



Increasing safety and performance in HDD: the role of the latest developments



Simon Herrenknecht

Herrenknecht AG

July 2021



UNDERGROUND CONSTRUCTION TECHNOLOGY

The Underground Utilities Event | July 13-15, 2021 | Music City Center | Nashville, TN

Herrenknecht AG in Schwanau, Germany.



210

TRAINEES IN 2020

5.244

**EMPLOYEES AT
YEAR END 2020***

1.069

**TOTAL OUTPUT
2020 IN MILLION
EURO**

1.007

**REVENUE 2020 IN
MILLION EURO**

1.153

**ORDER INFLOW 2020
IN MILLION EURO**



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Herrenknecht Group.

Application fields of Herrenknecht machine solutions.





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Herrenknecht Portfolio. Traffic Tunnelling

Roads

Railway

Metro





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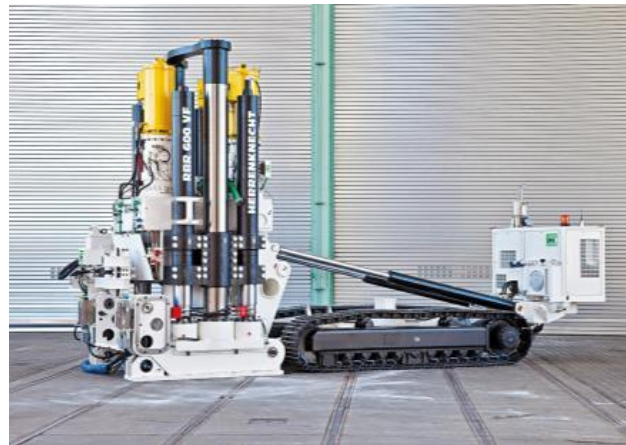
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Herrenknecht Portfolio. Mining

Shaft Drilling

Boxhole Boring

Raise Boring





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Herrenknecht Portfolio. Exploration

Exploration

Geothermal





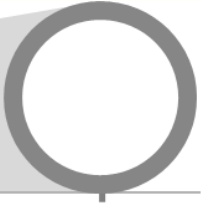
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Herrenknecht Portfolio. Utility Tunneling



0.25m



4.8m



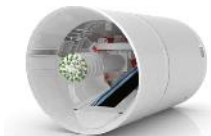
Tunnelling/Shfts



Pipeline



Energy





Herrenknecht HDD.

Risks of Projects

2 Types of Risk

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graph TD; A[2 Types of Risk] --> B[Project/Drilling]; A --> C[Personal Safety];
```

Project/Drilling

- Frac Outs
- Undersized equipment
- Pipe stuck

Personal Safety

- exposed danger zones
- insufficient control over equipment
- insufficient attention



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Frac Outs

Weeper Sub



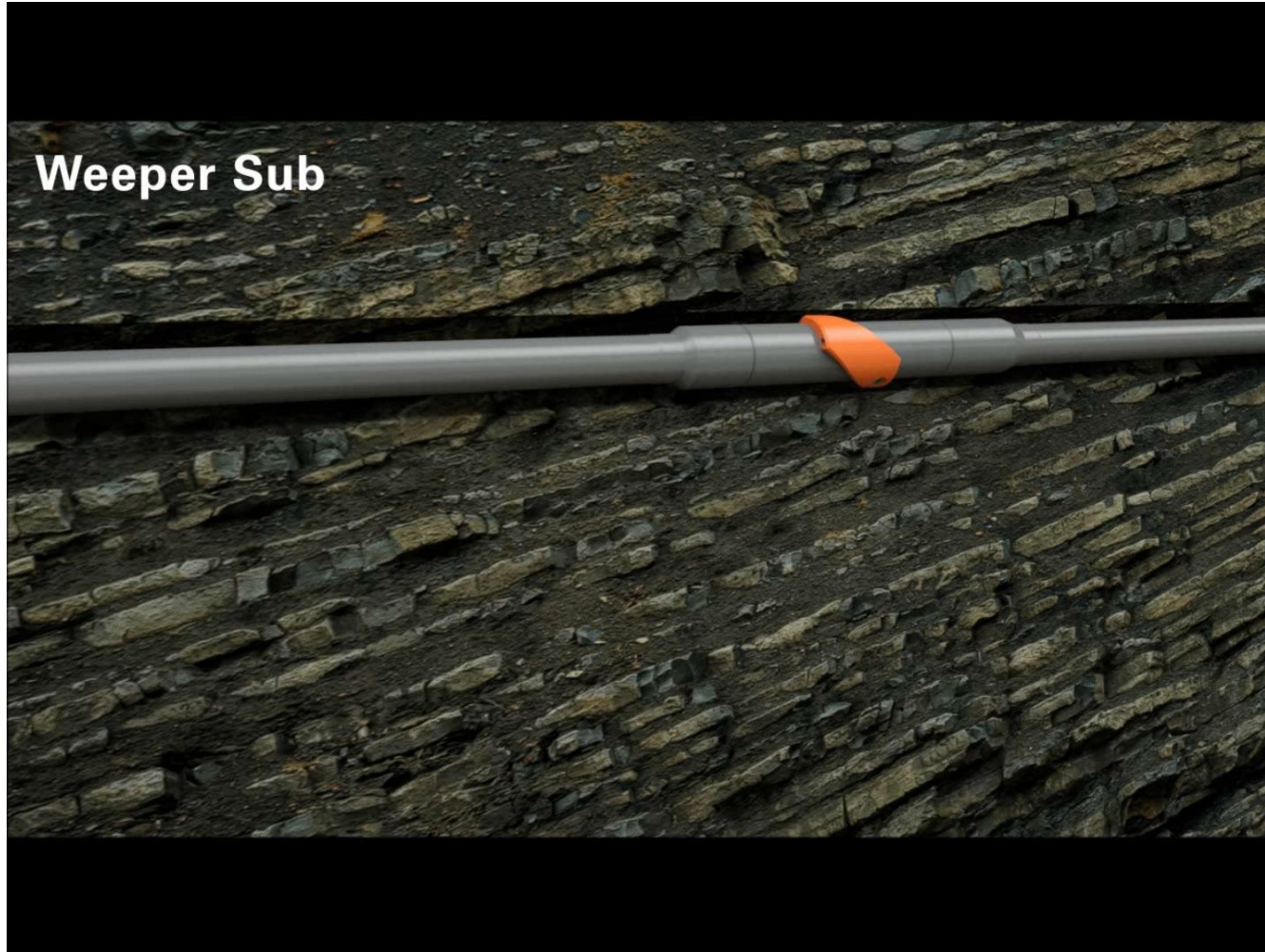


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Frac Outs

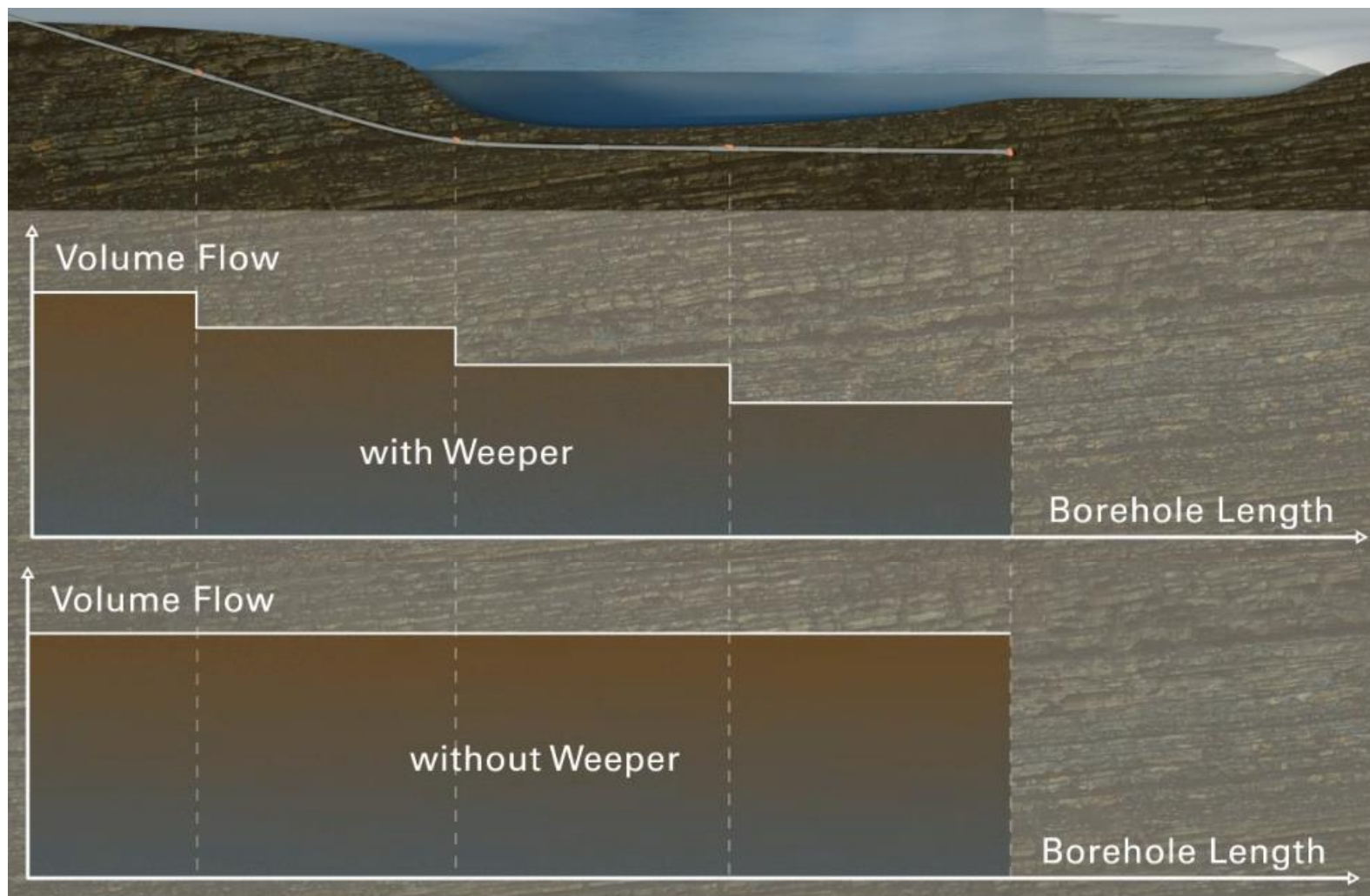
Weeper Sub





Frac Outs

Weeper Sub



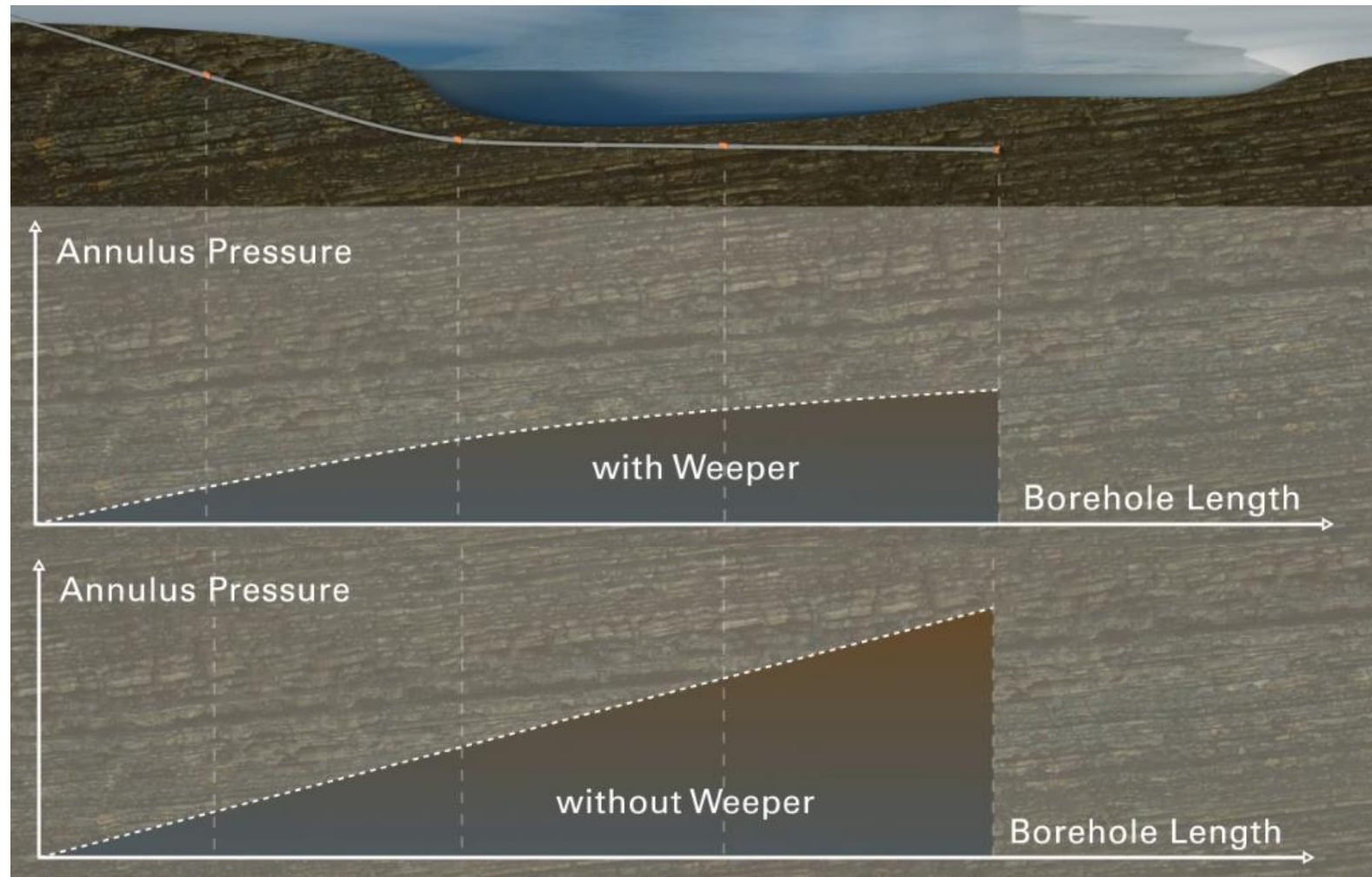


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Frac Outs

Weeper Sub





Frac Outs

Weeper Sub

Advantages at a Glance

- Low pressure axial jet nozzle instead of radial high pressure jet nozzles
- Hydr. & mech. agitation of the cutting bed
- Lifting of the drill string
- Open area for better “flow thru” & less resistance
- Pressure reduction down the hole

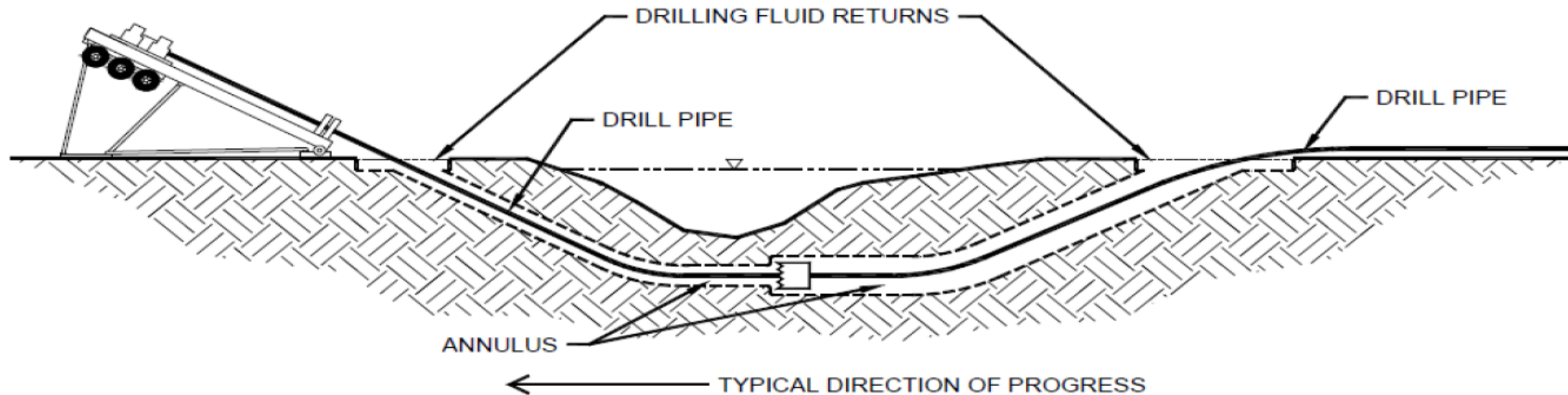




Frac Outs

Down Hole Jet Pump

- ▶ Principle HDD arrangement of the borehole and drill string
- ▶ Return flow through borehole
 - ▶ either to Rig side or to Pipe side





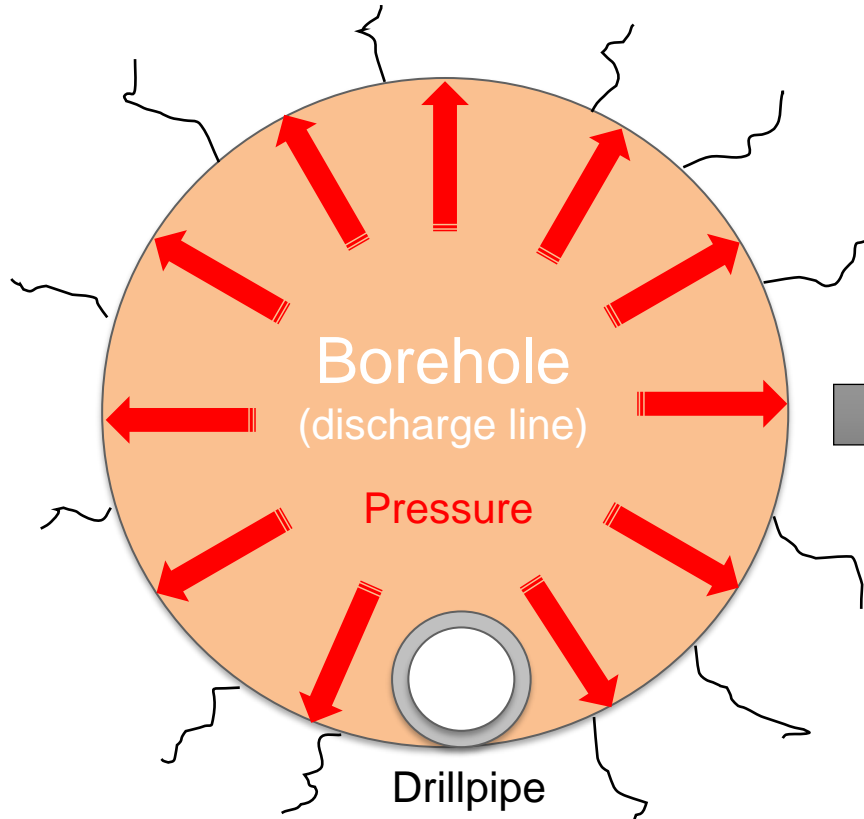
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Frac Outs

Down Hole Jet Pump

Conventional HDD



HDD with new Jet Pump





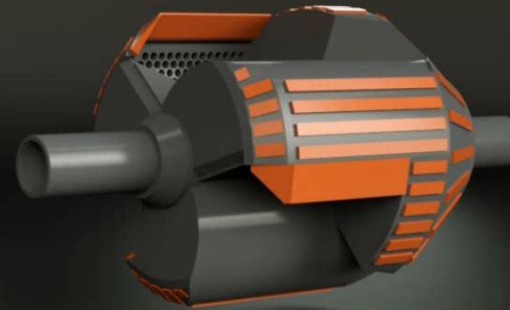
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Frac Outs

Down Hole Jet Pump

Down Hole Jet Pump

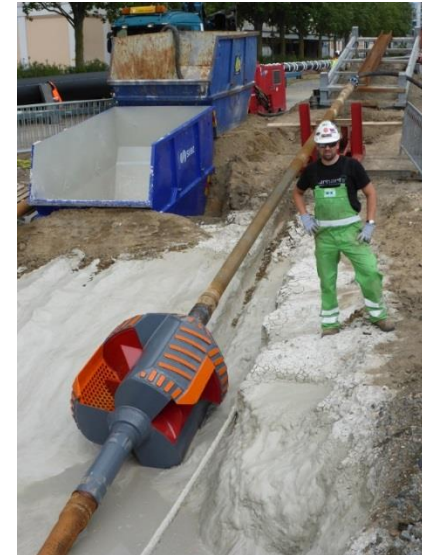




Frac Outs

Reference Project: Malmö Harbor Channel Crossing

- ▶ H-165, HK150C Crawler Rig
- ▶ Location: Malmö, Sweden
- ▶ Project: District Heating Pipeline
- ▶ Drilling length: 850ft. (263m)
- ▶ Pipeline: 40" HDPE casing pipe with inner steel pipeline for heat transport
- ▶ Geology: hard limestone, flintstones
- ▶ Contractor: BAB Rörtryckning AB



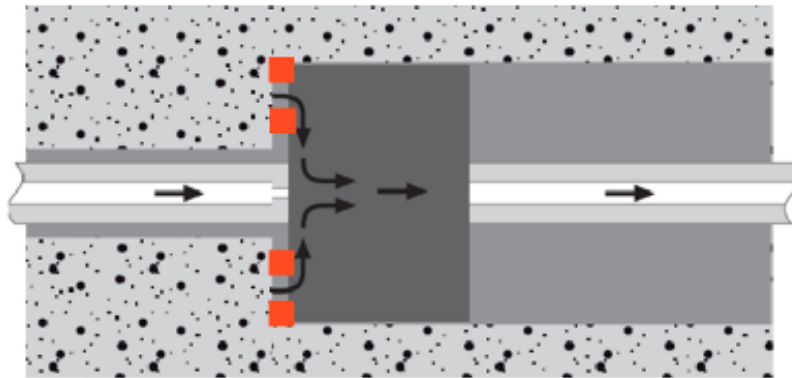


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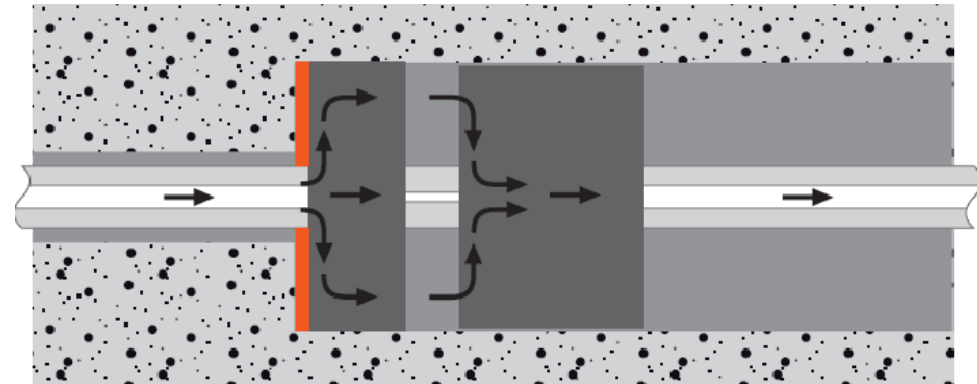
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Frac Outs

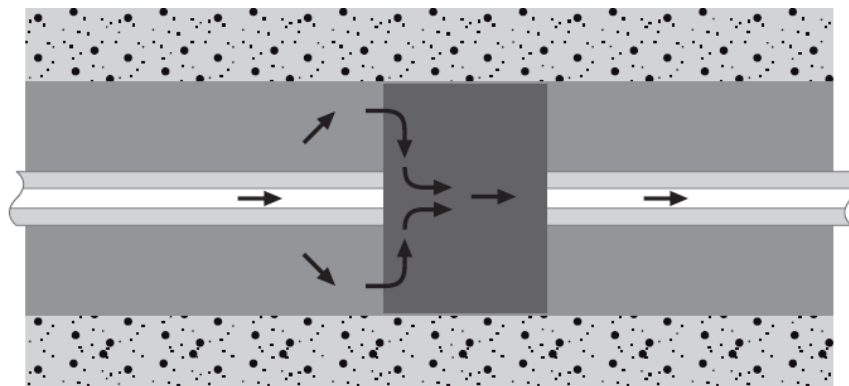
Down Hole Jet Pump



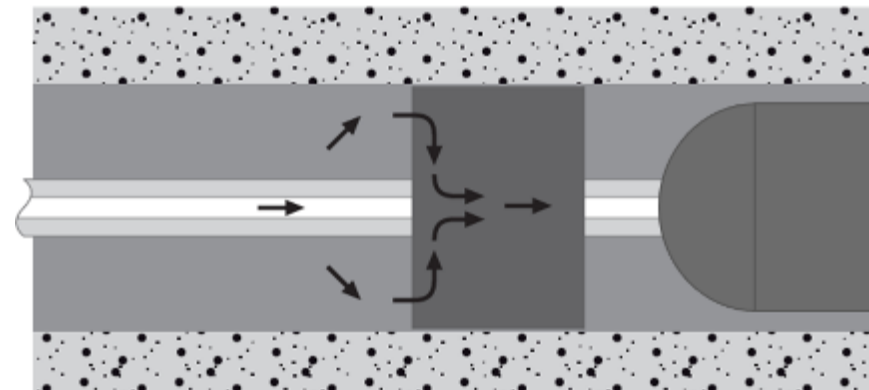
Soft ground tool mode for reaming



Tandem mode: with Full face hole opener for hardrock projects



Cleaning run after successful reaming



Pipe pull mode for pullback



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Correct size of equipment HDD Rigs

HK250T



HK80CK



HK500T





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Correct size of equipment

HDD Rigs



HK80CK

Pullforce 180,000 lbs

Torque 44,250 ft-lbs



51,630 ft-lbs



HK250T

Pullforce 560,000 lbs

Torque 66,380 ft-lbs



88,510 ft-lbs



HK500T

Pullforce 1,120,000 lbs

Torque 103,250 ft-lbs



132,760 ft-lbs

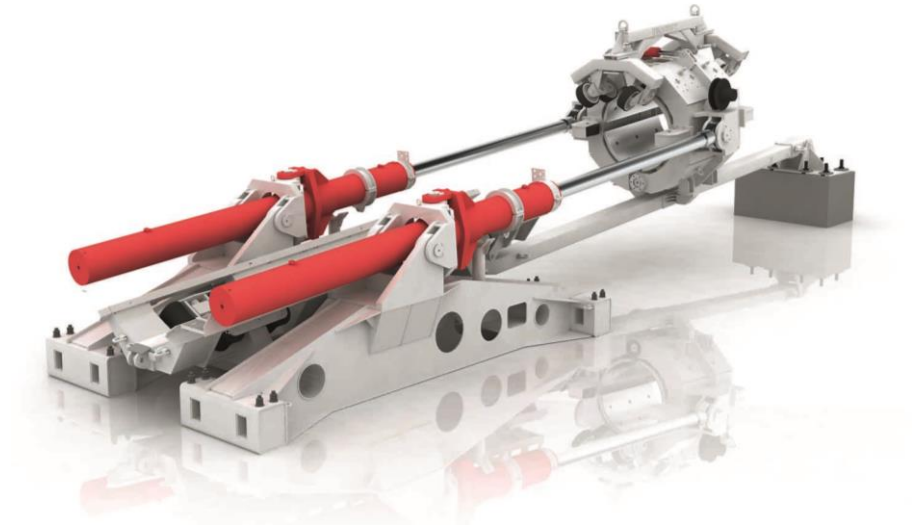


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Pipe Stuck

Pipe Thruster // HDD Assist



HK500PT

Push/Pull: 1,100,000 lbs

HK750PT:

Push/Pull: 1,650,000 lbs



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Pipe Stuck

Pipe Thruster // HDD Assist





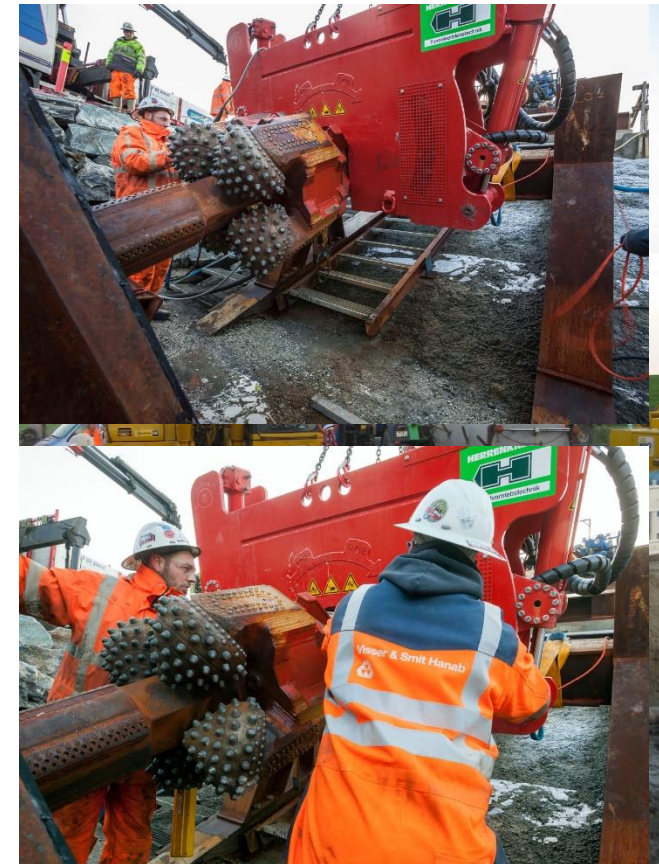
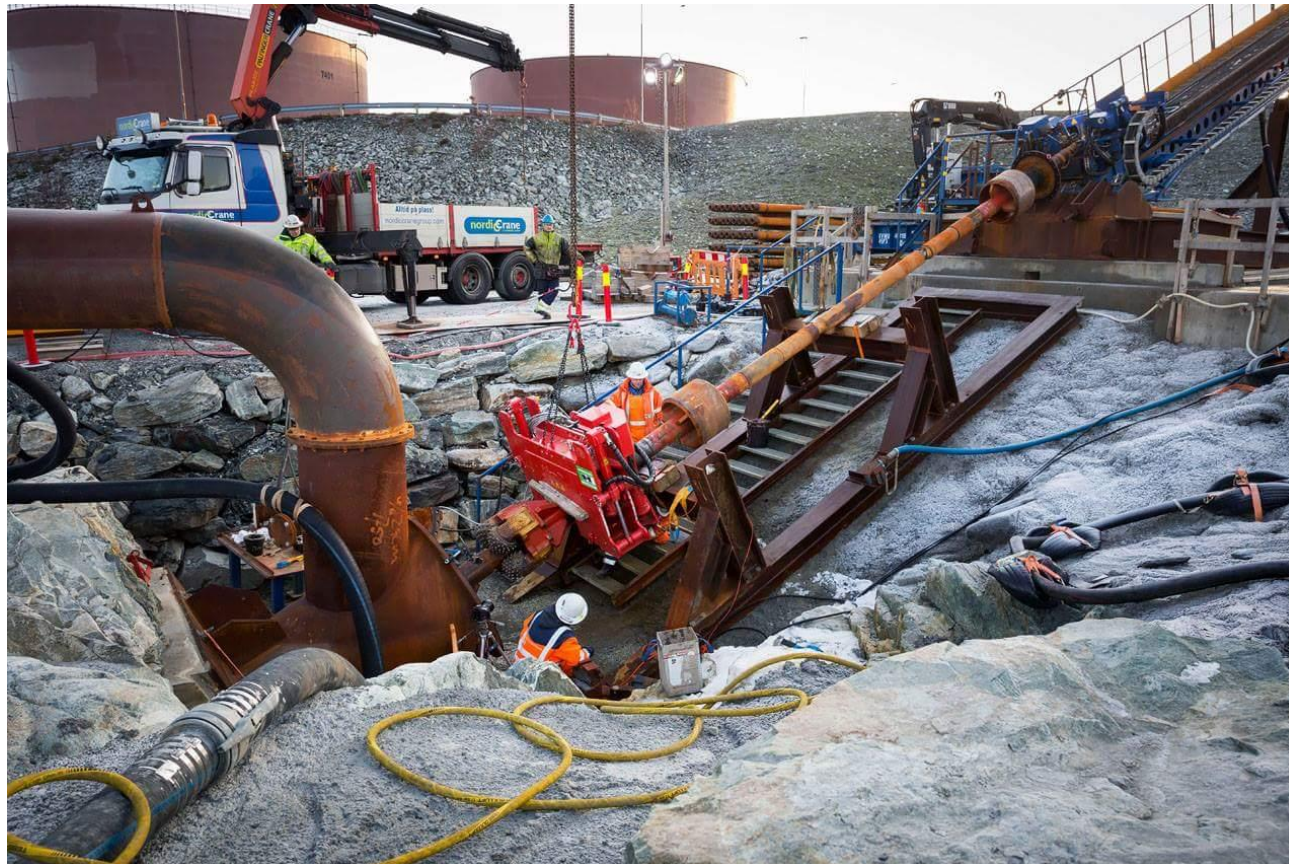
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Danger zone

Breakout/Makeup tools

Till now



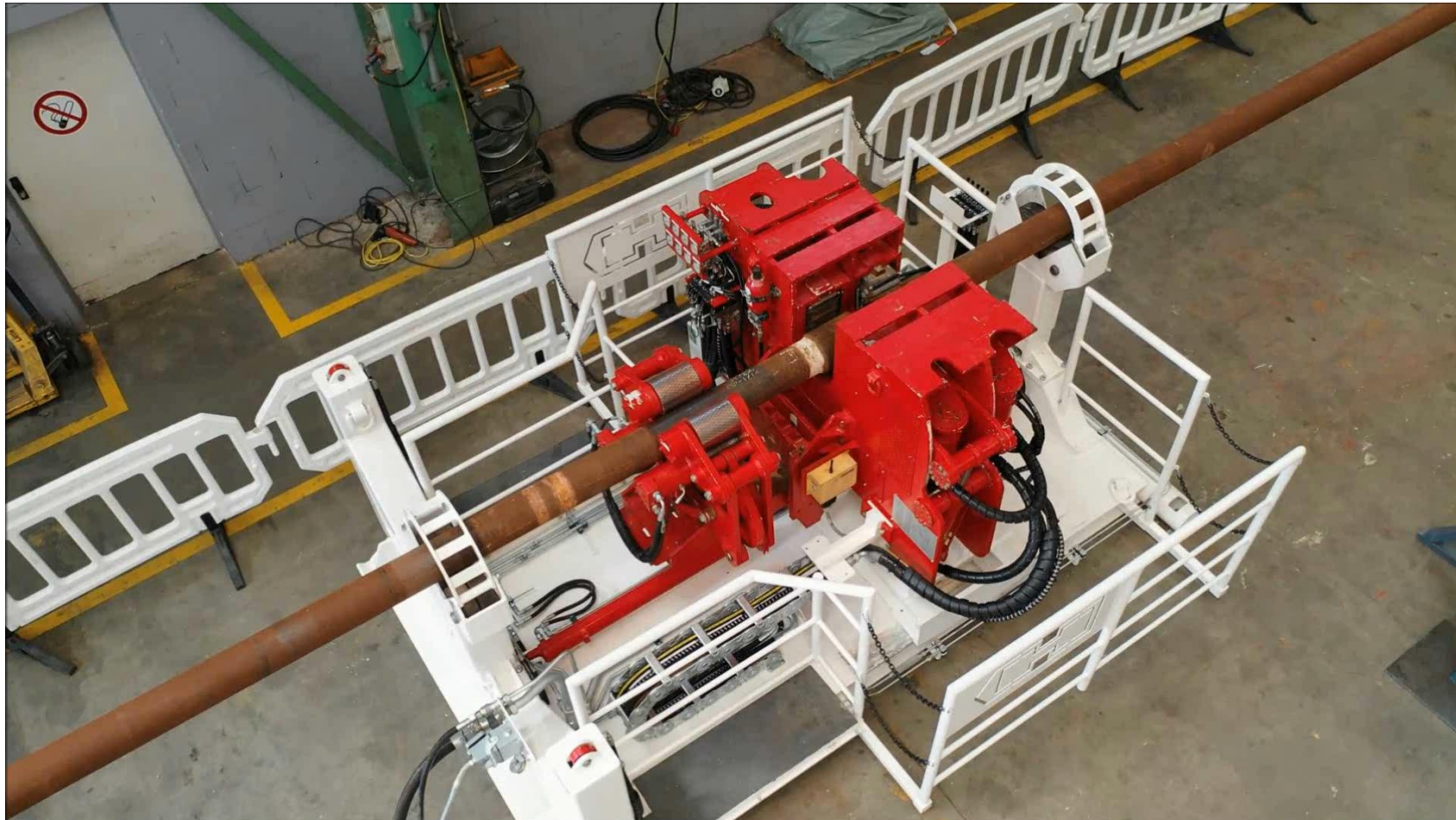


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Danger zone

Exit Side Unit





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Danger zone

Exit Side Unit



- ▶ Exit Side Unit with Spinner Unit (hydr. adjustable to drillpipe angle, demountable breakout unit, etc.)



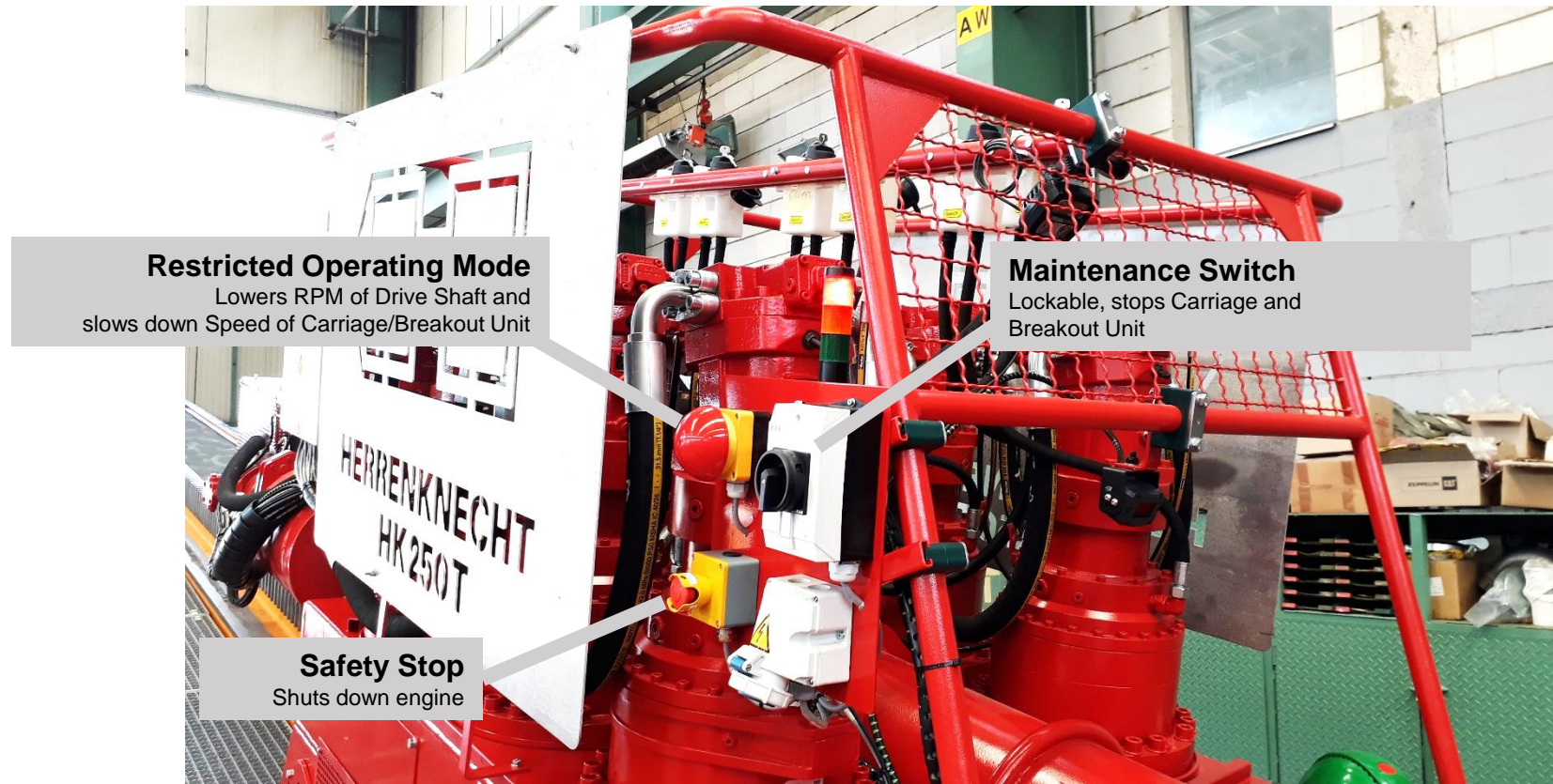


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Danger zone

Increase Attention



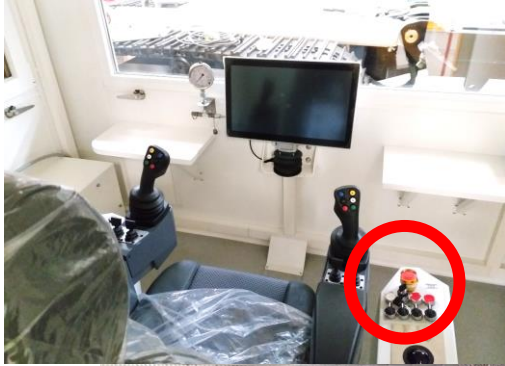


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Danger zone

Safety stops





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Possibilities

- Big and special projects possible





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Thank you.

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