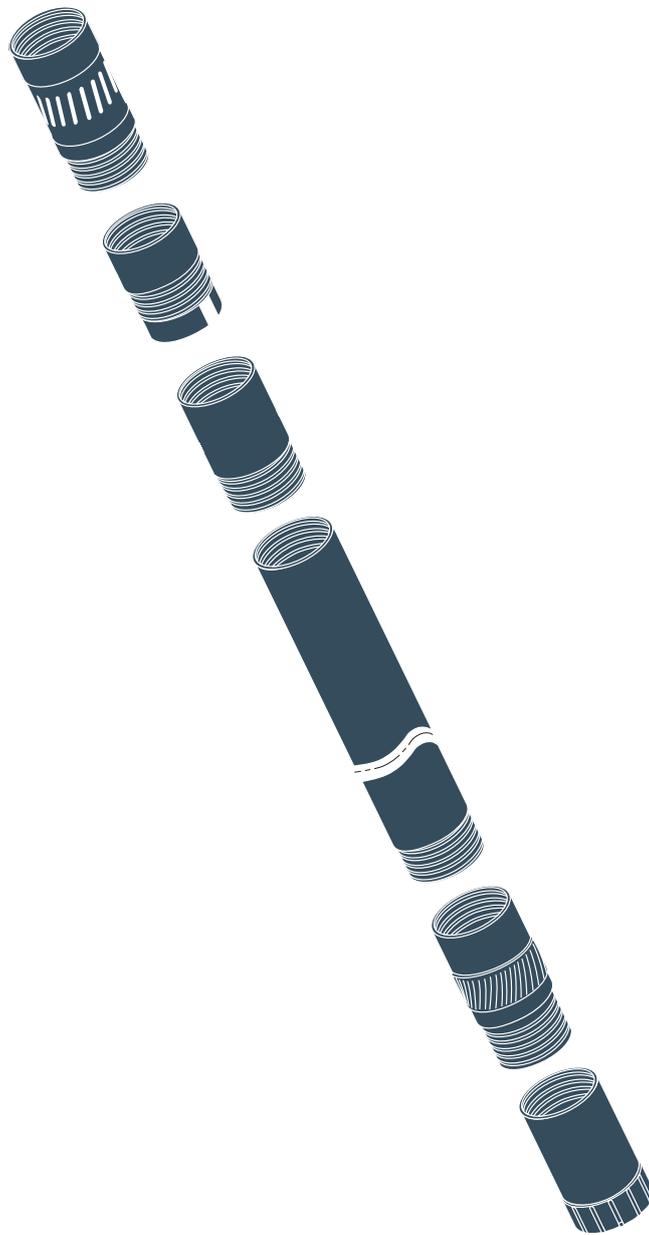




S Geobor wireline core barrel

Operator's instructions



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Introduction

These instructions are intended for operators of the TerraRoc equipment. The aim of the instructions is to provide you with knowledge of how to use the equipment in an efficient and safe way. These instructions also give you advice and tell you how to perform regular maintenance on the equipment. It does not replace thorough training of operator, it is a complement. For further information concerning service measures, please contact your nearest TerraRoc representative.

Always read these instructions carefully and make sure that you understand all of them before starting for the first time.

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Any user of this publication is requested to inform TerraRoc about deficiencies found, particularly in matters concerning product safety.



1. Product description

1.1. Description

The TerraRoc S Geobor wireline core barrel with standard diameter 146 mm was designed for core sampling from hard, to extremely soft and clayey formations, using a wide range of drilling methods. It is available in usable lengths of 1.500 m and 3.000 m.

In general, the S Geobor system is extremely versatile. As a triple core barrel, i.e. a double core barrel with a plastic liner, it can cope with most coring tasks. Water, fluid mud or air can be used as the flushing medium.

S Geobor can be adapted to almost all soil and rock situations using different types and shapes of drill bit.

Coring is optimised by changing the core lifter (with- or without catch springs), core lifter cases, inner tube assemblies, bits with varying design, etc.

The plastic liner filled with the core sample, can be used for protection during transport or storage.

The S Geobor drilling system is an original TerraRoc design and offers a number of advantages such as:

- Stable core barrel head with reliable triple latching
- Full flexibility in core sampling method 1–5 standard coring, pilot coring, Shelby tube sampling or non coring.
- Safety installation and recovering of inner tube assembly. The optional “Dry hole device” guarantee the inner tube will be inserted and released only when latched, working in liquid filled – or dry hole.

1.2. Method 1–7 description

The S Geobor wire line core barrel can be used in many ways, e.g.:

Method 1: Coring in hard to medium-hard formations

Drill bit with surface set- or impregnated diamonds, PCD, Corborit or carbide inserts. The cutting diameter of 146 (150) mm gives a core diameter of 102 mm.

The drill bits normally have flushing holes through the bit front (face discharge FD), but can also have water channels over the bit front (channel flush CF, ECF).

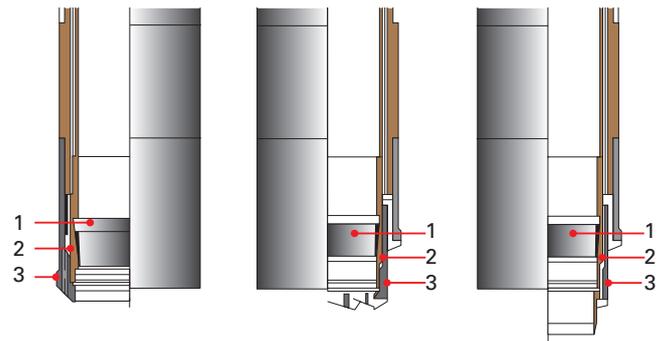
Method 2: Coring in soft to very soft formations

Here, the carbide bit is build divided in two steps,(reamer and pilot). The pilot step cuts the core and the reamer step keep the hole gauge. The flushing fluid comes out between the two steps, thus avoiding flushing out the core. The reamer keep the hole diameter of 150 mm. The pilot cuts a core diameter of 102 mm.

Method 3: Coring in very soft and loose formations, extremely sensitive to flushing.

This carbide bit is built in two steps. However the pilot ID allows the core lifter case to protrude about 25 mm in front of the bit, as a plunger sleeve, in order to keep the flushing fluid away from the core samples. The reamer cuts a hole of 150 mm, the pilot together with the special protruding core lifter case return a core sample with diameter 102 mm.

Fig 1.2.1. Method 1–3



Method 1

Method 2

Method 3

1. Core lifter

2. Core lifter case

3. Core bit

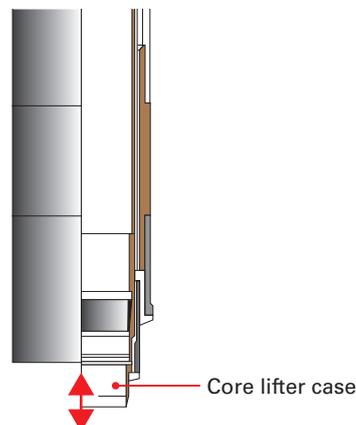
Method 4: Coring in soft varying formations.

(Mazier method). (Available on request).

For coring in very soft, loose formations with varying layers. The spring-loaded inner tube assembly is extended to run in front of the bit, but is retractable for optimized adaption to the hardness of the ground and to protect the core lifter case from destruction. For this method, a carbide bit OD/ID 146/109 is used. The core diameter is 102 mm.

The inner tube with the core lifter case protrude about 60 mm ahead of the bit. The assembly will retract at around 600 kg total pressure, to the bit front, which means that position of the core lifter case is constantly adjusted to the hardness of the rock. This will minimize the exposure of the sample to the flushing.

Fig 1.2.2. Method 4



Method 5: "Shelby tube" sampling.

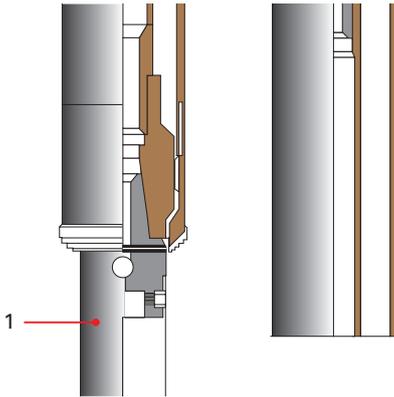
Used for taking samples from very soft and fine cohesion ground (clay etc.)

The inner tube assembly will be replaced with a non rotating Shelby tube assembly. Samples are collect in front of the bit by pressing the sampler down in the ground as far as the sample tube lebth allow (762/914 mm).

The Shelby tube tube return a core sample with diameter 95 mm:
– bit size OD/ID 146/102 mm.

Note! With this method, there is no rotation, only pressure.

Fig 1.2.3. Method 5: Non core drilling method



1. Sampler

Method 6: Non core drilling method

If core drilling will be alternated with non coring the inner tube assamble is replaced with a non coring inner tube assamble. The non coring assamble is designed for 3⁷/₈" (98,4 mm) non coring bit with 2³/₈" API REG pin connection.

The outer tube assamble should be equipped with standard S Geobor bit size (OD/ID 146/102 mm).

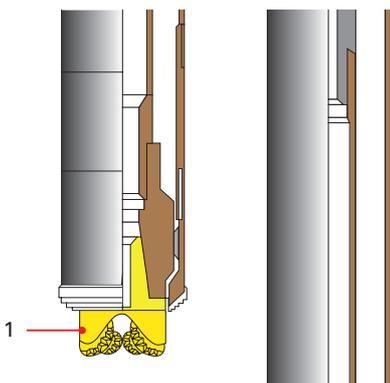
The S Geobor a strong and unique three latching system, allow 7 ton trust load.

"Pilot coring" optional alternative with method 6

Pilot coring is used for strain measurements in a 4" (102 mm) hole.

The non coring bit will be replaced with a core barrel (101T2, 101T6 or 101T6S) and a crossover adapter. Pilot coring will return a core sample with smaller diameter from the section where the 4" (102 mm) hole is required.

Fig 1.2.4. Method 6: Non coring method



1. Non coring bit

Method 7: Packer for water loss

(Lugeon) test and/or fluid collection. *(Available on request).*

Fig 1.2.5. Packer Method



1.3. Technical data – wireline core barrel

Diameter and core diameter		
Part	Diameter (mm)	
	OD	ID
Outer tube	139,7	128,0
Inner tube	117,0	111,0
PVC liner	110,0	105,6
Core	102	

Length and core length		
Part	Length (mm)	Core length (mm)
Core barrel x 1500 mm	2600	1500
Core barrel x 3000 mm	4100	3000

Weights	
Part	Weight (kg)
Core barrel x 1500 mm	101
Core barrel x 3000 mm	136
Inner tube unit x 1500 mm	46
Inner tube unit x 3000 mm	58
Outer tube unit x 1500 mm	55
Outer tube unit x 3000 mm	78
Core barrel head complete	25
Overshot (catcher)	11
Dry hole device	15
Overload protection complete	5

1.4. Technical data – rods

The following information applies for S Geobor Monobloc wire line core rods.

Technical data	
Material quality	P-105
Yield strength (min.)	740 N/mm ²
Tensile strength (min.)	880 N/mm ²
Expansion after A 5% (min)	13 %
Recommended make up torque	3 KNm
Maximum single torque	8,2 KNm
Maximum pull force	445 KN
Outer tube diameter	139,7 mm
Inner tube diameter	125,5 mm

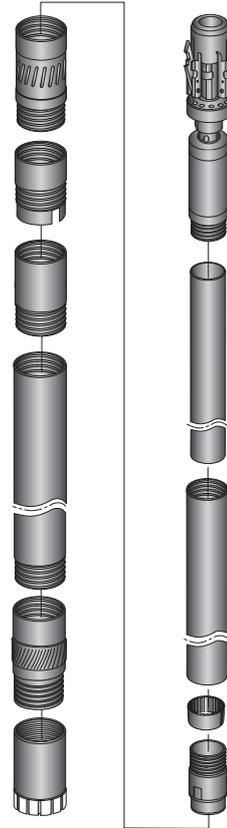
Rods are available in 3 lengths as standard:

Available rods		
Length (mm)	Part number	Weight per rod assembly (kg)
500	8393 0528 00	12
1500	8393 0528 20	35
3000	8393 0528-30	70

Rods described (Monobloc) are made in one piece.

They are cold-drawn and heat-treated.

Threads are conical with 3TPI. Surface treated by special coating.



1.5. Technical data – drill bits

Various types and designs of drill bit can be used for the S Geobor core barrel, depending on which method is used and in what formation drilling is to be carried out. The most common types and application are described here:

Method 1 (OD 146 mm, ID 102 mm)	
Type / Application	Part number
TCI – Tungsten Carbide Insert bit. Two step bit (pilot and reamer). Flushing holes (FD). For soft formation.	8372 0941 10
CRB – Tungsten Carbide Chip bit. Flushing holes (FD). For soft to medium soft formation.	8372 0925 05
DPX – Diapax bit with 12 x 13 mm. PCD inserts. Flushing holes (FD). For soft formation	3702 1901 17
DPX – Diapax bit with 8 x 13 mm. PCD inserts. Flushing channels (CF). For soft formation.	3702 6391 00
TRX – Tripax bits. with PCD inserts. For soft to medium hard formations.	
- 96 triangular inserts. With flushing holes (FD).	3702 5085 00
- 60 cubic inserts. With flushing channels (CF).	3702 6461 00
- 77 cubic inserts. Saw-tooth profile. With flushing holes (FD).	3702 5066 00
SS – Surface Set diamond bit. For soft to medium hard formations.	
- Tapered crown profile, 20/25 spc. With flushing holes (FD).	3702 1901 67
- Multi step profile, 20/25 spc. With flushing holes (FD).	3702 1901 62
IMP – Impregnated diamond bit. For hard to very hard formation. With flushing holes (FD).	
- #4, 6 mm impregnation. With flushing holes (9FD). For soft to medium soft, abrasive, highly fractured formation.	3740 4007 61
- #4, 6 mm impregnation. With flushing channels (12CF). For medium soft to hard, abrasive, fractured formation.	3740 4007 63
- #6–8, 6 mm impregnation. With flushing channels (12CF). For medium hard to hard, abrasive + mixed formation.	3702 6978 00
- #9, 10 mm impregnation. With flushing holes (12FD). For hard to very hard, slightly abrasive formation.	8370 2300 38
Reaming Shell SS Surface diamond set	3761 0014 77

Look to Terracore catalogue for wider selections of bits.

Method 2 (OD 150 mm, ID 102 mm)	
Type / Application	Part number
TCI – Tungsten Carbide Insert bit. Two step bit (pilot and reamer). For very soft formation. With flushing holes (FD).	8372 0902 10
To be used with Core lifter case	3867 2876 00

Method 3 (OD 150 mm, ID 110 mm)	
Type / Application	Part number
TCI-Tungsten Carbide Insert bit. Two step bit (pilot and reamer). For very loose formation. With flushing holes (FD).	8372 0941 40
To be used with core lifter case (protruding 25 mm).	3867 2881 00



CBT TCI



CBT CRB CF



CBT TRX CF



CBT DPX FD



CBT SS CF



CBT IMP FD

2. Operating instructions

2.1. Basic setting of the core barrel

Check that the three latches on the inner core barrel are in the outer position and that they can be pressed in if pressed lightly by hand and that they spring back of their own accord into the initial position. Mount the core lifter into the core lifter case.

This must be done from the thread side.

Once the inner core barrel has been positioned in the outer core barrel and the reaming shell and the drill bit have been assembled, the distance between the landing shoulder (7, 3702 1294 00) and the sleeve (9, 3702 1295 00) must be 70,5 mm.

This ensures the right basic setting for the distance between the core lifter case and the drill bit.

If the distance is too less, the flushing fluid will flushing out and disturb the core sample.

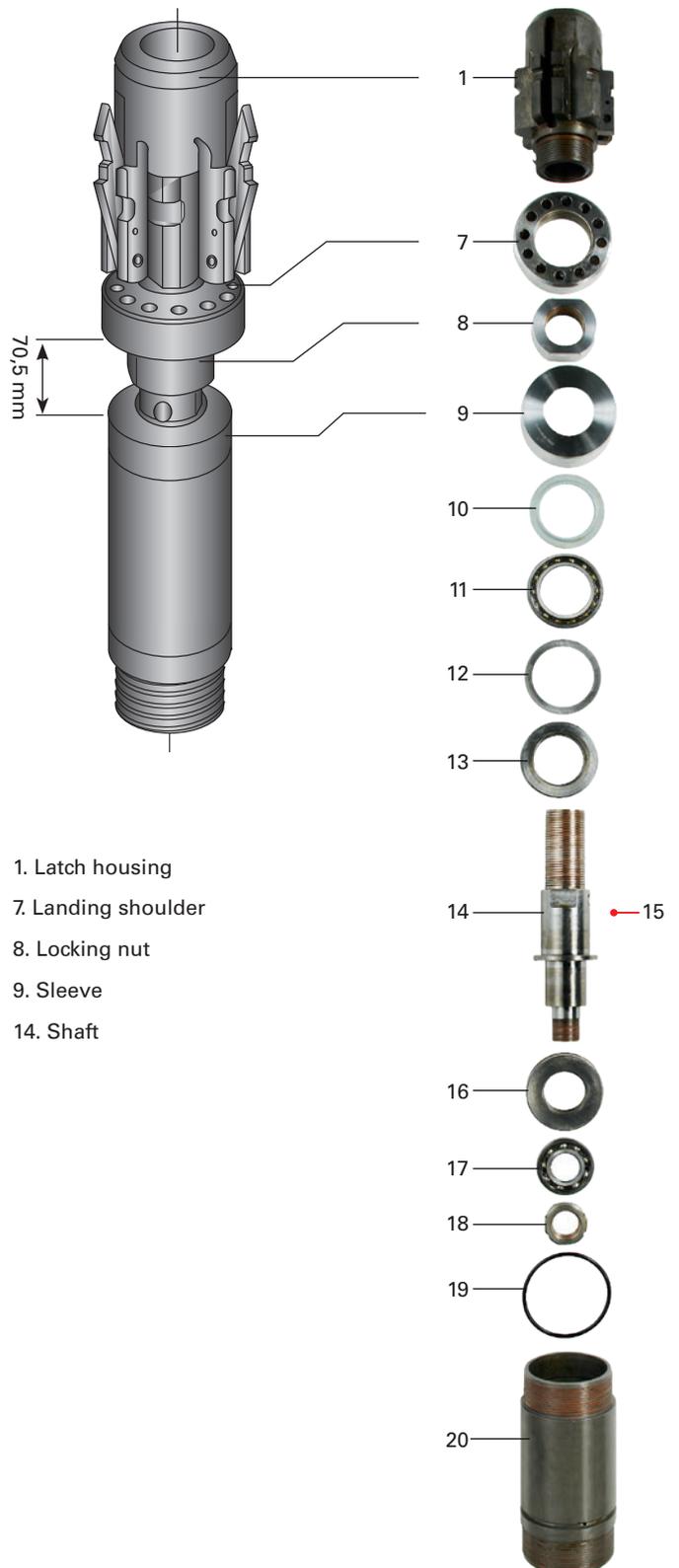
If the distance is too large, the inner core barrel might jam and turn with the outer core barrel. The inner tube core barrel might even not latch at all and be pushed upward during drilling. The core sample might be lost in the hole and destroyed.

Setting procedure

1. Place one wrench on the locking nut (8, 3702 1293 00).
2. Place the other wrench on the shaft (14, 3702 1292).
3. Loosen the locking nut by easy hitting it with a hammer.
4. Turn the core barrel head to the right = reducing the distance
5. Turn the core barrel head to the left = increasing the distance
6. After correctly setting the distance at 70,5 mm, tighten the locking nut with the wrenches and secure the setting.

Fig 2.1.1. Basic setting of the core barrel

(See also Product Catalogue 6991 1715 01).



2.2. Drilling

When the core barrel and drilling equipment are installed, the drilling will be performed in the same way as a normal drilling process.

To achieve an optimum drilling result, the right bit for the formation to be drilled must be selected, and correct drilling parameters used.

2.2.1. Recommended drilling parameters

Bit type	RPM
TCI – Tungsten Carbide Insert bit	50–100
CRB – Tungsten Carbide Chip bit	80–150
DPX – Diapax (PCD) bit	50–100
TRX – Tripax sawtooth (PCD) bit	80–150
TRX – Tripax (PCD Geoset)	150–300
SS – Surface Set diamond bit	200–400
IMP – Impregnated diamond bit	300–500

Drilling parameter	Recommended value
Flushing volume	140–250 l/min (water/mud flushing, depending on formation and bit type)
Air flushing	10–17 m ³ /min (air flushing depending on formation and bit type)
WOB (weight on bit)	Max 90 kN (depending on formation, bit type and method)
Core break force	With core diameter 102 mm in e.g. undisturbed, fault-free dolomite (laboratory data) 40–60 kN (experience has however shown that these values are lower in practice)

2.3. Catching and lifting the inner core barrel

If the core barrel is full, or core block occur, drilling is interrupted. Pull the drill rods up to break the core off. When the top rod joint visible above the rod holder this rod with water swivel (Kelly) have to be disconnected.

The rotation head is swung sideways (if rig design allow) to clear the box end of the drill rods.

Check that the wire line wire is securely fixed to the overshot and lower the overshot down into the drill string. When the overshot has come to a stop, grip the wire and pull, to check whether the overshot is locked to the inner core barrel head.

If the overshot is not locked, pull up the overshot approx. one metre and let it drop. When the overshot is locked to the inner core barrel, pull it up to the surface. Once the inner core barrel and the overshot is recovered from the hole, loosen the inner core barrel from the overshot by pressing the latches together. Remove the core sample from the inner tube. Sometimes it is necessary to use a rubber hammer to gently tap the inner tube to get the liner with core out. Never use a steel hammer. Dented inner tubes cause core blocks.

2.4. Installing inner core barrel – (water filled hole)

If the inner tube is empty or a second empty inner core barrel is used, check first the core lifter and the core lifter case are not damaged or worn. Check the correct distance between core lifter

case and bit (see 2.1. Basic setting of the core barrel). Check that the latches are free. The latches must always be in the outer position and must not show any tendency to “grab”

Insert the complete inner tube into the drill string and let it sink by gravity down to the outer tube core barrel. Once the inner core barrel has latched into the outer tube core barrel, a vibration or unusual noise can be heard. This shows that the inner core barrel is secured in the working position. Do not confuse this noise with the noise that can be heard when the inner core barrel passes the joints in the drill string.

2.5. Installing inner tube assembly – (dry hole)

Check the core barrel as described in 2.4.

If the hole contains little or no water, the inner tube assembly cannot be installed in the same way as with a water filled hole. The wire line hoist and optional accessory “Dry hole device” have to be used.

Instruction to mount, load and install the Dry hole device.

1. Disassemble (catch sleeve 12, P/N 3702 1238 00) from the Overshot 3702 1249 80.
2. Attach the dry hole device (13, P/N 3702 1220 80 to the sleeve (11) in the overshot).
3. Loosen the nut (1) on the Dry hole device (P/N 3702 1221 00) by turning it to the left.
4. Place the complete assembly on to the loading tool (11, P/N 3702 1229 00).
5. Press Dry hole device as far down as possible, until the three latches come out at the side.
6. Lock the Dry hole device at this loaded position by turning the nut (1, P/N 3702 1221 00) to the right.
7. Install and fix the complete Dry hole device on to the head of the inner tube assembly.
8. Use the wire line hoist and insert the complete Dry hole device and inner tube assembly into the drill rod. Stop the installation just when the nut (1, P/N 3702 1221 00) still available and visible above the end of the top rod.
9. Loosen the nut by turning left until you hear a snap from the released latches in the Dry hole device. The inside of the rod will now prevent the Dry hole device releasing from the inner tube. **WARNING, Risk for dropping the inner tube assembly if Dry Hole device is too far up.**
10. Continue to install the complete assembly with the wire line hoist, until you reach the final position in the core barrel outer tube.
11. When the inner tube is established in correct position the dry hole device will automatically release from the inner tube assembly, only in this position.

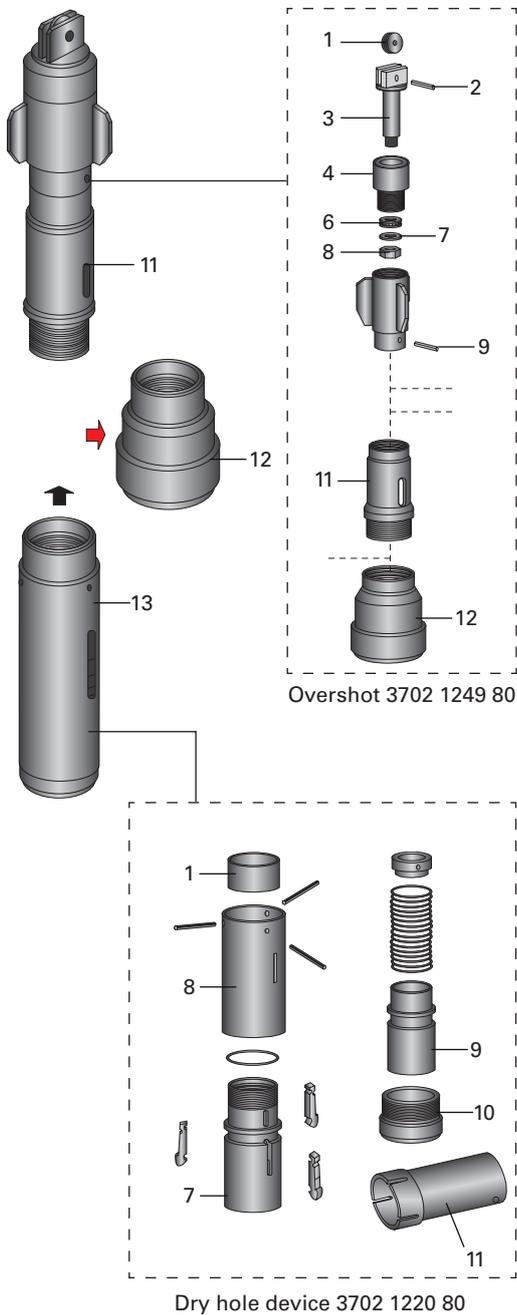
Installing the inner tube assembly with the Dry hole device will give you a guaranteed indication, that the inner tube is in correct position.

2.5.1. Using Dry hole device as overshoot

After attaching the Dry hole installation device as described in 2.5., the Dry hole does not need to be removed. The Dry hole device is recommended to be used as over shot to catch the inner tube once the inner tube assembly should be retrieved.

Fig 2.5.1. Installing inner tube assembly

(See also Product Catalogue 6991 1715 01).



1. Load the Dry hole device (repeat procedure 1–6 in section 2.5.).
2. The loaded Dry hole device will be utilized as overshoot assembly.
3. On surface the Dry hole device can be released from inner tube assembly by pressing in three core barrel head latches. Recommended to use latch ompression wire – Part No. 3702 1438 00).

2.6. Overload protection – optional safety device

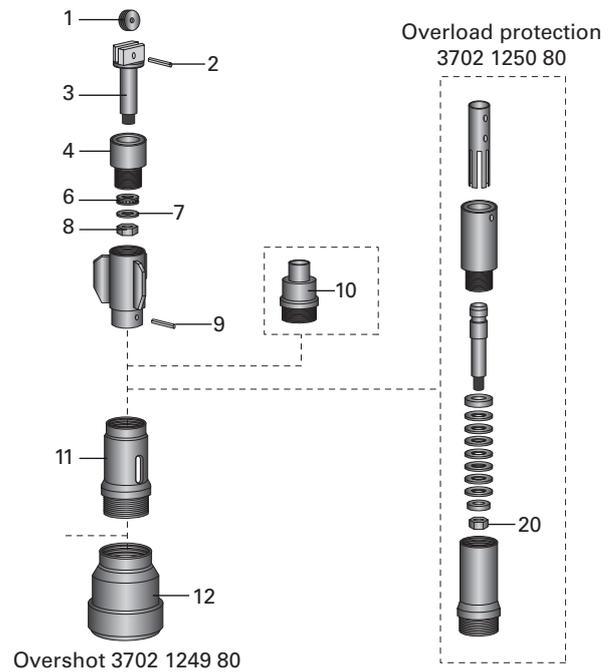
The overload protection prevents the wire to brake, if the inner tube assembly and overshoot get stuck in the rods.

Instruction to assemble the Overload protection.

1. Replace the coupling (10, 3702 1247 00) in the overshoot 3702 1249 80 with the complete overload protection 3702 1250 80.
2. If Dry hole device used, install overload protection as above (pos.1) and repeat installation procedure (1–6 in section 1.5).
3. Adjustment of release pressure: Tighten or loosen the lock nut (20, 0291 1114 00) to get correct release pressure. Recommended to test the setting on surface.

Fig 2.6. Overload protection.

(See also Product Catalogue 6991 1715 01).



2.7. Pilot coring 4" (101 mm hole)

Brief description of procedure

With Method 6, either non coring bit or a core barrel equipment can be used. With pilot core equipment, a 101T6/T2 core barrel is used in to be installed through the 102 mm inner diameter in the S GEOBOR bit.

Application of a "measurement process" in a 4" (101 mm) hole can be as follow:

1. S Geobor-S Method I used to drill 146 mm diameter hole with 102 mm diameter core size.
2. A strain measurement (dilation) is to be carried out at desired depth.
3. The inner tube assembly is pulled out.
4. Rods with core barrel outer tube are lifted about 2-3,5 m from bottom.
5. Non coring assembly is completed with an adapter to 101 mm core barrel assembly.
6. Complete assembly in pos 5. installed with Dry hole device and wire line hoist into the rods.
7. Drilling is carried out by rotating S Geobor rods.
8. 101T6 core barrel is pulled out after 1,5 m (3 m) pilot coring distance.

Core recovered and measurement can be carried out.

Replace the 101 mm core barrel and adapter with a 3⁷/₈" non coring bit, to ream up the pilot cored length to S (146 mm) hole size.

S Geobor inner core barrel installed and further full size coring can be carried out.

Fig 2.7. Pilot coring.

(See also Product Catalogue 6991 1715 01).



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