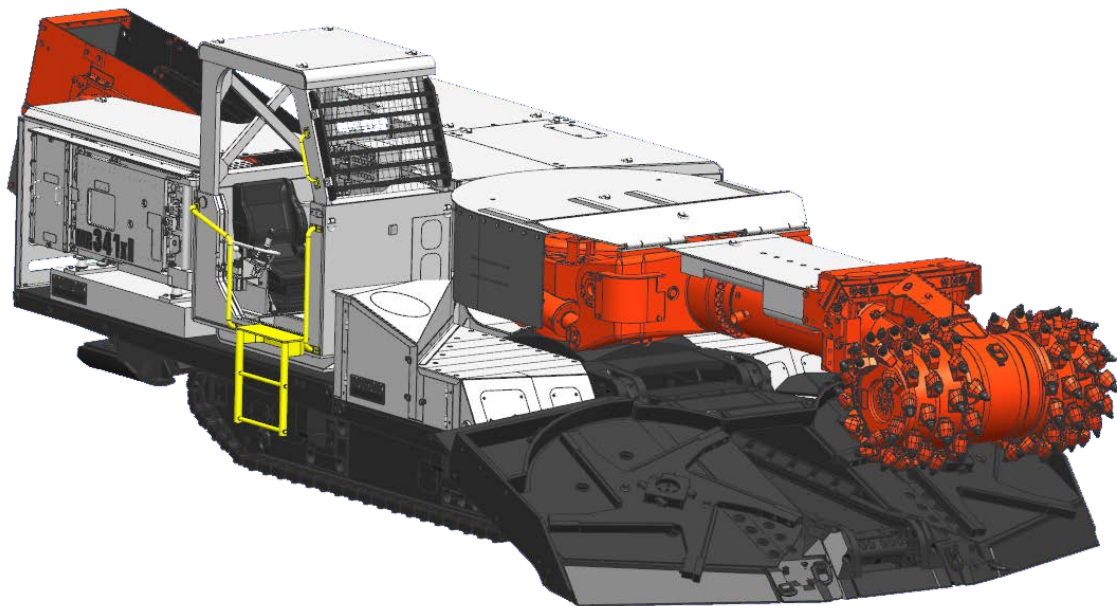


SANDVIK Roadheader

MR341 manual controlled – (ATEX)

Technical Description

Basic Machine



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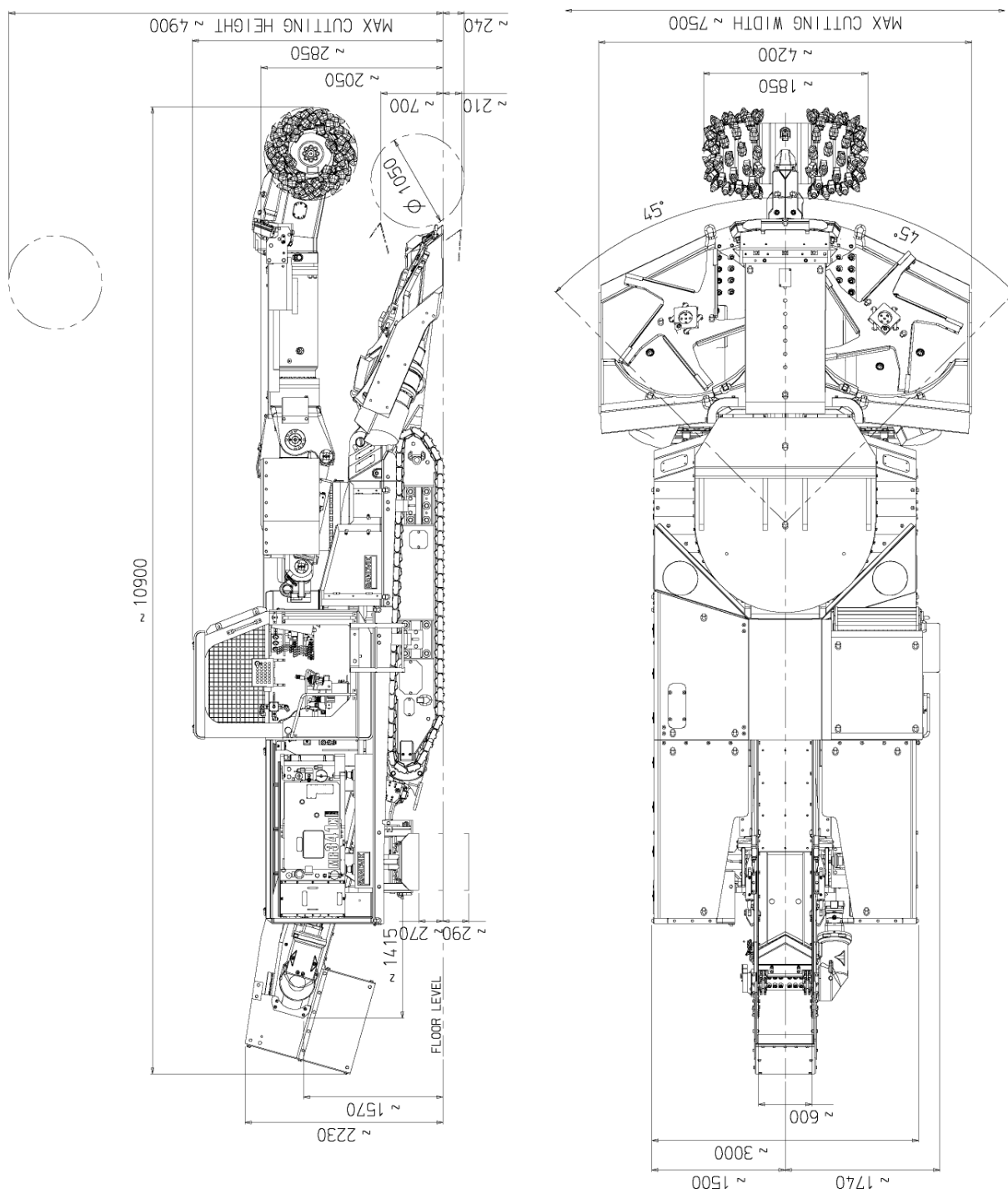
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1. Machine Layout MR341



All linear dimensions ± 50 mm

All angular dimension $\pm 2^\circ$

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2. Technical Data MR341

General		MR341
Total weight (metric tons, approx.)	[t]	60
Total length	[m]	10.9
Height over turret	[mm]	2050
Height over operator stand	[mm]	2850
Machine width over tracks	[mm]	2600
Machine width without loading table	[mm]	3240
Loading table width	[mm]	4200
Crawler track width	[mm]	600
Machine ground pressure	[MPa]	0.17
Ground clearance	[mm]	260

Cutting system		
Cutting height above track level, max	[mm]	4.900
Cutting width, horizontal	[mm]	7.500
Undercut below track level	[mm]	240
Cross section, above track level	[m ²]	34
Adjustment of loading table		
above floor level	[mm]	700
below floor level	[mm]	210

Spraying system [ITP]		
water quantity min.	[l/min]	39
water pressure min.	[bar]	11-20

Navigable Area of Application		
Cone radius	[m]	25
Basin radius	[°]	20
Slope side in rock, max.	[°]	± 5
Incline/Decline, max.	[°]	± 18

Geometric Characteristics		
Slewing of cutter boom	[°]	± 45
Vertical lifting from horizontal upwards	[°]	63.2
Vertical lowering from horizontal downwards	[°]	22.3

Forces		
Traction force per track (theoretical force on drive sprocket)	[kN]	624

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Technical Data MR341

Loading System		MR341
Loading star	[pcs]	2
Loading capacity	[m ³]	300

Conveyor System (double conveyor)		
Width of conveyor	[mm]	600
Conveying capacity	[m ³]	300
Headroom conveyor system	[mm]	420

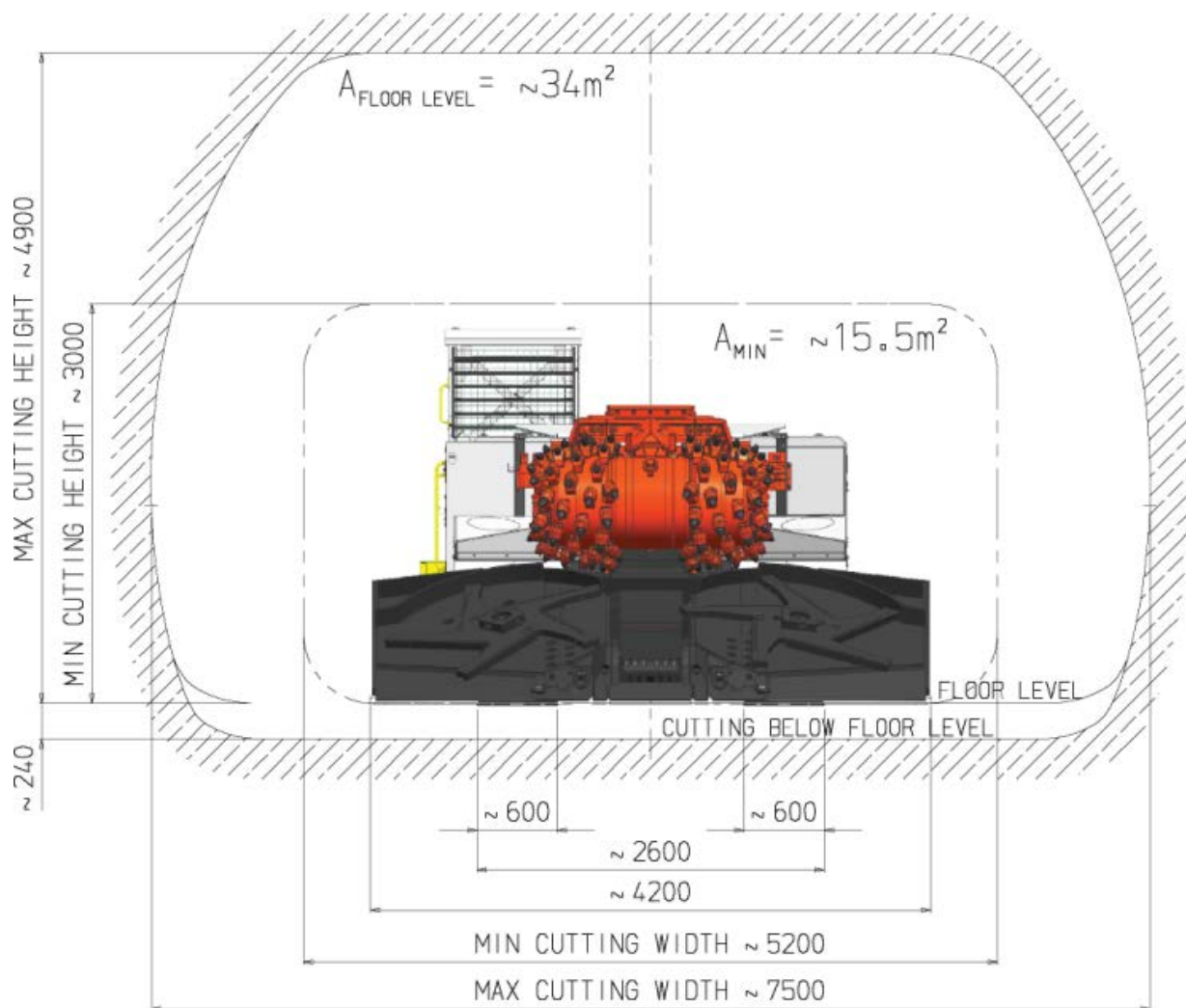
Electrical System		
Voltage	[V]	1000
Frequency	[Hz]	50
Total installed power	[kW]	404
Cutter motor water cooled		
nominal power	[kW]	200
nominal torque	[Nm]	1300
Hydraulic motor water cooled		
nominal power	[kW]	132
nominal torque	[Nm]	850
Loader motor water cooled		
nominal power	[kW]	2 x 36
nominal torque	[Nm]	2 x 237

Hydraulic system (load sensing)		
Hydraulic pumps	[pcs]	3
Filtration system	[l/min)	1300
Mineral oil hydraulic fluid	[l]	700
Nonflammable hydraulic fluid	[l]	700
Tank capacity	[l]	400
System pressure max.	[bar]	280

Speeds		
Tramming speed	[m/min]	0 – 6.8
Speed of cutter head	[m/s]	2.31
Slewing speed cutter boom	[m/s]	0.26
Conveying speed	[m/s]	0.34 – 0.95

3. Cutting Profile

All angular dimension $\pm 2^\circ$

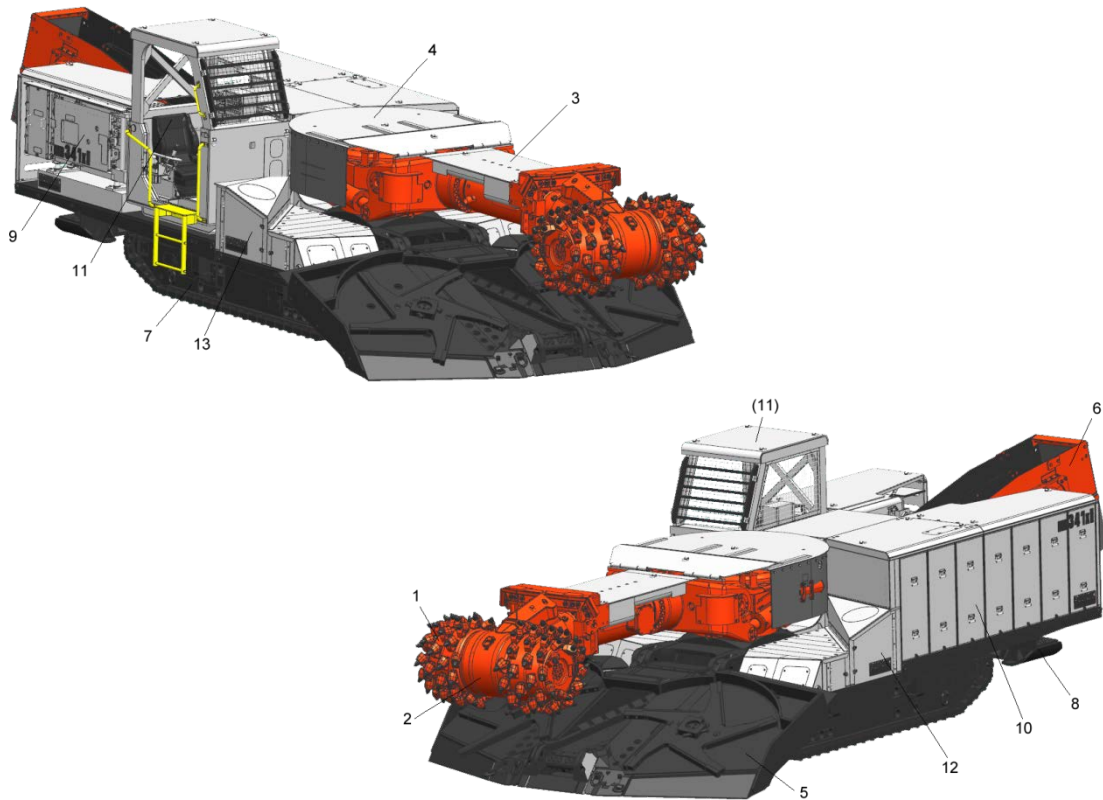


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4. Description of assembly groups

The basic machine of the Sandvik Roadheader consists of the following main components:



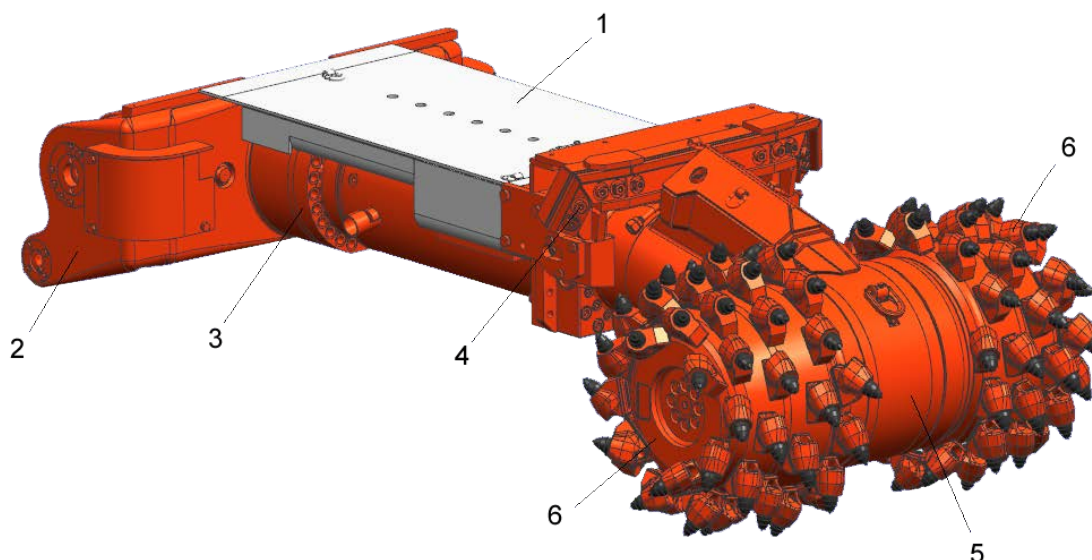
1	Cutter head	8	Frame with rear stabilizer
2	Cutter gear	9	Electrical equipment
3	Cutter boom	10	Hydraulic equipment
4	Turret	11	Operator stand with FOBS canopy
5	Loading device	12	Water supply – cooling system
6	Chain conveyor	13	Lubrication system
7	Crawler track assembly		

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4.1 Cutter boom

The cutter boom module comprises the cutter boom base, the cutter motor, the coupling, the cutter gear, the cutter head and if included the spraying system.



1	Cutter boom	4	Spray bar
2	Cutter boom base	5	Cutter gear
3	Cutter motor	6	Cutter head

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Cutter boom

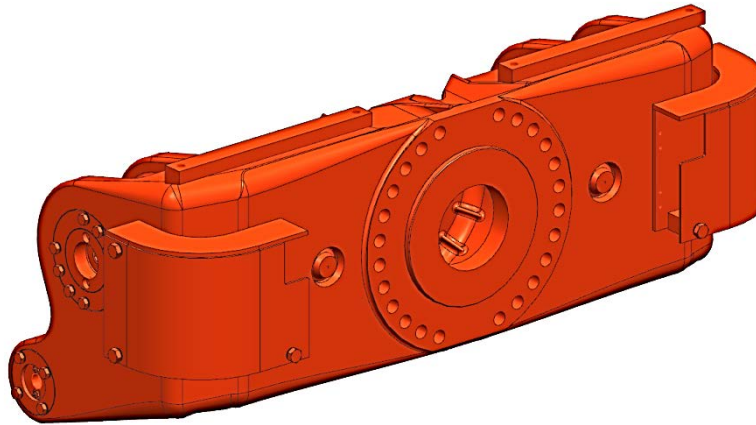
- | | | |
|---|------------------|--|
| 1 | Cutter boom | The cutter boom module comprises the cutter boom base, the cutter motor, the coupling (cardan shaft), the cutter gear, the cutter head and if included the spraying system |
| 2 | Cutter boom base | A steel construction mounted to the turret. It is used to support the motor and attaches the vertical pivoting cylinders. |
| 3 | Cutter motor | Self supporting design, water cooled. |
| 4 | Spraying system | The basic machine is equipped with a spraying system, using specific "ITP" hollow cone spray nozzles (incendive Temperature Potential). The system consists of spraying nozzles for the cutter head and for the loading table
For different spraying system - see Options. |
| 5 | Cutter gear | The gearbox consists of one cardan shaft, one bevel gear stage and one planetary gear stage and an oil circulation pump. Input shaft sealed with radial shaft gasket.
Output shaft is sealed with mechanical face seals
Cutter gear is available in different specification:
Dry transmission: At basic machine, if the machine is used with external spraying system only.
Wet transmission: With integrated water channels for supplying the cutter head with water. See Options |
| 6 | Cutter head | Consists of two cutter head halves, which are attached to the output shaft of the cutter gear. The cutter head halves are connected to each other via multiple spline shafts.
Different cutter heads available. See Options |

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4.2 Cutter boom base

The cutter boom base is a single piece cast iron construction mounted to the turret. It is the connecting part between cutter boom and turret. The cylinders for lifting the cutter boom are attached to it.



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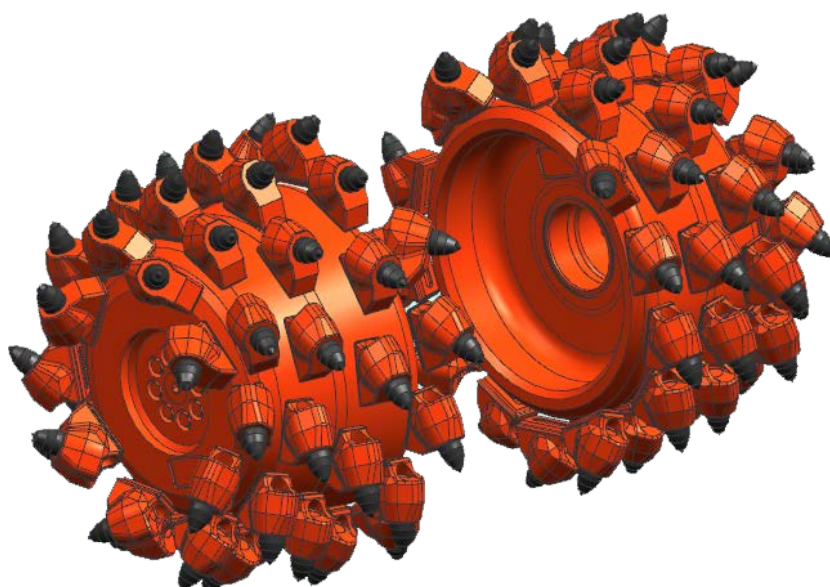
MR341 manual controlled – (ATEX)

4.3 Cutter Head

Depending on the geological conditions there are different cutter heads available. For standard soft applications, the cutter head R251-TC50 with 50 pick holders (type: EF58) is included in the basic machine.

The R251-TC50 is a cutter head for medium to hard cutting conditions, like shale, sandy shale, sandstone, coal etc. The pick holder system EF58 is a heavy-duty tool holder with changeable tapered bushing.

The cutter head is fastened to the gearbox with cylinder bolts and a spline for torque transmission. This arrangement allows easy and quick exchange of cutter head halves.



Type	R251-TC50
Optimum range of operation	Medium hard stone-shale and coal — 50 – 100 [MPa] uniaxial compressive strength. (UCS) With thin layers (10-15 cm) up to 110 MPa
Tooled with	2 x 50 pick boxes suitable for 38 mm shank-diameter picks. Locked by 1 clip-ring each in the pick holder
Used with cutter gear box type	MR341
Diameter	1050 [mm]
Width (included gearbox)	1850 [mm]
Cutting speed	2.31 [m/s] = at 50 [Hz]
Slewing speed	0.26 [m/s] = at 50 [Hz]

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4.4 Cutting tool system

Pick holder

The pick box is an element of the cutter head as it is directly welded to the cutter head. The configuration of the pick boxes, and consequently cutting tools, is therefore unique to each cutter head type.

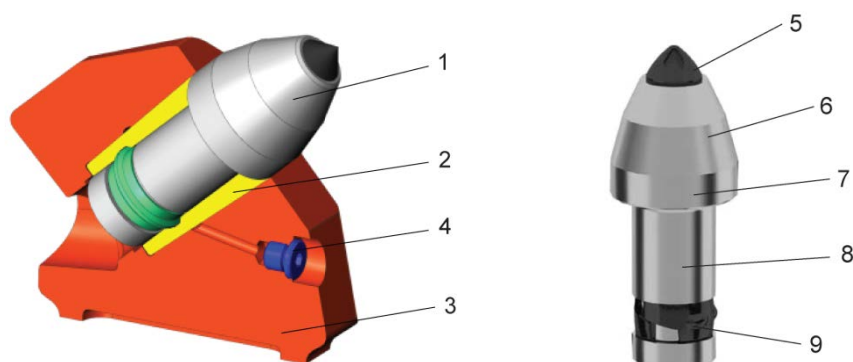
Pick

The geometry of the pick body and the carbide grade of the tip itself depend on the cutting conditions.

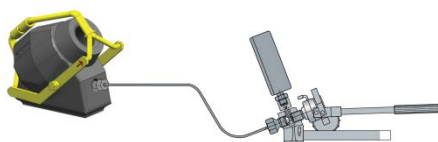
The picks must be selected according to the specific operating conditions. If the machine has been ordered without picks the machine user has to decide which suitable pick type would be used.

Sleeve

The correct sleeve depends on the geometry of the pick being used and on the size of the pick box into which the sleeve is inserted.



For bushing removal a special high pressure oil device is used, this makes the work simple and easy.



See options "Special tools for cutter head"

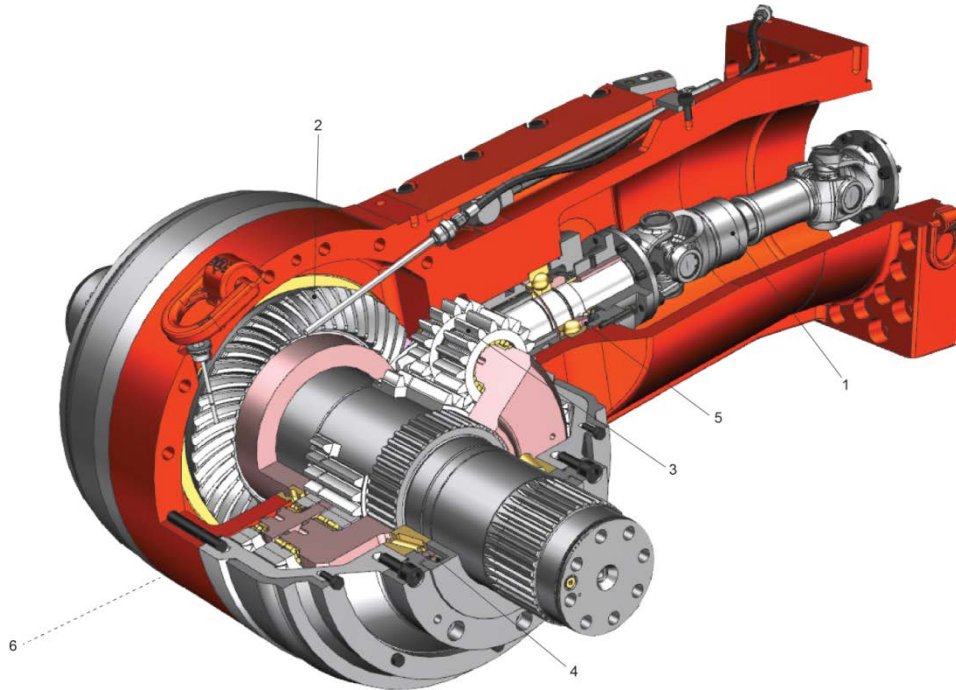
1	Pick	5	Tip (carbide)
2	Bushing	6	Pick body (steel)
3	Pick holder	7	Pick shoulder
4	Plug for high pressure device	8	Pick shank (straight)
		9	Internal retaining clip (ring)

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4.5 Cutter Gearbox dry (for frequency 50 [Hz])

Type MR341 (dry version)



1	Cardan shaft	4	Rotating mechanical seal
2	Bevel gear stage	5	Shaft seal
3	Planetary gear stage	6	Oil circulation pump

Input speed (rpm)	$[\text{min}^{-1}]$	1470	The gearbox consists of one cardan shaft, one bevel gear stage and one planetary gear stage and an oil circulation pump. All mating surfaces are sealed with suitable sealing compounds (Loctite or similar). The input shaft is provided with a shaft seal, the output shaft bearing is sealed with rotating mechanical seals.
Output speed (rpm)	$[\text{min}^{-1}]$	42,04	

The advanced gearing design ensures a high life expectancy of the cutter gear box.

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4.6 ITP Spraying System

The general principle of ITP-spraying system is to obtain a sufficient ventilation of the danger zone in the region of the cutting head

ITP” stands for “Incendive Temperature Potential”

Methane released during cutting process is washed away from the critical area and quickly diluted to a non-ignitable concentration.

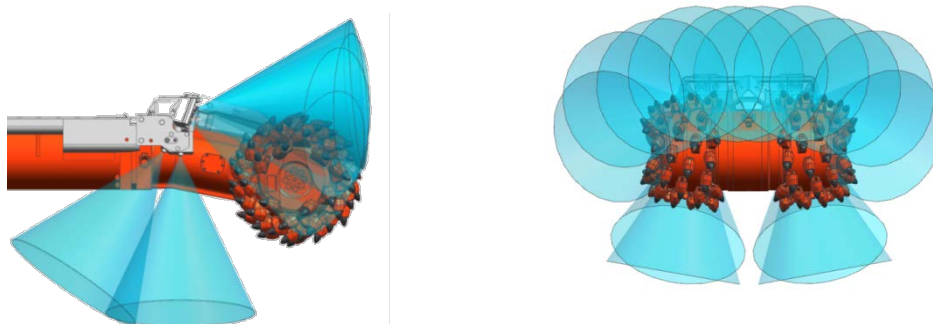
This is achieved by specialized hollow cone spray nozzles which are directed at the top of the cutting head or to the danger zone in the cutting area. The conical distributed spray water carries ambient air and generates an air-water mist, with high local air velocity. By arranging the nozzles in the top of the cutting head, the air flow is assisted by the rotation of the head. Additional nozzles directed to the pile of coal below the cutting head result in additional ventilation at this range.

A basic requirement for the system function is a sufficient supply of the face area with fresh air from the mine ventilation system. The ITP spraying ensures the effective, local ventilation of specified danger zone in the vicinity of the cutting head. Additionally by the air-water mist a cooling and extinguishing effect is given.

Interactive operation of ITP spraying with mine ventilation system

The supply of the face area with fresh air must be ensured by a special suction ventilation system. The air turbulence caused by the mine ventilation system overlap with the ITP spraying whereas the ITP nozzles take over the ventilation at the local danger zone of the cutting head.

At the area of the loading table, under the cutting head, ITP nozzles prevent potential methane accumulations if the special mine ventilation is located by the loading table back edge. To ensure adequate ventilation the methane concentration at the face area must be constantly monitored. A machine-mounted methane system as supplied with the machine and the methane sensor is mounted in practical position is the area behind and above the ITP nozzle boom. This ensures that the ITP nozzle actually draw in fresh ventilation air.



Water requirements: (to be provided by customer)

Quantity	[l/min]	39
Incoming pressure	[bar]	min. 11 – max. 20
Incoming temperature	[°C]	max. 35
Working pressure	[bar]	15

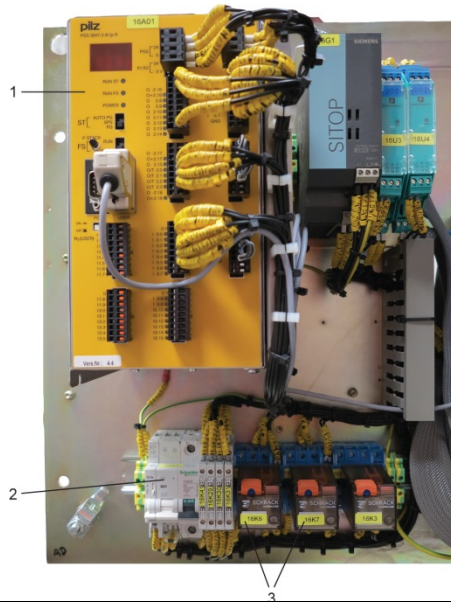
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Sandvik Monitoring System SMS

A display is integrated in the main enclosure for monitoring the spraying system. It shows the water pressure and the water flow characteristic curve with upper and lower tripping limits.

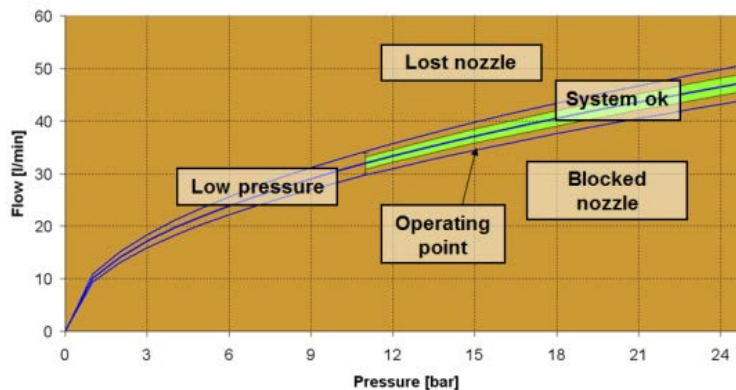
Additionally, it provides information regarding connection and spraying system failures.



1	Safety PLC	3	Cutter motor auxiliary contactors
2	Service button	4	Failure messages

Characteristic diagram

Current water flow
Water flow upper limit
Water flow lower limit



The limits are dynamic calculated from the current water flow sensor and water pressure sensor. This covers a period of 3 to 5 minutes, showing past events and providing trends for the future behavior of the system. If the values are not correct the cutter motor switches off.

Changes in pressure influence the upper and lower limits

In case of a failure the current water flow is above or below limits a failure message is shown. (4)

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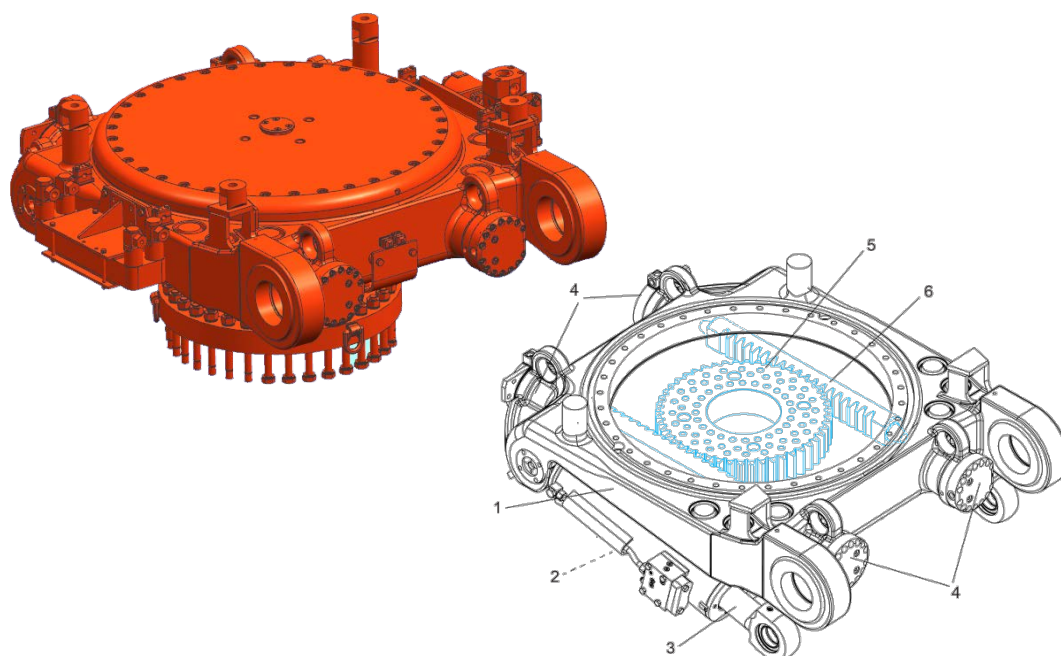
4.7 Turret

The turret is used to move the cutter boom in vertical and horizontal direction. It is bolted to the frame. A disc bearing ensures that very little vibrations occur during operation, even when difficult conditions are experienced.

Horizontal pivoting is achieved with a rack and ring gear arrangement powered by four integrated hydraulic cylinders, providing a constant slewing speed all across the face.

The pivoting range is approximately 45 [°] to right and left side.

The vertical pivoting is achieved with the aid of two hydraulic cylinders which are attached to the cutter boom and the turret. The vertical pivoting range is approximately 85 [°].



1	Housing of disk-bearing upper part	4	Horizontal slewing cylinders
2	Frame bridge	5	Sprocket
3	Vertical pivot cylinder	6	Rack

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4.8 Loading Assembly

The loading assembly consists of the loading table which can be raised and lowered hydraulically, the two loader transmissions and the loader stars.

The loading table for basic machine is delivered with a width of 4200 [mm] (split version).

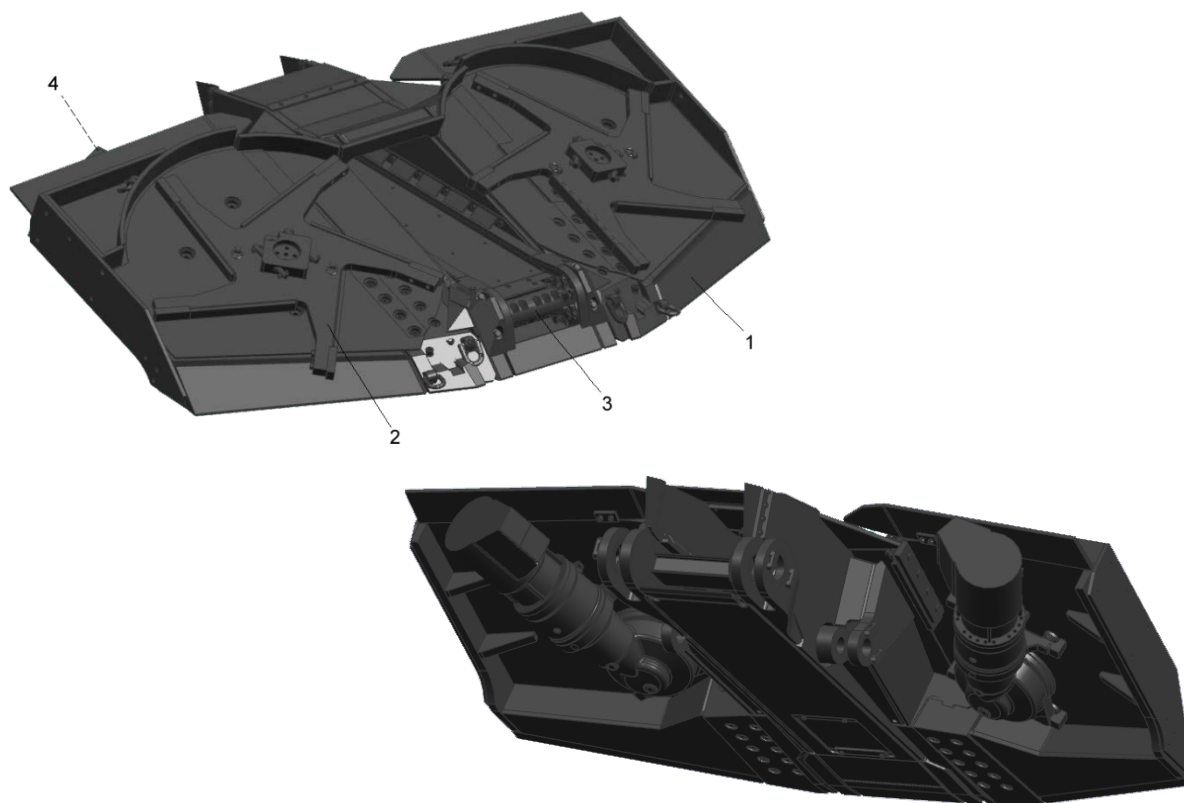
Optionally, there are loading table with extensions for different widths available, hydraulically operated variable extensions and a rigid extension. – See Options

The entire upper surface of the loading table which is in contact with the loaded material is covered with special high wear resistant plates.

The loading table is also used to stabilize the machine during cutting with its two hydraulic cylinders.

The two loader stars move the material from the loading table into the chain conveyor. The loader stars are also protected with high wear resistant plates.

Each loader star is driven by a 36 kW electric motor via a two-step planetary bevel gear.



1	Loading table	3	Deflection roller
2	Loading stars (2x)	4	Loader drive (36 kW electric motor)

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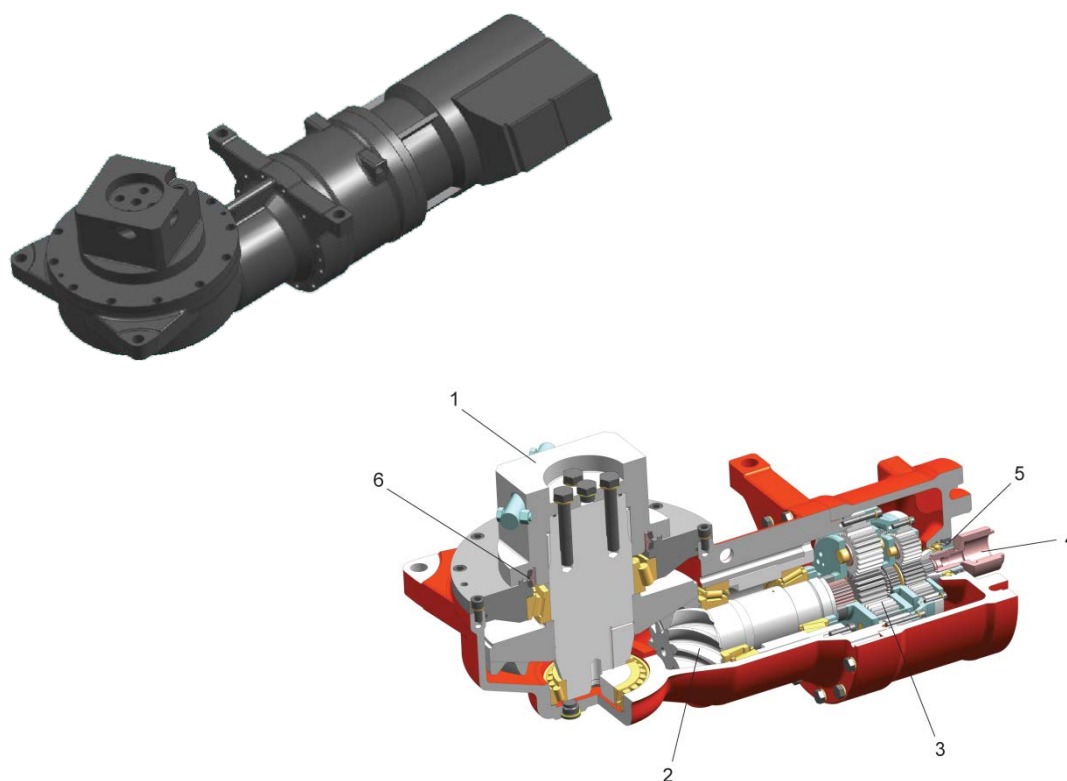
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Loader Drive Assembly

The loader drive consists of the electric motors and the gearboxes. The loader gearbox is a combination of a two-step planetary and a bevel gear stage.

The loader drive rotates the star that is mounted to the star take-up of the loader gearbox. Each gearbox is driven by one separate electric motor, attached to the planetary gear stage.

All contact faces are sealed by means of O-rings or appropriate liquid seals to protect the gear from dirt and water intrusion as well as from oil leakage. The input shaft bearing is provided with a shaft seal, the driven shaft bearings are sealed with rotating mechanical seals.



1	Loading star take up	4	Motor connection with coupling
2	Bevel gear stage	5	Input drive shaft
3	Planetary gear stage	7	Output drive face seal

Nominal power	[kW]	36
Input speed max.(rpm)	[min ⁻¹]	1440

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4.9 Double chain conveyor

The double chain conveyor is arranged in the center of the machine. It transports the material picked up by the two loader stars to the rear end of the machine, using a double chain conveying system.

The chain is a standard miner chain, size 19x64.5 [mm].

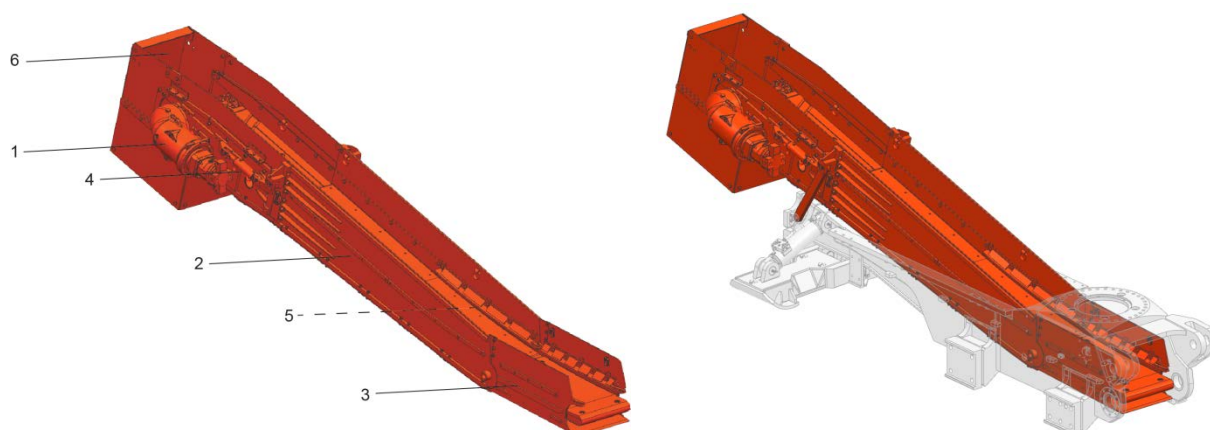
The chain conveyor is driven via a hydraulic motor.

The surface of the chain conveyor which is in contact with the transported material is protected with special high wear resistant plates.

The chain conveyor is in a fixed vertical position and the discharge end is high enough above the track level to allow easy loading of most of the common haulage systems.

The maximum conveying capacity is 300 [m³/h], allowing fast loading.

The large conveyor opening of 420 [mm] height by 600 [mm] width allows the passage of large lumps.



1	Driving station	4	Tensioning cylinder
2	Conveyor rear part	5	Conveyor chain
3	Conveyor center part	6	Dust box

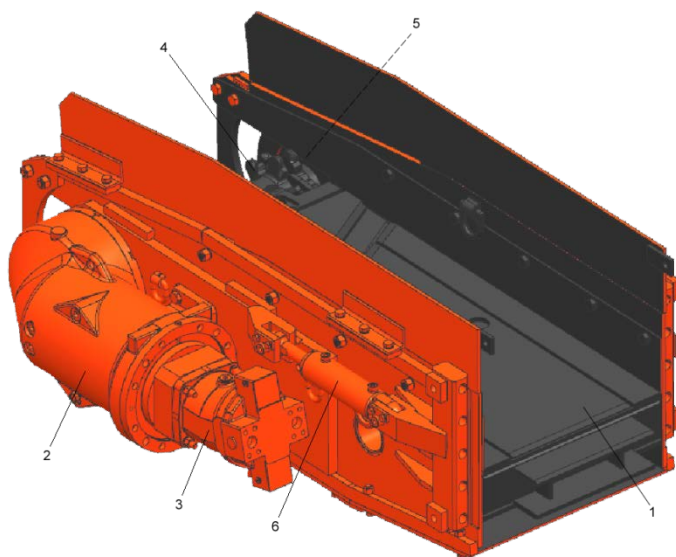
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Conveyor Drive Assembly

The conveyor is driven at the rear end by a sliding driving station using a hydraulic motor.

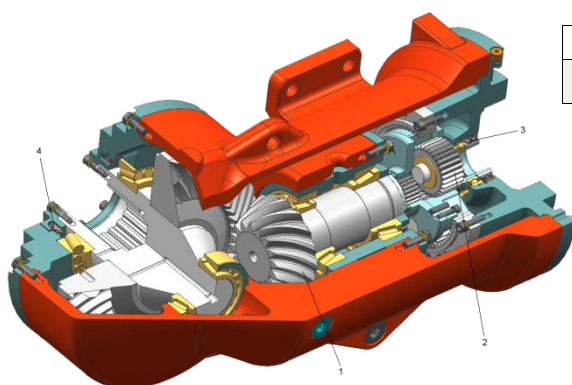
The driving station is also used for tensioning of the chain with cylinders.



1	Tensioning slide	4	Drive sprocket
2	Conveyor gear box	5	Blind bearing with speed monitoring
3	Hydraulic motor	6	Tensioning cylinder

The conveyor gearbox is part of the conveyor driving station which drives the conveyor. The gearbox is driven by a hydraulic motor.

Chain speed adjustable from 0.34 to 0.95 m/sec.



Nominal power [hydraulic]		
Input speed max.(rpm)	[min ⁻¹]	1440

1	Bevel gear stage	3	Input drive shaft seal
2	Planetary gear stage	4	Output drive face seal

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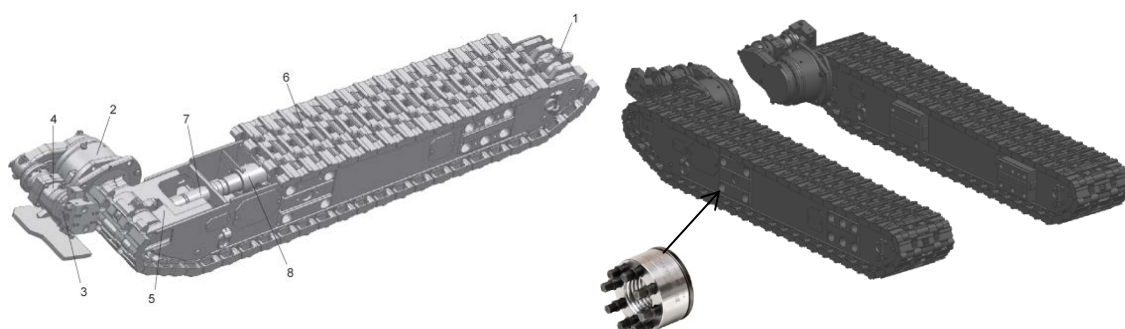
4.10 Crawler Track Assembly

The tracks are used to maneuver the Roadheader during cutting and for tramming the machine over longer distances. Each crawler track is driven individually, resulting in good maneuverability of the machine and allowing turning it on the spot. The complete undercarriage of the track frames are equipped with special slide plates. The special heavy duty track chains in combination with the special slide plates are strong enough to compensate the high cutting forces.

The Roadheader utilizes the hydraulic powered traction drive. This system is designed to minimize the maintenance associated with the traditional roller chain. Easy access to gearboxes, hydraulic motors and chain tensioning cylinder provides minimum maintenance time.

The 600 [mm] wide track chains ensure a firm traction in a wide variety of floor conditions. The tramming speed is variable between 0.3 and 6.8 [m/min], allowing safe and efficient place changes.

The crawler system is driven by two hydraulic motors with spring loaded, multiple disk brakes which are hydraulically released. In case of hydraulic pressure drop, the brakes immediately respond and bring the Roadheader to a standstill. The crawler chains are tensioned with a tensioning device and grease activated cylinders.



Interface bolt connection to main frame with “Super bolt” for easily mounting

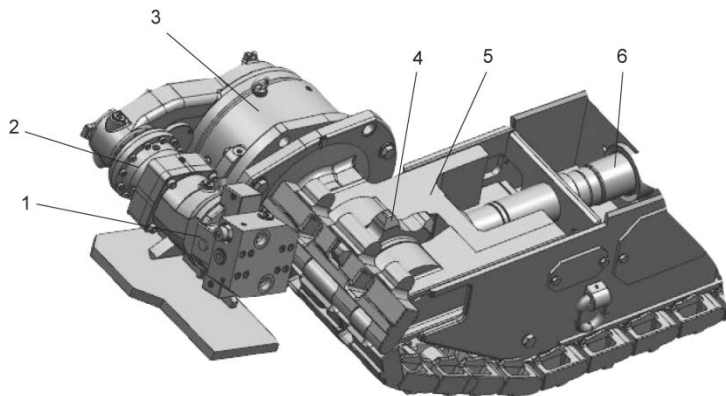
1	Idler roller with chain sprocket	5	Tensioning slide
2	Crawler track gear box	6	Crawler track chain
3	Hydraulic motor	7	Push rod
4	Multiple disk brake	8	Tensioning cylinder

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Track Drive unit

The hydraulic motor together with the multiple disk brake are directly flanged to the track gear. Power drive is over two spur gear and two planetary gear steps.

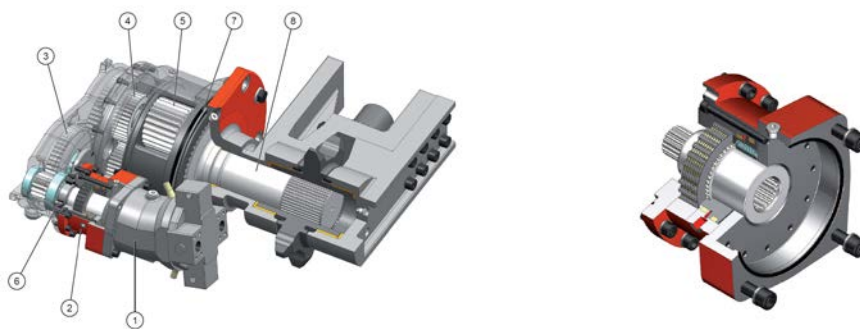


1	Hydraulic motor	4	Drive sprocket
2	Multiple disk brake	5	Sliding unit
3	Track drive gear	6	Tensioning cylinder

Technical data of track gear:

Power max.	[kW]	75
Input speed max.(rpm)	[min ⁻¹]	2000

Track gear and multiple disk brake



1	Hydraulic motor	5	Planetary gear steps
2	Multiple disk brake	6	Shaft seal (input shaft)
3	Spur gear steps	7	Shaft seal (output shaft)
4	Planetary gear steps	8	Drive shaft

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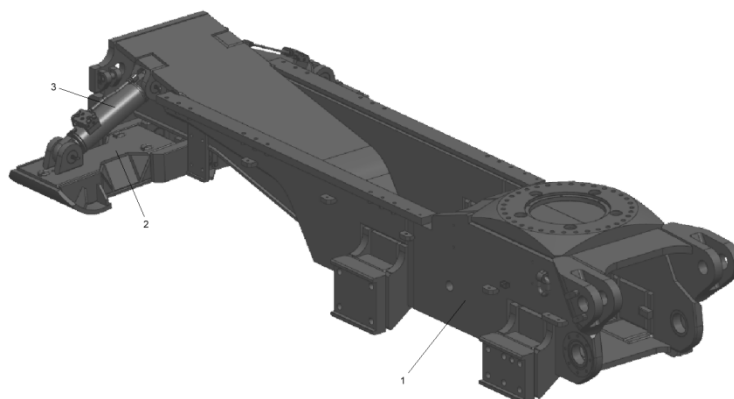
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4.11 Frame

The frame is a one-piece solid steel structure. It carries all other assembly groups.

Interface for bolted connection to track frame with studs and super bolts.

The hydraulically operated stabilizers are fitted at the rear end and serve as support during the sump-in and cutting operations.

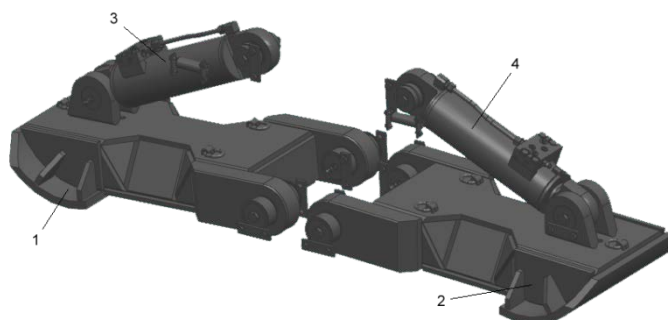


1	Main frame	3	Hydraulic cylinder
2	Rear stabilizer		

Rear Stabilizers

The stabilizers, which are located on the right and left of the frame's rear end, can be lifted and lowered by means of hydraulic cylinders.

The purpose of the stabilizers is to transfer machine weight to the front of the machine in order to assist in compensating the cutting forces when shearing down the face.



1	Stabilizer left	3	Hydraulic cylinder left
2	Stabilizer right	4	Hydraulic cylinder right

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4.12 Electrical Equipment flame proof

Main panel SMVEX11-A

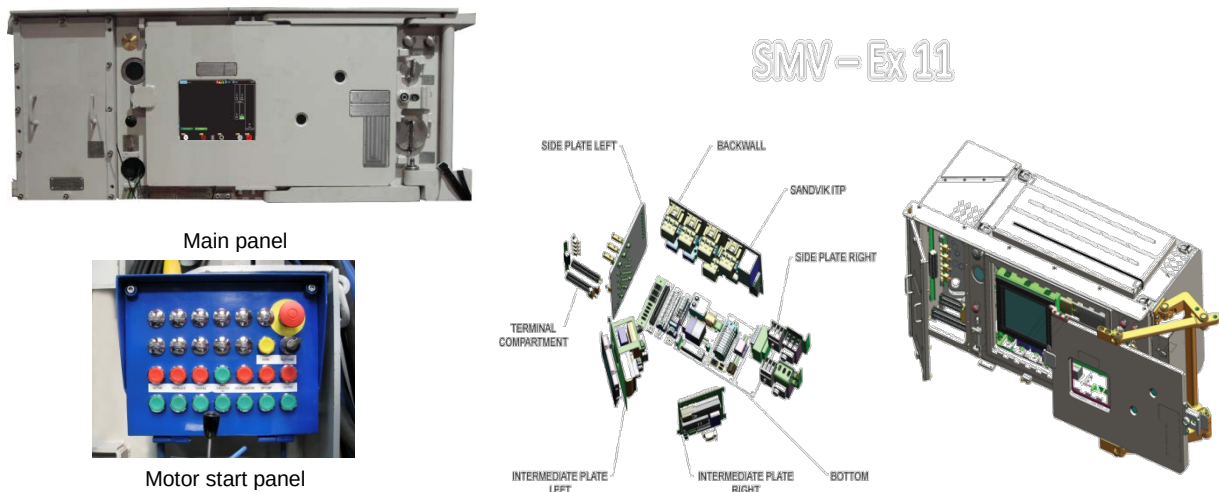
950 - 1140V / 50 Hz / IP 55

4 head lights, 2 rear lights and 3 area lights, start and drive back pre-warning

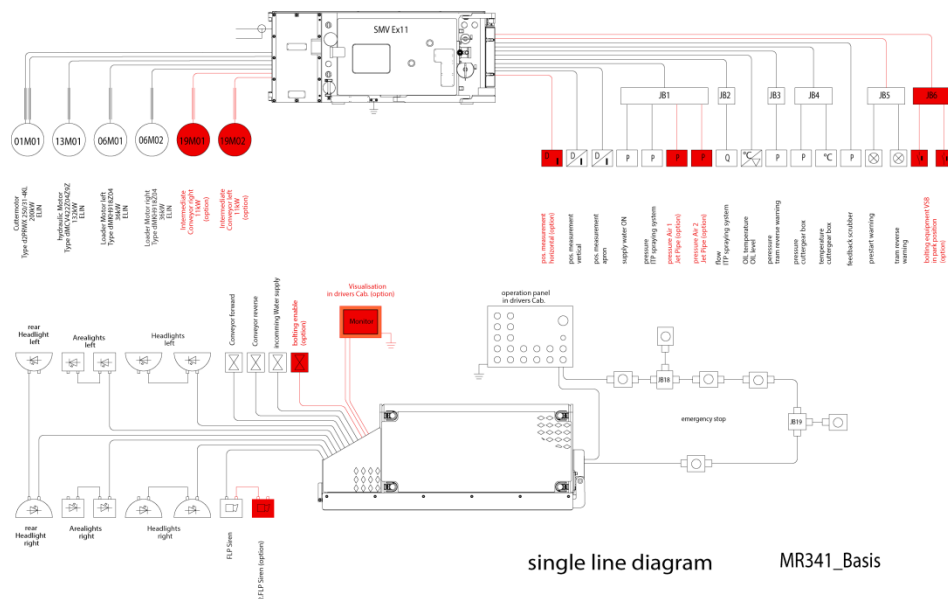
Integrated 15" color display, electric motors, motor start panel, PLC controlled anti collision device

The electric system is designed to work on 950 to 1140 [V] / [50 Hz] / 3 Phase power supply and is suitable for explosion hazardous environment, the protection class is minimum IP55.

Nearly all of the machine's functions are manual controlled. The Emergency Stop circuit is hard-wired and SIL 2 rated.



The electrical system is designed in a ExdI explosion-state construction and is available in different voltages and according required approved regulations.



single line diagram

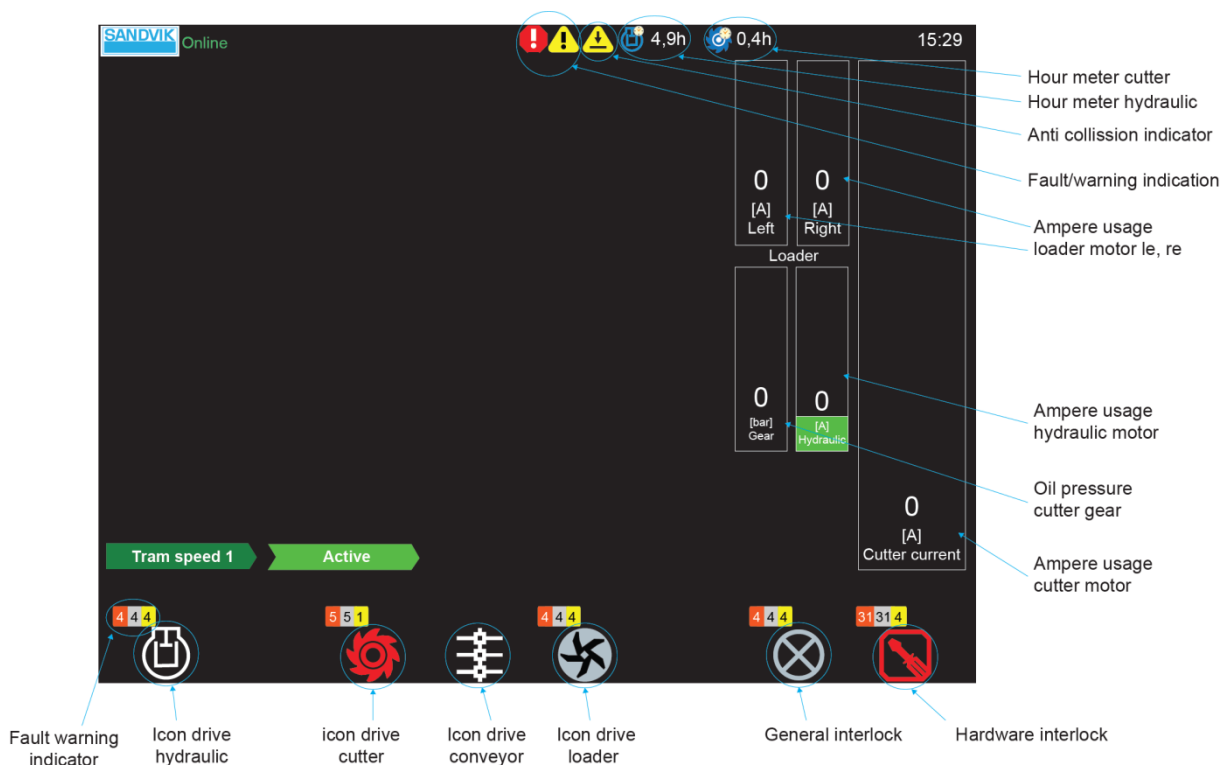
MR341_Basis

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The full graphic color LCD screen 15" is located in the main panel of the machine.

It is used to display several fault messages, motor status, ampere usage of cutter motor and loader motors, general and hardware interlocks, collision device and hour meters.



The monitor is also used to continuously display important diagnostic and status data of the machine.

The SMS (Sandvik Monitoring System) for ITP spraying system is also integrated by switching between the different screen pages (e.g. diagnostic for SMS).

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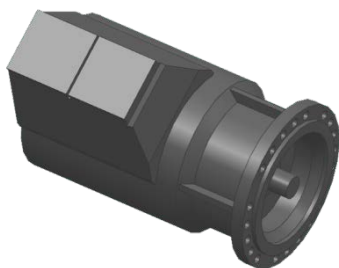
Electric Motors

All electric motors are of 3-phase squirrel cage type and direct-on-line started, requiring a stable power supply.

All motors are protected against overload by means of overload relays. The main motors have also build in temperature sensors (PTC resistors, thermistors) in order to monitor the temperature of the windings and bearings against over temperature.



Cutter motor



Loader motor



Hydraulic pump motor

Cutter motor (water cooled)	[IP 54]	200 [kW]
Hydraulic pump motor (water cooled)	[IP 55]	132 [kW]
Loader Motor (water cooled)	[IP 55]	2 x 36 [kW]

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4.13 Hydraulic system

The hydraulic system regulates the flow of the hydraulic oil at system pressure to perform cylinder-controlled functions like raising the cutter boom, conveyor or rear stabilizers or supplying hydraulic motors.

The hydraulic system operates with open circuits. The circuits are supplied with hydraulic energy from pumps mounted outside of the unpressurized hydraulic tank and are driven by an electric motor.

Control devices and instruments integrated throughout the system provide:

- Fluid level and temperature monitoring
- Pressure optical indication
- Filter Blockage optical indication

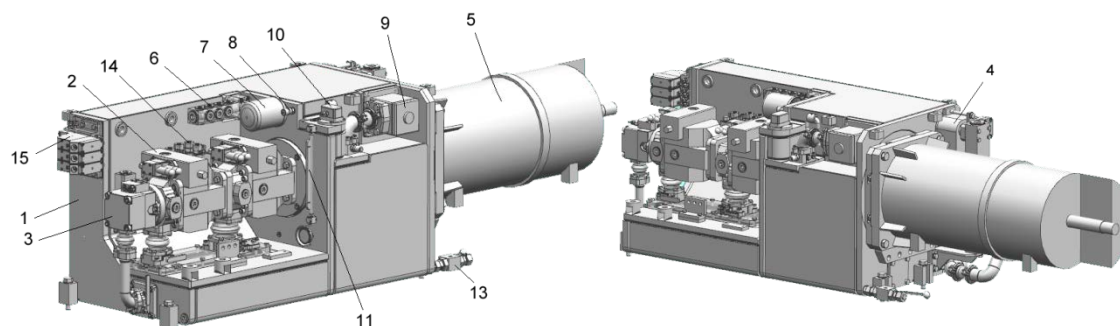
The standard hydraulic system is designed for hydraulic oil.

The hydraulic power pack of the machine consists of the hydraulic tank, the variable displacement piston-pump group, the control system, the accessories as well as the hoses.

The pumps are driven by one electric motor with couplings. The system is designed to facilitate maintenance procedures. By simply closing the butterfly valves in the suction lines, pumps can be replaced without emptying the hydraulic fluid from the tank.

High pressure and inline filters are used for filtering. A breather is installed which prevents dirt from penetrating into the tank and allows the pressure inside the tank to be equalized with the external atmospheric pressure.

All the hydraulic cylinders are equipped with directly mounted valve blocks such as check valves, counter balance valves, brake valves and secondary pressure relief valves. The required valve blocks are mounted directly on the cylinders.



1	Oil tank	9	Return line filter
2	Axial piston pumps	10	Oil level and temperature switch
3	Vane pump	11	Visual level indicator
4	Heat exchanger	12	Visual temperature gauge
5	Electric motor	13	Ball valve for oil change
6	Drain oil collector	14	Valve block
7	Breather	15	Series connection plate
8	Clogging indicator for breather		

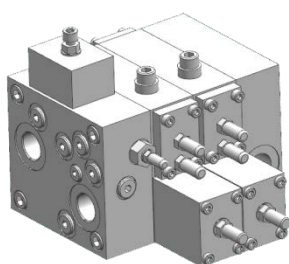
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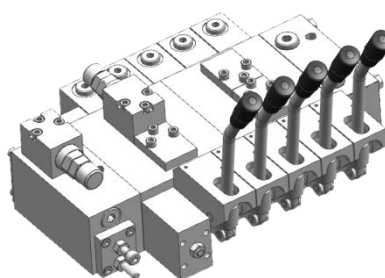
Hydraulic Control Valve

The hydraulic – control valves (partially directly operated and partially operated by pilot control) are structurally identical to proportional control valves with load pressure feedback to the variable displacement pumps (LOAD - SENSING). The cross-section of the opening of each valve corresponds to a certain oil flow rate through the valve. The resulting pressure difference is fed back to the variable displacement pump, which thereupon delivers automatically the required flow rate.

When reaching the max. system pressure adjusted at the pressure control valve, the pump swivels automatically towards to minimum volume by maintaining the system pressure.



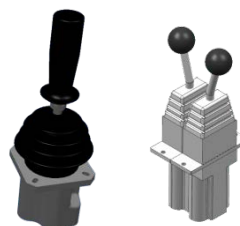
2SL12 control



6SV12 control



4WMM valve



Pilot valves

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4.14 Operators Stand (also see option)

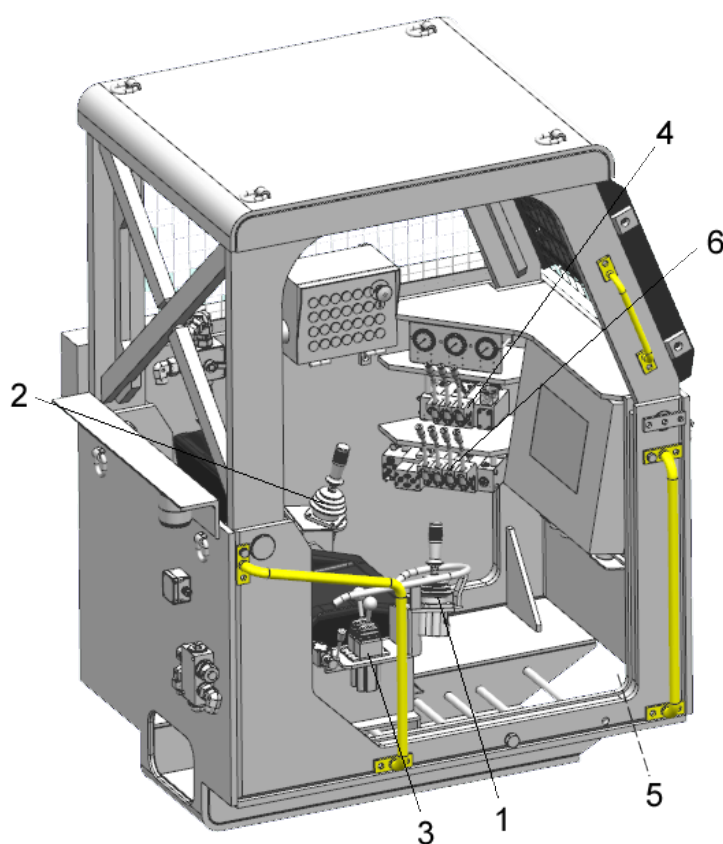
The operator's stand is arranged on the right side of the machine behind the turret. The operator has an optimum view to the cutter head.

The control instruments and devices are arranged around the operator.

An operator stand canopy can be ordered as an option.

The operator's stand canopy can be easily mounted.

Electrical and hydraulic control elements are mounted in locations visible and easily accessible from the operator's seat. The operator's seat is horizontally movable displaceable. A grid is pinned on the stand and protects the operator against falling rocks



1	Cutter boom	4	Additional tools (Option)
2	Track drive	5	Dead man switch
3	Loading table	6	Rear stabilizer

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4.15 Cooling and Water Supply System

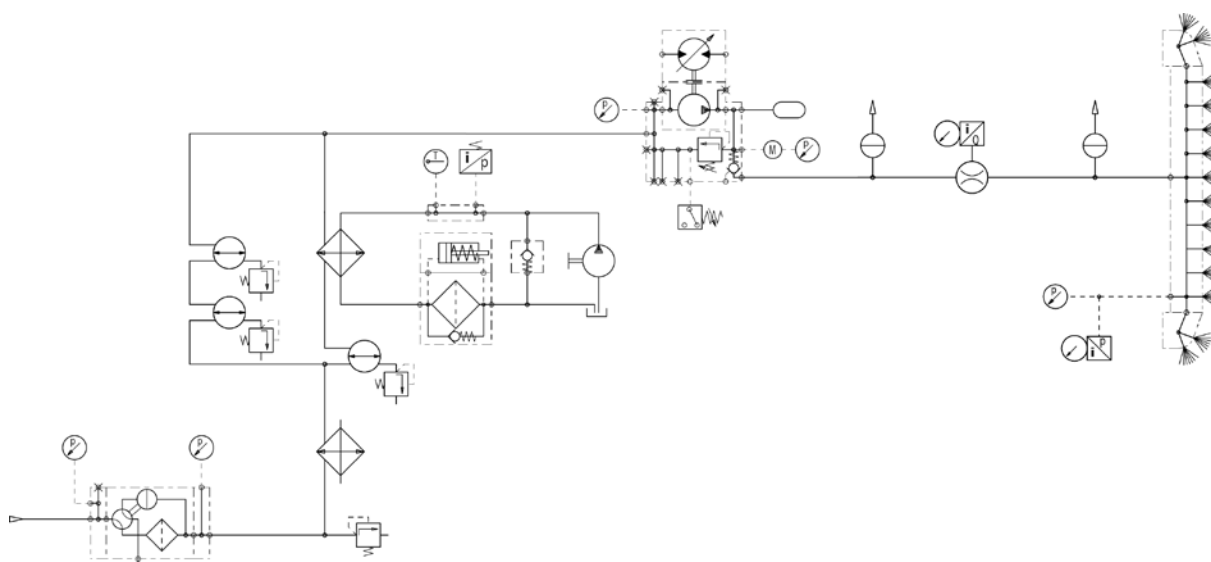
The purpose of the cooling system is to dissipate the heat losses which occur when operating mining machinery which is intended for use underground.

The cooling system is continuously supplied with fresh water from the mine side.

The return water from the cooling system get pressure increased by a booster pump and feeds it to the sprayers.

For the ITP-Spraying system a spray bar is assembled to the cutter arm / cutter gear of the machine.

The water consumption for cooling and spraying is countries specific and is between 30 and 60 l/min



Water supply ~ 39 l/min

P_{min} 10 bar

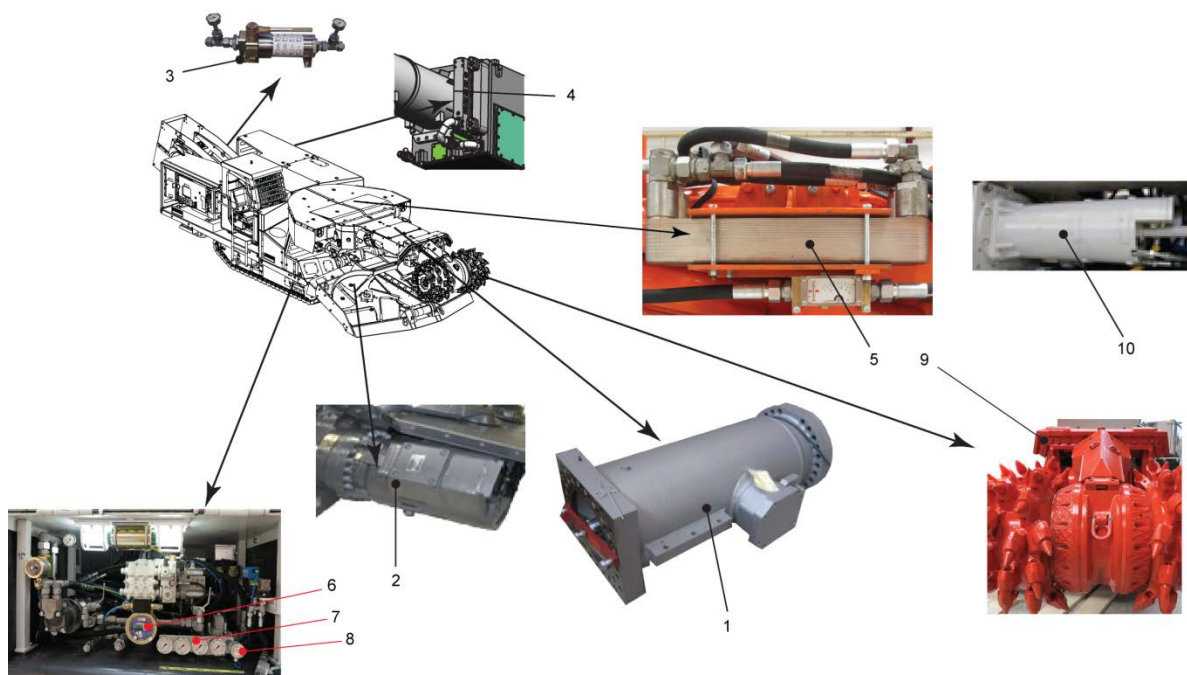
T_{max} 35°C

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Cooling circuit

Incoming water, mine supply, via filter into hydraulic oil heat exchanger to hydraulic motor and split to cutter motor and cutter gear and as well to loader motor right and left. Complete cooling water outlet goes into booster pump station and further to the ITP sprays.



Cooling system

1	Cutter motor cooling jacket	6	Flow sensor
2	Loader motor cooling jacket	7	Pressure gauges
3	Water filter	8	Pressure sensor
4	Heat exchanger hydraulic fluid	9	ITP Spray bar
5	Heat exchanger cutter gear oil	10	Hydraulic motor cooling jacketed

Water pump for the water/glycol circuit is placed at a maintenance friendly illuminated area.

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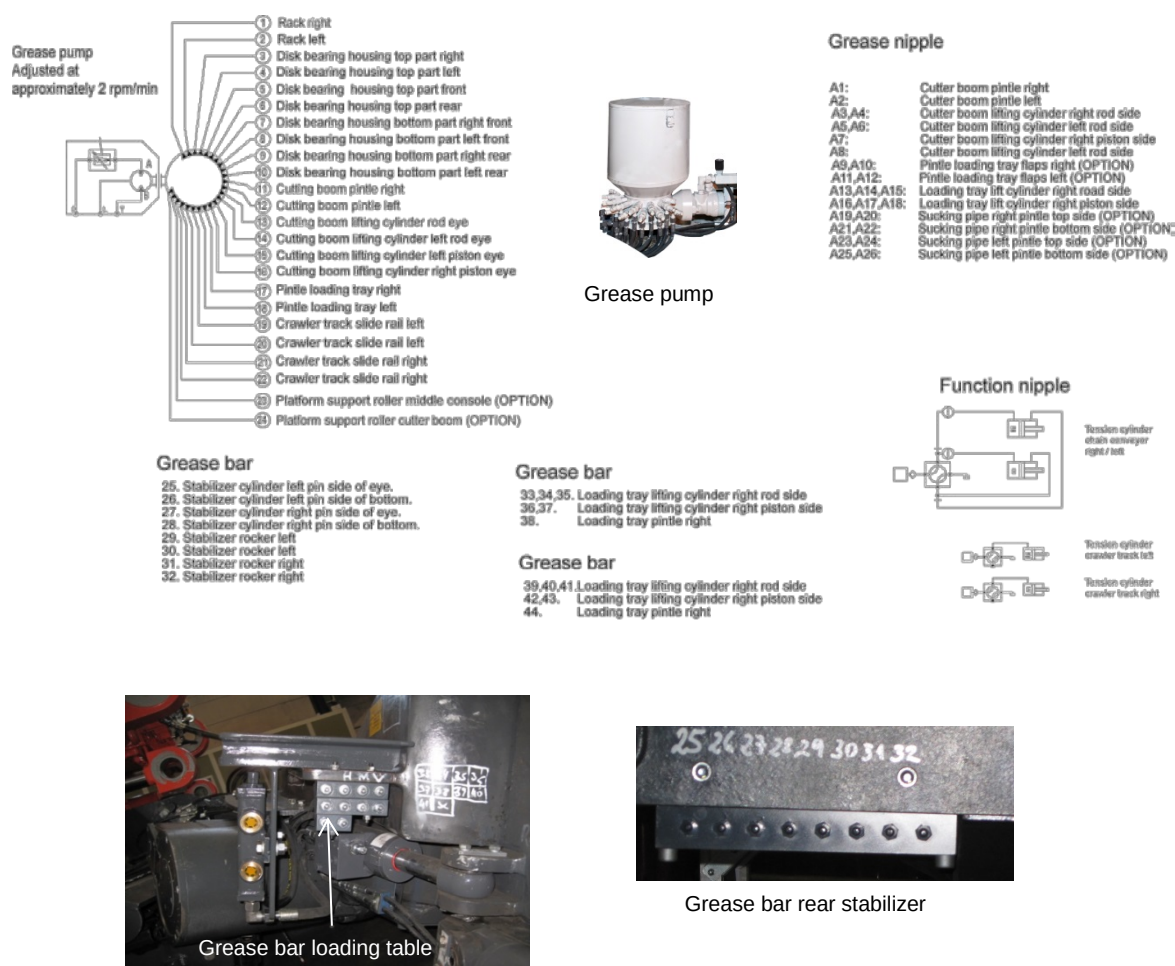
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4.16 Lubrication System

The Roadheader is equipped with one hydraulic driven multi-line lubrication pump, powered from the hydraulic and mounted on the turret.

The multi-line lubrication pumps accommodate pump elements and lubricating points. The delivery volume of each element is infinitely variable within a certain range. Grease is continuously supplied to the connected lubricating points.

Some elements are not lubricated via the central lubrication system but must be manually greased by means of some individual grease points and lubrication manifolds. The lubrication strips act as a central distributor to reach points which are difficult to access or which are located in one of the machine's danger areas.



Grease filling at the lubrication pump used for automatic greasing is very service friendly.

Grease can either filled by using a cartridge or filled manually by the use of a grease pump (air compressed driven) into the grease tank of the lubrication pump.

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4.17 Special tool set

A special tool set is part of the basic machine specification which includes the toolset for cutter head; a sealant lubricant set; a tool set for track assembly and cardan shaft assembly and a torque wrench and a jig for loading table assembly.

The cutting head tool kit is used for pick assembly and disassembly and for assembly and disassembly of the pick bushings. Furthermore the sealant and lubricant is used for the Roadheader assembly.

Also special tools for track assembly are needed to make correct mounting of the super bolts.

The jig is used for easier mounting of the pin of the loading table into the main frame.



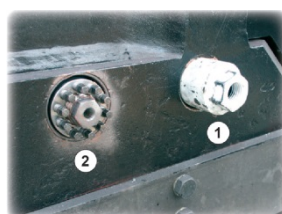
Cutting head-tool kit



Sealant and lubricant



Tool set for track mounting



Jig for loading device assembly



Lift 1,5 t



Torque wrench 750-2000 Nm



Assembly tool f cardan shaft and track assembly