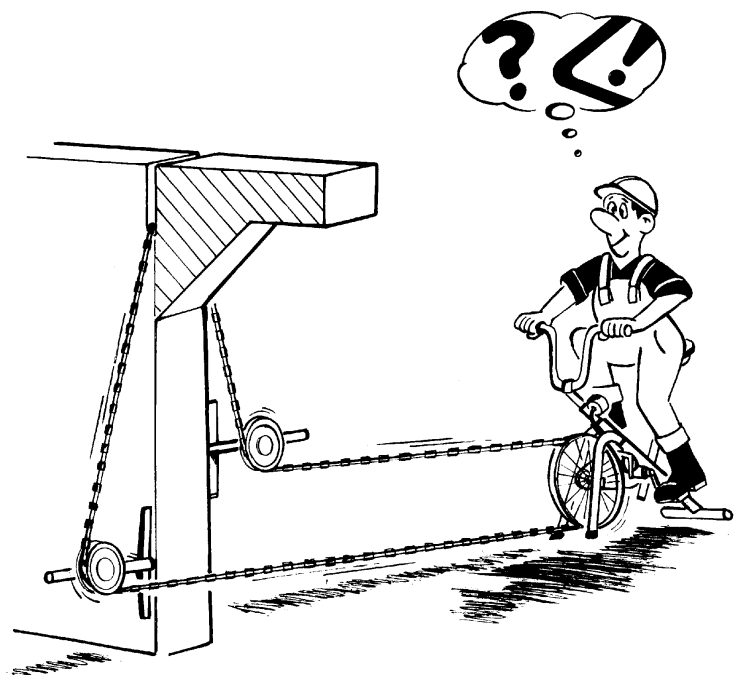


Safety Manual ***System Description***

Diamond wire saws

Issue: 20.2.04



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0 Introduction

0.1 Scope of the Safety Manual

The Safety Manual contains a description for safe handling of diamond wire saw systems. It contains all the safety instructions that must be followed when working with and on the system. Safety instructions specific to each machine will be found in the corresponding Operating Instructions and must likewise be strictly adhered to.

0.2 Document structure

The diamond wire sawing documentation is structured as follows:

- General system:** **Safety Manual** with the following contents:
(Technical Data, Safety Instructions, System Description, Design and Function, Assembly / Disassembly, Operation, Maintenance) Disposal)
- Machines:** **Operating Instructions** with the following contents:
(Product Description, Safety Instructions, Design and Function, Assembly / Disassembly, Operation, Maintenance)
- Components:** **Instruction leaflet** with the following contents:
(Exploded view with part numbers, important instructions on use)

0.3 Terms

0.3.1 General Terms

Operating Instructions

The Operating Instructions are an essential document accompanying the product. They contain all the information that is necessary to operate the product safely and to be able to maintain it.

The Safety Manual for diamond wire sawing systems along with the Operating Instructions for machines produced by **TYROLIT Hydrostress AG** and the descriptions of machines sourced from outside suppliers are supplied with the system parts.

Official EU language

The official languages of the European Union are currently: Danish, German, English, Finnish, French, Greek, Dutch, Italian, Portuguese, Swedish and Spanish.

National language

The official language of the respective country is referred to as the national language.

Original language

The language in which the document was written is referred to as the original language. The original language of this Safety Manual is German.

0.3.2 Terms related to diamond wire sawing

Term	Definition
Diamond wire saw	The diamond wire saw contains the feed motor (electric, hydraulic) for the diamond wire storage, and the drive motor (electric or hydraulic) for the cutting tool drive.
Diverter rolls	The diverter rolls act as guides for the diamond wire.
Supports	Supports are what the deflection rollers rest upon.
Cutting tool	The diamond wire is referred to as a cutting tool.
Water lances	Water lances are needed to convey water to the cut.
Drive (electric and hydraulic)	The drive provides the power for the electric motors and the control unit as well as the appropriate power for the hydraulic motors.
Motors	A distinction is made between a drive motor (tool) and a feed motor (forward and backward motion of the diamond wire storage rolls). The motors can be electrically powered for low outputs or hydraulically powered for higher outputs.
Diamond wire guard	The diamond wire guard is a safety device that prevents accidental contact with the tool, intercepts flying parts and at the same time acts as a spray guard.

1 Technical data

1.1 Recommended ambient temperature

Storage: between -15 °C and 50 °C

Usage: from -15 °C to 45 °C

Warning: At sub-zero temperatures to as low as -15 °C antifreeze must be used. If the system is shut down or at a standstill for long periods the cooling water must be blown out of the system.

At ambient temperatures of around $+45\text{ °C}$ the water must be cooled.

1.2 Water connection

Pressure: min. 1 bar to max. 6 bar at 25 °C

Quantity: min. 6 l/min.

1.3 Cutting speed

This must be selected according to the nature of the material.

The recommended values in m/sec. are

Granite, marble, old concrete with or without reinforcement 20-25 m/s

Abrasive materials, new concrete, asphalt, sandstone, etc. 25-30 m/s

Maximum permitted cutting speed
for TYROLIT tool

35 m/s

1.4 Specification for oils and grease

1.4.1 Oils

Hydraulic oil: HLP / ISO VG 46

Gear oil: ISO VG 100

1.4.2 Grease

Gear grease: Penetration: 420-460
NLGI: 00

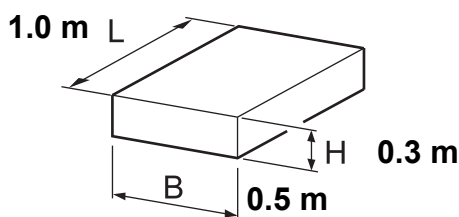
Lubricating grease: Penetration: 265-295
NLGI: 2

1.5 Weights

- Relative densities:
 - Asphalt: 1.5 t/m³
 - Reinforced concrete: 2.7 t/m³
 - Granite: 2.8 t/m³
 - Sandstone: 2.5 t/m³

1.5.1 Weight calculation (example):

- Calculation formula: $L \times B \times H \times \text{material} = \text{Weight}$
- Example (reinforced concrete): $1 \times 0.5 \times 0.3 \times 2,700 = 405 \text{ kg}$



Material in kg/m³
 Weight in kg
 Length, breadth, height in m

1.6 Power consumption

The power consumption of the various drives differs considerably.

Details of the power consumption of a particular drive can be found on the corresponding rating plate.

1.7 Name plates

All data specific to the type of machine and components can be found on the name plates fitted.

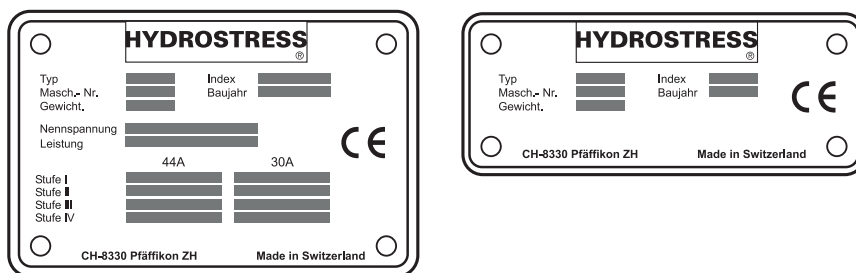


Fig. 1-1 Name plates

2 Safety instructions

2.1 General

2.1.1 Target audience

This chapter describes the safety instructions that it is essential to follow when using diamond wire sawing systems.

All persons who work on and with the diamond wire saws have a duty to read and understand the chapters of the Safety Manual relevant to their particular activities.

This applies in particular to the “Safety instructions” chapter which is mandatory for all persons and activities.

2.1.2 Observance of the safety instructions

No work must be performed on or with the diamond wire saw before the safety instructions contained in the Safety Manual and in the Operating Instructions (Chapter 2) have been read and understood. The Safety Manual and the Operating Instructions are the mandatory references for all work – instruction leaflets are of an informative nature and contain certain instructions only concerning correct use.

Diamond wire saws are inspected before being shipped and are delivered in perfect condition. **TYROLIT Hydrostress AG** does not accept any liability for damage caused by the failure to observe the instructions and information provided in the Safety Manual and in the Operating Instructions. This applies in particular to:

- Damage caused by improper use and operator error.
- Damage caused by improperly installed third-party software.
- Damage caused by failure to observe safety-related information in the Safety Manual or shown on the warning signs fitted to the machine.
- Damage caused by defective or absence of maintenance work.
- Damage caused by cutting unauthorised material.

Independently performed conversions and alterations may affect safety and are not permitted.

2.2 Information and symbols

2.2.1 Hazard symbols

In this Safety Manual and in the Operating Instructions information panels are used to draw attention to residual dangers and to point out important technical requirements.

Hazard symbols.

2.2.1.1 Hazard symbols in the Safety Manual



Danger

Warning of danger, where failure to comply could lead to death or serious injury.



Warning

Warning of danger, where failure to comply could lead to injury and/or damage to property.

Information symbols.

2.2.1.2 Information symbols in the Safety Manual



Information

Text displayed in this way is practical information and is aimed at achieving optimum use of the installation or apparatus. Failure to take note of this information may mean that the performances shown in the technical data can no longer be guaranteed.

2.2.2 Instructions on the product



Danger

Voltage warning

Before working in an area identified in this way, the installation or device must be fully disconnected from the power (voltage) and secured against being accidentally powered up again.

Failure to heed this warning may lead to death or serious injury.

2.2.3 Generally applicable warnings of residual dangers

In the following warnings of residual dangers are shown that are generally applicable to all work with and on the diamond wire saws and during all phases of the life of the systems.



Danger	
<p>Electric shock due to defective electrotechnical equipment.</p> <p>The electrotechnical equipment must be checked prior to each use and from time to time during prolonged usage. Defective parts such as cables and plugs must be exchanged by electrotechnically trained personnel in the powered down state.</p> <p>Failure to comply with this regulation may lead to serious physical injury or death. Secondary damage such as fires may also occur.</p>	



Warning	
<p>Danger from sharp edges of the diamond wire</p> <p>Touching the diamond wire whilst it is still in motion is prohibited.</p> <p>When touching the diamond wire it is recommended that protective gloves are worn.</p> <p>Failure to adhere to this regulation may result in cut wounds to the hands.</p>	



Warning	
<p>Danger of allergic reactions if skin comes into contact with hydraulic oil.</p> <p>Persons who have an allergic reaction to hydraulic oil must wear protective gloves and goggles when carrying out work where they come into contact with hydraulic oil. Any areas of the skin affected must be rinsed immediately with copious amounts of water.</p> <p>Failure to adhere to this regulation may result in allergic reactions or injuries to the eyes.</p>	

2.3 Safety principles

2.3.1 Delimitation of the safety concept

Diamond wire saws have no effect on the safety concept of other systems, apparatus and installations.

2.3.2 Safety elements

Protection of users is based primarily on a safety concept and design safety.

2.3.2.1 Passive safety elements

Protection from live parts

All functional units that contain parts which carry hazardous voltages, are shock-protected by suitable covers.

2.3.3 Removing protective devices

Protective devices should only be removed when the device is turned off, disconnected from the mains and at a standstill. Covers in particular should only be removed and refitted by authorised personnel (see Chapter 2.5.1 "Authorised personnel", 2-9).

The only exception should be the changing of diamond wire, including the diamond wire guard, but then only when the Emergency Stop button has been pressed.

Before using the diamond wire saw again, the safety elements must be checked for correct operation.

2.3.4 Safety measures (organisational)

2.3.4.1 Product monitoring obligation

Operating personnel must notify changes in operational behaviour or of safety-related parts to a responsible person or the manufacturer immediately.

2.3.4.2 Location of the Safety Manual

A copy of the Safety Manual must be available at all times to staff at the place of use of the apparatus.

2.3.5 Safety measures (personnel)

2.3.5.1 Individual protective equipment

Anyone working with and on diamond wire saws is required to wear individual protective equipment.

The individual protective equipment comprises the following:

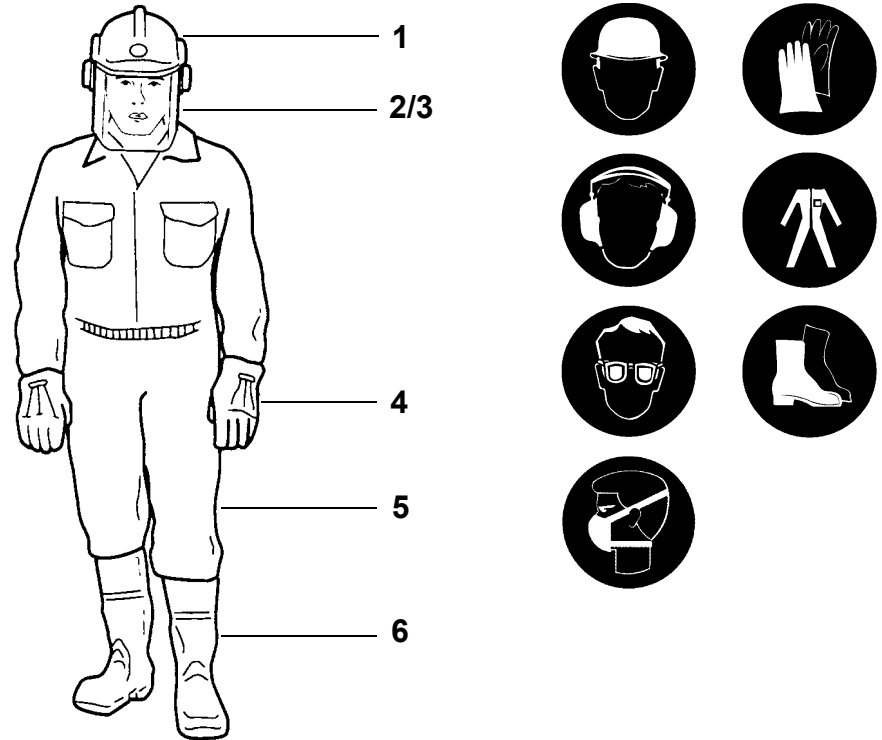


Fig. 2-1 Individual protective equipment

- | | |
|---|---|
| <ul style="list-style-type: none"> 1. Helmet with ear protectors 2. Visor or goggles 3. Breathing mask 4. Safety gloves | <ul style="list-style-type: none"> 5. Close-fitting, sturdy, comfortable clothing 6. Work boots with steel toecaps and non-slip soles |
|---|---|

The specific safety instructions given in the individual chapters may sometimes contain only some of the pictograms shown above. These relate to safety measures to be taken solely in relation to the associated specific hazard and therefore do not excuse the operator from heeding this instruction to wear all the items of individual protective equipment listed above.

2.4 General safety rules

2.4.1 Statutory provisions

The generally applicable national and local safety and accident prevention provisions and the supplementary operator regulations must be followed and complied with.

2.4.2 Warranty

TYROLIT Hydrostress AG warrants that its diamond wire saws will operate correctly and safely on condition that all the directions, working instructions and maintenance instructions contained in this Safety Manual and in the Operating Instructions are strictly followed and observed.

TYROLIT Hydrostress AG will not entertain claims for damages or warranty claims for damage that has arisen as a result of improper or inappropriate handling.

2.4.3 Inspection and maintenance obligation

The operator is under an obligation to only use diamond wire saws when they are in a perfect and undamaged condition. The maintenance intervals shown in the Safety Manual must be strictly observed. Malfunctions and mechanical damage must be rectified without delay.

2.4.4 Spare parts

Only original **TYROLIT Hydrostress AG** spare parts should be used. Otherwise damage may be caused to the diamond wire saws or property damage and personal injury may result.

2.4.5 Power connections

Diamond wire saws, that are operated by electrical components must be connected to an earthed power supply.

Before putting into operation a check must be made that the local mains voltage corresponds to the operating voltage of the electrical components. If this is not the case, the operating voltage setting must be adjusted accordingly. Detailed information on this will be found in the corresponding Operating Instructions.

The operating voltage of electrical components supplied by **TYROLIT Hydrostress AG** is basically set at 230 V AC or 3 x 400 V AC.

The power supply must be disconnected before removing any housings.

2.4.6 Modifications

No technical alterations should be made independently to the equipment and installation components in the form of additions or conversions without the written consent of **TYROLIT Hydrostress AG**. This concerns all additions and conversions that are not provided for by the system design.

2.4.7 Safety instructions in the individual chapters

The chapters of this Safety Manual and of the Operating Instructions contain additional safety instructions. These make reference to specific potential dangers (residual dangers). The instructions must be followed closely and require that the actions or sequences of actions described are taken.

2.4.8 Correct application

The diamond wire saw is designed and built for the following application:

- Cutting of concrete (including reinforced concrete) and natural stone, for other materials please contact us.
- Cutting of parting cuts, flush cuts, cross-cuts and joints in ceilings, floors or walls.
- Diamond wire saws should only be used and operated with the authorised anchoring systems.
- Only original TYROLIT cutting tools, diamond wire connectors and accessories should be used.

The applicable mandatory limitations on use and parameters are contained in Chapter 1 "Technical data", 1-1.

2.4.9 Abuse or misuse

Any use other than for the intended purpose (see Chapter 2.4.8, 2-7), constitutes improper use or misuse.

Since improper use or misuse can sometimes results in considerable danger, here details of what we believe constitutes improper use or misuse.

The following applications are prohibited:

- Cutting wood, glass and plastics
- Cutting of loose parts (including in concrete)
- Operation in explosion-protected areas
- Cutting without system and tool cooling
- Cutting with non-original TYROLIT cutting tools, diamond wire connectors and accessories
- Cutting without the safety devices provided
- Incorrect diamond wire guiding and non-observance of instructions for use
- Incorrect or absence of waste water disposal (saw sludge)

2.4.10 Making the workplace safe

Before starting work enough space should be created to ensure working without danger.

The workplace must be adequately lit.

Danger areas must be visibly cordoned off so that no-one can enter the danger areas during sawing.

The front, underneath and rear of the sawing area must be protected so that persons or equipment cannot be harmed or injured by falling parts or sawing sludge. Lumps of concrete that have been loosened must be secured against falling.

Breathing in the water fog that is created is a health hazard. Ensure adequate ventilation in sealed-off areas.

The sludge resulting from cutting is very slippery. Suitable steps must be taken (removal or cordoning off) so that persons do not slip and injure themselves.

2.5 Responsibility

2.5.1 Authorised personnel

Work on or with diamond wire saws should only be performed by authorised persons. Personnel are considered to be authorised if they meet the necessary training and know-how requirements and they have been assigned a precise functional role.

The personnel qualifications for the corresponding work are defined in the introduction under "General" of the respective chapters.

2.5.2 Delimitation of authority (functional roles)

2.5.2.1 The manufacturer

TYROLIT Hydrostress AG or its local agents in the EU are deemed to be the manufacturer of equipment components supplied by **TYROLIT Hydrostress AG**. Within the context of an integrated quality and safety control system the manufacturer is entitled to request from the operator information on its diamond wire saw.

2.5.2.2 Operator

As the primary legal entity, the operator is responsible for the correct use of the product and for the training and use of the authorised personnel. He sets out the mandatory skills and level of training of the authorised personnel for his company.

2.5.3 User (operator)

- Sets up the diamond wire saw systems for the material to be cut or the material thickness.
- Performs sawing tasks independently and monitors these.
- Locates malfunctions and initiates or performs troubleshooting.
- Carries out servicing and simple maintenance.
- Monitors the correct functioning of the safety devices.
- Makes the site safe.

2.5.4 Service engineers

The service engineer is an employee of **TYROLIT Hydrostress AG** or a person authorised by **TYROLIT Hydrostress AG**.

- Makes adjustments to the system.
- Performs repairs, complex service work and maintenance work.

2.5.5 Qualification and training

2.5.5.1 Operator

- Trained building expert in a management position
- Has extensive experience in personnel training and danger assessment.
- Has read and understood the “Safety instructions” chapter.

2.5.5.2 Operator

- Has attended user training at **TYROLIT Hydrostress AG** or corresponding technical courses at regional professional associations and federations.
- Has received an introduction (basic training) to the operation of diamond wire saw systems from the manufacturer.

2.5.5.3 Service engineers

- Specialist professional training (mechanical / electrotechnical).
- Has attended specialist courses at **TYROLIT Hydrostress AG**.

2.6 State-of-the-art

2.6.1 Standards applied (safety)

The following analyses have been performed and documented:

- Check for conformity to:
 - European Machine Directive 98/37/EC
 - Low Voltage Directive 73/23/EC
 - EMC (Electromagnetic Compatibility) Directive 89/336/EC

All safety-related findings from the analyses have been taken into account in the design, construction and description of the diamond wire saws and translated into appropriate action.

2.6.2 Analyses performed

As part of the development process, the known risks were systematically analysed. Hazard symbols on the system and in the Safety Manual make reference to residual dangers.

2.6.2.1 Residual dangers analysis

In order to be able to warn the user of residual risks, both in the Safety Manual and on the product itself, a residual risks analysis has been performed.

3 Design and function

3.1 General

Diamond wire saw systems comprise the following machines and components:

- Diamond wire saw (various types)
- Drive, feed motor (hydraulic or electric)
- Cutting tool (Diamond wire / Wire connectors)
- Diamond wire guard (various types)
- Diverter rolls, support rolls (various types)
- Supports (various types)
- Drive (hydraulic or electric in various power classes)
- Control unit (various designs)

Depending on the type of use (application) the customer assembles the diamond wire saw system according to the specific requirements of the job.

3.2 The various diamond wires

Diamond wire saws comes in various designs and types. Some of the most common variants are listed in the following.

3.2.1 Storage wire saw for direct mounting

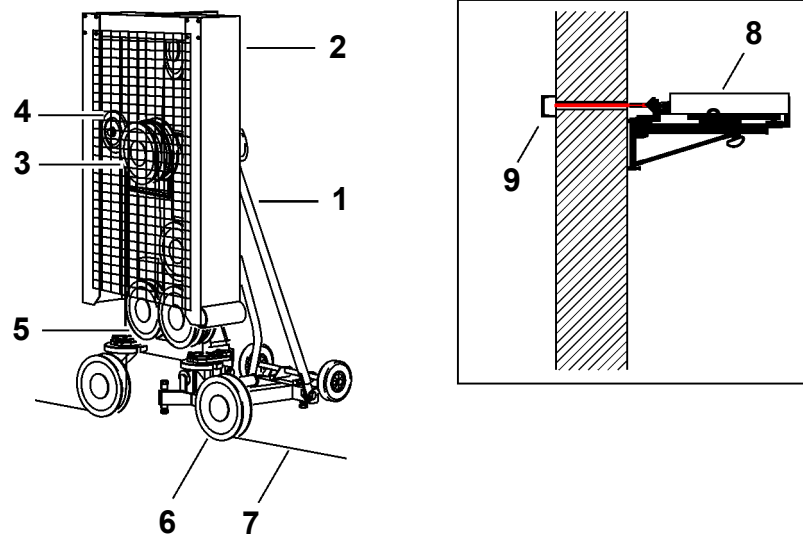


Fig. 3-1 Storage wire saw for direct mounting

- | | |
|-------------------------|--------------------------------------|
| 1 Chassis (drill rig) | 6 Swivel roll |
| 2 Diamond wire guard | 7 Diamond wire |
| 3 Drive roller assembly | 8 Mounted storage wire saw |
| 4 Clamping roll | 9 Free wire length protective device |
| 5 Diverter roll | |

3.2.1.1 Operational scope

The storage wire saw for direct mounting is used for smaller diamond wire sawing jobs. Direct mounting allows hazardous, free-running lengths of diamond wire to be avoided.

3.2.2 Storage wire saw with multiple roll drive

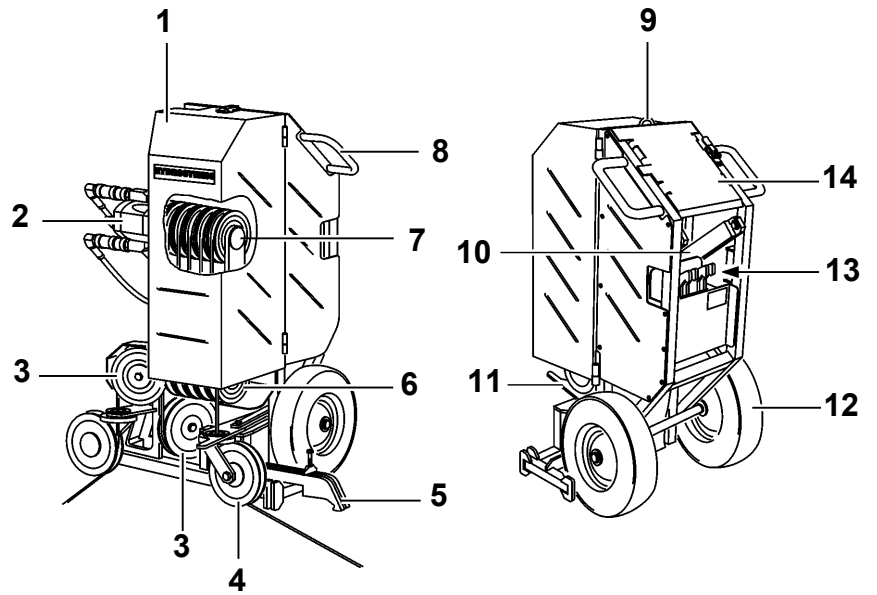


Fig. 3-2 Storage wire saw with multiple roll drive

- | | |
|--------------------------|--|
| 1 Protective hood | 8 Chassis with handle |
| 2 Drive motor | 9 Crane hook |
| 3 Diverter roll | 10 Rocker |
| 4 Swivel roll | 11 Guide roll for wire storage |
| 5 Clamp | 12 Wheel |
| 6 Diverter roll assembly | 13 Storage compartment for clamping elements |
| 7 Drive roll assembly | 14 Work bench, folding |

3.2.2.1 Operational scope

The storage wire saw with multiple roll drive is used for difficult cutting geometries.

3.2.3 Large storage wire saw

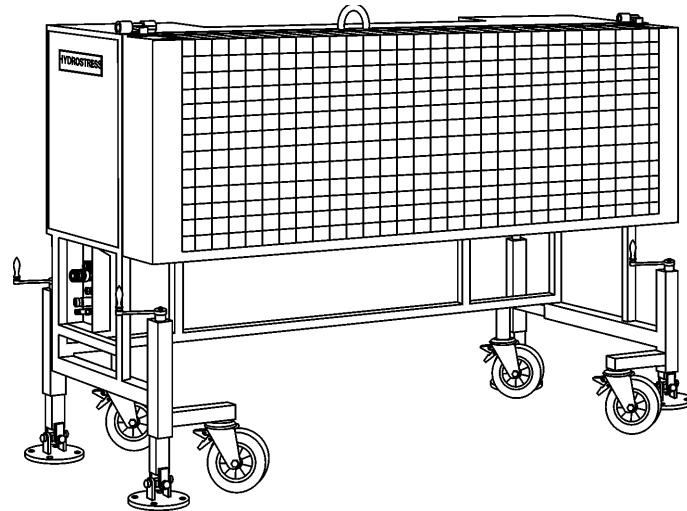


Fig. 3-3 Large storage wire saw

3.2.3.1 Operational scope

The large storage wire saw is predominantly used in civil and underground engineering. The high cutting power and the large diamond wire storage (60 m of diamond wire) allow the machine to work efficiently in large-scale operations.

3.2.4 Circular wire saw

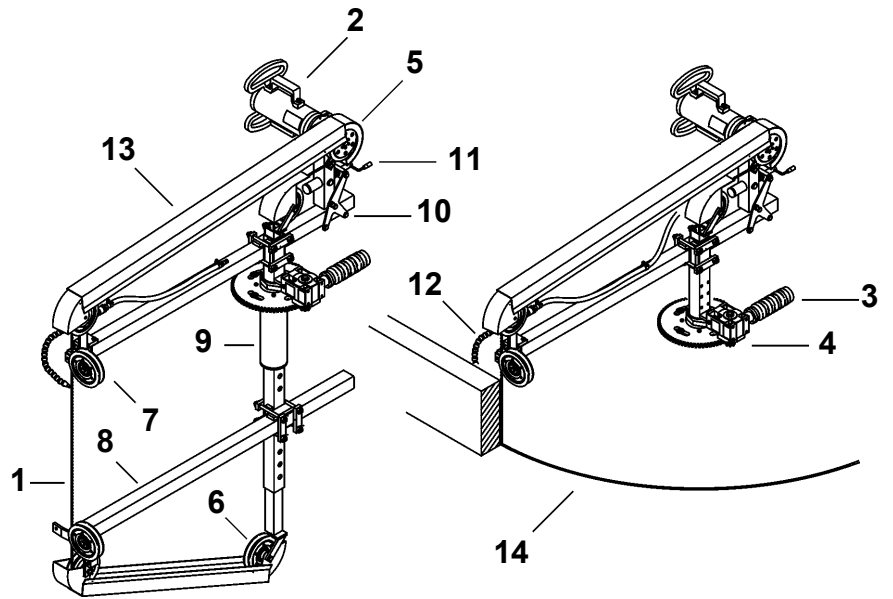


Fig. 3-4 Circular wire saw

- | | |
|------------------------------|--------------------|
| 1 Diamond wire | 8 Extension arm |
| 2 Drive motor | 9 Central tube |
| 3 Feed motor | 10 Swivel support |
| 4 Worm gear | 11 Wire tensioner |
| 5 Drive roll with wire guard | 12 Water feed line |
| 6 Diverter roll | 13 Wire guard |
| 7 Clamping roll | 14 Cut |

3.2.4.1 Operational scope

The circular wire saw is used for circular and curved cuts. The cutting radius is adjustable.

3.2.5 Pipe cutting diamond wire saw

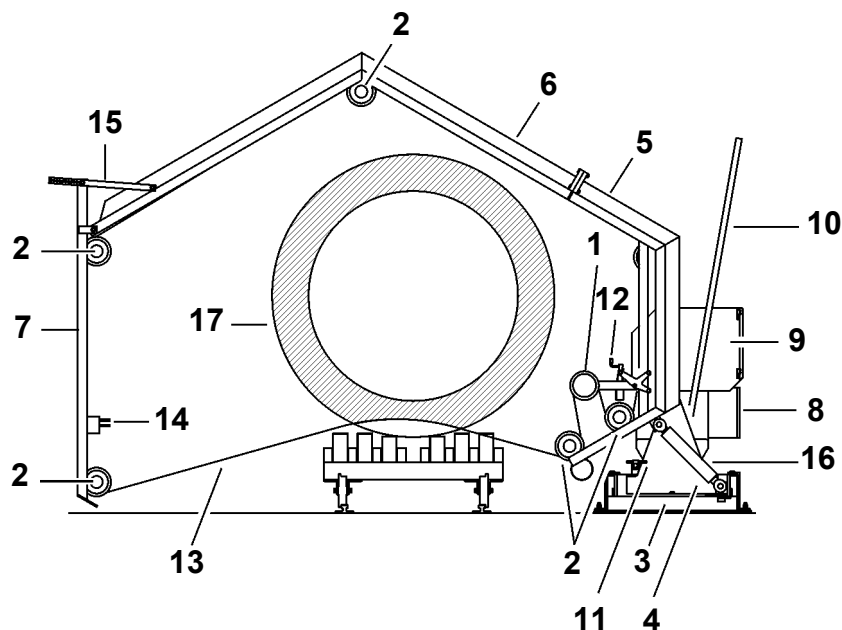


Fig. 3-5 Pipe cutting wire saw

- | | |
|---------------------|---------------------------|
| 1 Drive roll | 10 Swivel pipe |
| 2 Diverter roll | 11 Laser pin |
| 3 Rotating chassis | 12 Wire tensioner |
| 4 Swivel support | 13 Diamond wire |
| 5 Central yoke | 14 Water nozzle |
| 6 Yoke centre piece | 15 Swivel yoke angle stop |
| 7 Swivel yoke | 16 Cylinder |
| 8 Control box | 17 Concrete pipe |
| 9 Hydraulic unit | |

3.2.5.1 Operational scope

The pipe cutting diamond wire saw is used for straight and angle cutting of concrete pipes.

3.3 Functional description

3.3.1 System description

The overall function of all diamond wire saws always remains the same. A motor drives the diamond wire over one or more rolls. The driven diamond wire performs the cut by means of a tractive movement and a pressure movement. The diamond wire length released by the cut is taken up by the diamond wire storage.

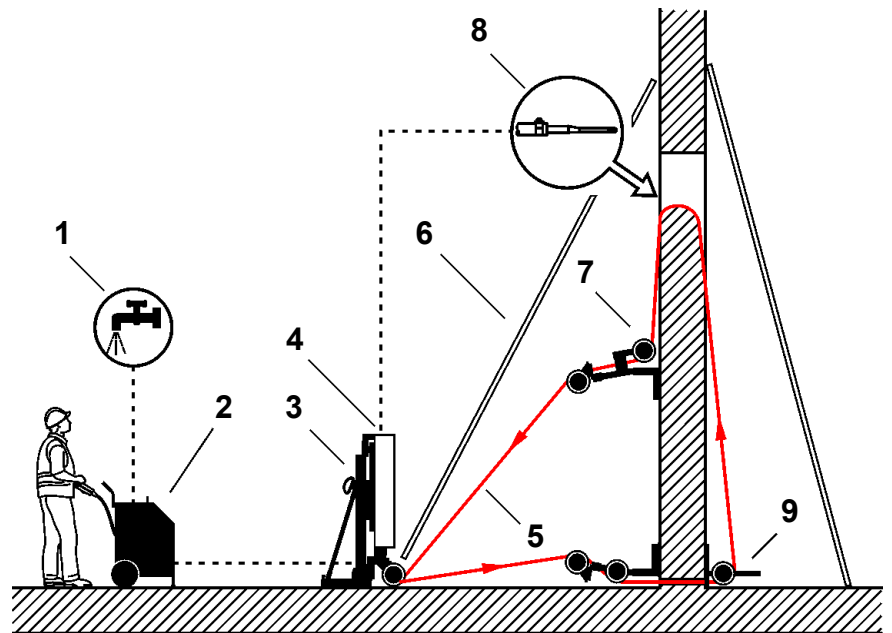


Fig. 3-6 System view

- | | |
|--------------------------------------|---|
| 1 Water connection | 6 Free wire length protective device (U-profile / H-profile / wooden channel) |
| 2 Drive unit | 7 Universal support |
| 3 Storage wire saw | 8 Water lance |
| 4 Storage wire saw protective device | 9 Support with diverter roll |
| 5 Diamond wire | |

The circular saw and the pipe cutting wire saw are an exception. The circular saw is needed if circular or curved cuts are required. The pipe cutting wire saw is a stationary diamond wire saw and is used for cutting concrete pipes.

Specially adapted system configurations are available in the various power classes. Various control units are also available.

Various drives with different power classes can be used to feed the motors according to the requirements.

3.3.2 Component description

3.3.2.1 Hydraulic drive unit / Power supply

The hydraulic drive unit supplies the hydraulic motors. The hydraulic motors are connected via flexible hoses to the hydraulic drive unit.

When electric motors are used an electrical supply with control unit is employed in place of the hydraulic drive unit. The electrical supply is connected via flexible electric cables to the motors.

3.3.2.2 Storage wire saw

The storage wire saw is the central component of the diamond wire saw system. The storage wire saw incorporates both the drive motor and the feed motor (wire tension / wire storage). The storage wire saw contains drive rolls, clamping rolls and diverter rolls for driving, guiding and wire storage.

Diamond wire guard

The diamond wire guard is a safety device and is positioned over the cutting tool. It prevents contact with the diamond wire when it is motion, intercepts flying parts and thus reduces the risk of injury. At the same time, the wire guard acts as a spray guard.

Wire guards are available in various types and sizes.


Drive motor

The drive motor drives the tool via the drive rolls. Both the power and either an electric or hydraulic version can be selected as required.

Feed motor

The necessary wire tension can be generated with the help of the feed motor. The feed motor is also used for diamond wire storage.

3.3.2.3 Cutting tool (Diamond wire)

Detailed information on the diamond wire and the diamond wire joining elements can be found in "Chapter 3" 3.4,  3-15.

3.3.2.4 Supports

Supports are what the wire rolls and the wire roll combinations rest upon and are used for diamond wire guidance.

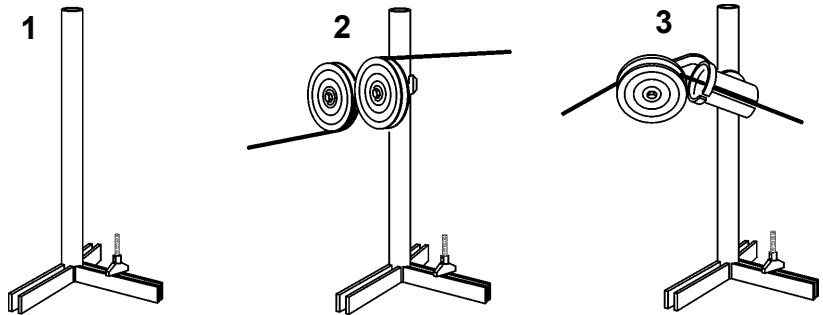


Fig. 3-7 Support with roll variations

- 1 Support with clamping spindle securing
- 2 Support with support roll pair
- 3 Support with distancing diverter roll

Universal support

With its varied mounting options for the guide rolls, the universal support offers a number of cutting options.

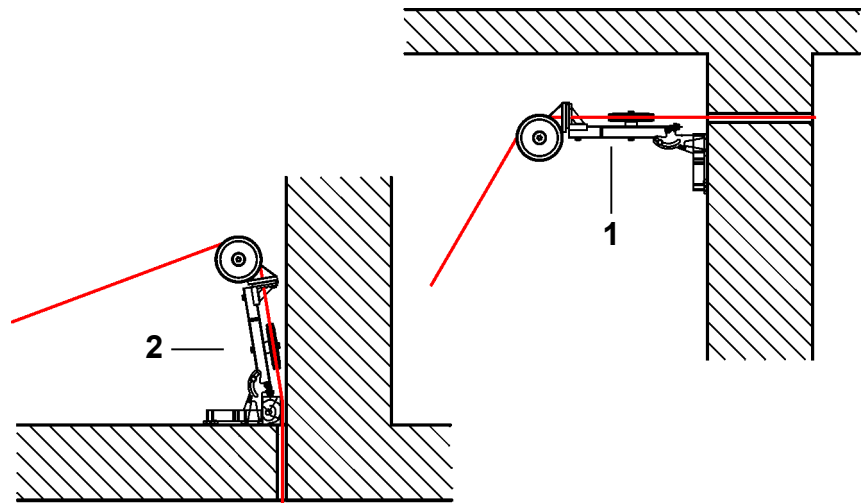


Fig. 3-8 Universal support

- 1 Universal support (horizontal cut)
- 2 Universal support (vertical cut, flush)

Usage examples with TYROLIT Hydrostress AG roll supports

Example 1

Drilling distance up to 1.5m

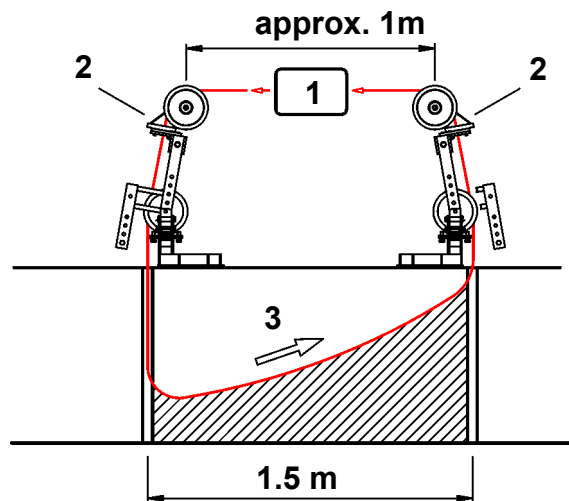


Fig. 3-9 Drilling distance up to 1.5m

- 1 Storage wire saw
- 2 Universal support
- 3 Diamond wire direction of travel

Example 2

Drilling distance up to 2m

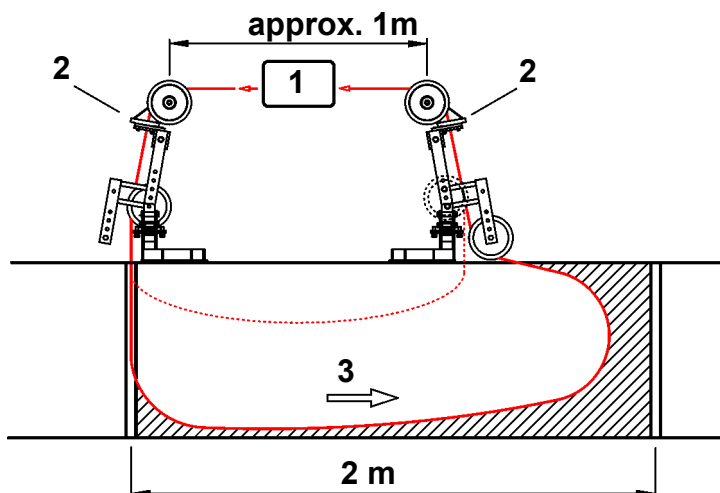


Fig. 3-10 Drilling distance up to 2m

- 1 Storage wire saw
- 2 Universal support
- 3 Diamond wire direction of travel

Example 3

Drilling distance up to 3m

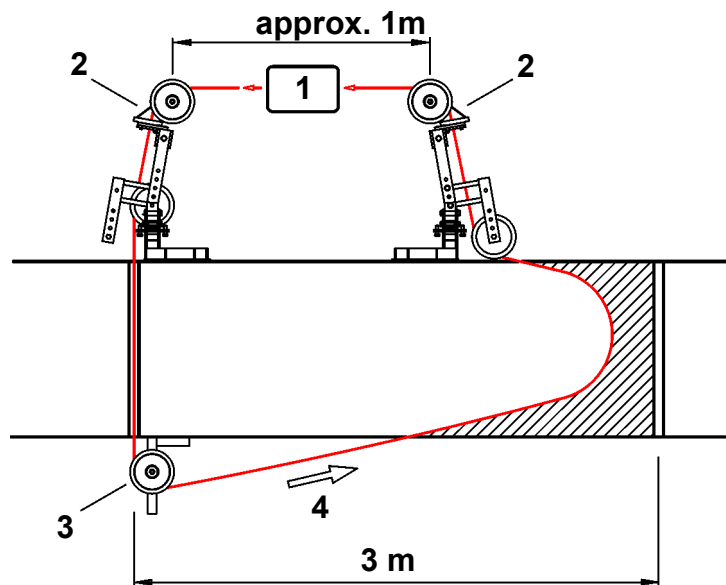


Fig. 3-11 Drilling distance up to 3m

- 1 Storage wire saw
- 2 Universal support
- 3 Support with diverter roll
- 4 Diamond wire direction of travel

Example 4

Drilling distance from 3m

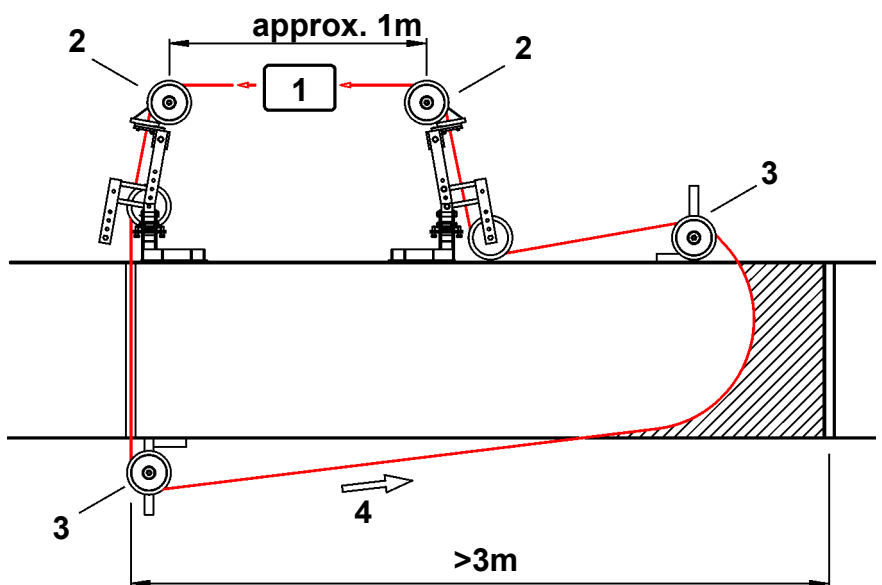


Fig. 3-12 Drilling distance from 3m

- 1 Storage wire saw
- 2 Universal support
- 3 Support with diverter roll
- 4 Diamond wire direction of travel

3.3.2.5 Water

Water is used for cooling the cutting tool. In order to ensure guaranteed cooling and flushing of the diamond wire, the drive rolls and the entry points of the diamond wire in the cut must be sprayed with water.

Connecting the water supply

- Water pressure: min. 1 bar
 max. 6bar
- Water temperature: max. 25°C



Information

When working with diamond wire saw systems ensure that the water feed is not interrupted or shut off. Correct flushing with water will allow you to extend the lifetime of your diamond saw significantly.



Information

In order to avoid frost damage, if there is a danger of frost once work is complete or prior to extended breaks in work the entire water system must be emptied and blown out. At sub-zero temperatures the use of antifreeze is recommended.

Water installation:

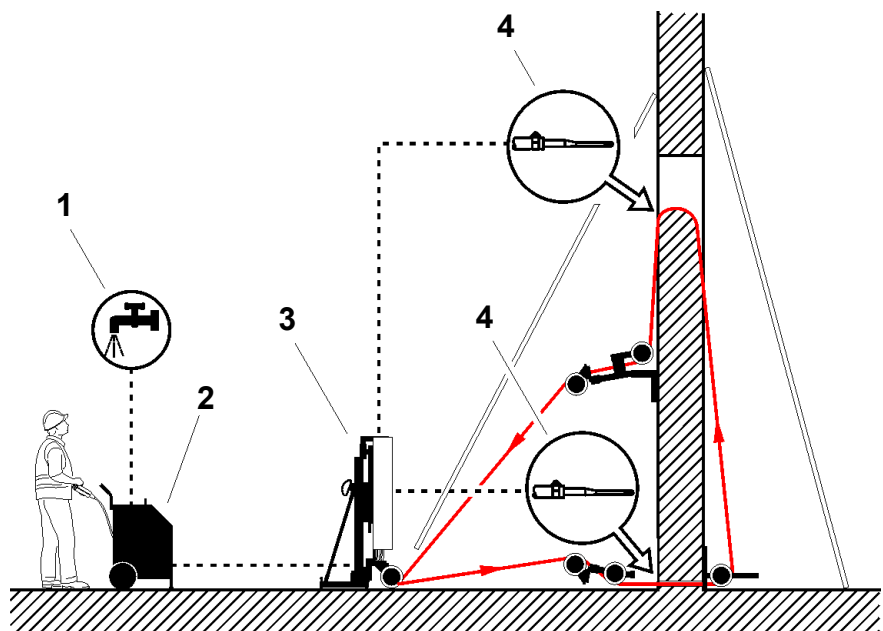


Fig. 3-13 Water lances

The water supply (1) runs over the drive unit (2) to the wire saw (3). There the water is distributed to the rolls and to the water lances (4).

Water lances:

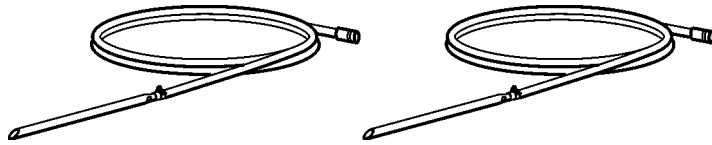


Fig. 3-14 Water lances

Water lances are used to convey water to the point where the diamond wire enters the cut.



Danger	
Danger from water lance resetting operations.	Water lance resetting work should only be carried out once it has been ensured that the saw system is at a standstill.
Failure to observe this regulation may lead to serious physical injury, or death, and to property damage.	

Water collection and disposal

In order to be able to collect and recycle the water, it is recommended that a water barrier is created using a unitary component polyurethane filling and assembly foam.

The water collected in this way can then be drawn off using a water extractor, filtered and pumped back into the water circuit for recycling.

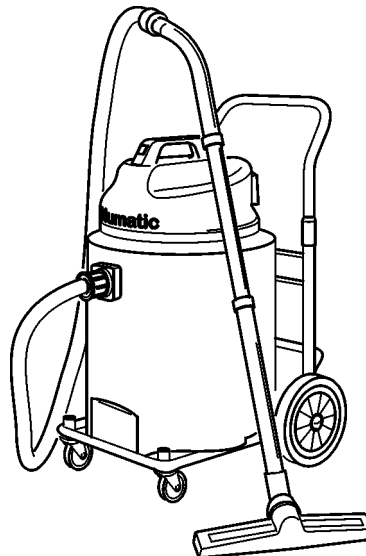


Fig. 3-15 Dust and water extractor with dry filter system

3.3.2.6 Free diamond wire length protective devices

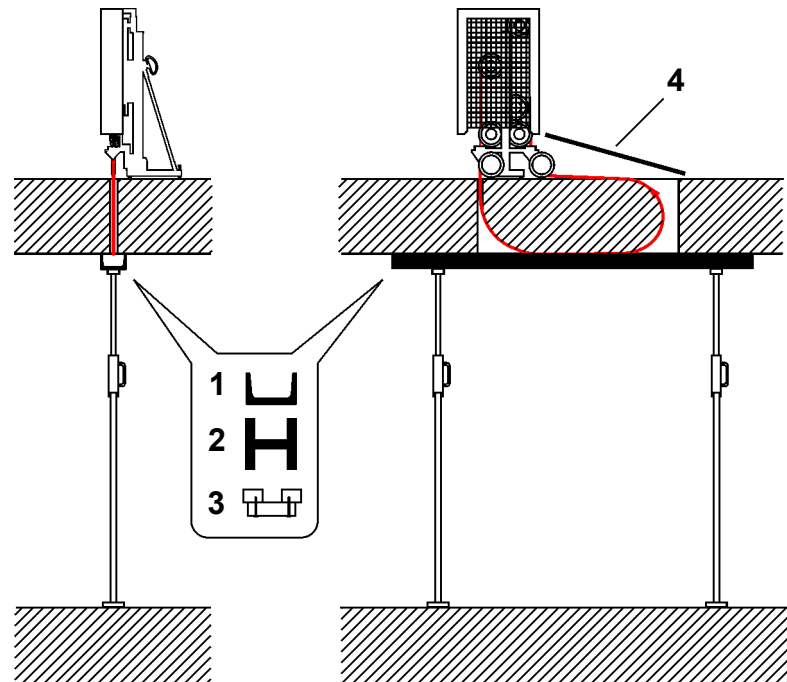


Fig. 3-16 Free diamond wire length protective devices

- | | |
|------------------------|------------------|
| 1 U protection profile | 3 Wooden channel |
| 2 H protection profile | 4 Wooden board |



Danger

When working with diamond wire saws there is a danger of the wire breaking. If the wire breaks the whiplash effect can lead to throwing of the free wire length.

Therefore, when installing diamond wire saw systems the shortest possible free length should always be observed. Furthermore, the free wire length should be secured by protective devices.

Failure to observe this regulation may lead to serious physical injury, or death, and to property damage.



Information

Practical measures to provide protection from whiplash effects and from flying parts can be taken by using simple, secure construction materials such as U-profiles / H-profiles / wooden channels / wooden boards (min. 20mm thick) / metal screens (max. mesh size: 8mm) / sheet steel (min. 3mm thick) / sheet aluminium (min. 5mm thick).

3.4 Diamond wire

3.4.1 Diamond wire types:

Basically at **TYROLIT Hydrostress AG** a distinction is made between two types of diamond wire:

- Sintered diamond wire Ø 11 mm
- Galvanic diamond wire Ø 10 mm

3.4.1.1 Sintered diamond wire Ø 11 mm

Type designation: e.g. **BS40**

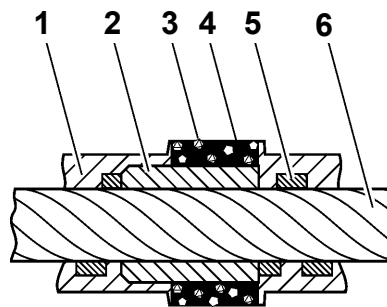


Fig. 3-17 Sintered diamond wire Ø 11 mm

- | | |
|--------------------------------|--|
| 1 Plastic sheathing | 4 Sintered bonding |
| 2 Steel core | 5 Steel spring (flat) |
| 3 Diamond grains (multi-layer) | 6 Steel wire (breaking load approx. 19000 N) |

3.4.1.2 Galvanic diamond wire Ø 10 mm

Type designation: e.g. **BSG1**

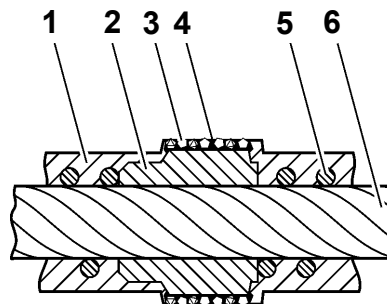


Fig. 3-18 Galvanic diamond wire Ø 10 mm

- | | |
|---------------------------------|--|
| 1 Plastic sheathing | 4 Galvanic bonding |
| 2 Steel core | 5 Steel spring (round) |
| 3 Diamond grains (single layer) | 6 Steel wire (breaking load approx. 19000 N) |

3.4.1.3 Areas of use

	Type BS40 Ø11mm	Type BSG1 Ø 10mm
Material: Concrete		
- highly reinforced		X
- normally reinforced	X	X
- low reinforcement	X	X
Material: Aggregates		
- hard		X
- medium	X	X
- soft	X	X
Tool: Characteristics		
- stable	X	X
- cutting-friendly	X	
- very cutting-friendly		X

3.4.2 Diamond wire direction of travel

The direction of travel is indicated on each diamond wire after every eighth bead by an arrow.

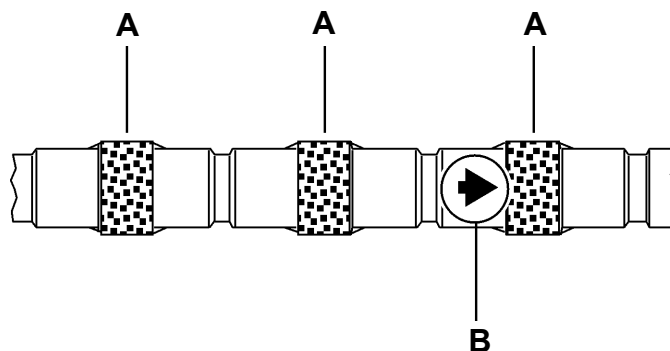


Fig. 3-19 Diamond wire direction of travel

- A Diamond beads
- B Direction of travel arrow

3.4.2.1 Diamond wire wear

Turning the diamond wire

In order to avoid noncircular wear of the diamond beads, both types of diamond wire must be rotated in an anticlockwise direction.

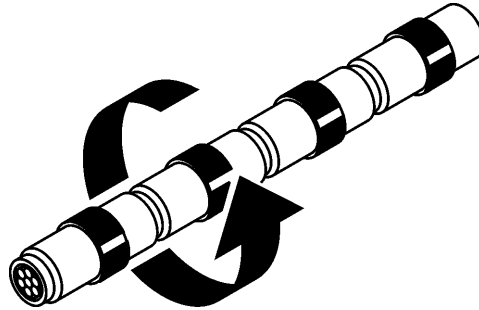


Fig. 3-20 Turning the diamond wire



Information

Turning must always take place in an anticlockwise direction since otherwise the wire strands of the steel wire will become untwisted.

Avoiding planar wear of diamond wire

Planar wear and planar running of the diamond wire can be avoided by systematic, frequent turning of the diamond wire.

This turning brings about a constant change in the position of the individual diamond beads in relation to each other and promotes all-round even wear of the diamond wire during working.

This method should be used above all during long-lasting cuts.

Turning table for sintered diamond wire

Turning at the start of work

Upon first use a sintered diamond wire must be turned for a meter’s length at least once in the anticlockwise direction.

Length of the diamond wire	Total turns
5.0 metres	5 - 6 turns
7.5 meters	8 - 10 turns
10 metres	11 -13 turns
15 metres	16 -18 turns

Turns following continuous cutting work

In order to guarantee even wear of the diamond beads, change the turning frequently by ±30%, but never by less than once per metre of diamond wire. Turns should be changed after each cut.

If the diamond wire begins to run in a planar manner the number of turns should be changed as much as possible, e.g. 2 to 4x or more.

Example: 10 m sintered diamond wire

following 1st cut	+ turn 3 x
following 2nd cut	+ turn 3 x
following 3rd cut	3 x release
following 4th cut	+ turn 3 x
following 5th cut	3 x release, etc.



Information
<p>Diamond wires with screw connectors are an exception. When turning proceed as follows: Turn diamond wire according to above turning table plus 3 turns for threaded connector (left-hand thread).</p>

Turning table for galvanic diamond wire

Turning at the start of work

Upon first use a galvanic diamond wire must be turned for a meter's length 0.5 times in the anticlockwise direction.

Length of the diamond wire	Total turns
5.0 metres	2.5 turns
7.5 metres	4 turns
10 metres	5 turns
15 metres	8 turns

Turns following continuous cutting work

In order to guarantee even wear of the diamond beads, change the turning frequently by $\pm 30\%$, but never by less than 0.5 or more than 1.5 times per metre of diamond wire each time.

Turns should be changed after each cut.

If the diamond wire begins to run in a planar manner the number of turns should be changed as much as possible, e.g. 2 to 4x or more.

Example: 10 m galvanic diamond wire

following 1st cut	+ turn 2 x
following 2nd cut	+ turn 2 x
following 3rd cut	2 x release
following 4th cut	+ turn 3 x
following 5th cut	3 x release, etc.

3.4.2.2 Diamond wire wear measurement

In order to be able to assess if the diamond wire is running in a circular manner, it should be periodically checked (e.g. every two hours). This must include determination of the taper and eccentricity.

Eccentricity wear measurement

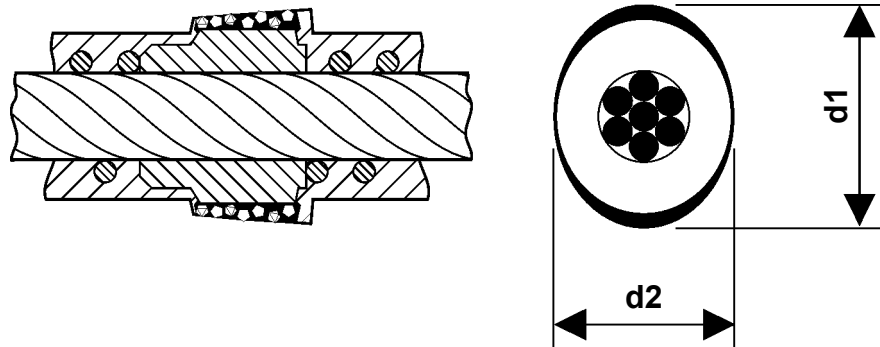


Fig. 3-21 Eccentricity wear measurement

Taper wear measurement

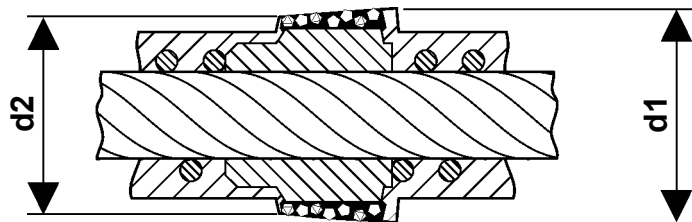


Fig. 3-22 Taper wear measurement



Information

In both measurements the deviation in diameter from d_1 to d_2 should not exceed a maximum of 0.4 mm.

3.4.2.3 Countermeasure in the event of diamond wire running in a planar fashion

If it is found that the diamond wire is running off-centre or in a planar fashion, an immediate response is necessary:

- Immediately turn the diamond wire tighter, so that the beads are introduced in a more spiral fashion into the concrete during cutting. This forced turning allows the beads to become rounded again.
- The cutting pressure should be reduced, above all for small diamond contact points.

3.4.2.4 Diamond wire sharpening

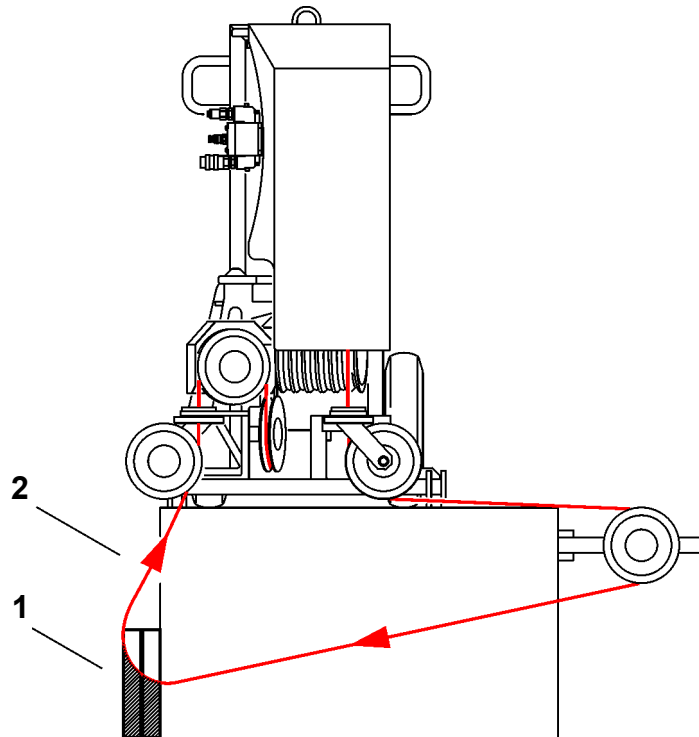


Fig. 3-23 Diamond wire sharpening

- 1 Sharpening block
- 2 Direction of pull of diamond wire

Proceed as follows:

- Secure one or two sharpening blocks using dowels or clamping (Other abrasive materials such as chalky sandstone, bricks, etc. can be used instead of sharpening blocks)
- Perform two or three vertical cuts with very little water



Information

Only sintered diamond wires can be sharpened with sharpening blocks. Diamond wires from the **TYROLIT Hydrostress AG** programme are pre-sharpened before delivery.



Information

Unless the diamond wire is sharpened, when unfavourable conditions are encountered, such as very hard aggregates, it will not be possible to achieve the optimum operational state.

With re-sharpened diamond wires optimum starting speeds can be achieved.

3.4.2.5 Storing diamond wires

Store diamond wire in the dry and away from light in order to avoid corrosion of the carrier wire and embrittlement of the rubber.



Danger

Rusting diamond wires run the risk of the diamond wire breaking.

Store your diamond wire where it cannot corrode or become brittle.

Failure to observe this regulation may lead to serious physical injury, or death, and to property damage.



Information

When storing used diamond wires, it is recommended to label these with the following details:

- Length of diamond wire
- Number of turns when last used
- Diamond bead diameter
- Manufacturer's reference
- Serial number

3.5 Joining diamond wire

Galvanic diamond wire

Galvanic diamond wires do not change diameter as they wear. So, when joining different worn diamond wires the diameter need not be taken into account.

Sintered diamond wire

The wearing of diamond wire can result in variations in diameter. So, when joining different worn diamond wires the diameter needs to be taken into account.



Information

Do not join different worn diamond wires whose diameters differ by more than 0.2 mm.

Joining diamond wires whose difference in diameter is greater than 0.2 mm can lead to jamming during wire sawing work. In turn, jamming can cause the wire to break.

3.5.1 Diamond wire joining pieces

Sintered diamond wires and galvanic diamond wires can be joined or repaired with the following joining pieces:

- Hinged connector
- Repair sleeve
- Screw connector



Information

Repair sleeves and screw connectors should only be used for large roll diameters (min. Ø 300 mm) .

Hinged connectors are also suitable for smaller roll diameters, but the rolls should not be less than Ø 200mm.



Danger

Incorrectly pressed or fitted connectors and worn connectors can cause the diamond wire to break during wire sawing operations.

When joining TYROLIT diamond wire use only TYROLIT connectors and tools.

Check connectors regularly for wear.

Failure to observe this regulation may lead to serious physical injury, or death, and to property damage.

3.5.2 Diamond wire connector installation tools

- Universal pliers
- Cutter
- 2 x ½" pipe wrench (for screw connector)
- Angle grinder

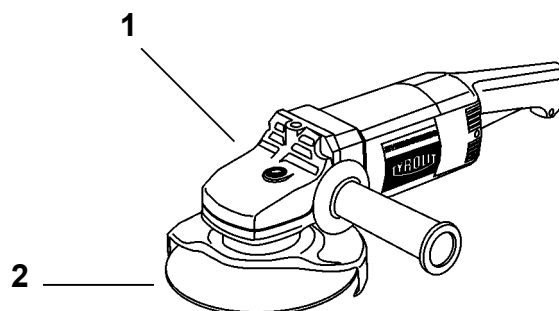


Fig. 3-24 Angle grinder

- 1 Angle grinder
- 2 Parting-off tool
TYROLIT Hydrostress-cutting-off wheel
Type 41F 125 x 1 x 22.2 A60Q-B FXA Type No. 77966

- Pressing tool

The extraction force for optimum pressing with the TYROLIT original manual press SPV 80KN-KPL is > 6000 N.

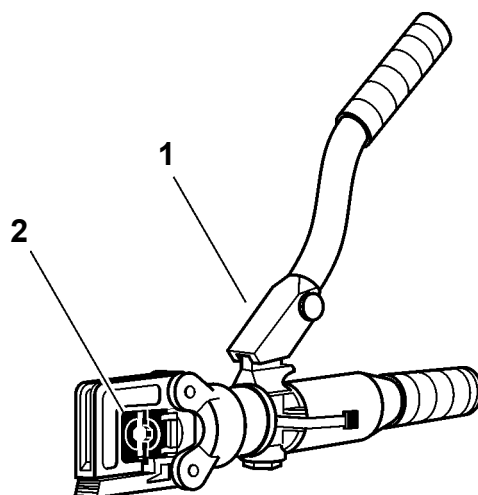


Fig. 3-25 Pressing tool

- 1 TYROLIT original manual press SPV 80KN-KPL
Type No. 117984
- 2 TYROLIT original press inserts SPEV 11 50/80
Type No. 578301

3.5.3 Preparation of diamond wires

In order for the diamond wire connectors to be correctly fitted, the diamond wires must be carefully prepared.

Cutting the diamond wire

- Make a clean and straight cut in the diamond wire with the cutting-off wheel
(one diamond bead will always be lost)



Information

To cut the diamond wire use only an angle grinder with a 1 mm to 1,6 mm cutting-off wheel. Use of other tools for cutting is not recommended as the wire ends cannot then be cut accurately and at the right angle.

- Remove steel spring using the universal pliers
- Using the cutter separate the steel wire from the plastic sheathing



Information

Before pressing the steel wire must be completely free of plastic residues. Otherwise the wire may be torn from the pressing.



Warning

When working with cutters there is a danger of cut injuries.

Perform cutting movements in such a way that no injuries can occur.

Failure to adhere to this regulation may result in slight to serious physical injury.

3.5.4 Hinged connector

TYROLIT Hydrostress AG - hinged connector Type No. 218909

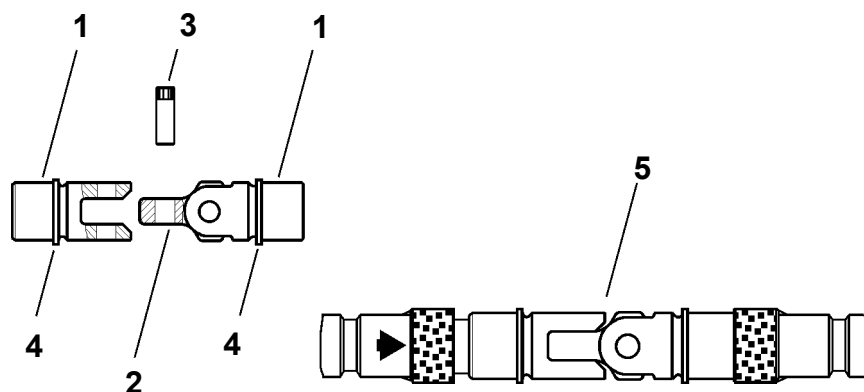


Fig. 3-26 Hinged connector

- 1 Connector fork
- 2 Articulation
- 3 Hinge pins
- 4 Pressing tool stop
- 5 Mounted hinged connector

3.5.4.1 Cutting diamond wire for hinged connector fitting

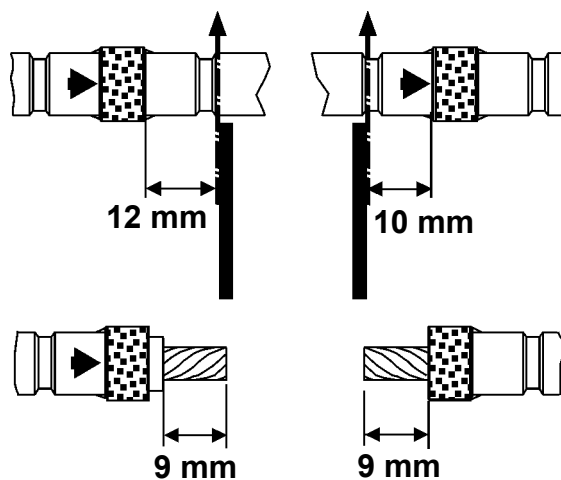


Fig. 3-27 Cutting diamond wire for hinged connector



Information

The diamond wire has been correctly cut if the hinged connector comes to rest directly at the beads, left and right.

3.5.4.2 Pressing the diamond wire into the hinged connector

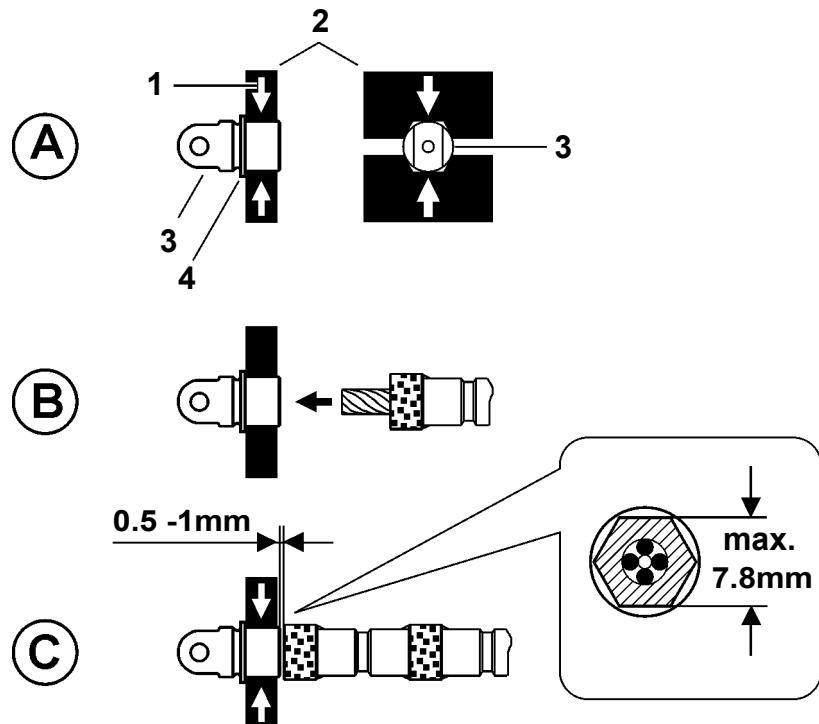


Fig. 3-28 Pressing the hinged connector

- | | |
|----------------------|--------------------------|
| 1 Pressing direction | 3 Connector fork |
| 2 Press insert | 4 Stop for pressing tool |

Proceed as follows:

- Insert the connector fork (3) with the groves in the direction of pressing (1) in the press insert (2) as far as the stop (4). Then gently clamp with the press tongs (see Figure A)
- Insert the bare wire end in the hole (see Figure B)
- In order that the material of the connector can expand during the pressing process, a small gap of between 0.5 and 1 mm should be visible (see Figure C)
- Press wire into connector fork. The pressed dimension at the connector piece should not exceed 7.8 mm (see Figure C)
- Press the second connector fork (with pre-fitted articulation) in the same way as the first connector piece

3.5.4.3 Closing and opening the hinged connector

To correctly close or open the hinged connector, use of the **TYROLIT Hydrostress AG** mounting device SMGV Type No. 860404 is recommended.

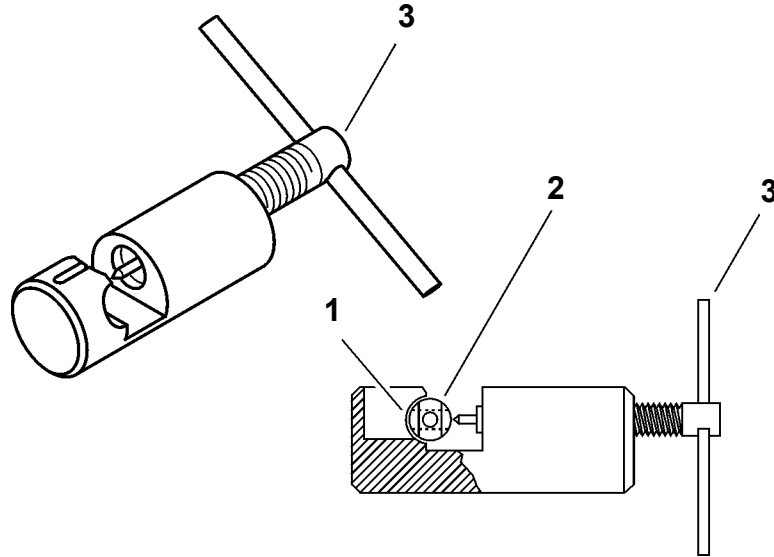


Fig. 3-29 Mounting device

- 1 Connector support
- 2 Hinged connector
- 3 Spindle

Closing the hinged connector

Proceed as follows:

- Turn the diamond wire as directed (see “Chapter 3”) 3.4.2.1, 3-17)
- Join the two connector pieces using the pin (flat side forward)
- Drive pin fully into the hole using the TYROLIT mounting device

Opening the hinged connector

Proceed as follows:

- Place the connector in the rest below the ejector spindle of the TYROLIT mounting device and align it in such a way that the pin can be pushed into the groove behind the rest.
- Eject the pin by turning the spindle.
- The diamond wire can be connected again using the same connector and a replacement pin.

3.5.5 Repair connector

The repair connector is used when the diamond wire breaks.

3.5.5.1 Repair connector design

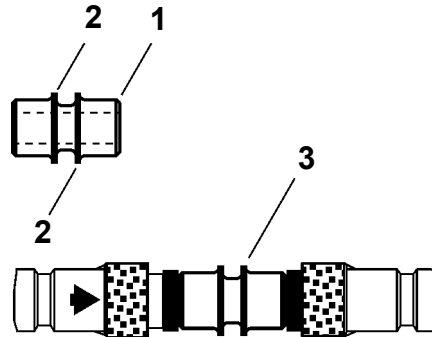


Fig. 3-30 Repair connector

- 1 Repair sleeve
- 2 Stop for pressing tool
- 3 Fitted repair sleeve

3.5.5.2 Cutting diamond wire for repair connector

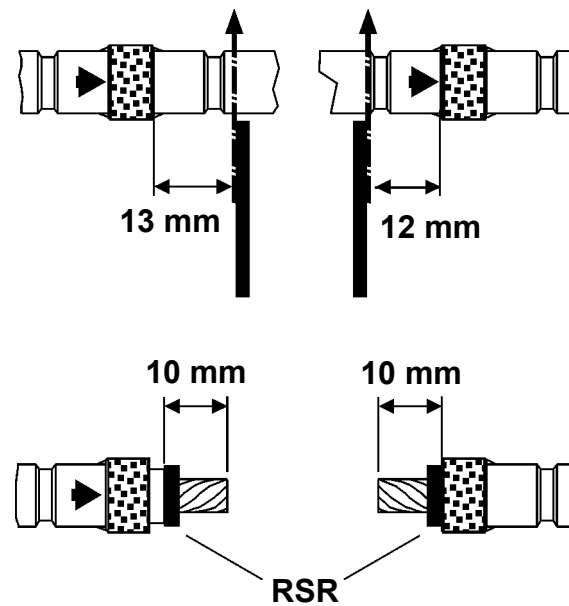


Fig. 3-31 Cutting diamond wire for repair sleeve



Information

Before fitting the repair connector a rubber sealing ring (RSR) must be slid on in order that flexibility around the point of cut is maintained.

3.5.5.3 Pressing the repair connector

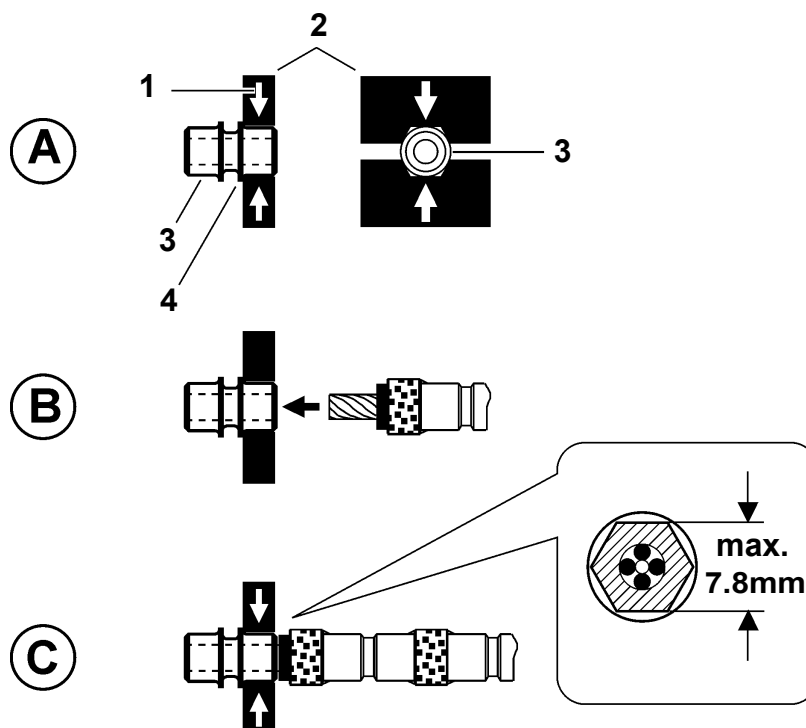


Fig. 3-32 Pressing the repair connector

- | | |
|----------------------|--------------------------|
| 1 Pressing direction | 3 Repair sleeve |
| 2 Press insert | 4 Stop for pressing tool |

Proceed as follows:

- Insert the repair sleeve (3) in the press insert (2) as far as the stop (4). Then gently clamp with the press tongs (see Figure A)
- Insert the bare wire end with the pre-fitted rubber ring in the hole (see Figure B)
- Press wire into connector fork. The pressed dimension at the connector piece should not exceed 7.8 mm (see Figure C)
- Press the other side of the repair sleeve in the same way as the first

3.5.6 Screw connector

3.5.6.1 Screw connector

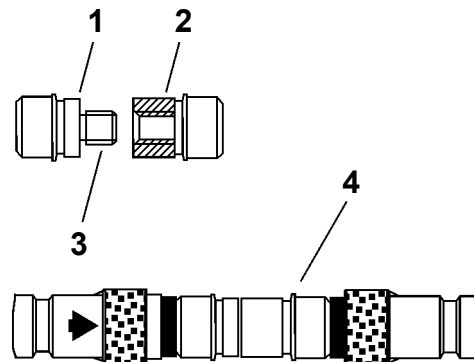


Fig. 3-33 Screw connector

- 1 Male connector
- 2 Female connector
- 3 Threaded stem
- 4 Mounted screw connector

3.5.6.2 Cutting diamond wire for screw connector

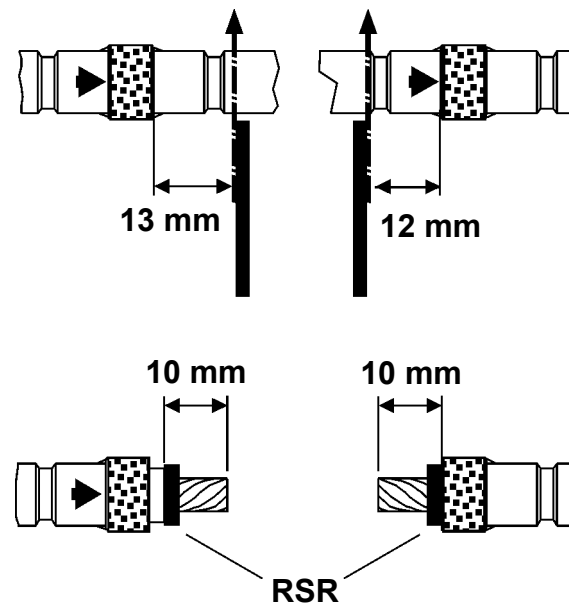


Fig. 3-34 Cutting diamond wire for screw connector



Information

Before mounting the screw connector a rubber sealing ring (RSR) must be slid on in order that flexibility around the point of cut is maintained.

3.5.6.3 Pressing the threaded connector

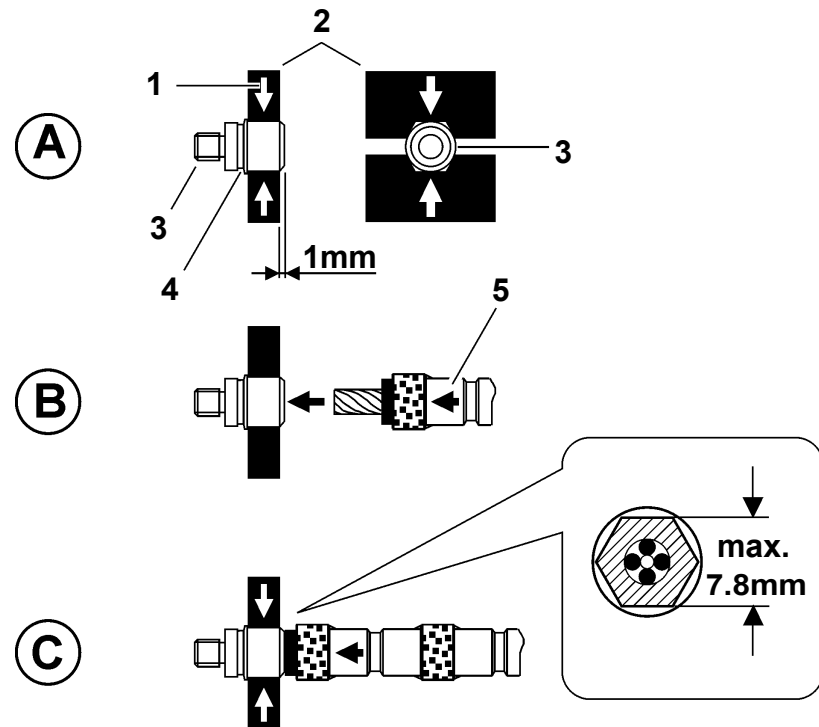


Fig. 3-35 Pressing the threaded connector

- | | |
|----------------------|--------------------------------|
| 1 Pressing direction | 3 Threaded connector male part |
| 2 Press insert | 4 Recess |

Proceed as follows:

- Insert male connector (3) in the press insert (2) with a 1 mm projection. Then gently clamp with the press tongues. The pressable area is indicated on the connector pieces by a recess (4) . (See Figure A)
- Insert bare wire end with pre-fitted rubber ring in the hole. Warning: The threaded stem must always point in the direction of travel of the diamond wire. Note the direction arrow on the diamond wire (5). (See Figure B)
- Press wire into connector fork. The pressed dimension at the connector piece should not exceed 7.8 mm (see Figure C)
- Press the female part of the connector in the same way as the male connector.

4 Assembly , disassembly

4.1 General

4.1.1 Safety instructions

Before proceeding read Chapter 2 “Safety instructions”, 2-1 in this system manual. Be sure also to take note of all the danger information given here and follow the instructions on how to avoid physical injury and damage to property.

4.1.2 Personnel qualifications

Assembly and disassembly of Wire saws should only be carried out by authorised personnel. Personnel are only authorised where they meet the following requirements:

- have successfully completed user training at **TYROLIT Hydrostress AG** or corresponding technical courses at regional professional associations and federations.
- the safety instructions in Chapter 2 must have been read and understood.

4.2 Assembly / disassembly



Information

Assembly and disassembly of diamond wire saw systems is described in Chapter 6 “Operation”, 6-1, since these activities are part of the normal operating sequence of diamond wire saw systems.

4.2.1 Transport to and from the place of installation

The system components must be transported in such a way that they are not damaged in transit. Where suitable means of transport are available, these must be used.

5 Putting into service

5.1 Putting into operation

Each time that the diamond wire saw system is put into service it must be checked to ensure that it is free of defects.

Putting into service of the individual system parts (machines and components) is described in the corresponding Operating Instructions or instruction leaflets.

6 Operation

6.1 General

Before proceeding read Chapter2 “Safety instructions”, 2-1 in this Safety Manual. Be sure also to take note of all the danger information given here and follow the instructions on how to avoid physical injury and damage to property.

6.1.1 Safety instructions

It is essential to observe the following safety instructions, in particular in relation to the operation of diamond wire saws.



Danger

Danger of falling heavy parts

When performing the types of work described in this chapter, it is essential to wear the following individual protective equipment: **Helmet, goggles, protective gloves and safety shoes**, see “Chapter 2” 2.3.5.1, 2-5.

It is essential that the work instructions and procedures described in this safety manual are followed.

Failure to observe this regulation may lead to serious physical injury, or death, and to property damage.

Danger



Danger from diamond wire breaks. If the diamond wire breaks the whiplash effect can lead to throwing of the free wire length. When there is a whiplash effect individual diamond wire beads or entire connectors may also come loose and fly through the air at great speed.

Always work with the protective devices fitted. Always observe the safety distances and working areas stated in this Safety Manual. See “Chapter 6” 6.4.3, 6-16

During cutting operations no persons should remain in the danger area.

Failure to observe this regulation may lead to serious physical injury, possibly even death, and to property damage.

Danger



Danger from machine suddenly starting up.

Before switching on the system the operator must ensure that no other person is present in the danger areas. If the system is left unattended it must be switched off and secured against being powered up again.

Failure to adhere to this regulation may result in crushing or cut wounds to body parts and damage to property.

Danger



Hazard from falling building structures.

The building structure must be properly secured (see Operating Instructions in this Safety Manual).

Failure to observe this regulation may lead to serious physical injury, possibly even death, and to property damage.

Danger



Noise danger.

When using diamond wire saw systems hearing protection must be worn.

If this instruction is not followed irreparable hearing damage may result.

Warning



When handling diamond wire and wire rolls there is a danger of fingers being crushed.

When grinding-in the diamond wire sufficient clearance between the hands and the rolls or the structure must always be ensured. The feed motors must not be started if the diamond wire is still being touched.

Failure to adhere to this regulation may lead to crushing or cut wounds to body parts.

Warning



Hazard from toxic exhaust gases (carbon monoxide)

When a drive is operated with a combustion motor in a sealed or underfloor area, it is essential that the exhaust gases are discharged into the open air.

Failure to adhere to this regulation may lead to symptoms of poisoning, or possibly death from suffocation.

Warning



Danger from hydraulic oil leaks.

Before use a visual inspection must be made of all hydraulic hoses and couplings. This must look for the correct connection of the couplings and damage to the hoses.

Leakages must be cleared away. In order to avoid environmental damage, always have a binding agent at the ready.

Failure to adhere to this regulation may result in damage to the environment and to property.

6.1.2 Personnel qualifications

Diamond wire saw systems should not be operated by unauthorised persons. Personnel are only authorised where they meet the following requirements:

- have successfully completed user training at **TYROLIT Hydrostress AG** or corresponding technical courses at regional professional associations and federations.
- the safety instructions in Chapter 2 must have been read and understood.
- Are familiar with all the general rules of construction

6.2 Safety-related operator's controls

6.2.1 Diamond wire guard on the machine

The diamond wire guard on the machine is a safety device. It provides protection from accidental contact with the diamond wire and from flying parts and at the same time acts as a spray guard. Working without the diamond wire guard is prohibited.

6.2.2 Free diamond wire length protective devices

Safety devices for free lengths of diamond wire can be conveniently created by using simple construction materials such as U-profiles / H-profiles / wooden channels / wooden boards (min. 20 mm thick) / sheet steel (min. 3 mm thick) / or sheet aluminium (min. 5 mm thick) (See "Chapter 3" 3.3.2.6, 3-14).

6.2.3 Emergency Stop pushbutton

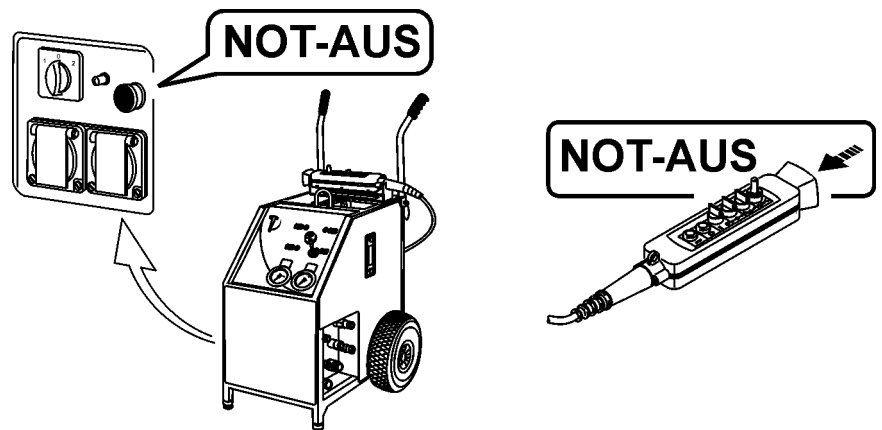


Fig. 6-1 Emergency Stop pushbuttons on the drive unit and remote controller

In danger situations the Emergency Stop pushbutton must be pressed immediately. Pressing the Emergency Stop pushbutton immediately halts the system and prevents the system being accidentally switched on again.

6.3 Controls and displays

Current diamond wire saws are controlled via the drives by means of a remote controller.

6.3.1 Controls and displays on the machines

The controls and displays of the individual machines and components are described in the corresponding Operating Instructions or instruction leaflets for each particular type of individual machine and component.

Example: Hydraulic wire saw system

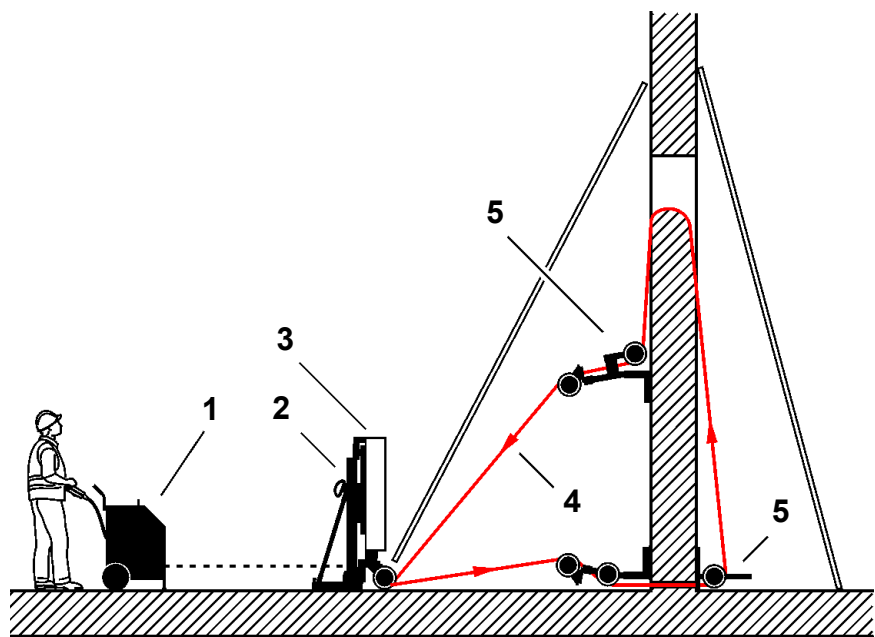


Fig. 6-2 Documents for a hydraulic Wire saws system

- 1 Operating Instructions for drive unit type ...
- 2 Operating Instructions for wire saw type ...
- 3 Instruction leaflet for diamond wire guard type ...
- 4 Instruction leaflet for diamond wire type ...
- 5 Instruction leaflet for diverter rolls support type ...

6.4 Operation

In order to guarantee that all work is carried out in complete safety, it is essential to perform the activities described in this Safety Manual.

6.4.1 Process checklist



Information

This checklist is intended solely to provide a better overview of the sequence in which the stages of the work should be carried out.

Checklist

1. Obtain approval from the supervision of works
2. Mark out cuts
3. Determine order of cuts and removal of structural blocks
4. Secure danger area
5. Mount diamond wire saw
6. Mount diverter rolls
7. Round off corners
8. Position diamond wire
9. Make connections
10. Install water supply
11. Secure structural blocks
12. Grind-in diamond wire
13. Sawing
14. Switch off diamond wire saw
15. Disassemble the diamond wire saw
16. Remove structural blocks
17. Secure cut-out sections
18. Dispose of sawing sludge

6.4.2 The procedure in detail

1. Obtain approval from the supervision of works

Before any work commences the approval of the supervision of works must be obtained. The following points must be clarified:

- are their static concerns about the building structure?

Action:

If structurally important bearing or support structures are cut through, this may have fatal consequences (static weakening or subsidence)

- are electrical lines laid in the wall or ceiling (floor)?

Action:



Danger

Danger from electric shock

If one or more electricity lines are located in the wall, the ceiling or the floor, it must be ensured that these have been de-energized and secured against re-energizing.

Failure to comply with this regulation may lead to serious physical injury or death. Secondary damage such as fires may also occur.

- are sanitation lines laid in the wall or ceiling (floor)?

Action:

If sanitary lines (supply or waste pipes for water or waste water) exist, these must first be drained.

2. Mark out cuts

The parts to be sawn out are normally already marked out by the customer. It is now a matter of determining the maximum concrete block weight and adapting to the conditions. In doing so the following points must be taken into account:

- it must be possible to adapt the handling to the task
- the crane or the lifting device must be designed for the loads to be lifted
- the weight of the structural block cut out should not exceed the maximum permitted floor loading

Then the anchoring holes for mounting the diverter rolls supports and the anchoring holes for securing the load hooks to secure the structural blocks and their removal must be marked.

3. Determine order of cuts and removal of structural blocks

Order of cuts

The order of cuts is important in order that the tool does not jam later and that the structural blocks can be removed without problems. When defining the sequence of cuts express account must also be taken of personal safety issues.

In principle, for a wall cutout for example, first the bottom, then the side and only at the end the top cuts must be performed.

Determine how to remove the structural blocks

If slightly conical cuts are made, then the direction of removal must be taken into account prior to sawing. See following illustration.

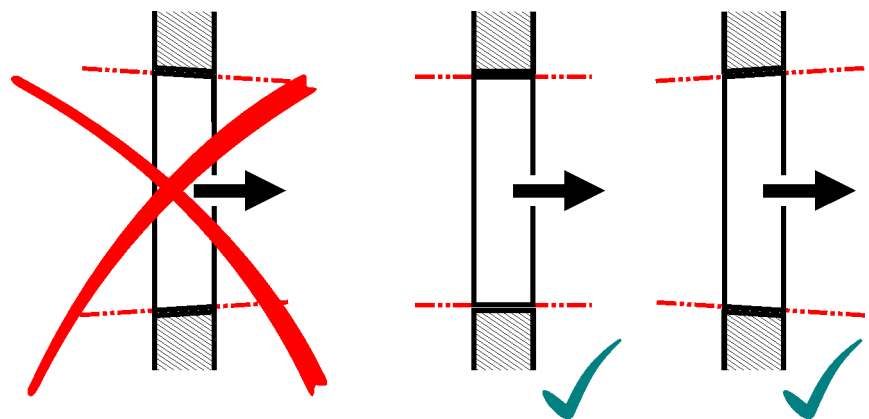


Fig. 6-3 Removal with straight and slightly conical cuts

4. Secure danger area

Before starting work the danger areas must be secured as directed:

- For danger and working areas
see "Chapter 6" 6.4.3, 6-16
- For danger and working areas in the case of direct mounting of wire saws
see "Chapter 6" 6.4.4, 6-17
- For danger and working areas in the case of floor cutting
see "Chapter 6" 6.4.5, 6-18

5. Mount diamond wire saw

Position the diamond wire saw in such a way that the minimum possible lengths of free diamond wire result. Then secure the diamond wire saw to the surface so that it is stable.



Information

To secure wire saws and roll supports, anchoring elements appropriate for the sub-surface must be used. When positioning the dowels the installation instructions of the dowel manufacturer must be followed.

6. Mount diverter rolls

When mounting the diverter rolls the following points must be noted:

- Diverter rolls must be aligned in the precise direction of cut. Here the largest possible \varnothing for the diverter rolls must be chosen (min. \varnothing 200 mm), smaller \varnothing lead to increased diamond wire breaks in the vicinity of connections.
- It is essential to position diverter rolls at the inlet and outlet points in order to gather the diamond wire at the end of cutting.
- Select the angle of arc of the diamond wire to be as high as possible in the drive wheel in order to prevent the diamond wire from slipping through (min. 50 % of the wheel circumference). Do not select the arc of contact of the diamond wire to be too small (small radii and small contact lengths lead to diamond wire breaks and increased wear).

7. Round off corners

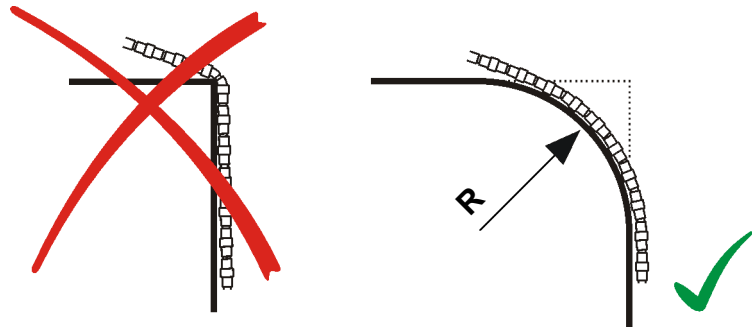


Fig. 6-4 Rounding-off corners

Danger

Danger from sharp edges during diamond wire sawing

Sharp edges can lead to breaks when working with diamond wire saws and therefore all edges must be rounded-off to a minimum radius of $R=10$ cm before the cutting procedure.

Failure to comply with this regulation may lead to serious physical injury or death. Secondary damage such as fires may also occur.



8. Position diamond wire

When positioning the diamond wire, note the following points:


- Note the direction of travel arrow on the diamond wire. The direction of travel arrow is located behind the beads
"Chapter 3" 3.4.2, 3-16
- When using wires with a small \varnothing , mount the conically worn beads towards the front
- The direction of travel should not be changed (due to significantly increased wear)
- Determine the diamond wire length taking into account the machine details
- Turn the diamond wire correctly as directed
"Chapter 3" 3.4.2.1, 3-17
- Connect the diamond wire as directed
"Chapter 3" 3.5, 3-23
- Note the information in the wire saw Operating Instructions

9. Make connections

Make the power connections between the drive unit and the diamond wire saw. If hydraulic motors are being used, ensure that the correct connections for the correct motor and for forward and reverse are created.

Finally the drive assemblies must be connected to the power connection.

10. Install water supply


Set up the water supply to the diamond wire.
"Chapter 3" 3.3.2.5,  3-12.

- Arrange the water feed at the entry point and at approximately the half-way point of the contact length of the diamond wire.
- A correct cooling water feed is of crucial importance for a satisfactory result (cooling water problems can lead to destruction of the tool).

11. Secure structural blocks

Before sawing work commences the structural blocks must be correctly secured from the structural engineering point of view. It must be ensured that the structural blocks neither overturn nor fall out or down and that they cannot displace.




Danger	
	Hazard from falling building structures.
	The building structure must be properly secured (see Operating Instructions in this Safety Manual).
	Failure to observe this regulation may lead to serious physical injury, possibly even death, and to property damage.

12. Grind-in diamond wire

Grinding-in means manually pulling the diamond wire over the building structure.

During the grinding-in it must be ensured that no hoses or cables are in the vicinity of the diamond wire or come to rest there.



Information	
	If the diamond wire cannot be pulled manually over the building structure, it will not start with the machine either.

13. Sawing

Now perform the cuts in the order envisaged.

- Allow the diamond wire to start at a low tension in order to avoid jamming.
- The cutting speed of the cutting wire should be 20-25 m/s, or for very high levels of reinforcement 18 m/s.
- The main pressure during cutting is 80-160 bar, according to the contact length of the wire. Excessive pressure leads to increased or to unilateral wear of the diamond beads. For wall thicknesses of below 80 cm and for circular cuts, work at a reduced pressure.



Information

Interrupting cutting:

In order to allow an easier subsequent start-up of the diamond wire in an existing cut, the diamond wire should be left in the cut for a few moments without feeding.

14. Switching off the diamond wire saw

Once the sawing work is complete, the diamond wire saw can be switched off and secured against unintentional starting up. Then the water feed can be shut off.

15. Disassembling the diamond wire saw

Once the saw system has been correctly switched off, the diamond wire saw can be disassembled. First the supply lines and then the individual components should be disassembled.

16. Removal of the structural blocks

Removal of the structural blocks is dangerous and therefore particular care is called for. It must in particular be ensured that no persons remain in the danger areas and the securing and suspension or crane apparatus are adequately designed for the load to be held or lifted.

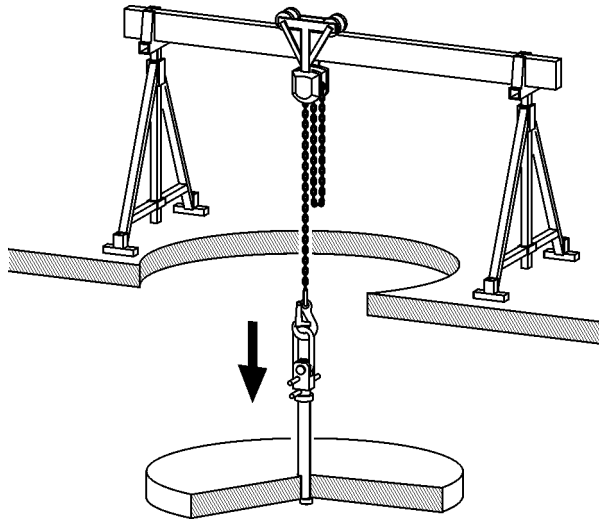


Fig. 6-5 Example of use of a floor cutout removal device



Information	
	1m ³ concrete weighs between 2,400 and 2,700 kg. Always take note of the floor loading during removal.

Suspension devices

Use the correct suspension devices for the size and weights of the blocks removed.

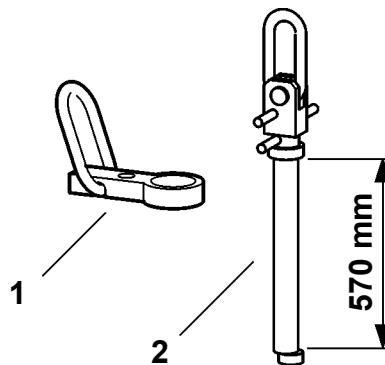


Fig. 6-6 Suspension devices for various suspended loads

- 1 2.5 t suspension device
- 2 4.0 t suspension device

17. Securing of cut-out sections

Once the structural blocks have been removed, floor and ceiling cut-outs must be secured.

Securing of floor or ceiling cutouts

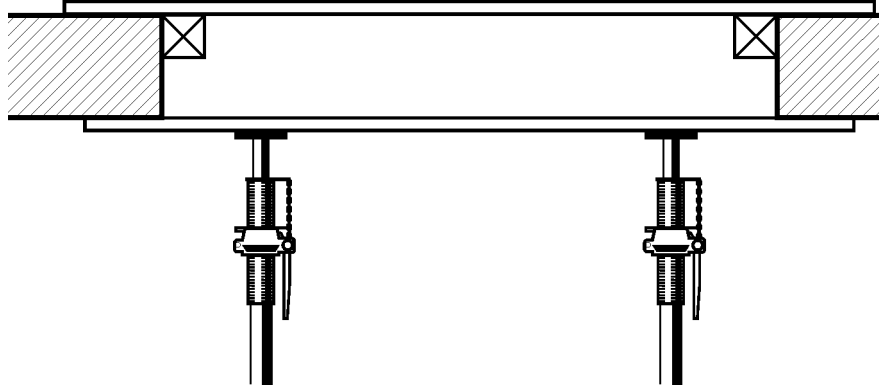


Fig. 6-7 Covering of floor and ceiling cutouts

Securing of large floor or ceiling cutouts

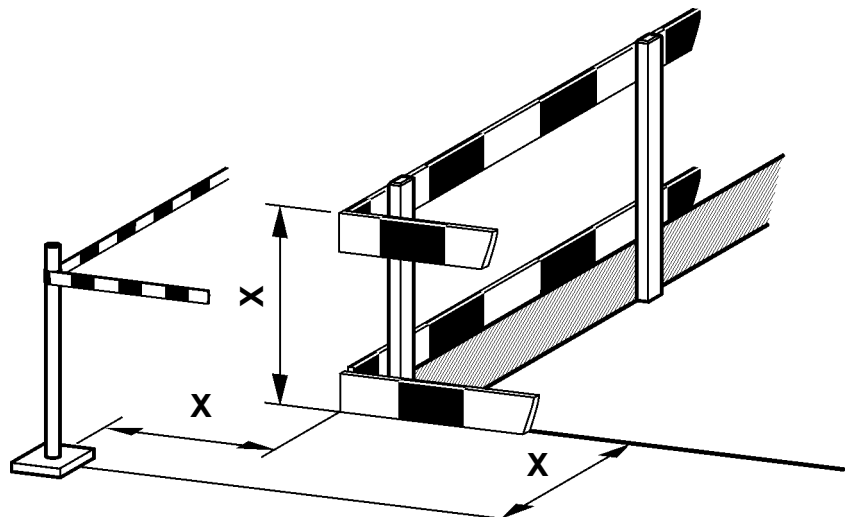


Fig. 6-8 Possibilities offered by hard edged barriers

X Dimensions in accordance with local regulations

18. Disposal of sawing sludge

If necessary the sawing sludge must be disposed of according to the normal local environmental regulations. The sawing sludge contains all the materials that have been sawn through and residues from the diamond wire tool.

6.4.3 Danger and working areas

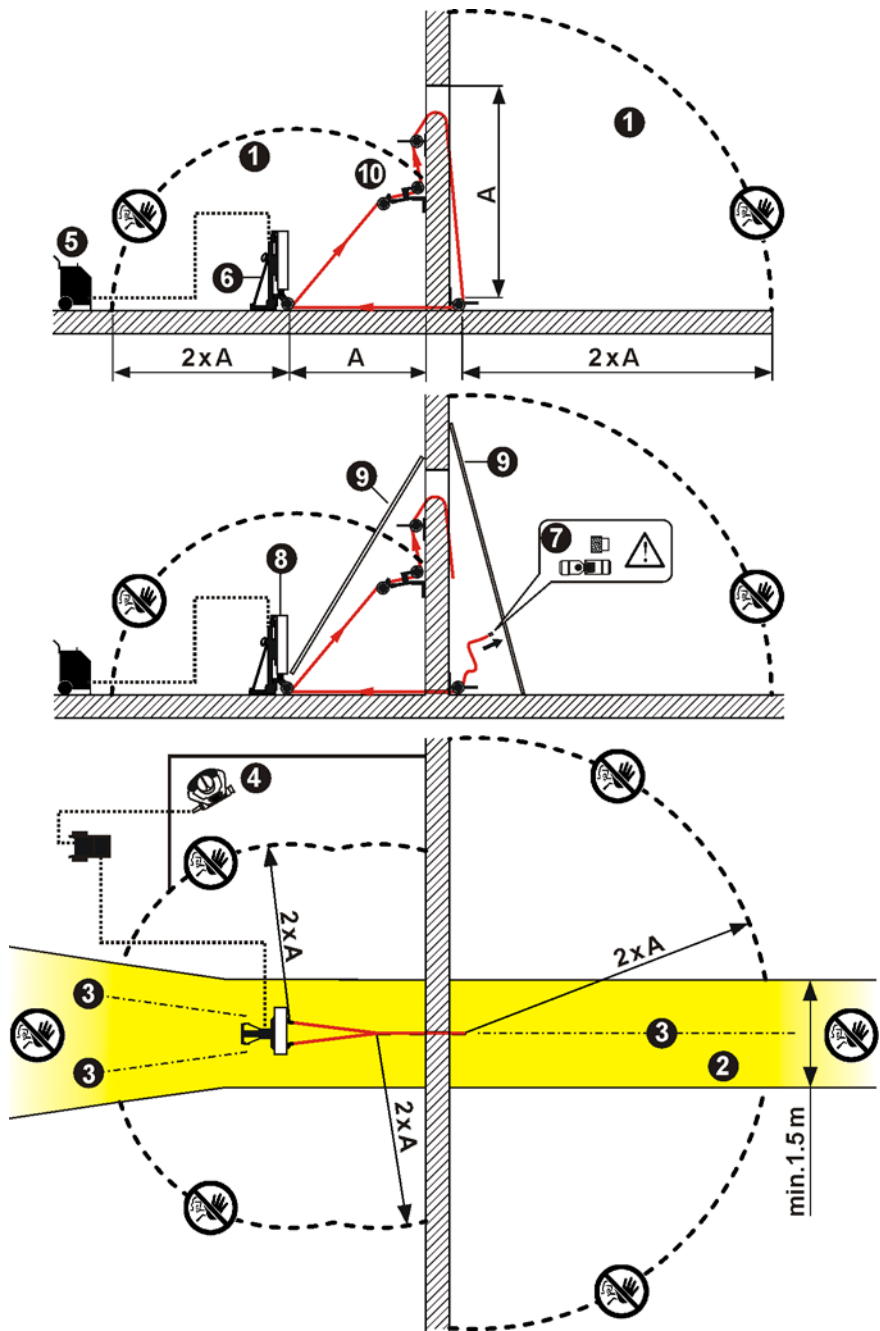


Fig. 6-9 Danger area

- | | | | |
|---|------------------------------------|----|------------------------------------|
| A | Longest free diamond wire length | 6 | Wire saw |
| 1 | Danger area | 7 | Wire segment / Wire connector |
| 2 | Diamond wire alignment danger area | 8 | Wire sawing protective device |
| 3 | Diamond wire alignment axis | 9 | Free wire length protective device |
| 4 | Recommended working area | 10 | Diverter rolls |
| 5 | Drive unit | | |

6.4.4 Danger and working areas for direct mounting of diamond wire saws

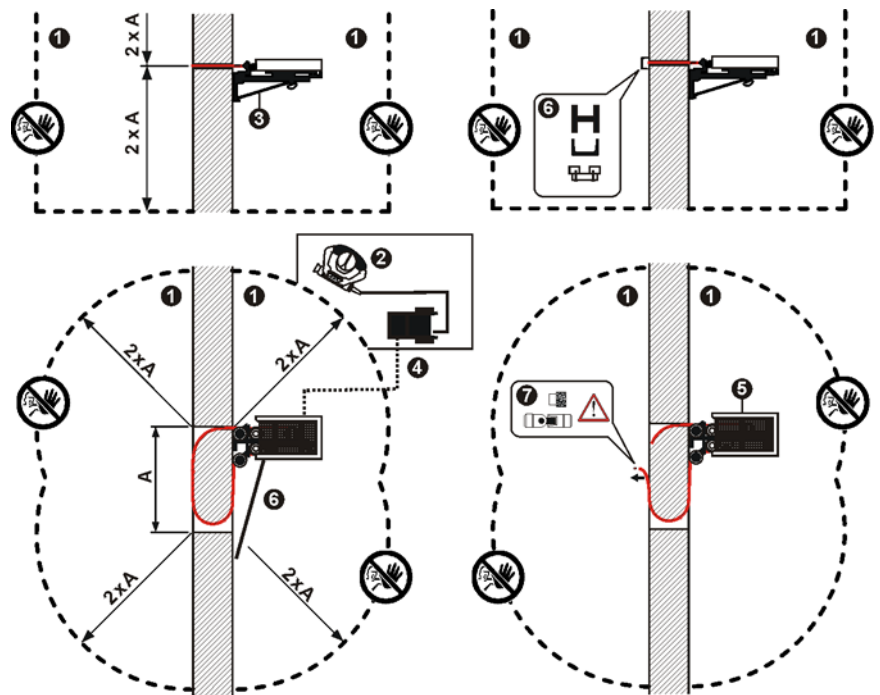


Fig. 6-10 Danger and working areas for direct mounting of the diamond wire saw

- | | | | |
|---|----------------------------------|---|---|
| A | Longest free diamond wire length | 5 | Wire sawing protective device |
| 1 | Danger area | 6 | Free wire length protective device (U-profile / H-profile / wooden channel) |
| 2 | Recommended working area | 7 | Wire segment / wire connector |
| 3 | Wire saw | | |
| 4 | Drive unit | | |

6.4.5 Danger and working areas for floor cutting

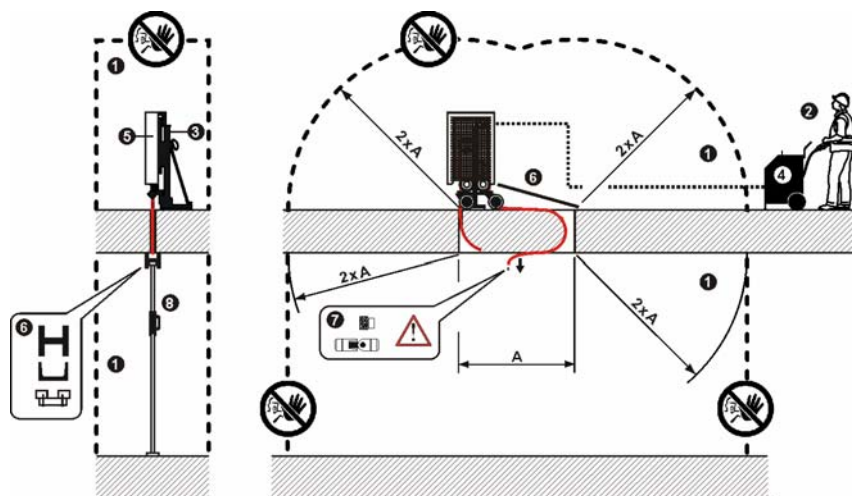


Fig. 6-11 Danger and working areas for floor cutting

- | | | | |
|---|----------------------------------|---|---|
| A | Longest free diamond wire length | 5 | Wire sawing protective device |
| 1 | Danger area | 6 | Free wire length protective device (U-profile / H-profile / wooden channel) |
| 2 | Recommended working area | 7 | Wire segment / wire connector |
| 3 | Wire saw | 8 | Anchoring of protective device |
| 4 | Drive unit | | |



Information

For floor cutouts the cutout blocks must be supported with suitable building material or suspended and secured on a crane or other suitable lifting apparatus with sufficient load-bearing capacity.

6.5 Practical working instructions

6.5.1 Taut and slack sides of the diamond wire

When setting up diamond wire saw systems the taut and slack sides of the diamond wire must be taken into account.

- The taut side is at the diamond wire entry to the diamond wire saw
- The slack side is at the diamond wire exit from the diamond wire saw

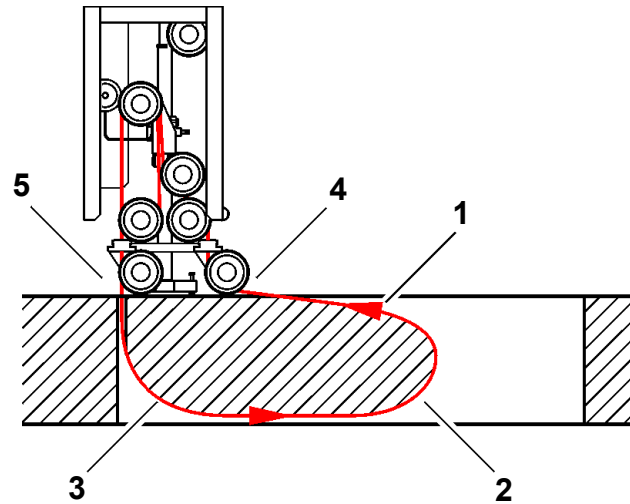


Fig. 6-12 Taut and slack sides of the diamond wire

- | | |
|------------------------------------|------------------------------|
| 1 Diamond wire direction of travel | 4 Machine diamond wire entry |
| 2 Taut side | 5 Machine diamond wire exit |
| 3 Slack side | |



Information

When setting up diamond wire saw systems it must be remembered that the cutting force is always greatest on the taut side of the diamond wire, that is where the diamond wire enters the storage wire saw. The cutting force at the diamond wire exit of the storage wire saw (slack side) is insufficient.

6.5.2 Cutting force during diamond wire sawing

6.5.2.1 Cutting force distribution for narrow cutting objects

In order that the diamond wire loading does not become too great with small objects and that the turning of the diamond wire has an effect, the cutting force must be distributed over a long cutting arc.

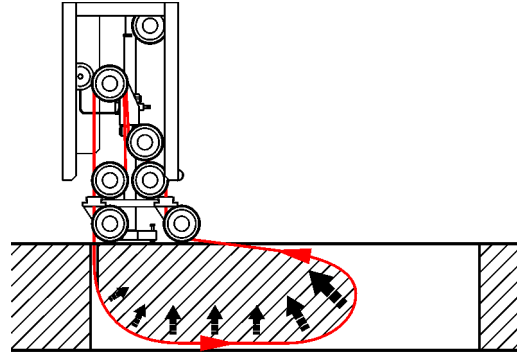


Fig. 6-13 Cutting force distribution for narrow cutting objects



Information

Narrow cutting objects are preferably cut with the storage wire saw mounted directly on the cutting object.

6.5.2.2 Cutting force distribution for wide cutting objects

In order that the contact length for wide section is not too great, the arc of cut must be reduced (e.g. by using diverter rolls).

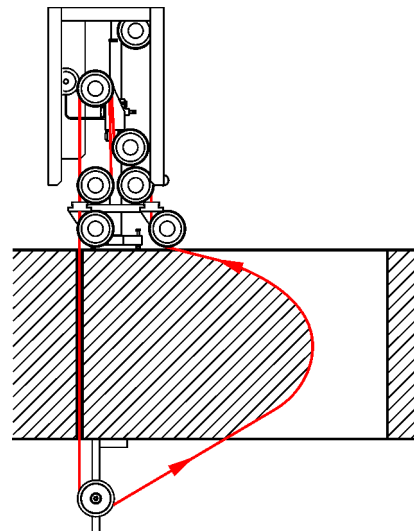


Fig. 6-14 Cutting force distribution for wide cutting objects

6.5.3 Flush cuts

The diamond wire can be run freely through diverter rolls and is thus a flexible tool that can be used for various types of cutting. By using auxiliary materials flush cuts can also be performed.

Wood as an auxiliary material

Wood can only be cut by diamond wire with difficulty. This characteristic makes wood a useful auxiliary material for flush cutting.

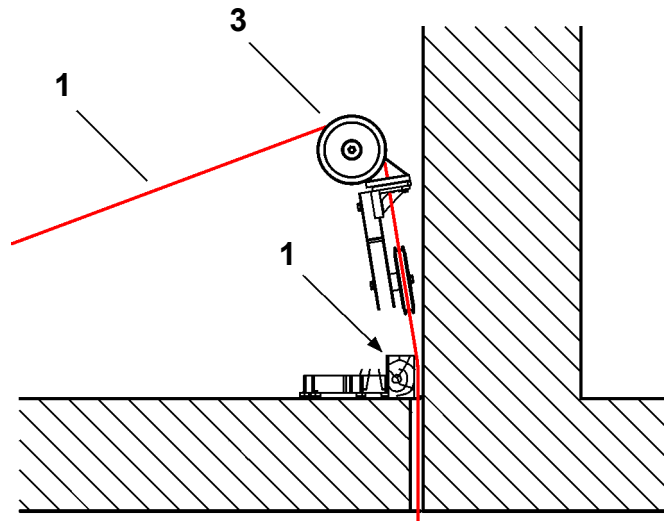


Fig. 6-15 Flush cutting

- 1 Wood as an auxiliary material for cut guidance
- 2 Diamond wire
- 3 Universal support



Information

Wood can be used as an auxiliary material in diamond wire cutting for guiding the cut. The wood should always be wetted before being used.

6.5.4 Plunge-sawing

The plunge-sawing cutting method allows angular pocket holes to be created.

6.5.4.1 Principle of plunge sawing

In the four corners of the planned pocket hole core bore holes of $\text{Ø}250 \text{ mm}$ are created. Then so-called plunge tubes are fitted. The plunge tubes are fitted with rotating diverter rolls. The plunge tube unit with the diamond wire fitted is inserted as far as the base of the bore holes and secured. Then cutting takes place from top to bottom.

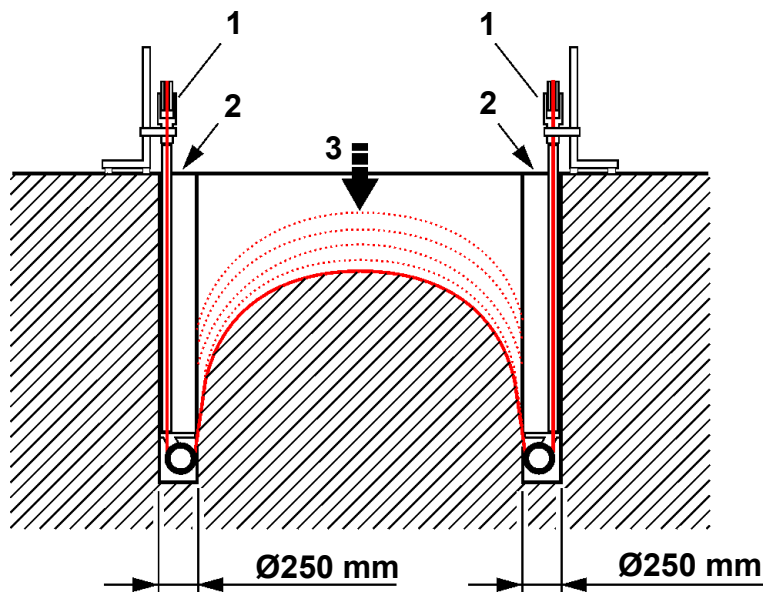


Fig. 6-16 Plunge-sawing

- 1 Plunge tube with rotating diverter rolls
- 2 Bore hole $\text{Ø}250 \text{ mm}$
- 3 Cutting arc

6.5.4.2 Sequence of cutting for plunge sawing

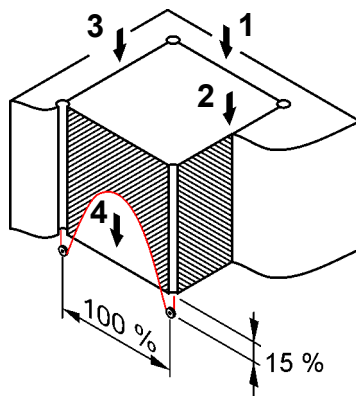


Fig. 6-17 Sequence of cutting for plunge sawing

In order to achieve the desired cutout volume, the diverter rolls should be positioned approximately 15% deeper than the width of cut.

6.6 Troubleshooting

Proceed systematically when looking for the causes of a fault. Refer to the Operating Instructions of the corresponding system components when doing this.

The following table will help you to narrow down and rectify the source of the fault.

6.6.1 Troubleshooting table

Fault	Possible cause	Solution
Diamond wire cuts very slowly or not at all	Very hard aggregate	Sharpen diamond wire, reduce diamond wire speed
	Excessive contact length	Reduce contact length, Position diverter rolls
	Diamond wire speed too high	Reduce diamond wire speed
	Diamond wire cuts on all sides of the material to be cut	Take account of taut and slack sides during mounting
Unilateral diamond wire wear	Diamond wire inadequately turned	Turn diamond wire tighter See "Chapter 3" 3.4.2.1, 3-17
	Insufficient water	Increase water feed
	Excessive pull on the diamond wire	Reduce feed pressure
	Insufficient clearance between drive wheel and the material to be cut	Increase clearance
	Diverter rolls sit at an angle and diamond wire is prevented from turning by the roll edges	Correct the alignment of the diverter rolls with diamond wire or alignment line
Diamond wire broken at connector	Excessive pull on the diamond wire	Reduce feed pressure
	Excessively sharp edges	Break edges, position diverter rolls
	Excessive wear at connector	Feed more water for cooling
	Excessively tight arc radius	Position diverter rolls
	Diamond wire vibrates heavily	Ensure short free diamond wire lengths
	Heavy wear at connector, incorrectly mounted	Mount connector as directed
Diamond wire break behind the connector	Excessive pull on the diamond wire	Reduce feed pressure
	Excessively sharp edges	Break edges, position diverter rolls
	Excessively tight arc radius	Mount diverter rolls
	Traction wire vibrates heavily	Check diamond wire for even diameter and work at a lower feed
	Connector incorrectly pressed	Press connector as directed

Fault	Possible cause	Solution
Diamond wire motor does not run	Excessive pull on the diamond wire	Reduce feed pressure
	Sharp edges	Break edges, set diverter rolls and manually grind-in diamond wire
	Diamond wire has differing wire thickness	Check wire for even diameter +/- 0.2mm
	Diamond wire connector pieces too tight	Check diamond wire connector
	New diamond wire in old narrower cut	Use worn diamond wire with smaller diameter
	Excessively long arcs in material to be cut	Mount more diverter rolls
	Rolls jamming	Check rolls and bearings
	Loose drive connections	Check drive
	Diamond wire cuts on all sides of the material to be cut	Take account of taut and slack sides during mounting
Diamond wire frequently jumps from drive rolls	Inadequate diamond wire tensioning	Increase feed pressure
	Rolls are not in the line of the diamond wire	Correct the alignment of the diverter rolls with diamond wire or alignment line
	Kinks in diamond wire (Be careful as diamond wire may be damaged)	Align and straighten diamond wire
	Angle of arc too tight	Increase angle of arc by further diverter rolls
	Diamond wire cuts on all sides of the material to be cut	Take account of taut and slack sides during mounting
Diamond wire frequently jumps from diverter rolls	Inadequate diamond wire tensioning	Increase feed pressure
	Rolls are not in alignment with the diamond wire	Correct the alignment of the diverter rolls with diamond wire or alignment line
	Kinks in diamond wire (Be careful as diamond wire may be damaged)	Align and straighten diamond wire
	Vibrations due to excessive clearance between drive wheel and the material to be cut	Mount diverter rolls
	Angle of arc too tight	Increase angle of arc

Fault	Possible cause	Solution
Strong and rapid vibration of diamond wire	Excessive diamond wire tensioning	Reduce feed pressure
	Excessively long arc sections	Mount more diverter rolls
	Sharp edges or reinforcements	Break edges and position diverter rolls
	Excessive speed	Reduce speed of drive wheel
Diamond wire continues to hang in cut	Connectors too thick, varying diamond wire thicknesses	Check diamond wire and connectors for uniform diameter
	Material to be cut is not wedged	Wedge material to be cut
	Insufficient water	Increase water feed
	Plastic heats up and telescopes together	Increase water quantity and water pressure Check water feed
	Diamond beads and plastic telescope together	Increase water quantity and water pressure
Diamond wire slips on drive wheel	Inadequate diamond wire tensioning	Increase feed pressure
	Excessively long arc in material to be cut	Mount more diverter rolls
	Bandage of drive wheel is worn	Replace rubber bandage
	Edges on the building structures	Grind-in diamond wire
	Inadequate arc at drive wheel	Increase angle of arc by increasing size of diverter rolls
	Diamond wire cuts on all sides of the material to be cut	Take account of taut and slack sides during mounting
Cutting untrue, cut is not straight	Insufficient diverter rolls	Mount more diverter rolls with alignment wire and bubble level
	Inadequate diamond wire tensioning	Increase feed pressure
	Diverter rolls not fixed or not in alignment during the cutting process	Modify and ensure accurate alignment and secure fixing of diverter rolls

Fault	Possible cause	Solution
Diamond wire beads telescope together	Plastic heating up due to insufficient water	Introduce more cooling water into cut
	Excessive pull on the diamond wire	Reduce feed pressure
	Heating due to diamond wire slipping on drive wheel	Increase diamond wire tensioning
	Whiplash effect when diamond wire breaks	Prevent whiplash effects of diamond wire by rolls or interception devices such as boards, sheet metal, etc.
	Sudden jamming in the cut	Wedge material to be cut
	Loose reinforcements	Remove loose reinforcements
Diamond wire is pulled out of press connection	Tongs incorrectly adjusted, inadequate pressing force	Check pressing and tongs setting
	Diamond wire section in diamond wire connector too short	Note details in connector mounting instructions
	Excessive diamond wire tensioning, excessive vibrations	Reduce feed pressure
Threading of screw connector does not fit	Thread crushed during pressing	Press threaded connector as indicated in the mounting instructions
	Dirty thread	Remove dirt and cutting sludge
Diverter rolls becoming distorted	Mounted with excessively long lever	Ensure short lever travel when mounting diverter rolls
	Supports not screwed tight	Mount supports securely
	Excessive diamond wire tensioning	Reduce feed pressure
Kinks in diamond wire	Whiplash effect when diamond wire breaks	Prevent whiplash effects of diamond wire by rolls or interception devices such as boards, sheet metal, etc.
	Small kinks caused when turning diamond wire	Do not cause tight kinks when turning
	Diamond wire loops not removed, only tightened	Do not pull diamond wire loops, remove them by turning
Diamond wire runs slowly and remains in same place	Excessive diamond wire tensioning	Reduce feed pressure
	Excessively long arc sections	Mount more diverter rolls
	Very soft material to be cut	Increase angle of arc by increasing size of diverter rolls

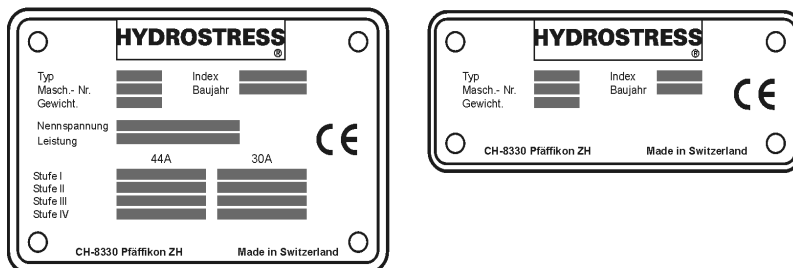
Fault	Possible cause	Solution
Cutting speed is too slow	Inadequate diamond wire tensioning	Increase feed pressure
	Excessively long arcs in material to be cut	Mount more diverter rolls
	Diamond wire polished	Feed less water, reduce speed
	Speed too high	Reduce speed
	Too much water	Feed less water
	Diamond wire worn	Replace diamond wire
	Diamond wire cuts on all sides of the material to be cut	Take account of taut and slack sides during mounting
Diamond wire polished	Too much water	Feed less water
	Inadequate diamond wire tensioning	Increase feed pressure
	Speed too high	Reduce speed
	Excessively long arcs in material to be cut	Mount more diverter rolls
Excessive diamond wire wear	Too little water or problem with feed	Increase water feed, optimise water feed
	Direction of rotation or running of diamond wire inverted	Ensure correct direction of rotation and running of diamond wire
	Excessively short contact length in material to be cut	Increase contact length in the material, reduce feed pressure
	Diamond wire speed too low	Increase diamond wire speed
Erosion in cut surfaces	Excessive diamond wire tensioning, thus strong vibration of diamond wire	Reduce feed pressure, check rolls
	Roller bearings worn out	Replace roller bearings
	Differing diamond wire thickness and quality	Check diameter of diamond wire and connector, use only same quality and hardness
Diamond wire jams in the material to be cut and seizes	Very soft material to be cut	Increase angle of arc by increasing size of diverter rolls
	Excessively short arc sections in material to be cut	Reduce feed and speed
	Differing diamond wire thicknesses	Check diameter of diamond wire and connector
Diamond wire broken and jammed in cut	Material to be cut not wedged	Wedge material to be cut

Fault	Possible cause	Solution
Extensive diamond wire whiplash when diamond wire breaks	Diamond wire beads telescoped together	Pull diamond wire from cut
	Sharp reinforcement edges	Break edges or position diverter rolls
	Caving in of loose material	Drill out or wash away
	Excessive clearance of diverter rolls	Mount more diverter rolls
	No diamond wire protection for the free diamond wire length	Prevent whiplash effects of diamond wire by rolls or interception devices such as boards, sheet metal, etc.
	No machine-diamond wire protection in use	Mount machine diamond wire protection
Diamond wire cuts on all sides of the material to be cut	No account taken of taut and slack sides	Take account of taut and slack sides during mounting

If you are unable to remedy a fault, please call our service centre (see Manufacturer's address ☐-II on the reverse of the title page).

To guarantee a rapid and professional solution to the problem, it is important that you have prepared as follows before calling:

- Try to describe the fault as accurately as possible
- Note the type and index of your system components.



- Have the Operating Instructions close to hand

7 Maintenance

7.1 General

7.1.1 Safety instructions

Before proceeding read Chapter 2 “Safety instructions”, 2-1 in this Safety Manual. Be sure also to take note of all the danger information given here and follow the instructions on how to avoid physical injury and damage to property.



Warning

Danger from sharp tool edges

Touching a tool whilst it is still in motion is prohibited.

When touching tools at a standstill it is recommended that protective gloves are worn.

Failure to adhere to this regulation may result in cut wounds to the hands.



Warning

Danger of allergic reactions if skin comes into contact with hydraulic oil.

Persons who have an allergic reaction to hydraulic oil must wear protective gloves and goggles when carrying out work where they come into contact with hydraulic oil. Any areas of the skin affected must be rinsed immediately with copious amounts of water.

Failure to adhere to this regulation may result in allergic reactions or injuries to the eyes.

7.1.2 Personnel qualifications

Diamond wire saw systems should not be operated by unauthorised persons. Personnel are only authorised where they meet the following requirements:

- have successfully completed, and hold a certificate from, user training at **TYROLIT Hydrostress AG** or corresponding technical courses at regional professional associations and federations.
- the safety instructions in Chapter 2 must have been read and understood.
- are familiar with all the general rules of construction

7.2 Maintenance interval table

The following maintenance work must be performed according to the specified cycles. Wear parts that are not subject to particular maintenance intervals should also be checked regularly for wear and adjusted or exchanged as necessary. For combustion motors the maintenance activities must be performed according to the separate maintenance instructions of the motor manufacturer.

		before each start-up	upon completion of work	Weekly	Annually	In the event of malfunction	In the event of damage
Overall system	Visual check	X				X	X
	Clean		X				
Hydraulic system (For drive units see Operating Instructions)	Hydraulic hose inspection (tightness / cleanliness)	X	X			X	X
	Coupling inspection (tightness / cleanliness)	X	X			X	X
Water economy	Water line (tightness/ cleanliness)	X	X			X	X
	Blow out water (frost hazard)		X				
Water nozzles and feed hoses / cable (For control unit see Operating Instructions)	Clean		X				
	Inspection	X					
Cutting tool (Diamond wire)	Inspection	X				X	
	Change						X
Accessible nuts and bolts	Retighten			X			
Flange	Clean		X				
	Change						X
Toothed belt / Toothed wheels (oil)	Inspection	X		X		X	X
	Change				X		X
Major service	Performed by TYROLIT Hydrostress after-sales service				X		

7.3 Inspection

Inspection activities are understood to be the work involved in checking wear parts, in order to exchange these where they show unacceptable levels of wear before they are able to cause a defect and a costly system failure.

Inspection activities are described in the Operating Instructions of the individual machines.

7.4 Maintenance

Maintenance activities are understood to be the maintenance work that must be performed in order to be able to guarantee trouble-free operation of the system. These activities usually consist of: cleaning, oiling, greasing, tool sharpening, etc.

Maintenance activities are described in the Operating Instructions of the individual machines.

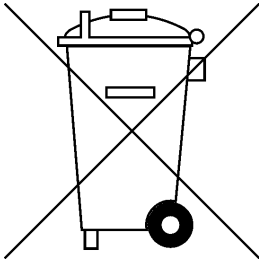
7.5 Servicing

Servicing activities are understood to be independently performed repair work. These may be a result of inspection if unacceptable levels of wear are detected in wear parts, or if other defects arise.

Servicing activities are described in the Operating Instructions of the individual machines.

8 Disposal

8.1 General



The operator can recycle or dispose of the components of a diamond wire saw system himself provided he observes the statutory provisions. In order to dismantle the components correctly and to properly remove the materials some knowledge in the area of mechanics and knowledge about differentiation of waste materials is necessary.

If during correct disposal doubts arise that represent a hazard for persons or the environment,

- the after-sales service of **TYROLIT Hydrostress AG** will be happy to provide information

8.2 Safety instructions

Before proceeding read Chapter 2 “Safety instructions”, 2-1 in this Safety Manual. Be sure also to take note of all the danger information given here and follow the instructions on how to avoid physical injury and damage to property.



Danger

Voltage warning

Before working in an area identified in this way, the installation or device must be fully disconnected from the power (voltage) and secured against being accidentally powered up again.

Failure to heed this warning may lead to death or serious injury.

8.3 Personnel qualifications

Only personnel with basic technical training and who are in a position to identify the various material groups should be involved in disposal.

8.4 Disposal regulations

The normal local and regional rules and guidelines must be observed when disposing of the machines making up the Wire saws.

8.5 Disposing of the diamond saw system

8.5.1 Disposal regulations

The normal local and regional rules and guidelines must be observed during disposal.

8.5.2 Disposing of installation components

To allow proper disposal the components must be dismantled. This is performed by the client's personnel.



Warning

Danger of injury from electric shock

Capacitors can still discharge in part of an installation even once all voltage supplies have been disconnected.

The dismantled parts of the installation are sorted by material and sent separately to the appropriate collection points. Ensure that the following parts in particular are properly disposed of.

Diamond wire saw systems consist of the following materials:

Cast aluminium	Rolled aluminium products
Bronze	Steel
Rubber	Rubber / Nylon fabric
Synthetic grease	Plexiglas

8.6 Obligation of notification

When a diamond wire saw system is taken out of service and disposed of the manufacturer **TYROLIT Hydrostress AG** or the corresponding service centre must be informed of this.