Wire rope hoist
# Wire rope hoists

## Standard

<table>
<thead>
<tr>
<th>Type</th>
<th>Max. capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rope hoist SH</td>
<td>25 t</td>
</tr>
<tr>
<td>Rope hoist AS70</td>
<td>125 t</td>
</tr>
<tr>
<td>Winch SHW8 /SW</td>
<td>160t/250t</td>
</tr>
</tbody>
</table>

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Wire rope hoist
Type SH up to 25 t

SH 3
SH 4
SH 5

SHR 6
SH 6
Wire rope hoist
SH Platform
**Classification**

**Basic information**

- **FEM** (Federation of European Material Handling Industry, Manufacturers' Association):
  - The mechanism group in accordance with FEM is an important design criteria for hoists
  - Hoists with identical reeving and S.W.L. may be classified differently
  - The FEM classification correlates to a defined lifetime in full load hours
  - FEM groups correspond to ISO groups

- **The FEM classification is laid down for:**
  - Rope drive: FEM 9.661
  - Mechanism: FEM 9.511
  - Motors: FEM 9.683

<table>
<thead>
<tr>
<th>Classification</th>
<th>Full load operating hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEM 5m</td>
<td>ISO M8</td>
</tr>
<tr>
<td>FEM 4m</td>
<td>ISO M7</td>
</tr>
<tr>
<td>FEM 3m</td>
<td>ISO M6</td>
</tr>
<tr>
<td>FEM 2m</td>
<td>ISO M5</td>
</tr>
<tr>
<td>FEM 1Am</td>
<td>ISO M4</td>
</tr>
<tr>
<td>FEM 1Bm</td>
<td>ISO M3</td>
</tr>
<tr>
<td>FEM 1Cm</td>
<td>ISO M2</td>
</tr>
</tbody>
</table>
## Classification

### Wire rope hoists in 1Am and 3m

<table>
<thead>
<tr>
<th>Hoist model</th>
<th>SH 4016–25 4/1 L2 KE</th>
<th>SH 5016–25 4/1 L2 KE</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.W.L.</td>
<td>6,300 kg</td>
<td>6,300 kg</td>
</tr>
<tr>
<td>Height of lift</td>
<td>6 m</td>
<td>6 m</td>
</tr>
<tr>
<td>Reeving</td>
<td>4 / 1</td>
<td>4 / 1</td>
</tr>
<tr>
<td>Hoisting speed</td>
<td>6.3 / 1.0 m/min</td>
<td>6.3 / 1.0 m/min</td>
</tr>
<tr>
<td><strong>FEM classification</strong></td>
<td><strong>1Am</strong></td>
<td><strong>3m</strong></td>
</tr>
<tr>
<td>Duty cycle of hoist motor</td>
<td>40 / 20% DC</td>
<td>50 / 20 % DC</td>
</tr>
<tr>
<td>Switching operations/hour</td>
<td>180 / 360 s / h</td>
<td>240 / 480 s / h</td>
</tr>
<tr>
<td>Deadweight</td>
<td>370 kg</td>
<td>755 kg</td>
</tr>
<tr>
<td>Headroom C</td>
<td>490 mm</td>
<td>555 mm</td>
</tr>
<tr>
<td>Hook size</td>
<td>RSN 2.5</td>
<td>RSN 4</td>
</tr>
<tr>
<td>Rope Ø</td>
<td>9.0 mm</td>
<td>12.5 mm</td>
</tr>
<tr>
<td>Rope safety factor</td>
<td>4 : 1</td>
<td>³ 8:1</td>
</tr>
<tr>
<td>Drum Ø</td>
<td>167 mm</td>
<td>219 mm</td>
</tr>
<tr>
<td>Rope sheave Ø</td>
<td>160 mm</td>
<td>225 mm</td>
</tr>
<tr>
<td>Wheel Ø</td>
<td>100 mm</td>
<td>140 mm</td>
</tr>
</tbody>
</table>

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Wire rope hoist SH
Gear
Wire rope hoist SH

Gear

- All bearings and gearing is oil lubricated: lifetime lubrication
- Gearing with high hardened flanks
- Low noise emission
- SH 3 – SH 5 enclosed housing
- SH 6 split housing
Wire rope hoist SH
Motor
Wire rope hoist SH

Motor

- Dual speed hoist motor

  > SH rope hoist: 2 windings (12/2-poled / 24/4-poled)
  > Standard protection class IP55
  > Motor rating up to 38kW standard
  > PTC temperature control standard
Wire rope hoist SH
Brake

- Two side magnetic brake
- Asbestos free
- Over dimensioned
- Low-maintenance, no re-adjustment
Wire rope hoist SH
Rope guide
Wire rope hoist SH
Rope guide

- Enclosed rope guide
- No over winding or slack rope
- Cause of the solid material GGG 40 (GJS400-15) robust and low-wear
- No temperature limitation
- Principle in fourth generation (type C, N, AS, SH)
- Reliable cause of the 360° clamping

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Wire rope hoist
Type AS up to 125 t
Wire rope hoist AS

Gear

- All bearings and gearing is oil lubricated: Life time lubrication
- Gearing with high hardened flanks
- Low noise emission
- SH 6 / AS 7 split housing
Wire rope hoist AS
Motor

- Dual speed hoist motor
  > SH rope hoist: 2 windings (12/2-poled / 24/4-poled)
  > Standard protection class IP55
  > Motor rating up to 38kW standard
  > PTC temperature control standard
Wire rope hoist AS
Rope guide
Wire rope hoist AS
Rope guide

- Enclosed rope guide
- No over winding or slack rope
- Cause of the solid material GJS400-15 robust and low-wear
- No temperature limitation
- Reliable cause of the 360° clamping
Wire Rope hoist
Winch SHW 8 / SW
The following parts are used on the wire rope hoists.
Rope hoist components
Panel / main contactor

- **Contactors**: Brand Siemens or Telemecanique

- Main contactor (switched through emergency button in pendant)
Rope hoist components
Panel / contactors

- Contactors:
  - Travel
  - Hoist
Rope hoist components
Panel / transformer

- Control voltages 42, 48, 230 Volt, optional 110 V or 24 V DC
For the yearly inspection of the Emergency end limit switch

**S260**: Drive into the Emergency stop.

**S261**: Drive back out of the Emergency stop.
Rope hoist components
Panel / rectifier

- Brake rectifier
The direct current of the brake is wired via terminals 3 + 4. On the one hand, this prevents the brake coil from being charged by feedback from the motor and thus being prevented from closing. On the other hand, the brake closes faster.

Terminals 5 + 6 are the connections for the brake coil.

The over excitation (over voltage) time for outputs 5 + 6 (brake coil) is determined by the resistor between terminals 7 + 8. This ensures that the brake is fed double voltage for a short time (0.05-2 sec) when the control pendant is activated and thus opens faster. This is particularly necessary for large brakes from H62 upwards. These two terminals are not available on smaller brakes.
Rope hoist components
Panel / rectifier

Example:
Hoist motor operating voltage: 400V

400V : 1.73 = 231V

Slow

Fast

1N = \frac{U}{\sqrt{3}}

2N = \frac{U}{\sqrt{3}}
Rope hoist components
Panel / gear limit switch

- **Hoisting limiting device:**
  Gear limit switch
**Gear limit switch:**

The old standard for the hoist limit switch, was only an emergency limit switch, for up and down, that means two switches.
Gear limit switch:

The option was operational hoist limit switch, that means a operational limit switch for up and down and an emergency limit switch for up and down, so four switches.
Gear limit switch:

The new standard is, an operational hoist limit switch with four switches.

But function of the switches is now different compare to the old one.
Rope hoist components
Panel / SLE3 / 22

- Condition monitoring system:
Function:
- Operation with dual channel load sensor 4 - 20 mA
- Motor management - adjusted via motor allocation table
- Operating hours counter
- Load cut-off - adjustable by switches
- Temperature-control for hoist and travel motors
- Crane test by means of test button
- Integrated function control (displayed by LED)
- Control of motor contactors only in economy connection
- Option relay programmable for special functions

New

SLE 3
Options relay output signal programmable to 95% of the nominal load.
Rope hoist components
Panel / SLE3 / SLE 22

Safety category 2 for load monitor

LCD1
Load sensor with two channel

SLE3

24 V

15 V
Crane test

Error display

Motor code
(motor allocation table)

Cut-off point
*rough*

Cut-off point
*fine*

Operating hours counter
Motor management

Disabling time: When activation of the hoisting motion has been completed (creep hoist / main hoist) the disabling time is started and until this has expired no start signal for the same hoisting speed is accepted (prevention of inching operation).

Change of direction: During the disabling time the hoisting motion is braked via creep hoist, stopped, then the hoist travels in the new direction in creep speed for a certain time and then changes to main speed if selected. All times depend on the motor type and are assigned automatically after selecting a motor code at the SLE 21.
Rope hoist components
Panel - option

Optional to SLE22 the SMC22

- **Special features of the SMC:**
  - Permanent overload protection by automatic load control (ALC)
  - Load spectrum recorder for load depended summation for operating time.
  - Temperature controlled (lift and drive)
  - Registration of operating data, for example operating hours, motor switching's and load cycles
  - Elimination of inching operation
  - Slack rope cut off (for example lifting beam)
  - optional connection of signal transmitter, load display
  - Data interchange with PC, either RS232 or USB
  - Activation of the crane-test, via button or the PC-Software
### Rope hoist components
#### Panel / SLE3 / 22

<table>
<thead>
<tr>
<th>Motor Type</th>
<th>S1</th>
<th>S3</th>
<th>( t_L ) [ms]</th>
<th>( t_S ) [ms]</th>
<th>( t_R ) [ms]</th>
<th>( t_A ) [ms]</th>
<th>( t_B ) [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>0</td>
<td></td>
<td>600</td>
<td>1250</td>
<td>1250</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>12/2H33</td>
<td>1</td>
<td></td>
<td>250</td>
<td>500</td>
<td>500</td>
<td>0</td>
<td>250</td>
</tr>
<tr>
<td>12/2H42</td>
<td>2</td>
<td></td>
<td>250</td>
<td>500</td>
<td>500</td>
<td>0</td>
<td>250</td>
</tr>
<tr>
<td>12/2H62</td>
<td>3</td>
<td></td>
<td>250</td>
<td>500</td>
<td>500</td>
<td>0</td>
<td>250</td>
</tr>
<tr>
<td>12/2H71</td>
<td>4</td>
<td></td>
<td>400</td>
<td>750</td>
<td>750</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>12/2H72</td>
<td>5</td>
<td></td>
<td>400</td>
<td>750</td>
<td>750</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>12/2H73</td>
<td>6</td>
<td></td>
<td>400</td>
<td>750</td>
<td>750</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>12/2H91</td>
<td>7</td>
<td></td>
<td>600</td>
<td>1250</td>
<td>1250</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td><strong>Ex-Motor</strong></td>
<td>A</td>
<td></td>
<td>400</td>
<td>750</td>
<td>750</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>A-xxx</strong></td>
<td>F</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

\( t_L \): delay times to slow speed  
\( t_S \): delay times to fast speed  
\( t_R \): delay for change of direction  
\( t_A \): starting time over the slow speed  
\( t_B \): braking time over the slow speed

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Wire rope hoist component

Overload protection

- Per EU machine directive, a load limiter is required for hoists with capacities over 1,000 kg.
There are three different types of sensors which are used for the standard overload protection:

**Compressive forced sensor**

LCD 1 (LET 1)* sensor, used for several falls at SH hoists and AS hoists (since 2013)

**Shear forced sensor**

LSD (LEI)* sensor, used for single fall at SH

LBD 1, 2, 3 (LET 8* / LET 9*) sensors used at the SHW8

LBD 3 (Load Bear Dualsensor) used for 6/1 AS

**Displacement sensor**

LGD (LAS)* sensor, used for AS7 hoists

*one channel
Overload protection standard SH wire rope hoist with LCD 1 Sensor

**Functionality:**
- The rope is reeved into the rope lock. As soon as the load pulls the rope lock, the arm gets pulled down and puts pressure on to the sensor.
AS(R)7 wird mit folgender Lasterfassung ausgestattet:

- Einscherung 2/1, 4/1, 4/2-1, 8/2-1 -> dualer Drucksensor LCD
Wire rope hoist component
Overload protection / Compressive forced sensor

- Standard Sensor LCD 1 cut through the middle
- Standard sensor LCD 1, functionality

15 Volt

24 Volt

2 DMS (strain gauge) + resistors

4 – 20 mA
Wire rope hoist component
Overload protection / Compressive forced sensor

Mounting position
Overload protection standard SH wire rope hoist with LSD Sensor

**Functionality:**
- The gearbox is overhung mounted to the frame
- As soon as the load is on the hook, the gearbox tries to turn around, but the sensor looms into the frame, so the gearbox pushes the sensor against the frame and measures the load.
AS7 will be equipped with:

- Reieving 6/1 -> **Dual shear force Sensor LBD**
The sensor LSD has the same principal function as the LCD 1
Standard sensor LSD, functionality

15 Volt  24 Volt

DMS (strain gauge) + resistors

\[ \frac{U}{I} \]

4 – 20 mA
As soon as there is load on the hook, the gear is moving because of its helical gearing, away from the sensor.

The movement of the sensor can be measured in mA.
Wire rope hoist component
Overload protection / Displacement sensor

Chip

Sensor housing
Magnet

Spring
Wire rope hoist component
Overload protection / Displacement sensor

**Function**
The spring pushes against the brass plate in the Gearbox Magnet Sensor
Wire rope hoist component
Overload protection / Displacement sensor

Mounting position
Standard pendant type STH (made by Telemecanique)

Operator has to move with the crane

Max. crane speed 63 m/min with pendant controls (BGV D6 § 17)

Pendant mounting position:
> Mobile along crane bridge

Standard features:
> Strain release cable
> Emergency-off button
Standard pendant STH
- Two-step buttons
- Up to 3 drives can be controlled by single pendant
- Plug connection

Options
- Warning light
- Key switch
- Horn switch
- Selector switch I, I+II, II
- Other buttons
Wire rope hoist component
Control – radio transmitter types

**quadrix**
- Most compact transmitter
- Dead weight 330 g
- Two step push buttons
- On-button
- Rechargeable battery

**micron 6**
- Industry standard
- Dead weight 450 g
- Two-step push buttons
- Key switch
- Emergency-off button
- Selector switch I, II, I+II
- Changeable batteries
- LC-Display can retrieve data from crane electronics

**spectrum**
- Comprehensive options
- Dead weight 1,800 g
- Joystick control
- Changeable batteries
- LC-Display can retrieve data from crane electronics
Structural design of a steel wire rope:

A steel wire rope is made up with a large number of steel wires (1). They are twisted together to strands (2a,2b). Some types of rope have also plastic inserts (4).
**Direction of lay:**
The direction of lay of the rope, is the direction of the helical line of the outer strands. There is right-handed and left-handed rope.

Right-handed (Z) ![Diagram]

Left-handed (S) ![Diagram]
**Direction of lay:**

Not only the rope has a direction of lay, the strands do also.

*Ordinary (cross) lay:*

- Right-handed: \( sZ \)
- Left-handed: \( zS \)

*Long lay:*

- Right-handed: \( zZ \)
- Left-handed: \( sS \)
**Ordinary (cross lay) rope:**
In most cases a ordinary rope suits better than a long lay rope. With ordinary ropes you can see broken wires generally earlier than on a long lay rope. That means more safety, because only if you see the broken wires you know when to change the rope before it gets dangerous.

**Long lay rope:**
The over lay rate in the rope groove is better than on ordinary ropes, that’s the reason why the use of long lay ropes is preferred in places where you have a very high dead load. The most cases where they are used is for multilayer spin, because the outer wires can’t catch the other rope liner, and so it doesn’t get damaged.
Rotation resistant rope:
A rotation resistant rope under tension will turn minimal around it’s own axis.
That means I need a rope swivelling anchorage point for multiple reeving.

When do I use a rotation resistant rope?
- Lifting an unguided load on a single fall
- Lifting an unguided load on several falls at a great lifting height
Wire rope
Non-rotation resistant rope

**Standard rope:**
A non-rotation resistant rope under tension tries to rotate around its own axis. That means I need a fixed anchorage point.

**When do I use a none-rotation resistant rope?**

- Lifting a guided load.
- Lifting an unguided load on several falls at a small lifting height.
- Lifting loads with right-handed and left-handed ropes operating in pairs.
Wire rope
Summary: Rotation resistant, non-rotation resistant

Rotation resistant

Non-rotation resistant

Rotation resistant

Non-rotation resistant
Why don’t we always use a rotation resistant rope?

Rotation resistant rope have a few disadvantages:

- higher price
- shorter lifetime
- with a guided load, the rope can’t really settle, so it will break earlier
- it is very difficult to check the wear
- the allowed deflection angle is only 1,5° (none-rotation resistant rope 3,5°)

We only use a rotation resistant rope only if we need it.
Broken wires:
Broken wires are the main reason that a rope must be changed.

Broken strands:
If the full strand is broken, the rope has to be changed immediately.

Reduction of the diameter:
As soon as the rope diameter is less than 10% from the new rope, the rope has to be changed.
Rope deformation

**Corkscrew:**

If the measurement $x$ is $1/3$ of the diameter, the rope must be changed.

*Bird caging:*

It’s caused by twisting the rope, the become longer than the rope.
**Formation of loops:**
If looping is visible as on the picture, change the rope immediately.

**Flatness, kinks:**
With permanent deformations the rope must be changed.
**Tightened kink:**
Formed if a loop sling was applied to tighten it.

**Rope bend:**
A rope bend is formed if the rope is pulled over a sharp edge.
Rope hoist trolley
Stationary

<table>
<thead>
<tr>
<th>Type</th>
<th>Lifting capacity up to (kg)</th>
<th>Standard-Reeving</th>
<th>Reeving for true vertical lift</th>
<th>Stationary</th>
</tr>
</thead>
<tbody>
<tr>
<td>SH 3</td>
<td>3.200</td>
<td>1/1, 2/1, 4/1</td>
<td>2/2-1, 4/2-1</td>
<td>□</td>
</tr>
<tr>
<td>SH 4</td>
<td>6.300</td>
<td></td>
<td></td>
<td>□</td>
</tr>
<tr>
<td>SH 5</td>
<td>12.500</td>
<td></td>
<td></td>
<td>□</td>
</tr>
<tr>
<td>SHR 6</td>
<td>16.000</td>
<td>1/1, 2/1, 4/1</td>
<td></td>
<td>□</td>
</tr>
<tr>
<td>SH 6</td>
<td>25.000</td>
<td>1/1, 2/1, 4/1</td>
<td>2/2-1, 4/2-1, 8/2-1</td>
<td>□</td>
</tr>
<tr>
<td>AS 7</td>
<td>125.000</td>
<td>2/1, 4/1, 6/1, 8/1</td>
<td>2/2-1, 4/2-1, 8/2-1</td>
<td>□</td>
</tr>
<tr>
<td>SHW 8</td>
<td>160.000</td>
<td></td>
<td>4/2-1, 8/2-1, 12/2-1</td>
<td>□</td>
</tr>
</tbody>
</table>

Different possibilities for crane builders or manufactures

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<table>
<thead>
<tr>
<th>Type</th>
<th>Lifting capacity up to (kg)</th>
<th>Standard-Reeving</th>
<th>Reeling for true vertical lift</th>
<th>Double girder crab OE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SH 3</td>
<td>3.200</td>
<td>1/1,</td>
<td>2/2-1,</td>
<td></td>
</tr>
<tr>
<td>SH 4</td>
<td>6.300</td>
<td>2/1,</td>
<td>4/2-1</td>
<td></td>
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<tr>
<td>SH 5</td>
<td>12.500</td>
<td>4/1</td>
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<td></td>
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<tr>
<td>SHR 6</td>
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<tr>
<td>SH 6</td>
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<td>2/2-1, 4/2-1, 8/2-1</td>
<td></td>
</tr>
<tr>
<td>AS 7</td>
<td>125.000</td>
<td>2/1, 4/1, 6/1, 8/1</td>
<td>2/2-1, 4/2-1, 8/2-1</td>
<td></td>
</tr>
<tr>
<td>SHW 8</td>
<td>160.000</td>
<td>-</td>
<td>4/2-1, 8/2-1, 12/2-1</td>
<td></td>
</tr>
</tbody>
</table>
Rope hoist trolley
OE

- Hoist installed on top of bridge girders, thus best usage of available height
- Typically used for capacities > 5 ton
- Total headroom from top of crane to hook is equal to total headroom of trolley. Overall headroom is independent from height of crane girders.

OE-S04 - OE-S05

OE-S06 - OE-S07
## Rope hoist trolley KE

<table>
<thead>
<tr>
<th>Type</th>
<th>Lifting capacity up to (kg)</th>
<th>Standard-Reeving</th>
<th>Reving for true vertical lift</th>
<th>Mono rail trolley KE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SH 3</td>
<td>3.200</td>
<td>1/1,</td>
<td>2/2-1,</td>
<td>■</td>
</tr>
<tr>
<td>SH 4</td>
<td>6.300</td>
<td>2/1,</td>
<td>4/2-1</td>
<td>■</td>
</tr>
<tr>
<td>SH 5</td>
<td>12.500</td>
<td>4/1</td>
<td></td>
<td>■</td>
</tr>
<tr>
<td>SHR 6</td>
<td>16.000</td>
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<td>■</td>
</tr>
<tr>
<td>SH 6</td>
<td>25.000</td>
<td>1/1, 2/1, 4/1</td>
<td>2/2-1, 4/2-1, 8/2-1</td>
<td>□</td>
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<tr>
<td>AS 7</td>
<td>125.000</td>
<td>2/1, 4/1, 6/1, 8/1</td>
<td>2/2-1, 4/2-1, 8/2-1</td>
<td>□</td>
</tr>
<tr>
<td>SHW 8</td>
<td>160.000</td>
<td>-</td>
<td>4/2-1, 8/2-1, 12/2-1</td>
<td></td>
</tr>
</tbody>
</table>
Available up to 16 ton

Most economical solution for cranes up to 10/16 t

Crane headroom = hoist headroom + bridge girder height

Headroom depends on flange width of bridge
## Rope hoist trolley

### UE

<table>
<thead>
<tr>
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<th>Reeling for true vertical lift</th>
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Rope hoist trolley
UE

- Up to 25 ton: 8 wheel trolley UE-S77. Up to 50 ton: possible with 12 wheels
- Typical application: maintenance hoist on monorail track (in power stations etc.)

**Advantage:**
- Only one bridge girder required

**Disadvantages:**
- Heavy dead weight
- Long headroom (trolley and bridge)

ℹ️ Over 16 ton, UE is more expensive than OE. Cost and bridge girder height make cranes in this capacity range impractical
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These trolleys are used on runways with small curve radius.

Rule of thumb: \(\text{wheelbase} = \text{curve radius}\).
Thanks for your attention
STAHL CraneSystems

> Lifting technology
> Drive technology
> Control technology

⇒ www.stahlcranes.com