

Safety Manual ***System Description***

Core drilling

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0 Introduction

0.1 Scope of the Safety Manual

The Safety Manual contains a description for safe handling of core drilling 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 core drilling system 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 core drilling 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 Core drilling

Term	Definition
Drill rig	The drill rig accommodates the drive motor (electric or hydraulic) along with the cutting tool (diamond drill bit). Its purpose is to accurately guide the diamond drill bit (forwards and backwards motion) and to achieve the contact force via the feed device. The drill rig is secured to the surface by means of a foot.
Motors	A distinction is made between a drive motor (cutting tool drive) and a feed motor (forward and backward motion of the cutting tool). The motors can be electrically powered for low outputs or hydraulically powered for higher outputs.
Modul-Drill 	Modul-Drill stands for the modular core drilling system from TYROLIT Hydrostress AG. The Modul-Drill system developed by TYROLIT Hydrostress AG is characterised by the sturdy, stable and safe quick-release levels.
Cutting tool	In core drilling the diamond drill bit is the cutting tool.
Drive unit (electric / hydraulic)	The drive provides the power for the electric motors and the control unit as well as the appropriate power for the hydraulic motors.

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 °C the water must be cooled.

1.2 Water connection

1.2.1 Pressure:



Information

Please note the maximum water pressure shown in the Operating Instructions for the drive motor.

1.2.2 Amount:

Drill bit-Ø	Water quantity
12 - 32 mm	0.5 – 1.0 l/min.
35 - 52 mm	1.0 – 2.0 l/min.
57 - 82 mm	1.0 – 3.0 l/min.
92 - 152mm	3.0 – 4.0 l/min.
162 - 250mm	4.0 – 5.0 l/min.
300 - 400mm	6.0 – 8.0 l/min.
500 - 1,000mm	8.0 – 12.0 l/min.

1.3 Specification for oils and grease

1.3.1 Oils

Hydraulic oil: HLP / ISO VG 46

Gear oil: ISO VG 100

1.3.2 Grease

Gear grease: Penetration: 420-460
NLGI: 00

Lubricating grease: Penetration: 265-295
NLGI: 2

1.4 Cutting speeds

The cutting speed must be selected according to the nature of the material.

Concrete 2.0 – 3.0 m/s
 Concrete with a high degree of reinforcement 1.2 – 1.8 m/s

1.4.1 Speeds for hollow drills

Concrete with a high degree of reinforcement

Concrete

Ø	1.2 - 1.8 m/s
12	1910 - 2860 1/min
14	1640 - 2460 1/min
15	1530 - 2290 1/min
16	1430 - 2150 1/min
18	1270 - 1910 1/min
20	1150 - 1720 1/min
22	1040 - 1560 1/min
24	950 - 1430 1/min
25	920 - 1380 1/min
26	880 - 1320 1/min
28	820 - 1230 1/min
30	760 - 1150 1/min
32	720 - 1070 1/min
35	650 - 980 1/min
37	620 - 930 1/min
40	570 - 860 1/min
42	550 - 820 1/min
47	490 - 730 1/min
52	440 - 660 1/min
57	400 - 600 1/min
62	370 - 550 1/min
67	340 - 510 1/min
72	320 - 480 1/min
77	300 - 450 1/min
82	280 - 420 1/min
92	250 - 370 1/min
102	220 - 340 1/min
107	210 - 320 1/min
112	200 - 310 1/min
122	190 - 280 1/min
127	180 - 270 1/min
132	170 - 260 1/min
142	160 - 240 1/min
152	150 - 230 1/min
162	140 - 210 1/min
172	130 - 200 1/min
182	130 - 190 1/min
202	110 - 170 1/min
222	100 - 150 1/min
225	100 - 150 1/min
240	100 - 140 1/min
250	90 - 140 1/min
300	80 - 110 1/min
350	70 - 100 1/min
400	60 - 90 1/min
450	50 - 80 1/min

Ø	2.0 - 3.0 m/s
12	3180 - 4770 1/min
14	2730 - 4090 1/min
15	2550 - 3820 1/min
16	2390 - 3580 1/min
18	2120 - 3180 1/min
20	1910 - 2860 1/min
22	1740 - 2600 1/min
24	1590 - 2390 1/min
25	1530 - 2290 1/min
26	1470 - 2200 1/min
28	1360 - 2050 1/min
30	1270 - 1910 1/min
32	1190 - 1790 1/min
35	1090 - 1640 1/min
37	1030 - 1550 1/min
40	950 - 1430 1/min
42	910 - 1360 1/min
47	810 - 1220 1/min
52	730 - 1100 1/min
57	670 - 1010 1/min
62	620 - 920 1/min
67	570 - 860 1/min
72	530 - 800 1/min
77	500 - 740 1/min
82	470 - 700 1/min
92	420 - 620 1/min
102	370 - 560 1/min
107	360 - 540 1/min
112	340 - 510 1/min
122	310 - 470 1/min
127	300 - 450 1/min
132	290 - 430 1/min
142	270 - 400 1/min
152	250 - 380 1/min
162	240 - 350 1/min
172	220 - 330 1/min
182	210 - 310 1/min
202	190 - 280 1/min
222	170 - 260 1/min
225	170 - 250 1/min
240	160 - 240 1/min
250	150 - 230 1/min
300	130 - 190 1/min
350	110 - 160 1/min
400	100 - 140 1/min
450	80 - 130 1/min

Fig. 1-1 Table of speeds

1.5 Weights

1.5.1 Relative densities:

- Asphalt: approx. 1,500 kg/m³
- Reinforced concrete: approx. 2,700 kg/m³
- Granite: approx. 2,800 kg/m³
- Sandstone: approx. 2,500 kg/m³

1.5.2 Weight calculation:

Volume (m³) x Relative density (kg/m³) = Weight (kg)

1.5.3 Drilling core example (reinforced concrete):

1.5.3.1 Calculation formula:

Volume:

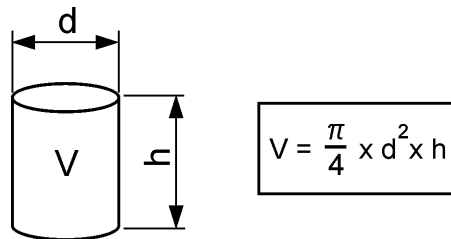


Fig. 1-2 Calculation formula for volume (V)

d = diameter (m)
 h = length (m)
 V = volume (m³)

Weight:

Volume (m³) x Spec. weight (kg/m³) = Weight (kg)

1.5.3.2 Calculation example:

Drilling core data:

Drilling-Ø 0.15 m
 Drilling length 0.30 m
 Relative density 2,700 kg/m³

Drilling core volume:

$$\frac{\pi}{4} \times 0,15^2 \times 0,3 = 0,0529875$$

Drilling core weight:

0.0052987m³ x 2,700 kg / m³ = **14.3 kg**

1.6 Power consumption

The power consumption of the various drive motors differs considerably.

Details of the power consumption of a particular drive motor 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.

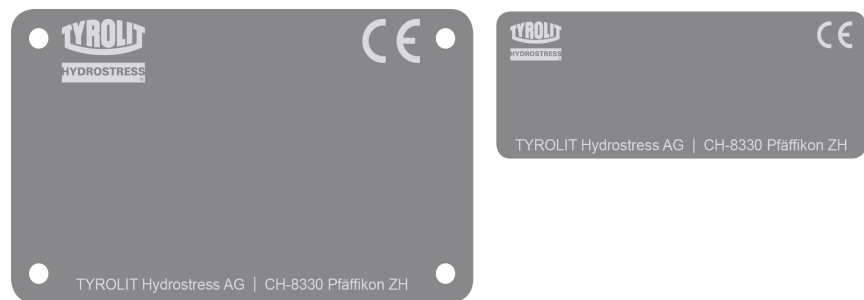


Fig. 1-3 Name plates

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 core drilling systems.

All persons who work on and with the core drilling equipment 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 core drilling system 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.

The components of the core drilling system have been 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 core drilling equipment 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 drill bit.</p> <p>Touching the diamond drill bit whilst it is still in motion is prohibited.</p> <p>When touching the diamond drill bit 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

Core drilling equipment has 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 drill bits, but then only when the Emergency Stop button has been pressed.

Before using the core drilling equipment 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 core drilling systems is strictly required to wear individual protective equipment.

The individual protective equipment comprises the following:

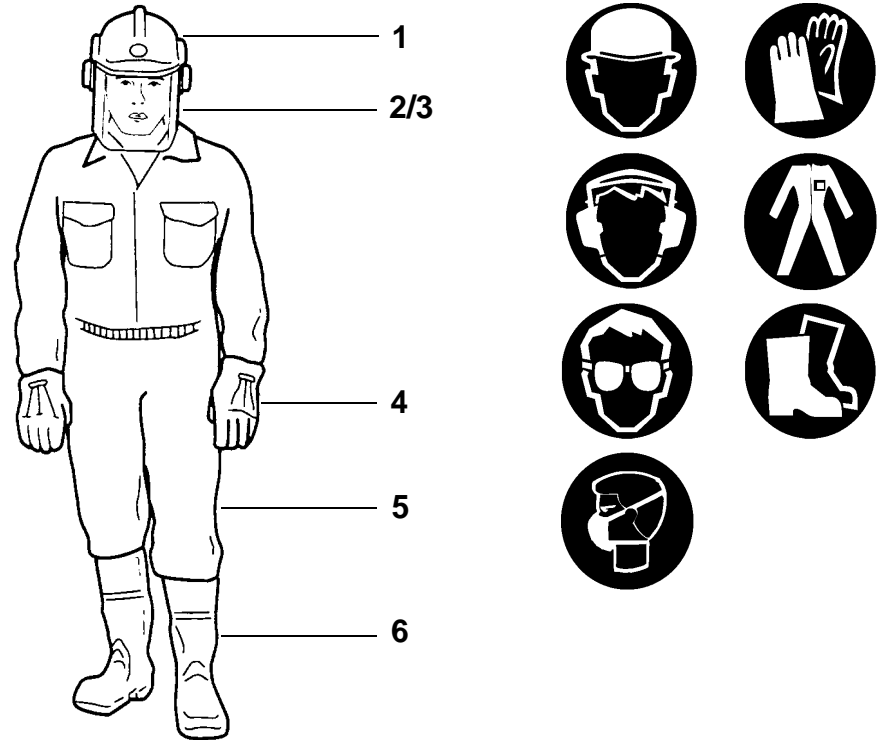


Fig. 2-1 Individual protective equipment

- | | |
|---|--|
| <ul style="list-style-type: none"> 1. Helmet with ear protectors 2. Visor or goggles 3. Respiratory mask 4. Safety gloves | <ul style="list-style-type: none"> 5. Close-fitting, sturdy, comfortable clothing 6. Work boots with steel toecaps and anti-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 core drilling equipment 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 core drilling equipment when it is 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 core drilling equipment or property damage and personal injury may result.

2.4.5 Power connections

Core drilling equipment that is 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

Core drilling equipment is designed and built for the following application:

- Drilling of concrete (including reinforced concrete) and natural stone, for other materials please contact us.
- Drilling of through- and pocket holes as well as diagonal bores in ceilings, floors and walls.
- Core drilling equipment should only be used and operated with the authorised anchoring systems.
- Only original TYROLIT Hydrostress AG diamond drill bits and accessory parts 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 result in considerable danger, details are given here of what we believe constitutes improper use or misuse.

The following applications are prohibited:

- Drilling wood, glass and plastics
- Drilling loose parts (including in concrete)
- Drilling in explosion-protected areas
- Drilling without system and tool cooling
- Drilling using non-original TYROLIT Hydrostress AG drill bits and accessories
- Drilling without the safety devices provided
- Drilling without observing the instructions for use
- Incorrect or absence of waste water disposal (drill 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 drilling.

The front, underneath and rear of the drilling area must be protected so that persons or equipment cannot be harmed or injured by falling parts or drilling sludge. Drilling cores 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 drilling 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 core drilling equipment 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 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 core drilling equipment.

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 core drilling system for the material to be drilled or the material thickness.
- Performs drilling 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 engineer

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 core drilling systems from the manufacturer.

2.5.5.3 Service engineer

- Specialist professional training (mechanical/electrotechnical).
- Has attended product training 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 core drilling systems 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 core drilling machines can be used as portable drilling machines or rig drilling machines. The drill bit is driven by an electric motor or a hydraulic motor.

Diamond core drilling machines and systems are used for creating passages through concrete, asphalt and various types of rock or to obtain a drilling core. Core drilling systems are also used for corner drill holes in wall- and wire-sawing operations. Of course, pocket holes can also be drilled for anchoring work.

The cutting tool used for this will be a diamond drill bit with a diameter of between 6 mm and 1,500 mm.

Core drilling systems can comprise the following machines and components:

- Core drill rig (various types)
- Drive, feed motor (hydraulic or electric)
- Cutting tool (diamond drill bit)
- Drive unit (hydraulic in various power classes)
- Accessory parts (e.g. water collection rings, adapters, extensions, spot drill centring, etc.)
- Connectable equipment (e.g. wet and dry suction devices, pressurised water tank, quick-change clamping columns, vacuum plates, etc.)

3.2 The various core drilling systems

Core drilling systems come in various designs and types. Some of the most common core drilling systems are listed in the following.

3.2.1 Free-hand core drilling system

3.2.1.1 Operational scope

The free-hand diamond core drilling system is suitable for dowel, socket and through holes. Core drilling systems for wet drilling of reinforced concrete or dry drilling of masonry can be operated either free-hand or using a drill rig.



Information

TYROLIT Hydrostress AG recommends using core drill rigs for bore hole diameter of Ø100 mm and above.

3.2.1.2 Wet drilling system

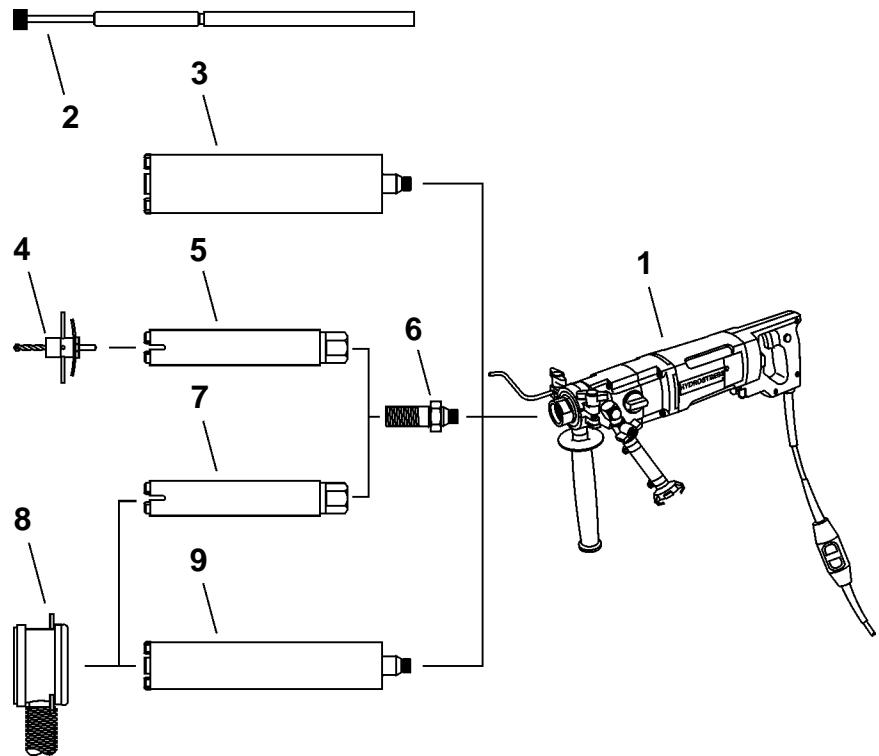


Fig. 3-1 Wet drilling system

- | | |
|----------------------------------|--------------------------------|
| 1 Wet drilling device | 6 Thread adapter 1¼" - ½" |
| 2 Spot drilling aid with damper | 7 Drill bit Ø 56-72mm, NL 250 |
| 3 Drill bit Ø 10-107mm, NL 340mm | 8 Water collection ring Ø 70mm |
| 4 Centre cross | 9 Drill bit Ø 10-72mm, NL 340 |
| 5 Drill bit Ø 56-107mm, NL 250mm | |

3.2.1.3 Dry drilling system

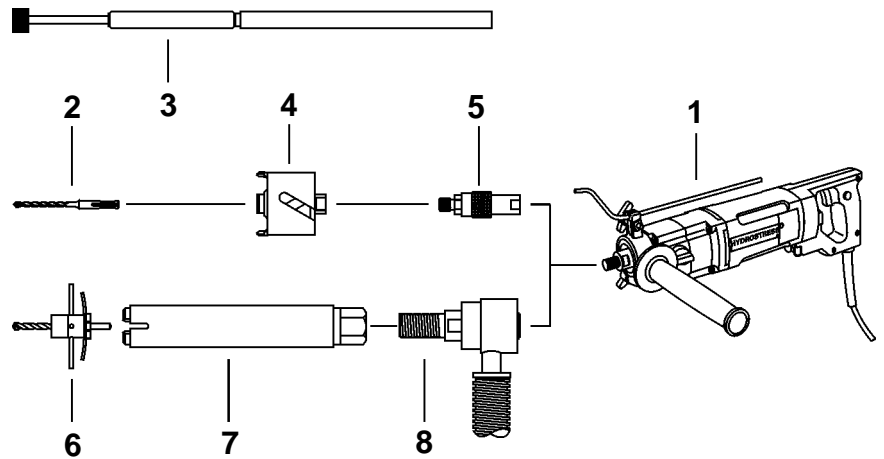


Fig. 3-2 Dry drilling system

- | | |
|---------------------------------|------------------------|
| 1 Dry drilling device | 5 Support spindle |
| 2 Centre drill | 6 Centre cross |
| 3 Spot drilling aid with damper | 7 Ø 56-162mm, NL 250mm |
| 4 Hollow drill | 8 Suction pipe |

3.2.1.4 Free-hand drilling machine on the drill rig

Free-hand wet and dry drilling machines can be mounted on drill rigs by means of clamping supports and used with system components such as water collection rings, spot drilling aids and bit stops.

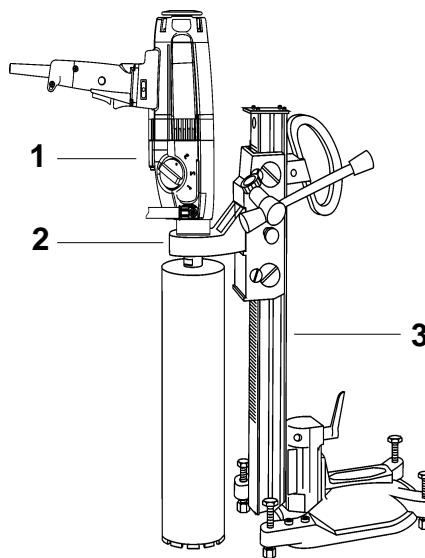


Fig. 3-3 Free-hand drilling machine on the drill rig

- | |
|-------------------------------|
| 1 Electric drill motor 1.6 kW |
| 2 Clamping support |
| 3 Core drill rig |

3.2.2 Electric core drill rig system

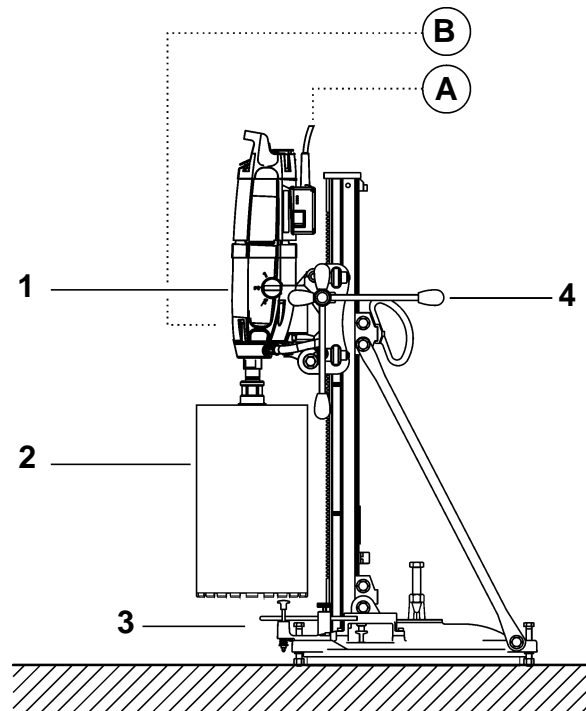


Fig. 3-4 Electric core drilling system

- | | |
|--------------------------------------|-------------------------------|
| 1 Electric "Modul-Drill" drive motor | A Electric motor power supply |
| 2 Drill bit | B Water feed |
| 3 Core drill rig | |
| 4 Hand crank (drill feed) | |

3.2.2.1 Operational scope

Depending on the power requirements, core drill rig systems can be fitted with A.C. motors, reluctance motors (230V), three-phase motors (400V) or high frequency motors.

Since electric motors are relatively cheap to buy and the power supply is available virtually everywhere, electric core drill rigs are often used for small- and medium-sized bore hole diameters (from Ø6mm to approximately Ø500mm).

3.2.3 Hydraulic core drilling system

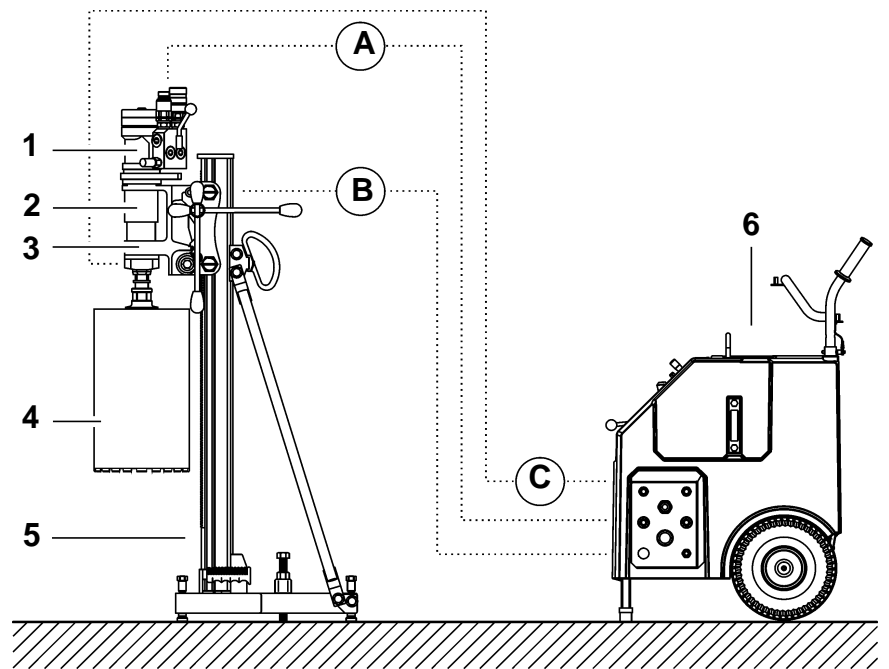


Fig. 3-5 Hydraulic core drilling system

- | | |
|---------------------------------------|-----------------------|
| 1 Hydraulic drive motor | A Line |
| 2 Drilling spindle | Hydraulic drive motor |
| 3 "Modul-Drill" drilling spindle seat | B Line |
| 4 Drill bit | Hydraulic feed motor |
| 5 Core drill rig | C Water feed line |
| 6 Hydraulic drive unit | |

3.2.3.1 Operational scope

Hydraulic core drilling systems are mainly used when there is a high power requirement and for safety reasons for overhead drilling or drilling in and under water.

Since during drilling motors with a constant absorption volume are mainly used, the motor size must be matched to the diameter to be drilled and the volume flow of the hydraulic pump. The use of hydraulic units with variable volume flows allows various speeds to be achieved with a fixed displacement motor. Hydraulic core drilling systems are used in the drilling range from Ø100mm to Ø1,000mm.

3.3 Functional description

3.3.1 System description

With diamond core drilling a drill bit fitted with diamond segments on its face performs a circular cutting movement in a solid, stationary material. A contact force must be applied to the diamond drill bit in order to achieve material removal in the material to be drilled and thus a drill feed. The axis of the diamond drill bit corresponds here to the feed direction.

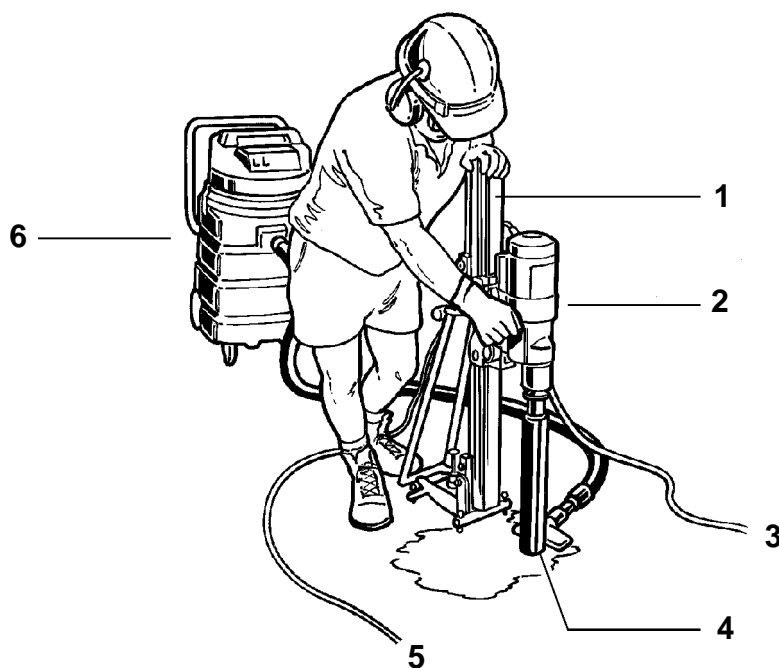


Fig. 3-6 System view

- | | |
|------------------------|-------------------------------|
| 1 Core drill rig | 4 Diamond drill bit |
| 2 Electric drill motor | 5 Electric motor power supply |
| 3 Water feed line | 6 Water suction device |

3.4 Component description

3.4.1 Core drill rig

The core drill rig is the central component of diamond core drilling systems. The core drill rig accommodates the drill motor (electric / hydraulic) along with the diamond drill bit. Its purpose is to accurately guide the drill bit and to achieve the contact force via the feed device. The core drill rig is secured to the surface by means of a foot.

Core drill rig basic design:

- Guide support with drill motor mount
- Guide rail
- Foot

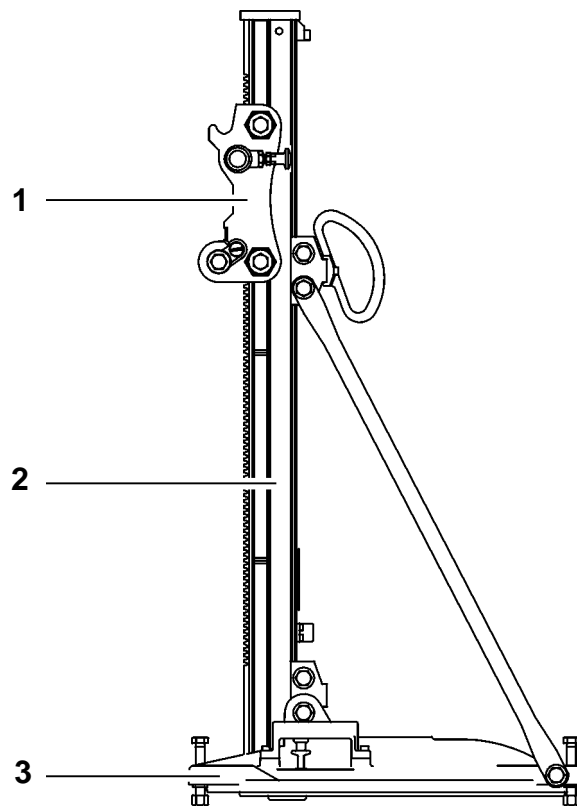


Fig. 3-7 Core drill rig

- 1 Guide support
- 2 Guide rail
- 3 Vacuum foot

3.4.1.1 Guide support with drill motor mount

Guide support

The guide support with feed device is mounted on the guide rail. The feed can be achieved, depending on the design of the core drill rig, by means of a rack or a chain. The feed can be driven either manually or by means of an electric or hydraulic feed motor. With motorised feed devices there is the possibility of increasing the contact force by incorporating a gear mechanism.



Information

In order to guarantee perfect and problem-free drilling, the drilling axis and the guide rail axis must run in parallel. This will ensure the optimum adjustment, without any play, of the guide on the guide support. If care is not taken to ensure this, then the drill bit speed may drop to zero as a result of wall friction and greater wear on the drill bit tube will result.

Drill motor mounts

Modul-Drill mount:



Thanks to its practical, sturdy quick-release levels, the Modul-Drill mount developed by TYROLIT Hydrostress AG has proven to be the de facto standard in motor mounts.

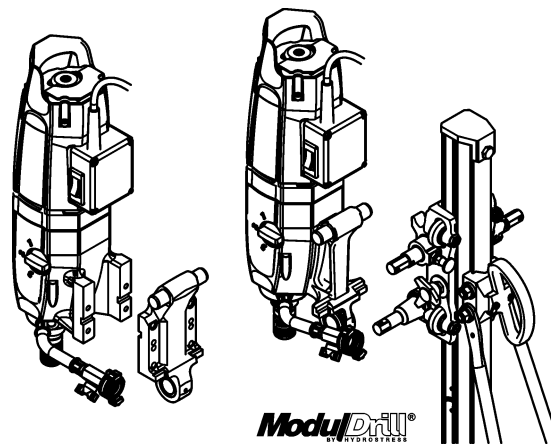


Fig. 3-8 Drill motor mount

Other common drill motor mounts include:

- Clamping collar mount
- Mounting plate
- Screw support

3.4.1.2 Guide rail

According to the design of the core drill rig, various profiles in steel or aluminium can be used as guide rails. The guide rail must be able to absorb the forces that are generated during drilling.

Guide rails differ according to their design and dimensions. This means that for any guide rail there is a maximum permitted drill bit diameter. The inherent stability of the guide rail has a direct effect on the drilling result. The stability of the guide rail can be increased by using supports.

3.4.1.3 Foot

The foot of the drill rig acts as a seat for the guide rail and for securing to the drilled material. The foot should guarantee a secure mounting and allow easy set-up at the drilling position.

Various feet and anchoring systems are available to meet individual requirements.

Dowel foot

The most common fixing method is securing by means of a dowel foot and anchoring dowel.

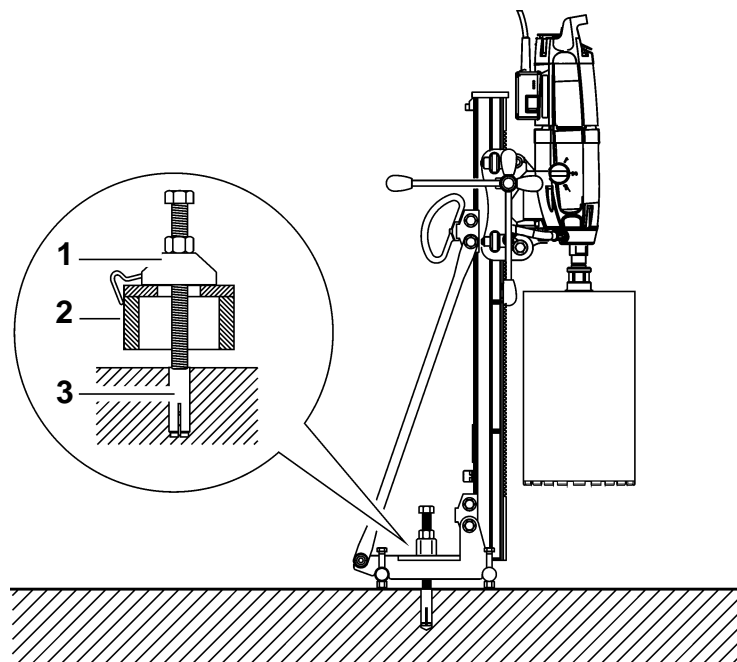


Fig. 3-9 Dowel foot

- 1 Tension spindle fixing point
- 2 Dowel foot
- 3 Drive-in dowel



Information

Assembly and disassembly of the dowel foot are described in Chapter 6 "Operation", since these activities are part of the normal operating sequence of core drilling equipment.

Vacuum foot

When anchoring drill rigs using a vacuum, the vacuum foot is placed on the surface. A connection to a vacuum pump creates a depression below the foot. The vacuum foot is thus pushed onto the surface by the prevailing air pressure. The contact force depends on the size of the vacuum foot and the depression created.

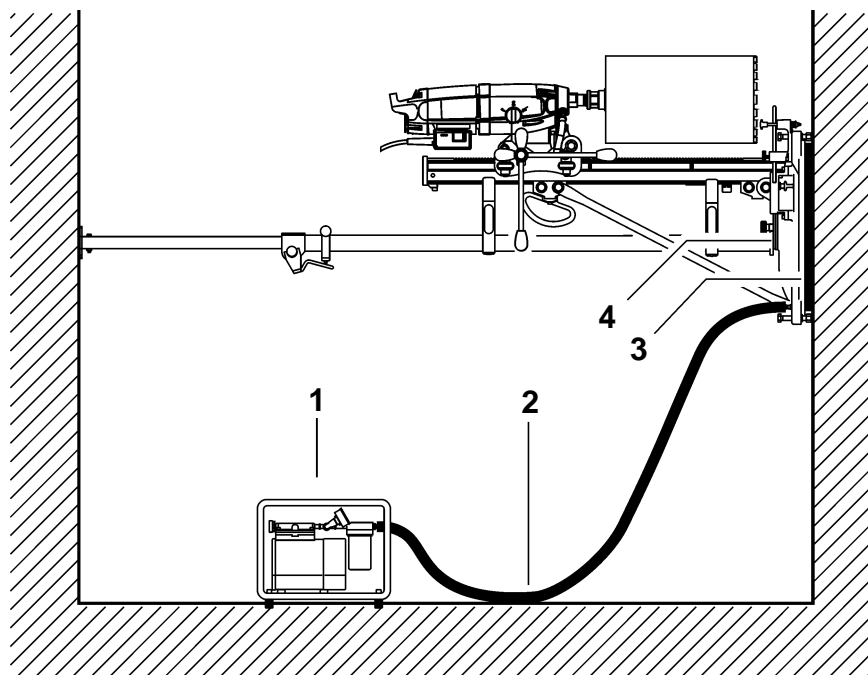


Fig. 3-10 Vacuum foot

- 1 Vacuum pump
- 2 Vacuum hose
- 3 Vacuum profile
- 4 Cover plate



Information

Assembly and disassembly of the vacuum foot are described in Chapter 6 "Operation", since these activities are part of the normal operating sequence of core drilling equipment.

Quick-change clamping column

The quick-change clamping column is used when no dowel holes are permitted and the surface is not suitable for vacuum anchoring. The quick-change clamping column can also be used to provide additional security for vacuum anchorings.

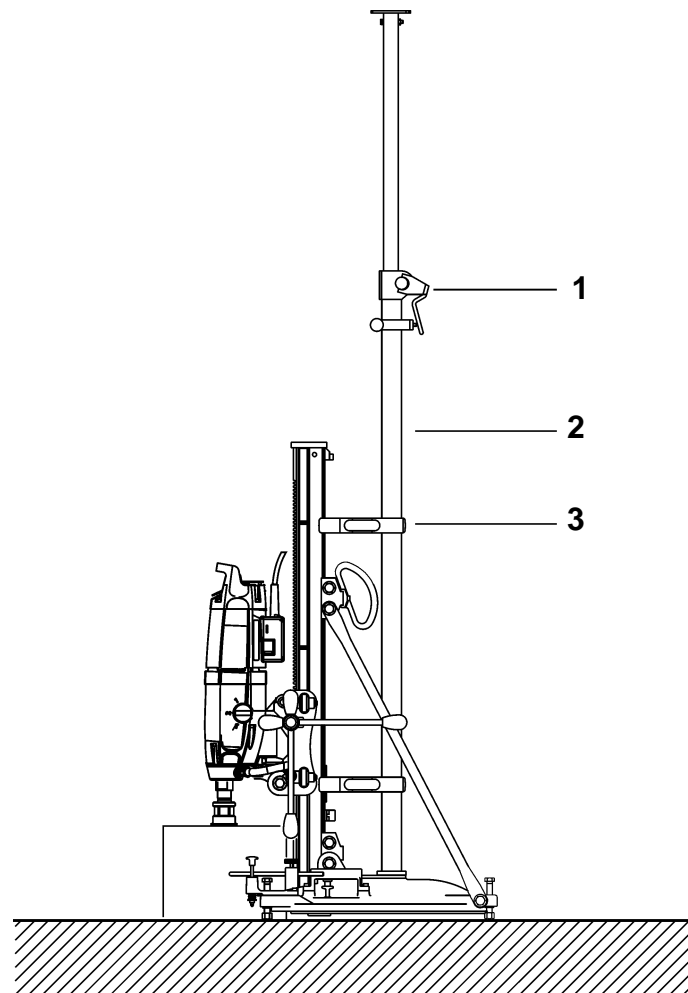


Fig. 3-11 Quick-change clamping column

- 1 Clamping lock
- 2 Quick-change clamping column
- 3 Retaining clip

3.4.2 Drive motors

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

The most common drive motors include:

- A.C. motors (230V)
- Three-phase motors (400V)
- Hydraulic motors

3.4.2.1 Electric drive motors

The electric motor converts the electrical energy into mechanical energy. It generates a rotating motion which is used to drive the drill bit.

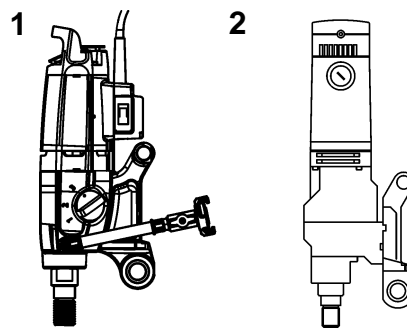


Fig. 3-12 Electric drive motor

- 1 TYROLIT Hydrostress AG Modul-Drill electric motor
- 2 External electric motor with Modul-Drill mounting plate

Advantages of A.C. and three-phase motors are that:

- an A.C. motor (230V) has a relatively low weight
- an A.C. motor (230V) is relatively cheap to buy
- the power supply (230V) is available virtually everywhere
- a three-phase motor (400V) has a high torque
- the energy costs are low
- there is no power loss through energy conversion

Disadvantages of A.C. and three-phase motors are that:

- there is a high safety risk if the safety instructions are not followed and if defective equipment is used
- an A.C. motor is limited to a maximum output of approximately 3 kW
- a three-phase motor (400V) has a relatively high weight
- three-phase motors are not suitable for drilling overhead

3.4.2.2 Hydraulic drive motors

The hydraulic motor converts the hydraulic energy into mechanical energy (rotating motion). Hydraulic motors are used with core drilling systems to drive the drill bit and for drill feed.

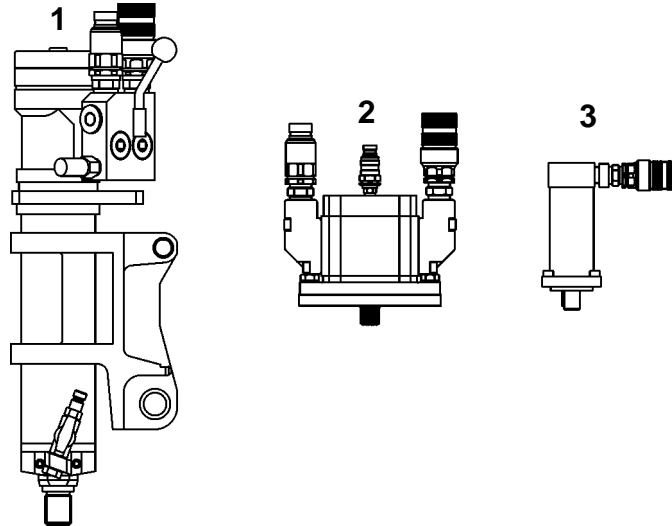


Fig. 3-13 Hydraulic drive motors

- 1 Drill motor with drilling spindle and Modul-Drill mounting support
- 2 Drill motor size 3
- 3 Feed motor

Advantages of hydraulic drive motors:

- a high equivalent rating is possible
- the usage possibilities are almost endless (drilling in and under water)
- a smooth speed change is possible
- the hydraulic motor has a simple overload protection

Disadvantages of hydraulic drive motors:

- a high level of investment is needed because of the additional hydraulic drive unit and hydraulic accessories
- power losses result from energy conversion and system losses
- there is a danger of environmental pollution from leaks

3.4.3 Cutting tool (diamond drill bit)

Drill holes are created using diamond drill bits. Depending on the system used, there is an almost limitless numbers of possible adaptations of both the type and the diameter.

3.4.3.1 Design of a diamond drill bit

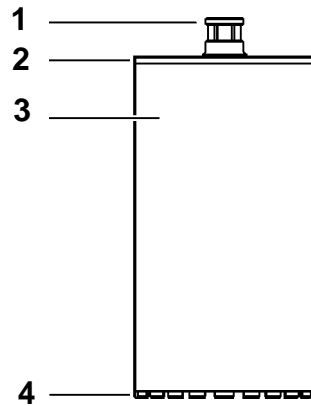


Fig. 3-14 Design of a diamond drill bit

- 1 Connecting thread
 $\text{Ø}12\text{-}42\text{ R}\frac{1}{2}$ " external thread, span 22
 $\text{Ø}47\text{-}500\text{ }1\frac{1}{4}$ " UNC internal thread, span 41
- 2 Cover
- 3 Drill bit tube
- 4 Diamond segments

3.4.3.2 Dimensioning of a diamond drill bit

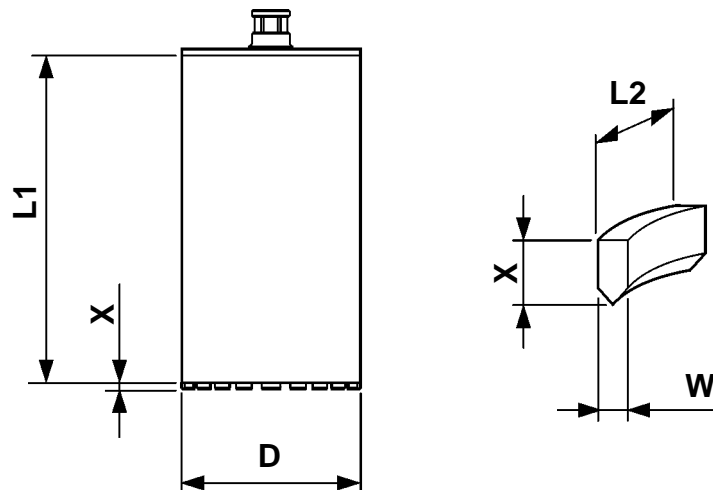


Fig. 3-15 Dimensioning of a diamond drill bit

- D External diameter
- L1 Useful length = possible hole depth = tube length
- L2 Segment length
- W Segment width
- X Segment height

3.4.3.3 Marking

All diamond drill bits or segments are colour-coded for ease of identification.

Segment and diamond drill bit colour coding:

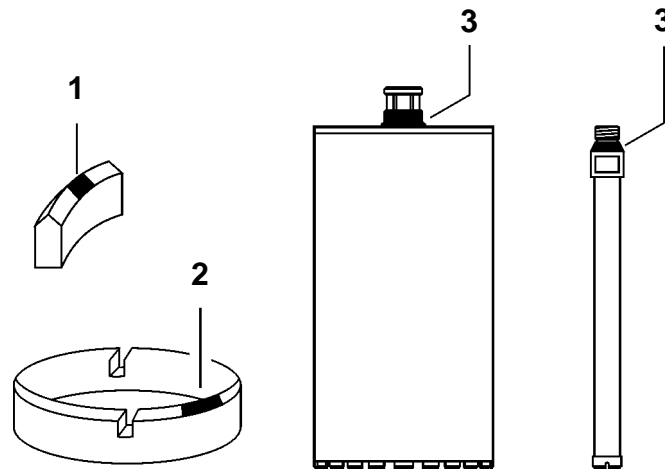


Fig. 3-16 Colour code

- 1 Segment colour code
- 2 Segment ring colour code
- 3 Diamond drill bit colour code



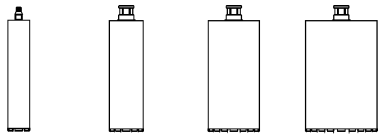
Information

Diamond drill bits can be fitted with various diamond segments. The type and structural shape of the segmentation depends on the material to be drilled. TYROLIT Hydrostress AG offers a range of different drill bits and segment arrangements. The complete range of drill bits is covered by a separate set of sales literature and can be ordered from TYROLIT Hydrostress AG.

3.4.3.4 Connections and adapters

Drill bits are mounted on various drive units such as electric motors, hydraulic motors, drilling spindles, gear arms, etc. In order that the various connections can be mounted on the different drive units TYROLIT Hydrostress AG offers suitable adapters.

Below are some of the most common drill bit adapters:







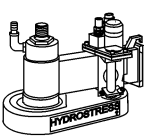
		Support		1/2"	1 1/4"	M 38	GRF
							
	R 1/2"				969148		
		1 1/4"	969138			974956	965562
		M 38					965808
	BY				974949		
	BC			974947	974947	974946	
	Special support Ø90-TKØ130 4x M16				971294 + 974947	971294 + 974946	977321

Fig. 3-17 Adapter table

- 965562 Adapter large holed flange to 1 1/4" internal
- 965808 Adapter large holed flange to M28 internal
- 969138 Adapter 1 1/4" internal to R 1/2" internal
- 969148 Adapter 1 1/4" external to R 1/2" external
- 971294 GR- flange M30
- 974946 Adapter M30 external (BC) to M38 external - R 1/2" internal
- 974947 Adapter M30 external (BC) to 1 1/4" external - R 1/2" internal
- 974949 Adapter M22 external (BY) to 1 1/4" external - R 1/2" internal
- 974956 Adapter 1 1/4" internal to M38 external / R 1/2" internal
- 977321 Large holed flange GR

3.4.3.5 Drill bit tube

The drill bit tube is the support for the diamond drill bit. The precision tubes used by TYROLIT Hydrostress AG allow a high level of truth of running. New bonding techniques allow the diamond segments to be securely joined to the drill bit tube.

Common bonding techniques include:

- Laser welding
- Resistance welding
- Hard-soldering

TYROLIT Hydrostress AG Drill bit tubes can be refitted once the diamond segments have worn.

3.4.3.6 Diamond segment

A wide range of diamond segments ensures the optimum cutting tool for all materials and machine types.

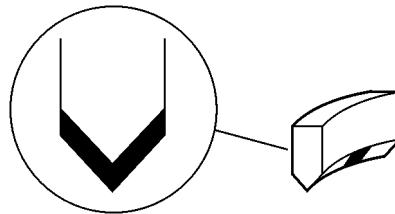


Fig. 3-18 Diamond segment

Diamond segment structural shape

The TYROLIT patented roof segments structural shape with special coating on the segments makes drill centring easier and is ready for immediate use without sharpening. Thanks to the narrow contact area of this structural shape only minimal vibrations occur when spot drilling. This means that the diamond drill bits cannot deflect resulting in reduced stress on the core drill rig and its motor.

Product advantages:

- diamond drill bits are ready to use immediately without the need to sharpen the segments
- rapid centring
- exceptional performance when spot drilling and drilling from the solid
- high feed rate from the very first drill hole
- high feed rates over the entire life
- considerable reduction in tendency to chatter against reinforcing irons

Diamond segment wear

Diamond segments are subject to natural wear. If the diamond segments wear too quickly, however, the following points must be checked:

Reasons for accelerated wear include:

- insufficient water
- wrong diamond tool for the job
- speed too low
- contact force too high
- drilling in abrasive materials

Sharpen diamond segments

Diamond segments that have worn down can be re-sharpened using a sharpening block.

Proceed as follows:

- Secure one or two sharpening blocks using dowels or mechanical clamping (other abrasive materials such as chalky sandstone, bricks, etc. can be used instead of sharpening blocks)
- Perform two or three vertical spot drillings with very little water and at low speed

Storing diamond drill bits

Store diamond drill bits in the dry and away from light in order to avoid corrosion.



Information

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

- Length of diamond drill bit
- Specification (colour code)
- Manufacturer's reference

3.4.4 Hydraulic drive unit

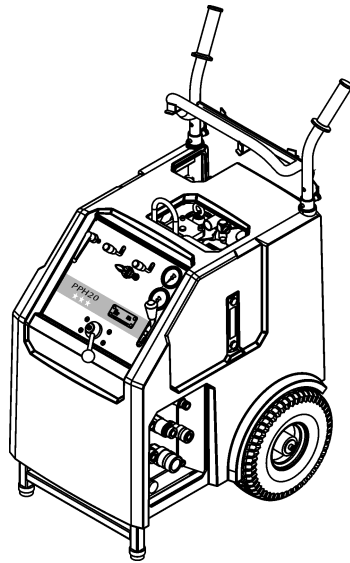


Fig. 3-19 Hydraulic drive unit

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

3.4.5 Water

Water is used for cooling the cutting tool. In order to ensure guaranteed cooling and flushing of the diamond drill bit, it must be ensured that when working with wet diamond drilling systems the water feed is not interrupted or stopped.

An inadequate quantity of water can lead to increased wear of the diamond segments and in extreme cases to the detachment of the segments. An excessive quantity of water, however, impedes the drill feed. Correct flushing with water will substantially increase the lifetime of your diamond drill bit.

Recommended water quantities: see “Chapter 1” 1.2, 1-1



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 supply for diamond core drilling:

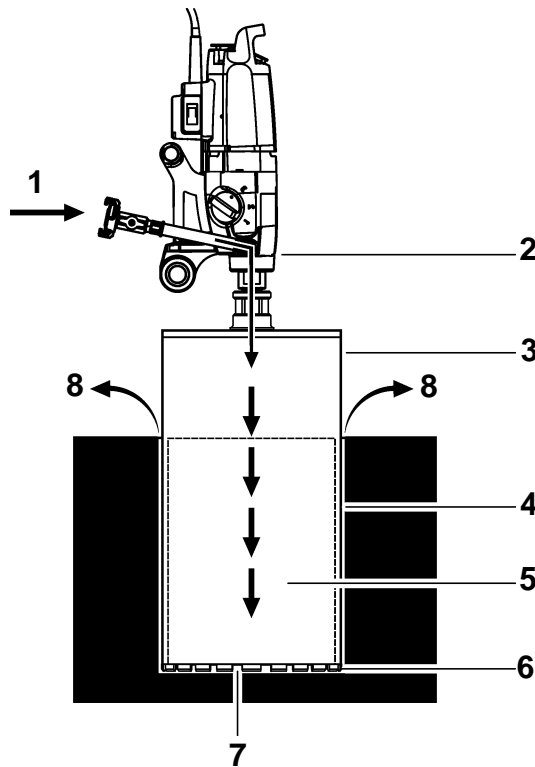


Fig. 3-20 Water supply

- | | |
|-------------------------|-------------------|
| 1 Water inlet | 6 Core |
| 2 Water flushing sleeve | 7 Water path |
| 3 Diamond drill tip | 8 Diamond segment |
| 4 Ring area | 9 Water outlet |

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 suction device or water pump, filtered and pumped back into the water circuit for recycling.

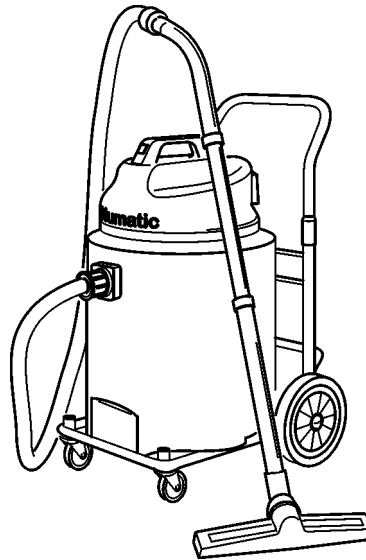


Fig. 3-21 Dust and water suction device with dry filter system

Water collection ring

The water collection ring is used to collect and carry away cooling and flushing water.

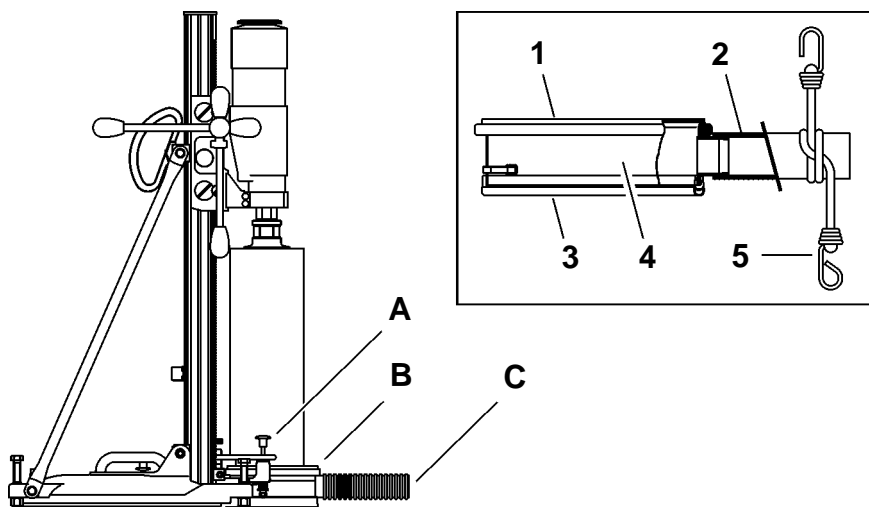


Fig. 3-22 Water collection ring

- | | |
|---------------------------|--|
| 1 Seal | A Water collection ring holding device |
| 2 Water hose | B Water collection ring |
| 3 Edge protection profile | C Water suction device |
| 4 Water suction ring | |
| 5 Rubber pull | |

Assembly:

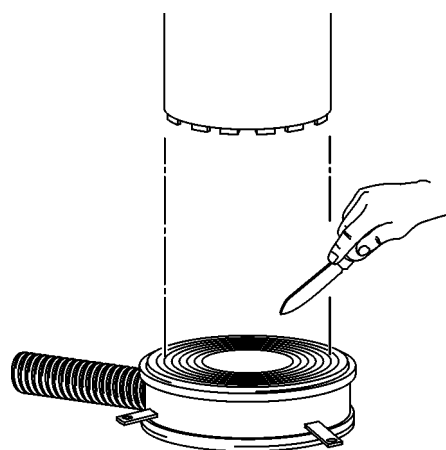


Fig. 3-23 Assembling the water collection ring

Proceed as follows:

- Cut an opening in the seal corresponding to the drill bit tube diameter
- Clamp the water collection ring to the water collection ring holding device of the core drill rig
- Connect the water suction device

3.4.6 Accessories

In order to allow any drilling job to be performed without problems, various accessories are available for the individual core drilling systems.

3.4.6.1 Special length guide rails

Drilling column extensions allow the use of drill bits of greater useful lengths.

3.4.6.2 Modul-Drill mounting plate

The Modul-Drill mounting plate allows the mounting of external motors on TYROLIT Hydrostress AG core drill rigs with Modul-Drill mounting.

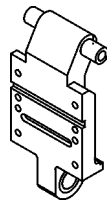
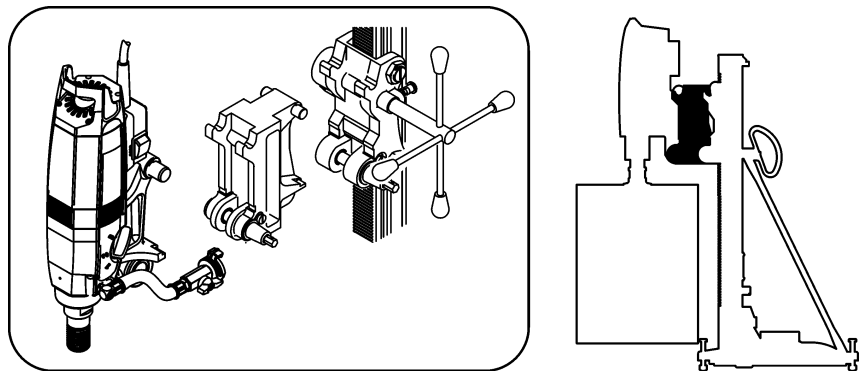


Fig. 3-24 Motor plate No.977464

3.4.6.3 Distance plates

The distance plates between the drive motor and guide support allow working with larger drill tip diameters.



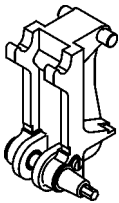
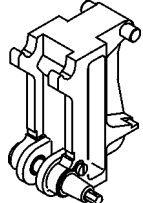
Distance plates Ø + 180mm	Distance plates Ø + 250mm
<div style="text-align: center;">  <p>Distance plate No. 964906</p> </div>	<div style="text-align: center;">  <p>Distance plate No. 964907</p> </div>

Fig. 3-25 Distance plates

3.4.6.4 Quick-change clamping column

For details on quick-change clamping columns see “Chapter 3” , 3-24

3.4.6.5 Covering for gripping brace

The covering for the gripping brace is used to stabilise the core drill rig.

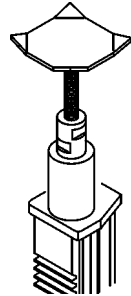


Fig. 3-26 Covering for gripping brace

3.4.6.6 Undercarriage

The undercarriage is used for easy transport of core drill rigs.

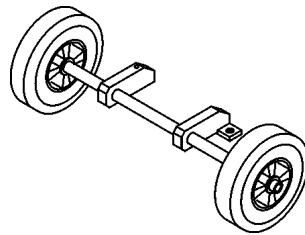


Fig. 3-27 Undercarriage

3.4.6.7 Water accessories

Information on the application and use of the water accessory can be found in “Chapter 1” 3.4.5, 3-20.

Water collection ring

For details on the water collection ring see “Chapter 3” , 3-22

Water suction device and water pump

The water suction device and water pump are used to collect and carry away cooling and flushing water.

Water lances

Water lances are used to convey water to the drilling point.

Pressurised water tank

The pressurised water tank is used to supply water during core drilling.

Polyurethane filling and assembly foam

The unitary component polyurethane filling and assembly foam is used for water collection and recycling of the cooling and flushing water.

3.4.6.8 Drill bit extensions

Greater drilling depths can be achieved by using drill bit extensions.



Extensions	Material	Description
R1/2" Ø 32mm and  above	No. 968612 No. 968613 No. 974992 No. 968614	Extension R 1/2" 100mm Extension R 1/2" 200mm Extension R 1/2" 300mm Extension R 1/2" 500mm
1 1/4" Ø 52mm and  above	No. 974987 No. 968615 No. 968616 No. 968617	Extension 1 1/4" 100mm Extension 1 1/4" 200mm Extension 1 1/4" 300mm Extension 1 1/4" 500mm

Fig. 3-28 Drill bit extensions

3.4.6.9 Drill bit adapters

Drill bit adapters are used to accommodate diamond drill bits with differing connection threads.

For details on TYROLIT Hydrostress AG drill bit adapters, see "Chapter 3" 3.4.3.4, 3-16.

3.4.6.10 Spot drill centring

Spot drill centring is used as a spot drilling aid and prevents any drift of the diamond drill bit during spot drilling.

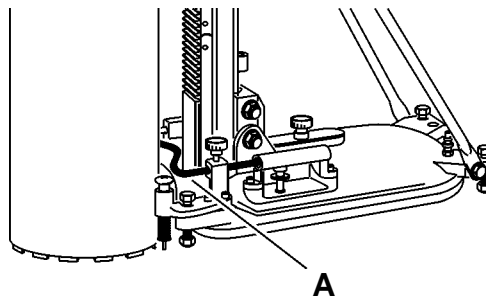


Fig. 3-29 Drill bit centring (A)

3.4.6.11 Centre indicator

The centre indicator indicates the centre of the bore hole and is used to set up the core drill rig.

3.4.6.12 Drilling core extraction device / core extraction tongs

These extraction devices are used for drilling core removal.

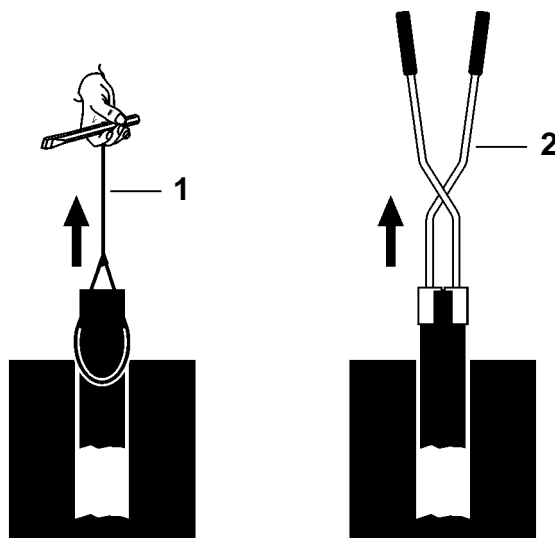


Fig. 3-30 Drilling core extraction device / core extraction tongs

- 1 TYROLIT Hydrostress AG-Drilling core extraction device
- 2 Core extraction tongs

3.4.6.13 Drill bit extraction device

The drill bit extraction device is used to extract clamped diamond drill tips.

Function:

The weight (A) is accelerated by hand against the stop (B). The impact loosens the diamond drill bit.

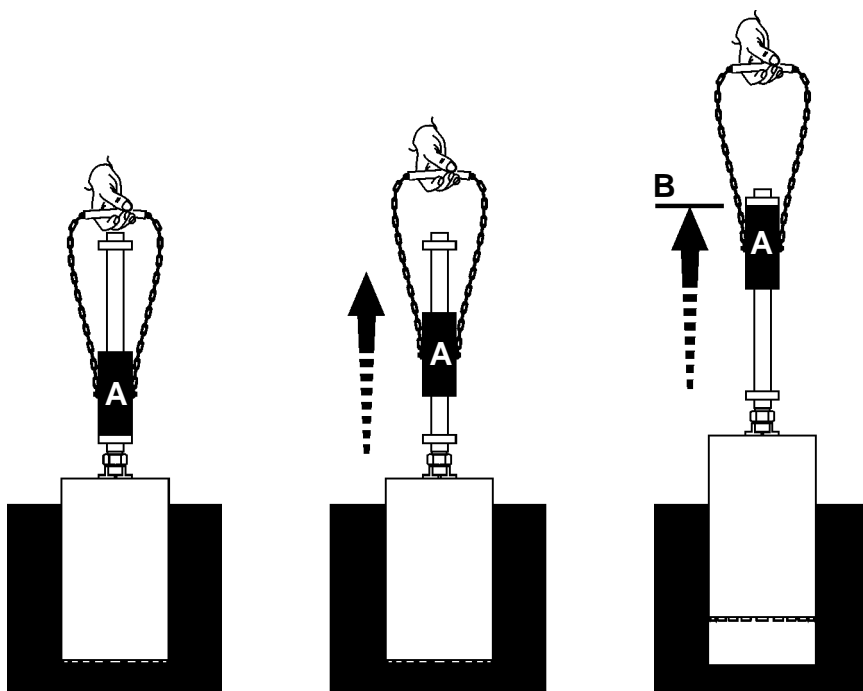


Fig. 3-31 Drill bit extraction device No 974270

3.4.6.14 Antifriction element

The antifriction element allows easier detachment of the drill bit. It is mounted between the drive shaft and the drill bit seat.

Part No.	
963339	Antifriction element for 1¼", max. 2.4 kW
965395	Antifriction element for 1¼", max. 5.2 kW
962508	Antifriction element Orca 1¼", max. 11 kW

3.4.6.15 Sharpening block

The sharpening block is used for sharpening the diamond drill bits. Instead of sharpening blocks other abrasive materials can be also used such as chalky sandstone, bricks etc.

Part No.	
484627	Sharpening block 160mm x 30mm x 320mm
484672	Sharpening block 320mm x 55mm x 320mm

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 all the instructions on how to avoid physical injury and damage to property.

4.1.2 Personnel qualifications

Assembly and disassembly of core drilling systems 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 core drilling systems is described in Chapter 6 “Operation”, 6-1, since these activities are part of the normal operating sequence of core drilling 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 core drilling system is put into service it must be checked to ensure that it is free from 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 all 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 core drilling systems.



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 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 core drilling systems hearing protection must be worn.

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

Danger

Hazard from toxic exhaust gases (carbon monoxide)

When a drive is operated with a combustion motor in sealed or underfloor areas and pits, 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 flying splinters.

Always wear eye protection and a safety helmet. Seal off the danger area against entry by third parties.

Failure to comply with this regulation may result in serious injury to body parts and damage to property.

Warning



Danger from an overheated diamond tool.

The diamond tool may heat up during use or sharpening. Always wear protective gloves when changing the diamond tool.

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

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.

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 from non-removal of tool wrenches.

Before switching on, make sure that wrenches and insertion tools have been removed.

Failure to comply with this regulation may result in serious injury to body parts and damage to property.

6.1.2 Personnel qualifications

Core drilling 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 Emergency Stop

Machines with motorized feed are not automatic machines. They must never be left unattended during operation. An emergency stop must be possible at all times.

6.2.2 Electric core drilling systems

Only ever work if a serviceable current-operated personal protection device is present (PRCD, GFCI).

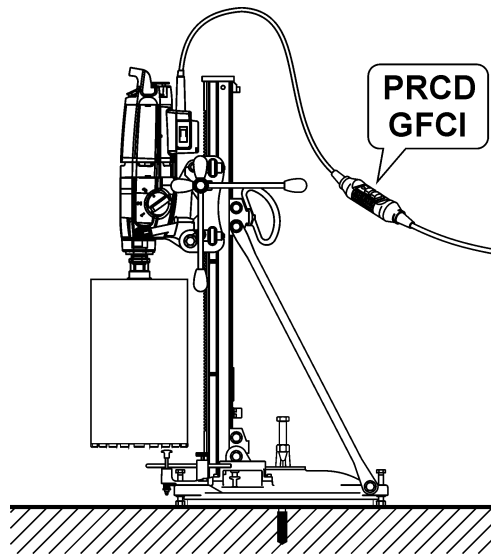


Fig. 6-1 Personal circuit breaker

6.2.3 Hydraulic core drilling systems with drive unit

In danger situations the Emergency Stop pushbutton or its remote controller must be operated immediately. Pressing the Emergency Stop pushbutton immediately halts the system and prevents the system being accidentally switched on again.

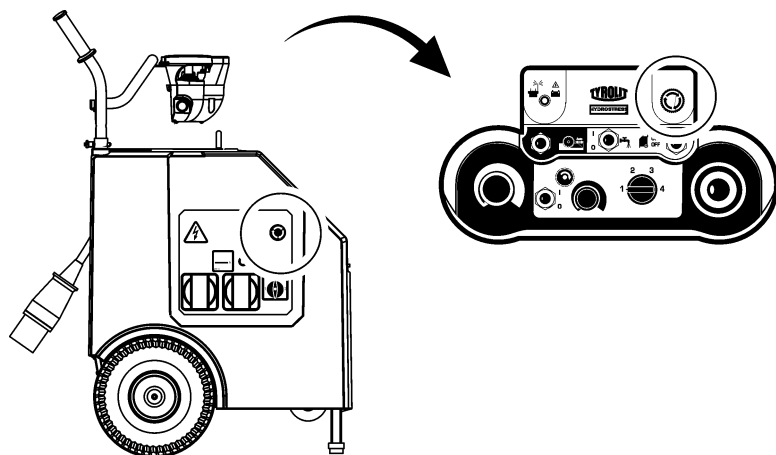


Fig. 6-2 EMERGENCY STOP on the hydraulic drive unit

6.3 Controls and displays

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: Core drilling system with vacuum anchoring

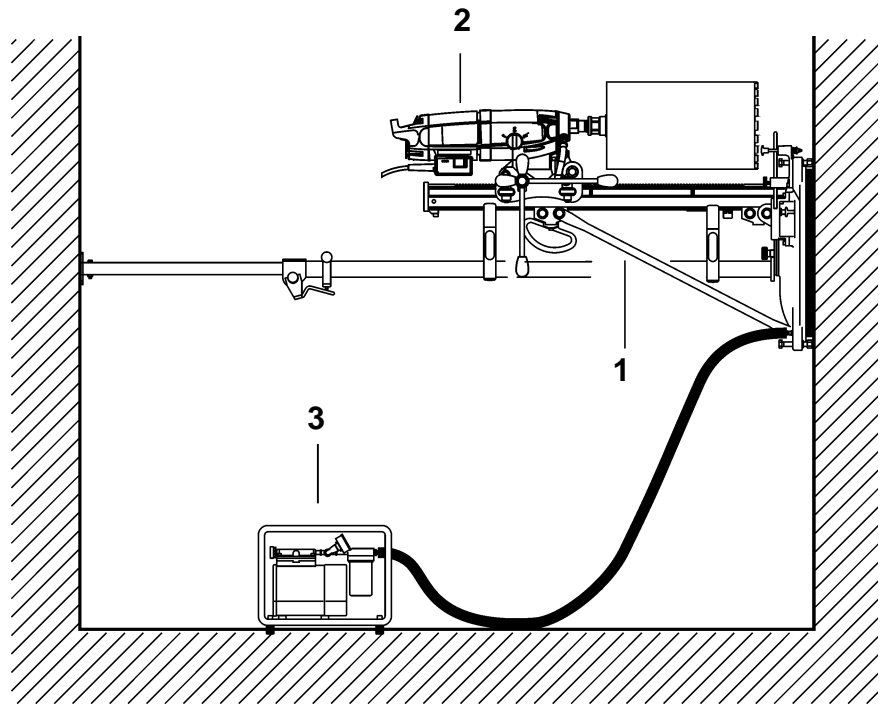


Fig. 6-3 Documentation for Core drilling system with vacuum foot

- 1 Operating Instructions for core drill rig type ...
- 2 Operating Instructions for electric drive motor type ...
- 3 Operating Instructions for vacuum pump 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 the hole
3. Decide on the removal and securing of the drilling core
4. Secure danger area
5. Mount and align core drill rig
6. Mount drill motor on core drill rig
7. Mount diamond drill bits on drive motor
8. Connect power supply
9. Install water supply
10. Visual inspection
11. Drilling
12. Terminating the work
13. Disassemble the core drilling system
14. Remove drilling core
15. Secure drill hole
16. Disposal of drilling 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 consequences (static weakening or subsidence)

- 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.

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



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.

2. Mark the hole

The drill holes are normally already marked out by the customer. It is now a matter of determining the maximum concrete core 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 core drilled out should not exceed the maximum permitted floor loading

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

3. Decide on the removal and securing of the drilling core

In order that during drilling there are no nasty surprises from loosening and falling drilling cores, the securing and removal of the drilling core must be decided upon prior to the actual drilling.

For safe removal of the drilling core the following points must be taken into account:

- Site of the core drilling
- Location of the core drilling
- Size and weight of the drilling core
- Material of the drilling core

Some of the common safety measures to prevent falling drilling cores are:

- Core catcher sleeve
- Core catcher device
- Core catcher spring
- Catching devices

Some of the common aids for removal of drilling cores are:

- Drilling core extraction device
- Core extraction tongs
- Crane apparatus
- Suitable lifting device
- Suspension devices

4. Secure danger area

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

- For danger areas in wall drilling
see "Chapter 6" 6.5.1, 6-20
- For danger areas in floor and ceiling drilling
see "Chapter 6" 6.5.2, 6-21

5. Mount and align core drill rig

Mounting and aligning core drill rig with dowel foot

Proceed as follows:

- Position the anchoring dowel specific to the sub-surface as specified by the dowel manufacturer
- Screw in the anchoring element
- Loosely secure the core drill rig
- Align the core drill rig using a centre indicator or centre gauge
- Fix the core drill rig securely to the surface using anchoring elements
- Check the anchoring of the core drill rig



Information

To secure core drill rigs, anchoring elements appropriate for the sub-surface must be used. When positioning the dowels the installation instructions of the dowel manufacturer must be followed.

Example:

Dowel instruction leaflet

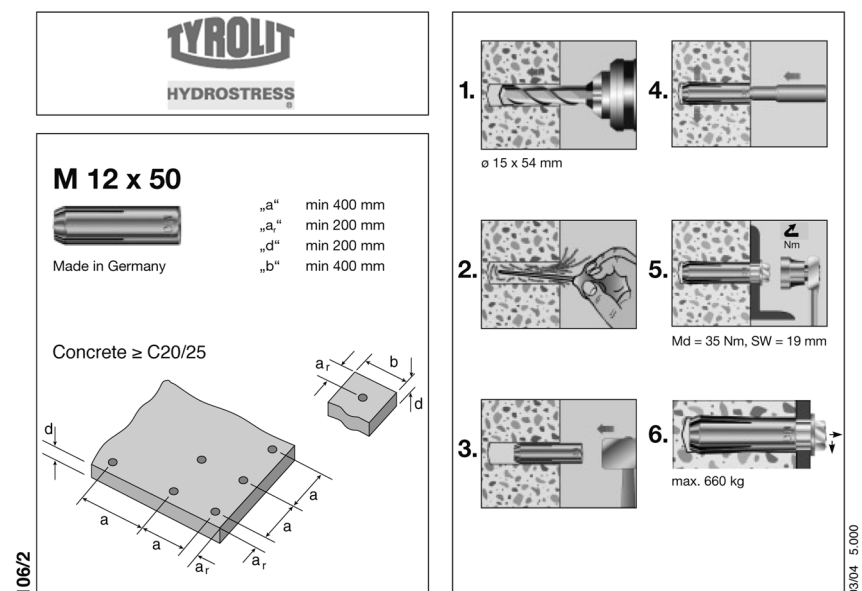


Fig. 6-4 Anchoring instructions

Example:

Concrete anchoring set:

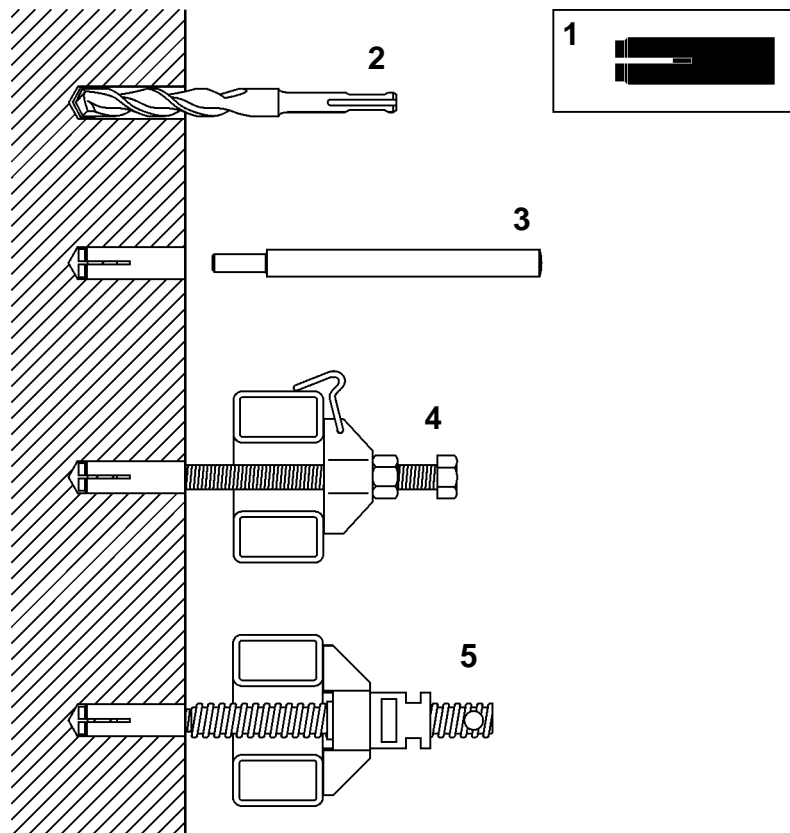


Fig. 6-5 Concrete anchoring set

- | | |
|---------------------------|------------------------------|
| 1 Drive-in dowel M12x50mm | 4 Anchoring block |
| 2 Dowel drill Ø15mm | 5 Clamping spindle anchoring |
| 3 Drive-in irons for M12 | |

Masonry anchoring set:

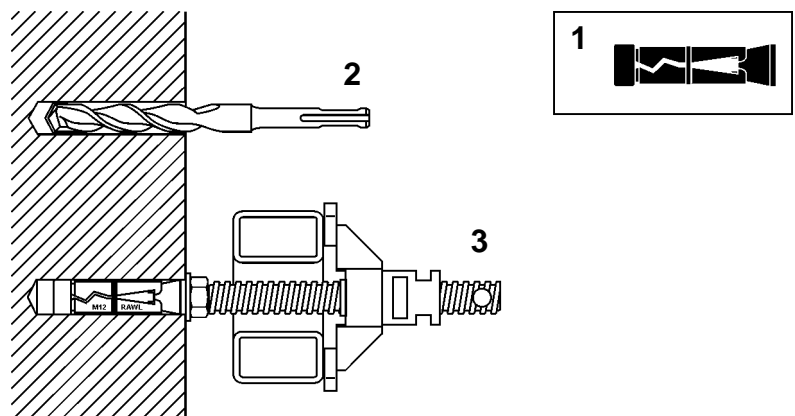


Fig. 6-6 Masonry anchoring set

- | |
|------------------------------|
| 1 RAWL M12x75mm dowel |
| 2 Dowel drill Ø20mm |
| 3 Clamping spindle anchoring |

Mounting and aligning core drill rig with vacuum foot

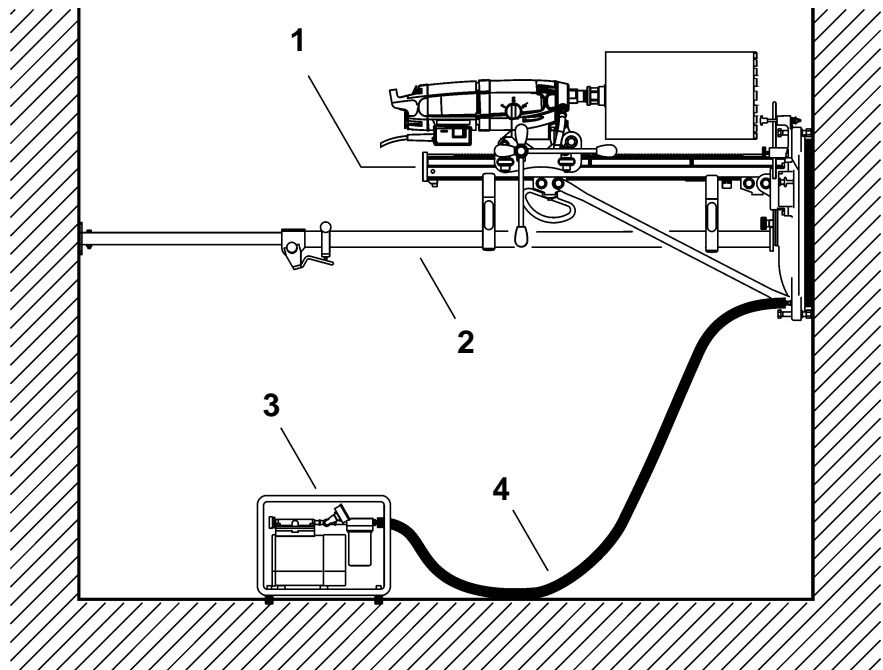


Fig. 6-7 Secured vacuum core drilling system

- 1 Core drill rig with motor and drill bit
- 2 Quick-change clamping column (safety element)
- 3 Vacuum pump
- 4 Vacuum hose

Proceed as follows:

- First clarify if the surface is suitable for vacuum anchoring (wall plaster may come away, building blocks may be air permeable, structures may be porous, all of which will make sealing of the vacuum profile impossible).
- Never anchor the core drill rig using the vacuum method alone when you are drilling into walls but secure it additionally using a suitable lifting tool or a quick-change clamping column.
- Connect the core drill rig foot to the vacuum pump using the vacuum hose.
- Clasp the core drill rig with both hands and accurately align the drill rig using the centre indicator or centre gauge.
- Switch on the vacuum pump.
- Once the vacuum pump has been primed correctly and fully, check the anchoring e.g. by body pressure.
- If realignment is necessary, grip the core drill rig with both hands and open the vacuum valve. Once the core drill rig has come away from the surface you can realign the core drill rig and re-close the vacuum valve.
- Only start drilling once the depression has been correctly and fully developed.
- Do not forget to fold in the centre indicator before drilling.

6. Mount drill motor on core drill rig

The drill motor mount can differ according to the design of the core drill rig or the motor manufacturer.

At TYROLIT Hydrostress AG the Modul-Drill mount has proven to be the de facto standard interface between drive motor and core drill rig. The anchoring principle is based on an axis mount and a clamp anchoring (eccentric shaft).

Modul-Drill anchoring principle:

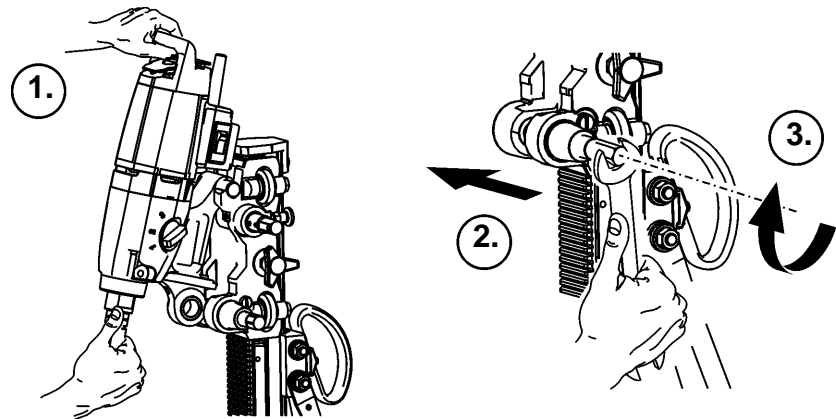


Fig. 6-8 Modul-Drill anchoring principle

1. Swivel the drill motor onto the axis mount
2. Push in the eccentric shaft
3. Tighten the drill motor by means of a rotating movement of the eccentric shaft to the guide support



Danger

Danger of the drill motor coming loose from the core drill rig

After mounting, check the anchoring of the drill motor. The drill motor must be securely fixed to the guide support.

Failure to comply with this regulation may lead to serious physical injury or death.

7. Mount the diamond drill bits on the drill motor

The choice of diamond drill bit should be made before deciding on the drill motor according to the material quality. The drive power and peripheral velocity (speed) of the drill motor should be selected according to the hole diameter.





Information

The peripheral speed of the diamond drill bit on concrete should be 2-3 m/s.

Assembly:

Grease the anchoring thread before mounting the diamond drill bit. In order to ensure easier removal of the drill bit, it is recommended that an antifriction element suited to the drill motor speed is mounted between the drive shaft and the drill bit seat.

An overview of TYROLIT Hydrostress AG antifriction elements can be found in "Chapter 3" 3.4.6.14,  3-27.

An overview of TYROLIT Hydrostress AG connecting threads and adapters can be found in "Chapter 3" 3.4.3.4,  3-16.



Warning

Danger from sharp edges of the diamond drill bit.

Sharp edges can cause cut wounds to the hands and body parts during mounting. It is mandatory to wear protective gloves when handling the diamond drill bit.

Failure to adhere to this regulation may result in cut wounds to body parts.

8. Connect power supply

Connect the drive motor to the power. If hydraulic motors are being used, ensure that the correct connections for the correct motor and for forward and reverse are created.

9. Install water supply

Set up the water supply to the core drilling system. A correct cooling water feed is of crucial importance for a satisfactory result. The water quantity depends on the size of the drill hole.

Recommended water quantities: see "Chapter 1" 1.2,  1-1

10. Visual inspection

Check your core drilling system for damage. Each time the electric tool is used you must carefully check that the safety devices are working correctly and without problems. Check that moving parts are working correctly and are not jamming, that there are no broken parts, that all other parts are correctly mounted and that all other conditions which could affect the operation of the core drilling system are correct. Damaged protective devices and parts should be properly repaired by a TYROLIT Hydrostress AG workshop or exchanged, unless otherwise stated in the operating instructions for the individual system components. Damaged switches must be replaced by a TYROLIT Hydrostress AG workshop. Do not use any electric tool if the switches cannot be switched on or off.

11. Drilling

Before drilling work commences the building structure and drilling cores must be correctly secured. It must be ensured that the building structures and drilling cores neither overturn nor fall out or down and that they cannot displace.



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

Drilling procedure:

- Open water feed, switch on motor and spot drill with moderate contact force, so that the diamond drill bit impacts as little as possible. Correct spot drilling ensures the accurate guidance of the diamond drill bit and prevents lateral friction on the drill bit tube.
- Increase the contact pressure and feed and adapt these to the material to be drilled. If you encounter reinforcement reduce the feed pressure.
- Once the desired drilling depth has been reached withdraw the diamond drill bit from the drill hole and only switch off the drill motor once out of the drill hole.



Warning
<p>Danger from sharp tool edges</p> <p>When touching tools at a standstill 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

Danger from touching diamond cutting tools while these are still in motion.

Touching diamond cutting tools whilst they are in motion is prohibited.

Failure to adhere to this regulation may result in physical injury and damage to property.

12. Terminating the work

Once the drilling procedure is complete the drill motor can be stopped and secured against unintentional starting up. Then the water feed can be shut off.

13. Disassemble the core drilling system

Once the core drilling system has been correctly switched off, disassembly can commence. First the supply lines and then the individual components should be disassembled.

14. Remove drilling core

Small- and medium-sized drill holes

For drilling cores which are longer than the core diameter (approximately 1.5 x drilling diameter), the core can be broken using a chisel without difficulty. The drilling core can be removed using core extraction tongs or the TYROLIT Hydrostress AG drilling core extraction device.

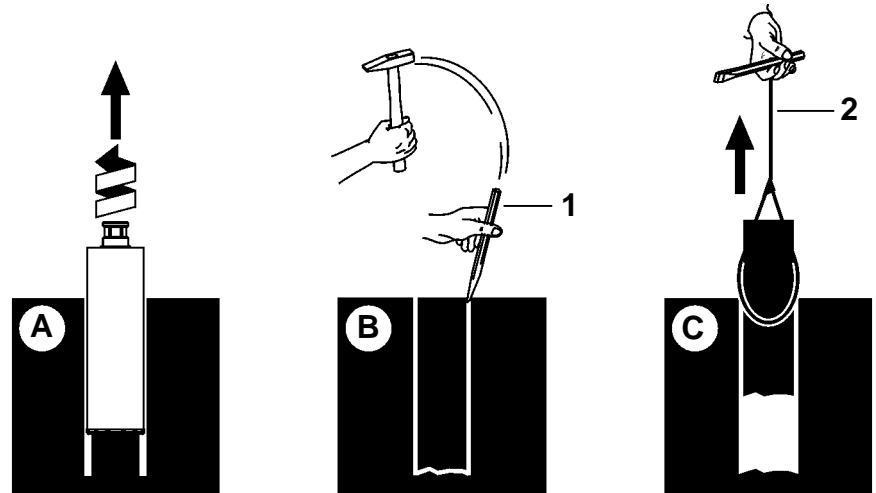


Fig. 6-9 Drilling core extraction device

- 1 Chisel
- 2 Extraction device

Proceed as follows:

- Figure A
Once the desired drilling depth has been reached remove the diamond drill bit from the drill hole with the rotating motion continuing.
- Figure B
Break the drilling core using a hammer and chisel
- Figure C
Extract the drilling core using the extraction device

Large hole drilling

In the case of large drilling cores use of splitting devices is unavoidable. For extremely large core diameters they may have to be broken down inside the drill hole with the help of a pneumatic hammer.

Extraction of drilling cores intact

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

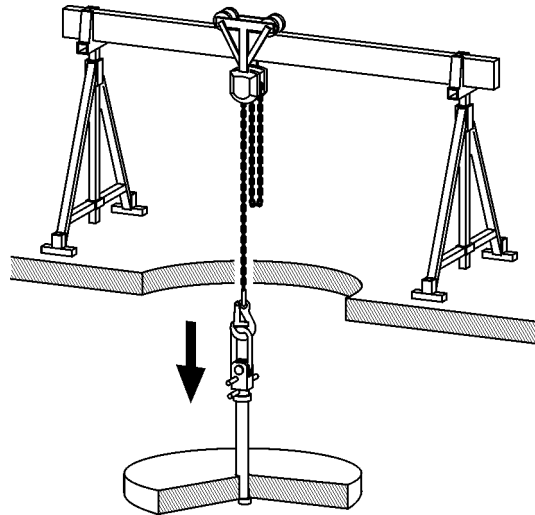


Fig. 6-10 Example of use of a drilling core extraction device in a large floor hole



Information

1m³ 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 core removed.

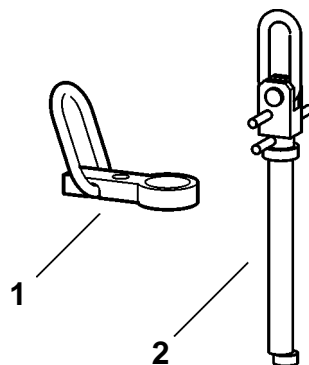


Fig. 6-11 Suspension devices for various suspended loads

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

15. Secure drill hole

Once the drilling cores have been removed, floor and ceiling holes must be secured.

Securing of floor or ceiling holes

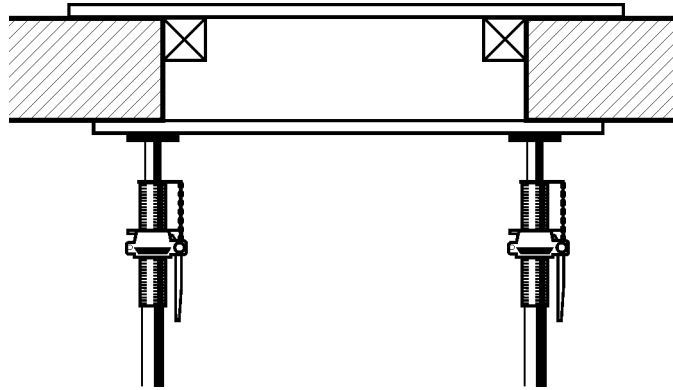


Fig. 6-12 Covering of floor and ceiling drill holes

Securing large ceiling and floor cut-outs

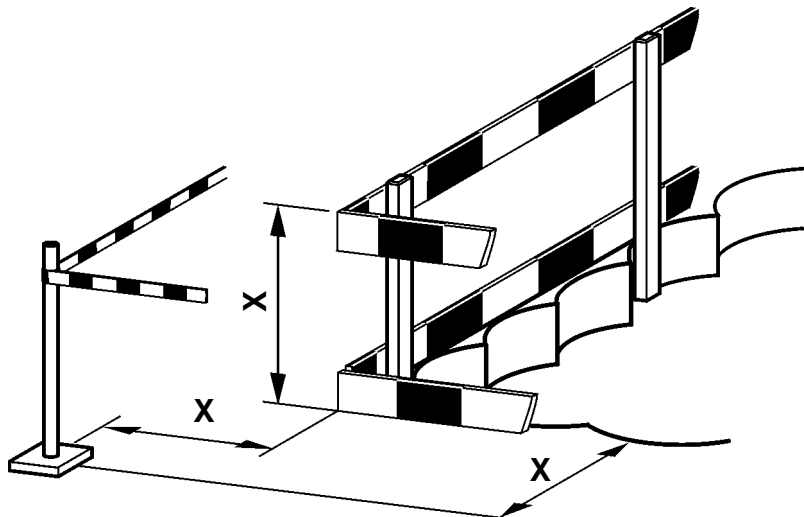


Fig. 6-13 Possibilities offered by hard edged barriers

X Dimensions in accordance with local regulations

16. Disposal of drilling sludge

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

6.5 Dangers and danger areas when core drilling

6.5.1 Danger areas when drilling walls

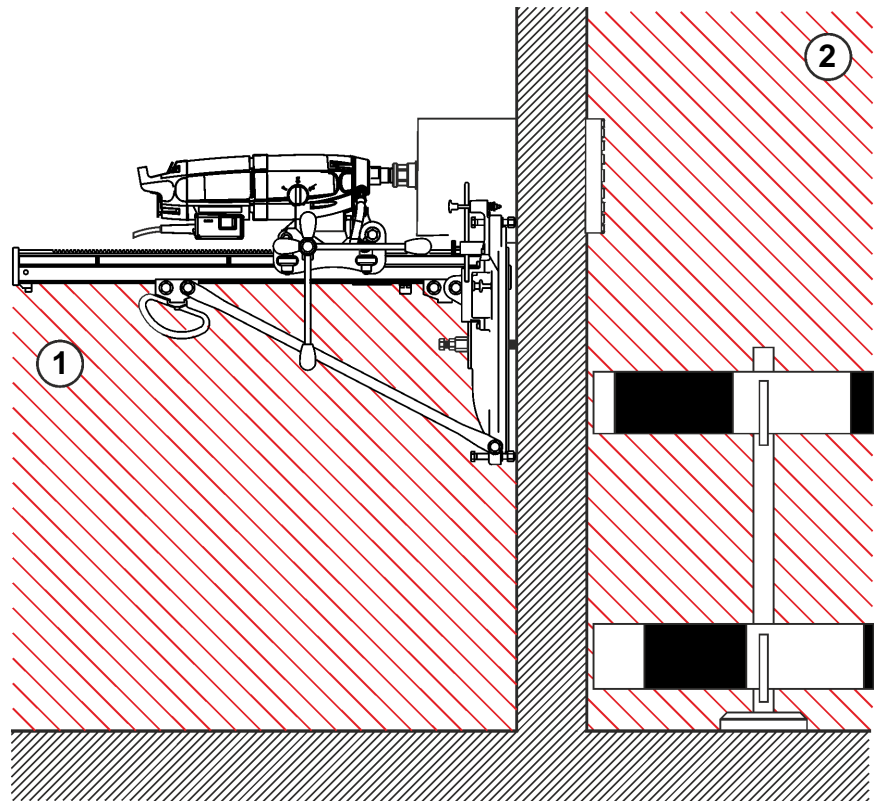


Fig. 6-14 Danger areas when drilling walls

- 1 danger area below
- 2 danger area behind

Clearly cordon off the danger areas (1+2) so that during drilling no person can enter the danger area.

The area underneath and to the rear of the drilling area must be protected so that persons or equipment cannot be injured or harmed by falling parts or drilling sludge.

6.5.2 Danger area in floor and ceiling drilling

6.5.2.1 Securing the danger area

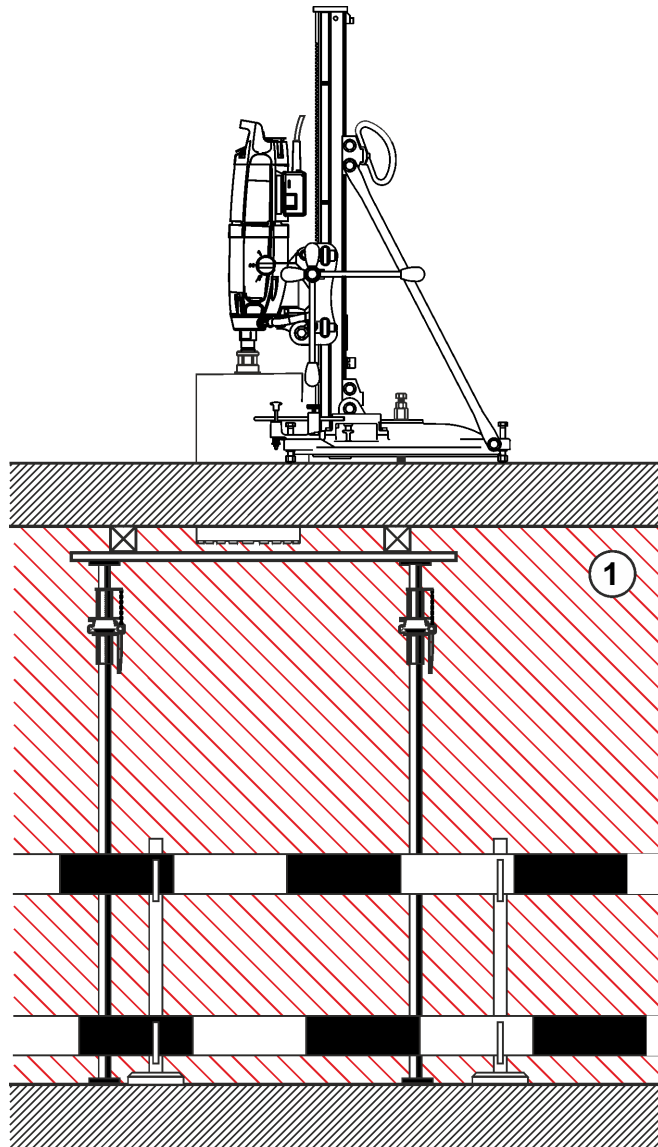


Fig. 6-15 Danger area in floor and ceiling drilling

Clearly cordon off the danger areas (1) so that during drilling no person can enter the danger area.

The area underneath the drilling area must be protected so that persons or equipment cannot be injured or harmed by falling parts or drilling sludge. Drilling cores and structural blocks must be secured against falling.

6.5.3 Danger when drilling overhead

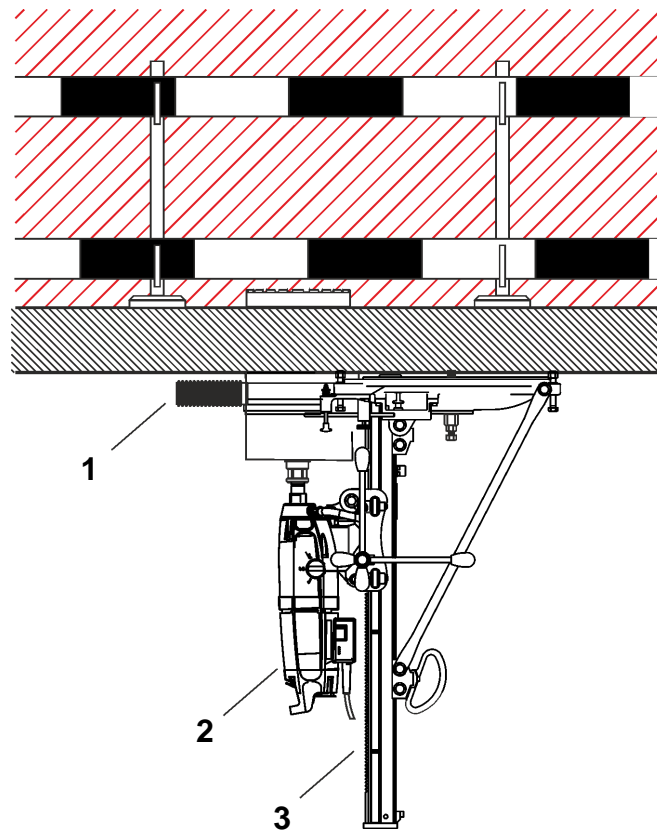


Fig. 6-16 Danger when drilling overhead

- 1 Water collection ring
- 2 IP 68 protected electric drill motor
- 3 Electric drill motor (IP 68 protection class)

Danger


Danger from electric shock



Since when drilling overhead the drill motors are exposed to a greater risk of contact with water, only hydraulic motors should be used.

In exceptional cases water-cooled electric motors with IP 68 protection class may also be used.

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

Danger	
	<p>Danger from vacuum anchoring coming loose.</p>
	<p>Never anchor the core drill rig by vacuum only when drilling overhead, but secure it, for example, with a suitable lifting tool or a quick-change clamping column.</p>
	<p>Failure to observe this regulation may lead to serious physical injury, possibly even death, and to property damage.</p>

Water collection system

An essential requirement when drilling overhead is that the water collection system is used in association with a wet extractor.

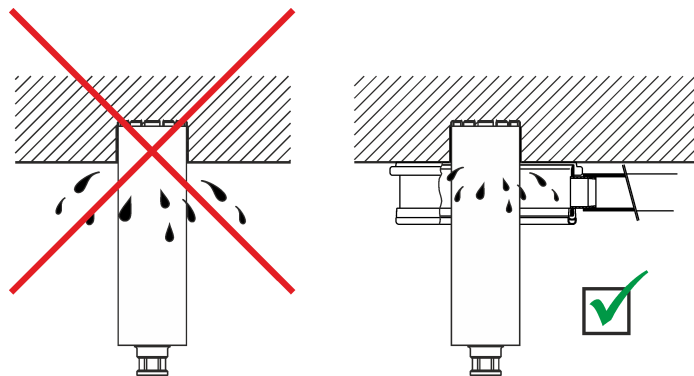



Fig. 6-17 Water collection ring / Overhead drilling

Information	
	<p>In order to prevent the drill bit filling with water during overhead drilling, and as a result high weight loading of the core drill rig and its anchoring, it is recommended, prior to drilling, to place a Styropor block in the drill bit.</p>
	<p>Once the drilling process is complete the residual water that has collected in the drill bit must first be emptied. Only then should the drill bit be rotated out of the drill hole.</p>

6.6 Practical working instructions

6.6.1 Recommended speeds

- In the case of highly reinforced material a reduced peripheral speed (1.2 – 1.8 m/s) is recommended.
- In the case of highly abrasive materials a higher peripheral speed (4 - 5 m/s) is recommended to prolong the life of the diamond segments.

6.6.2 Water and drilling core collection

In the case of floor drill holes with small drilling diameters water containers can be used to collect drilling core and water.

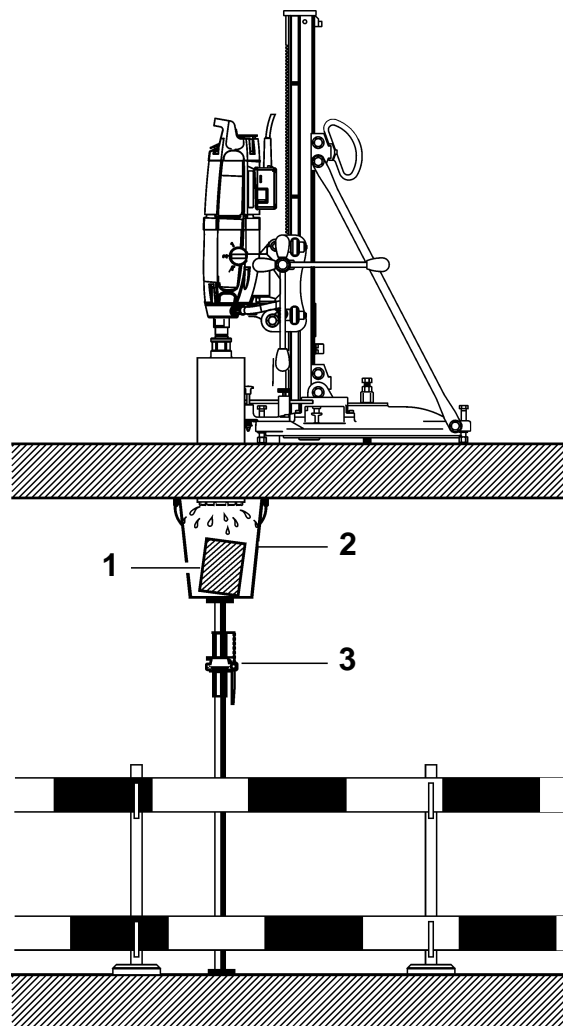


Fig. 6-18 Water container

- 1 Drilling core
- 2 Water container
- 3 Quick-change clamping column

6.6.3 What to do if the drilling core jams in the drill bit

If the drilling core remains jammed in the diamond drill bit, you should not remove the core by hitting the drill bit tube. There is a very high risk of denting, which can cause the diamond drill bit to wobble.

6.6.3.1 Solutions for releasing jammed drilling cores include:

Solution 1:

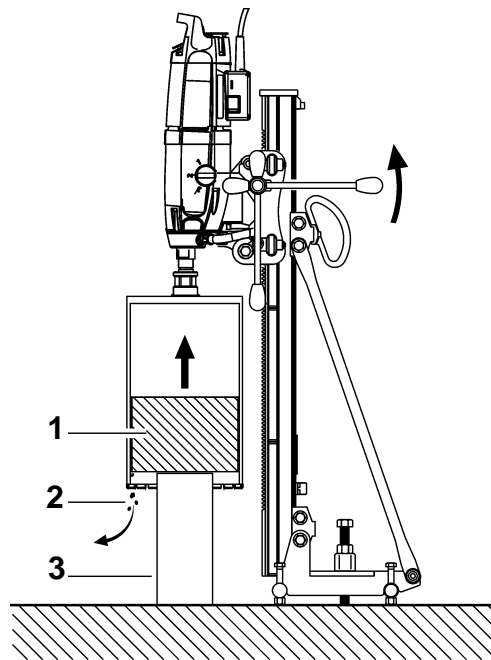


Fig. 6-19 Releasing drilling core

- 1 Drilling core
- 2 Jammed elements
- 3 Auxiliary block

Using the hand crank push the drilling core (1) backwards by means of the auxiliary block (3), so that the jammed elements (2) can loosen and the drilling core can then be extracted.

Solution 2:

Try to break down the drilling core and remove the individual pieces.

6.6.4 Diagonal bores

With diagonal bores there is frequently a problem with aligning the core drilling rig. Two solutions are shown below for aligning the core drilling rig with the hole centre.

Solution 1

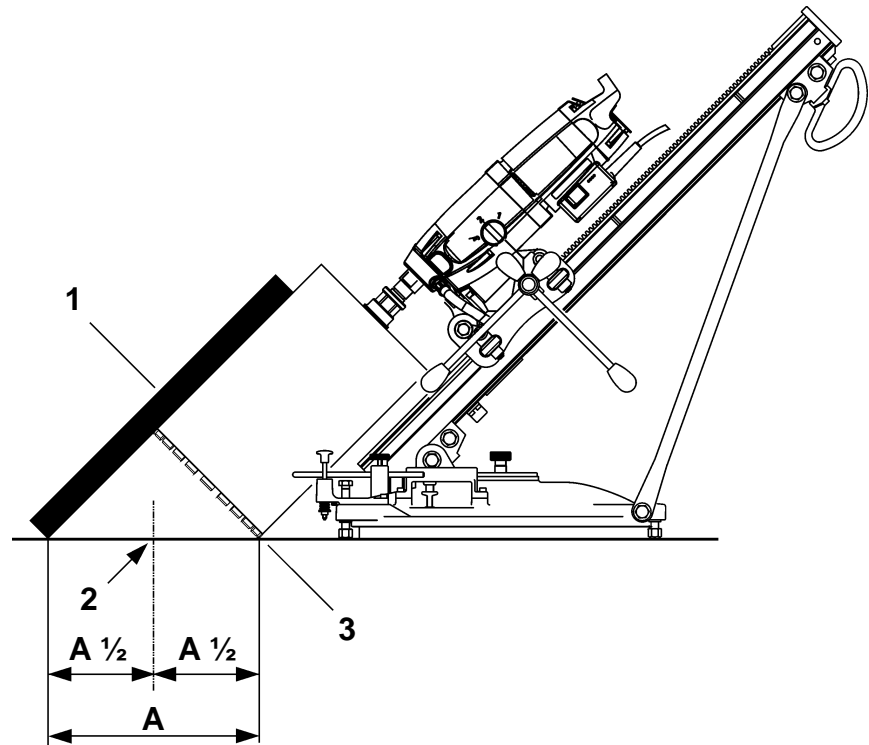


Fig. 6-20 Hole centre 1

- 1 Straight auxiliary item
- 2 Hole centre

Proceed as follows:

- Align the core drilling rig at the desired incline
- Move the diamond drill bit downwards until it is resting on the floor
- Place a straight auxiliary item (1) on the diamond drill bit
- Measure the distance A
- Mark a circle with radius $A/2$ around the hole centre (2)
- Align the drill rig with the touching edge (3) on the marked circle
- Secure the core drill rig

Solution 2

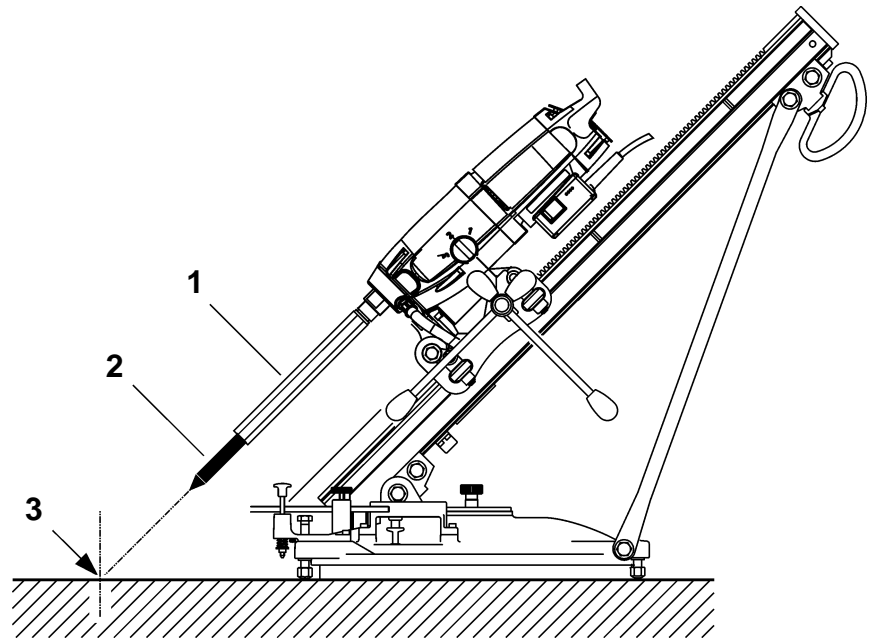


Fig. 6-21 Hole centre 2

- 1 Hole extension
- 2 Aligning centre
- 3 Hole centre

Proceed as follows:

- Align the core drilling rig at the desired incline
- Mount the drill bit extension (1) with alignment centre (2)
- Move the alignment centre downwards until it is resting on the floor
- Align the alignment centre with the hole centre (3) of the drill hole
- Secure the core drill rig
- Remove the drill bit extension (1) with alignment centre (2)
- Mount the diamond drill bit



Information

In order that when you are creating diagonal bores you do not drift you should always spot drill at low feed.

6.6.5 Supporting of large hole core drilling

In the case of large floor hole borings the bore hole must be supported separately from the drilling core. This will prevent the support coming loose and collapsing as a result of a rotating movement of the drilling core once drilling is complete.

The support should also be designed in such a way that a suspension device for secure extraction can be mounted.

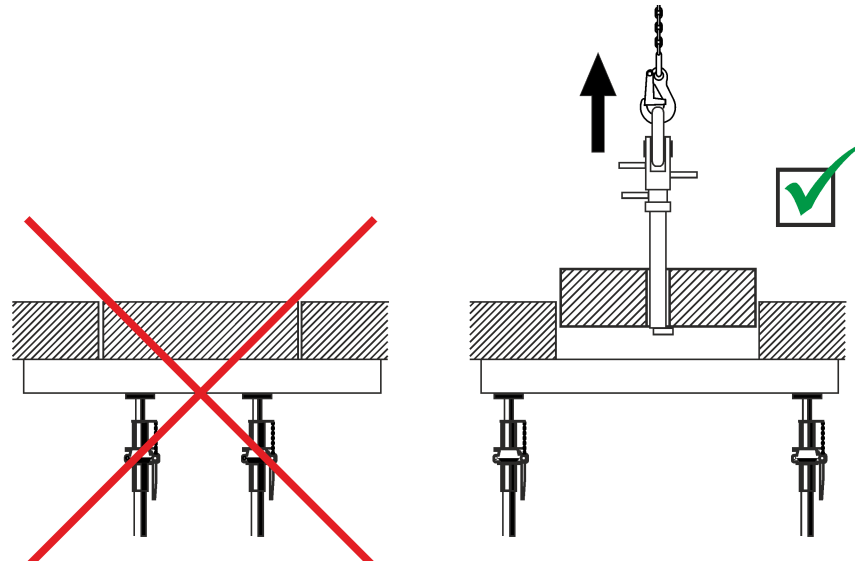


Fig. 6-22 Securing of large hole core drilling

6.6.6 Procedure in the case of a heavy drilling core

In order to avoid jamming of the core drill rig or of the drill bit during horizontal drilling due to a heavy drilling core, it is recommended that the drilling is not performed continuously, but that the drilling core is not broken until the drill bit has been removed and the drilling core is then removed using a suitable, safe extraction device.

6.6.7 Loose elements in the drill hole

Drill bit vibrations lead to loose elements such as reinforcing irons (bananas), chips, broken pieces of concrete, broken diamond segments, and so on. In order to avoid loosening of the active core drill segments, the drill hole should be cleared of loose parts.

6.6.8 Deep drill hole (approx. 2m and above)

6.6.8.1 Pre-drilling recommendation

When drilling deep drill holes a short drill tube and wide segments should be used for pre-drilling. The use of special screw drill bits is recommended.

6.6.8.2 Vertical deep hole drilling

When drilling deep holes the problem arises of long drilling cores and the removal of these. One solution to this problem is the core catcher spring.

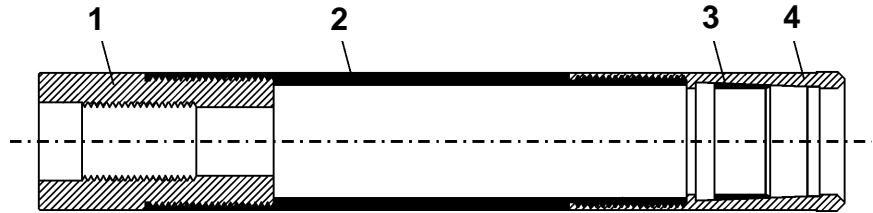


Fig. 6-23 Threaded tube lining

- | | |
|------------------|-----------------------|
| 1 Head piece | 3 Core catcher spring |
| 2 Extension tube | 4 Drill bit |

Function of the core catcher spring:

The core catcher spring (split ring), which cylindrically encloses the core internally, is in contact with its conical outer wall with a guide surface in the bit with the same taper. During drilling the core spring catcher has no function. During this it is pushed back against the rear stop and allows the core to pass unimpeded. As soon as the bit is removed from the hole, the core pulls the spring in the direction of the edge ring of the tip. Because of the narrowing taper in the tip the spring is compressed as a result until it has securely clamped the core. If a further pull is now applied then the core breaks and can be removed with the bit from the hole. Once the extension tube has been removed from the bit the core can be pushed backwards. The core capture spring then releases and the core can be removed.

6.6.8.3 Horizontal deep hole drilling

With horizontal deep hole drilling there is a danger of extension tubes dragging on the drill hole wall and therefore being prematurely destroyed. Reamer shells offer a solution to this. These are short sections of tube which are provided on their external wall with a hard metal armouring and thus protect the extension tube from wear.

The problem of long drilling cores can be overcome with core capture springs in the same way as in vertical deep hole drilling.



Information

Further information on threaded linings and core capture springs can be found in the specific product documentation.

6.7 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.

6.7.1 Troubleshooting table

Fault	Possible cause	Solution
Diamond drill bit cuts very slowly or not at all	Diamond segments worn	Replace diamond drill bit
	Very hard aggregate	Sharpen diamond drill bit, reduce diamond drill bit speed
	Excessive diamond drill bit speed	Reduce speed of diamond drill bit
	Too much cooling water (clear water coming from the drill hole)	Reduce cooling water feed
	Wrong drill bit segmentation	Use a diamond drill bit with another segmentation
Major wear of diamond segments	Speed too low	Increase speed
	Defective motor bearing	Replace motor bearing
	Too little cooling water (thick sludge coming from the drill hole)	Increase cooling water feed
	Extremely abrasive aggregate	Increase peripheral speed
	Wrong drill bit segmentation	Use a diamond drill bit with another segmentation
Lost diamond segment	Loose reinforcing irons in the concrete	Break up drilling core and remove reinforcing irons
	Too little flushing water	Increase flushing water quantity
	Welding fault when welding on diamond segments	Re-weld diamond segments

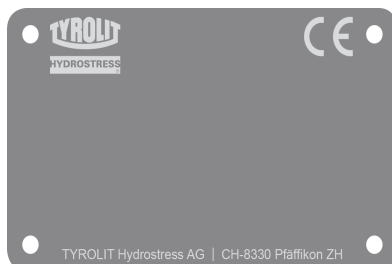
Fault	Possible cause	Solution
Diamond drill bit jams	Jamming due to loose parts in the concrete (e.g. cut-through reinforcing irons, aggregates, etc.)	If the power supply is interrupted, move the drill bit in both directions of rotation using a wrench and extract using the feed. In the case of drill bits with a clamping device, release the clamping device and break the drilling core or drill out with smaller drill bits
	Diamond drill bit off centre due to inadequate anchoring of guide rail or drill rig foot	Loosen and extract diamond drill bit. Break up drilling core and correct drill rig anchoring
	Diamond drill bit drifts due to excessive play in the carriage guides	Loosen core drill rig and readjust carriage guides
	No free cutting due to worn diamond segments	Replace diamond drill bit
	Dented drill bit tube	Re-weld diamond segments onto a new drill tube
Major wear on the drill bit tube	Poor guidance of the diamond drill bit in the drill hole	Readjust carriage guide
	Drilling spindle out of true	Replace drilling spindle
	Diamond drill bit is deformed	Straighten diamond drill bit
		Re-weld diamond segments onto a new drill tube
		Replace diamond drill bit
	Inadequate flushing of abrasive drillings	Correct flushing
	Protruding reinforcing irons	Remove reinforcing irons
Poor seating in the clamping device	Re-clamp diamond drill bit	
Feed jams along the whole length of the guide rail	Guide support clamped too tightly	Adjust guide support clamping
Feed jams at one point on the guide rail	Guide rail is distorted or damaged	Contact TYROLIT Hydrostress after-sales service
Difficulty in centring drill bit	Diamond drill bit off centre due to poor anchoring of the core drill rig	Correct core drill rig anchoring
	Diamond drill bit off drifts due to excessive play in the carriage guides	Readjust carriage guides
Diamond drill tip running off-centre	Defective motor bearing	Replace motor bearing
	Deformed connecting thread	Rework engaging surface or change connection
	Dented drill bit tube	Re-weld diamond segments onto a new drill tube

Fault	Possible cause	Solution
Difficult or impossible to twist the adjusting screw	Thread not lubricated	Lubricate thread
	Feet distorted	Contact TYROLIT Hydrostress after-sales service
Difficult or impossible to incline the core drill rig	Guide rail distorted or damaged	Contact TYROLIT Hydrostress after-sales service
Vacuum cannot be generated	Defective vacuum seal on vacuum foot	Replace vacuum seal
	Defective vacuum foot vacuum valve	Replace vacuum valve
	Defective vacuum pump or hose	Replace vacuum pump or hose
	Surface not suitable for vacuum anchoring	Choose another type of anchoring

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

Core drilling 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, service 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 putting into operation	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
Electrical system (cables, plugs, switches)	Visual check	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 drill bit)	Inspection	X				X	
	Change						X
Accessible nuts and bolts	Retighten			X			
Flange	Clean		X				
	Change						X
Toothed wheels (oil)	Inspection	X		X		X	X
	Change				X		X

		before each putting into operation	upon completion of work	weekly	annually	in the event of malfunction	in the event of damage
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.

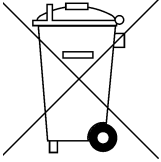
Maintenance activities are described in the Operating Instructions of the individual machines.

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 core drilling 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 Disposing of the diamond core drilling system

8.4.1 Disposal regulations

The normal national and regional rules and guidelines must be observed when disposing of core drilling systems.

8.4.2 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 core drilling systems consist of the following materials:

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

8.5 Obligation of notification

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