Matera

ИЗ-КАРТЭКС
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ELECTRIC MINING SHOVEL EKG-20K - EKG-20KM

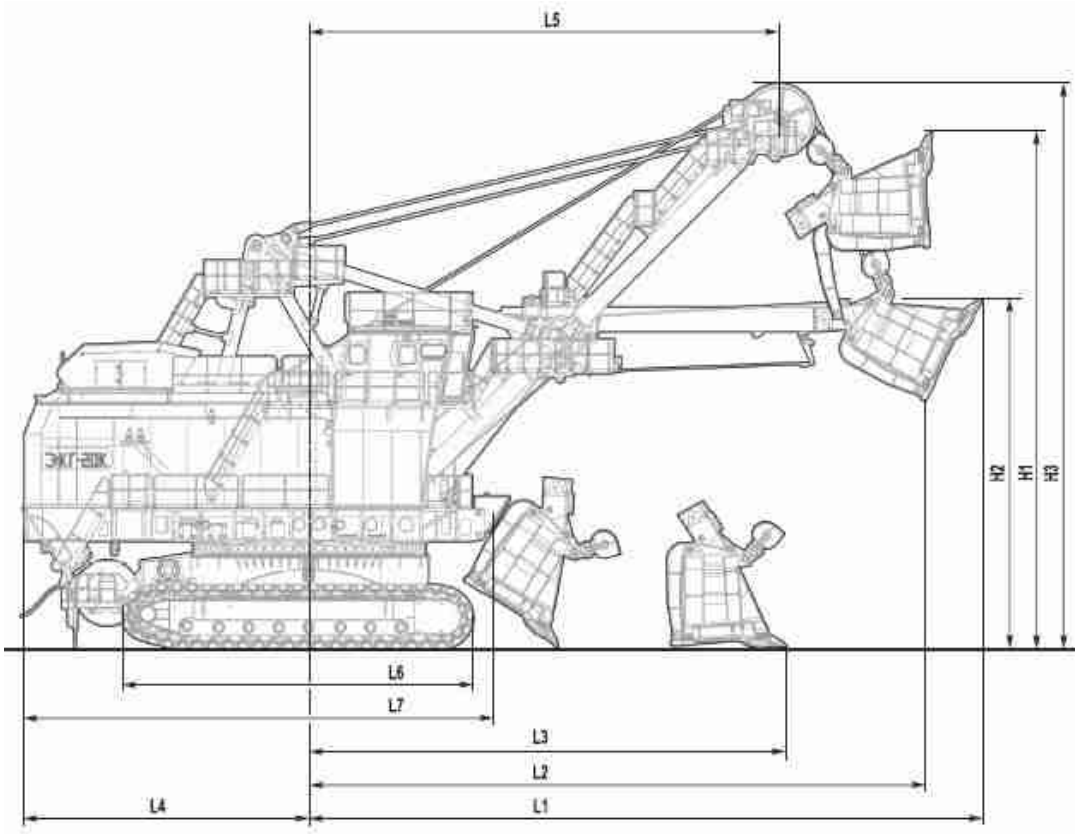
Combination of mining shovels and machinery

EKG-20K, EKG-20KM mining shovels are designed to work in combination with dump trucks with loading capacity of 130-220 tonnes.

Navoi Mining and Metallurgy Combinat – 136, 180 et 220 tonnes

Karelskiy Okatysh Mine – 220 tonnes

Performance parameters



Designation of parameters	Designation	EKG-20K	EKG-20KM
1. Maximum digging height, m	H1	17,3	17,5
2. Maximum dumping height, m	H2	11,2	11,2
3. Maximum digging radius, m	L1	22,6	22,5
4. Digging radius at floor level, m	L3	16	16
5. Maximum dumping radius, m	L2	19,4	19,4

Comparative specifications of mining shovels

Designation of parameters	IZ-KARTEX		P&H (США)	Caterpillar (США)		Taiyan (Китай)
	EKG-20K	EKG-20KM	2300XPC	7295HD	7295	WK-20A
Mechanism	Rope	Rope	rack and pinion	rack and pinion	Rope	rack and pinion
Bucket payload, t	40	50	45	38	45	36
Bucket capacity, m3 :						
For uncovered soles (The density in the pillar is 2.7 t/m3, in loosened state - 2.0 t/m3 - 2.0 t/m3)	20	25	22,5	19	22,5	18
For iron ore (The density in the pillar is - 3,6 t/m3, in loosened state - 2,5 t/m3)	16	20	18	15	18	14,5
Replaceable bucket capacity, m3	16-26	20-32	19-37	14-31	18-36	16-34
Estimated time for cycle with 90° rotation, s	27	28	28	29	29	30
Average specific pressure on the ground, kPa	250	245	288	331	284,1	297
Working weight of shovel, t	700	780	788	700	790	792

References

In 2010-2019, 16 x excavators (type EKG-20K, EKG-20KM) and their modifications were supplied

Company	Model	Зав. №	Year of delivery
Kuzbassrazrezugol	ЭКГ-18Р	1	2011
Kuzbassrazrezugol	ЭКГ-18Р	2	2011
Kuzbassrazrezugol	ЭКГ-18Р	3	2012
Kuzbassrazrezugol	ЭКГ-18Р	4	2012
Kuzbassrazrezugol	ЭКГ-18Р	5	2013
Navoi Mining and Metallurgy Combinat	ЭКГ-20К	1	2014
Navoi Mining and Metallurgy Combinat	ЭКГ-20К	2	2014
Navoi Mining and Metallurgy Combinat	ЭКГ-20К	3	2018
Navoi Mining and Metallurgy Combinat	ЭКГ-20К	4	2018
Navoi Mining and Metallurgy Combinat	ЭКГ-20К	5	2019
Navoi Mining and Metallurgy Combinat	ЭКГ-20К	6	2019
Lebedinsky GOK	ЭКГ-20КМ	1	2014
Mine Karelskiy Okatysh	ЭКГ-20КМ	2	2016
Mine Karelskiy Okatysh	ЭКГ-20КМ	3	2016
Mine Karelskiy Okatysh	ЭКГ-20КМ	4	2017
Mine Karelskiy Okatysh	ЭКГ-20КМ	5	2017

Main technical specifications:

Bucket payload, t:

- EGK-20K: 20 m3
- EGK-20KM: 25 m3

Production time: 9 months

Working weight : 710 – 780 t

Being released from 2010

Actual operating indicators

Excavators (series EKG-20K and EKG-20KM) are operated with an average vehicle availability rate of 0.80-0.90 and their productivity reaches 5,5 Millions cubic meters per year.

Company	Raw Materials produced	Shovel models	Production monthly achieved, thousands of m3/month	Average production, thousands of m3/year
Kuzbassrazrezugol	charcoal	EGK-18P	512	4 800-5 100
Navoi Mining and Metallurgy Combinat	gold	EGK-20K	560	5 000-5 500
Lebedinsky GOK	iron ore	EGK-20KM	305	2 800-2 950
Mine Karelskiy Okatysh	iron ore	EGK-20KM	315	3 000-3 200

Statistical data on actual productivity of EKG-20K excavators produced by IZ-KARTEX in the Navoi MMC conditions.

With a high usage rate of the equipment (= 0,74) EKG-20K shows impressive results in excavating gold-bearing ore and overburden.

		EGK-20K (зав. № 1) (bucket 20 м^3)		**EGK-20K (зав. № 2)** (bucket 20 м^3)	
№ п/п	Month	Production, thousands m3	VAR	Production, thousands m3	VAR
1	January	505,23	0,90	155,54	0,84
2	February	480,12	0,88	210,45	0,83
3	March	560,35	0,90	510,70	0,85
4	April	455,21	0,91	480,99	0,87
5	May	485,00	0,92	485,09	0,87
6	June	485,87	0,85	475,88	0,84
7	July	380,40	0,89	490,08	0,85
8	August	400,08	0,89	455,00	0,83
9	September	398,54	0,90	550,32	0,85
10	October	410,26	0,92	509,01	0,84
11	November	425,98	0,92	492,30	0,86
12	December	453,36	0,90	437,76	0,85
Total:		**5 440,40**	**0,90**	**5 253,12**	**0,85**

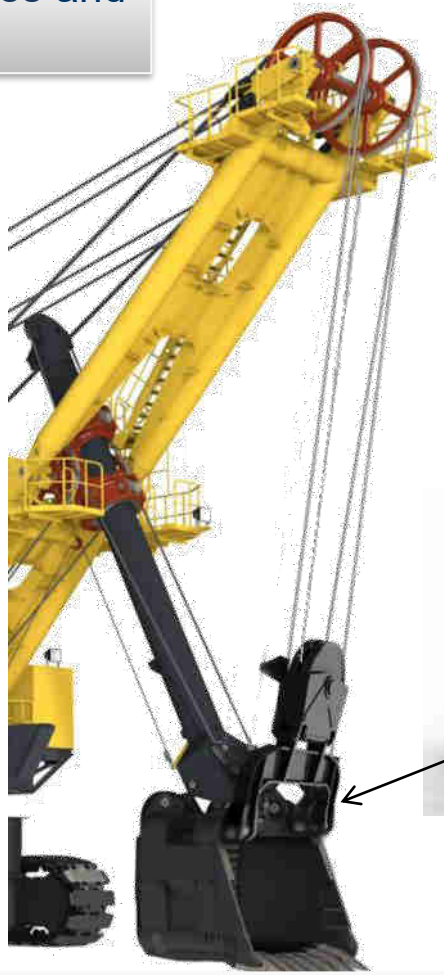
Working equipment– EGK-20K and EGK-20KM

Articulated boom made out of tubes and end castings

EGK-20K

The bucket linkage of EKG-20K provides maximum digging height

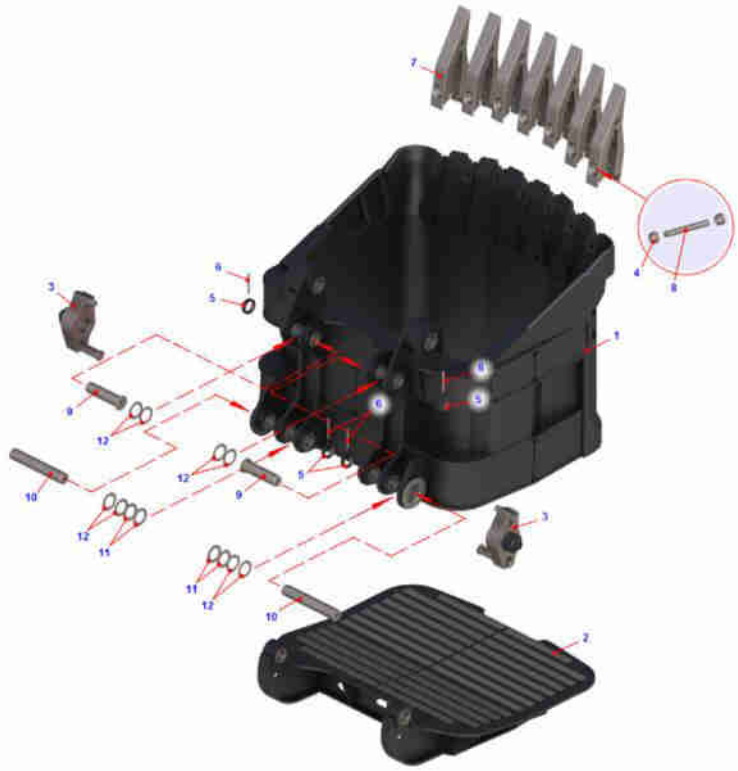
EGK-20KM



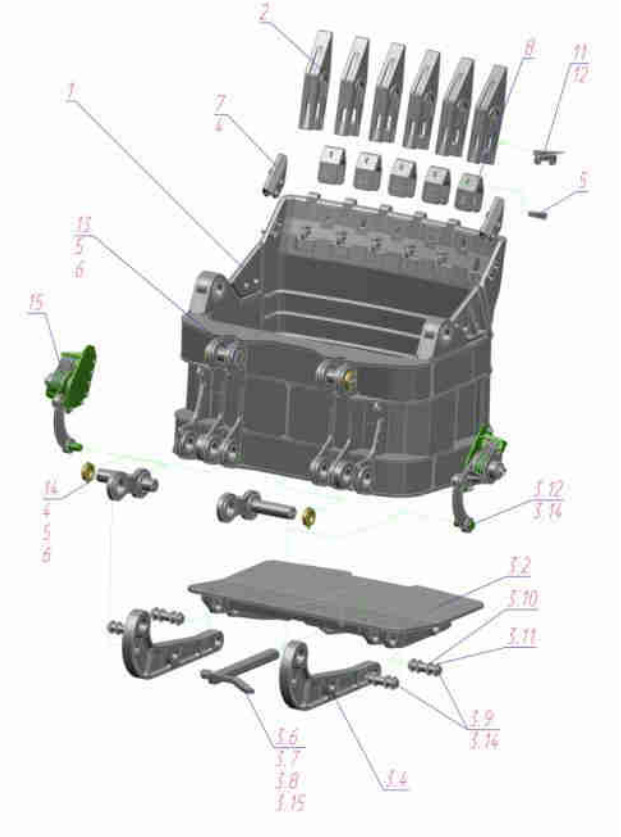
The bucket linkage of EGK-20KM ensures a uniformly distributed load to lifting ropes

Working equipment - Bucket

EGK-20K

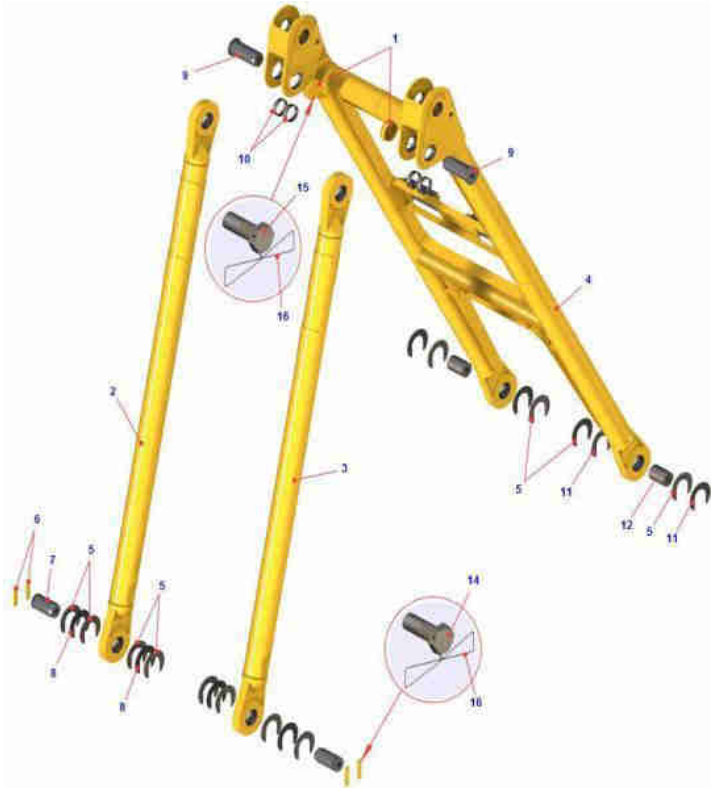


EGK-20KM



Welded bucket. Front wall of the bucket, hinges and teeth are made of anti-wear manganese steel. The side edges are protected by manganese steel castings and the bucket bottom is covered with wear-resistant strips.

The Boom. Bipod stand.



The double girder steelwork consists of two articulated sections: a bottom section and an upper section. The structures of the upper and lower sections are the same. The sections are beams made of tubes with steel castings at the ends, connected to each other by steel plates

Circular metal structures with end castings.
The side gaps at the front and rear ends of struts can be adjusted.
The left beam of the rear strut serves as an air reservoir (receiver) for the excavator's pneumatic system.

The boom suspension

The boom suspension is equipped with 4 steel cables with end terminations.

Does not require any adjustments during operation

The cable-stayed boom suspension life is 4-5 years

Electric drive

Electric shovels EKG-20K and 20KM are equipped with AC and DC electric drives

Electric drive characteristics	
DC power « Transistor Converter-motor » System	**AC power "Frequency converter - asynchronous motor" system**
Easy drive control, with optimized engine regulating characteristics	Increased complexity of the motor control system and higher price.
Brush-collector unit requiring regular maintenance.	Fully contactless, maintenance-free electric machines.
Will accept lower power net quality.	Lower specific power consumption.

Main drives motors

Main electrical motors EKG-20K

(electric drive with DC power and a « Transistor Converter-Motor » control system)

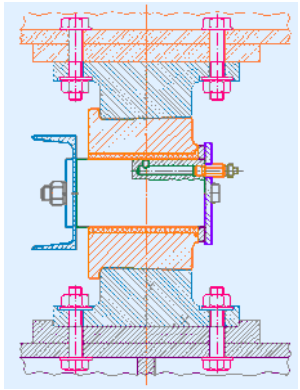
Drive	Power, kW	Revolutions per minute, r/min	Q-ty per shovel
Hoist	560	540	2
Crowd	220	600	1
Swing	350	900	2
Propel	200	750	2

Main electrical motors EKG-20KM

(electric drive with AC power and a "Frequency converter - asynchronous motor" control system)

Drive	Power, kW	Revolutions per minute, r/min	Q-ty per shovel
Hoist	600	500	2
Crowd	325	500	1
Swing	325	900	2
Propel	325	900	2

Rotation Unit



- A unique unit : its unparalleled circle composed of conical rollers of a large-diameter (7.6m) enables loads to be distributed evenly across the structure and reduces the excavator's operating weight and price.
- The circle with conical rollers is completed with plastic sleeves (NYLATRON) not requiring lubrication during operation.
- Compared to the previously used ring with cylindrical rollers, the reliability and durability of this rotation unit is increased and the maintenance costs are reduced.
- The specified service life of the conical rollers in the rotation unit is 10 years of operation.

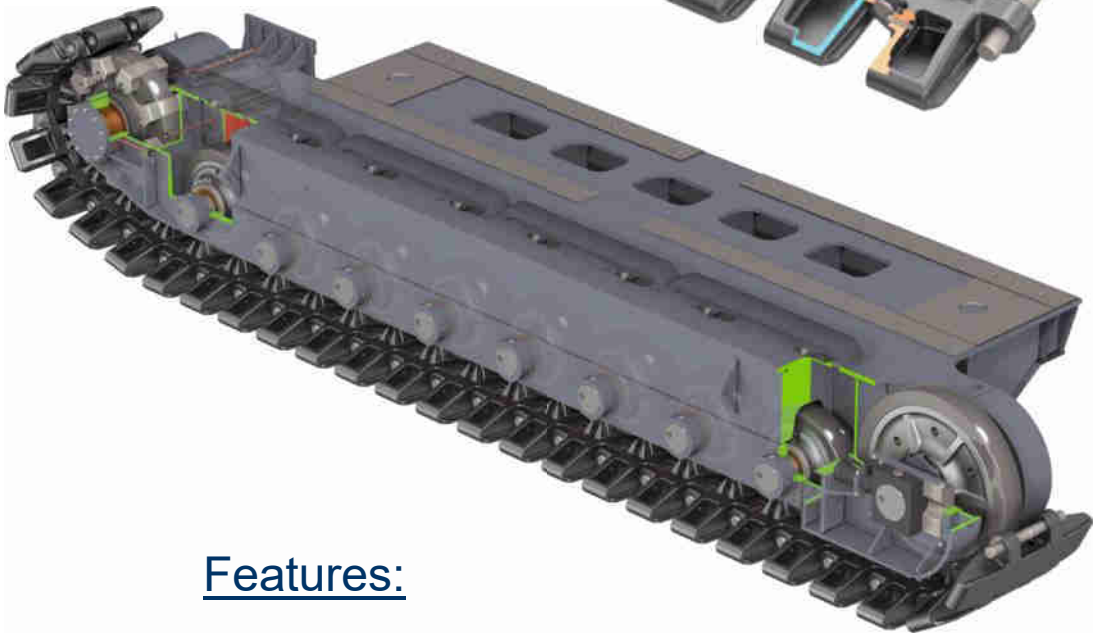
Crawler propel

The excavator crawler track has multiple supports and is enclosed.

The support and idler wheels are banded.

The drive wheel (which is forged) has interchangeable sprockets.

The track frames are a welded, U-shaped steel structure consisting of steel plates and forgings.



The shovel's crawler tracks are equipped with an individual drive for each track

Features:

- The gearbox of the running gear is located on the track frame and is not connected to the lower frame.
- High maneuverability of the shovel in cramped downhole conditions.
- The crawler chains are tensioned by hydraulic cylinders via an oil-pumping unit installed inside the lower frame.

New engineering solutions. Toothed links 20KM

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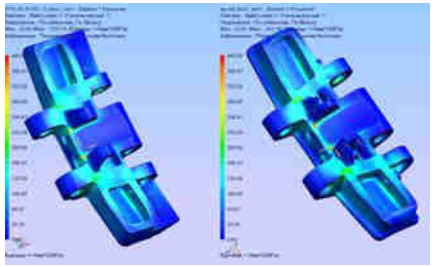
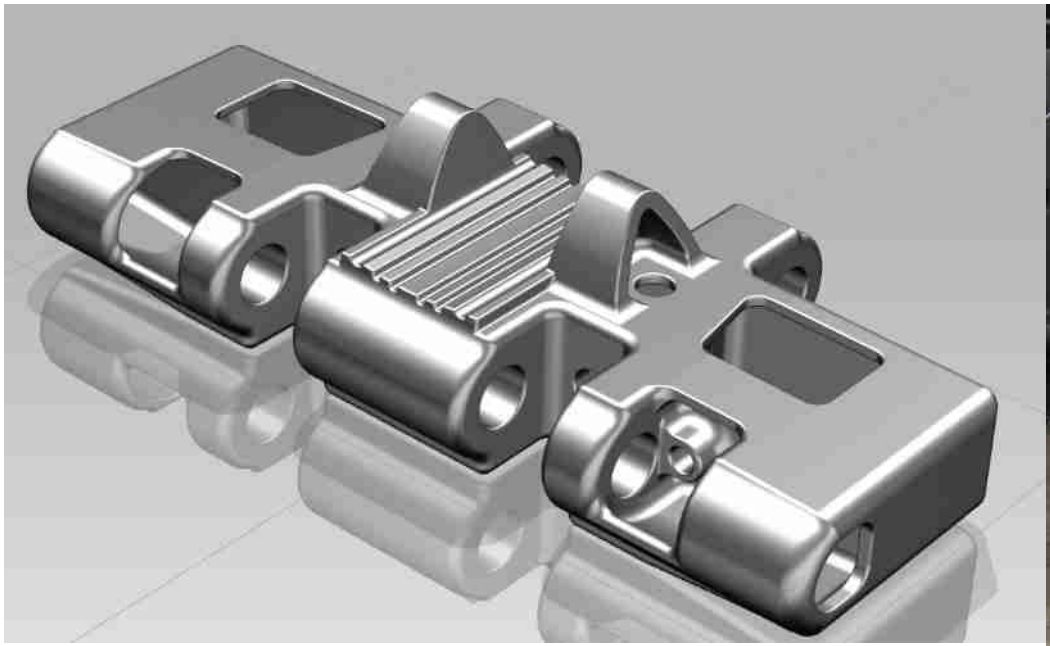
A new track link design has been developed and tested:

1. *The box structure has increased the rigidity of the track*
2. *Presence of lugs on the monobloc track shoes.*
3. *The axles are out of the rolling area as much as possible*
4. *The problem of jammed connecting axles in the centre of the track link has been eliminated*
5. *The circlips of piston pins are protected.*

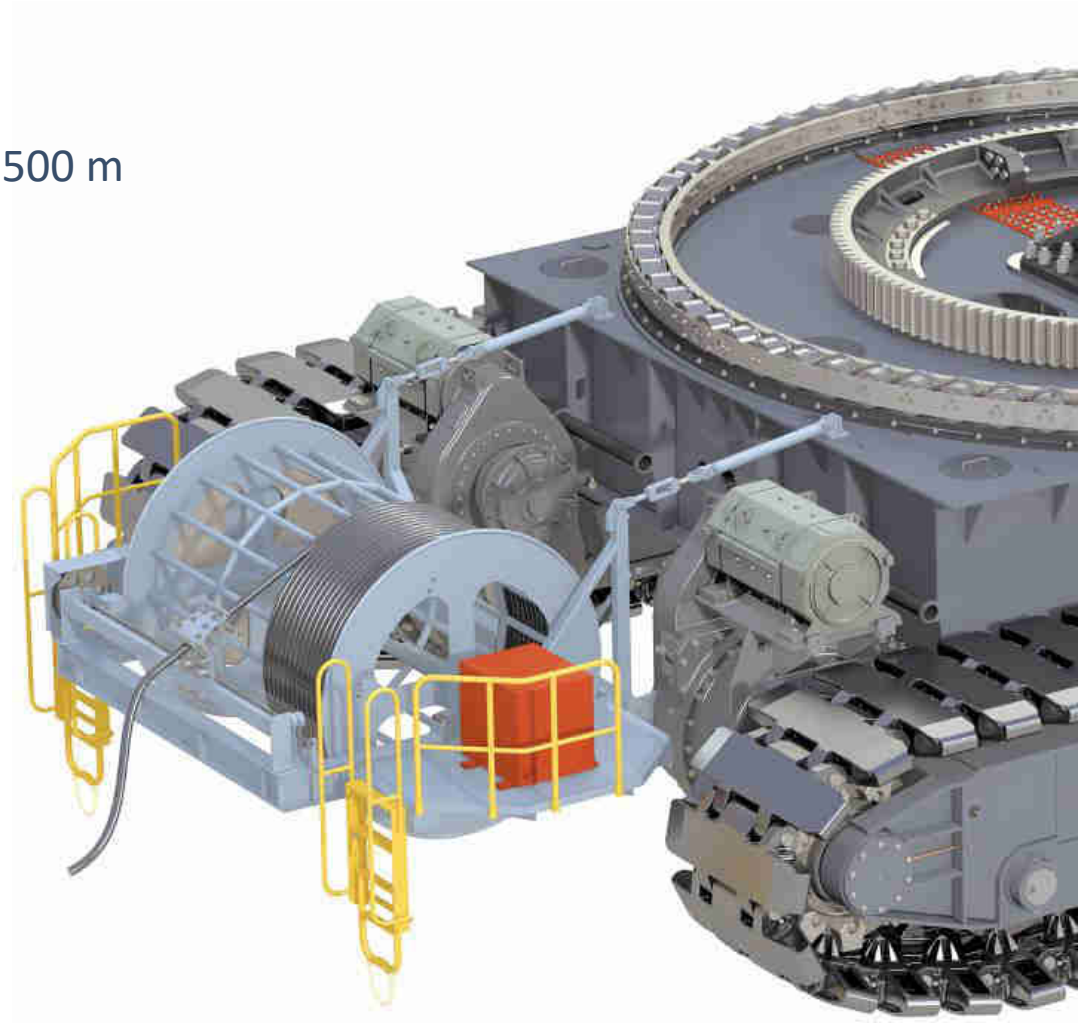




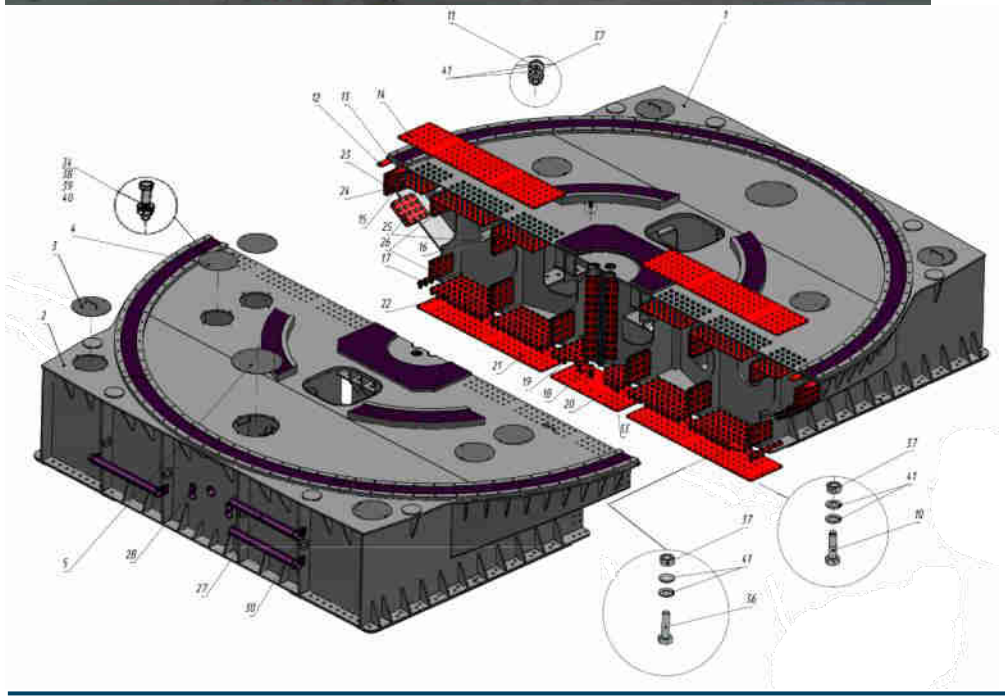
Cable drum

Excavators are equipped with a cable drum for winding and unwinding the supply cable when driving

Cable drum capacity - 500 m



Lower frame



- The lower frame is a welded box-type steel structure consisting of low-alloy steel sheets and pipes.
- In order to make transport easier, unit consists of two parts.
- During the assembly the two parts are joined using high-strength bolts with controlled tightening torque

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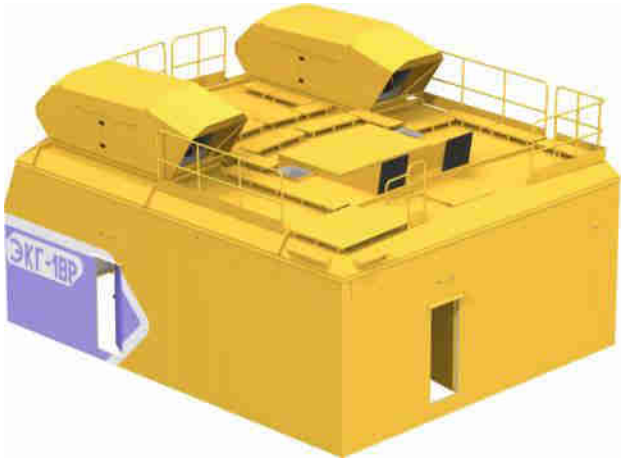
The ventilation unit

The shovels are equipped with a modular ventilation system



Functions:

- Purified air is supplied to heat generating devices (control cabinets, electric motors, etc.), which increases the efficiency of heat dissipation and the service life of the equipment.
- Creation of excess air pressure in the shovel body to prevent dust from entering from the outside.
- Monitoring and flexible control of the temperature in the shovel body.

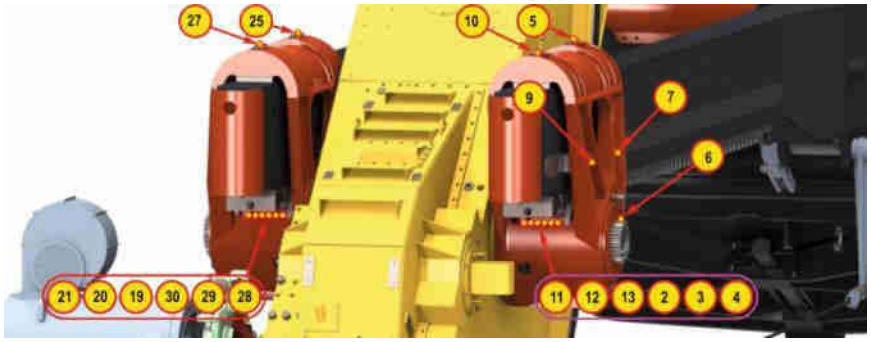
Centralized lubrication system

All excavators are equipped with a Lincoln automatic lubrication system (ALS)

The ALS automatically supplies lubricant to all friction points in the machinery of the shovel, precisely dosing each friction pair according to the lubrication chart.

The shovel's ALS using modern lubricants provides :

- Longer life of lubricated parts and friction pairs
- Avoidance of manual labour for lubrication work
- Optimisation of grease consumption rate
- Shovel operation at ambient temperatures ranging from -45 ^{0}C to +50 ^{0}C



Cabin unit

The comfortable and vibration-isolated cabin contains a resting area and provides an improved visibility of the working area.

The operator’s working area is fully compliant with current sanitary regulations. The cabin is equipped in order to create a comfortable space (air conditioning, fans, refrigerator, microwave oven)

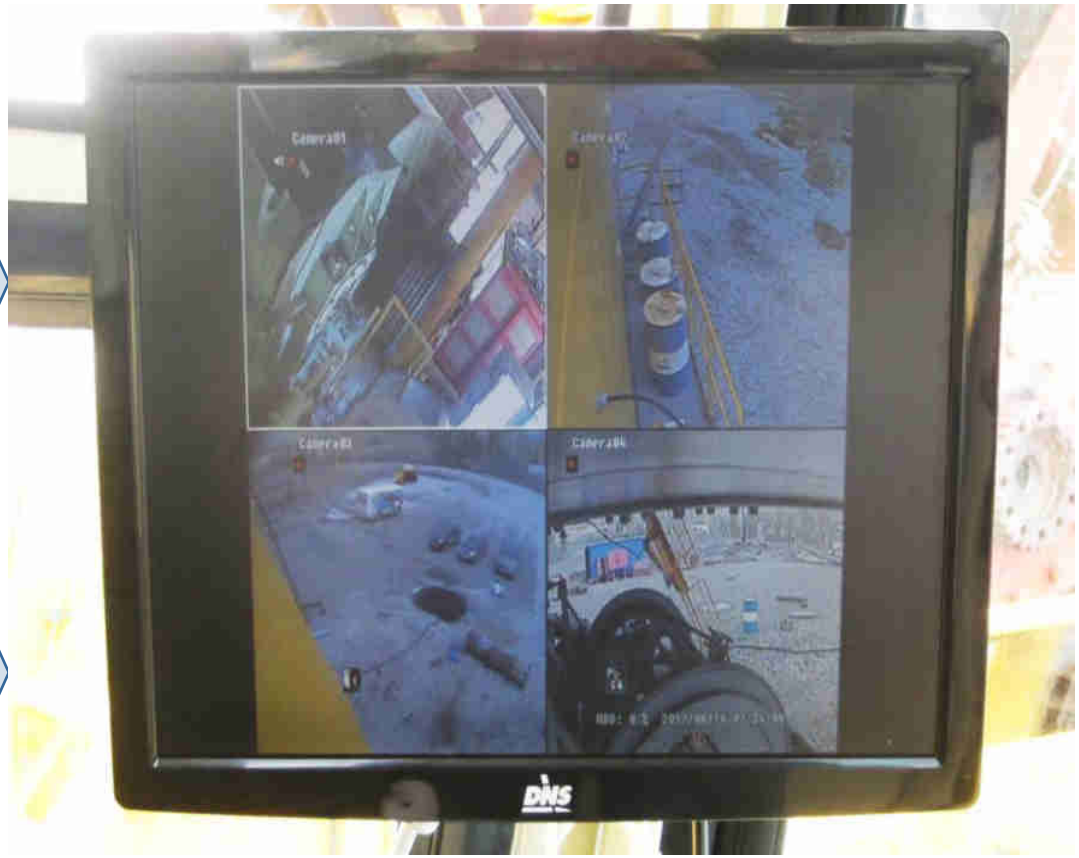
The ergonomically designed seat with vibration-isolating mount provides comfort and reduces fatigue.

The cab is designed with a higher degree of insulation and air purification for work in quarries with a high pollutant content.

Video monitoring system

For the operator's comfort and safety, the excavator is equipped with cameras:

View on the engine room



Rear view from the left-hand side of the body

Rear view from the right-hand side of the body

View on the cable drum and tail end of the body

Information and diagnostics integrated within the control system

Display and monitoring of main and auxiliary equipments parameters:

- ❑ Motors and gearboxes temperatures
- ❑ Pneumatic system air pressure
- ❑ Temperatures (shovel' body and operator's cabine)
- ❑ Tilt angle of the shovel
- ❑ Electrical consumption

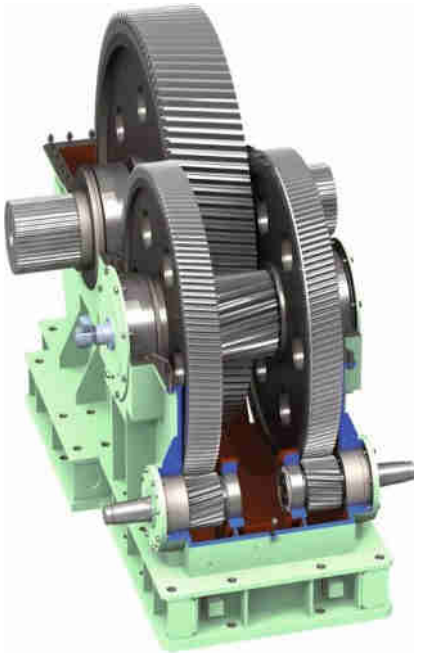
Tracking parameters and characteristics of the electric drive :

- ❑ power and auxiliary equipments
- ❑ Control system processes
- ❑ converters

Life time of main subsets

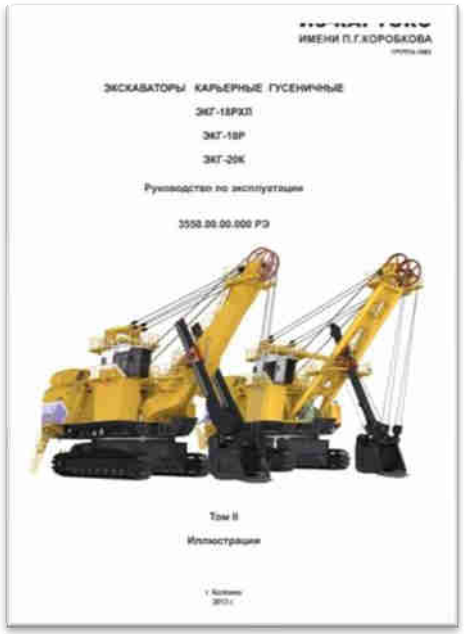
Life time of the shovels' main subassemblies has been increased compared to the previous shovels' generation

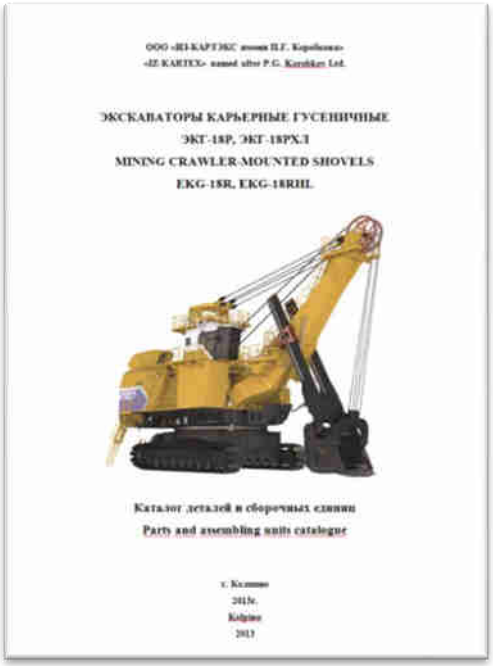
- One complete overhaul after 10 years of operation (65-70 thousand hours).
- The specified life time of the basic structures (turntable frame, bottom frame, crawler frames) is as shovel 'one- 20 years and more



- Mechanical drives have a lifetime enabling
- operation till reaching 65-70,000 hours overhaul.

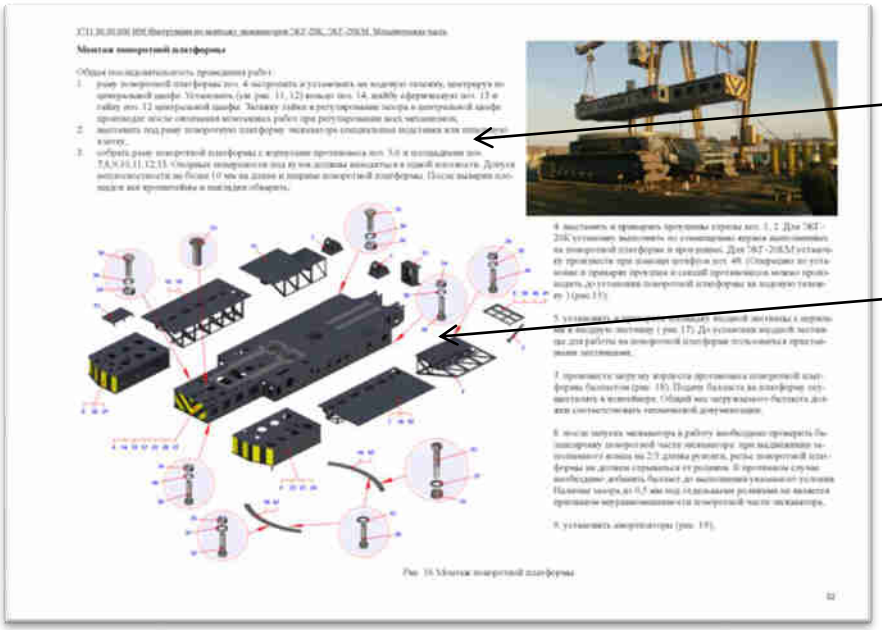
Operational documentation





1. Illustrated operation manual
2. Parts and assembly parts catalogue
3. Assembly, start-up, adjustment and running-in instructions
4. Maintenance manual
5. Manual for safe working practices when carrying out maintenance and repair work

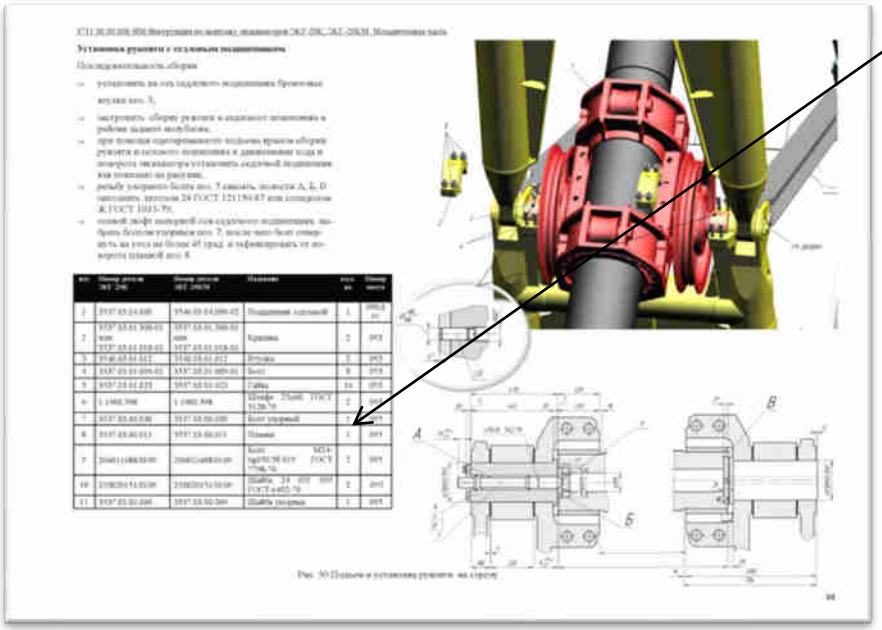
Assembly instructions (example)



Sequence of installation

Illustration

Explicative chart



Delivery and assembly times

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Manufacturing of EKG-18P/20K and EKG-20PM/20KM – 9-10 months

Delivery of the shovel by railroad and road

Turnkey assembly including commissioning and acceptance tests - 50-70 days

Cost of ownership

№ п/п	Parameters	Units of measure	EKG-20K	EKG-20KM
1	Bucket Payload	t.	40	50
2	Nominal service life	years	20	20
3	Quantity of complete overhaul	p.	1	1
4	Estimated cost of complete overhaul	KUSD	1250	1250
5	Annual energy costs	KUSD/year	84-93	70-81
6	Maintenance costs (average)	KUSD/year	64	64
7	Estimated annual cost of consumables (teeth)	KUSD/year	22	22
8	Estimated annual cost of consumables (ropes)	KUSD/year	16	16
9	Estimated annual cost of consumables (lubricant)	KUSD/year	6	6
10	Total annual costs	KUSD/year	190-200	180-190
11	Estimated operating capacity (overburden with a density of 1.8 t/m3)	million cbm/year	5,0-5,5	5,5-6,0
12	Average cost of mining rock mass shipped (excluding acquisition and overhaul costs)	Cent USD /cbm	3,6	3