

becker

WARKOP

SYSTEMY DLA GÓRNICTWA

minetrans





Becker-Warkop company, with headquarters in Świerklany, Poland, was founded in **1991** and specializes in the production of transport systems, based on floor mounted and suspended railways for transporting materials/personnel to headings and faces.

The company implements the most recent technological solutions and develops transport systems applied in mines.

In **1991** was the first year of production of KS-650/900/63/100 railway with 650 or 900 mm rail spacing and cable pulling force of 63 or 100 kN. The company introduced 95 such railways, from which 74 are still in operation. Cable railways have limited application due to the cable length and are gradually replaced by floor mounted rack-and-pinion railways, driven by electric or diesel motors.

In **1998**, a floor mounted rack-and-pinion railway type KSZ 650/900/30/60 was introduced to the transport products portfolio. 39 systems were commissioned, 32 of which are still operational. Based on up-to-date achievements, in **2003** a floor mounted rack-and-pinion railway with diesel engine type KSZS 650/900 was introduced. Today, 46 of such railways are in exploitation.

In year **2005**, a floor mounted rack-and-pinion railway was improved by the application of aggregates with power of 68 and 81 kW.

The consecutive stage of development was year **2006**, when as a result of applying modern diesel-hydraulic aggregates, pulling force of 240 kN was achieved for floor mounted railways type KSZS.

In year **2007**, diesel-hydraulic aggregate was elaborated and implemented, with power of 125 kW, for the use in diesel floor mounted rack-and-pinion railways.

Additionally, a suspended diesel rack-and-pinion monorail type KPZS-80 was introduced to exploitation, with 80 kW aggregate. The introduction of a suspended railway type KPZS-80 eliminated the slippage of driving wheels during transportation in headings characterized by large dampness of air and dustiness.

In **2009**, we have started the production of own Diesel-hydraulic unit for floor and suspended transporting systems of power 148 kW.

In **2010** a diesel suspended monorail with frictional-toothed drive type KPCZ-148 was introduced to the transport product portfolio. This monorail can be used on both kind of track i.e. suspended frictional or toothed track.

In **2011**, we have started the production of another own Diesel-hydraulic unit, this time of power 96 kW. Based on this engine, the suspended railway locomotive is created, type KP-96, with optionally used frictional, toothed or frictional and toothed drives. At the same time, we have designer and started the production of the suspended electro-hydraulic manoeuvring locomotive, type CMEH-22, that completes the suspended system offer.

In **2012**, we have introduced the 96 kW unit to the Diesel floor rack – and – pinion railway. At the same time, electro-hydraulic locomotive CEH-22 is being created based on the manoeuvring locomotive CMEH-22. This locomotive is the perfect alternative for the locations of special requirements, especially those, concerning noise and air parameters in the working. This locomotive is successfully operated in the historical hard coal mine Guido in Zabrze.

Thanks to the application of railways produced by Becker-Warkop it is possible to build extensive transport systems, beginning at the outset and ending at the heading or longwall. It must be also stressed that the utilization of transport systems manufactured by Becker-Warkop improves safety and efficiency of work. Together with the transport of materials it is possible to transport personnel.

Becker-Warkop company has a broad portfolio of products associated with transporting by means of floor mounted and suspended railways. The use of such products makes it possible to completely mechanize the most dangerous operations, associated with handling sections and heavy elements of longwall equipment. In order to guarantee the efficient operation of transporting, we offer projects of transport systems, as well as technical consulting.

We ensure round-the-clock service of offered railways in every weekday.

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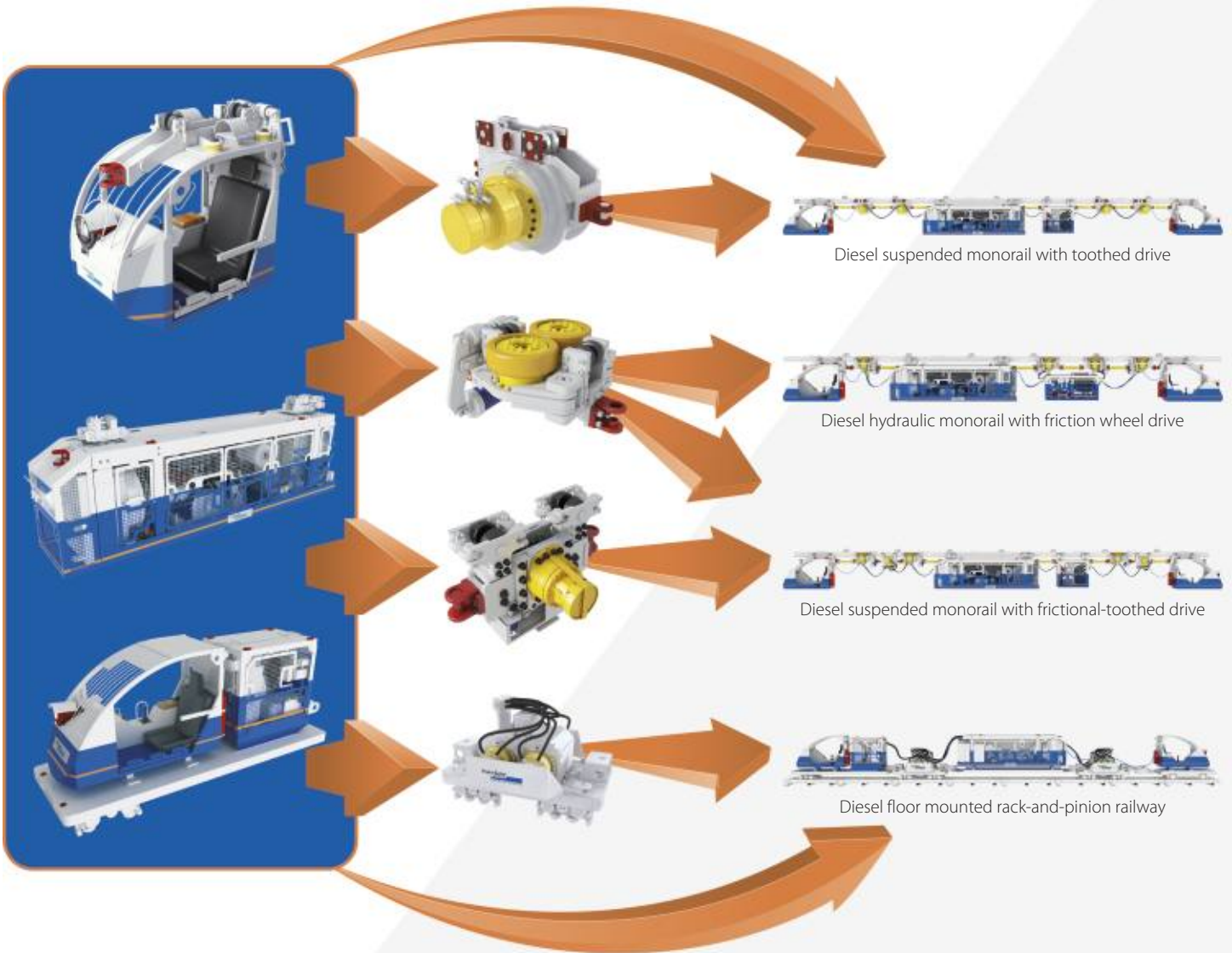
One power pack
Four solutions!

Commonly applied module-based construction concept concerning suspended, friction haulages enable any and practically unlimited configuration of the transporting assembly. The idea employed while creating the **MINETRANS** transporting system consisted in developing the module-based system used in one type of suspended transporting array to all transportation systems, i.e.:

- Diesel driven, floor mounted rack-and-pinion railway
- Diesel driven, suspended monorail with toothed drive railway
- Diesel driven, suspended monorail with friction drive railway
- Diesel driven, suspended monorail with friction and toothed drive railway

applied in underground workings which are manufactured and offered by our company. This way, we have created a system, in which the main elements of locomotives, i.e.:

- Power pack,
 - Auxiliary part (applied in some versions),
 - Operator cabs,
- are identical. The only elements that change depending on the transporting system type are driving elements (carriages).



Duo

Description

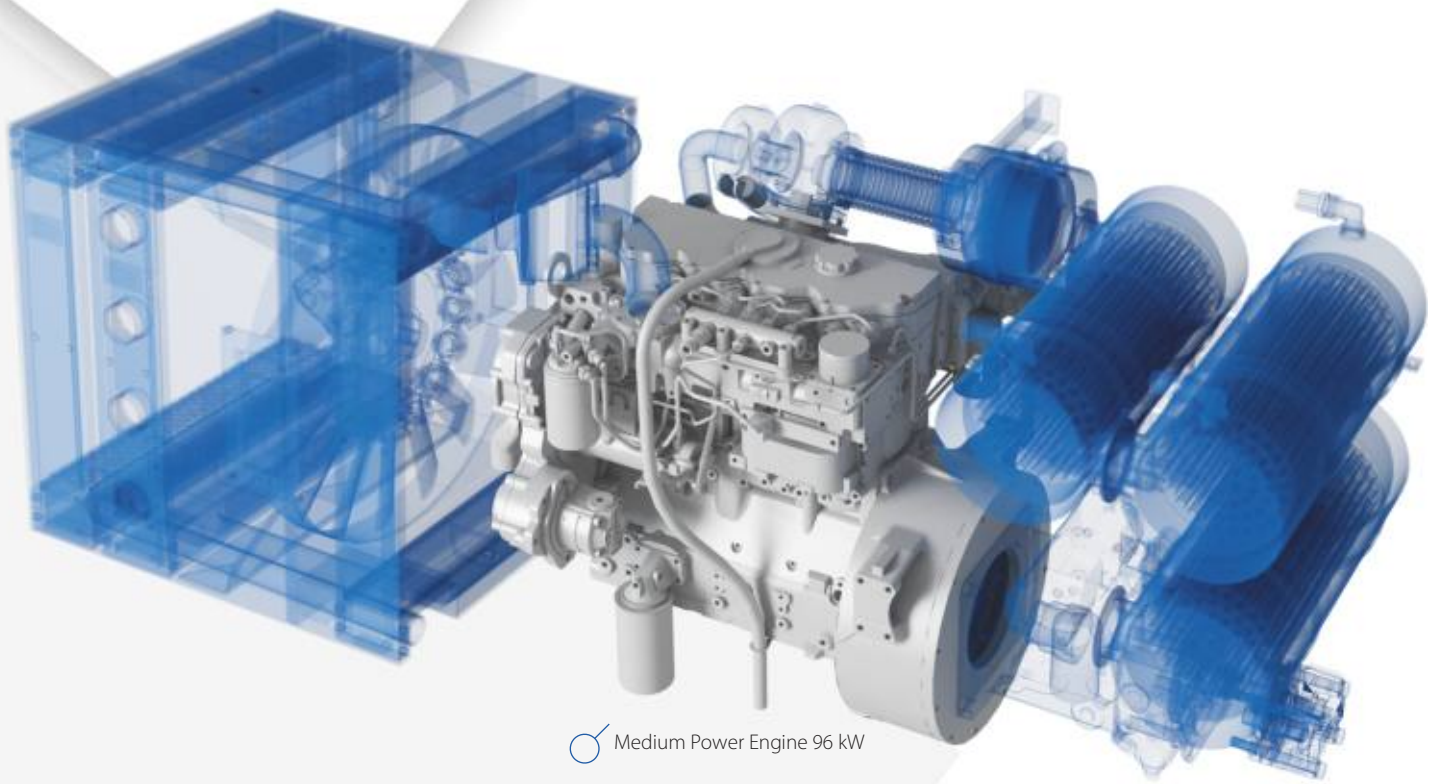
All locomotives of the suspended and floor mounted railways manufactured by BECKER-WARKOP are adapted to operate in DUO arrangement.

Such operation consists of the connected control systems of two machines (of the same type) and enables driving two locomotives from the level of one cab.

Necessary element to create and operate two machines in DUO arrangement is the coupling module.

This device is equipped with control and signalling elements and performs the following basic functions:

- information exchange between the controllers (control units) of both machines,
- mutual “coupling” of safety circuits of both machines,
- start-up and shut down of each machine,
- emergency shutdown of both machines.



Medium Power Engine 96 kW

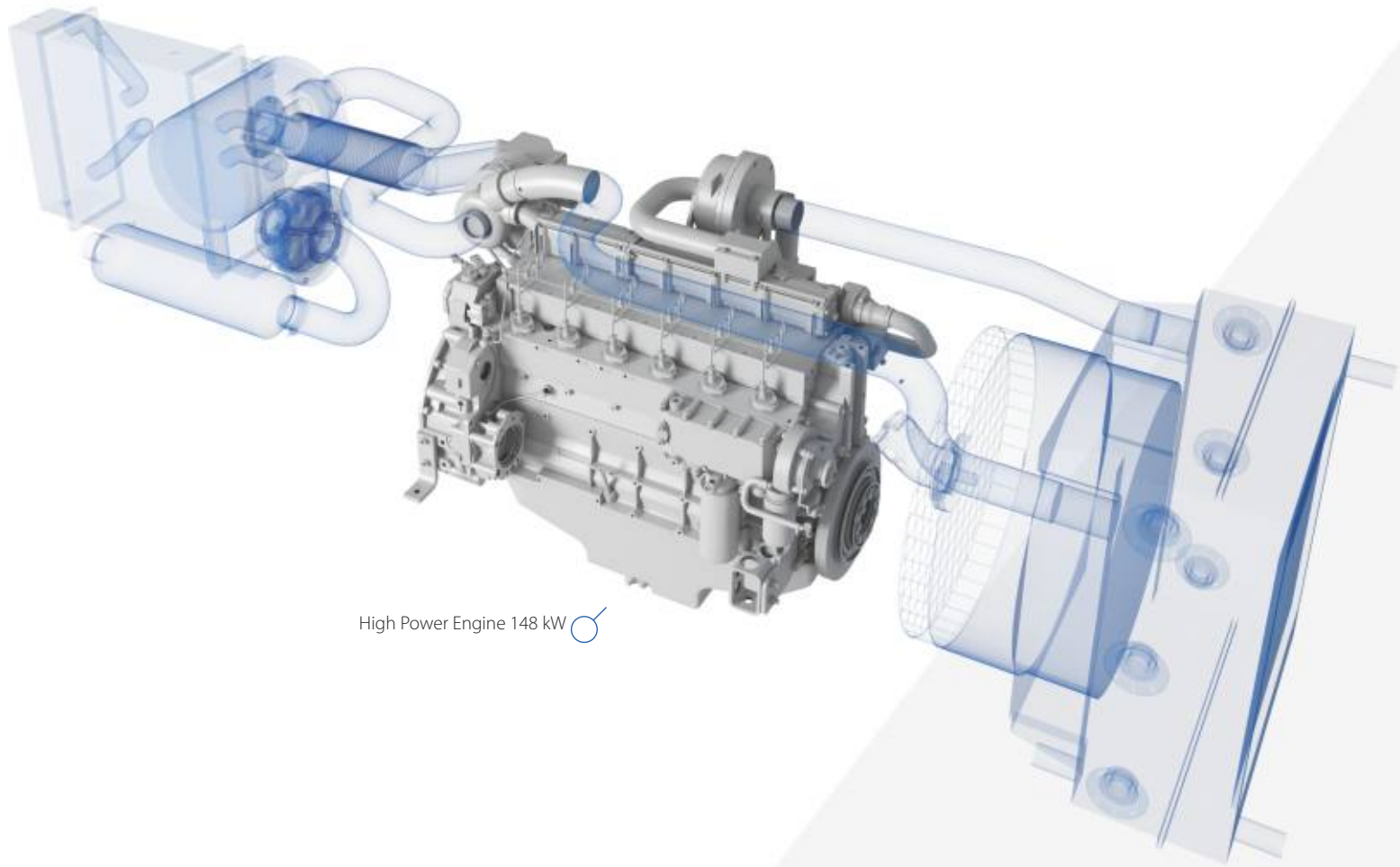
Medium Power Engine 96 kW


Features:

- power 96 kW / 131 KM / @ 2200 rpm
- 4-cylinder in-line engine
- fluid-cooled, forced circulation
- turbo-charged
- equipped with intercooler
- meets the standards EU TIER 3 / EPA Stage IIIA

Advantages:

- adapted to operation in explosion hazard zones group I, category M2 according to ATEX Directive
- closed / dry / exhaust gases cooling system
- low consumption of fuel and oil
- common rail fuel system
- electronic system controlling the engine operation – full engine diagnostics
- maintenance-free exhaust gases cooling system
- catalytic converter in the exhaust gases system
- hydraulic or electric start-up
- fluid-cooled turbocharger
- exhaust gases manifold – fluid-cooled
- maintenance intervals reaching 500 hours
- compact design



High Power Engine 148 kW 

High Power Engine 148 kW

Features:

- power 148 kW / 201 KM / @ 2300 rpm
- 6-cylinder in-line engine
- fluid-cooled, forced circulation
- turbo-charged
- equipped with intercooler
- meets the standards EU TIER 2 / EPA Stage II

Advantages:

- adapted to operation in explosion hazard zones Group I, category M2 according to ATEX Directive
- engine of the highest power used in suspended and floor locomotives
- closed / dry / exhaust gases cooling system
- low consumption of fuel and oil
- modern, high-pressure injection system
- two separated cooling systems – Diesel engine system and exhaust gases system
- readily available maintenance and service points – located on one side of the engine
- low level of noise
- hydraulic start-up
- fluid-cooled turbocharger
- exhaust gases manifold – fluid-cooled

> Diesel suspended monorail with toothed drive

NEW!

Description:

Diesel suspended monorail with toothed drive KPZS-148 is used to transport personnel, materials and devices, such as powered roof support sections, elements of heading machines, heavy elements of face conveyors, during reinforcing or decommissioning of longwall headings, as well as other transportation tasks.

Railway can be used as an independent transport equipment, or as an extension for transport realized by other means.

Locomotives are adjusted for work in DUO system, with steering two locomotives from one cabin.

Advantages:

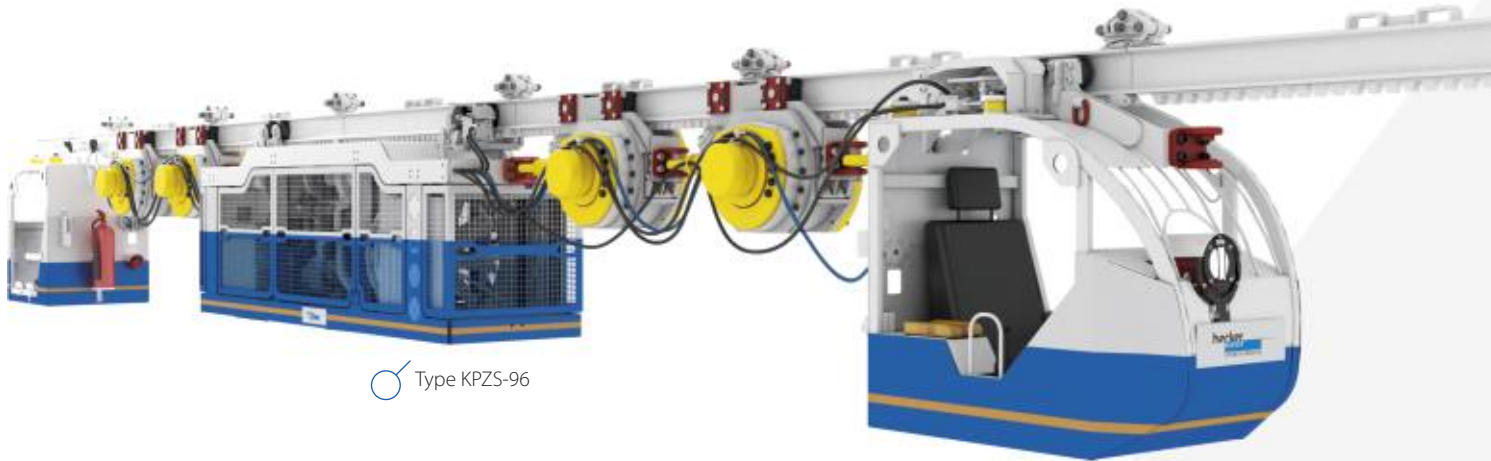
- **Application of dry exhaust cooling system**
operation without water filing
- **Compatibility**
possibility for using the same power pack (diesel hydraulic aggregate) intended for floor mounted railways manufactured by our Company
- **Safety**
the sliding possibility of the drive wheel has been eliminated
- **Universality**
unlimited transport configurations
- **Use dependability**
the toothed drives are automatically switch on and switch off on the track sections equipped with toothed bar

- **Comfort**
the ride from normal track (frictional) on to toothed track is realized during normal speed
- **Economic profitability**
lower costs of underground application due to the lack of frictional wheels wearing
- **Comfort**
Dry exhaust gases cooling system
- **Modernity**
Diesel hydraulic aggregate equipped with common rail system
- **Safety**
Constant measurement of methane concentration
- **Monitoring system**
Safe operation during manoeuvring ride (backwards) and with big elements
- **Lower exhaust fumes toxicity**
Applied engine meets the requirements of exhaust fumes toxicity standard and to be included for STAGE IIIA - 96kW engine and STAGE II - 148kW engine, additionally there are also applied catalytic converter (self-acting) and rarefying exhaust fumes system.
- **Convenience**
Fuel consumption control and fuel level control.
- **Data transmission**
Possibility for all monitored machine parameters to be transmitted (on-line) to mine net
- **Functionality**
Electric or hydraulic start
- **Usefulness**
Engine pre-heating system

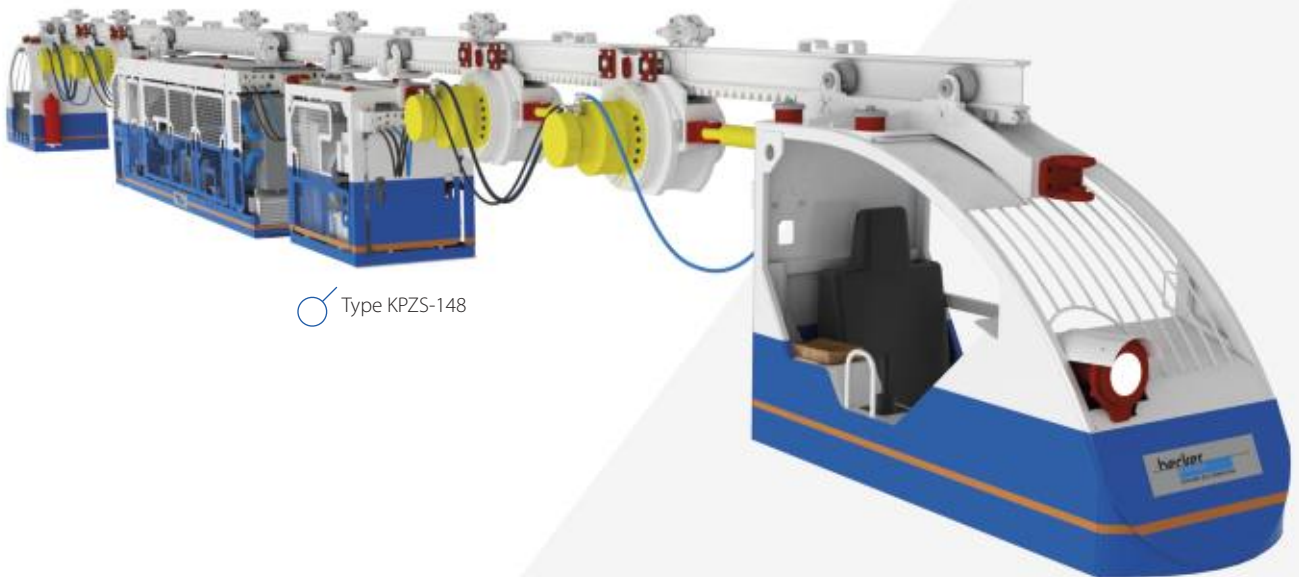
Technical data of the suspended monorail equipped with a diesel hydraulic aggregate

Diesel suspended monorail with toothed wheel drive		
Type	KPZS-96	KPZS-148
Locomotive		
Engine power	96 kW	148 kW
Drive pulling force	128 kN (for 4 drives)	128 kN (for 4 drives)
Maximum speed	2,5 m/s (Adjusted for valid regulations. The speed can be increased - as an option)	2,5 m/s (Adjusted for valid regulations. The speed can be increased - as an option)
Route		
Rail profile	I 155 equipped with toothed bar or others compatible	I 155 equipped with toothed bar or others compatible
Minimum radius of horizontal curvature	4 m	4 m
Minimum radius of vertical curvature	8 m	8 m
Maximum route inclination	±30°	±30°
Dimension		
Locomotive length	14000 mm (for 4 drives)	17980 mm (for 4 drives)
Width	800 mm	800 mm
Height	1200 mm	1275 mm

➤ Diesel suspended monorail with toothed drive



Type KPZS-96



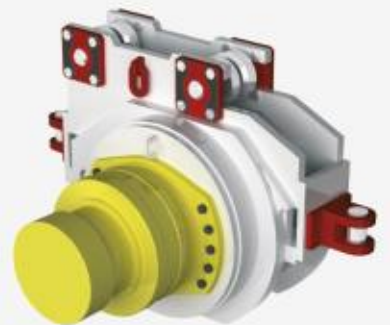
Type KPZS-148



Operator cabin



Auxiliary unit



HZA drive

› Diesel suspended monorail with friction wheel drive

Description:

Suspended frictional railway is intended to transport personnel and materials, such as powered roof support sections, elements of heading machine, heavy parts of face conveyors, as well as materials for reinforcing and decommissioning of longwall headings.

Such railway is also used for other transport tasks.

Locomotives are adjusted for work in DUO system, with possibility for steering two locomotives from one cabin.

Advantages:

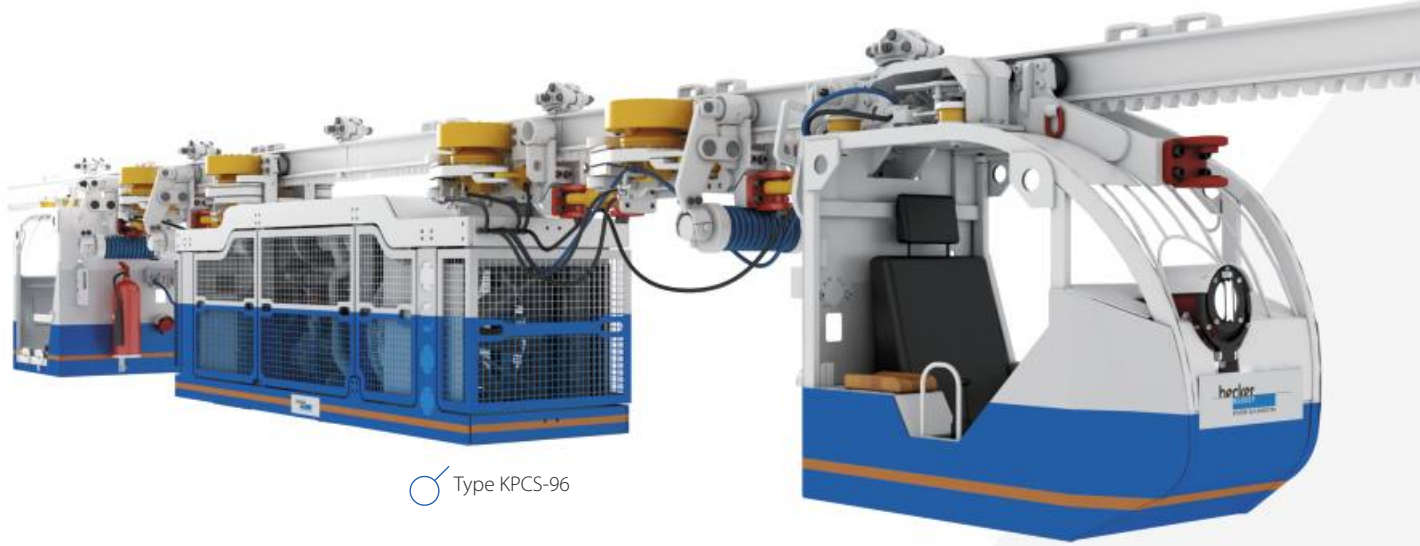
- **Comfort**
Dry exhaust gases cooling system
- **Modernity**
Diesel hydraulic aggregate equipped with common rail system
- **Safety**
Constant measurement of methane concentration
- **Monitoring system**
Safe operation during manoeuvring ride (backwards) and with big elements
- **Lower exhaust fumes toxicity**
Applied engine meets the requirements of exhaust fumes toxicity standard and to be included for STAGE IIIA - 96kW engine and STAGE II - 148kW engine, additionally there are also applied catalytic converter (self-acting) and rarefying exhaust fumes system.

- **Convenience**
Fuel consumption control and fuel level control.
- **Data transmission**
Possibility for all monitored machine parameters to be transmitted (on-line) to mine net
- **Functionality**
Electric or hydraulic start
- **Usefulness**
Engine pre-heating system
- **Application of dry exhaust cooling system**
operation without water filling
- **Compatibility**
possibility for using the same power pack (diesel hydraulic aggregate) intended for floor mounted railways manufactured by our Company
- **Universality**
unlimited transport configurations

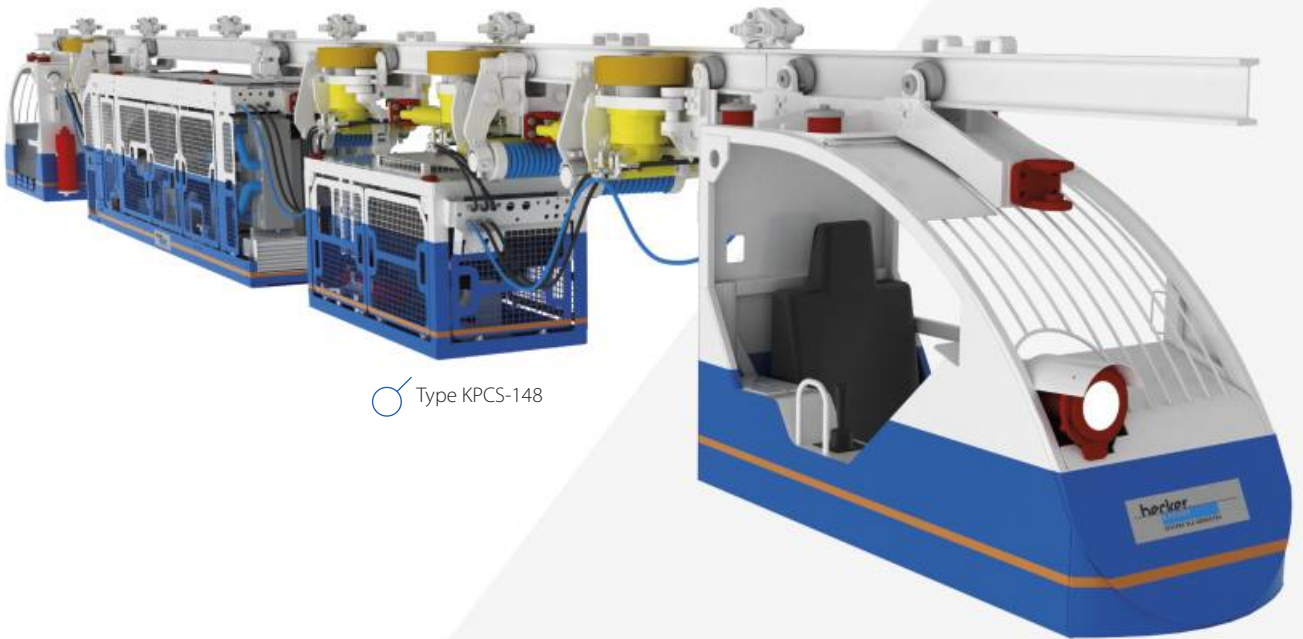
Technical data of the suspended monorail equipped with a diesel hydraulic aggregate

Diesel suspended monorail with friction wheel drive		
Type	KPCS-96	KPCS-148
Locomotive		
Engine power	96 kW	148 kW
Drive pulling force	80 kN (for 4 drives); 120 (for 6 drives); 240 (for 12 drives);	80 kN (for 4 drives); 120 (for 6 drives); 240 (for 12 drives);
Maximum speed	2,5 m/s (Adjusted for valid regulations. The speed can be increased - as an option)	2,5 m/s (Adjusted for valid regulations. The speed can be increased - as an option)
Route		
Rail profile	I 155 or I 140 E, I 140 V 95, I 250 or others compatible	I 155 or I 140 E, I 140 V 95, I 250 or others compatible
Minimum radius of horizontal curvature	4 m	4 m
Minimum radius of vertical curvature	8 m	8 m
Maximum route inclination	±30°	±30°
Dimension		
Locomotive length	11130 mm (for 4 drives)	16440 mm (for 4 drives)
Width	800 mm	800 mm
Height	1200 mm	1275 mm

➤ Diesel suspended monorail with friction wheel drive



Type KPCS-96



Type KPCS-148



Operator cabin



Diesel-hydraulic aggregate



Frictional drive

> Diesel suspended monorail with frictional-toothed drive

Description:

The suspended monorail with frictional-toothed drive is used for personnel and material transport for example: powered roof supports, shearers' elements, heavy units of the face conveyor and other devices, materials and parts during installation or liquidation of longwall face.

The monorail can be used for other transport works. Locomotive is adjusted for work in DUO system with possibility for steering of two locomotive from one cabin.

The number of toothed and frictional drives depend on purpose, geological-mining conditions (Inclination, humidity, dust) and track parameters.

Advantages:

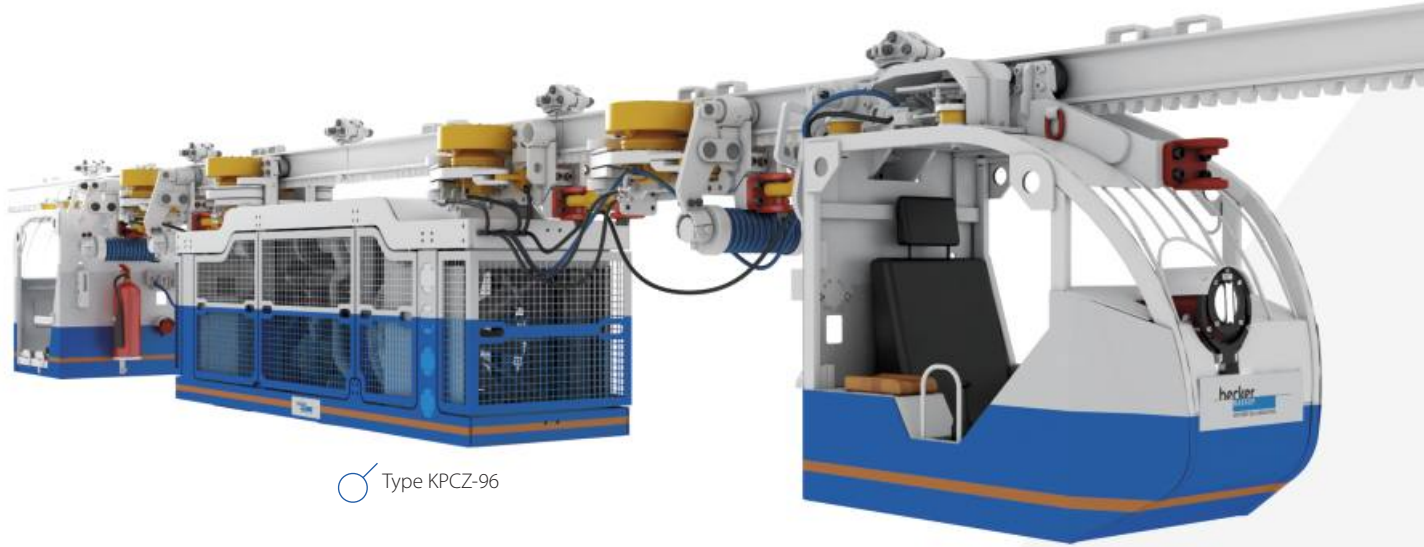
- **Comfort**
Dry exhaust gases cooling system
- **Modernity**
Diesel hydraulic aggregate equipped with common rail system

- **Safety**
Constant measurement of methane concentration
- **Monitoring system**
Safe operation during manoeuvring ride (backwards) and with big elements
- **Lower exhaust fumes toxicity**
Applied engine meets the requirements of exhaust fumes toxicity standard and to be include for STAGE IIIA - 96kW engine and STAGE II - 148kW engine, additionally there are also applied catalytic converter (self-acting) and rarefying exhaust fumes system.
- **Convenience**
Fuel consumption control and fuel level control.
- **Data transmission**
Possibility for all monitored machine parameters to be transmitted (on-line) to mine net
- **Functionality**
Electric or hydraulic start
- **Usefulness**
Engine pre-heating system

Technical data for configuration with 2 toothed drives and 3 frictional drives

Diesel suspended monorail with toothed wheel drive		
Type	KPCZ-96	KPCZ-148
Locomotive		
Engine power	96 kW	148 kW
Toothed drive pulling force per drive	32 kN	32 kN
Frictional drive pulling force per drive	20 kN	20 kN
Pulling force for configuration with 2 toothed drives and 3 frictional drives	124 kN	124 kN
Maximum speed	2,5 m/s (Adjusted for valid regulations. The speed can be increased - as an option).	2,5 m/s (Adjusted for valid regulations. The speed can be increased - as an option).
Route		
Rail profile	I 155 or I 140 E, I 140 V 95, I 250 or others compatible (for toothed drives equipped with a toothed bar)	I 155 or I 140 E, I 140 V 95, I 250 or others compatible (for toothed drives equipped with a toothed bar)
Minimum radius of horizontal curvature	4 m	4 m
Minimum radius of vertical curvature	8 m	8 m
Maximum route inclination	±30°	±30°
Dimension		
Locomotive length	12460 mm	17750 mm
Width	800 mm	800 mm
Height	1200 mm	1275 mm

> Diesel suspended monorail with frictional-toothed drive



Type KPCZ-96



Type KPCZ-148



Operator cabin



Auxiliary unit



Toothed drive

> Universal drive track type BWTU for suspended railways

Description:

Track is used for suspended railway with:

- rack and pinion drive
- frictional drive
- rope drive - after building pulleys set

Transport set used for material and personnel transport (or both at the same time) can moves on this track.

Application conditions


Drive track can be applied under the following conditions:

- load in the direction of track connection suspension does not exceed 200kN
- lengthwise load of track joints does not exceed 480kN
- particular elements of a driving track can be exploited together with other approved elements, rail subassemblies of suspended railways, manufactured by other companies, only in case of their full compatibility with the original track, with regard to conditions defined in decisions approving the use in mining facilities
- when rail joint is placed between arches of lining, while sling chain inclination exceeds boundary limits, it is required to use suspension with the use of crossbars

Technical data

Type	BWTU-50/100	BWTU-50/120	BW-50/100
Rail with toothed rack cross-section	I 155; (I 140 E wg DIN)	I 155; (I 140 E wg DIN)	I 155; (I 140 E wg DIN)
Length of straight rails (standard)	1980 mm	1980 mm	2000 mm
Toothed rack pitch	60 mm	60 mm	-
Horizontal curvature profile of running line	min 4 m	min 4 m	min 4 m
Vertical curvature profile of running line	min 10 m	min 10 m	min 8 m
Angle of deviation from rectilinearity of suspension rails on joints in a vertical plane	max $\pm 3^\circ$	max $\pm 3^\circ$	max $\pm 6^\circ$
Angle of deviation from rectilinearity of sleeve rails on joints in a vertical plane	0°	0°	0°
Angle of deviation from rectilinearity of suspension rails on joints in a horizontal plane	max $\pm 0,5^\circ$	max $\pm 0,5^\circ$	max $\pm 2^\circ$
Angle of deviation from rectilinearity of sleeve rails on joints in a horizontal plane	0°	0°	0°
Permissible running line inclination	max 45°	max 45°	max 45°
Load of rail joint in direction of suspension	200 kN	200 kN	200 kN
Load of rail joint along tracks	400 kN	480 kN	400 kN

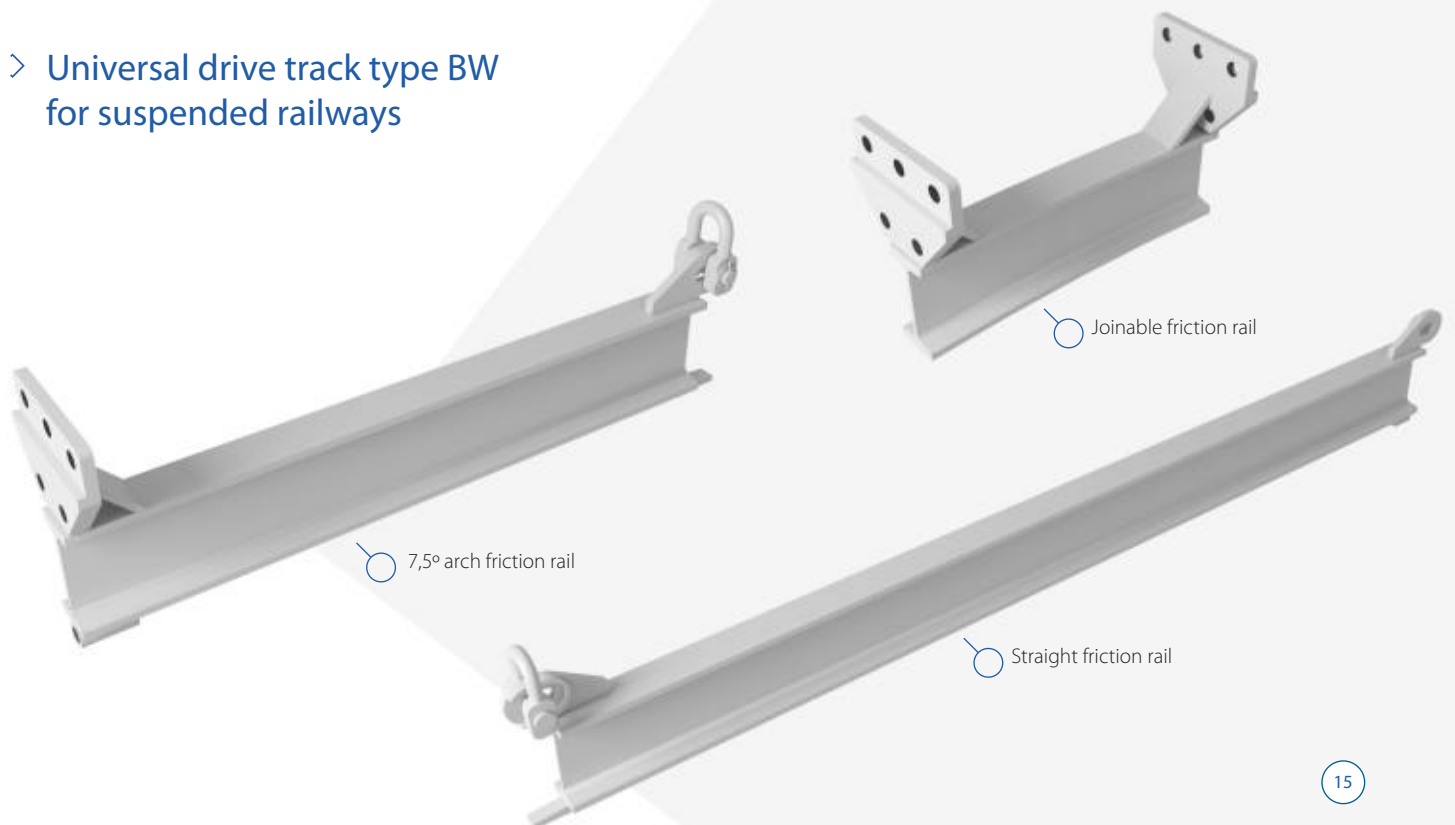


 universal drive track type BWTU for suspended railways

› Universal drive track type BWTU for suspended railways



› Universal drive track type BW for suspended railways



Description

Electric hydraulic suspended power units type CEH-22 and CMEH-22 are designed for monorail suspended railways used for transporting elements of machines, materials and personnel in underground mines.

Power units travel along tracks in the form of I155 (I140E), I140V95 and I250 profiles or other compatible, permitted type (e.g. Travel track type BWTU-50/100).

Each power unit is powered by a 22 kW electric motor, and the power is transferred with the use of a pump-motor hydraulic system. The power unit comprises an electric hydraulic power pack and frictional or toothed drives.

The number and type of drives are selected individually for each user. It is also possible to apply both a frictional and toothed drive simultaneously.

Individual elements and drives are interconnected by means of pull-rods.

A power cable is attached to cable trolleys connected with the power unit by means of a special pull-rod and secured with a line connecting cable trolleys or is dragged on the floor.

Technical data

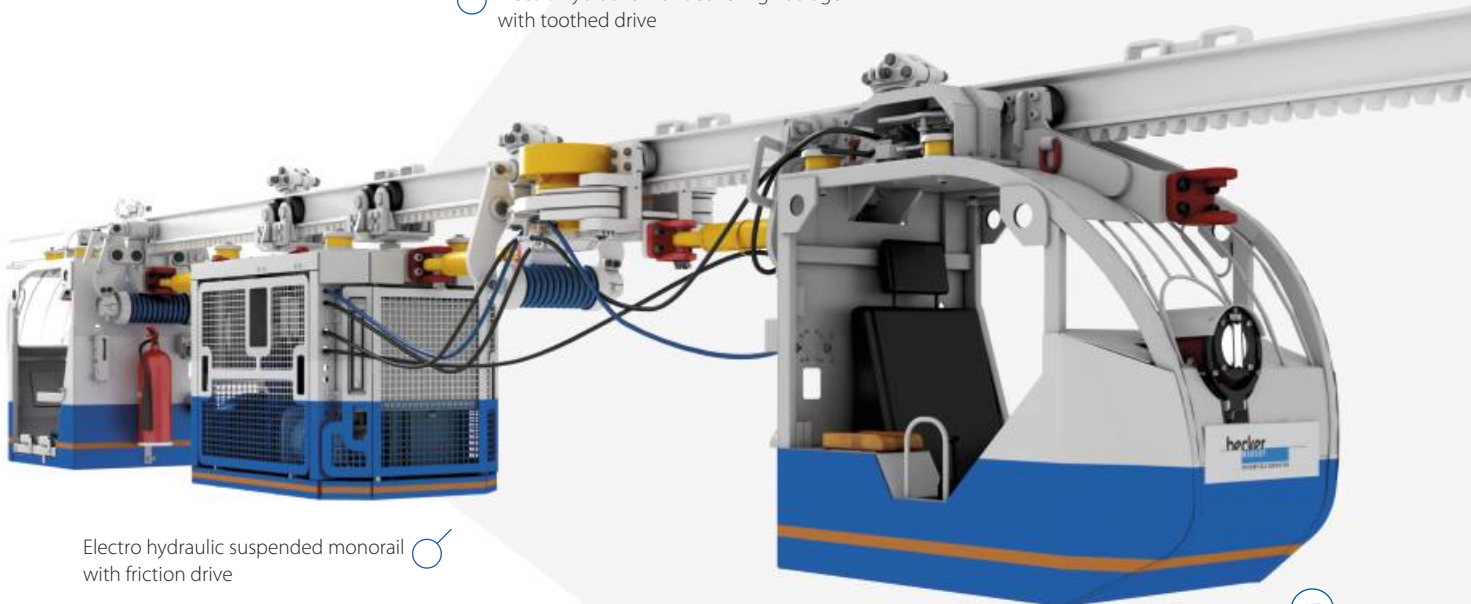
Type	CMEH-22	CEH-22
Max pulling force (toothed drive)	64 kN (for 2 drives)	64 kN (for 2 drives)
Max pulling force (frictional drive)	40 kN (for 2 drives)	40 kN (for 2 drives)
Maximum power installed	22 kW	22 kW
Maximum travel speed	0,9 m/s	1,8 m/s
Static braking force (toothed drive)	96 kN (for 2 drives)	96 kN (for 2 drives)
Static braking force (frictional drive)	60 kN (for 2 drives)	60 kN (for 2 drives)
Frictional wheel diameter	340 / 395 mm	340 / 395 mm
Maximum track inclination	±30°	±30°
Minimal turning radius in horizontal plane	4 m	4 m
Minimal turning radius in vertical plane	8 m	8 m
Dimensions		
Power unit length	3160 mm	7555 mm
Width	800 mm	800 mm
Height (from rail bottom edge)	1100 mm	1200 mm
Total weight [kg]	1900 kg (toothed drive)	3180 kg (toothed drive)
	1875 kg (frictional drive)	3155 kg (frictional drive)



Electro hydraulic manoeuvring haulage with friction drive



Electro hydraulic manoeuvring haulage with toothed drive



Electro hydraulic suspended monorail with friction drive

› Diesel hydraulic floor mounted rack-and-pinion railway type KSZS-96 and KSZS-148

Description:

Diesel floor mounted rack-and-pinion railway is intended for transporting personnel, powered roof support sections, heading machine elements, heavy elements of face conveyors and other devices during reinforcing and decommissioning of longwall headings or other transportation works.

Construction:

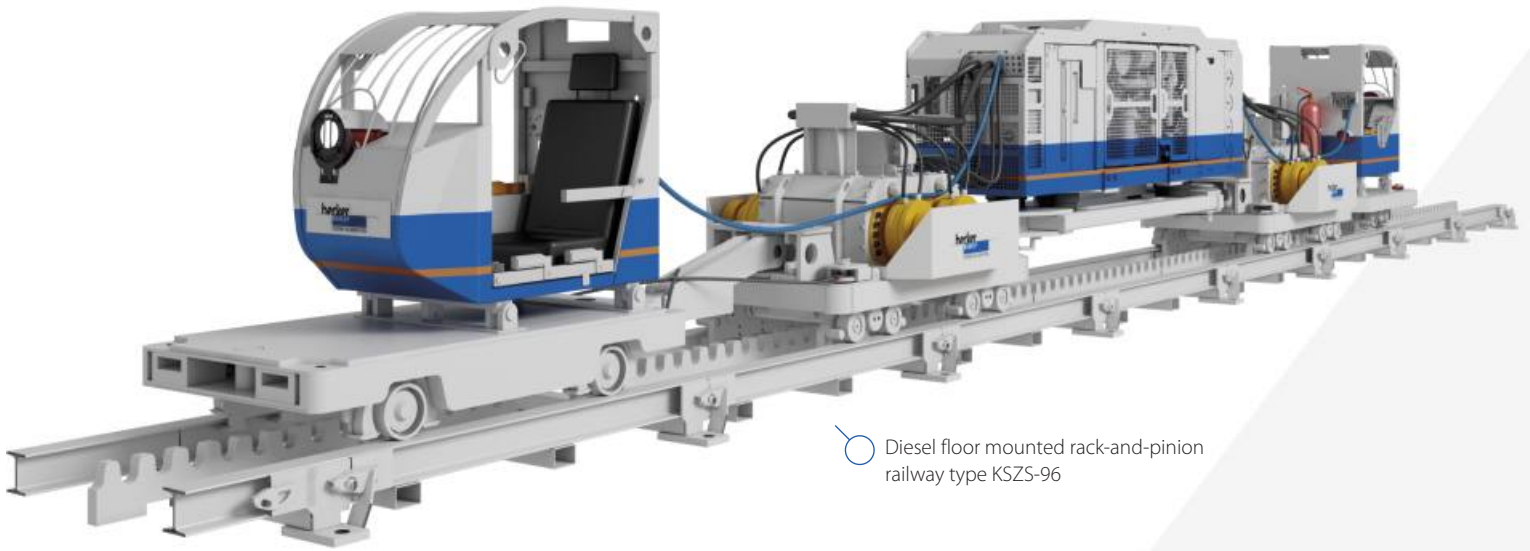
During the design process, operational experience from up-to-date exploited cable and rack-and-pinion railways with electrical drive was used.

Main components of the railway are:

- diesel locomotive
- track
- transport set
- auxiliary equipment

Diesel floor mounted rack-and-pinion railway		
Type	KSZS-96	KSZS-148
Locomotive		
Engine power	96 kW	148 kW
Max pulling force	240 kN	240 kN
Maximum speed	2,5 m/s (Adjusted for valid regulations. The speed can be increased - as an option)	2,5 m/s (Adjusted for valid regulations. The speed can be increased - as an option)
Route		
Rail profile	drive track of 650 or 900 mm width	
Minimum radius of horizontal curvature	4 m	4 m
Minimum radius of vertical curvature	22 m	22 m
Maximum route inclination	±30°	±30°
Dimension		
Locomotive length	10050/12700 mm	15000/16645 mm
Width	1200/1460 mm	1200/1460 mm
Height	1630/1620 mm	1790/1635 mm

➤ Diesel hydraulic floor mounted rack-and-pinion railway type KSZS-96 and KSZS-148



○ Diesel floor mounted rack-and-pinion railway type KSZS-96



○ Diesel floor mounted rack-and-pinion railway type KSZS-148



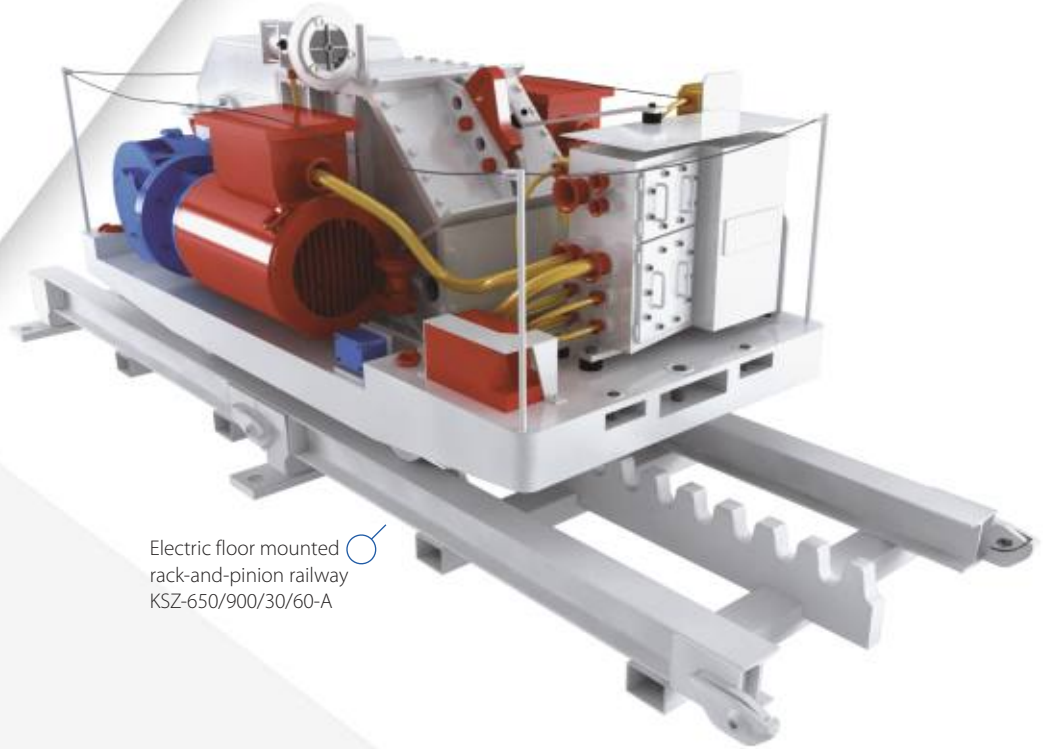
○ Auxiliary cabin with undercarriage



○ Diesel-hydraulic aggregate



○ Drive trolley



Electric floor mounted rack-and-pinion railway KSZ-650/900/30/60-A

Description:

Floor mounted rack-and-pinion railway type KSZ-650/900/30/60-A is assigned to transporting powered roof support sections, elements of heading machines, face conveyors during reinforcing/decommissioning of longwalls.

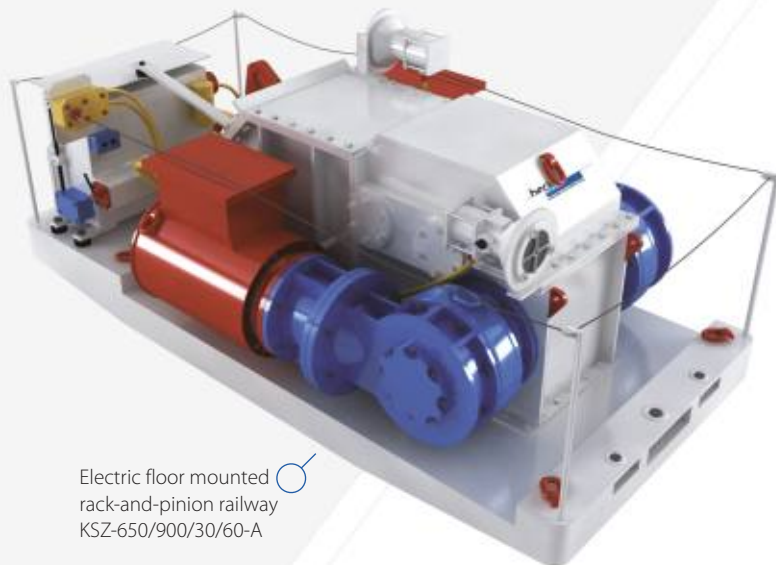
Transport by means of a railway includes longwall headings and galleries. The railway is used as an independent transport device in a reinforced (decommissioned) faces, or has the role of extending the transport system with different means of transport.

Floor mounted railway consists of:

- Driving track
- Locomotive
- Transport set
- Additional equipment

Basic components of a floor mounted rack-and-pinion railway are:

- Driving track of 650 or 900 mm width
- Locomotive – used for moving the transport set on tracks. Drive transfers the rotational moment from the electric motor through coupling, intersecting axes planetary transmission to gear wheels, and finally to drive pinion wheels.
- Self-locking, three-phase inductive motor is equipped with a frictional brake, pressed against by means of springs and loosened by an electromagnet. Control of motors is achieved remotely by means of radio control system.
- On a locomotive, apart from electric motors, there are also reflectors, as well as sensors and switches mounted. Electrical power supply is realized by means of a rubber-coated cable, dragged on the floor.
- Transport set – consists of a platform with connecting pulling rod and two safety ropes. According to the needs of the user, it is possible to use platforms with load-carrying capacities: 100, 150, 220, 320, 350 [kN]



Electric floor mounted rack-and-pinion railway KSZ-650/900/30/60-A

TECHNICAL DATA	
Maximum power	60 kW
Maximum pulling force	180 kN
Supply voltage	500, 660, 1000, 1100, 1140 V
Length	2900 mm
Width	1630 mm
Height	1380 mm
Locomotive weight	8300 kg

Drive track, laid on the floor, ensures forced guidance of a Diesel locomotive together with the set and protects it from derailing or turning over. Drive track elements of all floor mounted rack-and-pinion railway type KSZ and KSZS are compatible with each other.

Drive track cross-sections:

- C180 – driving surface is the surface 180 of a channel section
- 2 x C180 – driving surface is composed of two channel section shelves 180 joined by the middle surface
- BW - I140 – driving surface is a shelf 140 of a I-profile

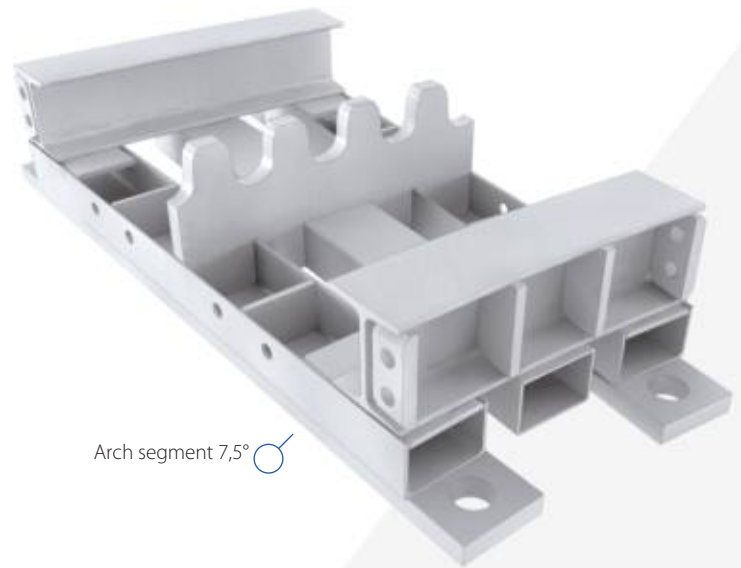
Track elements:

- straight segment
- arch segment
- joinable segment
- ending segment
- revision segment
- reinforced segment
- passing-by segment
- segment between arches
- check rail
- crossover
- shifter
- passing siding

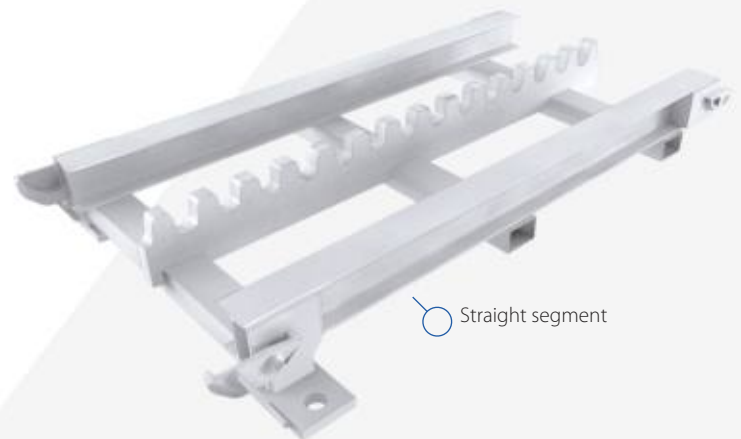
Mechanization of transport operations

For safe and efficient realization of transport operations it is possible to apply the following devices built-in to the driving track route:

- Retractable ramp with ending rail – allows loading and unloading material from platforms
- Loading-unloading wedge – used to load powered roof support sections from the floor to a platform and the other way around
- Loading/unloading device UZR-1 – used to load and unload shields or large and heavy elements of machines and equipment



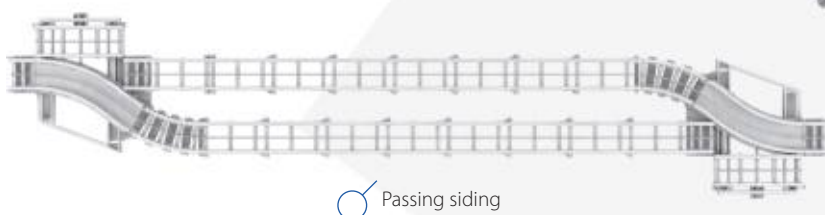
Arch segment 7,5°



Straight segment



Crossover



Passing siding

Design, functionality

Operator sitting in the cab can use the monitor installed in the central part to see the view captured by the camera. The picture is displayed on 7" LCD. The monitor is used to observe the objects and premises in the explosion hazard zone.

Set of devices (camera / projector) is installed in front of the transport set.

The camera is used to capture real time pictures using the vision signal "composite video" 1Vpp and send it to the monitor and the projector provides additional source of light in front of the pushed transport set.

The applied cables, method of connecting individual subassemblies, cable connectors enable fast disassembly of the whole system and its individual parts.

Advantages:

- increased field of vision of the operator in the underground mine workings during transport of materials and personnel,
- increased safety during the transport,
- option to turn on / off the monitoring system from the control panel,
- additional source of light in front of the pushed transport set thanks to the applied projector.

Elements included in the monitoring system:

- TV camera
- Local monitor
- Projector



Monitoring system camera, projector and local monitor mounted in operator's cabin

> Automatic methane-metering system

Advantages:

- safety elements during locomotive operation in explosion hazard atmosphere
- automatic detection, measurement of methane CH_4 concentration
- charging the methane-meter batteries during the locomotive operation
- adjustable two thresholds of operation, e.g. 1% and 1.5%
- shut down of the Diesel engine after exceeding the set threshold
- simple calibration
- optical and acoustic signalling system
- cooperation with the locomotive control system
- no option to start the Diesel engine in case of detecting that the admissible methane concentration threshold is exceeded.

Elements included in the methane-metering system:

- portable automatic methane-meter together with transducer
- connection box

Design, functionality

Methane-meter is equipped with modern metering transducer resistant to toxic substances in the exhaust gases.

The methane-meter is equipped with autonomous battery supply system that enable operation of the device without any additional supply from the locomotive system for 20 h. The methane-meter controls on current basis and displays on its LCD the content of methane in the mine atmosphere, and in case of detecting the set value, sends the signal to the Diesel locomotive control system and informs about the hazard.

Basically, the methane-meter is used in the locomotive system to warn the operator (first threshold) and shut down the Diesel engine (second threshold) in case of detecting increased concentration of methane in air.



Portable signaling methane-meter in auxiliary part

The transporting system can be optionally equipped with wireless voice communication and data transfer system that enable continuous communication between the dispatcher and operators. The offer covers two communication systems:

- digital/analogue radio communication VHF and UHF based on radiant cable (Leaky Feeder),
- digital wireless communication based on the technology WiFi 2.4 GHz and VoIP.

Digital communication system comparing to the analogue ones provide communication without interferences and noises. Using the offered communication systems it is possible to send data with Diesel locomotive parameters.

Data transfer

Advantages:

- data transfer performed by the application of different devices adapted to the structure of the User communication system,
- option to send haulage operation data on-line or based on the "docking station" principle to the dispatcher,
- option to visualize the generated codes of faults, emergencies, speeds, engine speed, pressures, temperatures, levels, flows, statuses of methane-meter contacts, dates, events time-stamps and serial number of the hoist,
- devices additionally introduced to the haulage installation do not change in any way the operation of the electrical system of the haulage and its control.

Elements included in the data transfer system:

- device transferring data between the haulage control system based on the CAN bus and the radio-modems equipped with RS 485 buses,
- radio-modems converting RS485 signal to VHF, UHF cooperating with the systems based on leaky cable,
- device converting and generating wireless signal Wi-Fi,
- set of data transmission devices and receiver – data transfer takes place at the moment when both devices are within the range of their operation.

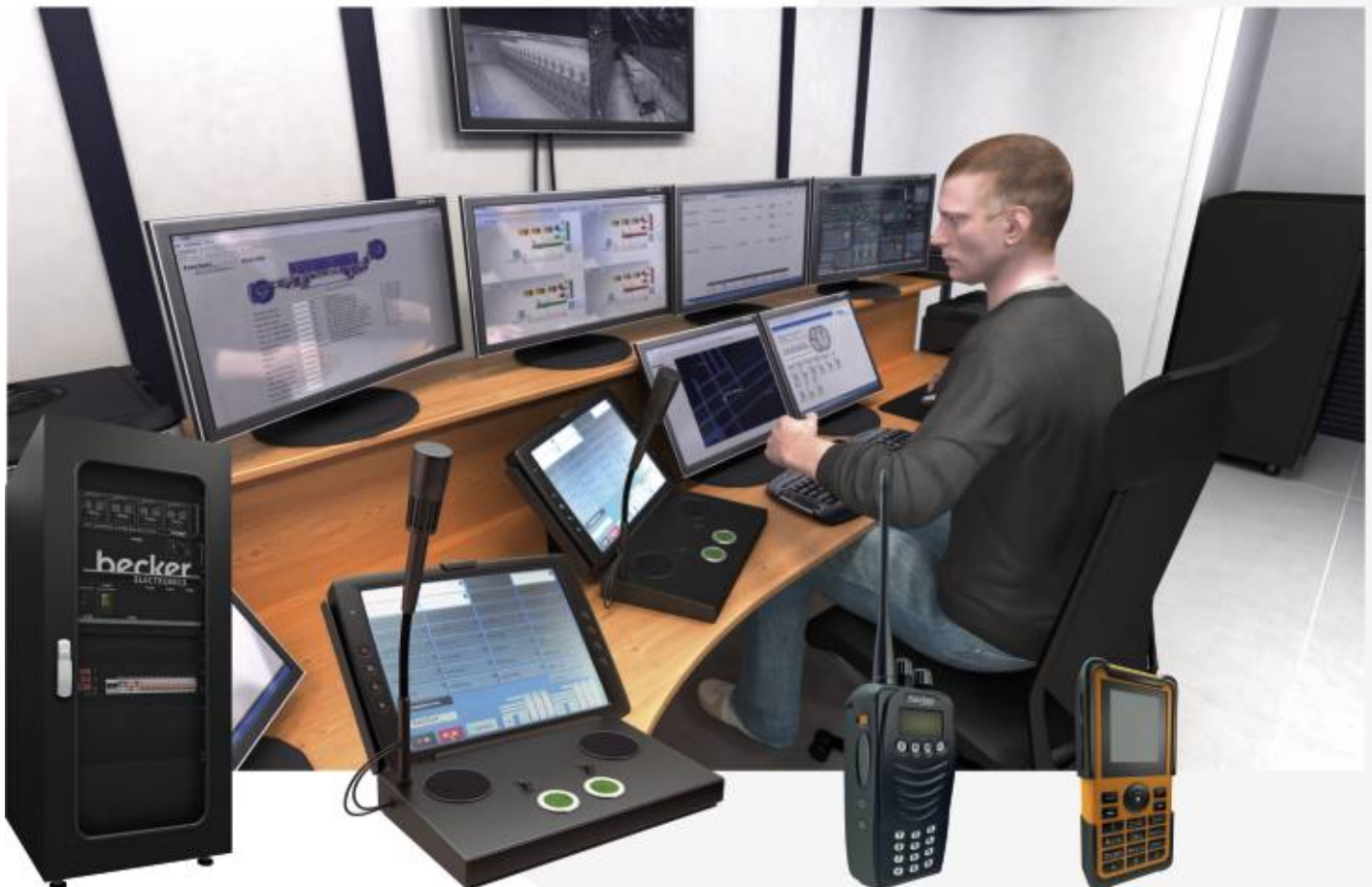
Design, functionality

Set of the data transfer devices is installed on a Diesel driven haulage and connected to the haulage control system using the data transmission device.

The data transmission devices are used only to "listen" the signals in the haulage communication buses and sending the selected data outside.

Data can be transferred using:

- radio-modem UHF,
- radio-modem VHF,
- modem Wi-Fi,
- radio using so called docking station.



Base station

Terminal BCOM IT

Radiotelephone
UFMR-100

WLAN Phone
type BCOM MP03.*

Maximum length	13,9 m
Length of track needed for set assembly	12,7 m
Height (min/max)	1,4 m/by request
Hoisting height	3,0 m/by request
Width (min/max)	0,65/1,8 m
Set weight	6550,0 kg
Maximum hoisting capacity	24,0 t
Maximum hoisting capacity of a single load	20,0 t
Maximum pulling force of a coupler	120,0 kN
Maximum track inclination	+/- 25°
Minimum track curvature radius in a plane:	
- horizontal	4,0 m
- vertical	10,0 m
Hoisting capacity of chain hoist	7,0 t
Type of medium	Hydraulic oil
Required filtration	80,0 µm
Working medium consumption	25-60,0 dm ³ /min
Supply pressure	13,0 MPa
Maximum amount of chain hoists	4,0 pcs.
Maximum hoisting speed	0,7 m/min
Maximum driving speed	2,0 m/s
Rail type	1155 (I140)

Modular Transport Set MZT240-A with hydraulic hoisting drive is intended to be built-in in transport sets of suspended railways, and to be used for hoisting and holding loads of up to 24.0 ton on a specific height. Modular transport set is adapted to drive along the tracks of suspended railways, it cooperates with pulling or pushing devices of maximum force 120 kN.

The set includes:

- Transport beam BW BT60-A,
- Bottom cross-bar BW TD115-A,
- Transverse beam BW BP110-A,
- Transverse beam BW BP55-B,
- Counterweight beam BW BW100-A,
- Chain hoist
- Connecting pull-rods,
- Hydraulic installation,
- Chain slings.



Modular Transport Set
BW MZT240-A - payload 20T



Module of transport Set
type BW MZT240-A - payload 11T

> Transport platforms

Transport platforms are used for transporting materials, equipment and personnel (in special passenger cabins). A carrying platform may be a part of a diesel or electric floor rack-and-pinion railway as well as floor cable railway. Thanks to turntables with equalizers, the platform's design allows for passing turns, undulations. The design of bearing wheel sets ensures proper distribution of pressure to drive tracks, as well as safe and reliable guiding of platforms along the entire route.

Type of platform	100 kN	150 kN	220 kN	320 kN	350 kN	400 kN
Bearing capacity	10 t	15 t	22 t	32 t	35 t	40 t
Weight [kg]	1500 kg	2000 kg	3000 kg	3698 kg	4500 kg	4550 kg
Overall dimensions						
/length x width x height – from a rail head	3150x1168x300 mm	3150x1150x300 mm	3800x1150x300 mm	3800x1550x mm	3800x1800x338,5	3800x1800x338,5 mm
Drive track width	650/900 mm	650/900 mm	650/900 mm	650/900 mm	900 mm	900 mm
Maximum longitudinal inclination	±35°					
Maximum transverse inclination	±10°					
Minimum horizontal turning radius of curvature	4 m					
Minimum vertical track radius of curvature	22 m					



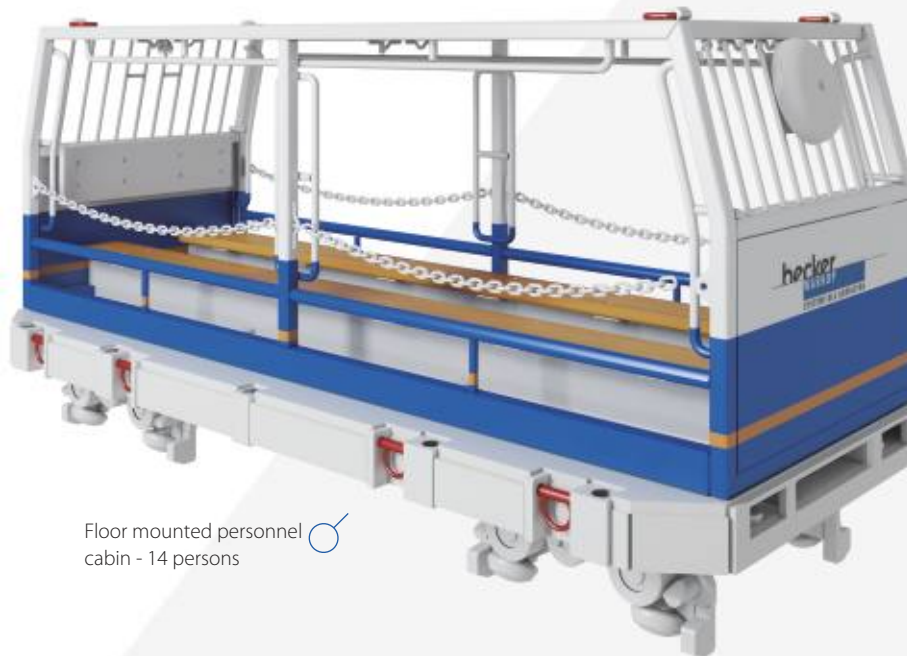
Transport platform type BW 150



Suspended personnel cabin - 8 persons

SUSPENDED PERSONNEL CABINS

The cabin is designated for transporting personnel in suspended trolleys in underground mine headings. Passengers are transported in a sitting position. The cabin is equipped in benches and back rests which are stable and comfortable for passengers. The floor is made of perforated sheet.



Floor mounted personnel cabin - 14 persons

PERSONNEL CABINS ON FLOOR PLATFORMS

A personnel cabin for transporting people in a floor railway is an element which, when mounted on a platform or a braking trolley, allows transporting up to 30 people (depending on the cabin type). The following cabin types are distinguished:

Purpose	No. of places
platform 100/150kN	14 people / 30 people
platform 220/320kN	30 people
personnel cabin (650)	6 people
personnel cabin (900)	12 people



○ BW WOP-A
OIL – FUEL CONTAINER



○ BW WK-A
MATERIAL CONTAINER

BW WOP-A OIL-FUEL CONTAINER

BW WOP-A oil-fuel container is intended for transportation of liquid materials, especially Diesel fuel for suspended monorails, floor mounted railways and Diesel locomotives for underground railways, as well as mineral and synthetic oil for mining machinery and equipment.

Modular solution allows for moving a part of the trolley, i.e. BW WOP-A oil-fuel pallet with tanks, service baskets, and additional equipment, on a wheel chassis suited for railway transport, or on chain slings and suspended railway hoists.

BW WK-A MATERIAL CONTAINER

BW WK-A material container trolley is produced in two versions, namely closed and open. It is intended for transportation of mining materials, especially bulk materials. It is also possible to transport other items on a pallet placed inside the container. Modular solution allows for moving a part of the trolley, i.e. a container with materials placed inside of it, on a suspended railway hoists.

BW WP-A PLATFORM CONTAINER

BW WP-A platform container is intended for transportation of mining materials, especially mine roadway support structures. It is also possible to transport other materials, such as pipes, wood, rail tracks, and all kinds of steel structures. Modular solution allows moving part of the trolley, i.e. a platform with materials placed on it, on a suspended railway hoists.

TECHNICAL CHARACTERISTICS

Type	BW WOP-A OIL-FUEL CONTAINER	BW WK-A MATERIAL CONTAINER	BW WP-A PLATFORM CONTAINER
Tank(s)/Container capacity	200 dm ³ or 2x200 dm ³	3000 kg	3000 kg
Dimensions (length, width, height)	3150/820/1600/ mm	3150/800÷1300/1260 mm	3150/800÷1300/1260 mm
Maximum length of transported item	-	-	4000 mm
Wheel track (rail breadth)	500÷1000 mm	500÷1000 mm	500÷1000 mm
Wheel base	1000÷1200 mm	1000÷1200 mm	1000÷1200 mm
Road wheel diameter	310÷375 mm	350 or 310 mm	350 or 310 mm
Minimum radius of the rail arc	8 m	-	-
Empty weight	985÷1150 kg	950÷1170 kg	950÷1170 kg
Maximum load capacity of the coupling	35 kN	35 kN	35 kN



○ BW WOP-A
OIL – FUEL CONTAINER



○ BW WP-A
PLATFORM CONTAINER



Manipulator BW MAN680L-A

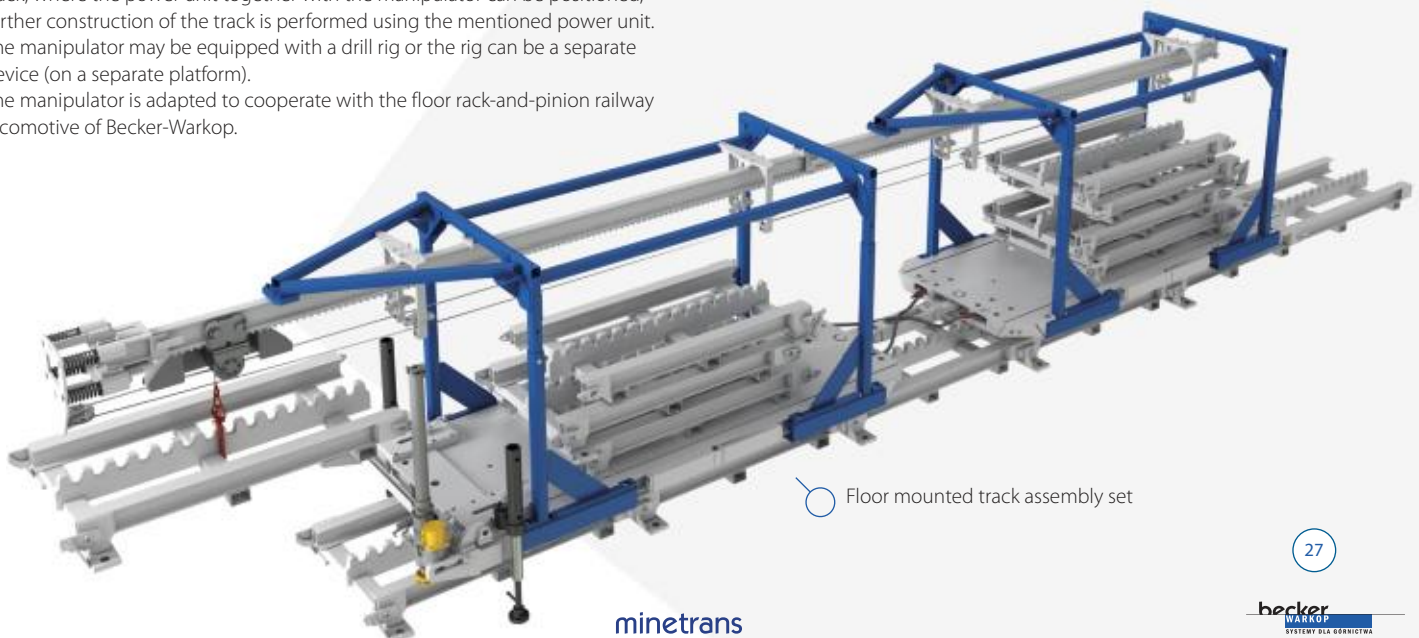
suspended

The suspended platform manipulator is used to works related to assembly, disassembly and repairs of the suspended railways tracks in mining workings. It is adapted to cooperate with the manoeuvring device of any type, such as: diesel locomotive of suspended railway, manoeuvring trolley, self-locking moving device of flitting type and other devices approved for operation in underground environment of mines. The construction of the manipulator consists of the working platform with the stock of rails, from which the employees suspend the said rails in the working. The manipulator enables the railway to "built itself", i.e. having installed the first section of the track, where the power unit together with the manipulator can be positioned, further construction of the track is performed using the mentioned power unit.

floor

The manipulator is a device that represents complementary equipment of the floor transportation systems. The manipulator consists of the platform equipped with a feeder facility. Using the feeder, rails are transported from the platform to the place of installation and are placed on the newly built track. The manipulator is supplied from the railway locomotive. The manipulator enables the railway to "built itself", i.e. having installed the first section of the track, where the power unit together with the manipulator can be positioned, further construction of the track is performed using the mentioned power unit. The manipulator may be equipped with a drill rig or the rig can be a separate device (on a separate platform). The manipulator is adapted to cooperate with the floor rack-and-pinion railway locomotive of Becker-Warkop.

Manipulator BW MAN680L-A – TECHNICAL DESCRIPTION	
Maximum length "L"	9010 mm
Length of route necessary to install the manipulator "3"	5080 mm
Height „H" (min/max)	895/3305 mm
Lifting height	2410 mm
Width „S"	1135 mm
Deadweight of the manipulator	2835 kg
Maximum number of persons on the manipulator platform	2 pcs
Maximum lifting capacity	680 kg
Load capacity of auxiliary basket	160 kg
Maximum towing power on the coupling	100 kN
Maximum track slope	+/- 10°
Admissible deviation of the platform floor from the level	+/- 5°



Floor mounted track assembly set

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WARKOP

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