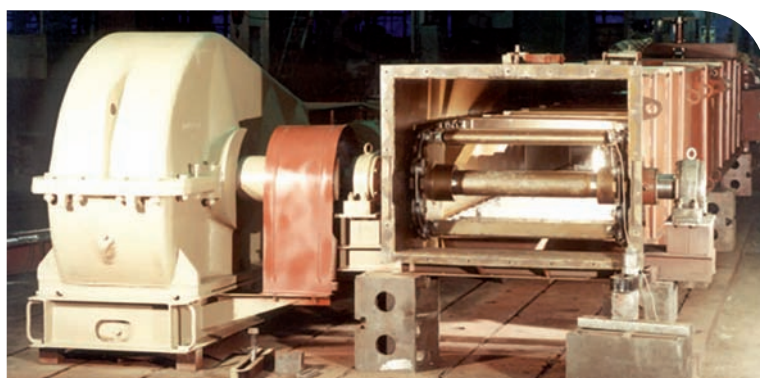
The shaking feeder has a rather simple structure, it is easy to repair and maintain as well as it is reliable in operation.

## SHAKING FEEDERS

SPECIFICATIONS	VALUE		
	PK-1,2-8	PK-1,2-10	PK-1,2-12
Capacity, m <sup>3</sup> /h (t/h)	320 (385)	420 (500)	630 (755)
Width of tray, mm	800	1000	1250
Length of tray, mm	1800	2060	2500
Rated power of drive, kW	4	7,5	15
Controlled stroke of tray, mm	0–200	0–200	0–200
Dimension, mm:			
– length	3600	4000	4400
– width	1600	1750	1950
– height	1500	1500	1750
Weight, kg, not more	1500	1900	2500

## SCRAPER FEEDERS

The stationary scraper feeder is installed underneath the bin and is designed for dosing and uniform feeding of bulk materials not predisposed to sticking on conveyor belt. The feeder is a welded metal structure and consists of casing, drive, scraper apron, drive and tension shafts with bearings, regulator of raw material layer. The control of scraper feeder capacity is made by changing the speed and thickness of raw material layer.



FEEDER TYPE & SIZE	PS-700						PS-1100					
	Length of fuel transportation	1500 3000 4000	6000			9000			5000 7000 9000 10000	20000		30000
Capacity, t/h	40 10 16	10	16	40	10 16	40	40	80	40	80	40	80
Power supply, kW	3.8		6.7	3.8	6.7	6.7	12	12	14	12	14	
Control range(motor shaft rotational speed)	5:1 (1500..300)											
Charging door size, mm	700x1400						1100x2200					
Outlet pipe size, mm	700x1100						1100x2100					



## VIBRATING FEEDERS

The vibrating feeder is designed for regulated feeding of non-sticky bulk, lump and granular materials as well as it serves as the gate of the bin chutes. The feeder consists of the supporting frame on which the tray is installed together with vibration unit and receiving bin. Under the action of inertial forces which is generated by the vibration unit, the spring-loaded mechanism of the tray performs vibratory motions, those provide continuous and uniform feeding of the material to process line. The feeder is supplied completed with control unit which is used to change the capacity of vibrating feeder from zero to the maximum.



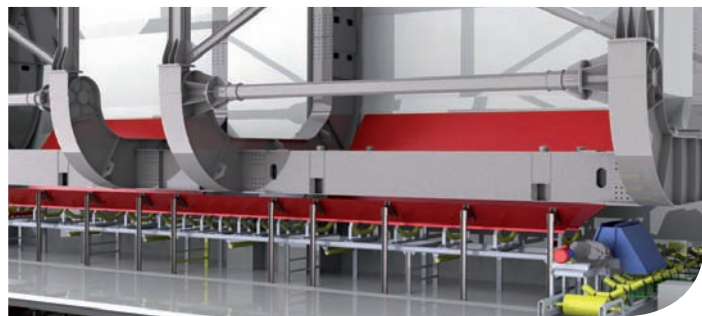
SPECIFICATIONS	VALUE			
	ZhVEm-0,5x1,3-M	ZhVEm-0,7x1,6-M	ZhVEm-0,95x2-M	ZhVEm 1,2x2-M
Capacity, m <sup>3</sup> /h (t/h)*	50 (77,5)	90 (140)	130 (200)	190 (295)
Width of tray, mm	500	700	950	1200
Length of tray, mm	1300	1600	2000	2000
Drive power, kW	0,5	1,0	2,0	4,0
Largest piece to be transported, mm	170	230	300	400
Dimension, mm:				
– length	1990	2200	3000	3200
– width	850	1000	1300	1650
– height	800	900	1200	1400
Weight, kg	580	980	1380	2660

\*The capacity is given for the material with bulk density of 1.55 t/m<sup>3</sup> in case of horizontal position of the tray.

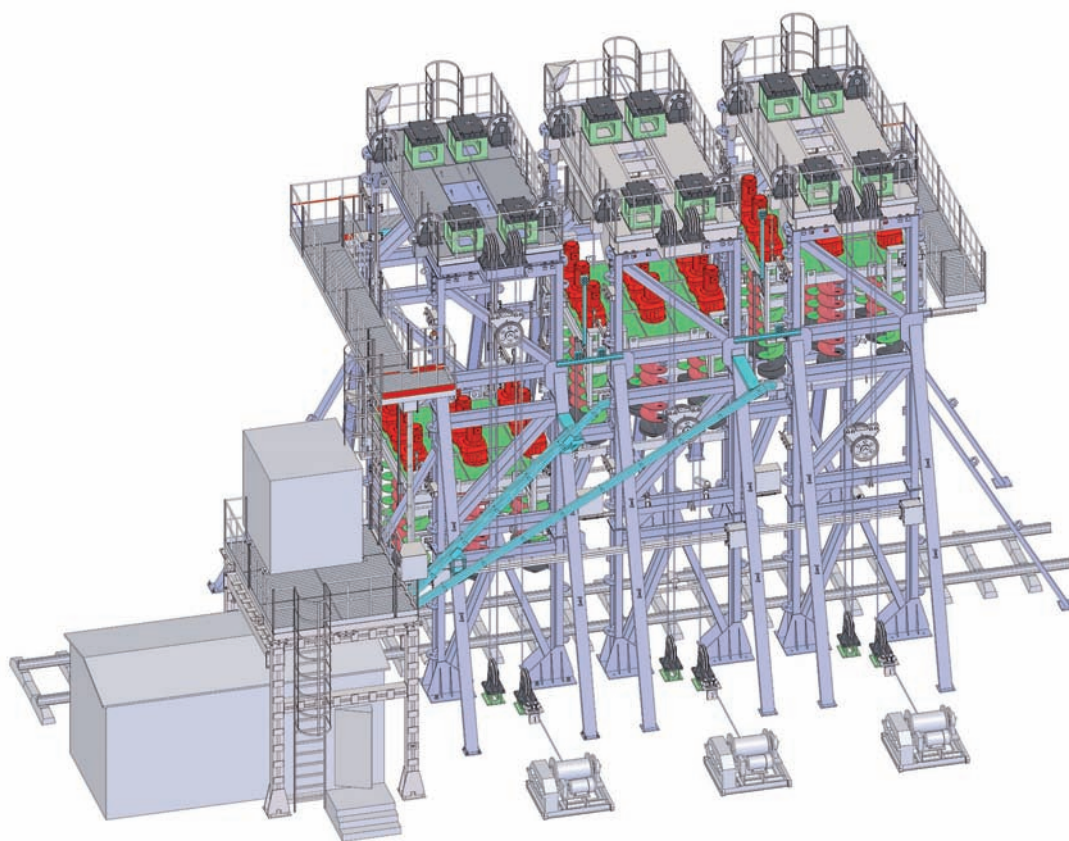
## SPILLAGE PICK-UP

The spillage pick-up is designed for automated cleaning of spillage formed in the process of unloading of railway open cars in the side stationary rotary car dumpers and overload of spillage to the main (under-bin) conveyor. The spillage pick-up is the system of conveyors and consists of the conveyor for spillage, the transfer conveyor and the bin.

All the latest models of side dumpers are equipped with spillage pick-ups.



SPECIFICATIONS	VALUE
Design capacity, t/h	12
Belt speed, m/s	0,8
Power supply, kW	10
Kind of current	alternating
Voltage, V	380



The bulk material milling machine (BFU) is designed for recovery of flowability of frozen coal located in the railway open car by means of drilling into it of vertical wells along the entire height of the open car prior to its arrival to car dumper.

The bulk material milling machine (BFU) is the stationary structure consisting of supporting metal structure, two carriages with mills for bulk material, control cabin and two systems of bogies.

## ADVANTAGES:

- ✓ coal ripping in open car without its moving in one operating cycle of BFU;
- ✓ the machine is equipped with device for regulation of traveling speed of each carriage;
- ✓ the movement of the carriage is performed by spring-loaded support rollers to prevent jamming of the carriage.

## BASIC DESIGN FEATURES OF BFU:

- The control system is on the basis of programmable controllers;
- It is equipped with the system for monitoring of open car position under BFU;
- Possibility to control both from the cab of BFU operator and from the cab of the car dumper operator;
- It is equipped with CCTV system;
- It is equipped with special facility preventing spillage of coal during drilling;
- It has heavy-duty winch with tractive effort of 6.5 t;
- Easy to repair as a whole and it does not require the special skills and methods of maintenance.

SPECIFICATIONS	VALUE
Drilling time of 1 car depending on freezing degree of coal, min	6–9
Number of carriage with mills to be moved, pcs	2
Number of mills per one carriage, pcs	8
Well diameter drilled by the mill, mm	800
Mill drive power, kW	30
Consumed power at drilling stage, kW	250

# DEFROSTERS (DEFROSTING HOUSES)



The defrosters are intended for heating of frozen bulk material in railway open cars prior to unloading in car dumper.

The defroster is shelter (garage) inside of which there is railway track. On both sides of the railway track there are distribution ducts with built-in stimulatory branch pipes (nozzles).

The defroster is to be built in the immediate proximity to the building of the car dumper on ways of pushing and it does not require additional occupied sites. The operating experience of dumpers in the conditions of low temperatures shows the feasibility of installing of bulk material milling complex before open cars sending to the defroster.

Depending on the method of heat supply to the cars the defrosters are divided into:

- Convection ones in which heating of the loaded material in railway open cars takes place owing to convection of forced circulating air heated by hot-air generators;
- Combined ones in which heating of the loaded material in railway open cars takes place owing to exposure to radiant energy of the steam tube water walls (radiators) and convection of forced circulation of air heated by water walls.
- Infrared defrosters can be of gas and electric type.

## **Gas infrared defrosters**

The defrosting system consists of separate independent heating systems: top, side and bottom. Infrared radiation is transmitted directly to the metal walls of the car and is not wasted for heating of surrounding air.

The equipment consists of:

- gas-distributing plant;
- air supply system;
- the control elements for train position relative to gas burners;
- remote control with automatic control system for defrosting process.

The car overheating is excluded owing to the control of temperature.

## **Electric infrared defrosters**

The defrosters with infrared electric heaters are the warming up complex of tunnel type, not having heat-insulated garage and insulated gate. During the train movement for unloading through the gallery of the heaters, the car heating occurs to the temperature providing unloading almost without further stripping for the car. From the moment of voltage supply to the heaters up to reaching the operating temperature it takes 2.5–3 min.

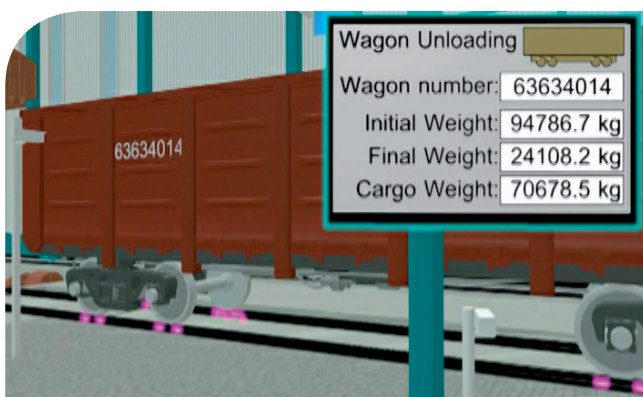


## SAMPLER



As additional option at Customer's request, in the process line of unloading complex it is possible to install and use the automatic coal sampler ENELEX, which allows selecting and preparing sample of coal according to international norms. Sampling is made using the screw that is located on mobile hydraulic arm that provides the possibility to take samples from any place of the surface of the loaded open car all the way down. Part of the coal samples is automatically routed to the belt feeder where there is installed gamma ash meter ENELEX designed for industrial express-analysis of ash content in solid fuel. The obtained data are displayed on the display and transmitted to upstream system.

## CAR SCALES



In the structure of unloading complex the car scales are used to determine the weight of the unloaded material and can be used before and after the building of the car dumper.

According to the special order of the Customer the car scales can be directly mounted on the platform of the car dumper.

Weighing for railway open cars is possible in the static, dynamic or combined modes.

### Static weighing

The method for static weighing has more precision in comparison with scales based on the method of weighing in motion. Weighing in the static is a good solution for enterprises with little stream of supply. The static weighing of each trolley and each car is possible.

### Dynamic weighing

During the large flow of supply the weigh-in-motion is used. In the course of train moving with constant speed, the system automatically weighs each car. This method allows weighing cars in motion for broad and narrow gauge of any model (two-, four-, six- and eight-axle cars) in the train without uncoupling and the train as a whole.

Weigh-in-motion is performed for each axle or each bogie.

Combined weighing includes the possibility of car weighing in two modes (static and dynamic) on the same scales. In this case the advantages of both methods are used.



## STATIONARY BELT CONVEYORS

SPECIFICATIONS	VALUE
Conveyor type	Belt and stationary
Capacity, t/h	up to 4000 (it is specified as per bulk density of load)
Length, m	up to 5000
Belt speed, m/s	up to 4
Width of belt, mm	from 400 to 2000
Drive power, kW	it is specified as per capacity, load characteristic and angle of slope of the conveyor
Tension device	screw, bogie, frame, winch
Tension stroke, mm	320–800



Stationary belt conveyors are designed for transportation load characteristic and angle of slope of the conveyor of lump, bulk materials and pieces. Performance of stationary belt conveyors depends on the width of belt, speed of belt, the angle of slope for conveyor, and reaches up to 4000 t/h. The tension device of the conveyor can be of screw type, bogie, frame or winch. Maximum angle of slope for conveyor depends on the transported load and the type of belt, and reaches 18°.

## HIGH-ANGLE CONVEYORS

The high-angle belt conveyors are designed for the transportation under the large angle of inclination (up to 90°) of various materials both of bulk dry and wet ones (slag, sand, coal, grain).

The operating element of the conveyor is high quality conveyor belt which has a special profile: transverse ribs and crimped board which depends on the type of transported material. The belt design gives the possibility of changing the angle of conveyor slope along the entire length of the track from the point of loading to the point of unloading avoiding the use of multiple conveyors and points for reload as well as reduces the number of drives and decreases destruction, crushing and dusting of the material to be transported.

It is possible to use two-belt high-angle conveyors those have increased angle of slope (up to 90°) achieved by the second belt, which runs parallel to the bearing branch of the operating belt. This creates the required pressure on the load and increases its adhesion with the belt.

Such conveyors provide high traveling speed (up to 6 m/s), independence of capacity from the angle of slope, and opportunity for tight transportation of bulk materials.



SPECIFICATIONS OF BELT CONVEYOR OF ЛK-K SERIES	VALUE
Belt width, mm	300, 400, 500, 650, 800, 1000
Conveyor length between drum axes, mm	from 000 to 50000*
Drum diameter, mm	from 273
Belt speed, m/s	from 0.2 to 2
Pitch of roller bearings of carrying (operating) run, mm	250 to 1400
Angle of slope to horizon, degree, not more	90
Type of gear motor	straight-tapered
Motor power, kW	from 1.5 to 30

\*If conveyor length is more than 6000 mm then it is supplied disassembled and consists of several sections.



# METAL SEPARATORS AND METAL DETECTORS

## SUSPENDED SELF-DISCHARGING METAL SEPARATORS SUSPENDED MEAL



SUSPENDED SELF-DISCHARGING METAL SEPARATORS



SUSPENDED MEAL SEPARATORS

Metal separators are used for extraction of ferromagnetic objects from bulk non-magnetic materials transported by the belt conveyors.

The metal separators can be of several types:

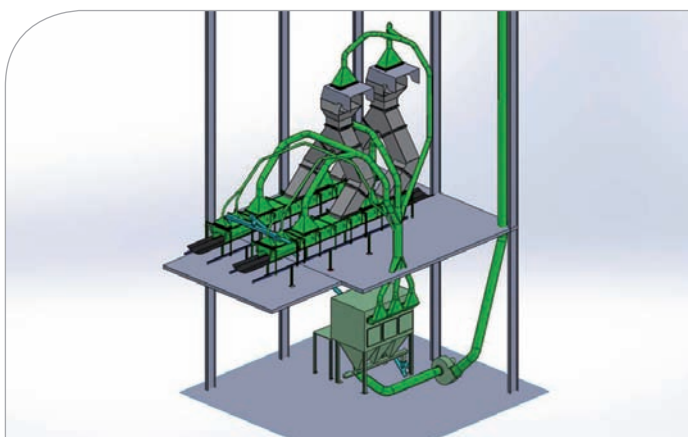
- Suspended (installed above the conveyor belt);
- Suspended self-discharging (installed at the discharge funnel along the conveyor at the angle for automatic extraction of ferromagnetic objects);
- Pulley-type (installed instead of drive pulley of the belt conveyor).

To detect in the flow of transported material the raw metal particles one can use the conveyor metal detector which is installed above or under the conveyor. In case of detection of metal objects in the transportable material the metal detector sends a signal for speed-up turning on of metal separator or to stop the conveyor belt.

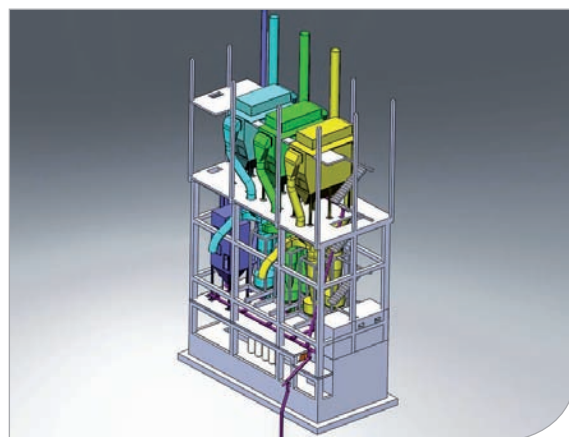
## EXHAUST SYSTEMS OF UNLOADING COMPLEX

To remove dust from the air formed in the course of the work of the unloading complex, the exhaust system is designed and mounted for above-bin space of the car dumper building and for units of re-discharge of raw material. The units for re-discharge of raw material include raw material discharge from one belt conveyor to another and are located by drive and tension stations for the belt conveyors. Their designing contains the basic data acquisition, calculation of exhaust systems, drawing of plans and sections. The calculation of the exhaust system is performed with the selection of equipment of required capacity.

Examples of the exhaust systems in the building of car dumper and at units for re-discharge are given below.



ELEMENTS OF EXHAUST SYSTEM IN CAR DUMPER BUILDING



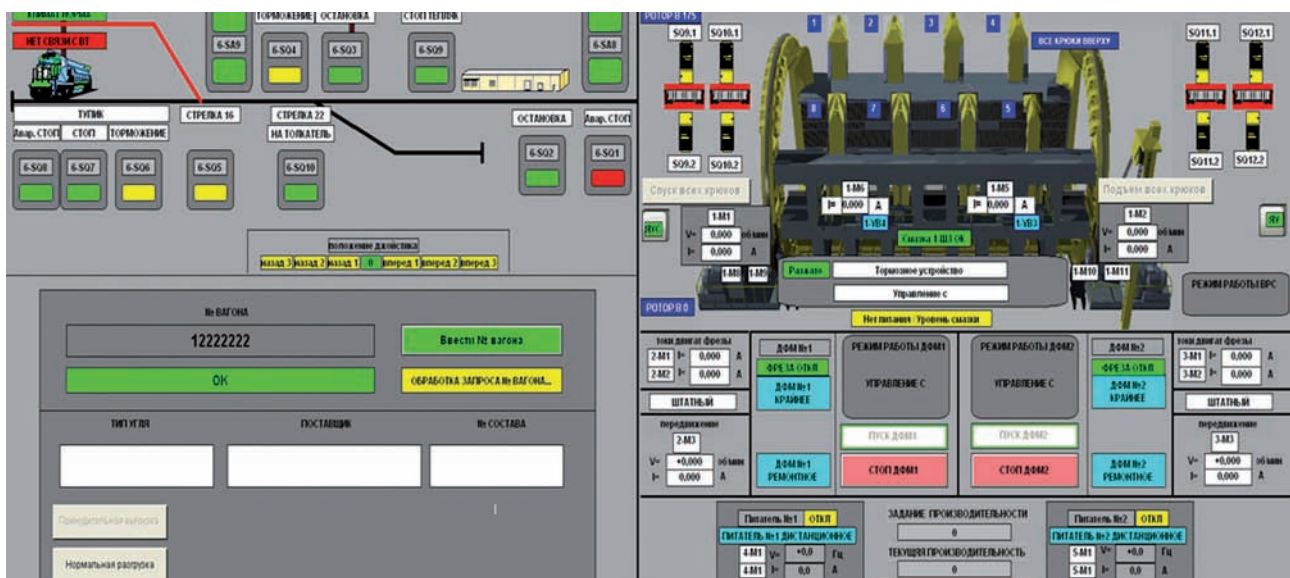
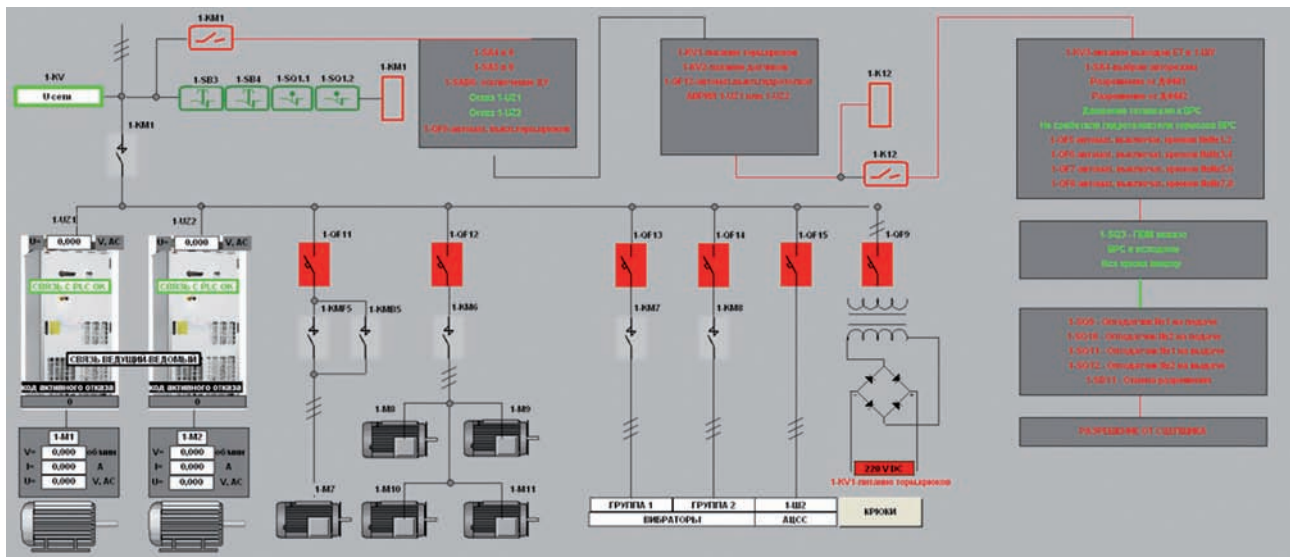
ELEMENTS OF EXHAUST SYSTEM OF RE-DISCHARGE UNIT



# UNLOADING COMPLEX CONTROL SYSTEM

## The automation system provides:

- General characteristics and possibilities:
- The control system is on the basis of programmable logical controllers of Siemens SIMATIC S7-300/S7-400/S7-1200, input / output stations, frequency converters of ACS800/550-07(01) type made by ABB and operator panels (HMI) with touch control;
- Collection of signals of objects and sensors, generating the control commands is performed using the device of decentralized periphery ET200M,(S) with input/output modules;
- As the main protocol for data transfer between segments of control system it should be used the field network – Profibus (PROcessFieldBUS);
- Operating modes: automatic / manual for adjustment.
- Visualization of processes; the visualization of current processes allows the operator to obtain more information and avoid errors;
- Archiving of data on the mechanisms operation and actions of the operator;
- Diagnostics and displaying of warning alarms for operator of emergency situations for the equipment. in performing of production processes;



# UNLOADING COMPLEX CONTROL SYSTEM

## Electrical equipment:

- There are unified control circuits and components for low-voltage distribution switchboard (HKY) which increases the maintainability and interchangeability of electric equipment;
- HKY (low-voltage distribution switchboards) of the whole unloading complex are equipped with components of Siemens, ABB or other completing items at Customer's request.



## Car Rotary Dumper:

- The electric drives of mechanisms of unloading complex are equipped with frequency converters (FC) which provide the control of process speeds, adjusting protection for the electric motor against overloading, disconnection of the drive in case of motor windings overheating and the phase breakage. The converters has available with vector control and patented system of Direct Torque Control “DTC”;
- The frequency converters are completed with special microcode software, focused on operation with car dumper. For example, load balancing between frequency converters is performed using the macro as “master – slave”. In this mode the control commands are to be received by one of drives (“master”), and the other drive (“slave”) is controlled by commands of master drive. The data transfer in this system between converters is provided by high-speed fiber-optic communication line. This allows to avoid the effect of torque failure of rotor and to react instantly to drive to change the load without disbalancing;

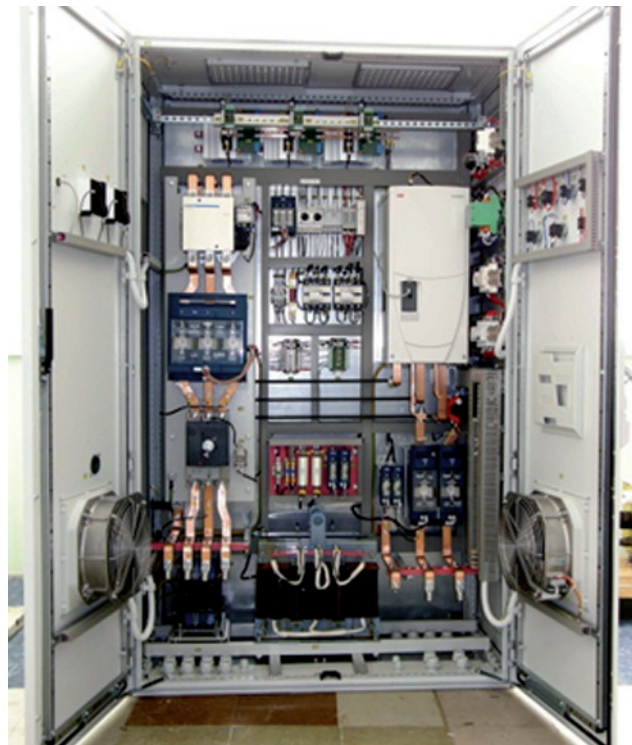


commands are to be received by one of drives (“master”), and the other drive (“slave”) is controlled by commands of master drive. The data transfer in this system between converters is provided by high-speed fiber-optic communication line. This allows to avoid the effect of torque failure of rotor and to react instantly to drive to change the load without disbalancing;

- All the frequency converters are supplied in the versions adapted to the conditions and modes of operation, the converters have the special acubicle or built-in design version;
- For the operation with FC the motors with squirrel-cage rotors are used, with built-in sensors for temperature of stator windings and they are adapted to operation with FC (reinforced insulation, isolated bearing).



# UNLOADING COMPLEX CONTROL SYSTEM



## Rail Car Pusher

For any car pusher it is possible to use any of the following control systems. The selection is defined by the Customer's availability of finished contact network, operation conditions, etc.

### Option 1

#### Trolley - DC, motors - DC

The rail car pusher with motors - DC; the motors are of crane and metallurgical series; number of trolleys - 3 pcs; Speed joystick control with smooth or three fixed speed values.

#### Control circuit features:

- Two DC motors with separate excitation are used for the drive of rail car pusher;
  - The rail car pusher power is from original DC drive by 3 trolleys;
  - Coils of electric magnet for brakes and alarm devices installed in car pusher are also powered from DC source = 220 V.
- The control is carried out remotely from the operator's control panel.





## Option 2

### Trolleys – DC / AC, motors - AC

The rail car pushers are installed by AC motors of general industrial series, the motors are adapted for operation with FC. The advantage in comparison with Option 1 is lower installed power with the same traction; the motors do not require maintenance.

Speed joystick, smooth or with three fixed speed values; transmission / receiving of control signals to / from rail car pushers performed by means of radio communication.

Features of the rail car pusher drive: •All the benefits of car pusher with DC drive, plus the reliability, durability and no operating costs for AC motors;

- The installed power is up to 1.5 times less in comparison with the similar rail car pusher with DC.

### Advantages of rail car pushers for all power supply circuits:

- Stable, independent of load (number of cars) traveling speed; stability of movement for the rail car pusher is maintained within the whole range of speeds;
- Accuracy of installation; the application of FC with vector control and regenerative braking allows to perform controlled braking according to adjusting front;
- The availability of controlled mechanical brakes; normally closed brakes allow to operate safely the rail car pusher and obtain additional braking torque in emergency braking situations;
- In case of application of AC/ DC complete drive it is not necessary to install additionally the throttles (reactors), additional transformers, rectifiers, fuses and other equipment. All the FCs are equipped with interface modules connected to the local network PROFIBUS-DP. This data bus transmits the control signal from the controller to FC, it collects the information on the drive status (diagnostics) and the current parameters of the drives.

### Crushing and milling machines (DFM)

The control system of the crushing and milling machines provides two modes of the machine operation: manual and automatic. In case of manual mode operation the switching on for the machine movement mechanism and its speed is determined by the operator, depending on filling volume and loads for motors of the mill drive. In case of automatic mode, the crushing and milling machine is controlled by its own controller. Analyzing the incoming signals from the machine mechanisms the controller optimizes the operation mode of the machine excluding overloads and slipping.

The control system of the crushing and milling machine allows:

- To use the automatic mode for control of the crushing and milling machine as the main one;
- To increase efficiency of use for manual mode during passing the particular difficult areas;
- To reduce significantly the number of travelling motor starts with provision of smooth change mode for rotational speed that increases the operational durability of motors and gearboxes of the movement mechanism;
- To maintain the operation of drive motor for the mill rotation in nominal conditions;
- To have the flexible control system for the crushing and milling machine with possibility to adapt to changing conditions of operation;
- To provide return of the machine to its initial position with traveling speed more than the nominal one, that reduces the total cycle time of crushing.

### Video surveillance:

The mechanisms of the unloading complex are equipped with cameras of industrial video surveillance (CCTV) with archiving for operative control of the mechanisms operation at unloading complex and for control of technological process. The special cameras have the following: the blow off and washing of the lens, heated casings. Monitors are installed in the premises of the operator for the car dumper and the portal pusher.



# REFERENCE LIST

## CAR DUMPERS

Early supplies –  

Modern supplies (since 2002) –  

CAR DUMPER MODEL	COUNTRY	CLIENT	QTY, PCS.	YEARS
Cable	Georgia Kazakhstan China Russia Ukraine Estonia Hungary	Enterprises of iron and copper industry, central concentrated mills, by-product coke plants, ore mining and processing enterprises, thermal generating stations and regional power stations.	67	1948–1961
Gear-driven	Azerbaijan Kazakhstan Russia Uzbekistan Ukraine	Enterprises of iron and copper industry, ore mining and processing enterprises, cement mills, commercial seaports, CHPP.	22	1961–1963
Rotary Dumper	Armenia Bulgaria India Iran Kazakhstan Kirgizia DPRK UAE Russia Turkey Uzbekistan Ukraine Estonia Yugoslavia	Enterprises of iron and copper industry, integrated mining and chemical plants, mining-and-metallurgical integrated works, by-product coke plants, central concentrated mills, commercial seaports, CHPP and regional power stations.	91	1963–1975
Side Dumper	Latvia Russia Ukraine	Enterprises of iron and copper industry, alumina refinery plants, commercial seaports, central concentrated mills.	25	1965–1975
SDS-93	Russia	Achynsky alumina refinery plant, Korshunovsky ore mining and processing enterprise, Kuznetskaya central concentrated mill, Lipetsky TPP and others	14	up to 2002
	Ukraine	Bagleysky by-product coke plant, Burshtynskaya regional power station, Komendantskaya central concentrated mill, Mariupol commercial seaport		
	Russia	Kuznetsk Concentration Plant	1	2005
	Kirgizia	Bishkek Power Plant-1	2	2006
	Latvia	Port of Ventspils	2	2007
	Kazakhstan	Askus Power Plant-1	1	2008
	Kazakhstan	JSC Kazakhstan Aluminum	1	2009
	Kazakhstan	Astana Power Plant-2	1	2009
	Russia	NLMK, Lipetsk	2	2010
		Yuzhnyi Port	1	2012
	Ukraine	Metallurgical complex after Dzerzhynsky	1	2014
		TIS-Coal	1	2015
SDS-75S	Russia	JSC Mosenergo	2	2003

CAR DUMPER MODEL	COUNTRY	CLIENT	QTY, PCS.	YEARS
RDS-75S	Ukraine	Vostochniy Ore Mining and Processing Works	1	2006
	Kazakhstan	Askus Ferroalloy Plant	1	2007
	Ukraine	PJSC Volyn-Cement	1	2008
	Ukraine	PJSC Yug-Cement	1	2008
	Russia	Nizhniy Tagil Iron and Steel Works	1	2011
	Kazakhstan	Aktyubinsk Ferroalloy Plant	1	2012
	Ukraine	Ivano-Frankivsk Cement	1	2016
RDS-2x75	Russia	JSC "Daltransugol"	2	2008
RDS-93	Armenia	JSC Armzoloto	72	up to 2002
	Belorussia	JSC Krasnoselsk-Stroymaterialy		
	Kazakhstan	Balkhashsky Mining and Metallurgical Company		
	Russia	Karagandinsky metallurgical complex, PD «Phosphor», Ayutinskaya central concentrated mill, Belovskaya central concentrated mill, NT metallurgical complex, Kuznetskaya central concentrated mill, Magnitorskyy metallurgical complex, NL metallurgical complex, Novosibirskaya CHPP-2, SC «Karelian Steel Pellet», Omsk CHPP-4, Aktiubinsk central concentrated mill, Tulachermet, Yasinovskyy by-product coke plant, West-Siberian metallurgical complex etc		
	Slovakia	Central Termoelectrica de Zvolen, Central Termoelectrica de Martin		
	Ukraine	Zaporozhskyy by-product coke plant, Kommunarovskyy by-product coke plant, Makeyevka by-product coke plant, Mariupol by-product coke plant, NZF, Dnepropetrovsk by-product coke plant, Dobrotvorskaya central concentrated mill, NKGOK, UMTS «Donetsk coal washing» etc.		
	Estonia	Pribaltiyskaya regional power station		
	Russia	JSC Tulachermet	1	2003
	Ukraine	Dzershinsk Concentration Plant	1	2004
	Estonia	Port Muuga, Tallinn	2	2005
	Kazakhstan	Petropavlovsk Power Plant-2	1	2006
	Ukraine	Nikopol Ferroalloy Plant	1	2007
	Ukraine	Heidelbergcement Ukraine. Doncement	1	2008
	Russia	Severstal Group	1	2008
	Estonia	Severstal Group	1	2008
	Belorussia	Krasnoselskstroyaterialy	1	2009
	Kazakhstan	CentrKazEnergoMontazh	1	2016
RDS-120S	Kazakhstan	Balhashmed JSC	1	1993
	Kazakhstan	Jezkazgan	1	2008
RDS-125	Armenia	Zodsky gold ore plant	51	up to 2002
	Kazakhstan	Askus ferroalloy plant, Ermakovskyy FZ, Western central concentrated mill, Novo-Dzhambulskyy phosphate plant, Karagandinsky machine-building plant		



# REFERENCE LIST

CAR DUMPER MODEL	COUNTRY	CLIENT	QTY, PCS.	YEARS
RDS-125	Finland	External trade	1	1975
	Mongolia	CHPP-4, r. Ulan-Bator	1	1977
	Russia	Altaysky by-product coke plant, Arckhangelsky pulp and paper mill, Barnaul CHPP-2, Novolipetsky MZ, OH metallurgical complex, Magnitorsky metallurgical complex, Starooskolsky TsZ, Cherepovetsky MP, Lipetsky MP, Ziminsky chemicals producer etc.		
	Ukraine	Avdeyevsky by-product coke plant, Komendantskaya central concentrated mill, Kommunarsky by-product coke plant, metallurgical complex «Azovstal», Krivbasruda, Northern ore mining and processing enterprise		
	Estonia	Baltic regional power station, Estonia regional power station		
	Estonia	Narvsk power stations	1	2004
	Kazakhstan	Askus thermal power plant-1	1	2004
	Kazakhstan	Astana CHPP-1	1	2005
	Estonia	Narvsk power stations	3	2005-2007
	Ukraine	Northern ore mining and processing enterprise	1	2011
RDS-134	Georgia	Rustavsky metallurgical plant	33	up to 2002
	Russia	Altaysky by-product coke plant, Gaysky ore mining and processing enterprise, Kostomukhshsky ore mining and processing enterprise, Krasnoyarsky ZTE, Magnitorsky metallurgical complex, NT metallurgical complex, Pecherskaya central concentrated mill etc		
	Slovakia	CHPP in Voyany town		
	Tadjikistan	Kirovobadsky aluminum plant		
	Ukraine	Kurakhovskaya central concentrated mill, Zaporozhskaya NS, Aleksandriya coal, Komsomolskaya central concentrated mill, Krivorozhsky CP, PSP «Sverdlovanratsyt», South ME		
	Russia	Kuzbasskaya central concentrated mill	1	2009
	Ukraine	PJSC «Heidelbergcement»	1	2009

## MOBILE DOWNLOAD BLOCKS

NAME	COUNTRY	CLIENT	QTY, PCS.	YEARS
RDS-125	Russia	Kotlassky pulp-and-paper plant	1	1976
		Arkhangelsky pulp-and-paper plant	1	1977
	Ukraine	Metallurgical complex after Illich	1	1970
RDS-125	Russia	Magnitorsky metallurgical complex	1	1972
RDS-134	Ukraine	Metallurgical complex after Dzerzhynsky	1	1981
RDS-80M	Ukraine	Zaporozhstal	1	2004

## PUSHERS FOR WAGONS

NAME	COUNTRY	CLIENT	QTY, PCS.	YEARS
Car Pusher T-24PS	Russia	Sakhalinskaya regional power station	1	1994
Car Pusher T-22P2	Kazakhstan	Aluminum of Kazakhstan	1	2009
	Ukraine	Alchevsky by-product coke plant	1	1994
		Burshtynskaya regional power station	1	1996

NAME	COUNTRY	CLIENT	QTY, PCS.	YEAR
Car Pusher T-22P2	Ukraine	Dobrotvorskaya regional power station	1	1996
		Krasnodonugol	2	1996–1998
		Krivorozhstal	1	1995
		Uglegorsk regional power station	2	1994
Car Pusher T-20	Russia	Cheliabinsk metallurgical complex	1	2005
	Uzbekistan	Novo–Angrenskaya thermal power plant	2	2007
	Ukraine	Metallurgical complex after Dzerzhynsky	1	2014
	Estonia	Estonia power stations, Narva	1	1998
	Kazakhstan	Tsentrkazenergmontazh	1	2012
Car Pusher T-20I	Iran	Esfahan Steel Co.	1	2007
Car Pusher T-20M	Kazakhstan	Euro–Asian energetic corporation	1	2009
	Russia	Chelyabinsk metallurgical complex	2	2006
Car Pusher VT-4	Russia	Tulachermet	1	2005
		Kuznetskaya central concentrated mill	1	2006
		EVRAZ NTMK	1	2011
	Kazakhstan	Aktyubinsk ferric plant	1	2011
Car Pusher VT-4L	Russia	Novolipetsky metallurgical complex	6	2007–2009
		OLKON	1	2013

## ELECTRIC TRACTORS

NAME	COUNTRY	CLIENT	QTY, PCS.	YEAR
Electric Tractor E-2	Kazakhstan	"Western" section	6	1986–1987
	Russia	Holboldzhynsky section, Buriatia	2	1992
		Section washing–house "Neriungrinsky", Yakutia	1	1994
		Standardtechnology	3	1999
Electric Tractor E-2B	Russia	"Bachatskaya–Energetic" washing–house	2	2002
		Kuzbassrazrezugol	1	2008

## CRUSHING–MILLING MACHINES

NAME	COUNTRY	CLIENT	QTY, PCS.	YEAR
DFM-20M	Kazakhstan	Kazakhstan aluminum	1	2009
	Kyrgyzstan	PJSC «Electric power plant»	2	2007
	Ukraine	Metallurgical complex after Dzerzhynsky	3	2013–2014
DFM-14	Ukraine	Volyn–Cement	2	2008
		South–Cement	2	2008
		Doncement	2	2008
	Kazakhstan	Kazchrome	2	2011
	Russia	Evrax NT metallurgical complex	2	2011
DFM-12	Kazakhstan	Tsentrkazenergmontazh	7	2006–2016
		Aksusky ferric plant	1	2008
		Aktyubinsk ferric plant	1	2012
		Ekibastuz GRES	4	2012–2014
DFM-12x2	Russia	PJSC «Daltransugol»	2	2008

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