USER'S MANUAL

# CRT500

## Casing Running Tool

| REFERENCE<br>CRT500 | REFERENCE DESCRIPTION<br>Casing Running Tool |
|---|---|
|  | **VarcoBJ BV**<br>Nijverheidsweg 45<br>4879 AP Etten-Leur<br>P.O. Box 17<br>4870 AA Etten-Leur<br>The Netherlands<br>Tel + 31-76-5083000<br>Fax + 31-76-5046000<br>www.nov.com |
| DOCUMENT NUMBER<br>**50000880-MAN-001** | REV<br>**-**<br>December 2007 |

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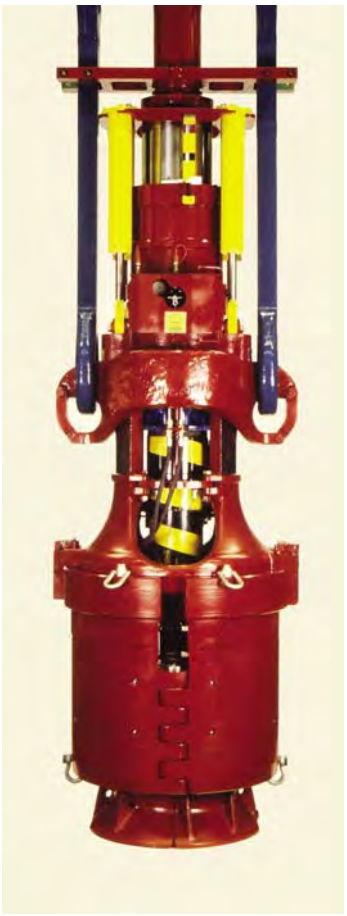

# User's Manual

## CRT500

## Casing Running Tool

## P/N 50008200Y2

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|---|---|---|
|  | VarcoBJ<br>Nijverheidsweg 45<br>4879AP Etten-Leur<br>Tel: +31-76-5083000<br>Fax: +31-76-5046000 | |
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## Revision History

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|---|---|---|---|---|---|
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| | | | | | |
| - | 31.12.2006 | Issued for Implementation | PGF | LS | AK |
| **Rev** | **Date** | **Reason for issue** | **Prepared** | **Checked** | **Approved** |

## Change Description

| Revision | Change Description |
|---|---|
| - | First Issue |

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# General information

## How to use this manual

This manual is divided into 9 sections. The first page of each section is marked with a black tab that lines up with the thumb nail index tabs for each section and the back cover. You can quickly find each section without looking through a full table of contents. Use the symbols printed at the top corner of each page as a quick reference system. Each section uses a different symbol.

When applicable, each section includes:

1. A table of contents, or an illustrated view index showing:
   - Major assemblies, system or operations
   - Page references to descriptions in text
2. Disassembly / assembly information and tools
3. Inspection information
4. Testing / trouble shooting information
5. Repair information
6. Adjustment information
7. Torque values

## Special information

Detailed descriptions of standard workshop procedures, safety principles and service operations are not included. Please note that this may manual contain warnings about procedures which could damage equipment, make it unsafe, or cause PERSONAL INJURY. Please understand that these warnings cannot cover all conceivable ways in which service (whether or not recommended by Varco) might be done, or the possible hazardous consequences of each conceivable ways. Anyone using service procedures or tools, whether or not recommended by Varco Systems, must be thoroughly satisfied that neither personal safety nor equipment safety will be jeopardized.

All information contained in this manual is based upon the latest product information available at any time of printing. We reserve the right to make changes at any time without notice.

## Illustrations

Illustrations (figures) represent a graphical representation of equipment components for use in identifying parts or establishing nomenclature. These figures may or may not be drawn to scale.

For more specific component information pertinent to your rig configuration, see the technical drawings that accompany your Varco documentation.

## Intended audience

This manual is intended for use by field engineering, installation, operation, and repair personnel. Every effort has been made to ensure the accuracy of the information contained herein. Varco® 2006, Varco LP, will not be held liable for errors in this material, or for consequences arising from misuse of this material.

## Conventions

### Notes, Cautions, and Warnings

Notes, cautions, and warnings provide readers with additional information, and to advise the reader to take specific action to protect personnel from potential injury or lethal conditions. They

may also inform the reader of actions necessary to prevent equipment damage. Please pay close attention to these advisories.

**Note:**

The note symbol indicates that additional information is provided about the current topics.

**Caution:**

*The caution symbol indicates that potential damage to equipment or injury to personnel exists. Follow instructions explicitly. Extreme care should be taken when performing operations or procedures preceded by this caution symbol.*

**Warning:**

**The warning symbol indicates a definite risk of equipment damage or danger to personnel. Failure to observe and follow proper procedures could result in serious or fatal injury to personnel, significant property loss, or significant equipment damage.**

# Safety Requirements

Varco equipment is installed and operated in a controlled drilling rig environment involving hazardous situations. Proper maintenance is important for safe and reliable operation. Procedures outlined in Varco manuals are the recommended methods of performing operations and maintenance.

*CAUTION: To avoid injury to personnel or equipment damage, carefully observe requirements outlined in this section.*

## Personnel Training

All personnel performing installation, operations, repair, or maintenance procedures on the equipment, or those in the vicinity of the equipment, should be trained on rig safety, tool operation, and maintenance to ensure their safety.

*CAUTION: Personnel should wear protective gear during installation, maintenance, and certain operations.*

Contact the Varco Drilling Equipment training department for more information about equipment operation and maintenance training.

## Recommended Tools

Service operations may require the use of tools designed specifically for the purpose described. Varco recommends that only those tools specified be used when stated. Ensure that personnel and equipment safety are not jeopardized when following service procedures or using tools not specifically recommended by Varco.

## General System Safety Practices

The equipment discussed in this manual may require or contain one or more utilities, such as electrical, hydraulic, pneumatic, or cooling water.

*CAUTION: Read and follow the guidelines below before installing equipment or performing maintenance to avoid endangering exposed persons or damaging equipment.*

- Isolate energy sources before beginning work.
- Avoid performing maintenance or repairs while the equipment is in operation.
- Wear proper protective equipment during equipment installation, maintenance, or repair.

## Replacing Components

- Verify that all components (such as cables, hoses, etc.) are tagged and labeled during assembly and disassembly of equipment to ensure correct installment.
- Replace failed or damaged components with Varco certified parts. Failure to do so could result in equipment damage or injury to personnel.

## Routine Maintenance

Equipment must be maintained on a routine basis. See the service manual for maintenance recommendations.

**WARNING: Failure to conduct routine maintenance could result in equipment damage or injury to personnel.**

## Proper Use of Equipment

Varco equipment is designed for specific functions and applications, and should be used only for its intended purpose.

## Identification numbers

You will find the identification of the tool stamped into the hoist ring in the oval text recess, the manifold blocks, compensator cylinder and on the top surface of the body.

**Examples:**

“CRT NL12345 – TF. NL 54321” on Torque Frame Assembly

“CRT NL12345 – Body. NL 98765” on Body Assembly

## Lifting points

The lifting procedures should carefully be observed and carried out according to the manual.

## CRT restrictions

- Torque applied to the CRT must not exceed the 45,000 lbs/ft@2,000 psi (61,010 Nm @ 13,789 KPa)
- The Supply pressure on the Pressure Line (P) must not exceed 2,500 psi (17,236 KPa)
- The back pressure measured at the rotating head must not exceed 150 Psi (1,050 KPa)
- The mud circulation pressure must not exceed 5,000 psi (34,472 KPa). When circulating, the pressure in the casing will force the CRT upwards if there is not sufficient weight on the CRT preventing it from doing so or when the pressure is too high.
- The total applied load must not exceed 500 STon (450 Mton)

## Limited warranty

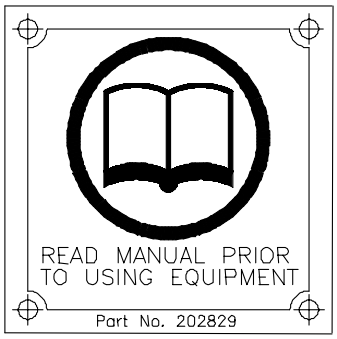
The warranty provided will be void if the CRT or parts were either:

- unauthorized modified, repaired or serviced
- replacement parts not manufactured by Varco were utilized
- not properly stored or maintained

# Warning plates

**WARNING: The warning plates must be present on the CRT. Do not remove the labels. When a label or warning plate has disappeared, it must be replaced.**


Warning plate p/n 201847: Overhead load can cause severe injury or equipment damage



Warning plate part.nr.202829: Read the manual prior to use


Warning plate p/n # 201646: Be careful. Keep hands out, hinging parts


Warning plate p/n # 203263: Be careful. Keep hands out, moving parts

CE

CE-plate p/n # 50006151: The CRT complies with the Machinery Directive

## Storage frame warning plates


Warning sticker p/n# 50008715: Do not lift the storage frame with a crane


Warning sticker p/n 50008716: Use a forklift to transport the storage frame.

## General safety note

**WARNING: Be aware of all the movements a CRT can make. Do not touch the CRT.**

## Marking

The CRT complies with:

Ex II 2G T5

**WARNING: Care should be taken to avoid creating possible ignition sources, like sparks, due to improper use of the tool in combination with other equipment.**

# General specifications

## Specifications and requirements

| CRT SPECIFICATIONS | | |
|---|---|---|
| **Subject** | **Description** | **Mass** |
| Mass & Dimensions | Appr. mass CRT with 9 5/8" slip assembly, bell & bottom guide | 12,350 Lbs<br>5,600 Kg |
| | Mass CRT slip assembly | 1,650 lbs<br>743 Kg |
| | Dimensions | Depending on configuration, see Dimensional Drawings |
| | Rotary size for body | 37.5" National |
| Rating CRT | Pipe size | 4 1/2" - 14" |
| | Maximum allowable load on the CRT, while suspended from the links | 500 tons (454 MTons) |
| | Maximum allowable casing load on the CRT, while suspended from the weight compensator. | 5 tons (4.54 MTons) |
| | Maximum allowable push down force from the CRT onto the (made-up) casing | 20 tons (18.1 Mtons) |
| | Maximum Slips Power Up force | 2,48 sTons @ 2,000 psi supply pressure (2,25 mTons@13,789 KPa supply pressure) |
| | Maximum allowable load on single joint elevator: | 5 tons (4.54 MTons) |
| | Maximum allowable torque | 45,000 lbs/ft@2,000 psi (61,010 Nm @ 13,789 KPa) |
| Temperatures | Minimum - maximum operational ambient temperature | - 20° - +40°C (-4° - 104°F) |
| | Operational temperatures outside this range | Contact VarcoBJ for guidance. |

| TOPDRIVE REQUIREMENTS | | |
|---|---|---|
| **Subject** | **Description** | **Mass** |
| Hydraulics | Minimum flow through CRT-manifold via rotating head. | 3 GPM (11 l/min) >800 Psi<br>7 GPM (27 l/min)<800 Psi |
| | Maximum flow through CRT-manifold via rotating head. | 15 Gpm (57 l/min) |
| | Minimum CRT working pressure:<br><br>Recommended maximum HPU pressure: | Minimum 1,800 psi (12,410 KPa)<br>Maximum 2500 psi (17,230 KPa) |
| | Maximum back pressure of the ports measured at the rotating head. | Maximum 250 psi (1,725 KPa) |
| | Type of hydraulic system. | Closed center |
| | Power Unit | Constant power unit |
| | Minimum inside diameter of hydraulic pressure line from rotating head | 3/8 " |
| | Minimum inside diameter of hydraulic tank line from rotating head | 1/2" |
| | Fluid contamination class | SAE class 6<br>ISO 18/15<br>NAS class 9 |

| CRT SPECIFICATIONS | | |
|---|---|---|
| **Subject** | **Description** | **Mass** |
| | Required filtration return line | 10 micron |
| Pneumatics | Minimum air pressure through CRT-manifold | 90 psi (620 KPa) |
| | Maximum air pressure pilot line (circulation mode) | 70 psi (480 KPa) |
| | Maximum air pressure through CRT-manifold | 150 psi (1,030 KPa) |
| | Minimum inside diameter of pneumatic line from rotating head | 3/8” |
| TDS output shaft | Torque accuracy | 1% |
| | Turns accurancy | 360°/1000 |
| | Torque accuracy repeatability | to be determined |

# General description

The Casing Running Tool is used to make-up / break out a casing connection and run the casing string to a maximum string weight of 500 short Tons. The CRT is installed onto the shaft of the Top Drive and is also suspended from links. The rotation and torque, necessary to make / break a connection is supplied by the Top Drive.

## Major component description

The CRT body is suspended from the torque frame through an internal load shoulder and is rotational locked to the torque frame. Located on top of the torque frame are the splined ring (with inner splines) and the weight compensator barrel.

The splined shaft runs through the compensator & the splined ring, where the splines meet and the torque is transferred. The splined shaft is connected to the Top Drive main shaft, with a x-over sub. The retainer connects the weight compensator piston to the splined shaft. This enables a vertical motion between the splined shaft and the splined ring.

The torque frame is suspended from the solid body elevator through the links.

During make-up/break-out, a part of the weight of the CRT and casing joint is transferred from the CRT through the weight compensator, through the Top Drive-main shaft. The other part of the weight is suspended by the springs.

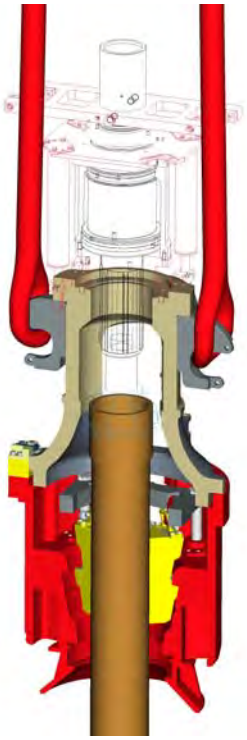
During hoisting/lowering of the whole casing string, the weight of the CRT and casing string is transferred from the CRT through the links, via the torque frame, through the hoist ring through into the links and finally into the solid body elevator of the top drive.

The spin/make/break torque is transferred from the Top Drive-shaft through the splined shaft, through the splined ring, through the torque frame, through the body, through the slips, into the casing joint.

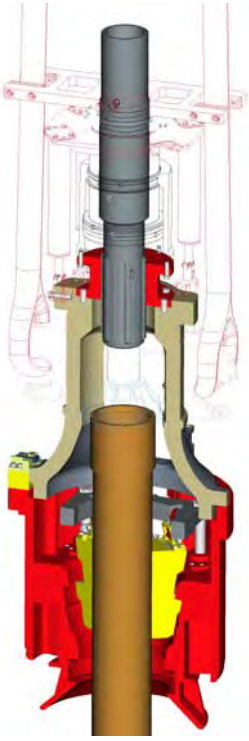
A manual single joint elevator is suspended from the CRT-body and is used to transfer a casing joint from the V-door to well center.

A fill-up tool is connected to the bottom of the hollow splined shaft and can be used to fill-up the casing during tripping and for circulating mud under pressure.

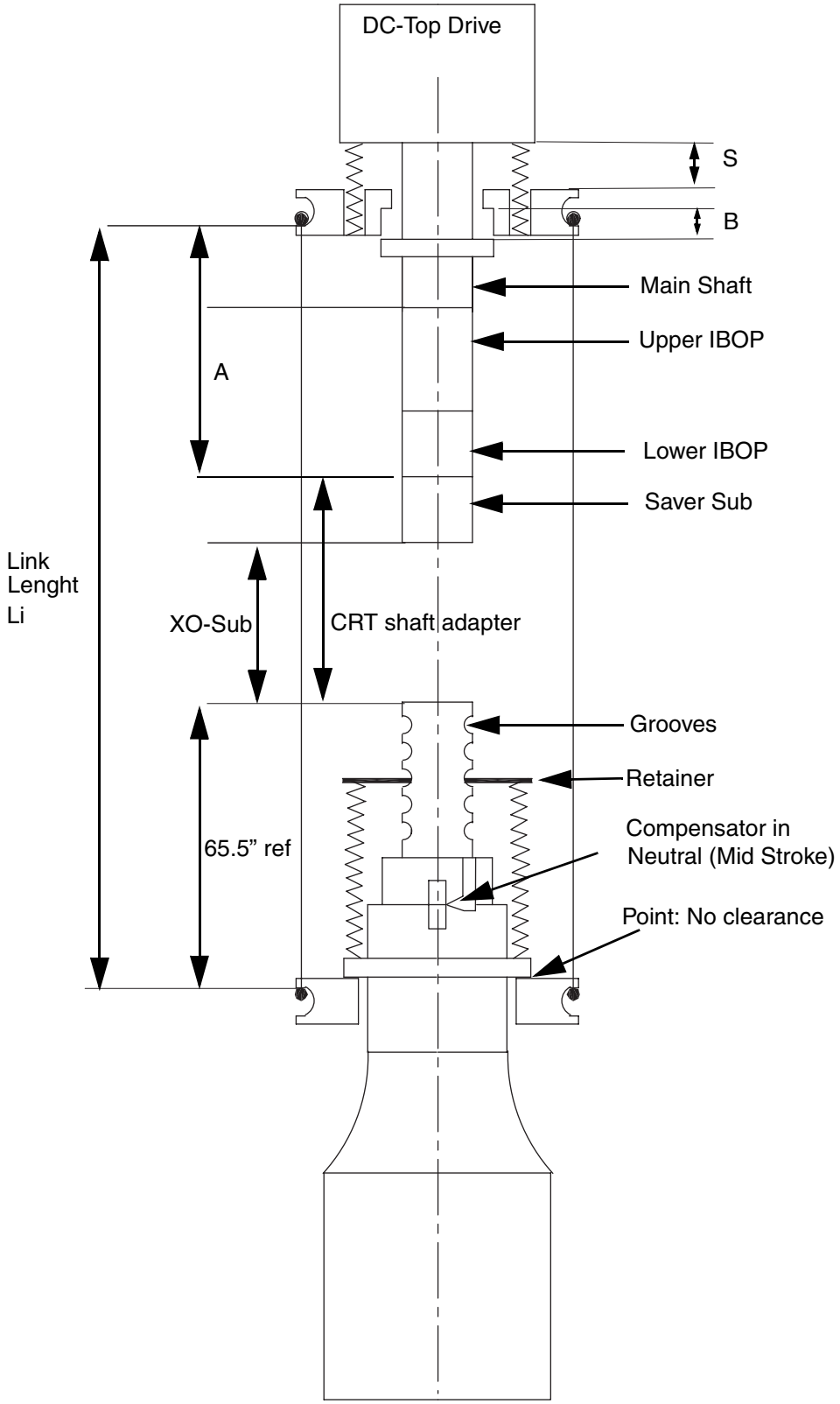
## Load path



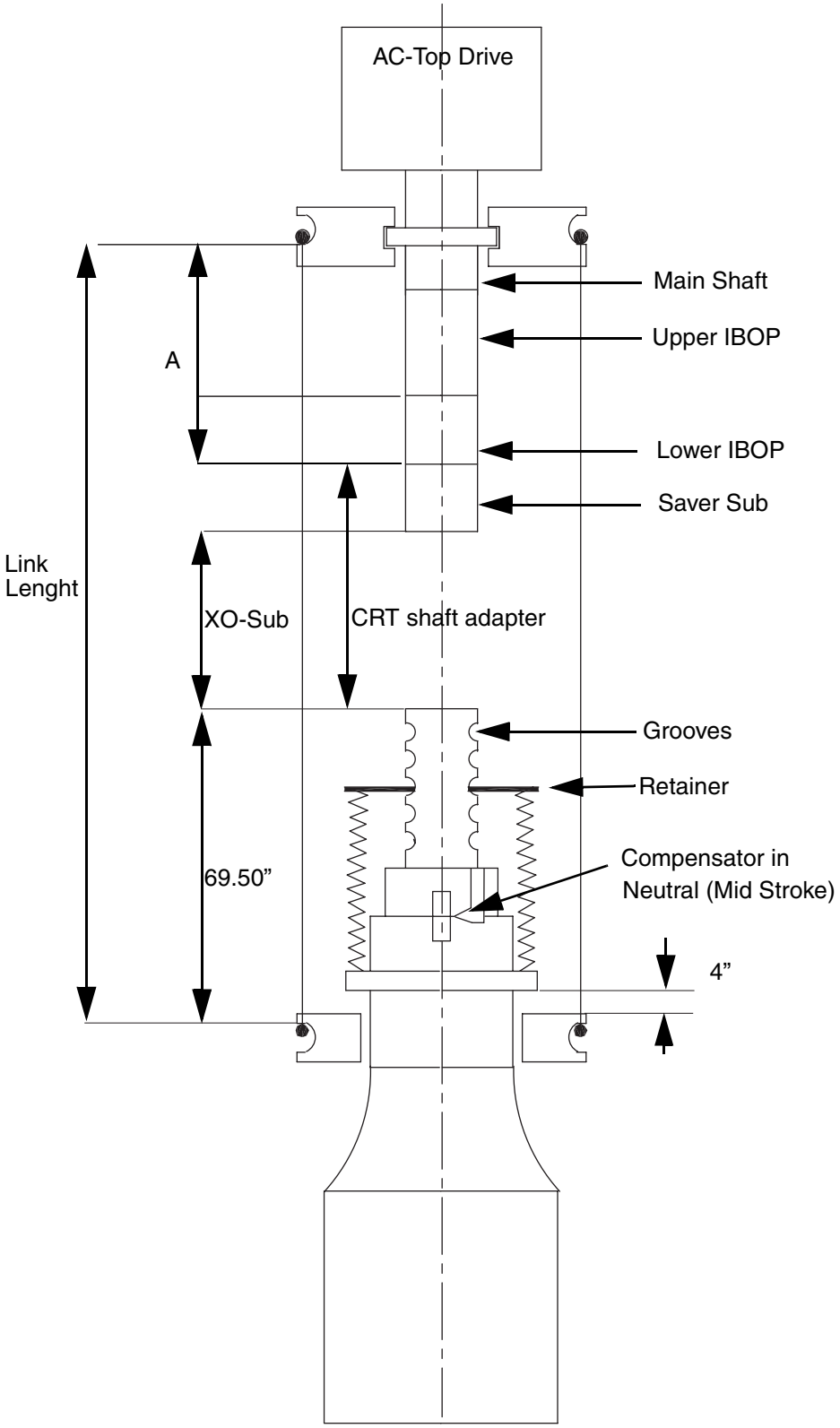
## Torque path



## Schematical view of Top Drives

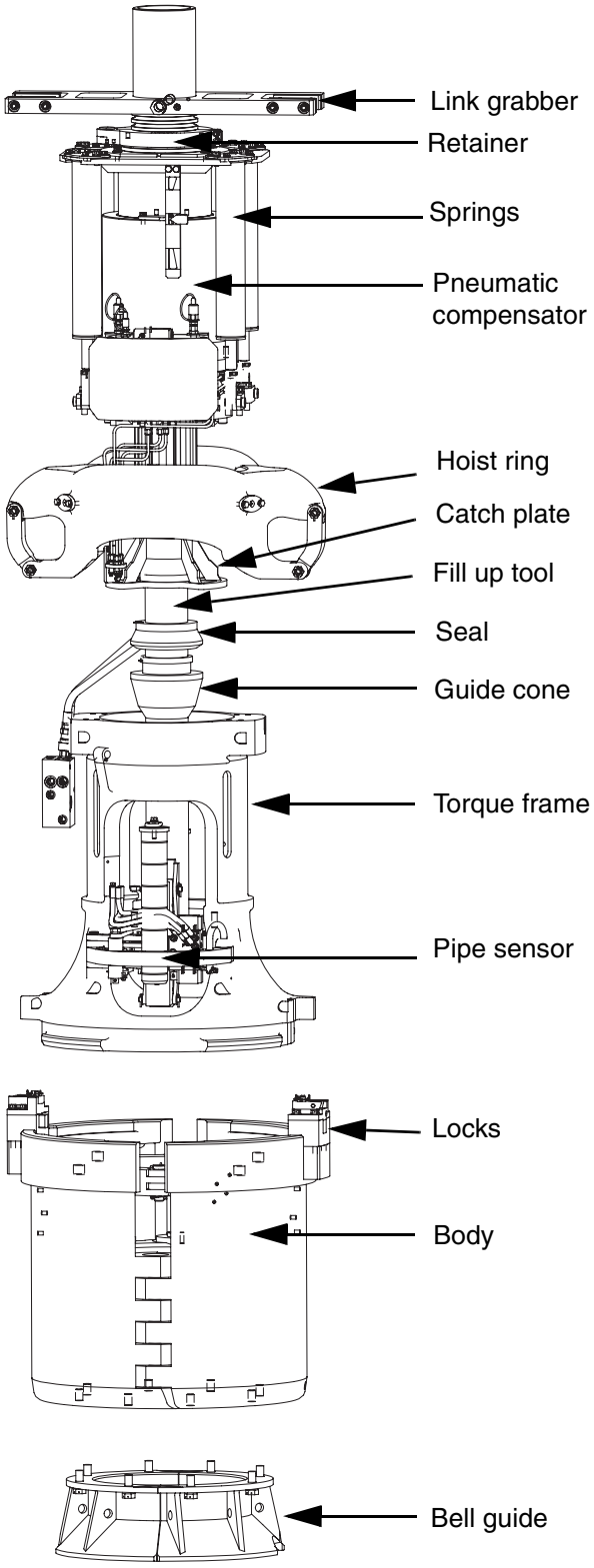



CRT underneath Top Drive with torque arrestors

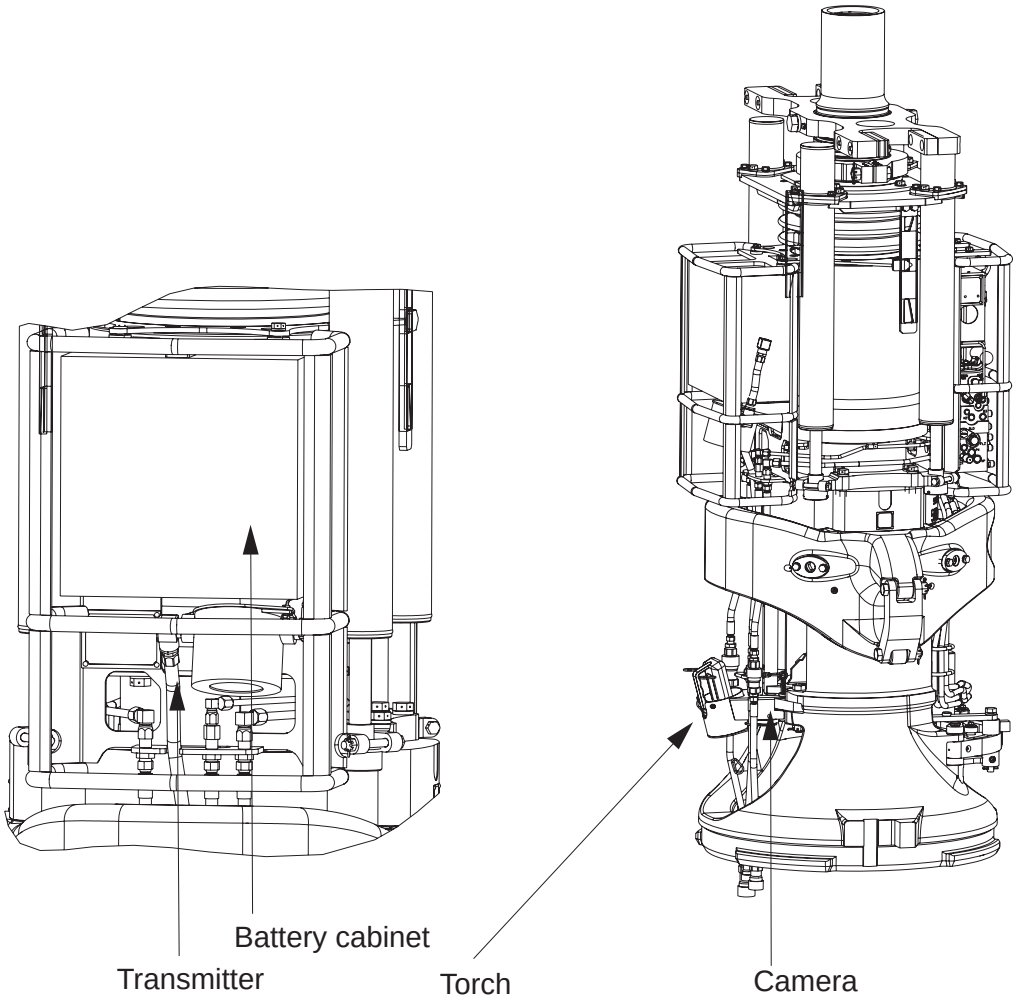



CRT underneath Top Drive without torque arrestors

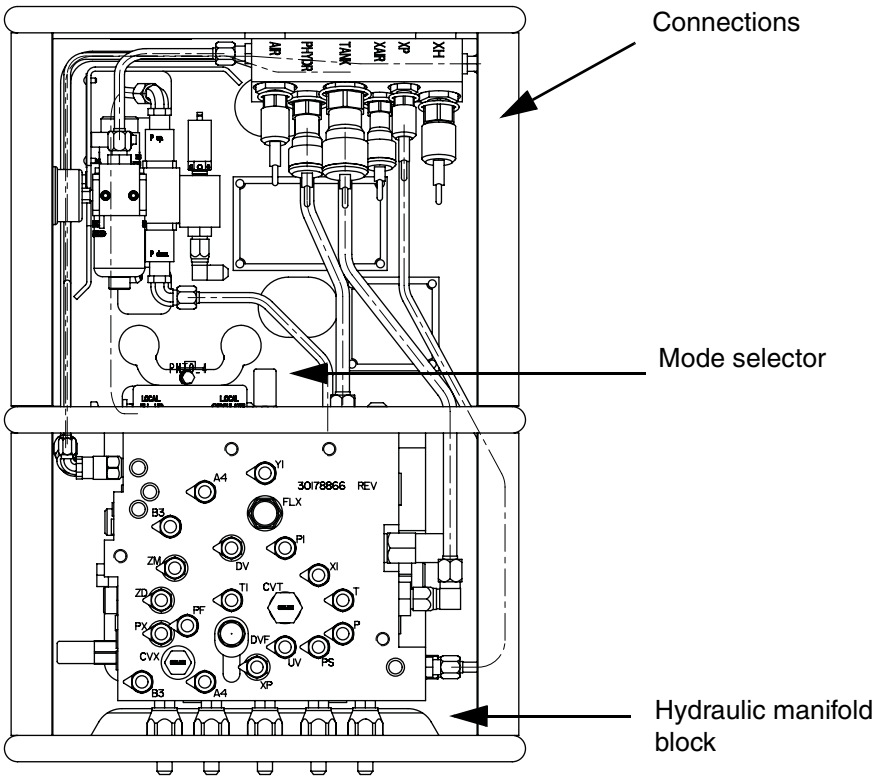
# Major components



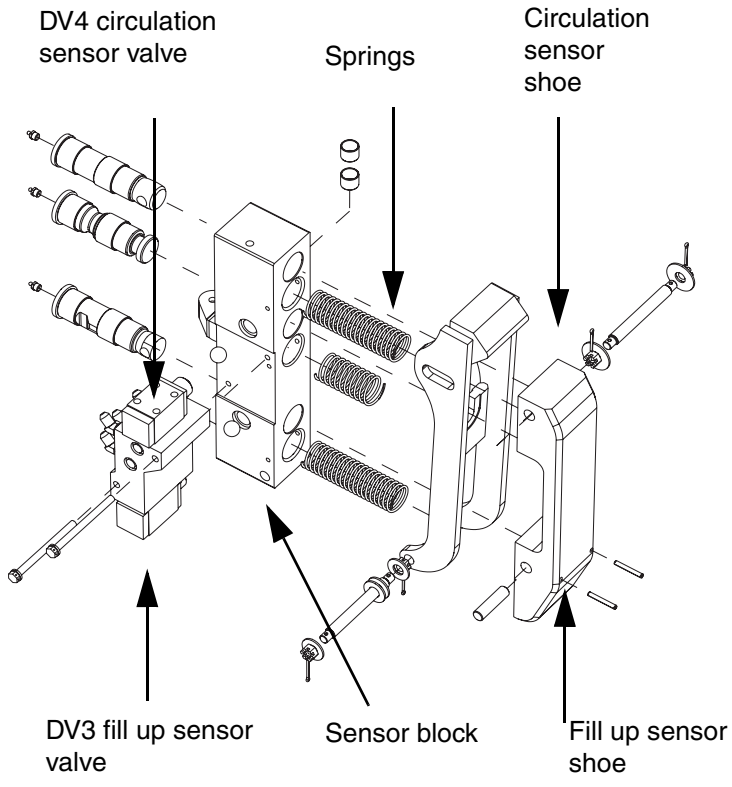
## Torch, camera, transmitter & battery



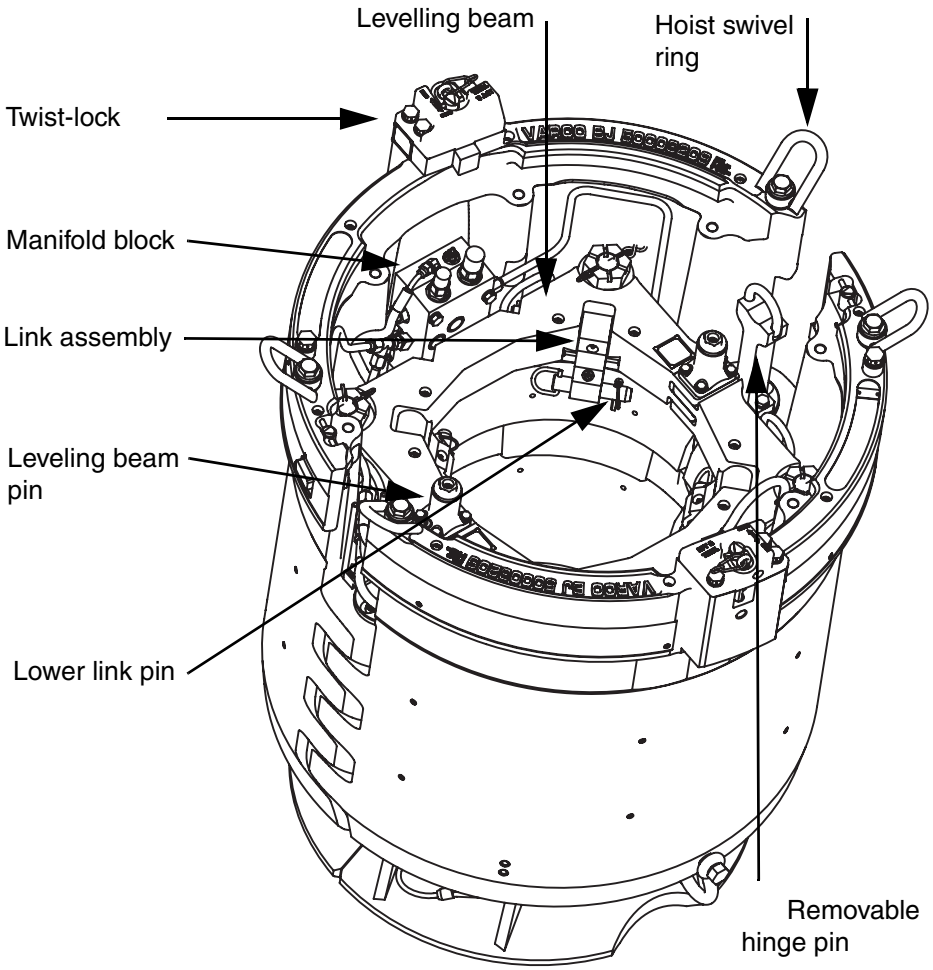
## Hydraulics and pneumatic control

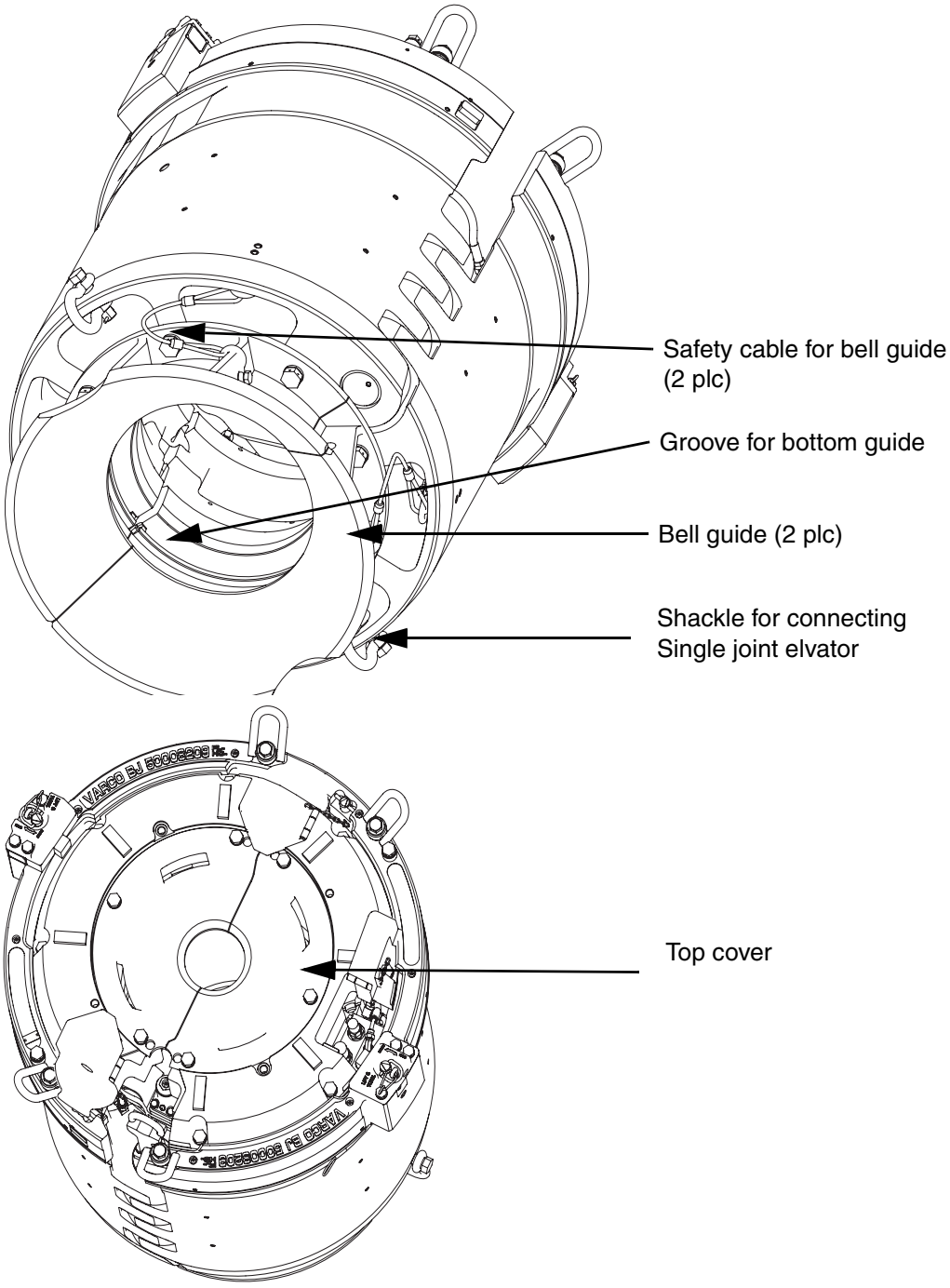



## Pipe sensor



## CRT body


Levelling beam
Hoist swivel ring
Twist-lock
Manifold block
Link assembly
Leveling beam pin
Lower link pin
Removable hinge pin



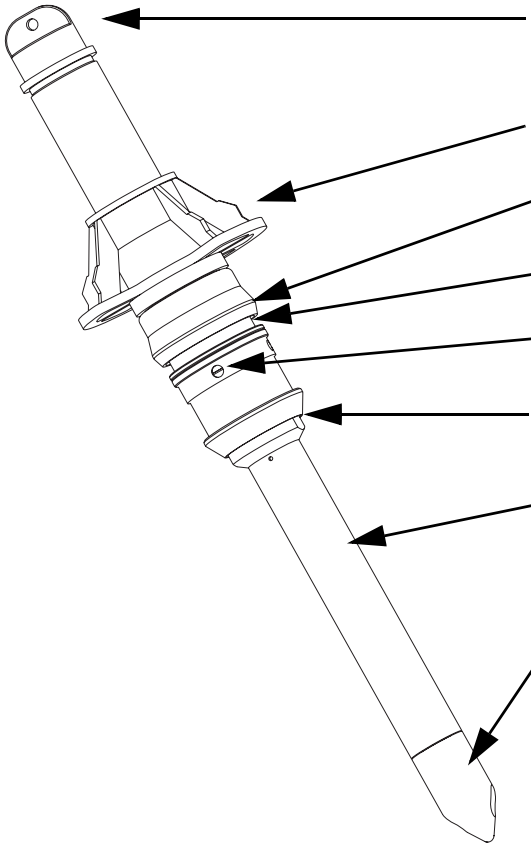

## Booster

The booster allows lower hydraulic supply pressure, resulting in an increased seal life of the Rotating Head.

## Double rod feature

The double rods reduces the quantity of flow, which is an adavantage when working with the NOV TDS11. The power up force is reduced due to the reduction of surface of the piston down to 2,48 sTons (2,25 mTons) @ 2,000 psi (13,780 KPa) without loosing any power down force. The the risk for a false UP movement of the slips due to backpressure is elimited.

## Fill up And Circulation-tool (FAC-tool)



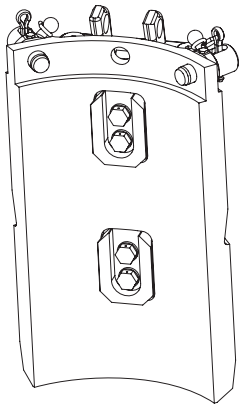

FAC-tool

(9-5/8” - 14”)

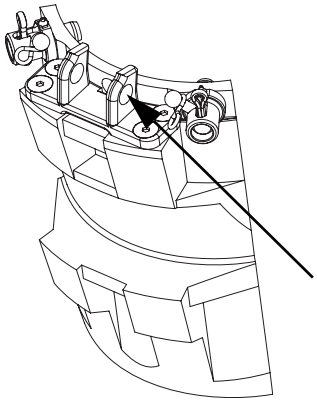
## Partnumbers FAC-tool

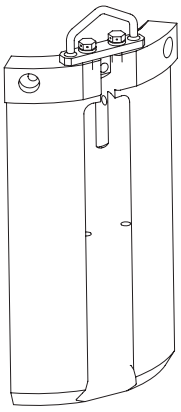
| Tool | Part number |
|---|---|
| 7" - 8-5/8" (fill up and circulation) | 50008256-10 |
| 9-5/8" - 14" (fill up and circulation) | 50008251-10 |
| 4-1/2” to 6-5/8” (for filling up, not for circulation) | 50008253 |

## Slips with Insert carriers



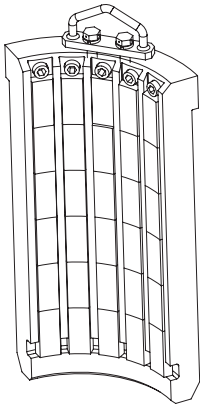
Slip (without insert carrier) front view



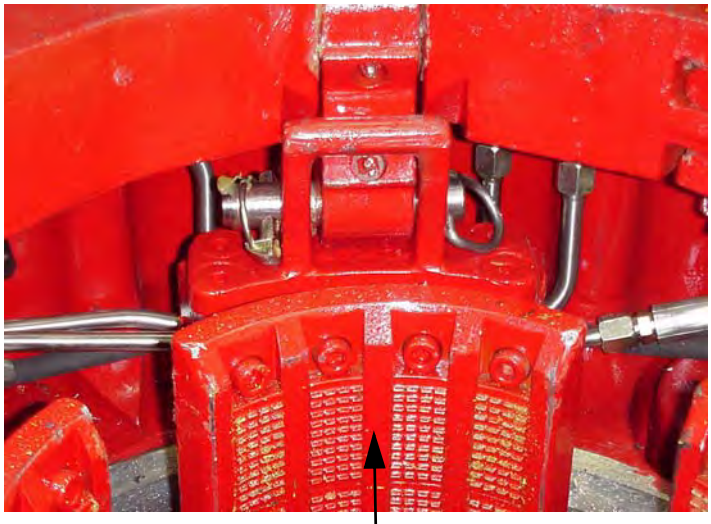
Insert carrier

( rear view)



Insert carrier ( front view) + inserts

## Standard 500 E/S Varco slips




# Design Safety Factor

The design-safety factor and the design verification of the CRT14 is in accordance with requirements of API specification 8C.

# Lubrication and maintenance

**WARNING: Carry the inspections and maintenance out according to the manual.**

NOTE: To reduce the chance of inserts seizing in the insert slots, Varco recommends to remove inserts after each job, preserve the insert slot with light machine oil, EP-2 grease or any other preservation fluid that does not affect the friction coefficient with string weight compared to a none preserved insert slot.

## API recommended practice RP 8B

NOTE: Varco recommends maintenance acc. to API RP8B

**Category I**.

Observation of equipment during operation for indications of inadequate performance

**Category II**.

Category I inspection plus further inspection for corrosion, loose or missing components, deterioration, proper lubrication, visible external cracks and adjustment.

**Category III**

Category II inspection plus further inspection which should include NDE of exposed critical areas and may involve some disassembly to access specific components and identify wear that exceeds the manufacturers allowable tolerances.

**Category IV**

Category III inspection plus further inspection where the equipment is disassembled to the extent necessary to conduct NDE of all primary load carrying components

# Selecting hydraulic fluid and grease

## Recommended specifications of hydraulic fluid

**The requirements for the hydraulic oil are based upon the best performance of the motors at specific temperatures / viscosity.**

| | |
|---|---|
| Recommended oil type | Mineral oil type HLP (DIN 51524) or equivalent |
| Surrounding temperature range | -20° C up to 50° C (-4° F up to 122° F) |
| Oil operational temperature range | 40° C up to 50 °C (104° F up to 122° F) |
| Minimum viscosity | 13cSt |
| Maximum oil temperature | 60° C (140° F) measured in the tank line |
| Viscosity at working temperature | 20 cSt up to 43 cSt |
| Optimum working viscosity | 35 cSt |

**Determination of the required viscosity class regarding the working temperature**

| **Viscosity class** | **Working temperature (acc. ISO 3448)** ° C |
|---|---|
| 32 | 30 up to 50 ° C (86° F up to 122° F) |
| 46 | 40 up to 60 ° C (104° F up to 140° F) |
| 68 | 50 up to 70 ° C (122° F up to 158° F) |
| 100 | 60 up to 80 ° C (140° F up to 176° F) |

## Recommended hydraulic fluid

| | **Above -20° C** | **Below -20° C** |
|---|---|---|
| **Castrol** | Hyspin AWS-46 | Hyspin AWS-32 |
| **Chevron** | AW Hyd oil 46 | AW Hyd oil 32 |
| **Exxon** | Nuto H 46 | Nuto H 32 |
| **Gulf** | Harmony 46AW | Harmony 32AW |
| **Mobil** | DTE 25 | DTE 24 |
| **Shell** | Tellus 46 | Tellus 32 |
| **Texaco** | Rando oil HD 46 | Rando oil HD 32 |
| **Union** | Unax AW 46 | Unax AW 32 |

## Recommended grease

| **Temperature range** | **Brand** | **Type** | **Part Number** | **Remarks** |
|---|---|---|---|---|
| For warmer and colder area's<br>Minimum temperature -30°C (-22°F)<br>Maximum temperature + 110°C (230°F) | AUTOL | TOP 2000 | 59000194 | This type is conform Norwegian Environmental OLF Standard |


**WARNING: Make sure that all hydraulic supply is isolated before ANY work is carried out to the CRT. Shut off the Power Unit / Close the valves.**

# Daily maintenance (when in use,cat II)

NOTE: Keep all parts, especially all pins and blank surfaces lubricated in order to prevent corrosion and provide lubrication.

## Procedures

### Daily Inspection (cat II) Visually inspect and repair when needed

| | |
|---|---|
| 1. Check for worn and damaged parts | ❑ OK |
| 2. Check for loose and missing parts | ❑ OK |
| 3. Check for leakage free fittings, tubes, hoses, valves & cylinders. | ❑ OK |
| 4. Check proper locking of all lock bolts and nuts | ❑ OK |
| 5. Check that all slips are well seated and retained in body and doors. | ❑ OK |
| 6. Check that all slips are locked by secondary safety snaps. | ❑ OK |
| 7. Check hoses for signs of cracks, wear or abrasion. | ❑ OK |
| **Check the proper locking of:** | |
| 1. Bolts and nuts | ❑ OK |
| 2. Slotted nuts & cotter pins | ❑ OK |
| 3. Lock tabs & lock bars | ❑ OK |
| 4. Roll pins and dowel pins | ❑ OK |
| 5. Snap rings | ❑ OK |

### Daily Lubrication

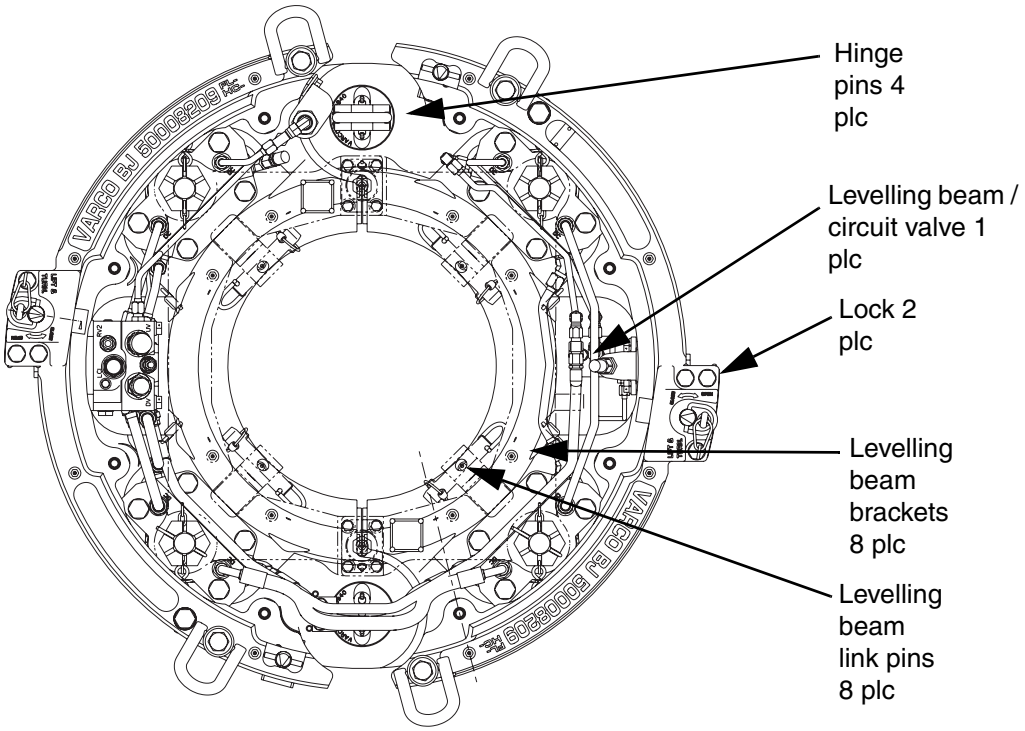
| Grease point | How to apply | Number |
|---|---|---|
| 1. Splined shaft | Brush | 1x |
| 2. Dove tail insert carrier | Brush | 4x |
| 3. Pipe sensor + supporting frame | Grease nipple | 8x |
| 4. Body hinge pin | Grease nipple | 4x |
| 5. Grease nipples fill up tool (depending on part number) | Grease nipple | 2x |
| 6. Upper slip link pin | Grease nipple | 12x |
| 7. Lower slip link pin | Grease nipple | 4x |
| 8. Levelling beam indicator | Grease nipple | 1x |
| 9. Levelling beam pin | Grease nipple | 4x |
| 10.Twist lock-sliders | Grease nipple | 2x |
| 11. Hoist ring | Grease nipple | 6x |
| 12. Insert carrier lock pin | Grease nipple | 8x |

### After 25 joints or prior to cementing

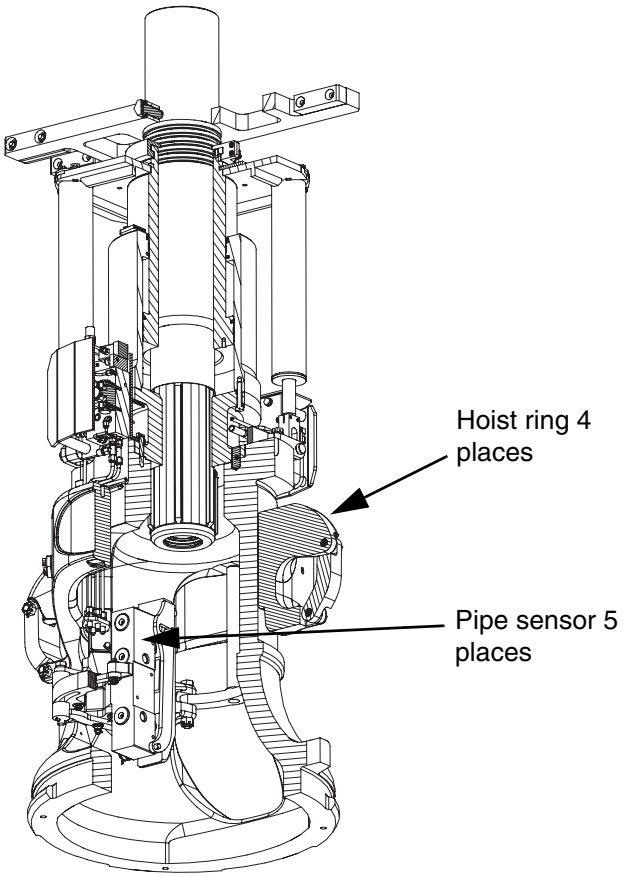
| Grease point | How to apply | Number |
|---|---|---|
| 1. Back of slips | Grease nipples on top of body | 8x |

## Daily maintenance

### Body

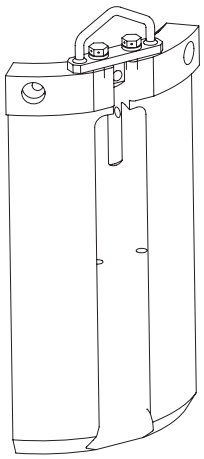



### Torque frame



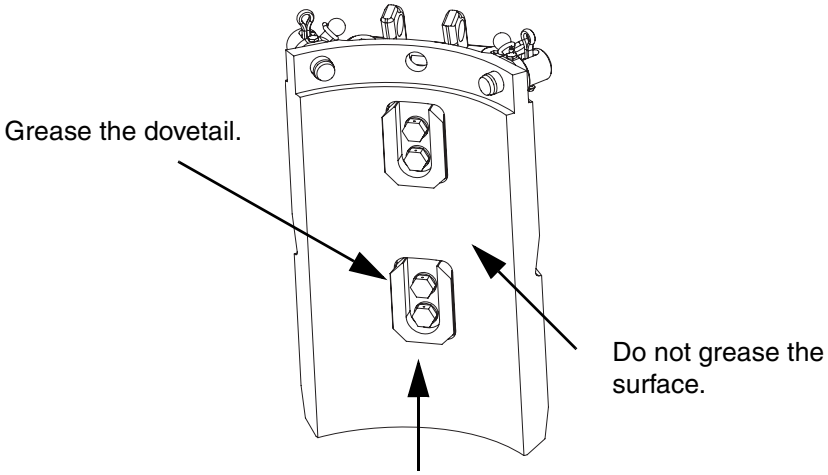
## Back of insert carrier

Grease the dove tail slot of the insert carrier before installation and after usage.



**WARNING: Do not grease the back of the insert carrier, but do grease the dovetail slot.**

## Front of slip




**WARNING: Do not grease the front of the slip, but do grease the dovetail.**

# Inspections

## Prior to each run

**Procedure**

### Inspection prior to each run

| |
|---|
| Prior to each run, or when starting to use the CRT after storage longer than 3 days, perform the following: |
| 1. Lubricate all greasing points as per Daily Lubrication procedure |
| 2. Check for the proper condition as per Daily Inspection procedure |
| 3. Carry out the “CRT function checks” as per “Installation and commissioning paragraph”. |
| 4. Check if seals are in proper condition |

## Six monthly inspection (cat III)

**Procedure**

### Six montly inspection

| |
|---|
| 1. Check proper functioning, lubrication status and excessive wear of pipe sensor assembly. |
| 2. Check proper functioning, lubrication status and excessive wear of hoist ring torque/lock pins. |
| 3. Check pneumatic compensator cylinder protection sleeve for damage. If damaged, check status of pneumatic compensator cylinder |
| 4. Check proper functioning of pneumatic adjustment valve (still adjustable?) |
| 5. Check status of air exhaust plugs (air control assembly) |
| 6. Check status of FAC-tool. Must be disaasembled and cleaned after last run. |

## Six monthly inspection (cat III) NDE

**Procedure**

### Procedure on rig

| |
|---|
| 1. Carry out NDE on exposed critical areas according Critical Area Drawings. |
| 2. Check if indications are out of acceptance standard. If indications out of acceptance standard, remove elevator of service. The elevator needs repair at the nearest authorized repair facility. Please contact Varco BJ for guidance |

## Annual (1 year) inspection (cat IV) NDE

**Procedure**

### Annual (1 year) Inspection (cat IV)

| |
|---|
| Magnetic Particle Inspection; please contact a Varco BJ repair center for guidance |

# Annual maintenance

## Annual maintenance of the compensatorsprings

### Procedure

**Annual (1 year) maintenance**

Check every year that all compensator springs are well greased. Lubricate liberally if required. Use Autol Top 2000 or equivalent.

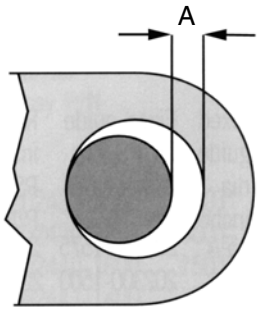
## Maintenance of the pipe sensor

### Procedure

**Annual (1 year) maintenance**

Check all hinge pins / sliding pins for wear. Maximum allowed clearance is 0.01”.

# Wear data/criteria



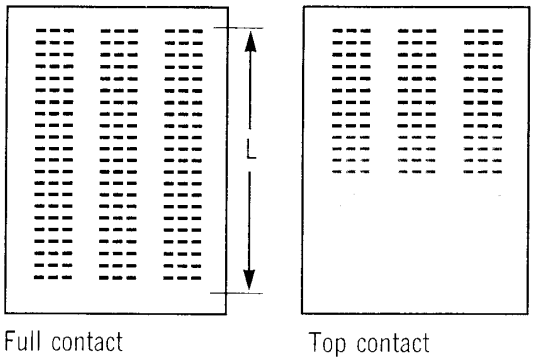

Body hinge pin wear data

| Description | |
|---|---|
| Stationary hinge pin pn 200940-11 | |
| Removable hinge pin pn 50008222 | |
| Total clearance "A" | 0.050" |
| Hinge pin min. dia new: | 3.490" |
| Max. bore dia new: | 3.505” |
| Max. bore dia worn: | 3.530” |

### Procedure bore wear

- Clean an area of pipe where there are no insert marks.
- Clean the slip inserts with a wire brush.
- Wrap a layer of test paper around the cleaned section of pipe, use friction tape to hold the paper to the pipe.

- Carefully set the slips on pipe using 2,500 Psi (17,200 KPa) power down pressure.
- Carefully raise the slips, ensuring the paper doesn't get damaged due to the moving slips.
- Evaluate the paper.




### Evaluation

Full insert contact indicates CRT and slips are good (no further analysis needed).

Insert contact on top section only indicates worn CRT-bowl or slips.

ACTION:

1. Replace slip by NEW slip with NEW inserts. Carry out paper test.
2. Full contact? CRT fit for operation using the new slip and inserts.
3. Top contact only? Worn out CRT-bowl
4. Remove CRT from service
5. The CRT needs repair at the nearest authorized repair facility. Please contact Varco BJ for guidance.

## Acceptance criteria for rig floor equipment components

**References**

- ASTM E 709; Standard practice for magnetic particle examination
- ASTM A 275; Standard test method for magnetic particle examination of steel forging
- ASTM E 125; Reference photographs for magnetic particle indications on ferrous castings
- MSS SP-55; Quality Standard for Steel Castings Visual Method
- NOV critical area drawings
- API Specification 8C
- API Recommended practice RP8B
- Of above references the latest editions shall apply.

**Qualifications**

All personnel performing and interpreting examinations using this work instruction shall be qualified in accordance with the guidelines of ASNT-TC-1A (latest edition).

**Evaluation Of Indications; relevant indications:**

- Only those indications with major dimensions greater than 1/16 inch (1,6 mm) and associated with a surface rupture shall be considered relevant.
- Relevant indications are indications that result from discontinuities within the test part. Non relevant indications are indications that result from excessive magnetising current, structural design or permeability variances within the test parts.
- Any indication believed to be non-relevant shall be regarded as relevant and shall be re-examined to determine whether an actual defect exists.
- Linear indications shall be considered as those having a length of more than three times the width. Rounded indications shall be considered as those having a length less than three times the width.
- A lined indication shall be considered as a group of three or more indications which touch an imaginary straight line connecting any two of the group.

## Acceptance criteria for Critical hoisting components

ASTM E 125 and, where applicable, NOV critical area drawings shall be used as a reference standard for the evaluation of magnetic particle indications.

When no critical area drawings are available all areas shall be considered non-critical.

**Equipment covered**

All critical parts of the CRT and slips when capable of being used as hoisting equipment.

For castings:

- see table 1a for API Specification 8C/PSL-1
- see table 1b for API Specification 8C/PSL-2

| Table 1a | Discontinuity description | Maximum permitted degree | |
|---|---|---|---|
| | | Critical area | Non critical area |
| I | Hot tears and cracks | None | Degree I |
| II | Shrinkage | Degree II | Degree II |
| III | Inclusions | Degree II | Degree II |
| IV | Chills and unfused chaplets | Degree I | Degree I |
| V | Porosity | Degree I | Degree II |

| Table 1b | Discontinuity description | Maximum permitted degree | |
|---|---|---|---|
| | | Critical area | Non critical area |
| I | Hot tears and cracks | None | None |
| II | Shrinkage | None | Degree I |
| III | Inclusions | Degree I | Degree II |
| IV | Chills and unfused chaplets | None | Degree I |
| V | Porosity | Degree I | Degree II |

## Acceptance criteria for rig floor and non-critical hoisting equipment components

ASTM E 125 and, where applicable, NOV critical area drawings shall be used as a reference standard for the evaluation of magnetic particle indications.

When no critical area drawings are available all areas shall be considered non-critical.

**Equipment covered**

CRT-parts and slip-parts

For castings:

- see table 1d

| Table 1d | Discontinuity description | Maximum permitted degree | |
|---|---|---|---|
| | | Critical area | Non critical area |
| I | Hot tears and cracks | 1/4” (6.25 mm) | Degree III |
| II | Shrinkage | Degree II | Degree III |
| III | Inclusions | Degree II | Degree IV |
| IV | Chills and unfused chaplets | Degree I | Degree II |
| V | Porosity | Degree II | Degree II |

# Installation and commissioning

## Safety notes

**WARNING: All connections between the Top Drive and the CRT should be marked with a painted line so that any slack off can be visually seen.**

*CAUTION: Use the link ears for any transportation of the CRT around site. Use a 3 tons certified lift plug for moving the CRT main shaft OR the torque frame only.*

*CAUTION: Ensure that feet are kept clear of the tool when it is being transported around the site/workshop*

**WARNING: The control panel may differ from rig to rig, but the CRT MUST be operated through the designated torque-turn controls to prevent faulty connections.**

NOTE: A calibrated load cell must be present on the rig in order to calibrate the Top Drive

*CAUTION: **NOV** strongly recommends to only use one of the Varco's original CRT controls to operate the CRT. Other controls may damage the CRT*

**WARNING: Make sure that all hydraulic lines are isolated before any work is carried out on the CRT**

*CAUTION: Do not operate the CRT until the commisioning is successfully and officially completed.*

NOTE: The valves in the CRT are pre-set and should ONLY be adjusted by ***NOV*** personnel.

NOTE: Make sure to have a higher torque value between the lower and upper IBOP, or it won't be able to break out the CRT after the casing job. If not, the wrong connection might B/U during the R/D

# Electrical, software, TDS modifications & HUK

## Electrical installation

The electrical installation modifications needs to be carried out by trained Varco personnel. Please contact DSS for details, guidance when required.

## Programming software

See documentation Varco Drilling Systems, V-ICIS or other applied software. Please contact DSS for details, guidance when required

## Top drive modifications

Top drive modifications are carried out by top drive supplier. Please contact DSS for details, guidance when required

## Installation of the Hook Up Kit (HUK)

See documentation Varco Drilling Systems, V-ICIS or other available documentation.Please contact NOV for details, guidance when required

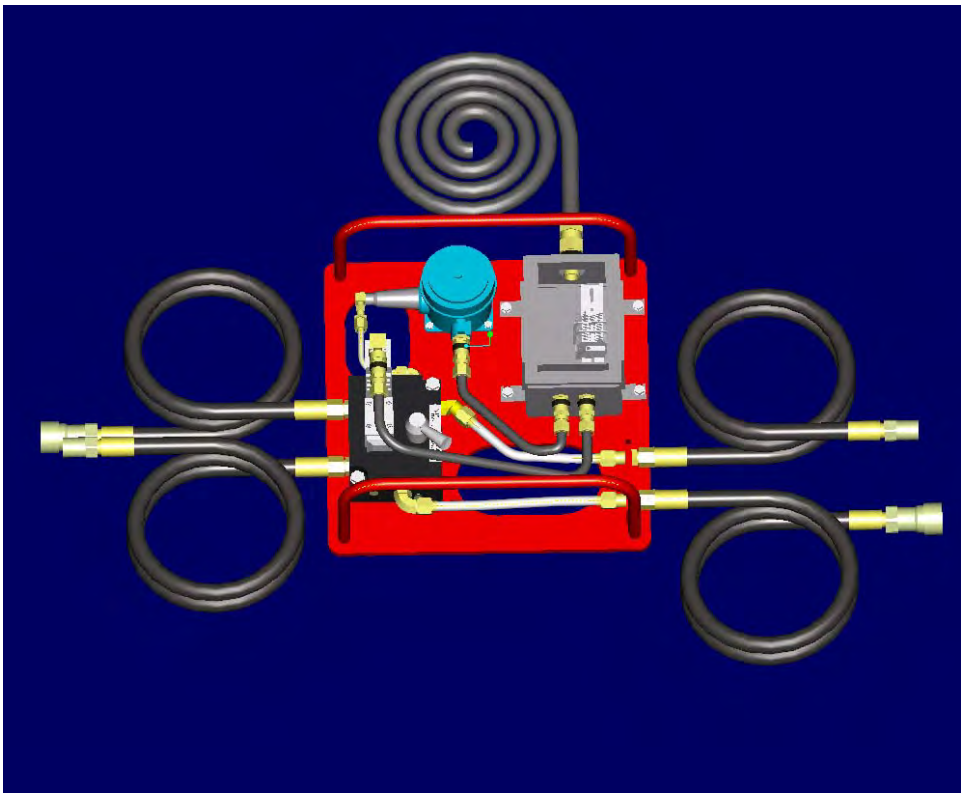
# Gate assembly 50008225

## Applicable drawings.

See chapter “Drawings”.

50008225 : Gate assembly drawing

50008230 : Hydraulic schematic of this gate assembly.



## Functionality

This gate assembly is designed to allow the FMS to be hooked up to the CRT controls and/or to any rig specific slips/elevator interlock system. However, in its essence it can be used to hook up any hydraulic operated spider or elevator to the mentioned control systems.

This gate assembly is designed to cooperate with an existing hydraulic operated FMS without the need for any modifications to either that FMS or its hydraulic power unit (HPU).

## Features:

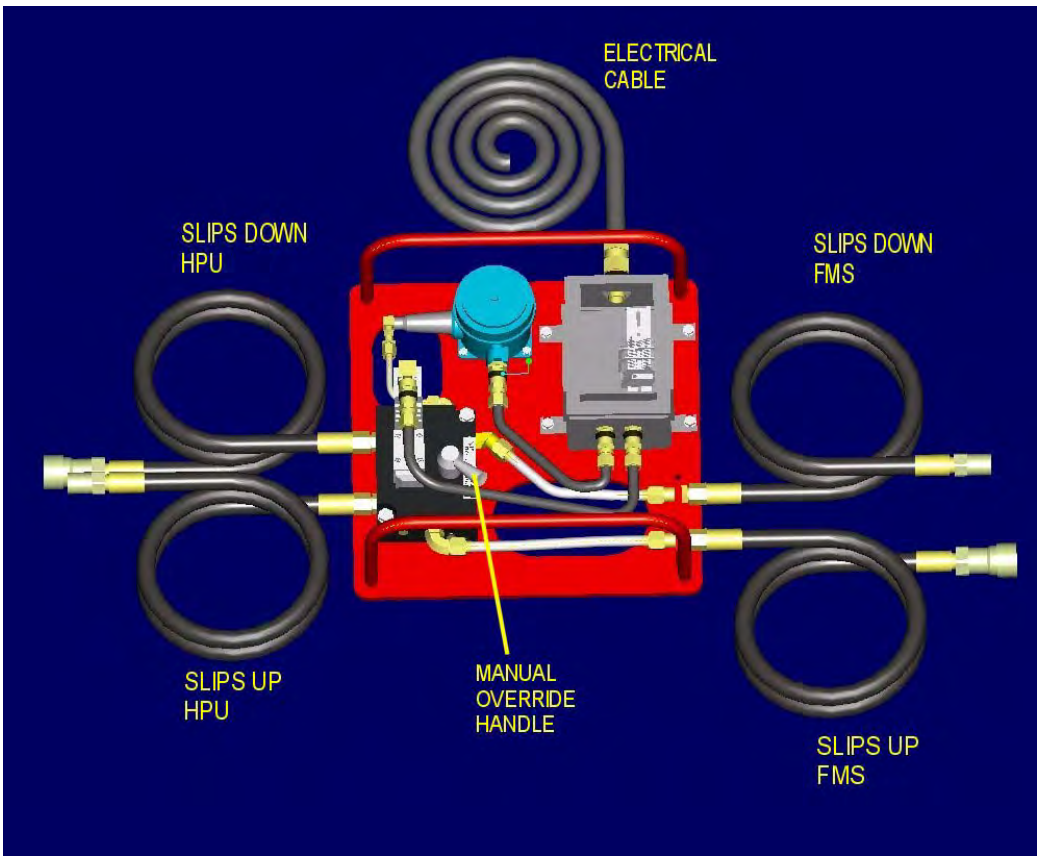
A pressure switch giving a 24 VDC signal when the FMS slips are set.

A manifold block housing a pilot operated check valve, a solenoid operated directional control valve and a manual operated directional control valve.
The pilot operated check valve enables free flow to set the FMS slips at all times, but disables flow to release the FMS slips. Free flow to the FMS can be established by powering the 24 VDC solenoid valve.
When activated, the manual operated directional control valve overrides the solenoid valve. There is therefore no need to disassemble the interlock assembly from the hydraulic FMS circuit in case an override of the interlock is needed.

Hydraulic quick disconnects matching the existing connections on the FMS hoses and the HPU. Therefore this interlock can be hooked up in any existing FMS circuit without any modifications to that circuit.

The unit is designed as a portable unit, but can also be fixedly mounted without any modifications.

### Overview.




The hoses marked with “HPU” need to be connected to either:

Any existing FMS operation panel 200979, 200979-1, 200979-2 or 200979-3.

A Varco HP3 air-over-hydraulics power unit for the FMS.

Any other power unit currently in use to operate an FMS and featuring a directional control valve to operate the FMS slips.

The existing directional control valve on any of these hydraulic power supplies remains its functionality to operate the FMS slips.

The hoses running from the FMS to the power supply need to be disconnected from that power supply and rerouted to the hoses marked with “FMS”.

## Installation (first time) on a rig

This paragraph describes the procedure for the installation of the CRT after the rig-survey was carried out and all rig-modifications have been carried out.

## Workflow

| Action | Applicable document |
|---|---|
| 1. Check the system requirements and the pre-installation sheets. | Original PSEL-0006 (produced during rig-survey) and PSEL-0010 (electrical), TSEL-0085 (Commissioning spec procedure). Also required commissiong procedure of Top Drive (see DSS). |
| 2. Installation CRT | See paragraph RU/RD |
| 3. Conduct field commissioning procedure and sign off commissioning sheet | Field commissioning procedure TSEL-0085 |
| 4. Tool ready for operation | |

# 1. Verification system requirements

The installation engineer must ensure all requirements accoding to TSEL-0085 and Top Drive Test Specs are met.

Installation CRT

# 2. Installation CRT

## Unpacking (see also TSEL0154)

**Warning: Use the dedicated lifting points, lifting eyes, straps etc. for lifting the CRT and the parts. Do not lift the complete CRT with a lifting plug, use the lifting ears instead. Do not use the storage frame for lifting purposes.**

## Torque frame crate and storage frame

Use the CRT-storage frame for manoeuvring the CRT Torque Frame. It is easy to move the torque frame from a horizontal position into a vertical position and vice versa.

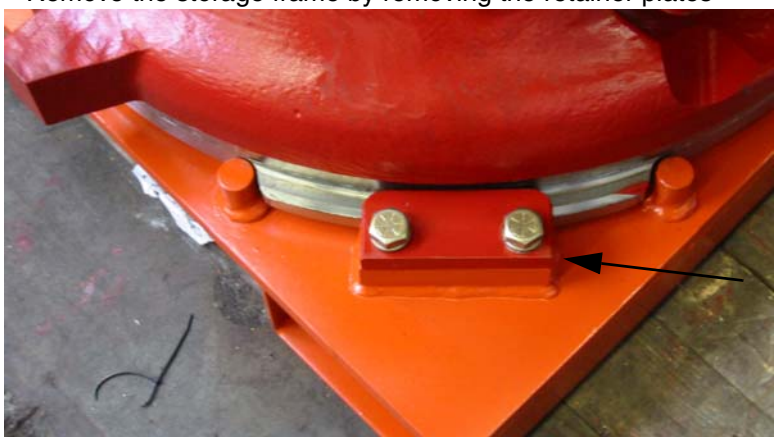
### Procedure

1. Check for presence of all parts
2. Open the crate

3. Remove the 4 walls of the crate
4. Fit a lift plug (minimum 3 tons lifting capacity) in the main shaft.
5. Lift the CRT Torque Frame to a vertical position.

## Installation CRT

6. Remove the storage frame by removing the retainer plates



Retainer plate (2 plc)

7. Lift the CRT by it's ears vertical from the plate.
8. Store the storage frame with the retainer plates fixed to it.

**WARNING: Transporting the CRT in it's storage frame is allowed by fork lift only OR via the certified lifting plug in the CRT main shaft. Do not use a crane lifting the storage frame.**

# Installation CRT

## Skid

In case a transport skid is available, the following procedures are applicable:

### 1. Lifting skid horizontally

The skid has 4 lifting points; all 4 for handling the skid with or without the CRT in a horizontal position.


Lifting horizontally (with or without CRT)

### 2. Lifting skid vertically

**Without CRT:** Lift the skid by the 2 top one lifting eyes for handling the skid in a vertical position.


Lifting the skid vertically (Do **NOT** lift like this with CRT in skid)

## Installation CRT

**With CRT:** Lift the skid vertically by using the lifting ears of the CRT.

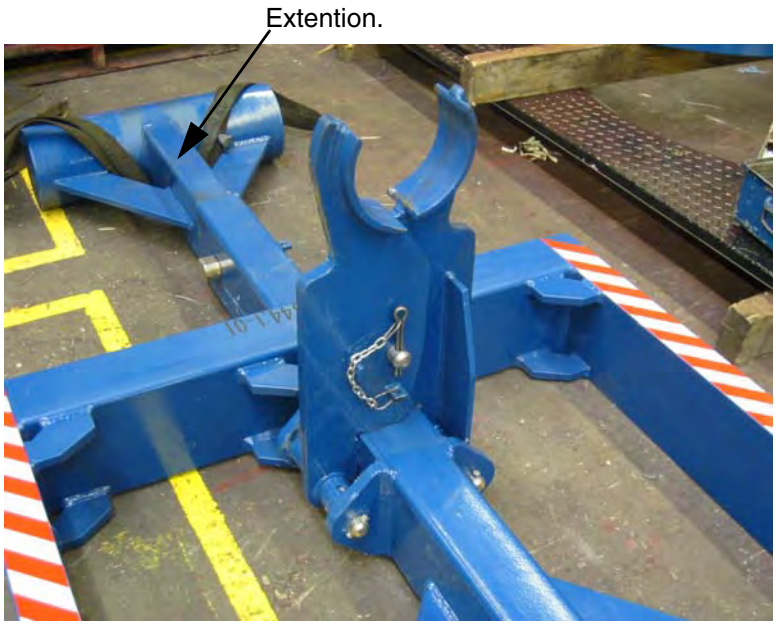

**WARNING: Do not lift the skid including the CRT by the upper lifting eyes of the skid. Use the lifting ears of the CRT.**

**WARNING: The support beams must be utilized when the skid is brought into a vertical position. Not doing so may cause the skid to tip over.**

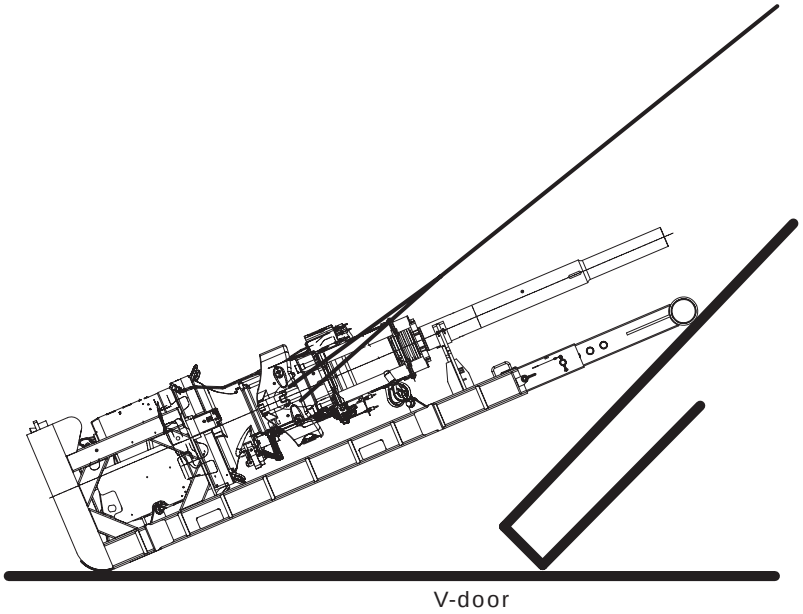
Support beams extended and locked

## Installation CRT

The extension beam can be elongated for transport purposes when the CRT is connected to a X-over sub. The beam is used for transporting the skid upto the V-door.




### Schematic pulling CRT up to work floor

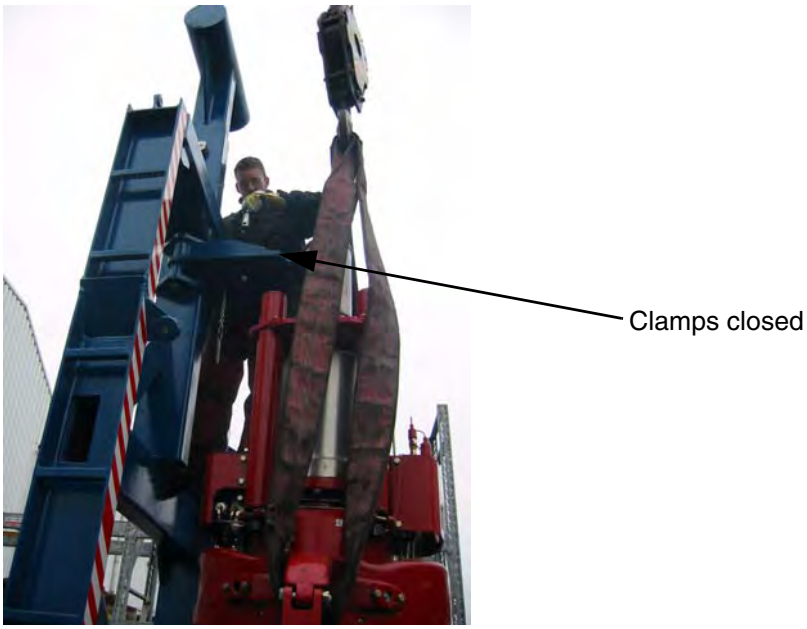


## Installation CRT

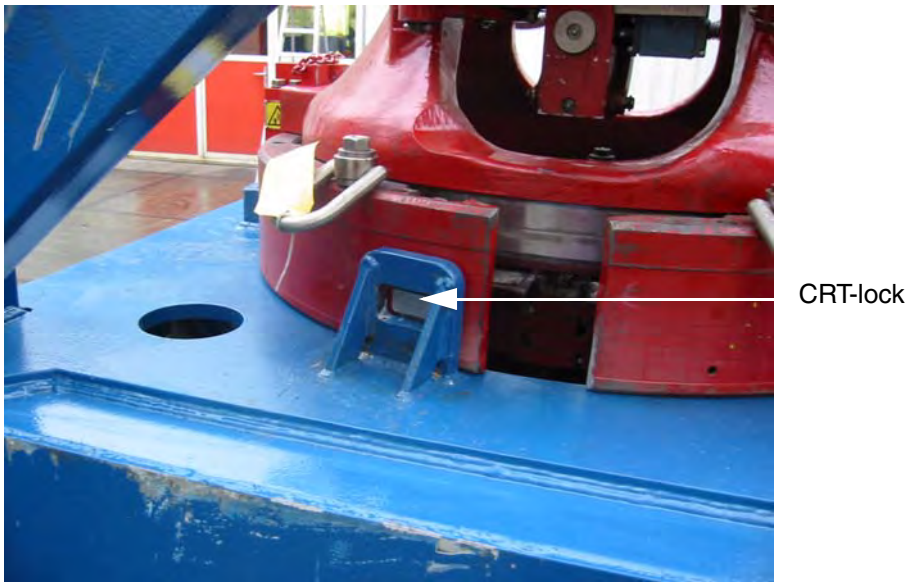
# Fixating the CRT in the skid

## Procedure

1. Ensure the clamps are closed and locked prior to lifting




2. Ensure the CRT-lock is engaged



## Installation CRT

# Tilting the skid

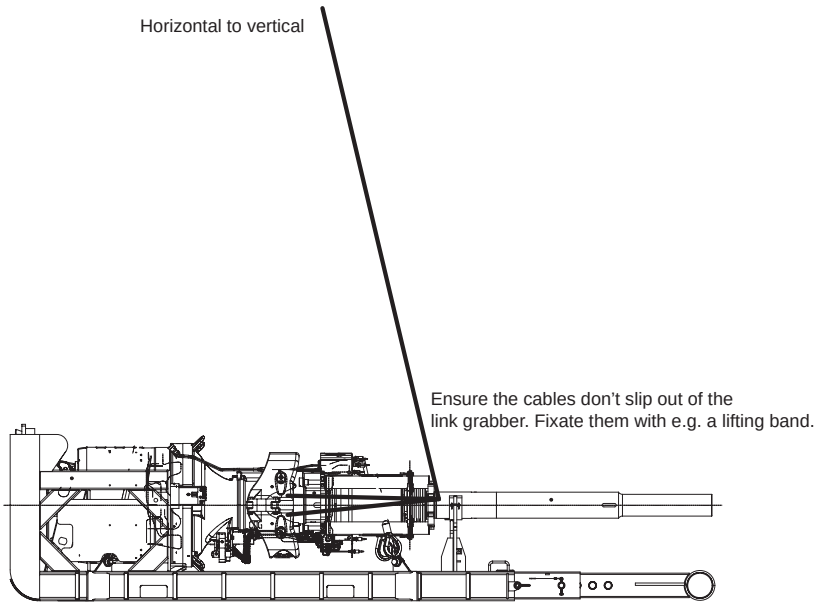
For moving the skid with the CRT from a horizontal into a vertical position or vice versa, use the CRT lifting ears and cables or lifting bands.

**WARNING: Do not use the lifting eyes of the skid for lifting the skid with the CRT. They are not strong enough.**

## Procedure

When tilting from horizontal to vertical.

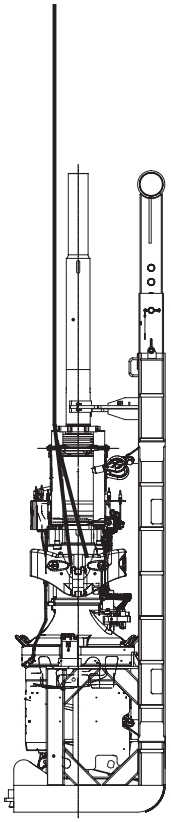
1. Lead the lifting cable through the link grabber of the CRT.
2. Ensure the ropes are held tight in the link grabber,  use e.g. a band or rope.
3. Carefully tilt the skid into it's verical position.



## Installation CRT

When tilting from vertical to horizontal.

1. Lead the cables in front of the link grabber.
2. Carefully lower the skid



Vertical to horizontal

Lead the cables in front of the link grabber.

# Placing the Skid+CRT on PS21/PS30/FMS

The skid is utilized with a centering plate, fitting over the PS21, PS30 or FMS (depending on the centering ring). Using this plate will ensure proper alighnment while connecting the cRT to the TDS-main shaft.

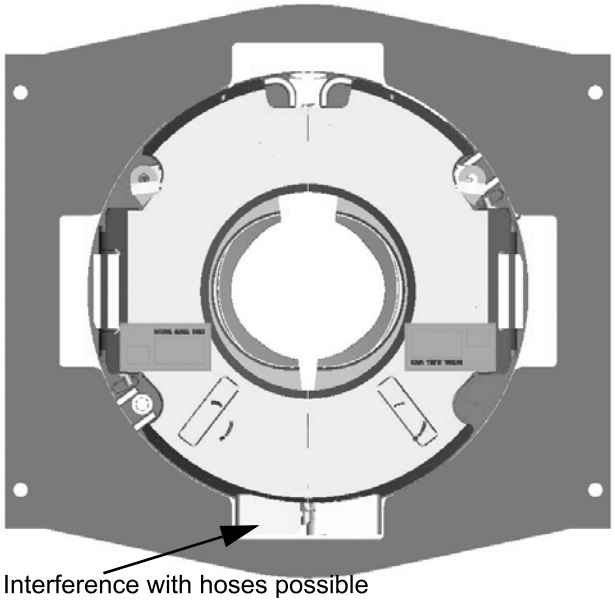
**Partnumbers centering ring:**

| |
|---|
| FMS: 50008319-62 |
| PS21: 50008319-61 |
| PS30: 50008319-60 |

## Procedure

1. Prior to landing the skid on the PS21, disconnect the PS hoses.
2. Land the skid on top of the PS or FMS
3. Make up the connection between the CRT-main shaft and Top Drive
4. Loosen the CRT-clamps and centering ring of the skid.
5. Pick up the CRT
6. Remove she skid.

## Installation CRT

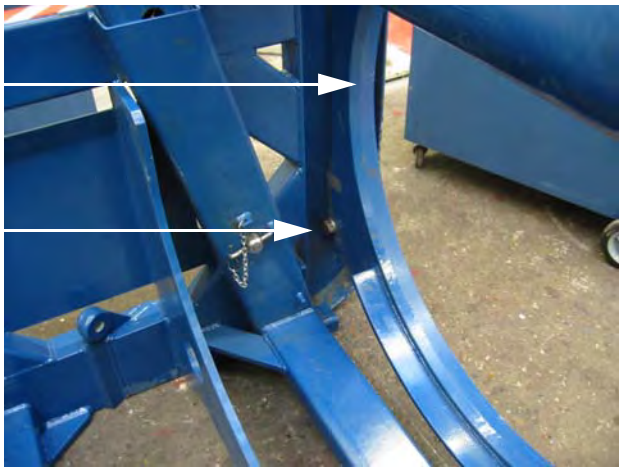



# Exchanging the centering plate

It is possible to exchange/remove the type of centering plate, depending on the type of power slip being used (e.g. PS21, PS30 or FMS).

## Procedure

1. Set the skid in a vertical position
2. Loosen the 4 bolts as indicated in the picture
3. Change out the plate
4. Fit the bolts



## Installation CRT

# Weights

All numbers are approximate, and are for info only.

| Item | Mass (Kg) | Mass (lbs) |
|---|---|---|
| FMS modified (with 9-5/8 slips & bottom guide & bell guide) | 2,446 | 5,392 |
| Torque frame assy | 2,600 | 5,775 |
| Splined shaft | 280 | 625 |
| Splined ring | 115 | 255 |
| Compensator barrel | 115 | 255 |
| Compensator piston | 170 | 375 |
| Compensator retainer | 15 | 35 |
| Link grabber | 80 | 175 |
| Hydraulics & pneumatics | 100 | 225 |
| Fill-up tool | 215 | 480 |
| Bell guide | 200 | 450 |
| Bottom guide | 50 | 110 |
| Catch plate | 20 | 44 |
| Pipe sensor assembly | 50 | 110 |
| **MAXIMUM TOTAL w/o SKID** | **5,600** | **12,350** |
| Skid | 2,000 | 4,400 |
| **MAXIMUM TOTAL incl SKID** | **7,600** | **16,850** |

# Installation of the CRT underneath TDS

## Installation for use underneath Varco DC Top Drive 3, 4, 5, 6, 8

When using a Top Drive with a Solid Body Elevator (SBE) WITH torque arrestors of the standard VARCO DC-Top Drive Top Drive with 500 or 650 ton capacity, one has to ensure the CRT hoist ring is locked in it's uppermost position (shoulderd against CRT Torque Frame). This is to be able to connect the casing links to the CRT and to carry out a critical check later in the proces.

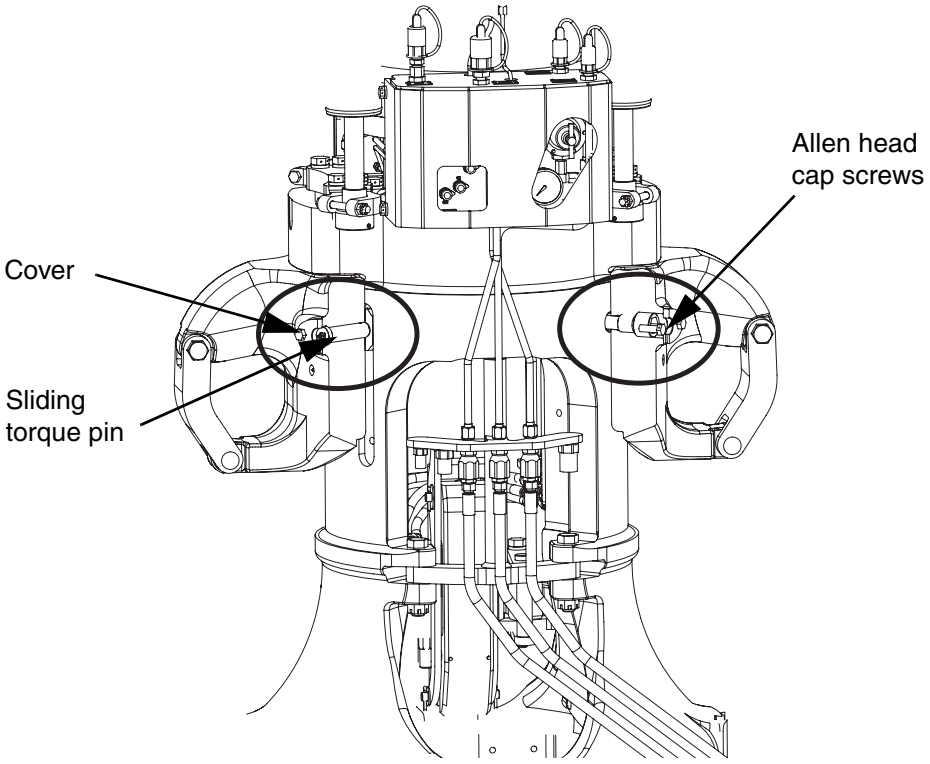
The SBE has a travel of 8".The SBE is supposed to be in Mid Stroke position after installation of the CRT, preferably lifting 1 stand of pipe. In this case the Pneumatic Compensator is supposed to be in Neutral (Mid Stroke Position). This is happening automatically, and is to be checked by the ruler placed on the Compensator.

Various configurations of the Top Drive-torque arrestors exist. Refer to Top Drive-manual for information.

### Procedure

1. Lock the CRT Hoist ring in the most upward position by turn 2 Allen Head Cap Screws fully in. These are located behind the oval shaped cap plate, they are 180° opposite each other.
2. Do not remove the covers of the sliding lock pins.

# Installation CRT




## Installation for use underneath Varco AC Top Drive 9,10,11

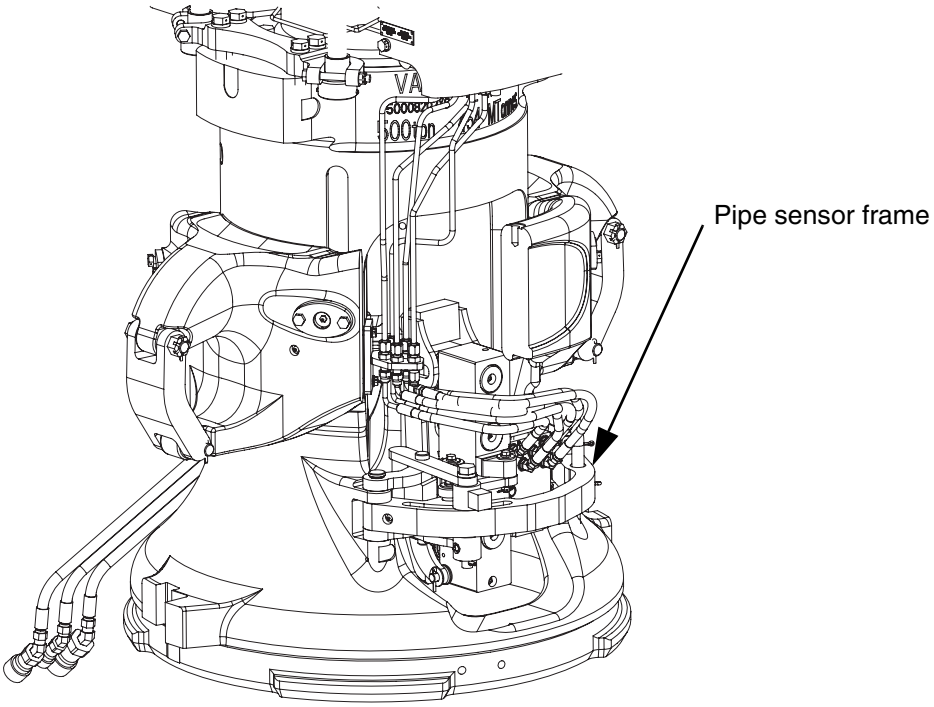
When using a Top Drive with a Rotating Link Adapter (RLA) of an AC-Top Drive WITHOUT torque arrestors, the RLA has no travel and is fixed vertically to the Top Drive main shaft, one has to ensure the CRT hoist ring is free to travel along the torque frame. When the Pneumatic Compensator is in Neutral (Mid Stroke Position), the CRT Hoist Ring needs a clearance of 4" whilst lifting 1 stand of pipe. This is to be checked by the ruler placed on the Compensator.

### Procedure

1. Suspend the hoist ring with a tugger line.
2. For use underneath an VARCO AC Top Drive ( e.g Top Drive 9, 10, 11 & IDS 4, certain types MH-DDM etc) turn both Allen Head Cap screws fully out until head hits cap-plate.
3. Lower the hoist ring and remove the tugger line.

*CAUTION: Ensure the pipe sensor frame is not swung open. This may cause damage.*

## Installation CRT




# Jobs prior to moving the CRT to the floor

## Procedure

NOTE: It is critical that the following steps are completed before proceeding with installing the CRT

1. If required, remove the saver-sub from the top drive Main Shaft.
2. Remove if needed the Top Drive bell guide, depending on the OD of the X-O-Sub.

NOTE: Make sure the CRT body doesn't interfere with the mud diverter. The distance from floor level to diverter must be 40". For diameters of diverters; see dd-50008208-20 and 50008208-210

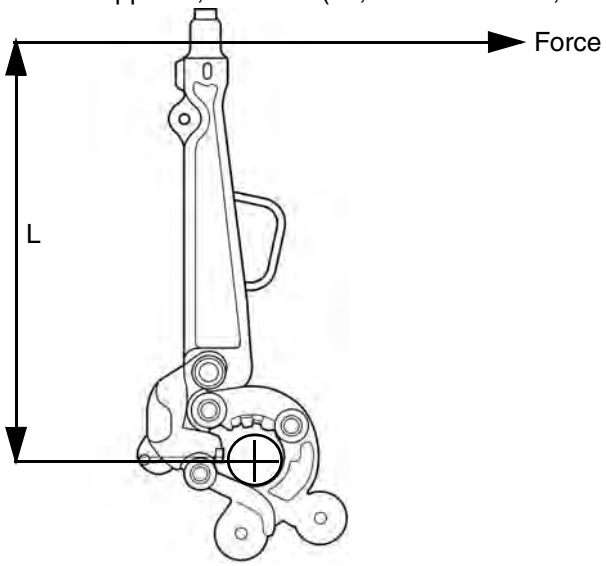
3. Fit the casing links onto the Top Drive

NOTE: Do not fit the casing links to the CRT at this point. MU the connection to the Top Drive shaft. You won't be able to Rig Up the tool when using the links at this stage.

4. Check if the correct X-O length sub is connected onto the splined shaft. The length must comply with the length of the links. Verify this with stack-up drawing.
5. The lower connection between the splined shaft & the cross over sub is 55,000 ft/lbs (74,570 Nm) for 6 $^{5}/_{8}$ API REG (RH-thread).

## Installation CRT

**Example:** Torque is the measurement of the amount of twist applied to two pipes as they are screwed together. The product of the tong arm length L and the line pull F is the measurement of torque, when the tong-arm and the pulling line are at a (90°) angle.The HT tong capable of supplying the required torque is e.g. the HT 65 tong. The length of the tong arm is appr. 4.25 Ft (1.29 m). The force to be applied on the pull line will be: F = make-up torque / arm lenght = 55,000 / 4.25 = appr. 12,940 Lbs. (74,750 / 1.29 = 57,945 N = appr. 6,000 kg)




NOTE: A line-pull measuring device should be used in making-up connections. It is important that the line-pull is measured when the line is at the right 90° angle relative to the tong handle. When applying line-pull to the tong, apply a long steady pull rather than jerking the line.

6. When needed place the CRT Splined shaft prior to MU into the Rotary Support Table while using some drill collar slips, in order to lower the work level of the tongs and to prevent excessive side load on the Torque Frame.

*CAUTION: Do not torque the CRT cross over sub (shaft adapter) while CRT-splined shaft is fitted in the torque frame.*

*CAUTION: Ensure the splines of the CRT-splined shaft do not get damaged while MU the connections.*

7. Check if the retainer is in the correct location. The position must comply with the deviation in the link length as measured during the rig survey.

NOTE: Check the retainer position now

## Installation CRT

8. The position of the retainer must be according the following table:

| Groove position retainer | Link length deviation (measured link length) |
|---|---|
| 1 (top groove) | -2” shorter than nominal |
| 2 | -1” shorter than nominal |
| 3 | 0 shorter than nominal |
| 4 | +1” shorter than nominal |
| 5 (bottom groove) | +2” shorter than nominal |

9. Dress the CRT body and FAC-tool with the correct size components, see chapter “Operations”.

## Assembly of fill up tool into torque frame

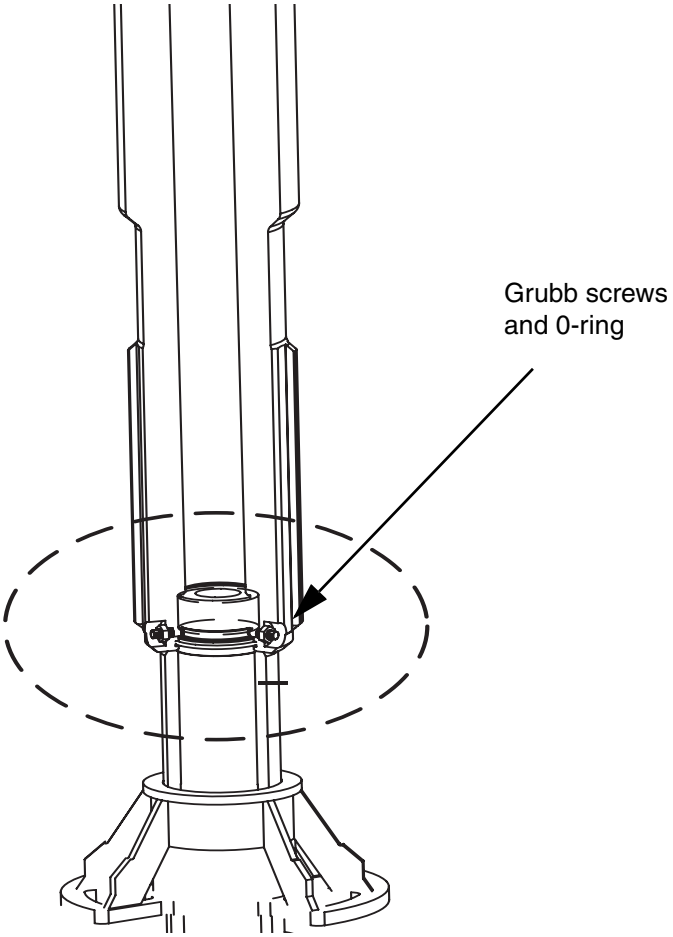
### Procedure

1. Place the body onto a flat surface, crane at hand.
2. Place complete FAC-tool into it’s assembly stand.
3. Remove lift cap from FAC-tool
4. Ensure the grub-screws for the FAC-tool inside the lower end of the CRT-main shaft are removed (2 plc)
5. Ensure o-ring at lower end of main shaft is in place
6. Pick up CRT torque frame with a suitable lift plug in the main shaft and place gently over the FAC-tool
7. Ensure the correct catch plate is fitted inside the torque frame. The size depends on the size of the mandrel of the FAC-tool.
8. Lower until threads of FAC-tool engage.
9. Spin the torque frame manually about 3/4 turn CCW if required
10. When threads engage spin CW while slowly lowering the torque frame.
11. Torque the thread connection to 1,500 Lbs-ft (2,033 Nm), RH thread.

NOTE: Do not apply above mentioned 1,500 Lbs-ft (2,033 Nm) torque onto the mud saver valve or the mud saver sub, as they have Left-Hand threaded connections and will loosen. The grubb screws will damage the thread.

12. Fit the grubb screws into the main shaft

## Installation CRT




*CAUTION: Ensure the hex-heads of the grubb screws are under flush. When they are disengaged, the screws AND main shaft will get damaged when an attempt is made to lift the CRT, or when the main shaft is removed.*

# Installation CRT

## Assembly of Torque frame to the body

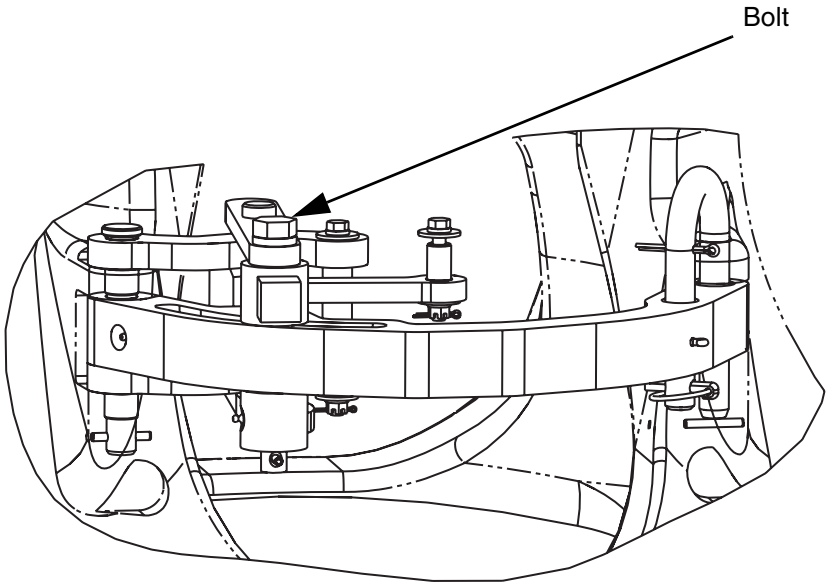
### Procedure

1. Pick up the torque frame out of the stand.
2. Place over body and align bajonet connection
3. Lower the torque frame till the torque frame engages the bajonet.
4. Do not let the body take the full weight of the torque frame, but ensure it is possible to rotate the torque frame 45° CW. Use a steel bar throught one of the link ears to rotate the torque frame.
5. Rotate the locks and lock.
6. Finally connect the hoses between body and torque frame

## Pipe sensor adjustment

### Procedure

1. Make sure the correct guide cone and packer is installed into the fill up tool.
2. Adjust the lower sensor guide shoe to the correct casing diameter.Act as follows for horizontal adjustment:
   - Loosen the bolt for horizontal adjustment.
   - Adjust the shoe of the lower pipe sensor horizontally.
   - Adjust the pipe sensor horizontally in such a way, that there is no clearance between the FAC tool Guide Cone and the lower shoe.
   - Do not compress the sensor whilst adjusting.
   - Tighten the bolt.



## Installation CRT

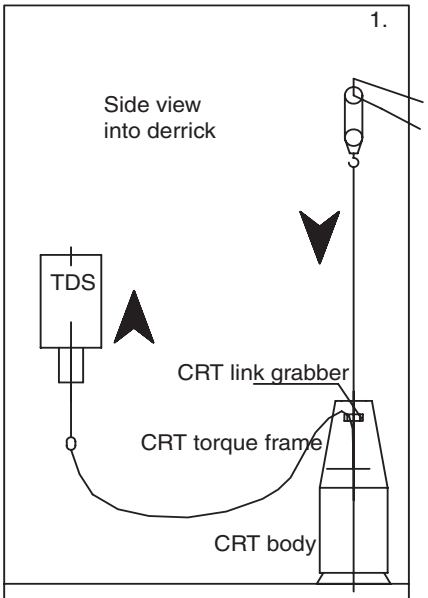
# Moving the CRT to the rig floor

## Procedure

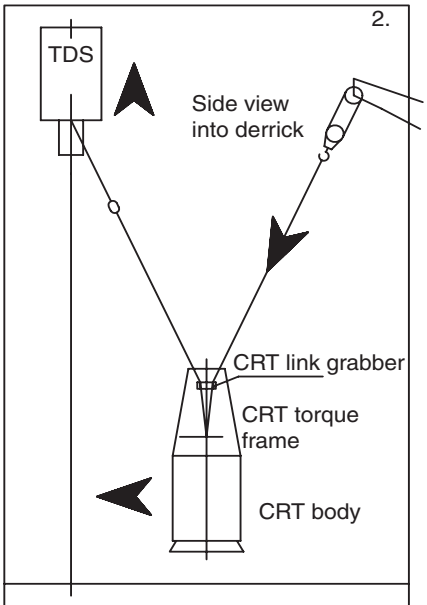
1. Ensure rotary configuration is 37-1/2” National.
2. Take the CRT in 1 piece to the rig floor use rig-crane as follows:
   - Attach crane-cables to lifting ears (2 plc) and lead thru link-grabber
   - Attach another set of cables to CRT lifting ears
   - Move the CRT to the V-door.
   - Connect the extra slings to the ends of the casing links, to take over with Top Drive
   - Lift Top Drive and lower crane to tail in CRT to well center
3. Place the CRT-body into the rotary table (leave CRT in 1 piece)
4. Pick up the CRT with the Top Drive.
5. Ensure the correct position (rotation) of the CRT relative to the Top Drive in order to have hoses on the correct side.
6. Lower block, spin in and M/U connection at applicable torque value

# Installation CRT

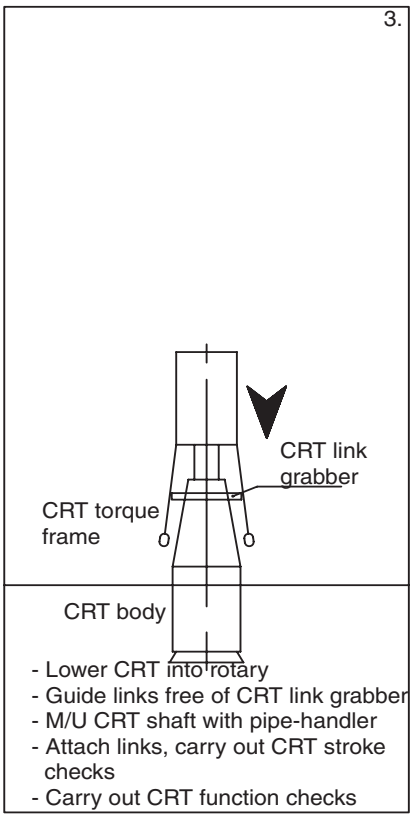
## Graphics Rig Up




- Place CRT in V-door with rig crane
-Attach double sling to lower link-eyes
- P/U TDS untill slings are tight
- Run all slings thru CRT-link-grabber

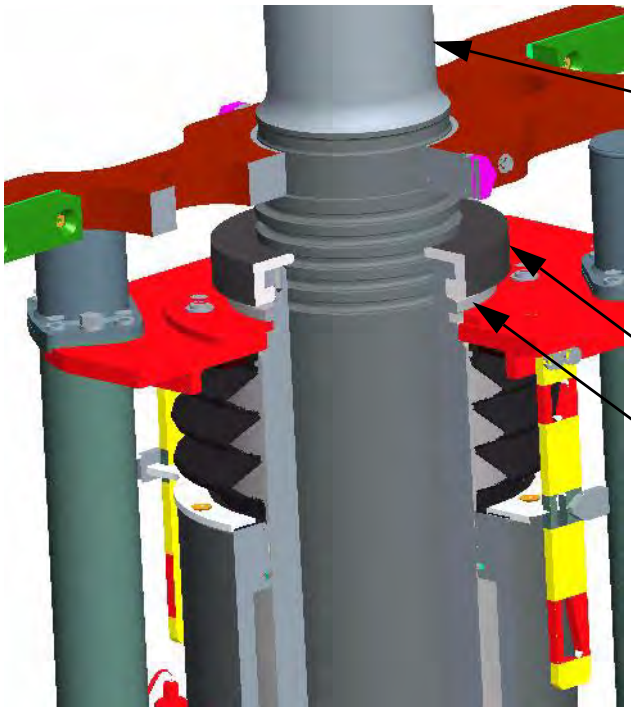



- Lift CRT free from rig-floor
- Take over CRT weight with TDS
- Move CRT side ways over well center
- Lower CRT into rotary




- Lower CRT into rotary
- Guide links free of CRT link grabber
- M/U CRT shaft with pipe-handler
- Attach links, carry out CRT stroke checks
- Carry out CRT function checks

## Installation CRT



**Change groove:**

Support the shaft

Ensure no vertical force is applied to clamp (up-down)

Do not extend compensator springs

Remove clamp

Lift or lower shaft untill correct groove is visible just above compensator

### 1) SBE only (no sagging torque arrestors)

**Procedure**

1. With the links fitted to the Top Drive, verify Top Drive torque arrestor sagging (extension) is 0”.
2. Connect links to CRT.
3. The links must show clearance relative to the ears of 1-1/2” with no torque arrestor sagging/extension allowed
4. When MORE than 2” clearance, move CRT-shaft 1 groove UP (i.e. one MORE groove visible).
5. When LESS than 1” clearance, move CRT-shaft 1 groove DOWN (i.e. one LESS groove visible).

### 2) SBE only (sagging torque arrestors)

**Procedure**

1. With the links fitted to the Top Drive, verify/measure Top Drive torque arrestor sagging
2. Connect links to CRT.
   - Add the Torque Arrestor Sagging distance measured in step 1 to the nominal clearance of 1-1/2” . So;
   - When Links clearance is MORE than; 2” + Torque Arrestor Sag measurement, move the CRT-shaft 1 groove UP (i.e. one MORE groove visible).
   - When Links Clearance is LESS than; 1” + Torque Arrestor Sag measurement, move the CRT-shaft 1 groove DOWN (i.e. one LESS groove visible.)

## Installation CRT

**Example:**

- When links fitted, the top drive torque arrestors have sagged 3/4".
- After connecting the links to the CRT, a clearance (between link and CRT-ear) is measured at 3".
- The allowed MAXIMUM Links clearance in this case is 3/4" + 2" = 2-3/4".
- The allowed MINIMUM Links Clearance in this case is 3/4" + 1" = 1-3/4"
- The measured Link Clearance of 3" is therefore too much (max allowed is 2-3/4").
- So, now move the CRT shaft UP one groove (1 MORE groove visible).
- Measure the clearance between link and link ear again. It is supposed to be 2". This is allowed.

### 3) RLA only (hydraulic lift port)

**Procedure**

1. With the links fitted to the Top Drive, verify RLA hydraulic lift port is disengaged.
2. Connect links to CRT. The links must show clearance relative to the ears of 1.5" plus/ minus 1/2"
3. If the distance is not correct, lower or raise the CRT shaft in order to create the required distance as close as possible.

**Example:**

- After connecting the links to the CRT, a clearance (between link and CRT-ear) is measured at 3".
- The allowed MAXIMUM Links clearance in this case is 2"
- The allowed MINIMUM Links Clearance in this case is 1"
- The measured Link Clearance of 3" is therefore too much (max allowed is 2").
- So, now move the CRT shaft UP one groove (1 MORE groove visible).
- Measure the clearance between link and link ear again. It is supposed to be 2". This is allowed.

### 4) RLA only (supported by spring pack)

**Procedure**

1. In case the RLA is supported by belle ville spring pack or similar, determine RLA-travel to top-drive main shaft load shoulder, use in step 3.

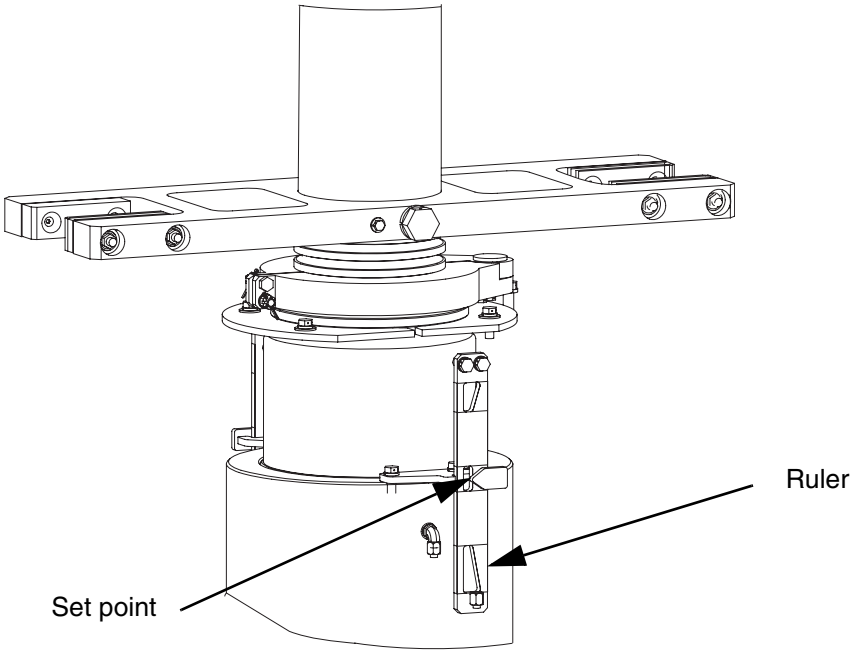
*CAUTION: I*n case the possible travel is more than 1/2" contact Varco BJ for guidance.

2. In case the the travel is less than 1/2", regard the RLA to be fixed vertically.
3. Go to step 2 of previous procedure **3) RLA only (hydraulic lift port)**

# Installation CRT

## Check compensator stroke

4. Check now the stroke of the compensator as follows:
   - P/U the CRT
   - The compensator will bottom out.
   - Check the reading of the ruler on the compensator
   - The ruler may be in the lower part of the scale, BUT NOT IN THE RED. If the ruler reads RED, the link is too long OR the XO-Sub is too short. STOP and fix the problem..




5. Lower Top Drive fully. Land CRT into rotary. Ensure compensator fully stroked in.
6. Connect all air and hydraulic hoses.
7. Switch Top Drive to CRT / casing mode, like e.g.
   - pressure switches activated
   - rotating link adaper motor disabled
   - link tilt in lock position, including release cable
   - etc (rig specific)
8. Pick up CRT free from floor
9. Set CRT slips to “armed-to-close”.
10. Ensure air supply to CRT-compensator is switched ON and rig air pressure is sufficient.
11. Verify CRT-compensator reached “mid-stroke” (ruler in mid-position)
12. Carry out function-check as described below:

# Installation CRT

## CRT function checks

### Function tests during / after Rig Up (R/U)

Description of the function test procedures during / after rigging up the CRT unit on-to the topdrive.

*CAUTION: These tests shall, at all times, be performed to the rigged up CRT prior to the casing run.*

### 1. Function test of slips up/down and the compensator

**WARNING: Prior to any test, place the FMS or casing slips into the rotary in order to shut off the rotary opening. The following test can be carried out safely, but ensure to do this with one man on the controls and one man at the CRT. During the tests, several parts and the CRT will move up and down. Ensure the CRT is sufficiently above floor level. Keep feet clear from the rotary table hole. UNDERSTAND THE PROCEDURE PRIOR TO COMMENCING THE TEST. RECOMMENDATION: The man on the floor is in command during the test.**

**Procedure**

1. Start with the CRT ±2ft above the rig floor and compensator in neutral position
2. Open the CRT slips.
   - Check if slips move(d) fully up (no slips-up feedback!)
   - Check if compensator releases it's air and moves down
3. Set CRT to armed-to-close again
   - Check if compensator moves back to neutral position
   - Check if slips do NOT move down
4. Manually pull lower skate not more than 1 inch.
   - Check if slips move down fully
   - Check if compensator stays in its neutral position
5. Keep skate activated and open CRT slips
   - Check if slips move up fully
   - Check if compensator releases it's air and moves down
6. Keep skate activated and set CRT to armed-to-close again
   - Check if slips stay in up position
   - Check if compensator moves back to neutral position

7. Release skate.
8. Repeat step 4, 5, 6 and 7, a total of 2 times and record twice;
   - The time for the slips to move down (t slips-down),
   - The time for the slips to move up (slips up)
   - The time for the compensator to move up to its neutral position (t neutral)
9. Inform driller about the recorded times.
   - t slips-down_____sec
   - t slips-up_____sec
   - t neutral_____sec

## 2. Function test for “circulation mode”

**Procedure**

1. Lower the CRT ±2ft above the rig floor.
   - Check if compensator is in neutral position
2. Open CRT (slips-up) and release “open CRT” button.
3. Put circulation mode switch in “circulation mode”. Manually pull the skate of lower pipe sensor not more than 1 inch.
   - Check if slips stay in up position. (no movement)
4. Keep lower skate activated and pull upper sensor skate not more than 1 inch.
   - Check if slips move fully down
5. Keep both skates activated, push “open CRT' button (t-slips up).
   - Check if slips move fully up
6. Keep both skates activated and release “open CRT” button
   - Check if slips stay in up position
   - Check if compensator moves back to neutral position
7. Release skates.
   - upper skate first.
   - lower skate last.
8. Put circulation switch back to normal “fill-up mode”
9. Repeat step 4, 5, 6 and 7 of **Function test 1**, one cycle.

## 3. Rotational checks

**Procedure**

1. Carry out these tests at floor level and at the height of 1 casing joint or stand
2. Rotate the CRt at 5 rpm, check any interference between CRT and Top Drive, i.e. Link tilt, Rotating head connections, Service loop, etc

# Installation CRT

## Single joint elevator installation

**Procedure**

1. Connect the safety cables and the single joint elevator to the CRT body.

# Field commissioning

## Fieldcommissioning TSEL-0154

**Procedure**

1. After installation verify the working of the CRT using the document TSEL-0154
2. For the working of the controls, please refer to documentation of the controls manufacturer.

NOTE: During the commissioning of the CRT, refer to documentation of the controls manufacturer with regard to the Controls, Graphs and other HMI-issues.

# Tool ready for operation

## Tool ready for operation

Now you have finalized the Installation and Commissioning procedure. The CRT is ready for use as far as the Hardware and mechanical interface of the CRT-system is concerned.

# Operations Prep & Operation

## Operations prep

For operation and maintenance of the Torque Turn Controls; see documents in Varco Systems documentation

## Preparation before operation

Check the following points before operation.

| |
|---|
| Check slips up/down |
| Check interface between CRT and Hydraulic Slip |
| Check fill up tool |
| Check single joint elevator |
| Check signals |
| Check slip set feedback signals |
| Check visually for damage to rubber cups and hose |
| Check visually for dents to any steel parts of the filling up tool. |
| Check the conditions of the thread in the top sub of the filling up tool. |
| Grease all the greasing points until grease comes out of the bores |
| Check for any hydraulic leakage |
| Check for any sign of wear of hoses and couplings |
| Check that the lever of the levelling beam indicator valve can move freely |
| Check pipe sensor moves and slides freely |
| Check proper attachment of safety cables |
| Check lock items are closed properly |
| Check Quick Disconnects are properly connected and in working order |
| Check presence of camera, torch and batteries |
| Check charge condition of batteries |

*CAUTION: When running premium casing, a specialist may be required for proper interpretation of the torque graphs.*

*CAUTION: In order to understand the effect of the CRT-operation in relation with the Top Drive, reading of the Top Drive manual prior to operation is required.*

The following procedures need to be carried out before the casing job is performed on the rig.

NOTE: For the preparation of the Torque Turn Controls; see Torque Turn Control documents

## Operations prep

### Removing torque frame from body

#### Procedure

1. Lower the CRT and place the body on top of the Rotary table OR on top of the RU/RD-adapter plate.
2. Make sure that the SJX slings are free and CRT-slips are UP.
3. Shut of hydraulic power and bleed the pressure.
4. Disconnect the hydraulic hoses (store hoses) between the CRT on board manifold and the body manifold.
5. Open the twist-locks (2 plc)

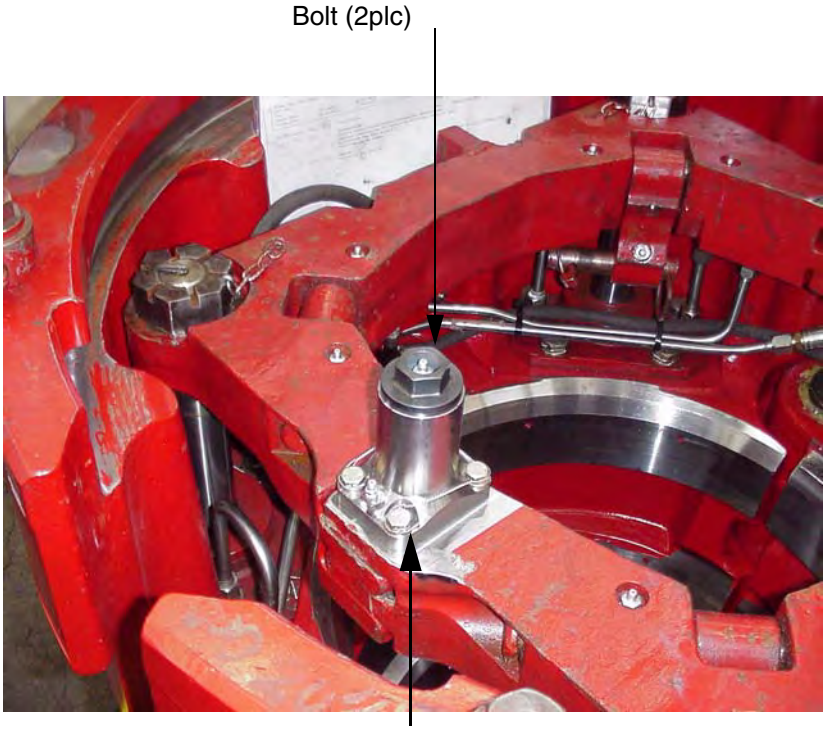
**WARNING: Ensure everyone is out of the direct vicinity of the CRT, because the actual split may cause the CRT to move with force.**

6. Lift the tophalf of the CRT slightly in order to give the bajonet some slack
7. Rotate top half (torque frame assembly) 45° CCW direction, using a steel pipe through one of the link ear openings
8. Lift up and remove the torque frame. Store temporarily.

### Dressing the body with size components

#### Procedure

1. In case one has to change/dress the body bottom guide, the body needs to be opened.
2. Turn the leveling beam pins (2 plc) CCW until rotating freely.




3. Pull out the removable hinge pin.

## Operations prep

4. Lift the body slightly up, using a 4 way sling pn 200982-1
5. Open the body
6. Lower the body to the floor
7. Install the bottom guides in the retaining grooves, using washers.
8. Close the body
9. Assemble the removable hinge pin first, then connect the levelling beam pins.

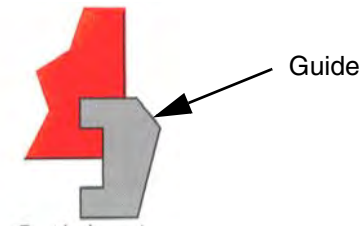
NOTE: Do not split body when changing insert carriers and/or slips.

## Installation of the bottom guide

### Procedure

The bottom guide will guide the pipe into the tool and MUST be installed for proper CRT functioning.

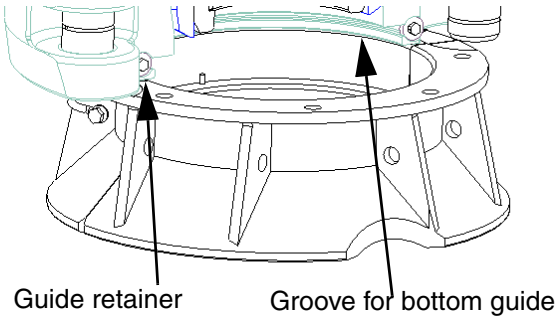
**WARNING: If the bottom guide is not installed, serious damage to slips and/or fill-up tool may occur.**



## Determine the right bottom guide size

**Bottom guide**

| Part number | Inner Diameter |
|---|---|
| 11787 | 5 ¾ |
| 11788 | 6 ¼ |
| 11789 | 6 ¾ |
| 11791 | 8 ¼ |
| 11792 | 9 ¼ |
| 11793 | 10 ¼ |
| 11794 | 11 ¼ |
| 71231 | 12 ½ |
| 11795 | 12 3/8 |
| 11796 | 13 5/16 |
| 11797 | 15 |
| 71228 | 15 ¼ |
| 15939 | 15 5/8 |




NOTE: Remove the removable hinge pin only

# Dressing the CRT with slips or insert carriers

There are 2 possible ways of dressing the CRT. Either with slips and removable insert carriers, OR with standard Varco removable ES slips.

## 1) Dressing the CRT with insert carriers

### Procedure

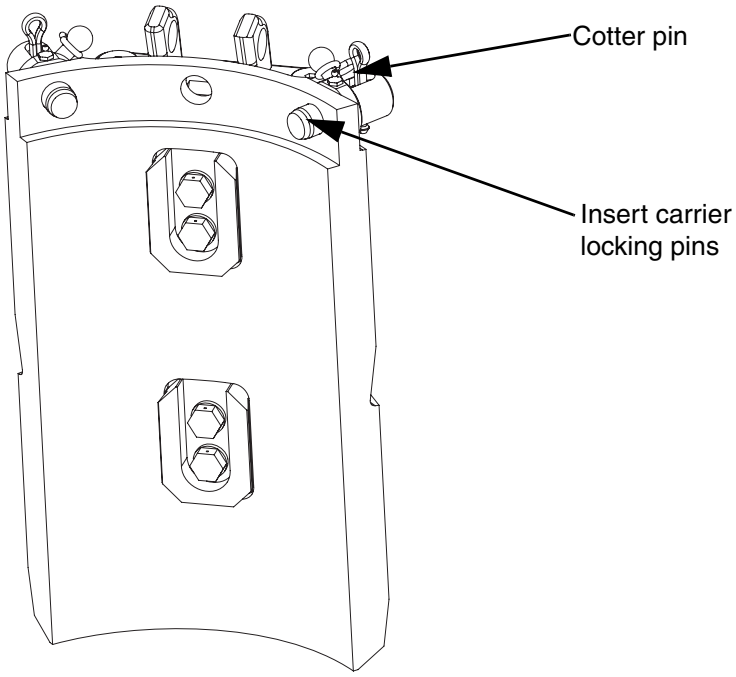
1. Raise the slips (levelling beam) completely.

**WARNING: Switch OFF the hydraulic power NOW.**

2. Disconnect the hydraulic hoses, and remove the torque frame from the body according to the procedure “Removing torque frame from body

## Operations prep

3. Remove the cotter pin and detach the insert carrier locking pins



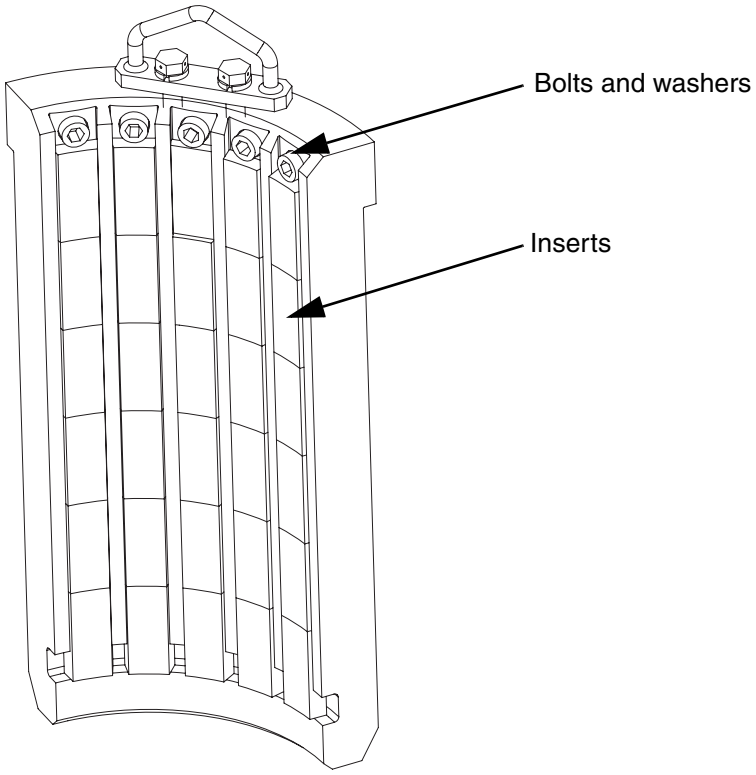

4. With overhead hoist attached to the insert carrier lifting eye, pick up the weight and lift hoist the insert carrier out of the slip
5. Remove the screws and spring washers on top of the insert carrier assembly

## Operations prep

*CAUTION: Only grease the grooves. Do NOT grease the back surface.*

*CAUTION: The bottom inserts must be tapered.*

NOTE: The basic insert is a plastic insert, marked with the dress size, replaces one of the inserts




6. Dress the insert carrier and lock the inserts with socket head lock screws and lock washers.
7. The inserts have the part number stamped in the back
8. Do not forget the size (basic) inserts
9. Grind and re-mark the size marking when changing the size of the inserts.

## Operations prep

### Insert carrier assemblies

| Part number | Description |
|---|---|
| 50008270-700 | Insert carrier assembly 7" in special 14" 500Ton E/S slip |
| 50008270-763 | Insert carrier assembly 7-5/8" in special 14" 500Ton E/S slip |
| 50008270-963 | Insert carrier assembly 9-5/8" in special 14" 500Ton E/S slip |
| 50008270-1075 | Insert carrier assembly 10-3/4" in special 14" 500Ton E/S slip |

### 2) Dressing the CRT with Varco removable ES-slips

**Procedure**

1. Raise the slips (levelling beam) completely.
2. Make sure the hydraulic power unit is switched OFF.
3. With overhead hoist attached to slip lifting eye, pick up enough to take up the weight of the slip
4. Take the slip weight off the upper link pin by pulling out the hitch pin clip and than pulling the upper link pin out.
5. Hoist the slip from the CRT.
6. Repeat this for the remaining slips.

### Selecting slips

**Procedure**

1. Select slips according below table.

| Pipe size | Body size | Slip set part number | Insert set part number | Number of inserts |
|---|---|---|---|---|
| 4 1/2 | 5 ½ | 13842-3 | 2168-16B-32 | 48 |
| 5 | 5 ½ | 13842-2 | 2169-16B-32 | 48 |
| 5 ½ | 5 ½ | 13842-1 | 2170-48 | 48 |
| 6 5/8 | 7 5/8 | 13841-3 | 2632-24B-48 | 72 |
| 7 | 7 5/8 | 13841-2 | 2623-24B-48 | 72 |
| 7 5/8 | 7 5/8 | 13842-1 | 2633-72 | 72 |
| 8 5/8 | 9 5/8 | 13840-3 | 2640-32B-64 | 96 |
| 9 5/8 | 9 5/8 | 13840-1 | 2633-96 | 96 |
| 9 7/8 | 9 5/8 | 13840-2 | 2649-96 | 96 |
| 10 ¾ | 11 3/4 | 13839-3 | 2640-40B-80 | 120 |
| 11 ¾ | 11 3/4 | 13839-2 | 2637-120 | 120 |
| 11 7/8 | 11 3/4 | 13839-1 | 2651-120 | 120 |
| 12 | 11 3/4 | 71763-1 | 2651-120 | 120 |
| 12 ¾ | 14 | 70734-7 | 2657-40B-80 | 120 |
| 13 3/8 | 14 | 70734-5 | 2636-40B-80 | 120 |
| 13 5/8 | 14 | 70734-3 | 2653-40B-80 | 120 |
| 14 | 14 | 70734-1 | 2635-120 | 120 |

## Operations prep

2. Remove dirt and grease from the CRT bowl and the back surface of the slips.Grease the back surface of the slips and the bowl

**WARNING: Do not use tool joint compound (pipe dope or anti seize compound) to lubricate.**

3. Hoist the slip into place and install using the lower link pin assembly.
4. Repeat this for the remaining slips.

## Determining pipe crushing loads

### Procedure

The maximum pipe weight which can be lifted safely with the FMS, equals the critical hook load of the pipe MINUS the applied power down force

**F = ((Yp x A x K1) - (Phydr x 36.5)) / 2000 {short tons}**

with:

$K1 = (1/ (1 + R \times K2 / L + (R \times K2 / L)^2 ))$

K2 = crushing load factor = 2.6

L = Length of slip contact (inch)

R = Outside radius of pipe (inch)

A = Cross sectional area of pipe ($inch^2$)

Yp = Yield strength of pipe material (psi)

Phydr = Hydraulic supply pressure (psi)

NOTE: No safety factor is taken into account for dynamic factors in this formula.

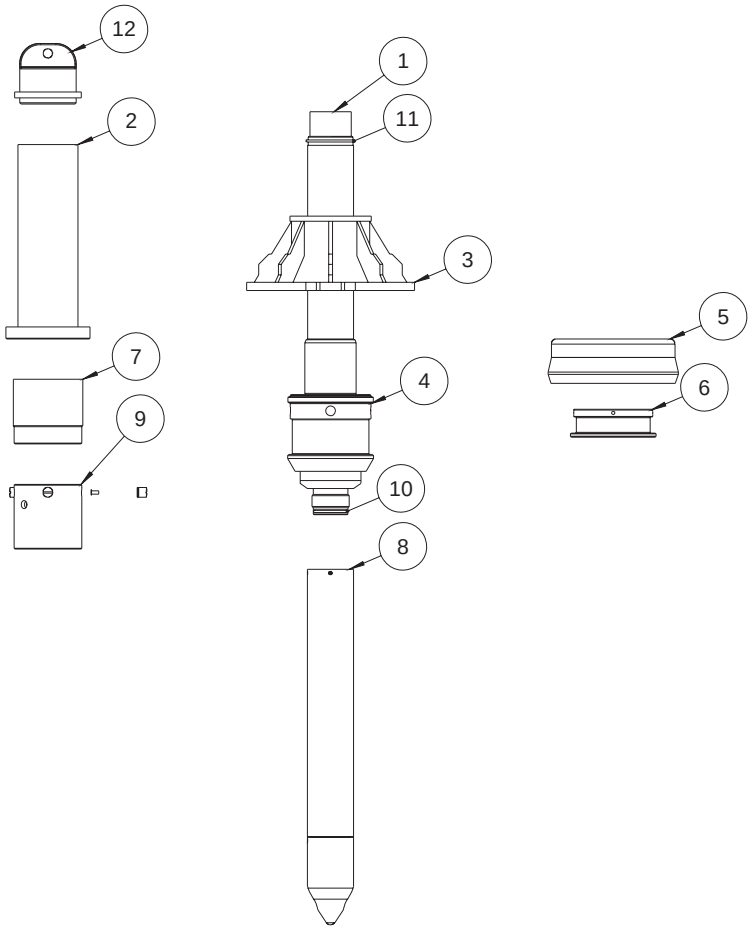
**WARNING: This formula is a guide line. Pls. refer to the pipe manufacturer for detailed information.**

## Operations prep

# CRT fill-up tool dressing

## Procedure

1. Install the correct guide and seal. Use the VARCO change out tool pn#50008048-***




1. Mandrel
2. Upper spacer
3. Catch plate
4. Guide cone
5. Packer cup
6. Cup spacer Shown is 10.75” and up
7. Top sleeve
8. Mud valve
9. Bottom sleeve assy
10. o-ring
11. o-ring
12. Lifting cap

All parts except the guide cone and packer cup are part of the fill up tool ass’y (see paragraph Parts)

2. The cup-spacer is depending on the size of the pipe

## Operations prep.

### Fac-tool 9-5/8” to 14”, see Drawings DD-50008056 & DD-50008057, DD-50008251-10 & 50008251-10

NOTE: The guide cone diameter must be confirmed as being a clearance fit with the casing being run. Packer cup diameter must be confirmed as being an interferance fit with the casing being run. The spacers are supplied with the FAC-tool.

1. Place the exchange tool on top of the casing in the drill floor while the slips are in the down position.

| Part number Exchange tool | Casing size |
|---|---|
| 50008048-963 | Change Out Tool 9-5/8 |
| 50008048-1075 | Change Out Tool 10-3/4 |
| 50008048-1175 | Change Out Tool 11-3/4 |
| 50008048-1338 | Change Out Tool 13-3/8 |

2. Measure the inside diameter of several casing joints in the rig yard to make sure guide cone & packer will fit.

**Pipe Size overview for FUT 4.1/2" - 6.5/8" #50008253**

**Cone Number 50008237-***-** -pipe/size - weight**
**Sorted to Pipe diameter**
**Cone dia's is equal to Smallest Drift Dia in a 3/8" Drift Range**

| Pipe Size | Lbs/ft | Drift dia | Coupling OD | Cone Dia | Cone Partnumber |
|---|---|---|---|---|---|
| 4.1/2" | 26.5 | 3.115 | 5.311 | 3.115 | 50008237-450-26 |
| 4.1/2" | 24.6 | 3.255 | 5.333 | 3.115 | 50008237-450-26 |
| 4.1/2" | 21.6 | 3.375 | 5.3 | 3.115 | 50008237-450-26 |
| 4.1/2" | 18.8/20 | 3.515 | 5.201 | 3.515 | 50008237-450-20 |
| 4.1/2" | 16.6/ 17.1 | 3.629 | 5.1 | 3.515 | 50008237-450-20 |
| 4.1/2" | 15.1 | 3.701 | 5.118 | 3.515 | 50008237-450-20 |
| 4.1/2" | 13.5 | 3.795 | 5 | 3.515 | 50008237-450-20 |
| 5.0" | 34 | 3.375 | 5.238 | 3.115 | 50008237-450-26 |
| 5.0" | 31.6 | 3.501 | 5.241 | 3.115 | 50008237-450-26 |
| 5.0" | 29.2 | 3.625 | 5.244 | 3.515 | 50008237-450-20 |
| 5.0" | 26.7 | 3.751 | 5.247 | 3.515 | 50008237-450-20 |
| 5.0" | 24.1 | 3.875 | 5.806 | 3.515 | 50008237-450-20 |
| 5.0" | 23.2 | 3.919 | 5.756 | 3.515 | 50008237-450-20 |
| 5.0" | 21.4 | 4.001 | 5.756 | 3.965 | 50008237-550-36 |
| 5.0" | 20.8 | 4.031 | 5.75 | 3.965 | 50008237-550-36 |
| 5.0" | 18 | 4.151 | 5.63 | 3.965 | 50008237-550-36 |
| 5.0" | 20.3 | 4.184 | 5.736 | 3.965 | 50008237-550-36 |
| 5.0" | 15 | 4.283 | 5.587 | 3.965 | 50008237-550-36 |
| 5.0" | 13 | 4.369 | 5.587 | 4.315 | 50008237-550-28 |
| 5.0" | 11.5 | 4.435 | 5.563 | 4.315 | 50008237-550-28 |
| 5.1/2" | 40.5 | 3.751 | 5.761 | 3.515 | 50008237-450-20 |
| 5.1/2" | 38 | 3.875 | 5.851 | 3.515 | 50008237-450-20 |
| 5.1/2" | 36.4 | 3.965 | 6.303 | 3.965 | 50008237-550-36 |
| 5.1/2" | 35.3 | 4.001 | 5.767 | 3.965 | 50008237-550-36 |
| 5.1/2" | 32.6 | 4.125 | 5.77 | 3.965 | 50008237-550-36 |

## Operations prep

**Pipe Size overview for FUT 4.1/2" - 6.5/8" #50008253 CONT.**

| | | | | | |
|---|---|---|---|---|---|
| 5.1/2" | 32.3 | 4.151 | 6.201 (6.45) | 3.965 | 50008237-550-36 |
| 5.1/2" | 29.7 | 4.251 | 5.74 (6.40) | 3.965 | 50008237-550-36 |
| 5.1/2" | 28.4 | 4.315 | 6.325 | 4.315 | 50008237-550-28 |
| 5.1/2" | 26.8 | 4.375 | 6.26 | 4.315 | 50008237-550-28 |
| 5.1/2" | 26 | 4.423 | 6.325 | 4.315 | 50008237-550-28 |
| 5.1/2" | 23 | 4.545 | 6.15 | 4.315 | 50008237-550-28 |
| 5.1/2" | 20 | 4.653 | 6.15 | 4.653 | 50008237-550-20 |
| 5.1/2" | 17 | 4.767 | 6.075 | 4.653 | 50008237-550-20 |
| 5.1/2" | 15.5 | 4.825 | 6.075 | 4.653 | 50008237-550-20 |
| 5.1/2" | 14 | 4.887 | 6.05 | 4.653 | 50008237-550-20 |

**Pipe Size overview for FUT 4.1/2" - 6.5/8" #50008253**

**Cone Number 50008237-***-** -pipe/size - weight**
**Sorted to Pipe diameter**
**Cone dia's is equal to Smallest Drift Dia in a 3/8" Drift Range**

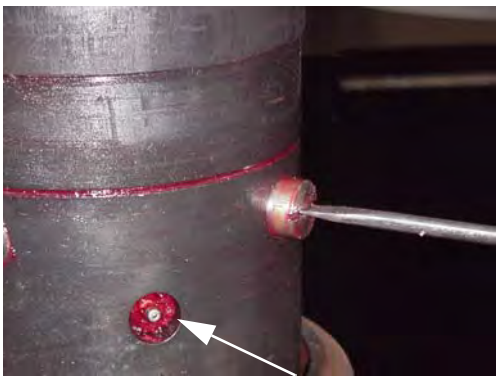
| Pipe Size | Lbs/ft | Drift dia | Coupling OD | Cone Dia | Cone Partnumber |
|---|---|---|---|---|---|
| 6.0" | 20 | 5.227 | 7.413 | 5.126 | 50008237-663-43 |
| 6.5/8" | 53.7 | 4.75 | 6.942 | 4.653 | 50008237-550-20 |
| 6.5/8" | 50.4 | 4.876 | 6.946 | 4.653 | 50008237-550-20 |
| 6.5/8" | 47.1 | 5 | 6.948 | 4.653 | 50008237-550-20 |
| 6.5/8" | 43.7 | 5.126 | 6.951 | 5.126 | 50008237-663-43 |
| 6.5/8" | 40.2 | 5.25 | 6.887 | 5.126 | 50008237-663-43 |
| 6.5/8" | 36.7 | 5.376 | 6.921 | 5.126 | 50008237-663-43 |
| 6.5/8" | 34.5/35 | 5.45 | 7.463 | 5.126 | 50008237-663-43 |
| 6.5/8" | 33 | 5.5 | 6.768 | 5.126 | 50008237-663-43 |
| 6.5/8" | 32 | 5.55 | 7.413 | 5.55 | 50008237-663-32 |
| 6.5/8" | 28 | 5.666 | 7.413 | 5.55 | 50008237-663-32 |
| 6.5/8" | 24 | 5.796 | 7.39 | 5.55 | 50008237-663-32 |
| 6.5/8" | 23.2 | 5.845 | 7.413 | 5.55 | 50008237-663-32 |
| 6.5/8" | 20 | 5.924 | 7.413 | 5.55 | 50008237-663-32 |

## Operations prep

| Csg Size OD. | Csg Weight Lbs/ft or ppf (#) | Fill Up ( & Circulation Tool) Applicable Tool for the Casing Size & Weight Listed. | Guide Cone | Thimble for Packer Seal Quote 1 Off per Casing OD when Appl. | Packer Seal (Quote 3 Off per requested CSG Size & Weight | Packer Seal Change Out Tool |
|---|---|---|---|---|---|---|
| - Note for the 4.1/2" - 6.5/8" range, Each individual Guide Cone covers a 3/8" Dia range in ID of the casing. See DD-50008253 for Casing to Guide Cone Cross-reference | | | | | | |
| 5.1/2" | 20.0# | 50008253 | 50008237-550-20 | N/A | N/A 4.1/2" - 6.5/8" Fill-Up Only | |
| 7.00" | 23.0# | 50008256 | 50008247-700-23 | 50008246-700 | 50008246-700-23 | |
| 7.00" | 26.0# | | 50008247-700-26 | | 50008246-700-26 | |
| 7.00" | 29.0# | | 50008247-700-29 | | 50008246-700-29 | |
| 7.00" | 32.0# | | 50008247-700-32 | | 50008246-700-32 | |
| 7.00" | 35.0# | | 50008247-700-35 | | 50008246-700-35 | N/A "C" Plate with the Fill-Up Tool. |
| 7.5/8" | 24.0# | 50008256 | 50008247-763-24 | 50008246-700 | | N/A the 7.0" - 8.5/8" MKII FAC Tool uses "C" Plate #50008256-4<br><br>This Plate is part of the FAC |
| 7.5/8" | 26.4# | | 50008247-763-26 | | | |
| 7.5/8" | 29.7# | | 50008247-763-29 | | | |
| 7.5/8" | 33.7# | | 50008247-763-33 | | | |
| 7.5/8" | 39.0# | | 50008247-763-39 | | | |
| 7.5/8" | 42.8# | | 50008247-763-42 | | | |
| 7.5/8" | 45.3# | | 50008247-763-45 | | | |
| 7.5/8" | 47.1# | | 50008247-763-47 | | | |
| 7.5/8" | 51.2# | | 50008247-763-51 | | | |
| 7.5/8" | 52.8# | | 50008247-763-52 | | | |
| 7.5/8" | 55.3# | | 50008247-763-55 | | | |
| 7.5/8" | 59.2# | | 50008247-763-59 | | | |
| 7.5/8" | 63.2# | | 50008247-763-63 | | | |
| 7.5/8" | 66.9# | | 50008247-763-66 | | | |
| 7.5/8" | 70.7# | | 50008247-763-70 | | | |
| 8.5/8" | | | Not yet Available | | | Tool Assembly |

## Operations prep

### 9 5/8” - 14” type



Grease nipple
fill up tool

1. Lower the tool until the guide cone is resting on the change out plate.

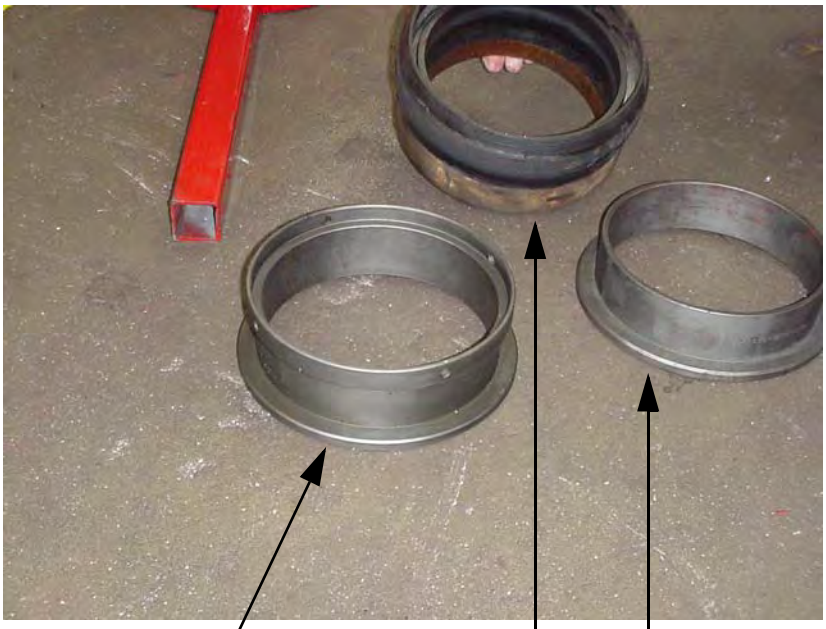
*CAUTION: While in the middle of a casing run, ensure the weight of Top Drive will not land on the change out plate. Keep a clearance of 1/2” for safety.*

2. Depress buttons in guide cone and rotate 90° to release the cone from the mandrel (see above image). The guide and sleeve ass’y is free to rotate around the mandrel.
3. Slowly raise the tool whilst easing guide cone, spacer ring and packer cup of the mandrel
4. Raise the tool until the end of the mud valve is clear of the Packer cup.
5. Apply grease to the inside of the new cup & cone & spacer

Mock up from pipe with
change out plate

## Operations prep

6. Use the correct spacer




7. Position new guide cone, spacer and packer cup on change out plate.
8. Slowly lower the FAC-tool and stab the mud valve and mandrel through the new size component stack assembly.

*CAUTION: The 9-5/8" size component stack up is not stable while stabbing. Take extra care.*

9. Ensure that packer cup is in the uppermost position without excessive force being applied to the sub assembly.
10. Align the holes in the guide cone with the buttons on the mandrel.
11. Rotate the buttons 90° and ensure that all the buttons extend to their normal operating position.

NOTE: Guide cones manufactured from January 2007 onwards have the spacer integrated into them. These cones are fully interchangeable with older FAC-tools.

# Operations prep

## Single joint elevator

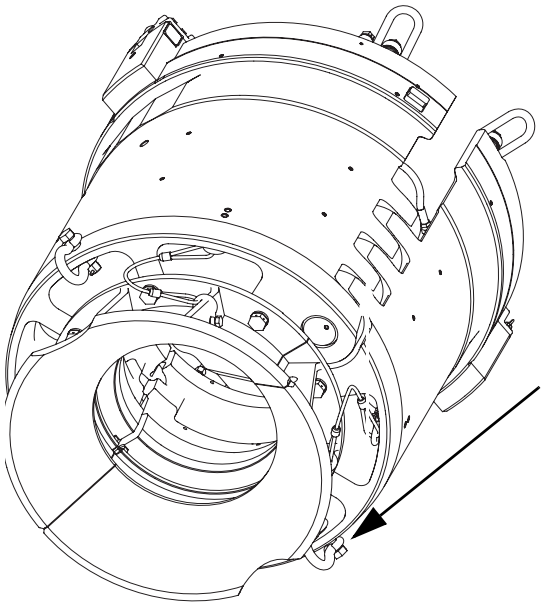
**WARNING: The load in the single joint elevator must not exceed 5 Short Tons, as this is the maximum load on the sling set connecting the SJX with the CRT-body.**

The length of the slings are standard 15” (4.5 m)

### Procedure

1. Connect the slings with the shackles to the bottom of the body using the holes as shown in the next figure.
2. Do this after the CRT is installed on to the top drive.

*CAUTION: Do not attach the single joint elevator to the bell guide or to the safety cable attachments.*



# Operations prep

## Controls settings

### Procedure

The proper set up for certain casing size & types: Program make up torque curve (torque vs. time and vs. rpm's).

For info see documentation of the used control system.

## Pre-Operation procedure

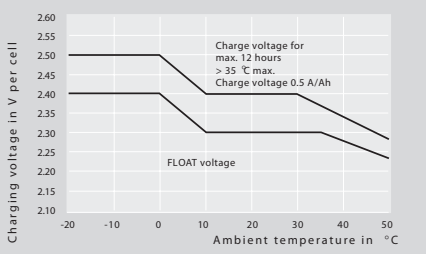
### Procedure

1. Dress the tool for the casing size which is going to be run.
2. Load correct casing size make up program.

## Camera, torch and batteries

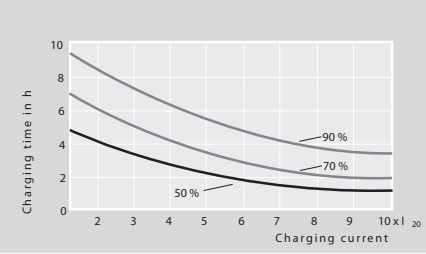
### Procedure

1. Install the camera, torch and batteries
2. Ensure the batteries are charged
3. The available capacity period depends of the way the batteries are recharged, stored and the ambient temperature, see graph below.

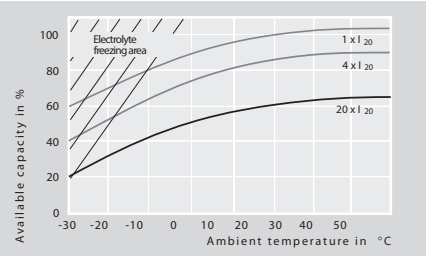



Constant charge voltages for various ambient temperatures.

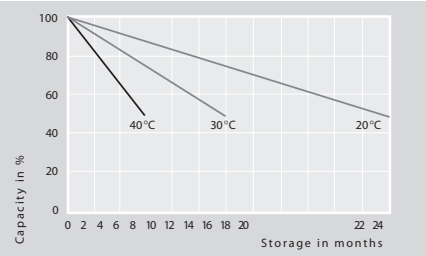
Note:
For charge voltages > 2.4 V per cell the charging current must be limited to max. 0.4 A/Ah .




Recharging time in relation to initial current up to 50%, 70% and 90% charging state, charging voltage 2.4 V/cell.




Available capacity in relation to the ambient temperature.




Self-discharge in relation to the storage temperature.

# Operation

Torch in place holder, fixated with chattering.

Battery of camera / transmitter

Operation

# CRT operation

## Calibrating the torque logging system

### Procedure

1. Close BOP
1. CRT function check.
2. Pick up shoe-track with single joint suspended by CRT
3. Lower the shoe-track into the FMS for 6 – 8 feet maximum.
4. Set the slips of the FMS
5. Lower the CRT over the top of the shoe-track until the CRT slips are set (automatically)
6. Latch a manual tong with line pull meter (load cell) onto the shoe-track.
7. Open the FMS-slips.
8. SYSTEM READY FOR TORQUE CALIBRATION

## Running the shoe-track

### Procedure

NOTE: It is advised to assemble the shoe track parts off the drill floor, e.g. on shore, in order to have at least suitable long (6 ft min) pup joints pre-made-up to the shoe, float collar, or any other special equipment in the casing string. Using the FMS and/or CRT is not possible when the parts are not long enough, and manual handling often leads to cross threading.

1. After calibration, remove the manual tong.
2. Lower the CRT until it's bell guide is appr. 3-4 inches above the top-cover of the FMS.
3. While lowering the CRT remove the single joint elevator from the shoe track.
4. Set the FMS slips.
5. Open the CRT slips and hoist the CRT into the derrick.
6. While hoisting the CRT, pick up the next joint from the V-door using the single joint elevator.
7. While the next joint is suspended by the SJX, stab this joint into the top of the shoe-track.
8. On a floater; now engage manipulator arm to hold the joint vertical.
9. Lower the CRT over the top of the casing joint until the CRT slips are set.
10. Make up the casing connection using the Top Drive-motor. See procedure.
11. On a floater; now disengage & retract the manipulator arm.
12. Open the FMS slips.
13. Lower the CRT until the bell guide is 3 inches above the top cover of the FMS.
14. OPTIONAL: Start the fill-up procedure simultaneously as follows:
15. Fill-up the joint _____pump strokes

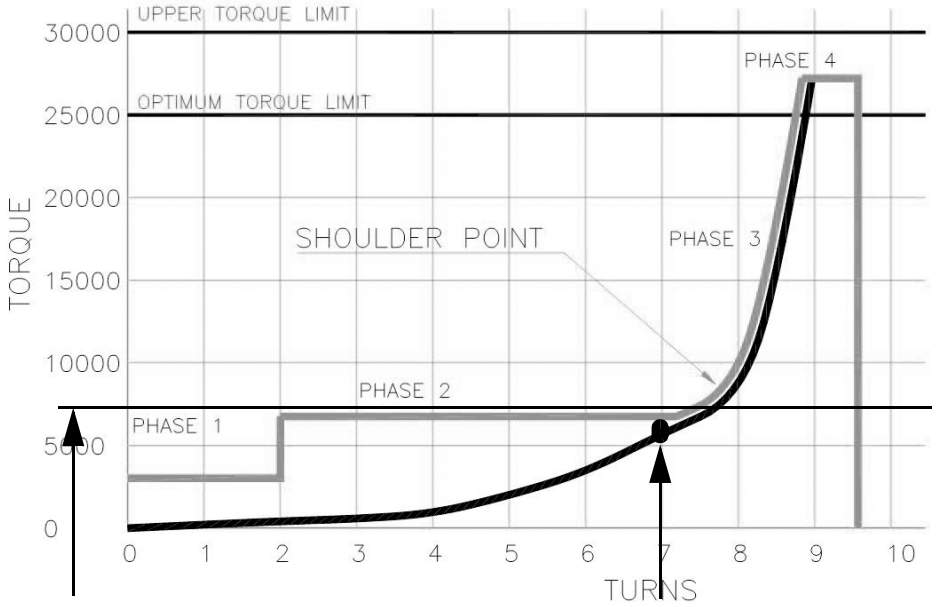
# Operation

## Theory of making up the connection

NOTE: The procedure is applicable to the TDS 3&4 Top drive controls only. NO TTR controls.

*CAUTION: The operator must understand the following: When spinning in with 20 rpm at 10% torque, the rotation should visibly start slowing down before shouldering as a result of generated torque in the connection. When no visible slowing down occurs, the operator should decrease rotation to 5 rpm before the casing shoulders. Not doing so may result in over shoot due to inertia of the Top Drive System, damaging the thread. It is also advised to ensure slowing down rpm and increasing torque before the connections shoulders, as this is the only way one can be sure the connection will be made properly.*

Below figure for info only




Phase 1: Manual cross threading detection with reduced motor Amps-limit.

Phase 2: Thread spin-in

Phase 3: Controlled Amps-limit ramp up during seal and shoulder make-up.

Phase 4: Short hold time at required make-up level of completed make-up.

# Operation

## Make up the connection

### Procedure

*NOTE: Straight spin-in is usually possible for premium casing.*

1. Set torque limit at ±at 10% of M/U value with “auto brake ON”
2. Increase speed to 10 rpm counter clockwise (CCW) until thread engages.
3. Reverse rotate direction switch.
4. Slowly turn casing (CW) for first 1 to 2 turns (beware cross-threading!)
5. Increase speed to 20 rpm max. (10 - 15 rpm on first joints)
6. Reduce speed to 5 rpm before the casing shoulders (observe visually).
7. Rotate until Top Drive stalls:
8. Ramp up the torque limit to the final Casing M/U value. Ramp up time: 3 – 4 seconds
9. After the casing stalls again, remain torque-ing for 2-3 seconds

**WARNING: Do never stall for more than 5 seconds (to prevent motor damage)**

10. Step down the torque limit and speed to 0 rpm

*CAUTION:* Now check after running 5 stands of pipe by bleeding the compensator and check the ruler is NOT in red.

## Making up the hanger

### Procedure

NOTE: It is advised to assemble the hanger parts off the drill floor, e.g. on shore, in order to have at least suitable long (6 ft min) pup joints pre-made-up to the hanger. In order to ensure the proper stick-up length (ideally 60”) of the last landing joint, determine the exact length prior shipping the pipes for the job. Using the FMS and/or CRT is not possible when the parts are not long enough, and manual handling often leads to cross threading.

1. The thread of the hanger connection can be Left-Hand-Thread.
2. Making or breaking this connection requires little torque. When using the CRT the risk exists that one damages the existing hanger connection due to over torque.
3. In order to prevent this, one is advised to use a manual tong for making up the casing connection below the hanger connection.
4. When the hanger is through the FMS in the Rotary Support Table, it is possible to continuo using of the CRT as the FMS prevents any torque to be transferred into the hanger connection.

*CAUTION: Once the hanger is made up to the casing string, it is not possible to rotate the string as this will lead to unscrewing the hanger.*

NOTE: Above procedure is not applicable on a floater as usually drill pipe is being used for the purpose.

# Operation

## Fill-Up Operation Procedure

### Procedure

Prior to fill up, the FAC tool is partially inserted into the casing so that there is sufficient clearance between the bottom of the packer cup and the top of the casing. Fill up can be carried out while the casing is stationary, or while the casing is being lowered into the hole.

NOTE: To Prevent Spillage: Keep the fluid level down by 0.5-1 joint (Below top of casing) in order to prevent overflow.

Choose from:

1) Circulation /w remote control

2) Circulation w/o remote control

3) Fill up /w remote control

4) Fill up w/o remote control

## Wear on the FAC-tool

**Erosion**

Erosion is never as a result of filling up but as a result of extended circulation at high pump rates (> 10bbl/min) with abrasive muds. It is recommended to use the mud saver for fill up and short periods of circulation. But for aggressive circulation better results (for hydraulic & pressure loss as well as erosion) are achieved with the mud saver removed. The internal parts of the mud valve are coated to resist abrasion but once the coating has been worn away erosion advances at an advanced rate. For limited circulation a repair scheme is available for the spring housing in the mud saver that inserts a sacrificial sleeve, this has to be checked / changed at the end of each job.

**Wear life for the spring assy and valve.**

It depends on the type of circulating fluid, the circulating rate and the length of time for circulation.

The key is to identify the erosion when it first starts and repair or replace the spring housing before the erosion eats through the spring housing and affects the valve body. Ideally the valve should be stripped down and inspected after very job where fluids have been circulated.

A repair scheme for the spring housing is available that introduces a "sacrificial part" to reduce the cost of repairs, pn 50008053-4. Contact your local NOV-distributor.

# Operation

## Circulation

### Procedure

1. Set the switch on the CRT Torque frame in the required position.

Choose from:

1) Circulation /w remote control

2) Circulation w/o remote control

3) Fill up /w remote control

4) Fill up w/o remote control

2. Maximum allowable temperature 250° F (121° C) for short periods
3. Maximum tested cup pressure (circulating) 5,000 psi (34,473 KPa)
4. If anticipated flow rate is to be between 5 and 10 bbl/min – no redressing of the valve is required.
5. If anticipated flow rate is greater than 10 bbl/min – the mud valve should be removed to improve circulating hydraulics and reduce valve erosion.
6. Ensure that the mud supply line is opened and pressure is bled to zero prior to lowering tool.

**WARNING: Ensure that the casing is completely filled with fluid, prior to circulation, because any air pocket left at the top of the casing will be compressed when circulation begins. This would create a pressurized air pocket.**

**WARNING: If the tool is removed prior to pressure bleeding to zero, personnel injury or equipment damage may occur**

**WARNING: Always stab the FAC, so that any derrick misalignment is compensated by the free length of the casing above the spider.**

# Operation

**WARNING: When the tool is being used for circulation, beware of any hydraulic forces that may be created under high pressures. With this in mind, do not stand above or near the casing until all pressure has been relieved. Fill the casing as per procedure with mud prior to RIH.**

*CAUTION: When the tool is being lowered into the casing, ensure that the top drive does not come in contact with the casing coupling. The tool must never be lowered into the casing at floor level in case of misalignment of the derrick. This may cause damaged cones and / or seals.*

## Circulation mode procedures

### Procedure

**WARNING: Keep clear of the rig floor until all pressure has been relieved**

**WARNING: Never have the spider/slips set while circulating. Always have the weight of the string taken up by the CRT.**

## Planned circulation (on next joint)

1. P/U and M/U joint as per normal procedure.
2. Fill-up completely
3. Keep the FMS closed and check, (do not lower this joint)
4. Open CRT
5. P/U block approx. 4 ft (CRT-skate to clear casing coupling)
6. Set circulation switch to “ON”
7. Lower the CRT again over joint, continue to lower blocks slowly until the CRT set again (but now in circulation)
8. Check if CRT is set far enough over casing joint, so that cup is properly inserted into the joint to safely circulate without leakage/damage to FAC seal.
9. P/U block and open FMS
10. Increase pump pressure slowly to circulation pressure
11. RIH as per rig procedure for circulation
12. Set FMS-slips and check
13. After circulation wait ±15 seconds to bleed off mud-pressure in pipe
14. Open CRT
15. Slowly P/U blocks off the pipe.
16. Set circulation switch back to normal “fill-up mode” position

# Operation

## Unplanned circulation

### Procedure

1. CRT has hold of string and joint is filled completely
2. Check if the joint is filled completely
3. Close FMS and check
4. Now carry out procedure as if it is “planned circulation” (start at item 5 of paragraph “planned circulation”).

## Running a mixed string

### Procedure

If a mixed string is run (different casing sizes / types in a casing string) the size of the slips and sometimes the bottom guide, fill up tool guide cone and packer need to be changed out.

1. Place the CRT on top of the FMS OR on top of the adapter plate over well centre around the casing. The top of the joint needs to be about 5 ft (1.5 meter) above drill floor level.
2. Make sure that the SJX slings are free
3. Disconnect the hydraulic hoses between the CRT body manifold and the CRT frame manifold (quick disconnects are located on top of body manifold)
4. Open the 2 twist locks from the CRT
5. Adjust the pipe sensor fully out.
6. Rotate the torque frame 90 deg. Counter Clock Wise until the bajonet type connection between body and frame disconnects
7. Hoist the CRT upper part ca. 20ft (6m).
8. Then, if applicable, change out the FAC-size components. Place the VARCO change out tool for guide cone & packer on top of the casing joint with the correct base plate.

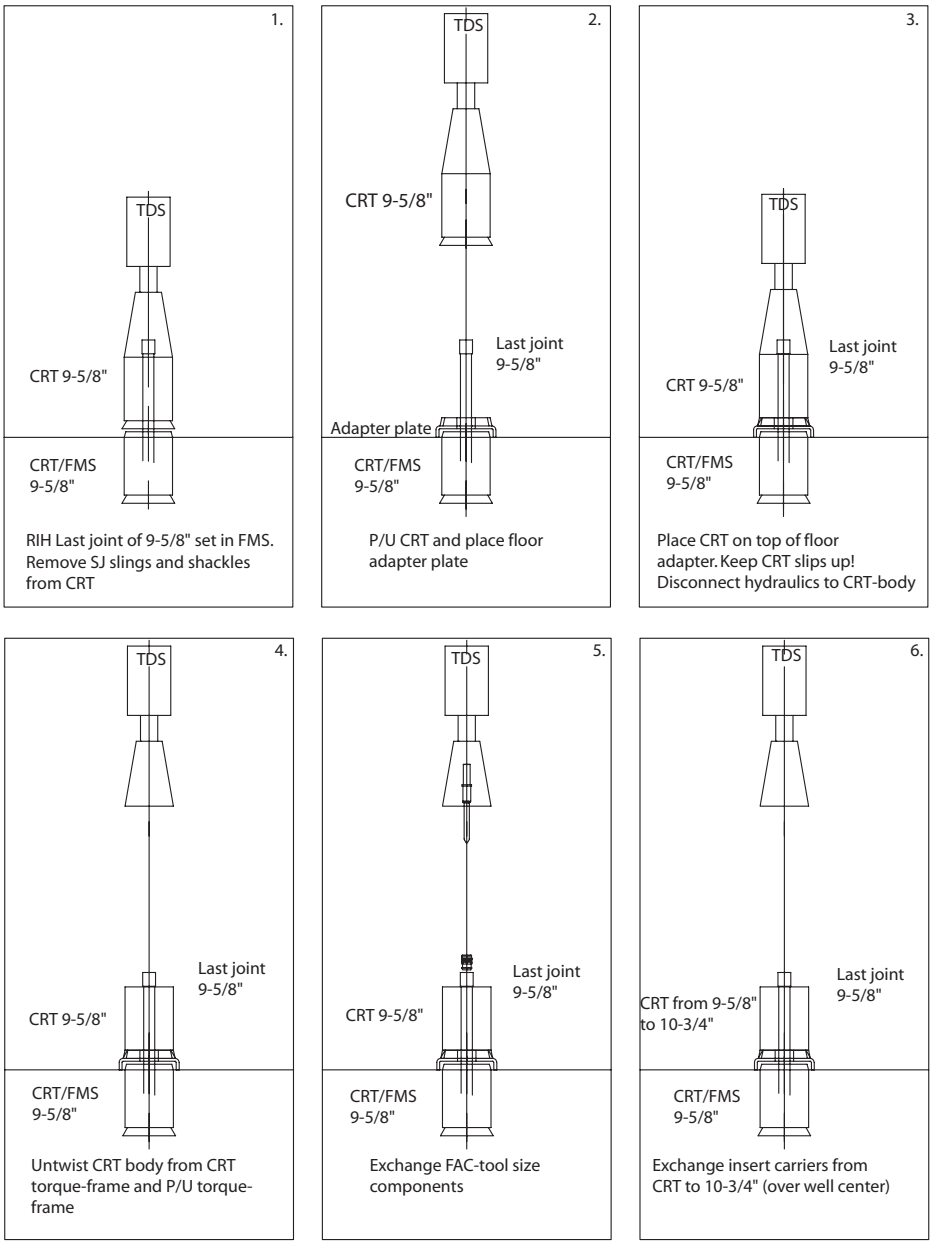
- Lower the CRT upper part until the guide cone JUST touches the change out tool
- Push and turn the fill up lock buttons.
- Lift the CRT. If the cone & packer don’t come loose from the fill up tool shaft, use a mallet to loosen them.
- Remove the guide cone & packer from the change out tool. Place the correct size of cone & packer on the tool with the correct spacer in between.
- Lower the CRT until the cone & packer are at the right height (so that the buttons mate the holes in the cone). Turn the buttons and make sure all 4 buttons protrude correctly.

9. Lift the CRT to the level in order to be able to attach the body again.
10. Rotate the torque frame 45° Clock Wise.
11. Lock the twist locks.
12. Reconnect the hydraulic hoses
13. Adjust the lower pipe sensor shoe in the correct location.
14. Lift the CRT and change out the SJX-elevator.
15. Remove the adapter table.
16. Continue casing job as per rig procedure.

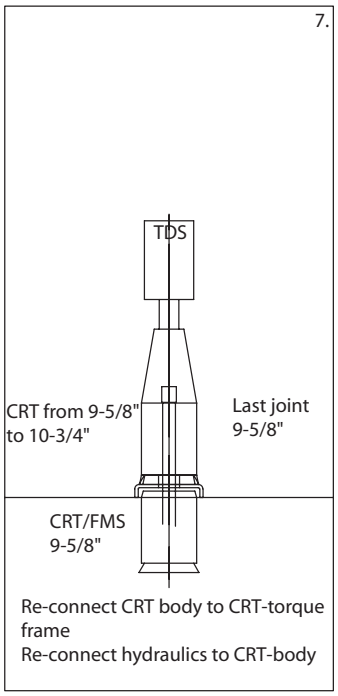
# Operation

## Graphics running a standard mixed string

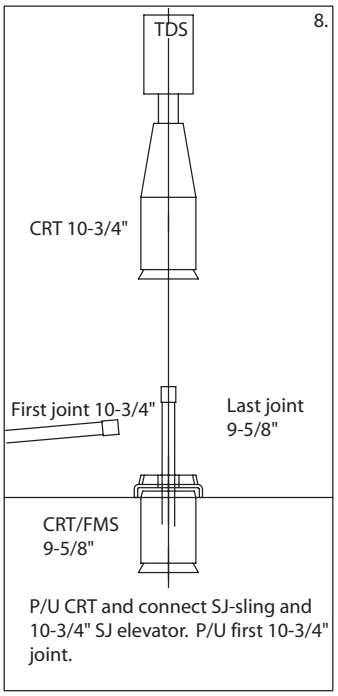
FMS375 &CRT body available. Change out of components connection is over well center (on-line)



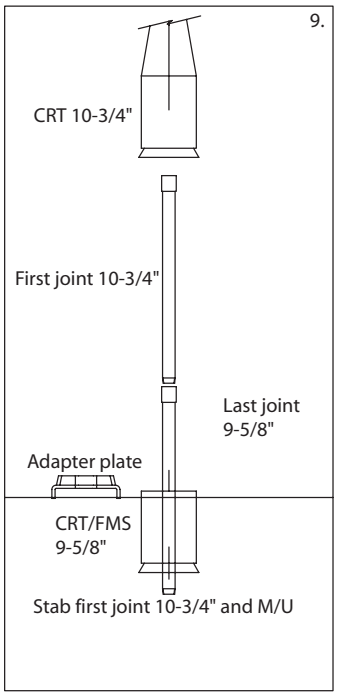
## Operation



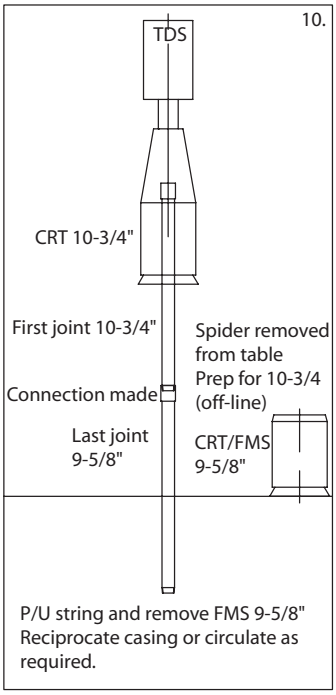

Re-connect CRT body to CRT-torque frame
Re-connect hydraulics to CRT-body



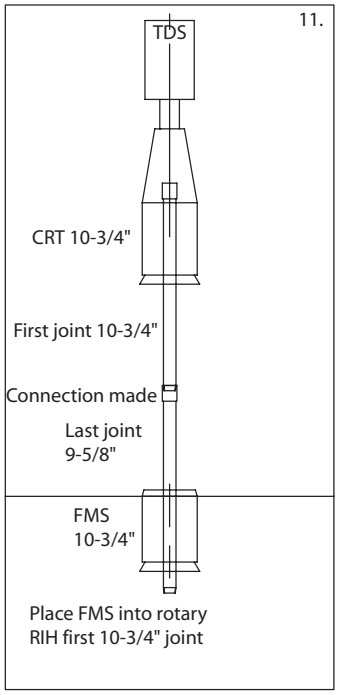

P/U CRT and connect SJ-sling and 10-3/4" SJ elevator. P/U first 10-3/4" joint.



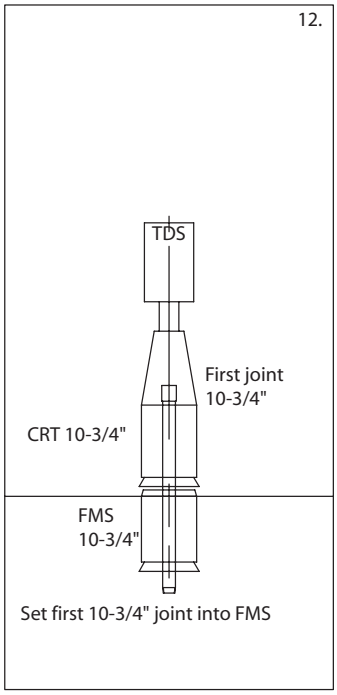

Stab first joint 10-3/4" and M/U




P/U string and remove FMS 9-5/8"
Reciprocate casing or circulate as required.




Place FMS into rotary
RIH first 10-3/4" joint

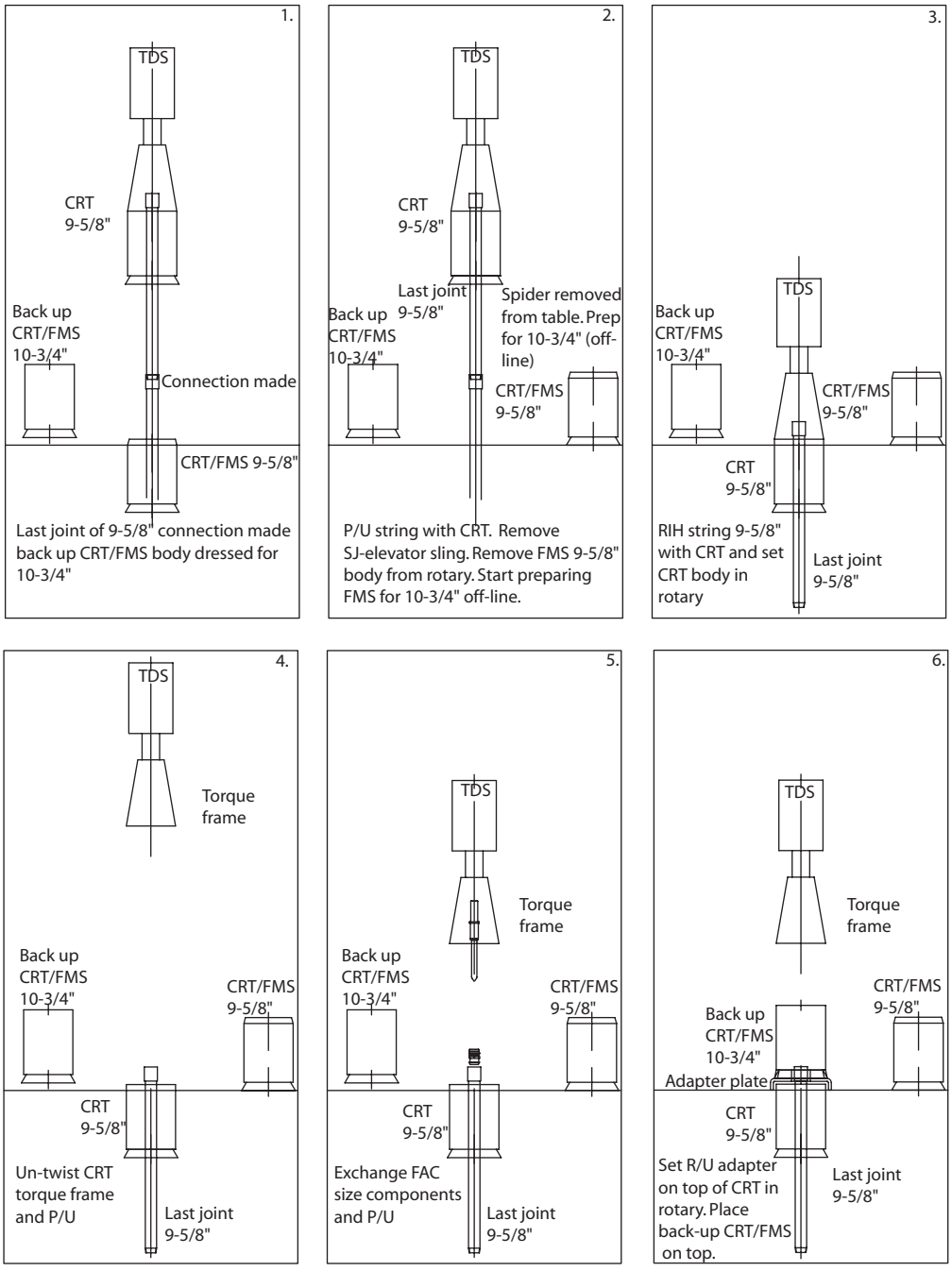



Set first 10-3/4" joint into FMS

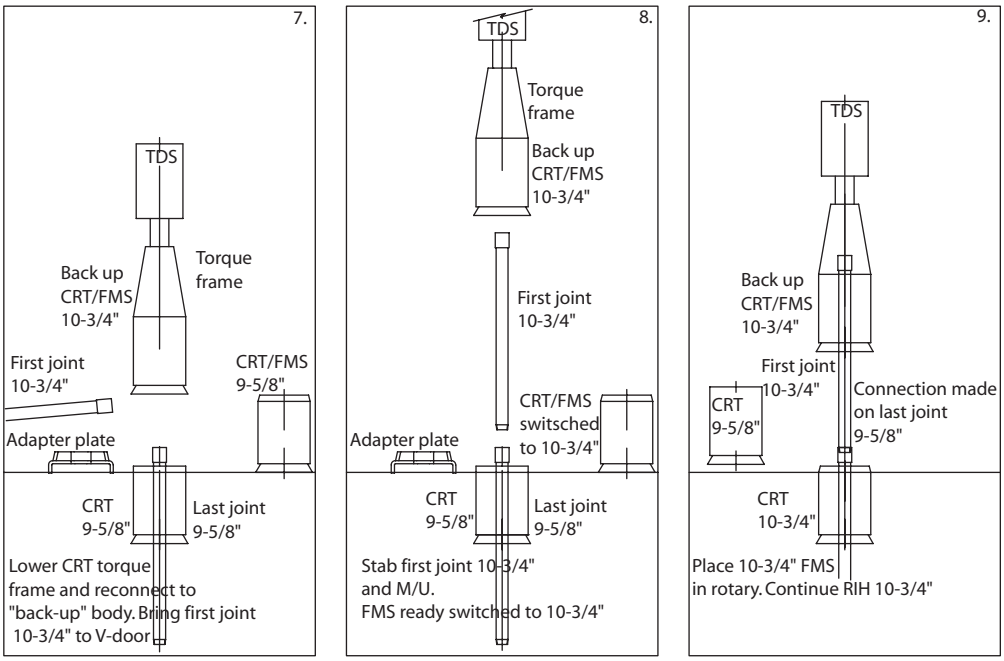
# Operation

## Graphics alternative running mixed string

Back up CRT body & suitable controls for both CRT body and FMS375 available. Change out of size components connection is off well center (off-line)



## Operation




## Emergencies

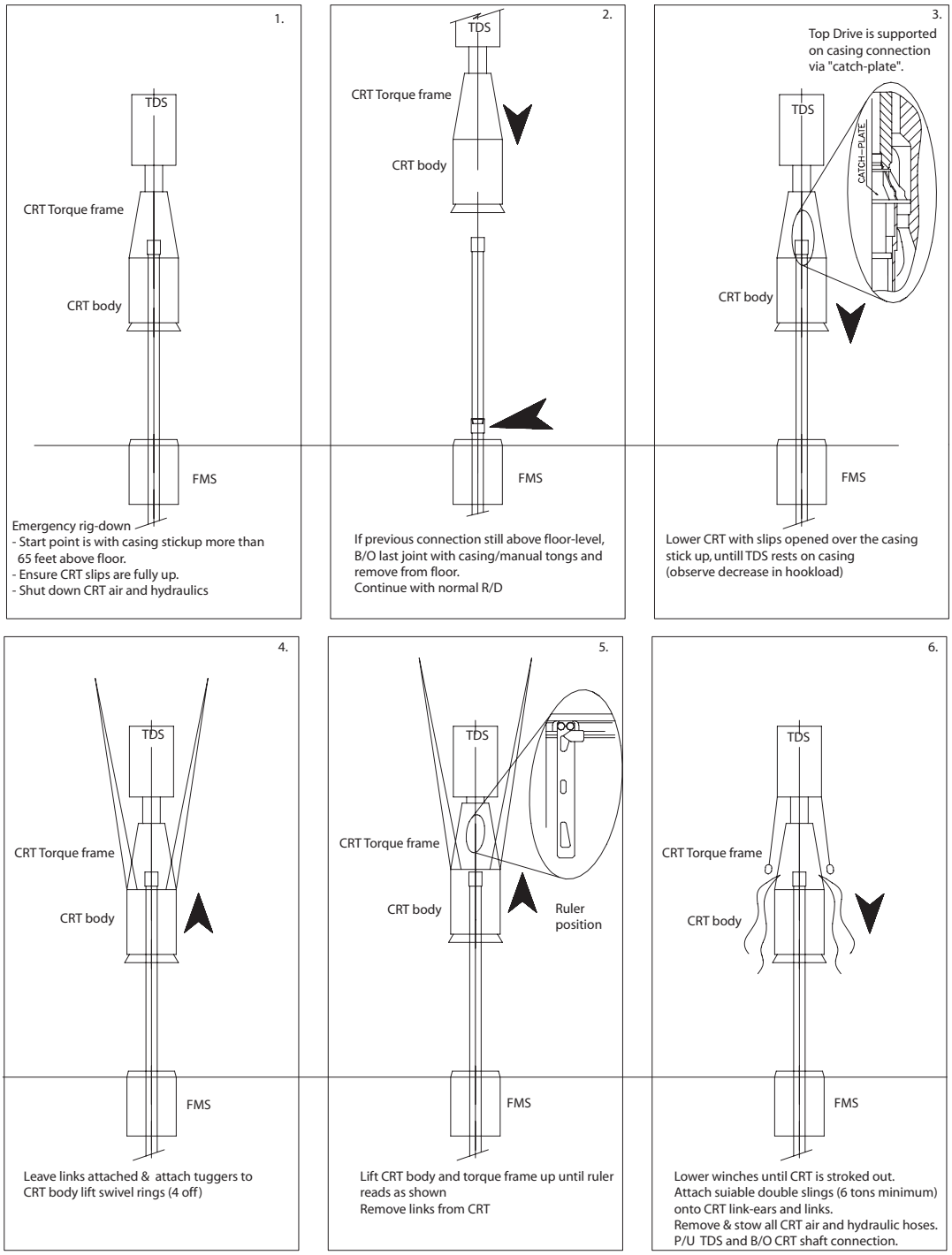
### Procedure

In case of an emergency or in case the body can't be lowered on the drill floor or RST (Rotary Table), carry out the following procedures in order to remove the CRT quickly from the drill floor..

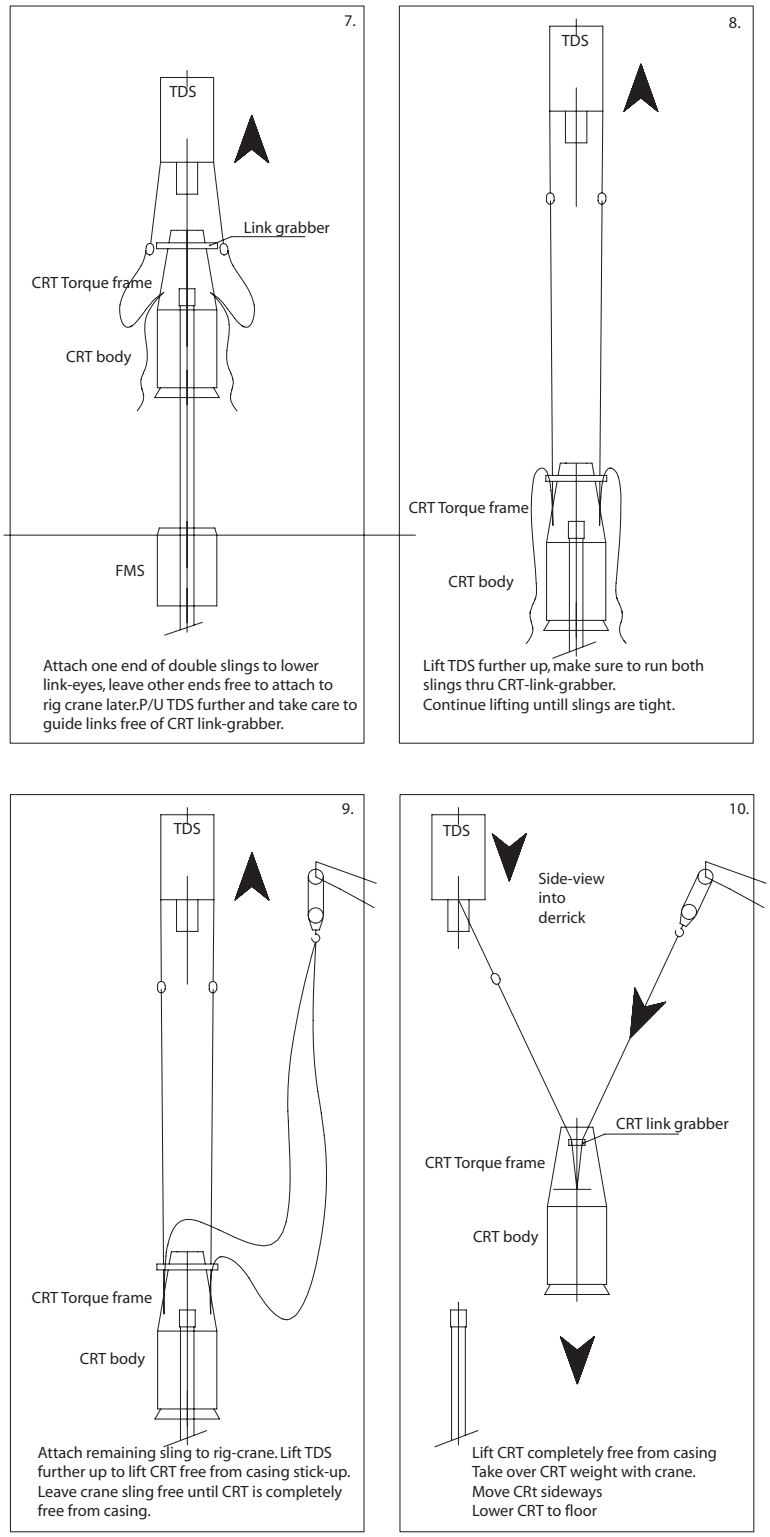
**WARNING: The CRT-Compensator is not active during this operation, so closely watch decrease of hook-load.**

# Operation

## Graphics emergency procedure



# Operation


7.
TDS
Link grabber
CRT Torque frame
CRT body
FMS
Attach one end of double slings to lower link-eyes, leave other ends free to attach to rig crane later.P/U TDS further and take care to guide links free of CRT link-grabber.
8.
TDS
CRT Torque frame
CRT body
Lift TDS further up, make sure to run both slings thru CRT-link-grabber.
Continue lifting untill slings are tight.
9.
TDS
CRT Torque frame
CRT body
Attach remaining sling to rig-crane. Lift TDS further up to lift CRT free from casing stick-up.
Leave crane sling free until CRT is completely free from casing.
10.
TDS
Side-view into derrick
CRT link grabber
CRT Torque frame
CRT body
Lift CRT completely free from casing
Take over CRT weight with crane.
Move CRt sideways
Lower CRT to floor

# Operation

## Pulling casing (when NO pipe handler available)

### Procedure

**WARNING: Ensure that the threads are fully disengaged when starting to hoist the pipe**

*CAUTION: To avoid possible thread damage, increase air pressure to maximum pressure available.*

*CAUTION: Set CRT as high as possible on joint. I.e. DO NOT overshoot slips set point when stabbing CRT over next joint.*

1. Lower CRT over pipe (top of pipe appr. 6 ft above floor level, dep. on rig situation)
2. Set the CRT slips
3. Open the FMS slips
4. POOH the casing string until the next casing coupling is appr. 6 ft above floor level
5. NOTE: Latch Single joint elevator to the casing
6. Set FMS slips.
7. Break out connection using the Top Drive motor

NOTE: It is recommended to have a back up tong on the casing collar to prevent breaking the wrong connection

8. Start with speed setting of 20 RPM Counter Clockwise
9. Then ramp up torque limit until the connection breaks
10. Release slips CRT
11. Clamp mud bucket around pipe (if available)
12. Hoist Top Drive until the single joint picks up the loose joint.
13. Lay down the pipe
14. Start at 1.

# Operation

## Pulling casing (when pipe handler available)

### Procedure

**WARNING: Ensure that the threads are fully disengaged when starting to hoist the pipe**

1. Lower CRT over pipe (top of pipe appr. 6 ft above floor level, dep. on rig situation)
2. Set the CRT slips
3. Open the FMS slips
4. POOH the casing string until the next casing coupling is appr. 6 ft above floor level
5. Set FMS slips.
6. Break out connection using the Top Drive motor

NOTE: It is recommended to have a back up tong on the casing collar to prevent breaking the wrong connection

7. Start with speed setting of 20 RPM Counter Clockwise
8. Then ramp up torque limit until the connection breaks
9. Release slips CRT
10. Clamp mud bucket around pipe (if available)
11. Hoist Top Drive.
12. Start at 1.

# Operation

## Rig down (R/D)

### Procedure

This procedure describes in general terms the steps to be taken to R/D the CRT onto the top-drive. Depending on local circumstances the exact order in which all this takes place may differ from this procedure.

NOTE: The minimum stick-up required for CRT = 56” (1.42 meters) above cover.

If stick-up is up to 63” (1.6 meters) rig down as follows: FMS still in rotary.

1. Lower block until CRT is ~4 inches above FMS top cover
2. Close FMS and check
3. Open CRT.
4. P/U CRT until pipe skate above coupling
5. P/U CRT ~20 ft set transport skid over FMS.
6. Remove last pup-joint when possible
7. Switch off the hydraulic power supply to the CRT.
8. Set CRT into skid, slips CRT must remain open

NOTE: If the casing stick up is too large (>63” / > 1.6M), above procedure may not be possible. See Emergency R/D and R/D CRT without skid. Place the CRT into the skid off well center.

9. Lower block until compensator is stroked in completely.
10. Disconnect CRT hoses from rotating head
11. Connect ph hoses to rotating head.
12. Remove links from CRT ears and close CRT link retainers again
13. Break CRT connection and spin out slowly.
14. P/U block. keep links clear of CRT upper link “grabber”
15. Lock CRT onto skid CRT.
16. Install slings to CRT skid
17. Set CRT aside with crane.

## If stick-up is over 63” (1.6 meters), rig down as follows

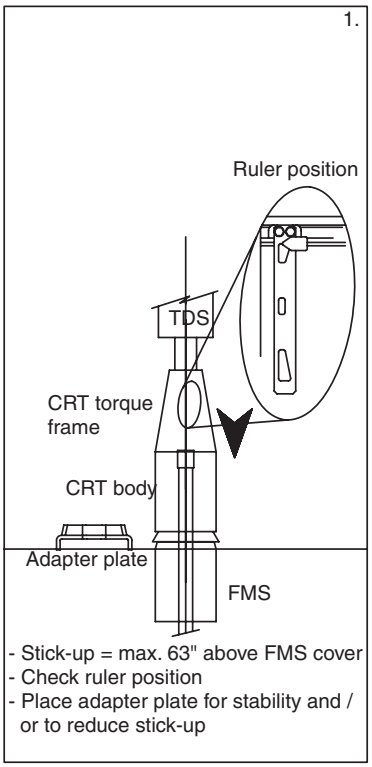
### Procedure

1. See emergency R/D

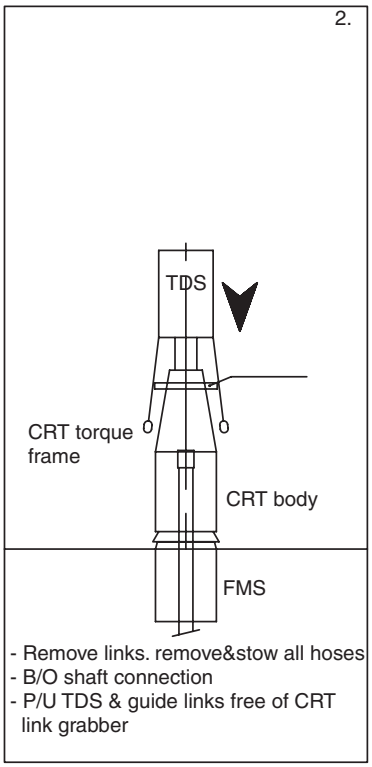
**WARNING: Lift the CRT by the link ears ONLY. Lifting by other points is prohibited**

# Operation

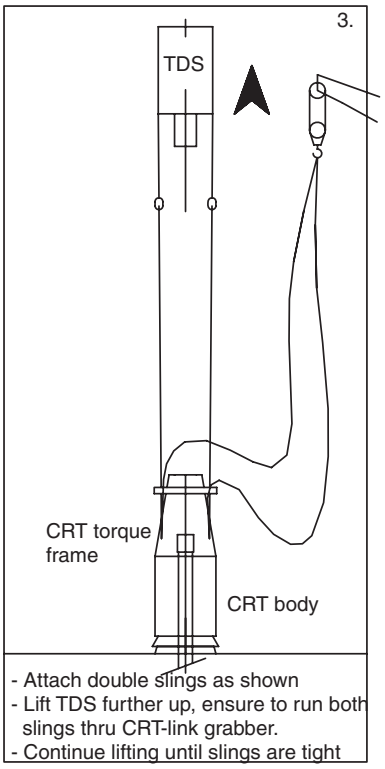
## Graphics Rig Down



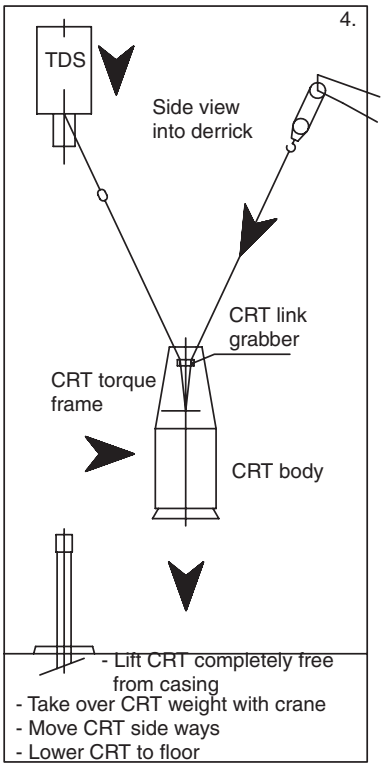

- Stick-up = max. 63" above FMS cover
- Check ruler position
- Place adapter plate for stability and / or to reduce stick-up




- Remove links. remove&stow all hoses
- B/O shaft connection
- P/U TDS & guide links free of CRT link grabber



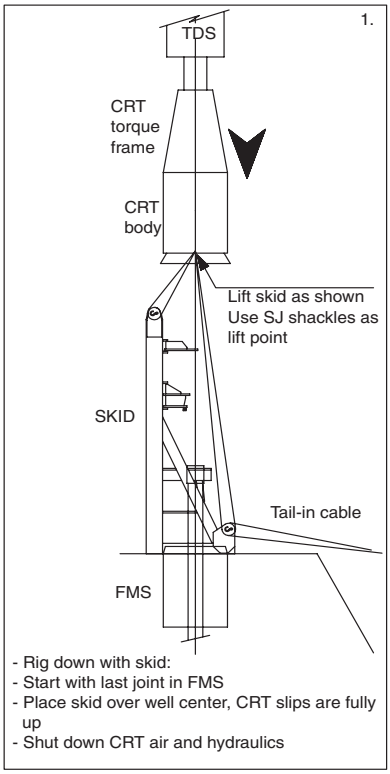

- Attach double slings as shown
- Lift TDS further up, ensure to run both slings thru CRT-link grabber.
- Continue lifting until slings are tight



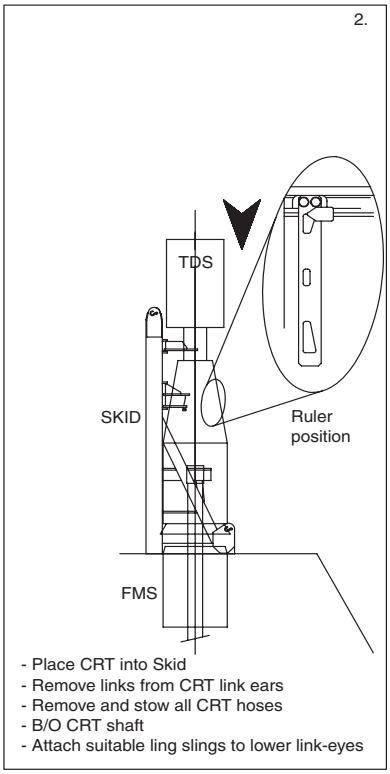

- Lift CRT completely free from casing
- Take over CRT weight with crane
- Move CRT side ways
- Lower CRT to floor

# Operation

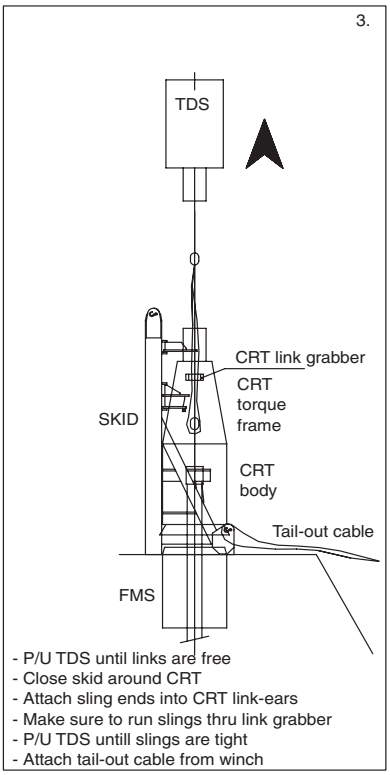
## Graphics Rig Down with skid



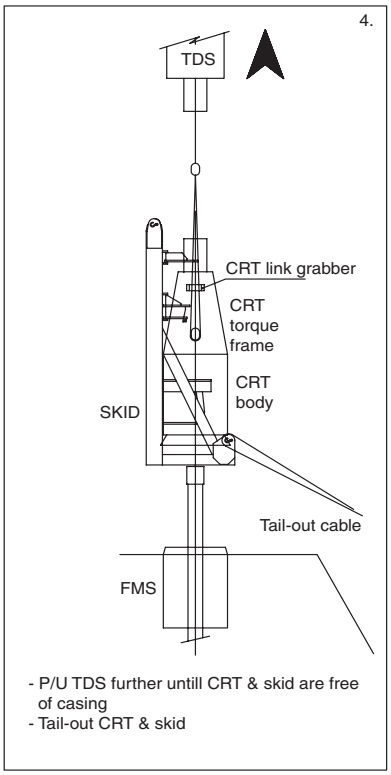

- Rig down with skid:
- Start with last joint in FMS
- Place skid over well center, CRT slips are fully up
- Shut down CRT air and hydraulics




- Place CRT into Skid
- Remove links from CRT link ears
- Remove and stow all CRT hoses
- B/O CRT shaft
- Attach suitable ling slings to lower link-eyes




- P/U TDS until links are free
- Close skid around CRT
- Attach sling ends into CRT link-ears
- Make sure to run slings thru link grabber
- P/U TDS untill slings are tight
- Attach tail-out cable from winch




- P/U TDS further untill CRT & skid are free of casing
- Tail-out CRT & skid

# Operation

## Post job maintenance filling up tool

*CAUTION: Always drain the CRT immediately after the casing run in order to prevent spillage and damage of the FAC tool*

### Procedure

1. Remove FILLING UP TOOL tool from CRT tool.
2. Remove guide cone, spacer and packer cup.
3. Remove catch plate, upper spacer & top sleeve.
4. Clean all components with a water blaster or similar, inside and out.
5. Inspect all threads & check for deformation, damage etc.
6. Check packer & guide cones for deformation, cuts, abrasions & rubber degradation, especially around the sealing face of the cup, and on the inside sealing lip.
7. Check catch plate for damage.
8. If the buttons show signs of corrosion then the bottom sleeve assembly will have to be removed and cleaned. Care should be taken to ensure that the button springs are not damaged when removing the lower sleeve assy.
9. Grease catch plate via grease nipples.
10. Grease buttons via grease nipples.
11. Reassemble all components as required.

## Fill up tool mud valve disassembly

NOTE: The valve, valve seat, and valve body are coated. The coating is brittle and can easily chip if dropped or struck. Care should be taken with these parts during disassembly.

### Procedure

1. Remove all grub screws.
2. Remove fill-up valve from the FILLING UP TOOL Tool (Left-hand thread).
3. Remove the mule shoe (left-hand thread)
4. Insert the inner assembly tool into the upper end of the spring housing and engage the key on the end of this tool into the key way of the valve body. Screw the nut into the top end of the spring housing (left-hand thread) until the holes in this nut and the inner assembly tool line up. Place a ½" (12 mm) bolt or pin through the holes of these parts.
5. Using a 1 $^{3}/_{8}$" end wrench, remove the valve from the valve body while holding a back up on the upper end of the inner assembly tool (right hand thread).
6. Remove the valve seat, valve body, spring piston and spring assembly from the spring housing.
7. Remove the check valve (ball) from the valve body.
8. Remove the spring assembly from the valve body.
9. Remove the spring piston from the valve body.

## Operation

10. Remove and check all seals and the check valve ball.
11. Clean and inspect all parts. Use spray gun equipped with pipe bore cleaner to clean the inside of the spring housing.
12. Inspect the valve, valve body, and valve seat for signs of cracking, crazing, chipping, erosion, or wear. Discard the valve, valve body, or valve seat if there are any signs of erosion.
13. Inspect check valve sealing surfaces.
14. Inspect the upper end of the spring housing seal surface for wear, erosion or corrosion. Discard the spring housing if it is apparent that it has or will not provide a sealing surface for the spring piston. Ensure that inside of spring housing is clear of all debris.
15. Carry out compression test on spring to ensure that it moves freely.

# Assembly

## General safety

NOTE: All images in this chapter are for info only. Please use the official drawings for reference

**WARNING: Make sure that all hydraulic lines are isolated before any work is performed on the CRT.**

**WARNING: When working on the CRT, lock and tag the controls in order to prevent unexpected movement of the CRT.**

**WARNING: Do not weld on CRT or individual parts**

NOTE: Prior to assembly or disassembly, clean the CRT thoroughly with a steam-cleaner in order to prevent the parts from getting contaminated with dirt, mud etc.

## Before (dis)assembly of the CRT.

### Procedure

1. All tools are at hand
2. Hoisting equipment is available
3. Lifting equipment is suitable for handling heavy parts (crane, lifting bands, chains, eyes etc)
4. If the CRT is connected to a power unit, bleed the system prior to assembly / disassembly as follows:
   - Shut the valve in the Pressure line
   - Shut off the power unit
   - Give command <slips up> and <slips set> a number of times
   - Gve command <circulation mode> a number of times

## Torques

Use the proper torque for assembly parts. Applying too much torque easily could damage cartridges. See the torque lists in this manual.

## Required tools

For normal maintenance and repair, standard tools will be sufficient for all work. However, bigger size spanners may be required for hydraulic tubes

# (Dis)-assembly hoist swivel ring

**WARNING: Loads may slip or fall if proper hoist ring assembly and lifting procedures are not used. A falling load may cause serious injury or death.**

**WARNING: Make sure there are no spacers (washers) used between bushing flange and the mounting surface**

1. Always be sure threads on shank and receiving holes are clean, not damaged, and fit properly.
2. APPLY LOCKTITE NO. 243 TO THE THREAD.
3. Installation torque: 100 ft-lbs (136 Nm)
4. SWL hoist ring: 2,267 Kg (5,000 lbs)
5. After installation, always ensure free movement of link. The link should pivot 180º and swivel 360º.
6. Ensure free movement of the bail. It should pivot 180° and swivel 360°.

# (Dis)-assembly FAC-tool

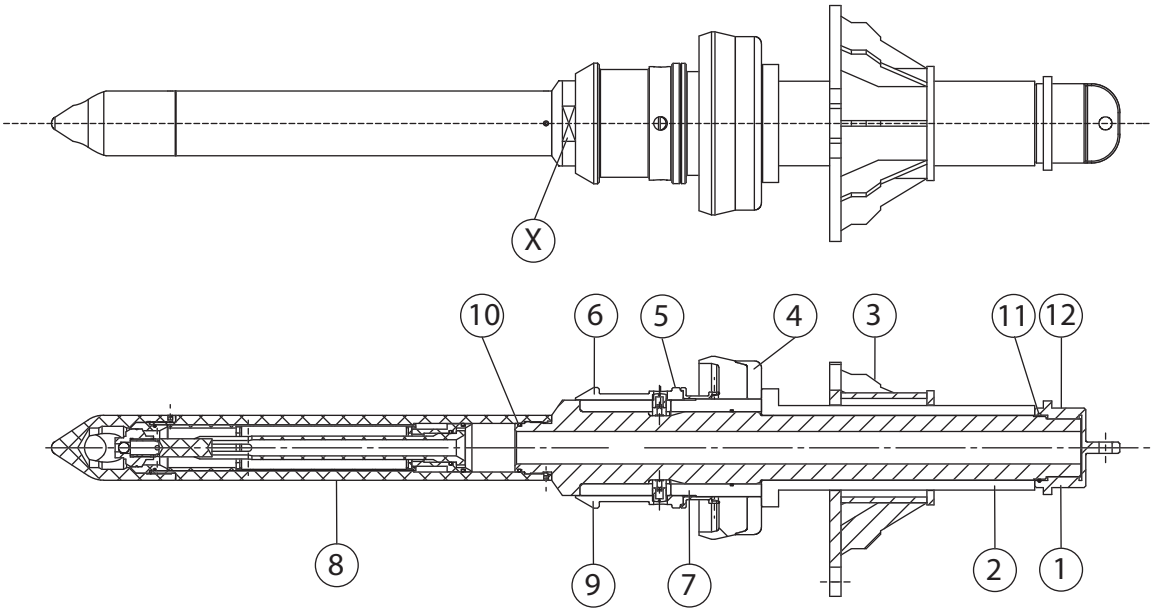
## Recommended grease

NOTE: Immerse all parts in Rust Veto 201, or equivalent until all parts are completely coated inside and out. Grease all o-rings and seals with Shell Durina or a similar grease.

## (Dis)-assembly fill up tool mandrel

### Procedure

1. Ensure the size components (packer cup, spacer and guide cone) are removed
2. Clamp the mud saver horizontally into a suitable clamp
3. Remove the lift cap (1) and catch plate (3)
4. Slide off the upper spacer (2)
5. Slide off the top sleeve assy (7)
6. Release the 4 buttons by depressing and turn 90°.
7. Slide off the bottom sleeve carefully (9) in a rotating action to ease removal.
8. When passing the changing diameter of the innder mandrel, the springs inside the 4 button assemblies will release. Ensure don't loose or damage them.
9. Remove the 3 grub screws on the connection by depressing and turn 90°.
10. Break the connection with the mud saver valve (LH-thread). Use the flat surface (X) as gripping area for the wrench.
11. Check condition of O-ring, grub-screws, buttons, sliding parts etc. Clean and lubricate prior to assembly.



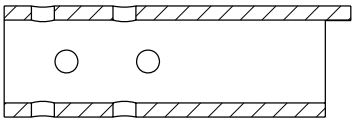

## (Dis)-assembly fill up tool mud valve

### Procedure

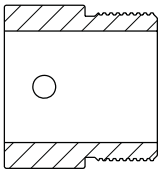
1. Fit o-ring (part #2-329 ) into the inner groove of the spring piston.
2. Fit o- ring (part # 2-337) into the outer groove of the spring piston.
3. Fit the upper end of the spring piston onto the valve body to the shoulder (o- ring will be near the top of the valve body).
4. Assemble the spring assembly into the spring housing being certain that the upper end of the spring assembly (spring end) is at the upper end of the spring housing.
5. Fit o- ring (part # 2-233) into the outer groove of the valve seat.
6. Place the upper end of the valve seat into the lower end of the spring housing.
7. Screw the mule shoe onto the lower end of the spring housing hand tight to hold the valve seat in place.
8. Place the valve body and spring piston assembly into the upper end of the spring housing and spring assembly.
9. Place the check ball into the lower end of the valve body.
10. Screw the valve onto the valve body hand tight.
11. Place the inner assembly tool into the upper end of the spring housing engaging the key on the end of this assembly tool into the keyway of the valve body. Screw the assembly tool nut into the upper end of the spring housing until the holes in the nut and inner assembly tool line up. Place a ½" (12 mm) bolt or pin into the holes of these parts.
12. Tighten the valve to the valve body with a 1-$^{3}/_{8}$" end wrench and tighten to 150 ft-lb (203 Nm) while holding back-up on the upper end of the inner assembly tool (right hand thread).
13. Tighten the muleshoe to the top sub to 1,500 ft-lb (2030 Nm) (left hand thread).
14. Fit Grub Screws.

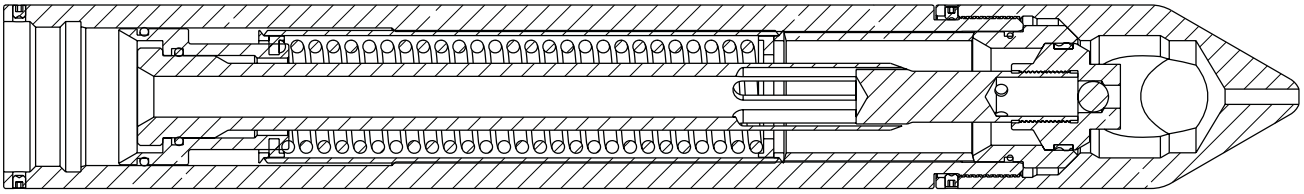
15. Repaint as necessary.
16. Re-grease all exposed threads and replace thread protectors.

Assembly tool 1

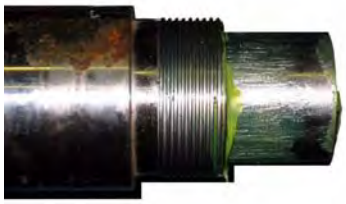


Assembly tool 2





## For info only



Observe the LEFT HAND thread. Lubricate

Fit the part onto the shaft

Slide the shaft into the fill up tool

Fit the nut on the other side

Use the special tool on this side for locking the shaft

Use a spanner to tighten the nut (RIGHT HAND THREAD)

Fit the end cap

Use a wrench to fit the end cap

Lubricate the threat liberally

Fit the mule shoe

Use a wrench to tighten the mud saver valve

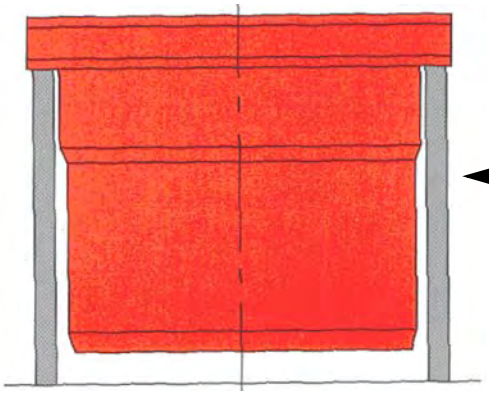
Finally secure the hexon screws

## (Dis)-assembly of the body

Follow the reverse order for disassembly of the CRT-body

### Procedure No. 1

1. Put the manifold into position on the CRT-body. Tighten the bolts and lock wire.
2. Use some liquid GASKET on the mounting surface of the block.
3. Lower the 4 cylinders into the mounting holes
4. Fit the outer bolts, but do not tighten yet.
5. Fit the 2 body-hinge pins.
6. Position the 2 body halves in the CRT-body load test fixture as outlined in figure.
7. If no such arrangement can be made, position both halves on a flat machined surface.



Aligning the body

NOTE: A concrete floor does NOT provide sufficient flatness.

**WARNING: Align the cylinders properly, preferably by using the cylinder installation tool pn 50000080-4, as not properly aligned cylinders will lead to failure and equipment damage during usage.**

8. Ensure the CRT-body bore is clean
9. Fit the special assembly tool pn#50000080-4 in the remaining “inside” holes of the cylinder-flanges

10. Drive the assembly tool down with a mallet into the upper clamping cone, until it stops “wobbling”. The cylinders are now centered.
11. Check the spacing between the alignment tool and the clamping cone. The clearance should be equal or nil measured over the circumference. Use a thin caliper.
12. Tighten and torque the outer bolts with 185-205 ft-lbs (250 - 275 Nm) and lock wire.
13. Remove the special assembly tool
14. Fit the “inside” bolts, tighten and torque with 185-205 ft-lbs (250 - 275 Nm) and lock wire.
15. Remove the CRT-body from the load test fixture, remove the removable hinge pin and split the bowl
16. Finalize the assembly except the leveling beams.
17. Close the CRT and position it back in the load test fixture
18. Raise the clinder pistons hydraulically with minimum hydraulic pressure.
19. Assemble the levelling beams. They should drop gently over the 4 cylinder rods.

*CAUTION: If it is necessary to rotate the piston rods to locate into the leveling beam always rotate clockwise and without hydraulic pressure in the system. This is to prevent any failing of the secured piston units.*

20. Fit the nuts by hand. Do not torque.
21. With the levelling beam down and without pressure in the system torque the levelling beam nuts with 760-900 ft-lbs (1,030 - 1,220 Nm) and secure them with cotterpins.
22. Assemble the leveling beam pins and fit a slips set.
23. Let the slips engage an appropriate piece of casing pipe.
24. Check easy (dis) assembly of the levelling beam pins with the levelling beam in the up and down positions. Adjust if necessary.
25. Check the position of the levelling beam indicator valve. The valve must be activated when the back of the slips is in the 9.5° taper and the teeth on the inserts are about to contact the pipe.

26. Remove the pipe and the slips.
27. Finally pressurize (2,500 psi - 17,200 KPa) and function test the unit for 5 minutes with the cylinders fully extended and then fully extracted.

### Checking cylinder alignment of an existing CRT-body.

**Procedure No. 2**

1. Check all hydraulic lines and connections for signs of wear or leaks.
2. Ensure the leveling beams are in top position
3. Remove the removable hinge pin and the leveling beams.
4. Remove the cylinder inner mounting bolts. Leave the outer bolts in place
5. Position the CRT-body in the load test fixture or on a flat machined surface.
6. Ensure the CRT-body bore is clean
7. Fit the special assembly tool pn#50000080-4 in the remaining “inside” holes of the cylinder-flanges. When it doesn’t fit, loosen the outer cylinder bolts and start with step 9 of procedure No. 1.
8. Check for even spacing or non-clearance between tool cone and body upper clamping cone. When an uneven clearance is detected, loosen the outer cylinder bolts and start with step 9 of procedure No. 1.
9. Check that plate rests on 4 cylinder flanges evenly and does not wobble. When it wobbles there is probably also uneven clearance. Again, loosen the outer cylinder bolts and start with step 9 of procedure No. 1.
10. Now start with step 18 of procedure No. 1.

*CAUTION: If it is necessary to rotate the piston rods to locate into the leveling beam always rotate clockwise and without hydraulic pressure in the system. This is to prevent any failing of the secured piston units.*

## Dis-assembly torque frame

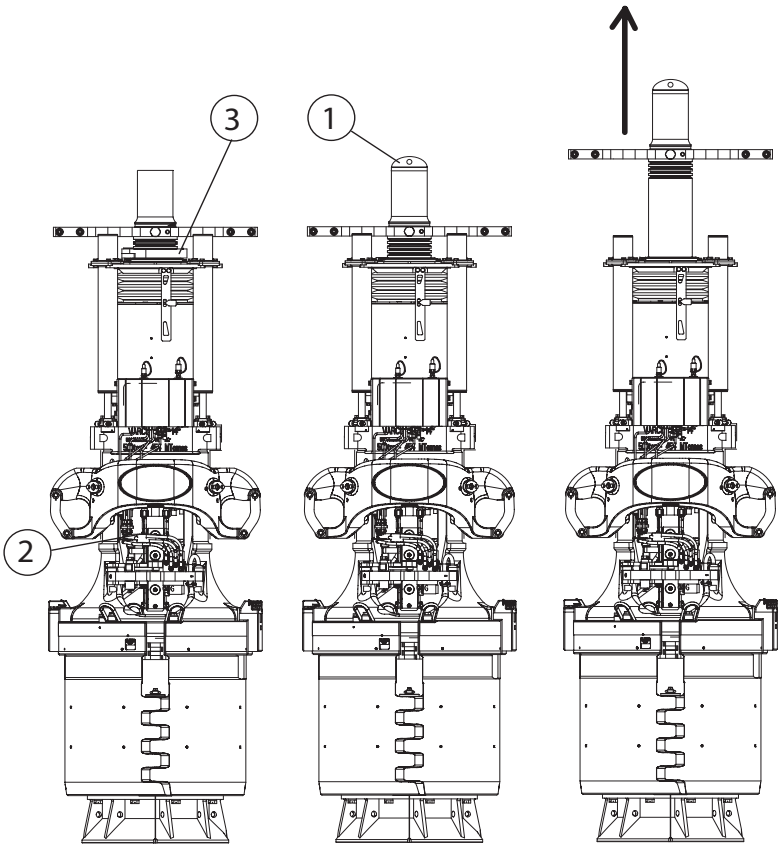
### Change out of main shaft

**Procedure**

1. Fit lift cap to main shaft (1)
2. Ensure FAC-tool grub screws are removed from CRT main shaft (2)
3. Pick up weight from shaft. Do NOT lift yet.
4. Remove shaft retainer clamp (3).

*CAUTION: Ensure the clamp is not dropped while loosening (22 Lbs - 10Kg). Watch out the main shaft while removing the clamp. It may sag.*

5. Lift out the main shaft.




## Change out compensator spring assy

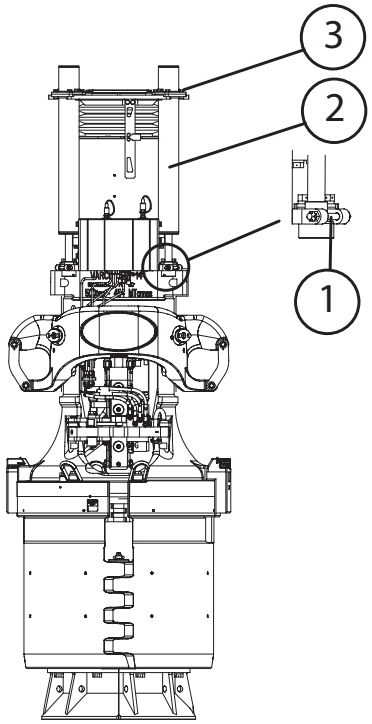
### Procedure

1. Ensure the CRT is in rest position (compensator fully stroked in)
2. Loosen up lower spring bracket bolts
3. Remove the lower retainer bolts from the spring bracket (4 plc)
4. Attached a suitable lifting sling around the tube of the compensator spring assy

*CAUTION: The compensator spring assy is heavy (*69 Lbs - 31 KG)

5. Remove the 2 bolts (5/8”) per compensator spring assy
6. Pull out the compensator spring assy from the lower brackets
7. Now lift and remove the compensator spring assy

**WARNING: Do not take the compensator spring assy apart. The spring inside is pre-tensioned and requires special tools for (dis)-assembly. Please contact Varco for guidance.**



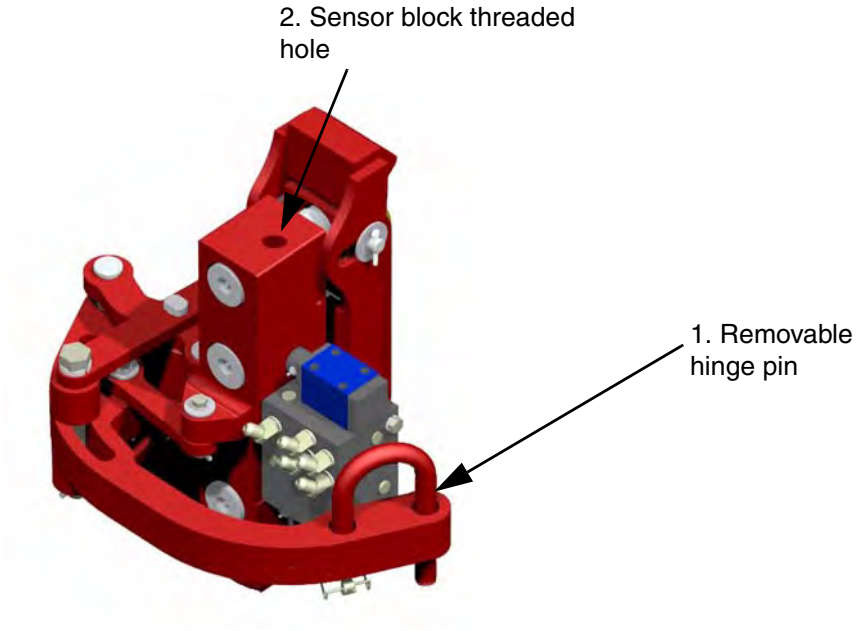

## Change out pipe sensor.

### Procedure

1. Support the torqframe in order to be able to remove the stationary hinge pin of the pipe sensor assy

**WARNING: Ensure the CRT torqueframe is stable and supported properly before attempting to carry out any work, as the torque frame is top-heavy.**

2. Ensure the tilting plate is removed.
3. Lock the hoist ring in it's upper position
4. Remove 5 hydraulic hoses from the pipe sensor
5. Remove removable hinge pin (1).
6. Attached a 1/2" eyebolt to the hole (2) on top of the sensor block
7. Support the pipe sensor assy with the overhead crane
8. Drive out cross pins from stationary hinge pin
9. Remove stationary hinge pin (upwards)




*CAUTION: The sensor block is heavy 50 kg (110 Lbs)*

## Change out pneumatic compensator

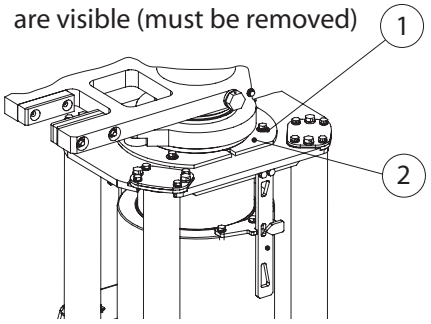
### Procedure

1. Ensure the main shaft is removed
1. Ensure the compensator spring assy's are removed
2. Remove the locking plates (1 & 2). (2 plc)
3. Remove the 8 bellow retainer ring bolts (covered by locking plates 1)
4. Remove the uppper compensator support plate
5. Remove the lower bellow retainer ring
6. Remove the rubber bellow
7. Attach two eye bolts in the INNER tube of the pneumatic compensator cylinder
8. Attach two appropriate lifting slings to the eye-bolts. Pick up the weight without lifting.
9. Remove the tubing to the compensator
10. Remove the 8 pneumatic compensator bolts
11. Lift the compensator from the torque frame

**WARNING: Do not lift the pneumatic compensator at the outer barrel. The inner part may drop**

NOTE: It is advised to prevent the inadvertant separations of the inner barrel from the outer piston barrel by mounting two bolts with large washer in the outer barrel (bottom side).

In this image mainshaft, compensator spring assy's are visible (must be removed)




## Change out splined ring

### Procedure

1. All above described items must have been removed
2. Remove all bolts of the lower flange
3. Use the 3 threaded holes to press out the splined ring of it's mounting surface
4. Be aware of the 2 torque pins. They are a light press fit inside the torque frame and spline ring. They may not come out easily. There is no need for removing from the torque frame by force if not damaged.

## Change out hoist ring

### Procedure

1. Remove above described parts. There is no need to remove the main-shaft (ex. link grabber), pneumatic compensator cylinder and the splined ring
2. Pick up the weight of the hoist ring
3. Fully turn out the hex. screws till they touch the oval cover rings.
4. Lower the hoist ring untill seated
5. Remove the lock pins and keys.
6. There are holes located inside the torque frame to enable one to drive out the lock pins.
7. Lift the hoist ring.
8. Rotate the hoist ring 90° and lift it off the torque frame completely.

# Trouble shooting

## Prior to trouble shooting a problematic CRT

NOTE: When problems occur, carry out the following checks according the PCOL-rule.

**WARNING: Make sure that all hydraulic lines are disconnected and the ball valve is closed before ANY work is carried out on the CRT**

NOTE: When problems cannot be solved please contact an authorized Varco BJ repair facility

**P.** Check that Pressure is between 1,800 and 2,500 Psi (12,410 - 17,200 KPa) at the inlet of the manifold and air pressure between 70 and 150 Psi (480 - 1,030 KPa)

**C.** Check that all hoses and quick disconnects are properly.

**O.** Check whether Oil leakage is visible at manifold blocks, Quick Disconnects or hoses.

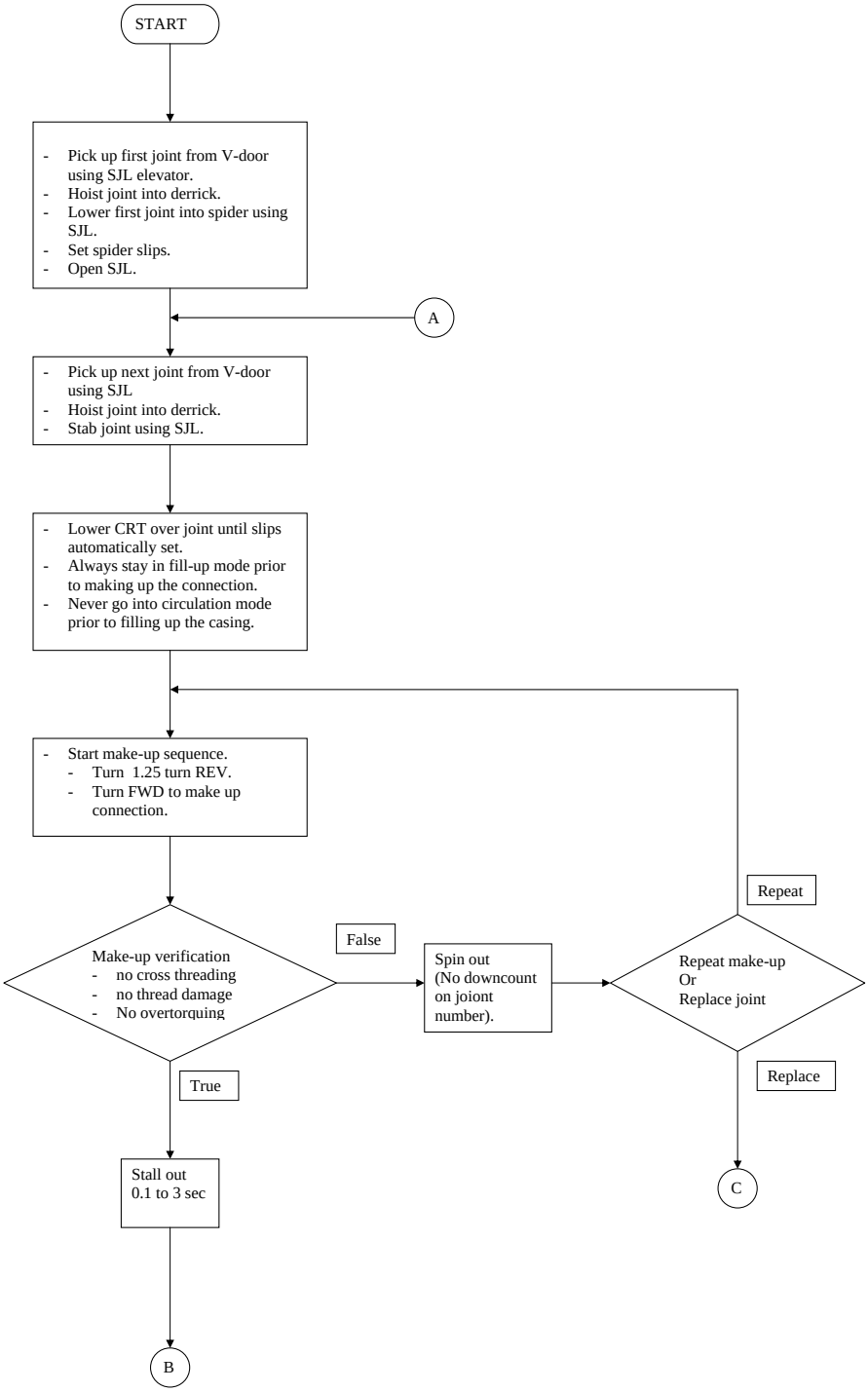
**L.** Check Lubrication status of tool.

NOTE: See drawings 50008200-20 sheet 1 & 2 for trouble shooting. See also drawings 50008200(-)TDS-SBE page 1 to 3 and 50008200(-)TDS-RLA page 1 to 3

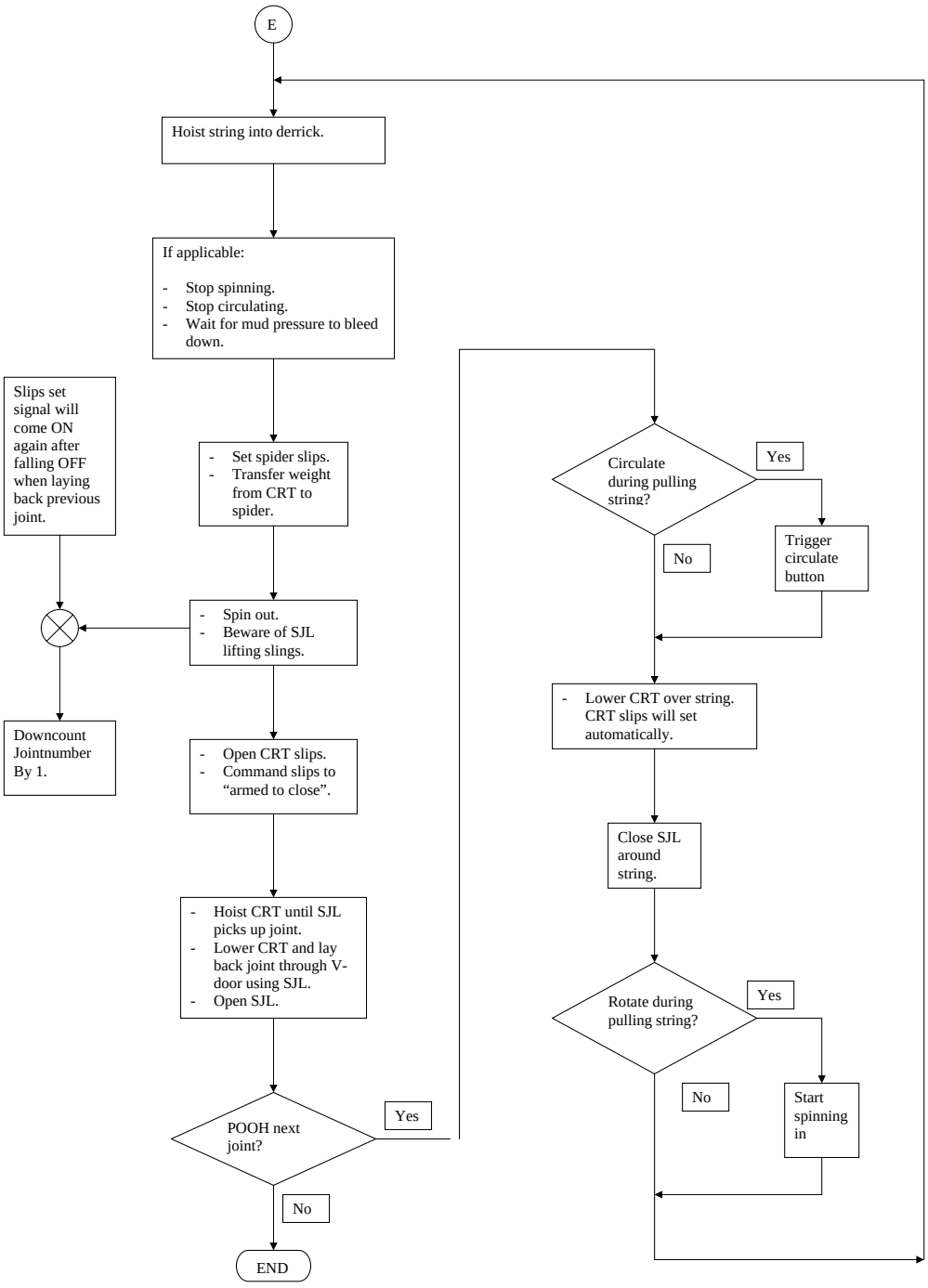
# Graphics trouble shooting operation RIH/POOH



RIH / POOH



Page 2 of 5


E
Hoist string into derrick.
If applicable:
- Stop spinning.
- Stop circulating.
- Wait for mud pressure to bleed down.
Slips set signal will come ON again after falling OFF when laying back previous joint.
- Set spider slips.
- Transfer weight from CRT to spider.
- Spin out.
- Beware of SJL lifting slings.
Downcount Jointnumber By 1.
- Open CRT slips.
- Command slips to "armed to close".
- Hoist CRT until SJL picks up joint.
- Lower CRT and lay back joint through V-door using SJL.
- Open SJL.
POOH next joint?
Yes
No
END
Circulate during pulling string?
Yes
No
Trigger circulate button
- Lower CRT over string. CRT slips will set automatically.
Close SJL around string.
Rotate during pulling string?
Yes
No
Start spinning in

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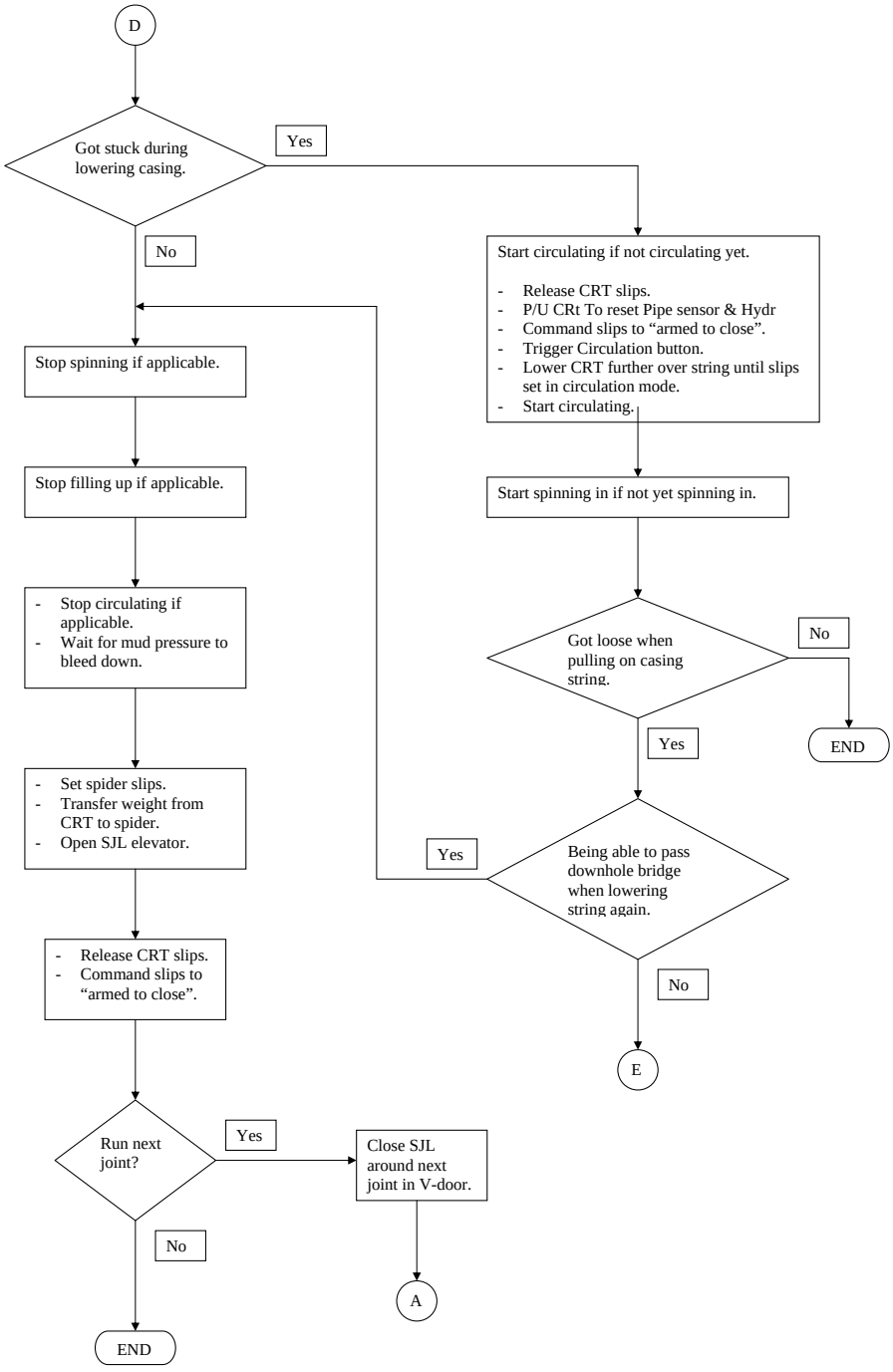
D
Got stuck during lowering casing.
Yes
No
Start circulating if not circulating yet.
- Release CRT slips.
- P/U CRt To reset Pipe sensor & Hydr
- Command slips to “armed to close”.
- Trigger Circulation button.
- Lower CRT further over string until slips set in circulation mode.
- Start circulating.
Stop spinning if applicable.
Stop filling up if applicable.
Start spinning in if not yet spinning in.
- Stop circulating if applicable.
- Wait for mud pressure to bleed down.
Got loose when pulling on casing string.
No
Yes
END
- Set spider slips.
- Transfer weight from CRT to spider.
- Open SJL elevator.
Yes
Being able to pass downhole bridge when lowering string again.
- Release CRT slips.
- Command slips to “armed to close”.
No
E
Run next joint?
Yes
Close SJL around next joint in V-door.
No
A
END

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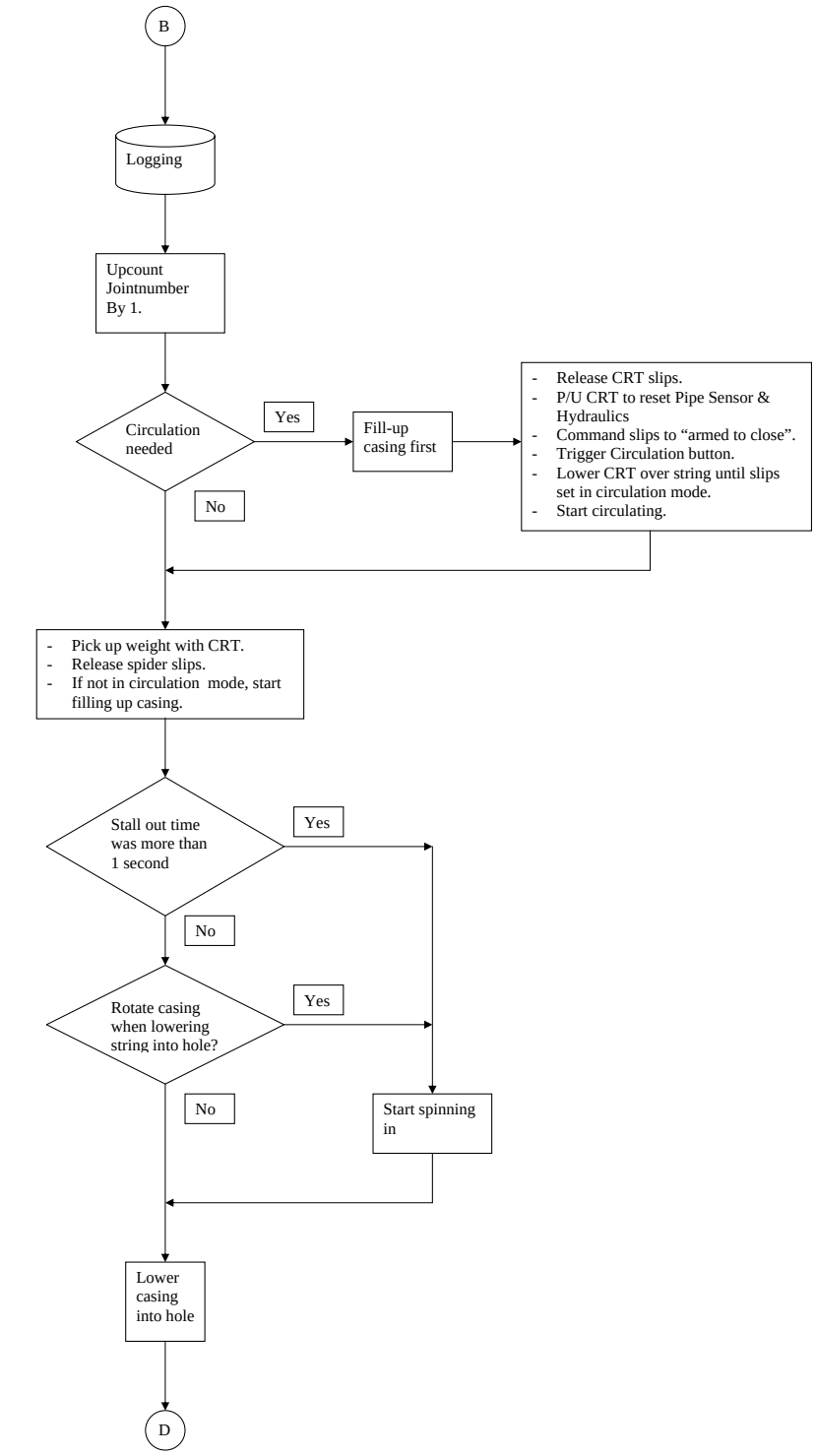
B
Logging
Upcount Jointnumber By 1.
Circulation needed
Yes
Fill-up casing first
- Release CRT slips.
- P/U CRT to reset Pipe Sensor & Hydraulics
- Command slips to “armed to close”.
- Trigger Circulation button.
- Lower CRT over string until slips set in circulation mode.
- Start circulating.
No
- Pick up weight with CRT.
- Release spider slips.
- If not in circulation mode, start filling up casing.
Stall out time was more than 1 second
Yes
No
Rotate casing when lowering string into hole?
Yes
No
Start spinning in
Lower casing into hole
D

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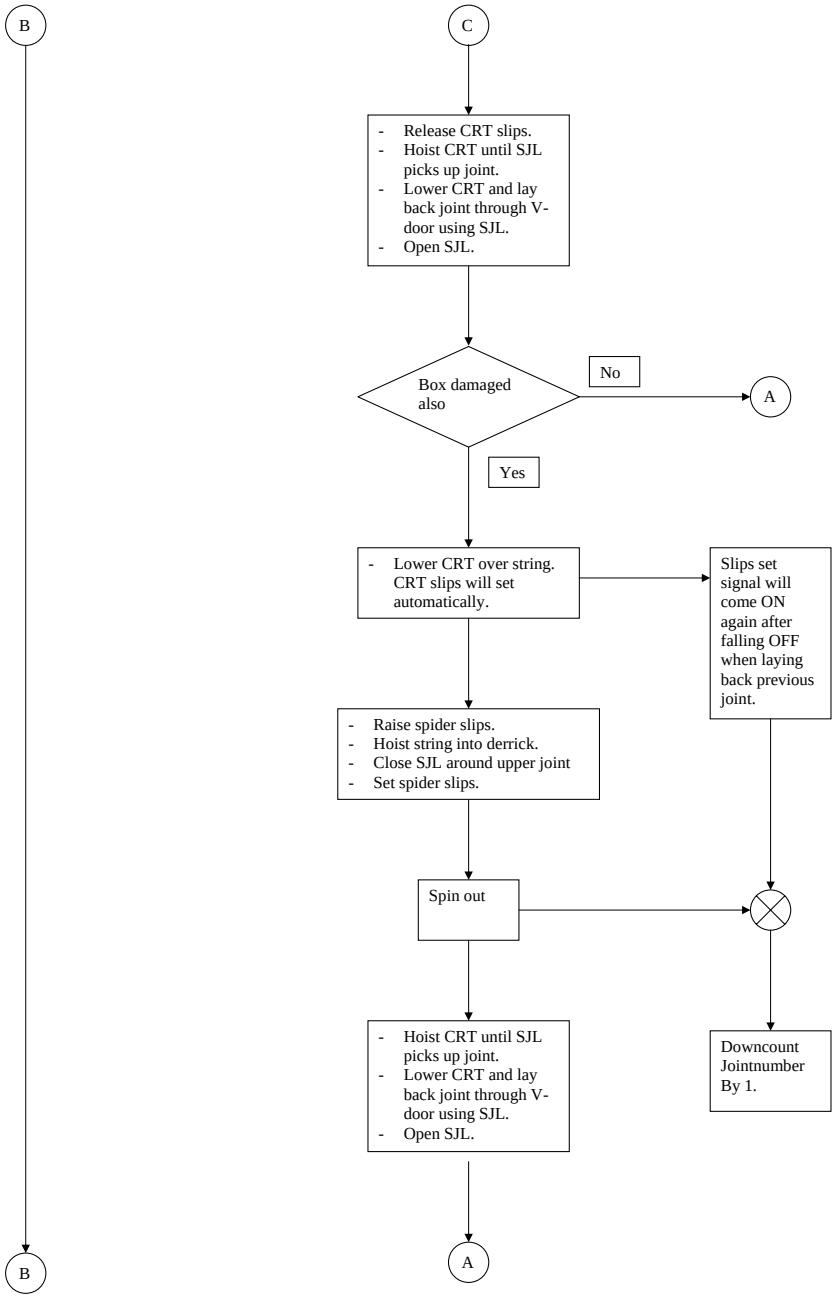

B
C
- Release CRT slips.
- Hoist CRT until SJL picks up joint.
- Lower CRT and lay back joint through V-door using SJL.
- Open SJL.
Box damaged also
No
A
Yes
- Lower CRT over string. CRT slips will set automatically.
Slips set signal will come ON again after falling OFF when laying back previous joint.
- Raise spider slips.
- Hoist string into derrick.
- Close SJL around upper joint
- Set spider slips.
Spin out
- Hoist CRT until SJL picks up joint.
- Lower CRT and lay back joint through V-door using SJL.
- Open SJL.
Downcount Jointnumber By 1.
B
A

# Appendixes

## One year spare parts

### One year spares kit p/n 50008200-11

| Item No | Qty | Partnumber | Description |
|---|---|---|---|
| 1 | 2 | 944515-2 | 5/8" shackle, bolt type |
| 2 | 4 | 50008017-500 | Wear block link grabber 500t link |
| 3 | 2 | 50008018 | Link grabber torque pin |
| 4 | 4 | 50308-C | Hex jam nut ½"unc |
| 5 | 4 | 50608-32-C | Flat head cap screw ½"unc 4.00"long |
| 6 | 4 | 979485-13 | SS lockwasher 13mm acc. din 432 |
| 7 | 1 | 50008170 | Pipe sensor valve |
| 8 | 2 | 50008170-1 | Pipe sensor valve plunger |
| 9 | 2 | 50008171 | Ball, sensor valve |
| 10 | 8 | 50167-30-P04 | Socket head cap screw m5x30mm |
| 11 | 5 | 56557-6-6-S | Elbow 45degr, 9/16"unf "o"ring to –6jic |
| 12 | 2 | 30107236-1AN | Sequence valve sun scca-lan |
| 13 | 4 | 50167-90-P04 | Socket head cap screw m5x90mm |
| 14 | 3 | 979798-1 | Gauge connect mev20 m16*2 – 7/16"unf |
| 15 | 2 | 55909-4-4 | Male quick connect fd45 #4 |
| 16 | 2 | 55908-4-4 | Female quick connect fd45 #4 |
| 17 | 1 | 55909-6-6 | Male quick connect fd45 #6 |
| 18 | 1 | 55908-6-6 | Female quick connect fd45 #6 |
| 19 | 2 | 55909-8-8 | Male quick connect fd45 #8 |
| 20 | 3 | 55908-8-8 | Female quick connect fd45 #8 |
| 21 | 1 | 55909-12-12 | Male quick connect fd45 #12 |
| 22 | 1 | 55908-12-12 | Female quick connect fd45 #12 |
| 23 | 2 | 55915-4 | Dust cap plastic #4 |
| 24 | 1 | 55915-6 | Dust cap plastic #6 |
| 25 | 2 | 55915-8 | Dust cap plastic #8 |
| 26 | 1 | 50008490 | Hose T1 connection |
| 27 | 2 | 50008491 | Hose PS connection |
| 28 | 2 | 50008492 | Hose A3 connection |
| 29 | 2 | 50008493 | Hose A4 connection |
| 30 | 1 | 912374-1 | Safety lock pin sensor |
| 31 | 4 | 979771-2220 | Plain bearing 22x25-20mm |
| 32 | 4 | 979771-1815 | Plain bearing 18x20-15mm |
| 33 | 6 | 979771-4030 | plain bearing 40x44-30mm |
| 34 | 8 | 51222-06-12 | Pin spiral ss ¼" – 1.5" long |
| 35 | 2 | 59000240 | Compression spring d-292-a |
| 36 | 1 | 59000241 | Compression spring d-291 |
| 37 | 1 | 59000057-320 | Dirt scraper compensator cyl. |
| 38 | 1 | 59000058-29320 | Guide strip compensator cyl. |
| 39 | 1 | 59000058-29380 | Guide strip compensator cyl. |
| 40 | 1 | 59000059-81 | Seal, barrel 380mm dia |
| 41 | 1 | 59000060-81 | Seal, piston 320mm dia |
| 42 | 1 | 59000338 | Air manifold package |
| 43 | 4 | 50803-R-C | Washer # 10 |
| 44 | 1 | 50514-C | Nut 7/8"-9 UNC |

**One year spares kit p/n 50008200-11 CONT.**

| | | | |
|---|---|---|---|
| 45 | 1 | 50008205-1 | Assy lock screw FAC tool |
| 46 | 1 | 51403-16-S | Cotter pin 3/16” |
| 47 | 3 | 50167-45-P04 | Socket head cap screw m5x45mm |
| 48 | 3 | 50167-70-P04 | Socket head cap screw m5x70mm |
| 49 | 1 | 979849-4 | Air gauge 0-150psi |
| 50 | 3 | 980018-4 | Gauge connector mev20 - -4 jic swivel |
| 51 | 1 | 980017-4 | Gauge connector bsp ¼” – m16-2 swivel |
| 52 | 1 | 203261 | Link block bolt |
| 53 | 1 | 50008494 | Hose B3 connection |
| 54 | | 50008495 | 1/2” hose ZD up & down |
| 55 | 2 | 200938 | Upper link pin fms |
| 56 | 2 | 200939-1 | Lower link pin assy, fms |
| 57 | 2 | 200936-11 | Levelling beam pin assy, fms |
| 58 | 2 | 200960 | Levelling beam nut, fms |
| 59 | 1 | 980473-2 | Hoist swivel adb, 5000lbs |
| 60 | 1 | 980473-10 | Hoist swivel adb, 2250lbs |
| 61 | 2 | 200973-1 | 3/8” hose assy, j8-j8-9.3/8” long |
| 62 | 1 | 980312-14 | ¼” hose assy, j6-j45 6 14” long |
| 63 | 1 | 59901006-53 | ¼” hose assy, j45s6 – j45s6 53” long |
| 64 | 2 | 50008235-11 | Seal kit cylinder |
| 65 | 1 | 979504-1 | Connector 1-1/16"-12 o-ring/ ¾"-14 nptf |
| 66 | 1 | 979504-2 | Connector 1-1/16"-12 o-ring/ ½"-14 nptf |
| 67 | 4 | 7887 | Lynch pin ½” |
| 68 | 4 | 7903 | Pull loop. |
| 69 | 1 | 50008026-15 | Safety cable bell guide |
| 70 | 2 | 944515-2 | 5/8” shackle, bolt type |
| 71 | 1 | 50008384 | Hose 1/2” Cyl B to Cyl SAE-100R2A-8-J90S-J90S-H1 |
| 72 | 1 | 50008384 | Hose 1/2” Cyl B4C to Cyl SAE-100R2A-8-J90S-J90S-H13 |
| 73 | 1 | 50008384 | Hose 3/8” Ux to DV1 SAE-100R2A-6-JS-J4SS-H41 |

# Commissioning spares

## Commissioning spares kit p/n 50008200-12

| ITEM# | QTY | PARTNUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 55909-12-12 | male hydr. quick connect ¾” fd-45 |
| 2 | 1 | 55909-8-8 | male hydr. quick connect ½” fd-45 |
| 3 | 1 | 979504-1 | connector 1-1/16"-12 o-ring/ ¾"-14 nptf |
| 4 | 1 | 979504-2 | connector 1-1/16"-12 o-ring/ ½"-14 nptf |
| 5 | 4 | 7887 | lynch pin ½” |
| 6 | 4 | 7903 | pull loop. |
| 7 | 1 | 50008026-15 | safety cable bell guide |
| 8 | 2 | 944515-2 | 5/8” shackle, bolt type |
| 9 | 3 | 55908-8-8 | valved coupler, qck disc./int pipe |
| 10 | 1 | 55909-6-6 | valved nipple, qck disc./int pipe |
| 11 | 1 | 55908-6-6 | valved coupler, qck disc. int pipe |
| 12 | 2 | 55909-4-4 | valved nipple, qck disc./int pipe |
| 13 | 2 | 55908-4-4 | valved coupler, qck disc. int pipe |
| 14 | 1 | 55908-12-12 | valved coupler, qck disc. int pipe |
| 15 | 4 | 50008017-500 | wear block link grabber 500ton link |
| 16 | 4 | 50308-C | nut, hex-jam (unc-2b) |
| 17 | 4 | 50608-32-C | screw, cap-flat head (unc-2a) |
| 18 | 3 | 979798-1 | pressure gauge connector |
| 19 | 4 | 979485-13 | lock washer s.s. din 432-13-a2 |
| 20 | 1 | 979849-4 | pressure gauge 0-150 psi |
| 21 | 1 | 980018-4 | pressure gauge connector |
| 22 | 2 | 50008031 | screw 1/2” UNC for compensator |
| 23 | 1 | 59000122 | silencer, exhaust, G 1/4”, BSP#4, BSP-4 |

# VARCO partnumbers BJS fac tools.

## 9-5/8” – 14” MKII FAC Tool

Varco Assy. number 50008251-10 (2006 version).

Full Spares Kit (incl. Mud valve Spares); # 50008251-11

Service Tools; # 50008251-12

| Varco Number | Description | Qty/Assy |
|---|---|---|
| 50008251-2 | Mandrel 9.5/8” –14” | 1 |
| 50008251-3 | Upper Spacer | 1 |
| 50008251-1 | Catch Plate 9.5/8”-14” 2003 | 1 |
| 50008251-1075 | 10.3/4” &UP Spacer | 1 |
| 50008251-963 | 9.5/8” Spacer | 1 |
| 50008054 | Top Sleeve Assy | 1 |
| 50008054-1 | Top Sleeve | 1 |
| 51300-250-B | “O” Ring | 1 |
| 50008053-20 | Mud Saver Valve | 1 |
| 50008055 | Bottom Sleeve Assy | 1 |
| 50008055-1 | Bottom Sleeve | 1 |
| 50008055-2 | Button Assembly | 4 |
| 50008058 | Lift Cap | 1 |
| 51300-337-B | “O” Ring | 1 |
| 51300-348-B | “O” Ring | 1 |

## 7” – 8.5/8” MKII FAC Tool

Varco Assy. number 50008256-10 (2006 version)

Full Spares Kit (incl. Mud valve Spares); # 50008256-11

Service Tools; # 50008251-12

| Varco Number | Description | Qty/Assy |
|---|---|---|
| 50008256-2 | Mandrel 7” MKII FAC | 1 |
| 50008256-3 | Sleeve, Spacer MKII FAC | 1 |
| 50008256-4 | “C” Plate 7” MKII FAC | 1 |
| 50008256-5 | SUB, Mud Valve. MKII FAC | 1 |
| 50008252-1 | Catch Plate 7” Tool 2003 | 1 |
| 50008053-20 | Mud Saver Valve | 1 |
| 50008058 | Lift Cap | 1 |
| 51300-231-B | “O” Ring | 1 |
| 51300-337-B | “O” Ring | 1 |
| 51300-348-B | “O” Ring | 1 |

## 4.1/2” – 6.5/8” Varco Tool FUT

Varco Assy. number 50008253. (2005 version).

Full Spares Kit ; # 50008253-11
This Tool has NO Mud-saver valve, so no special service tools required.

| Varco Number | Description | Qty/Assy |
|---|---|---|
| 50008253-2 | Mandrel 4.1/2” – 6.5/8” FUT | 1 |
| 50008252-3 | Guide Cone Sub | 1 |
| 50008253-4 | Centralizing Shaft | 1 |
| 50008058 | Lift Cap | 1 |
| 50008253-5 | 4.1/2” Tool C-Plate | 1 |
| 51300-134-B | “O” Ring | 2 |
| 51300-348-B | “O” Ring | 1 |
| 979628-8-8 | Grubb Screw M8 x 8 | 4 |

# Spare Part Kits and General Numbers.

## Spare parts KIT MUD Saver Valve 50008053-11

| Varco Number | Description | Qty/KIT |
|---|---|---|
| **50008053-11** | **Spares Mud Saver Assy** | |
| 51300-233-B | “O” Ring | 1 |
| 51300-329-B | “O” Ring | 1 |
| 51300-337-B | “O” Ring | 2 |
| 50008053-8 | ¾” Plastic Ball | 1 |

## Full Spare Parts KIT MKII FAC 7” - 8.5/8” 50008256-11

| Varco Number | Description | Qty/KIT |
|---|---|---|
| **50008256-11** | **Spare parts & Seal Kit** | |
| 50008053-11 | Spares Mud Saver Assy | 1 |
| 51300-231-B | “O” Ring | 2 |
| 51300-337-B | “O” Ring | 2 |
| 51300-348-B | “O” Ring | 2 |
| 979628-8-8 | Grubb Screw M8 x 8 | 8 |

## Full Spare Parts KIT VARCO FUT 4.1/2” -6.5/8”

50008253-11

| Varco Number | Description | Qty/KIT |
|---|---|---|
| 50008253-11 | Spare parts Kit | |
| 51300-134-B | “O” Ring | 2 |
| 51300-348-B | “O” Ring | 1 |
| 979628-8-8 | Grubb Screw M8 x 8 | 4 |

## Full Spare Parts KIT MKII FAC 9.5/8" – 14" 50008251-11

| Varco Number | Description | Qty/KIT |
|---|---|---|
| **50008251-11** | **Spare parts & Seal Kit** | |
| 50008053-11 | Spares Mud Saver Assy | 1 |
| 50008055-2 | Button Assy FAC Tool | 4 |
| 51300-250-B | "O" Ring | 2 |
| 51300-337-B | "O" Ring | 2 |
| 51300-348-B | "O" Ring | 2 |
| 979628-8-8 | Grubb Screw M8 x 8 | 8 |

## MUD valve Service Tools (Inner and Outer) 50008251-12

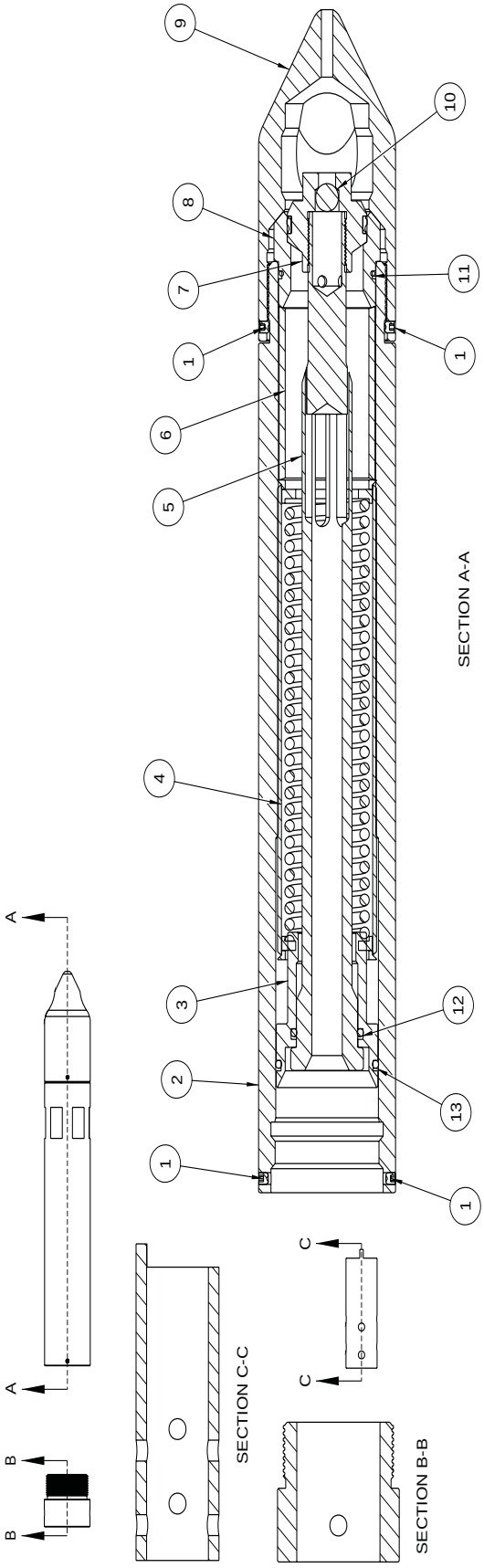
| Varco Number | Description | Qty/KIT |
|---|---|---|
| 50008251-12 | Inner & Outer Service Tools | 1 |

## Mud Saver Valve, Varco Part-number 50008053-20.

Seal Kit; (incl. Valve) # 50008053-11

Service Tools; # 50008251-12

| Item No. | Varco Number | Description | Qty/Assy |
|---|---|---|---|
| 1 | 9792628-8-8 | Grubb Screw M8x8 | 4 |
| 2 | 50008053-21 | Housing, short | 1 |
| 3 | 50008053-5 | Spring Piston. | 1 |
| 4 | 50008053-4 | Spring ass'y | 1 |
| 5 | 50008053-6 | Valve Body | 1 |
| 6 | 50008053-42 | Erosion sleeve | 1 |
| 7 | 50008053-7 | Valve | 1 |
| 8 | 50008053-3 | Valve Seat. | 1 |
| 9 | 50008053-2 | Mule Shoe. | 1 |
| 10 | 50008053-8 | 3/4" Plastic Ball | 1 |
| 11 | 51300-233-B | "O" Ring | 1 |
| 12 | 51300-329-B | "O" Ring | 1 |
| 13 | 51300-337-B | "O" Ring | 1 |


9
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SECTION A-A
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13
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1
A
C
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B
SECTION C-C
SECTION B-B

## Torque values (US) for bolts

| | | Bolts Lubricated with Light Machine Oil | | | Bolts lubricated with Anti-seize compound | | |
|---|---|---|---|---|---|---|---|
| | | Grade 8 | | | Grade 8 | | |
| **Dia.** | **Threads per inch** | **Min. Torque (ft lb)** | **Max. Torque (ft lb)** | **Clamp force (lb)** | **Min. Torque (ft lb)** | **Max. Torque (ft lb)** | **Clamp force (lb)** |
| Coarse Thread Series, UNC | | | | | | | |
| 1/4” | 20 | 11.4 | 12.6 | 2860 | 8.6 | 9.5 | 2860 |
| 5/16” | 18 | 24 | 26 | 3720 | 17.8 | 19.7 | 3720 |
| 3/8” | 16 | 43 | 47 | 7000 | 32 | 35 | 7000 |
| 7/16” | 14 | 67 | 74 | 9550 | 50 | 55 | 9550 |
| 1/2” | 13 | 105 | 116 | 12750 | 78 | 87 | 12750 |
| 9/16” | 12 | 143 | 158 | 16100 | 107 | 118 | 16100 |
| 5/8” | 11 | 209 | 231 | 20350 | 157 | 173 | 20350 |
| 3/4” | 10 | 361 | 399 | 30100 | 271 | 299 | 30100 |
| 7/8” | 9 | 570 | 630 | 41600 | 428 | 473 | 41600 |
| 1” | 8 | 855 | 945 | 54500 | 641 | 709 | 54400 |
| 1 1/8” | 7 | 1216 | 1344 | 68700 | 912 | 1008 | 68700 |
| 1 1/4” | 7 | 1729 | 1911 | 87200 | 1297 | 1433 | 87200 |
| 1 3/8” | 6 | 2261 | 2499 | 104000 | 1696 | 1874 | 104000 |
| 1 1/2” | 6 | 3002 | 3318 | 126500 | 2252 | 2489 | 126500 |

Tensile Strength = 120,000 psi to 1” dia. Proof Strength = 85,000 psi

| | | Bolts Lubricated with Light Machine Oil | | | Bolts lubricated with Anti-seize compound | | |
|---|---|---|---|---|---|---|---|
| | | Grade 8 | | | Grade 8 | | |
| **Dia.** | **Threads per inch** | **Min. Torque (ft lb)** | **Max. Torque (ft lb)** | **Clamp force (lb)** | **Min. Torque (ft lb)** | **Max. Torque (ft lb)** | **Clamp force (lb)** |
| Fine Thread Series, UNF | | | | | | | |
| 1/4” | 28 | 13.3189 | 14.7 | 3280 | 10 | 11 | 3280 |
| 5/16” | 24 | 24 | 26 | 5220 | 17.8 | 19.7 | 5220 |
| 3/8” | 24 | 48 | 53 | 7900 | 36 | 39 | 7900 |
| 7/16” | 20 | 76 | 84 | 10700 | 57 | 63 | 10700 |
| 1/2” | 20 | 114 | 126 | 14400 | 86 | 95 | 14400 |
| 9/16” | 18 | 162 | 179 | 18250 | 121 | 134 | 18250 |
| 5/8” | 18 | 228 | 252 | 23000 | 171 | 189 | 23000 |
| 3/4” | 16 | 399 | 441 | 33600 | 299 | 331 | 33600 |
| 7/8” | 14 | 627 | 693 | 45800 | 470 | 520 | 45800 |
| 1” | 14 | 950 | 1050 | 59700 | 713 | 788 | 59700 |
| 1 1/8” | 12 | 1368 | 1512 | 77000 | 1026 | 1134 | 77000 |
| 1 1/4” | 12 | 1900 | 2100 | 96600 | 1425 | 1565 | 96600 |
| 1 3/8” | 12 | 2584 | 2856 | 118400 | 1938 | 2142 | 118400 |
| 1 1/2” | 12 | 3382 | 3738 | 142200 | 2537 | 2804 | 142200 |

Tensile Strength = 120,000 psi to 1” dia. Proof Strength = 85,000 psi

## Torque values (metric) for bolts

| | | Bolts Lubricated with Light Machine Oil | | | Bolts lubricated with Anti-seize compound | | |
|---|---|---|---|---|---|---|---|
| | | Grade 8 | | | Grade 8 | | |
| Dia meter | Threads per inch | Min. Torque (Nm) | Max. Torque (Nm) | Clamp force (N) | Min. Torque (Nm) | Max. Torque (Nm) | Clamp force (N) |
| Coarse Thread Series, UNC | | | | | | | |
| 1/4” | 20 | 15.5 | 17.14 | 12870 | 11.7 | 12.9 | 12870 |
| 5/16” | 18 | 32.6 | 35.4 | 16740 | 24.2 | 26.8 | 16740 |
| 3/8” | 16 | 58.5 | 64 | 32500 | 43.5 | 47.6 | 31500 |
| 7/16” | 14 | 91.1 | 100.6 | 42980 | 68 | 92.5 | 42980 |
| 1/2” | 13 | 143 | 158 | 57380 | 106 | 118 | 57380 |
| 9/16” | 12 | 195 | 215 | 72450 | 145.5 | 160 | 72450 |
| 5/8” | 11 | 284 | 314 | 91580 | 213.5 | 235 | 91580 |
| 3/4” | 10 | 491 | 542 | 135450 | 368 | 407 | 135450 |
| 7/8” | 9 | 775 | 857 | 187200 | 582 | 643 | 187200 |
| 1” | 8 | 1163 | 1285 | 245250 | 872 | 965 | 245250 |
| 1 1/8” | 7 | 1654 | 1828 | 309150 | 1240 | 1370 | 309150 |
| 1 1/4” | 7 | 2351 | 2598 | 382400 | 1764 | 1949 | 392400 |
| 1 3/8” | 6 | 3075 | 3398 | 468000 | 2306 | 2549 | 468000 |
| 1 1/2” | 6 | 4082 | 4512 | 569250 | 3062 | 3385 | 569250 |

| | | Bolts Lubricated with Light Machine Oil | | | Bolts lubricated with Anti-seize compound | | |
|---|---|---|---|---|---|---|---|
| | | Grade 8 | | | Grade 8 | | |
| Dia meter | Threads per inch | Min. Torque (Nm) | Max. Torque (Nm) | Clamp force (N) | Min. Torque (Nm) | Max. Torque (Nm) | Clamp force (N) |
| Fine Thread Series, UNF | | | | | | | |
| 1/4” | 28 | 18.1 | 20 | 14760 | 13.6 | 15 | 14760 |
| 5/16” | 24 | 32.6 | 35 | 23490 | 24.2 | 26.8 | 23490 |
| 3/8” | 24 | 65.3 | 72 | 35550 | 49 | 53 | 35550 |
| 7/16” | 20 | 103 | 114 | 48150 | 77.5 | 86 | 48150 |
| 1/2” | 20 | 155 | 171 | 64800 | 117 | 129 | 64800 |
| 9/16” | 18 | 220 | 239 | 82130 | 165 | 182 | 82130 |
| 5/8” | 18 | 310 | 343 | 103500 | 232 | 257 | 103500 |
| 3/4” | 16 | 542 | 600 | 151200 | 406 | 450 | 151200 |
| 7/8” | 14 | 853 | 943 | 206100 | 639 | 707 | 206100 |
| 1” | 14 | 1292 | 1428 | 268650 | 970 | 1071 | 268650 |
| 1 1/8” | 12 | 1860 | 2056 | 346500 | 1396 | 1542 | 346500 |
| 1 1/4” | 12 | 2584 | 2856 | 434700 | 1938 | 2128 | 434700 |
| 1 3/8” | 12 | 3514 | 3884 | 532800 | 2635 | 2913 | 532800 |
| 1 1/2” | 12 | 4599 | 5083 | 639900 | 3450 | 3813 | 639900 |

# Summary of risk assessment

| Ref | Identified potential hazard | Probable consequence/ injury | Corrective actions | Risk |
|---|---|---|---|---|
| **PERSONNAL** | | | | |
| 1 | Squeezing hand, finger or foot by CRT during installation | Fractures | Handle the CRT with 2 persons, 1 at the body side and one opposite, having their hands on the lower circular section (where it is crimped on the cable) of the swage socket of the lifting sling. It is to be considered to provide this preferred gripping section with rubber gripping pads (or such) indicating that this is a safe gripping area. Still beware of lowering CRT on foot. Wear personal safety equipment | 6 |
| 2 | Get jammed between the 2 body halves while opening or closing body halves | Fracture of fingers/hand/ limps | Follow up rig procedures / Read manual / Follow training Indicate safe gripping area on lower section of lifting slings. Presence of warning label indicating pinch points on CRT top cover. | 6 |
| 3 | Sharp corners may cause cuts, for example while lifting slips. | Injury of body parts. | Wear personal safety equipment | 5 |
| 4 | Breaking of lifting sling. | Loss / fractures of body parts | While pulling up the CRT out of the RST with the 4 way lifting sling it is required to unlock the rotary table lock. Not doing so will cause the 4 way lifting sling to break prior to the breaking of the rotary table locks. The breaking cables might injure the drilling crew. | 5 |
| 5 | Pinching fingers between body and door, while opening door | Fractures of fingers and hand | Follow up rig procedures / Read manual / Follow training Indicate safe gripping area on lower section of lifting slings. | 5 |
| 6 | Feet placed above the hole when the CRT is lowered into the rotary table | Cut of feet | Follow up rig procedures / Read manual / Follow training | 3 |
| 7 | Get fingers/hand jammed between body and cover plate/torque frame while fitting parts | Fractures of fingers/hand | Follow up rig procedures / Read manual / Follow training Indicate safe gripping area on lower section of lifting slings Presence of warning shield indicating pinch points on CRT top cover. | 5 |
| 8 | | Injury of fingers, hand | Follow up rig procedures / Read manual / Follow training While changing slips, tool should stand with body/door opened and hydraulically disconnected? | 5 |
| 9 | Hydraulics | Injection of oil into or through the body | Hose gets damaged by wrong hoisting procedure Hoses have a burst pressure of 5.5 x working pressure. The possible damage of hoses by wrong hoisting procedures is as far as possible reduced by using quick disconnects. External hoses should be disconnected at all times when hoisting tool. | 7 |
| 10 | | Grabbed by the hoses, fractures and bruises | Follow up rig procedures / Read manual / Follow training | 5 |
| 11 | Unable to talk to each other because of the noise on the rig floor | Misunderstan dings and failures | On the rig floor it is very noisy so that it is difficult to communicate by talk. This can lead to miss- understanding. Varco recommends the driller to be the operator of the CRT. | 4 |
| 12 | Installing/removing of the insert carriers by manual force | Excessive effort | During installing/removing the insert carriers with manual force this can apply excessive effort to the human body. Tugger line must be used. | 5 |
| 13 | Casing jobs are monotonous | Carelessness during the job | The danger exists of carelessness during the jobs. This is hard to avoid and therefore the CRT should be operated by instructed people only. | 5 |

| Ref | Identified potential hazard | Probable consequence/ injury | Corrective actions | Risk |
|---|---|---|---|---|
| 14 | Not reading the manual / not being instructed, may result in hazardous situations when described procedures are not carried out properly | Several injuries possible | This may result in hazardous situations because dictated procedures are not carried out properly. Every CRT will have to be supplied with instructions for safe operation. These instructions must be written in accordance with the requirements of the Machinery Directive. Information regarding hazardous events, consequences and procedures for rigging up, assembly, operating, maintenance, inspection, trouble shooting and repair of the CRT are written and emphasized in the operations manual. | 11 |
| **HARDWARE** | | | | |
| 15 | Slips stick in hole due to failing lubrication | Not able to lift slips. Rig down time | Carry out lubrication: Follow up rig procedures / Read manual / Follow training | 5 |

| Ref | Identified potential hazard | Probable consequence/ injury | Corrective actions | Risk |
|---|---|---|---|---|
| 16 | Breaking link pin | Slip falls into well | Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 3 |
| 17 | Failing leveling beam assembly | Bending cylinder rods | Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 3 |
| 18 | Breaking link assy | Slip falls into well | Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 3 |
| 19 | Missing hinch clip pins on slip hanger pins. | Slip falls into well | Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 3 |
| 20 | Missing warning labels | Not understanding dangers of CRT | Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 3 |
| 21 | Failing hoist swivel rings | Falling/swinging CRT | Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 5 |
| 22 | | Cable of lifting sling moves freely around hitting crew members | Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 5 |
| 23 | Loose parts like bolts/nuts | Parts falling down the well | Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 3 |
| 24 | Missing/loose guide retainer bolts | Guide will not guide properly, damage to pipes. Loosing guide into well? | Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 3 |
| **OPERATION / HYDRAULICS** | | | | |
| 25 | Malfunctioning / failing of hydraulics | Malfunctioning of CRT | Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 4 |
| 26 | Failing hydraulic connectors | Spilling large qty hydraulic fluid | Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 4 |
| 27 | Setting slips on tool joint. | Setting at wrong moment, damaging joints | This a very unlikely event, and detectable. Working: pressure gauge is showing low pressure in slips down hose when set on coupling. Only when set properly on pipe, then pressure jumps up to system pressure. **Interlocking** rquired. | 7 |
| 28 | Setting whilst exchanging slips | Fractures | Follow up rig procedures / Read manual / Follow training Disconnect hydraulics prior to any slip change. | 7 |
| 29 | Slips rise with pipe in hole | Loosing string | This is only possible during running first few joints in hole. **Interlocking** required | 5 |
| 30 | Slips stuck with pipe in CRT | CRT cannot be released from pipe, possibly positioned high in derrick --> people need to be raised by tugger line to correct tool. Rig down time | Undefined failure of hydraulics or lubrication issue. Manifold blocks are factory pressure tested before assembly | 3 |
| 32 | Slips do not move after command | Rig down time | Undefined failure of hydraulics or lubrication issue. Manifold blocks are factory pressure tested before assembly | 3 |
| 33 | Breaking hose | Slips do not move after command | Carry out Inspection. Follow up rig procedures / Read manual / Follow training | |
| 34 | Dirt/contamination in hydraulic system | ANY of above events may take place. | Check filters / hydraulic system. Follow up rig procedures / Read manual / Follow training | 6 |
| **COMPONENTS** | | | | |
| 35 | Treaded ends on cylinder rods break off due to fatigue. | Cylinders + leveling beam not correctly lined out according to mounting instructions in CRT manual -->leveling beam nuts/rod ends break off --> heavy parts fall down on rig floor. | After assembly seal cylinder bolts and leveling beam nuts not only with lockwire (which is replacable) but also with wax seal. | 4 |
| 35 | Leveling beam down position detection valve mechanically fails / pedestal breaks off. | Tool does not sequence to high clamping pressure --> no "slips set" signal on upstream pressure switch + slips may tangentailly slip on pipe when absence of signal is ignored. No risk of parts falling down due to lockwiring / parts attached to hoses. | Carry out Inspection. Follow up rig procedures / Read manual / Follow training **Interlocking** | 4 |
| 36 | Bell guide bolts fail / were not properly fastened | Heavy parts may fall down on rig floor | Securing bell guide with safety cables | 4 |
| 37 | Counter-clockwise-twistlock-lock fails due to high impact | Body disengages from torque frame while turning CCW --> hoses shear and slip clamping force is released --> body slides down along pipe until dropped on floor. | Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 4 |
| 38 | Counter-clockwise-twistlock-lock fails due to improper engagement | Body disengages from torque frame while turning CCW --> hoses shear and slip clamping force is released --> body slides down along pipe until dropped on floor. | Secondary lock must be in place. Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 8 |

| Ref | Identified potential hazard | Probable consequence/ injury | Corrective actions | Risk |
|---|---|---|---|---|
| 39 | Link ear retainer bolts fail | Links are kicked out and disengage from link ears --> links will swing out due to rotation of tool. Tool not expected to fall down, because attached to TDS main shaft. Heavy damage of compensator to be expected (max load on compensator before break = appr. 100 T) | Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 5 |
| 40 | Rotation locks between T-frame and hoist ring fail. | Links not driven to rotate --> links may twist due to friction of rotating head --> failure of rotating head parts or link grabber on CRT. | Lock on hoist ring strong enough to support load and have second lock as backup.Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 4 |
| 41 | Parts breaking off due to pipe impact | Parts falling down on rig floor. | Secondary retention, impact proof design | 4 |
| 42 | Pipe sensor support fails | Pipe sensor is pushed away from pipe without detecting pipe --> slips do not set --> possible thread damage to pipe due to impact with catch plate | Ensure sensor is fixed properly to torque frame. Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 5 |
| 43 | Compensator clamp fails due to improper engagement | Loss of compensator function --> full weight transferred to links --> thread damage to pipe + clamp falling down. | Clamp is secured by 2 bolts. Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 7 |
| 44 | Seals on compensator fail / wear out and/or compensator springs fatigue. | Loss of compensator function --> full weight transferred to links --> thread damage to pipe. | Check required compensator pressure falls within operational limits. Carry out Inspection. Follow up rig procedures / Read manual / Follow training | 3 |
| 45 | Bell guide needs to be mounted underneith heavy body | CRT body falling on person when not properly supported | Caution needs to be taken when doing so. | 3 |
| 46 | Uncommon way of assembly of T-frame to body due to bayonet design. | Risk of trapping/ injuring fingers during assembly. | Follow up rig procedures / Read manual / Follow training | 3 |
| 47 | Handling of all heavy components. | Personal injury due to falling objects. | Follow up rig procedures / Read manual / Follow training | 6 |
| 48 | High pressure oil leaks and / or unexpected component movements | Eye damage or risk of trapping/ injuring fingers during assembly / pressure testing. | Train personnel to never work on tools when connected to power supply. Beware of trapped energy sources such like accumulators or cylinders with external loading. | 9 |
| 49 | Closing body halves | Risk of trapping/ injuring fingers during assembly. | Follow up rig procedures / Read manual / Follow training | 3 |
| 50 | Overhead hoisting of heavy equipment. | Falling objects --> causing serious or even fatal injuries. | Use lifting points. Use special handling equipment.Follow up rig procedures / Read manual / Follow training | 6 |
| 51 | Mounting lift plugs on top of main shaft | Climbing onto tool required to mount lift plug --> risk of falling or sliding | Avoid to climb onto tool. Follow up rig procedures / Read manual / Follow training | 6 |
| 52 | Damaging male / female thread due to tilting over or cocking. | Fill-up up tool becomes unusable. Tool might fall on foot. | Use mounting standard for fill-up tool. | 7 |
| 53 | Connecting hoses to wrong ports | Malfunctioning of tool, unexpected movement of components --> personal injury and/or damage of tool. | Each hose must be provided with its own unique coupling. | 3 |
| 54 | Release of fluid / energy at disconnecting | Eye injuries and/or inadvertent movement of components--> personal injuries | Pressure gauges on tool are already provided. Follow up rig procedures / Read manual / Follow training | 3 |
| 55 | Adjustments might be out of reach | Need to climb onto the tool to make adjustments --> risk of sliding / falling | Avoid to climb onto tool. Follow up rig procedures / Read manual / Follow training | 6 |
| 56 | Handling, assembly and disassembly of heavy links. | Pinching fingers | Proper pre-installation investigation allows use of standard drilling links in combination with CRT. In that case no link changeout is required. | 5 |
| 57 | Slip changes during casing run (mixed string). | Handling of heavy equipment in narrow space. Need to split and open body halves. | Use insert carriers. Follow up rig procedures / Read manual / Follow training | 5 |
| 58 | Loosing parts / dangerous situation while sensor position re-adjustment during casing run (rare handling, because mixed strings usually have same coupling OD). | Hands-on operation on tool on rig floor, probably over open hole. | Assure adjustment is possible with no loose parts. Follow up rig procedures / Read manual / Follow training | 3 |

| Ref | Identified potential hazard | Probable consequence/ injury | Corrective actions | Risk |
|---|---|---|---|---|
| 59 | Loosing parts while exchanging of size components over open hole. Mostly needed in case of packer damage. Mixed strings have usually same ID. | Handling has been eased because special exchange toold have been designed. No handling of heavy parts involved. | Follow up rig procedures / Read manual / Follow training | 3 |
| 60 | Overtorqing casing connection during manual make-up | Heavy equipment damage + unusual equipment handling (tripping out joint and removing through v-door). | Provide manual end-stop on torque-throttle on TDS controls --> mechanically limitting maximum applyable torque. | 6 |
| 61 | Srapping hoses and service loops in derrick while rotating with CRT | Heavy equipment damage + possibility of objects falling on rig floor. | Check clearance during rig-up procedure. | 3 |
| **62** | **Injury of persons on rig floor because blocks (if mounted) are protruding from outer body contour.** | **Personal injury** | **Remove blocks prior to standard operation of CRT. Only assemble in case assembly in rotary table is needed.** | |
| 63 | Rotating at too high speed during manual operation. | Parts breaking off tool due to high radial forces --> parts flying through derrick and falling on drill floor. | Provide manual end-stop on speed-throttle on TDS controls --> Mechanically limitting maximum applyable speed. | 6 |
| 64 | Lowering tool at too high speed during stabbing of joint | Joint thread damage | Only proper training of operator can avoid this kind of failure. Follow up rig procedures / Read manual / Follow training | 5 |
| 65 | Lowering tool at too high speed during lowering over next joint. Pipe jams against catch plate and/ or goes inadvertently in circulation mode. | Joint thread damage or well damage due to pumping air bubbles down the string | Only proper training of operator can avoid this kind of failure. Follow up rig procedures / Read manual / Follow training | 5 |
| 66 | Manual tailing of joint during stabbing | Pinching fingers during manual tailing. | Always use additional stabbing guides while manually tailing, or use automated pipe handling equipment. | 5 |

A possible division in acceptability of safety-levels is:

- 1 - 4 risk low
- 5 - 7 risk medium high
- 8 -10 risk high
- 11 - 14 risk very high

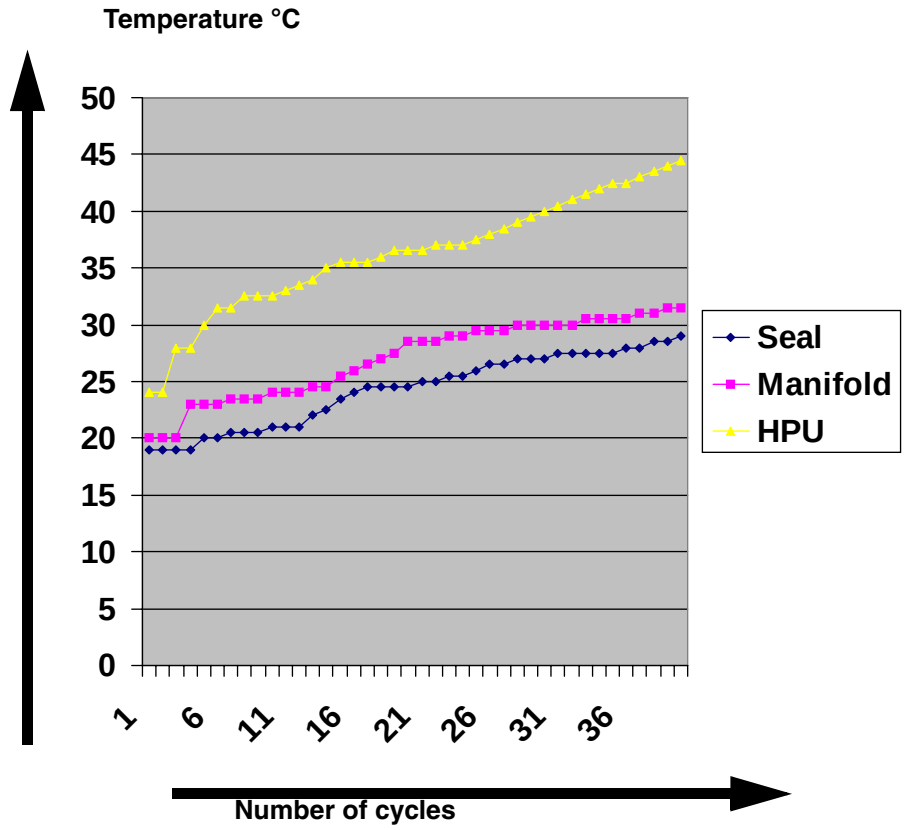
## Conclusion:

In general, crew must:

- Wear personal safety protection like safety glasses, hard hat etc
- Follow instructions as stated in the manual
- Have knowledge of rig procedures
- Must have been instructed for safe use of the CRT
- Ensure interlocking between CRT and Rotary Slips is in working order

## ATEX-relevant test

A CRT-body was subject to a temperature test. The cycle-time was 2 minutes.




## Conclusion Temperature Test

The maximum reached temperature is 31.5°C (88.7°F) on the CRT-manifold and 29°C (84°F) on the seal of the cylinder. The HPU temperature was at that time 44.5°C (112°F).

# Storage, transport & decommissioning.

## Storage

When the CRT is not being used for a longer period then 3 days the following steps should be carried out:

- Remove the slips.
- Clean CRT and slips.
- Grease CRT and slips as described in checklist lubrication.
- Grease all blank parts.
- Use an extreme pressure, multi-purpose, lithium based grease of No. 1 or No. 2 consistency and multi grade motor oil.
- Clean and cap hydraulic Quick Disconnect Couplings.
- Recommended rust preventative (slushing compound) for bare metal surfaces: Kendall Grade 5(GE-D6C6A1) or equivalent.
- The temperature of storage should be between -20°C (-4°F) and +40°C (104°C)
- Humidity during storage should not exceed 70%
- Store the CRT in a dry room with sufficient ventilation

## Transport

- Lift the CRT by the dedicated lifting points (see lifting prooedures) only.
- The best way of transporting the CRT is in its original skid or crate.

## Scrapping

- The tool contains hydraulic fluids, grease, aluminum, steel, rubbers, plastic and several assembled components from undefined consistency or mixtures. The tool can be contaminated with mud.
- When the tool is taken out of permanent service it is recommended to disassemble the tool in a place where drainage for waste fluids is possible.
- Hydraulic fluids, mud and grease are unsafe when in contact with the skin. Always wear gloves and safety goggles when disassemble the tool.
- Remove all quick-disconnects, hoses, cylinders and manifold block and bleed of hydraulic oil.
- Clean the tool with a steam cleaner.
- Carry of to proper place for final storage or destruction.

# Drawings + Test procedures

## Test procedures

| PSEL-number | Description |
|---|---|
| PSEL-0006 | Pre installation sheet CRT |
| TSEL 0151 | Inspection criteria for CRT body |
| TSEL-0150 | Inspection criteria torque frame |
| TSEL-0152 | Inspection criteria CRT500 Final Assembly |
| TSEL-0154 | Field commissioning and instruction |

## Drawings

| Number | Description |
|---|---|
| - | CRT part number overview |
| 50008005 | Compensator assembly |
| 50008065 | Compensator retainer assembly |
| 50008315 | Link grabber assembly 350, 500 & 750 T links |
| 50008021 | Suspension sling set (5 ton) |
| DD-50008253 | Fill Up Tool 4-1/2” - 6-5/8” |
| 50008253 | Fill Up Tool 4-1/2” - 6-5/8” |
| DD-50008200-2 | Assembly CRT Double Rod BX interface |
| 50008200-2 | CRT Double Rod BX interface |
| DD-50008210-30 | Assembly CRT Double Rod BX interface |
| 50008210-30 | CRT Double Rod BX interface |
| DD-50008208-20 | Assembly CRT body |
| 50008208-20 | CRT body |
| 50008300 | Cover plate assembly |
| 50008200-20 | Diagram CRT on BX-controls |
| 50008448 | Pipe sensor assembly |
| 50008449-1 | CRT Pipe sensor manifold |
| 50008160-1 | Position unit pipe detector |
| 50008150-1 | Compensator spring assy |
| 50008430 | Ass’y CRT manifold, BX controls |
| 50008375 | Ass’y manifold double rod cylinder |
| 50008397 | Ass’y 2 2 way cam valve FC10/NC combined |
| 50008422 | Assembly hydraulic manifold bracket CRT500 |
| 50008438 | Lamp bracket ass’y complete |
| 50008436-1 | Ass’y quick connector block |
| 50008222 | Removable hinge pin assy CRT |
| 50008222-1 | Assy, hinge pin extension CRT |
| 50008205-1 | FAC Tool lock screw Assy |
| 50008259 | FAC tool stand |
| DD-50008251-10 | FAC Tool 9 5/8” - 14” |
| 50008251-10 | FAC Tool 9 5/8” - 14” |
| DD-50008256-10 | FAC Tool 7” - 8 5/8” |
| 50008256-10 | FAC Tool 7” - 8 5/8” |
| 50008247 | 7in-MKII FAC Tool GUIDE CONES |
| DD-50008056 | MKII redress kits |
| DD-50008057 | MKII Guide cones |

| Number | Description |
|---|---|
| 50008365 | Lock cover assy CRT body |
| 50008280-1 | Insert carrier slips assy 14” 500 T E/S |
| 50008270-1 | Insert carrier assy 14 E/S |
| 50008270-3 | Insert carrier assy 14” E/S |
| 50008319 | Skid assembly |
| DD-50008319 | Skid dimensional drawing |
| DD-50008319-1 | Skid dimensional drawing |

NATIONAL OILWELL VARCO

**Drilling Company name** :_____

**Rig name** :_____

**Oil Company name** :_____

**Surveyor name** :_____

**Date of survey** :_____

**Remarks** :_____

_____

_____

# CRT-14
# CASING RUNNING TOOL.
# Pre-Installation Sheet
# Mechanical

| First Issue | Name: | Date |
|---|---|---|
| Prepared | HvR/JON | Nov. 27 01 |
| Checked | A.Kr. | Nov. 27 01 |
| Approved | R.Roling | Nov. 27 01 |

| Latest Revision. | |
|---|---|
| Name; | P.Dekker /P. Frank |
| Date: | June 10th 2005 |
| ECN. | 700125 |

Rev. **F**



Title: **CRT-14" Survey Sheet Mechanical Interface**

Document No.: **PSEL-0006**

## Customer Contacts

Customer Project manager :_____

Rig Phone Number : _____

Rig Fax Number : _____

Rig E-mail address : _____

Name Rig Manager (OIM) : _____

Name Tool Pusher : _____

Name Rig Maintenance Supervisor : _____

Name Company man : _____

Other : _____

Casing Company : _____

## Purpose of Document;

This document describes the Survey for the CRT Mechanical Top-drive/Rig interface only.
It is to be used when the info from the CRT Rig questionnaire (PSEL-0008) is insufficient to determine the CRT installation Package.
For all Electrical and Controls Survey items refer to PSEL-0010.

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## TDS Mechanical Data

TDS Brand and Model : _____

Varco DC models

- ❑ TDS-3
- ❑ TDS-3S
- ❑ TDS-4
- ❑ TDS-4S
- ❑ TDS-5
- ❑ TDS-6S
- ❑ TDS-7
- ❑ IDS-1

Varco AC models

- ❑ TDS-8SA
- ❑ TDS-9SA
- ❑ TDS-11SA
- ❑ TDS-1000SA
- ❑ IDS-4A
- ❑ OTHER

TDS Identification Numbers*: _____

: _____

Solid Body Elevator (SBE) or Rotating Link Adapter (RLA) Hoisting Capacity: _____ Short Tons

SBE Torque Arrestor part-number and Qty _____ _____ off

Pipe Handler Type and Identification Numbers*:: _____

Pipe handler

- PH-50
- PH-60d
- PH-75
- PH-85
- PH-100
- Other; _____

| First Issue | Name: | Date |
|---|---|---|
| Prepared | HvR/JON | Nov. 27 01 |
| Checked | A.Kr. | Nov. 27 01 |
| Approved | R.Roling | Nov. 27 01 |

| Latest Revision. | |
|---|---|
| Name; | P.Dekker / H v Rijzingen |
| Date: | June 10th 2005 |
| ECN. | 700125 |

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Title: **CRT-14" Pre-Installation Sheet**

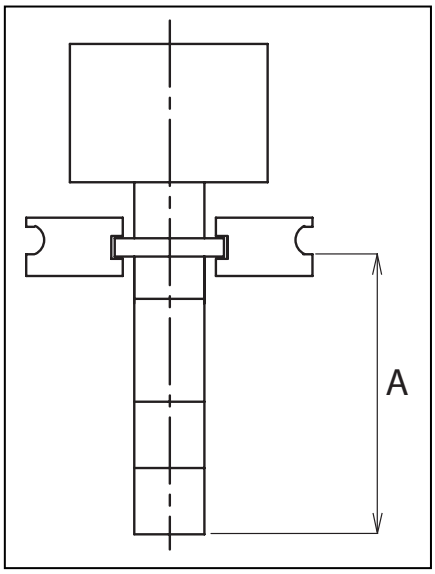
Document No.: **PSEL-0006**

**“AC”-top drive:**

**Measuring Procedure;**

Measure distance “A” from RLA bail rest to bottom shoulder of lower IBOP with the RLA “Lift-Port” (if any) de-activated (de-pressurized).

_____inch




| First Issue | Name: | Date |
|---|---|---|
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Rev. **F**



Title: **CRT-14” Pre-Installation Sheet**

Document No.: **PSEL-0006**

**“DC”-top drive:**

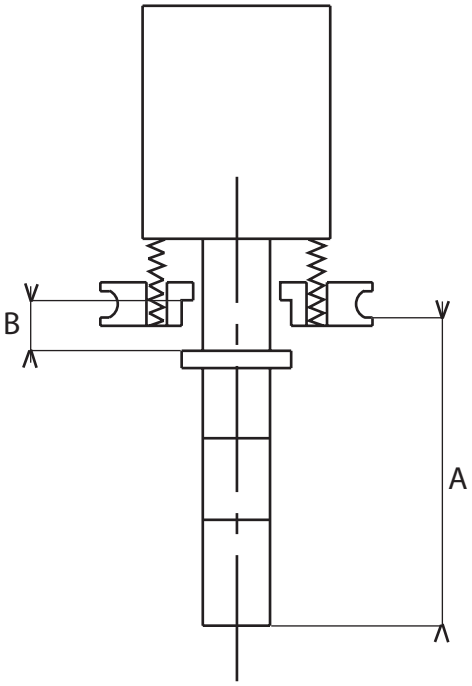
**Measuring Procedure;**

Measure distance “A” from SBE bail rest to bottom shoulder of lower IBOP with distance “B” pressed solid; (e.g. during Tripping when there is sufficient Hook-load to pull the SBE on it’s landing collar.)

_____inch (A)

Measure Torque Arrestor extension in this position; _____ Inch.(B)

If not possible to measure with hook load, drop SBE on landing collar by releasing torque arrestors.



**Pipe-Handler Data:**

IBOP Lower connection & OD:

- ❑ 6 5/8 API reg. OD _____Inch.
- ❑ 7 5/8 API reg OD _____Inch.
- ❑ _____(Other) OD _____Inch.

**Saver Sub Data:**

Provide Data of saver sub that will be used prior and after the CRT run (discuss with customer; Varco recommends to take saver sub off. If decided otherwise, it is the Customer's responsibility to maintain (Log) correct stack up length for CRT-use. Explain to customer correct length X-O-sub is critical).

Lower Connection, Saver Sub OD and Saver Sub Length.

❑ _____. OD _____Inch. Length _____Inch.

Min. and Max. Clamping Dia. Pipe Handler: _____ _ _____Inch.
Pipe-Handler Bell-Guide ID (what size is it dressed for?) _____Inch.
Vertical distance from lower IBOP shoulder to
lower edge Pipe-Handler Bell-Guide _____Inch.

List data of (H2S) seal in the lower IBOP (if any) that may conflict with CRT shaft adapter?

_____

**Auto return cylinder on Varco 7 & 10 port rotating head.**

a) Are any modifications made? If YES, carry on with b)*.
b) Connection(s) on Ports Auto Retract Cylinder on rotating head (make sketch or picture if possible).
Check the type (JIC or NPT) and size and number of hoses connected to each port:
Provide pictures of area around Auto Retract Cylinder.

Piston side: _____

Rod side: _____

**** = List as many identification numbers as possible, like part number, serial number, configuration number, drawing numbers etcetera.***

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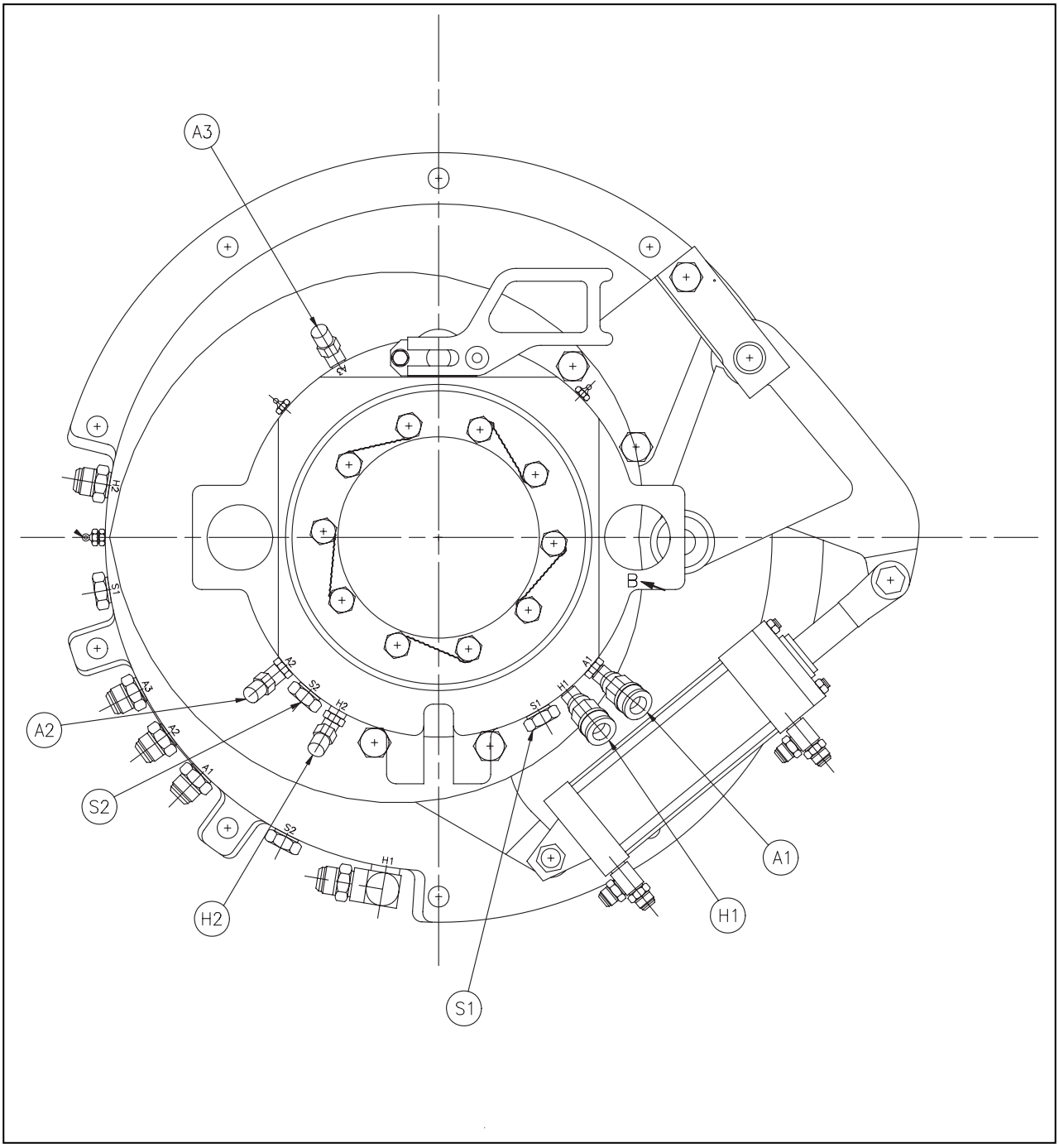


Sketch of port location and numbering (bottom view) 500 T, 7 ports Varco

**Make (Detail) pictures of rotating head! (Especially around Motor alignment Cylinder)**

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| Approved | R.Roling | Nov. 27 01 |

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Title: **CRT-14" Pre-Installation Sheet**

Document No.: **PSEL-0006**

Sheet: **7** of **17**

**TDS Rotating Head Data:**

Numbers of ports on Rotating Head:_____

Hydraulic schematic drawing number(s):_____

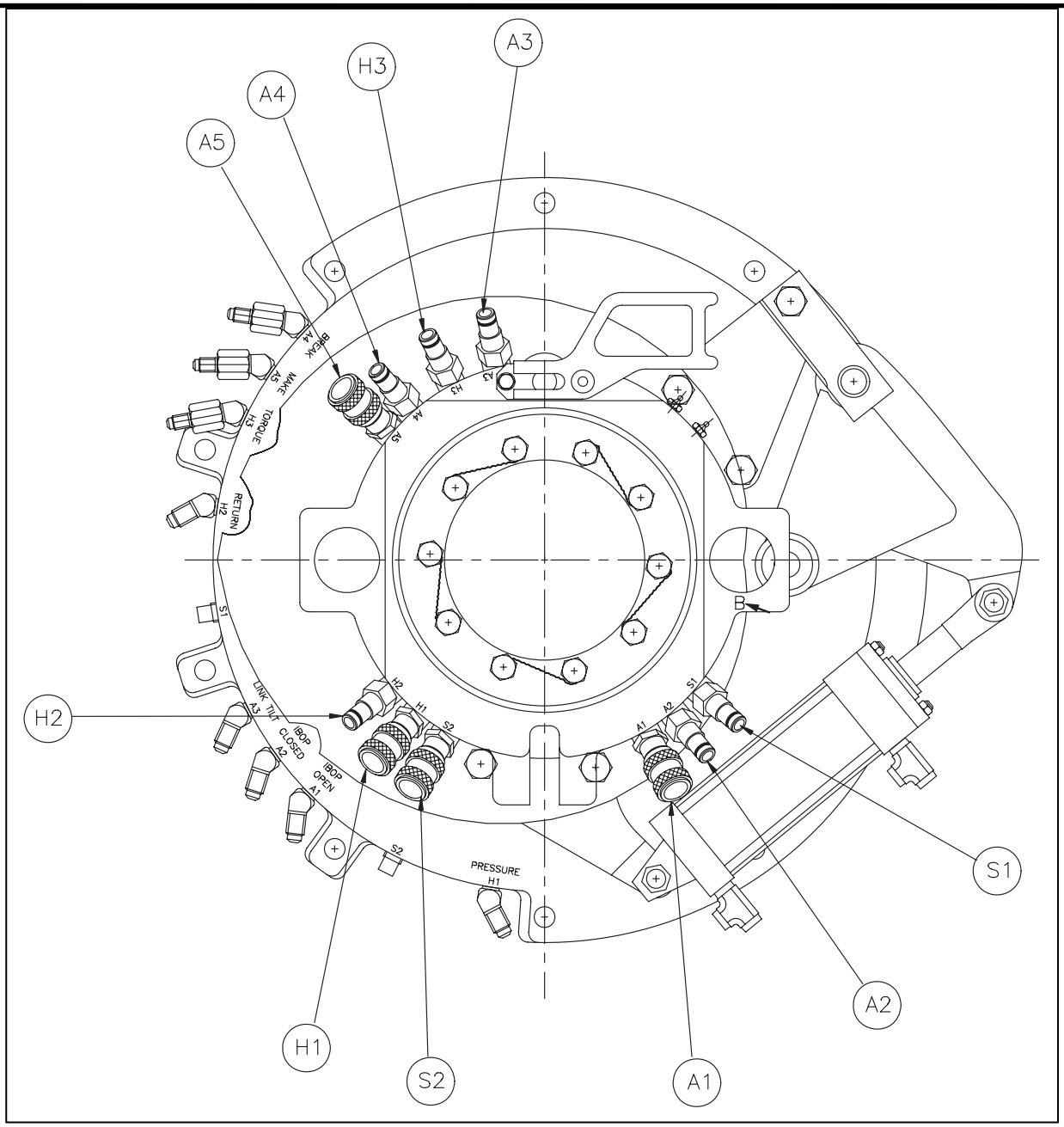
Make copies of drawings, especially when modifications to the original hydraulic schematic were made on the rig. If it is impossible to determine the correct data during the survey, ask the tool-pusher and rig mechanic to fill out this form at a later point during survey.

Port data:

| Port # ( ID ) | Medium (Air or Hydraulics) | Function (i.e. IBOP close) | Port thread size and port type. (i.e. SAE-"O"-Ring or BSP etc.) |
|---|---|---|---|
| A1 | | | |
| A2 | | | |
| A3 | | | |
| A4 | | | |
| A5 | | | |
| H1 | | | |
| H2 | | | |
| H3 | | | |
| S1 | | | |
| S2 | | | |

If not Varco TDS, provide similar views of rotating head as above

.




Sketch of port location and numbering (bottom view) 650 T, 10 ports Varco

**Make (Detail) pictures of rotating head! (Especially around Motor alignment Cylinder)**

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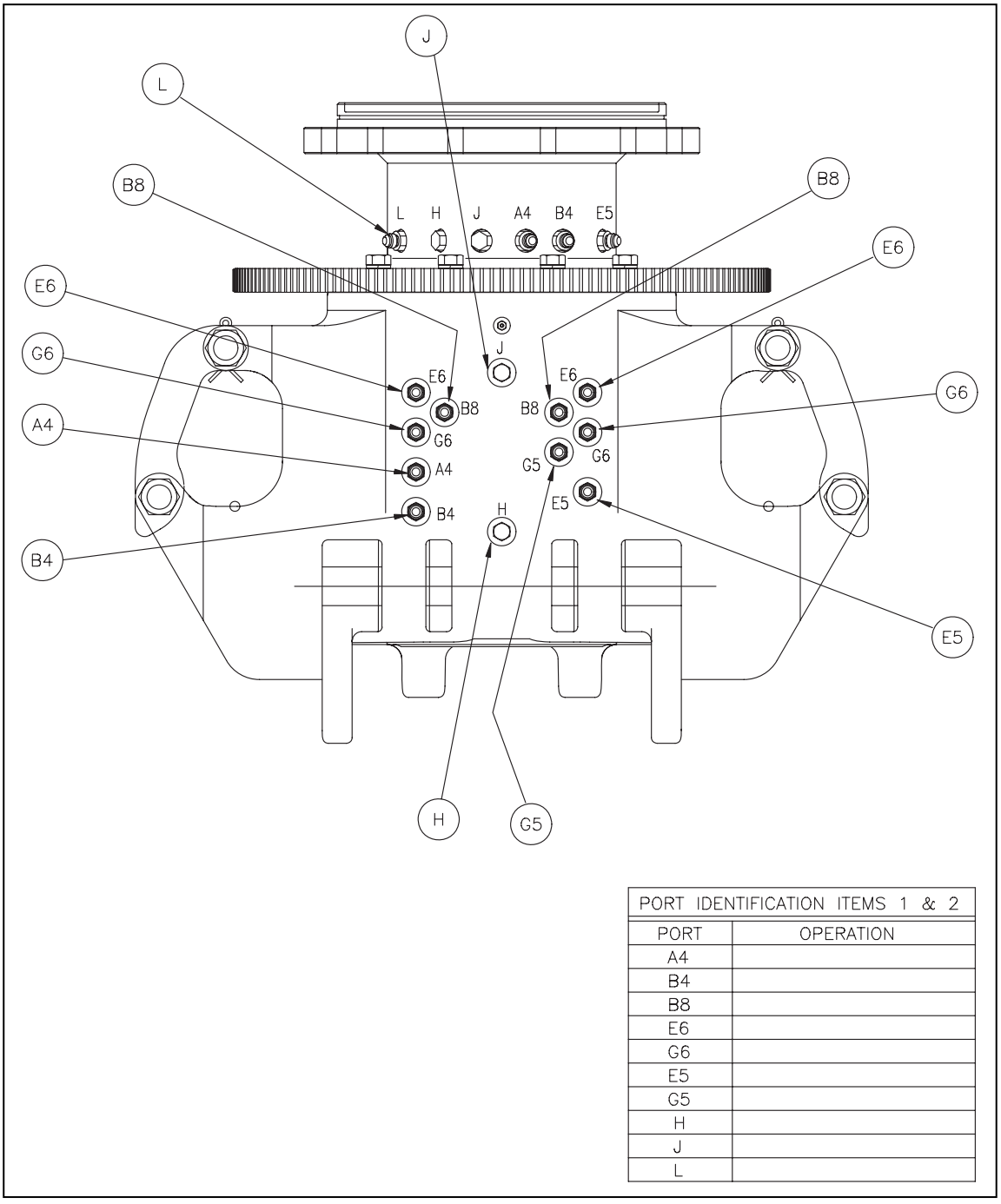
| Approved | R.Roling | Nov. 27 01 | ECN. | 700125 | |



| Title: | Document No.: | Sheet: |
|---|---|---|
| **CRT-14" Pre-Installation Sheet** | **PSEL-0006** | **9** of **17** |




| PORT IDENTIFICATION ITEMS 1 & 2 | |
|---|---|
| PORT | OPERATION |
| A4 | |
| B4 | |
| B8 | |
| E6 | |
| G6 | |
| E5 | |
| G5 | |
| H | |
| J | |
| L | |

Sketch of port location and numbering (rear view), 10 ports Varco.

**Make (Detail) pictures of rotating head! ( Especially around RLA Motor )**

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| Prepared | HvR/JON | Nov. 27 01 |
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| Latest Revision. | |
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Title: **CRT-14" Pre-Installation Sheet**

Document No.: **PSEL-0006**

Sheet: **10** of

## TDS Hydraulics Data

Provide HPU-details (especially when remote hydraulic supply is provided (i.e. through service loop):

Pressure/flow rate: _____

Brand/type: _____

Confirm pressure at pipe handler : _____Psi

## TDS Pneumatics Data

Confirm rig air pressure : _____Psi

Required Pneumatic Conditioning on Top drive (filter, lubricator, water separator) available?

- ❑ Filter
- ❑ Lubricator
- ❑ Water-separator

## TDS – Torque Calibration

Date of last TDS Torque Calibration: _____

TDS Torque Calibration Method: _____

_____

**Add Copy of latest Torque calibration report.**

## TDS – Well Centre Alignment

Confirm alignment center top drive corresponds to center alignment Rotary Table:

Misalignment in X-direction: _____ inch

Misalignment in Y-direction: _____ inch

## CRT Clearance Data

Confirm TDS-rail set back and rail spacing dimension: _____-_____

The outside radius of the CRT is 23.5". To determine if the CRT doesn't collide with TDS-track(s) or service loops, check the following:

- Distance between well centre and TDS tracks > 23.5"? ❑ Yes ❑ No
- Distance between well centre and service loops > 23.5"? ❑ Yes ❑ No

Verify alignment of TDS over vertical travel required for casing run. Maximum misalignment at floor level = 1/4"

**When in doubt: Do rails require to be surveyed by rig builder?**

❑ Yes
❑ No

## Bails Data

Please only list the data of the bails that are selected to run the CRT with.
Only 500Ton 144" or 180" bails are normally used. Actual bail length may differ slightly compared to standard bail lengths. (In some cases 132" Bails or longer than 180" may be possible)

Bail Rating: _____ Short Tons

Actual Bail Length, to be measured, from contact area to contact area!: _____ inch

Bail Brand and Type: _____

### Link-Tilt Mechanism.

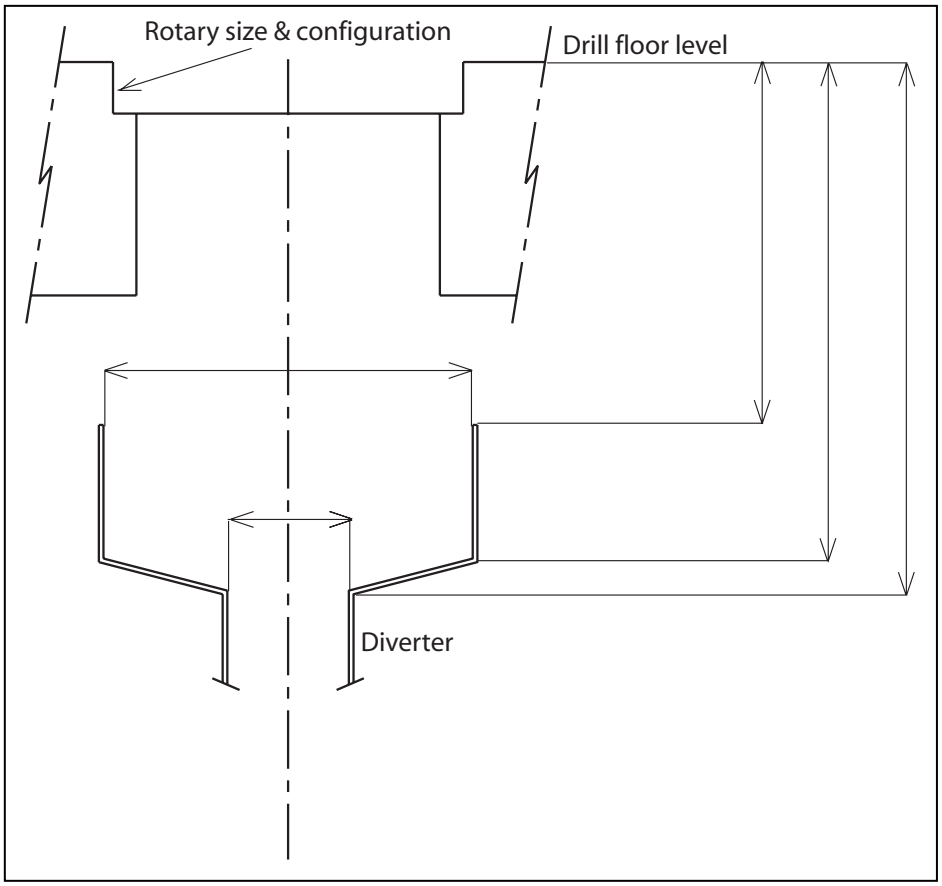
Verify whether Link-Tilt mechanism clears Service Loops and other derrick equipment when the TDS spins the Pipe Handler around.
Note Do this check at various heights in the derrick.
If not possible make note that Link-Tilt is to be removed prior to the CRT run. _____OK
Verify link-Tilt can be properly locked in it's most inward position. _____OK

## Rotary Table Dimensions.

During R/U the CRT is best placed into the Rotary-Table to ease handling
and aligning of CRT with Top-Drive. (The CRT elevator Body has a 37.5" National configuration)

Rotary Table Size and Configuration _____

Measure (Inches) as shown below and fill out below picture.




A = _____
B = _____
C = _____
D = _____
E = _____

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|---|---|---|
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| Approved | R.Roling | Nov. 27 01 |

| Latest Revision. | |
|---|---|
| Name; | P.Dekker / H v Rijzingen |
| Date: | June 10th 2005 |
| ECN. | 700125 |

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Title: **CRT-14" Pre-Installation Sheet**

Document No.: **PSEL-0006**

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## Pipe handling operation

If a pipe handling system is available, check if the CRT can work together with the pipe handling system. Write down the way to operate the pipe handling system in conjunction with the CRT*.

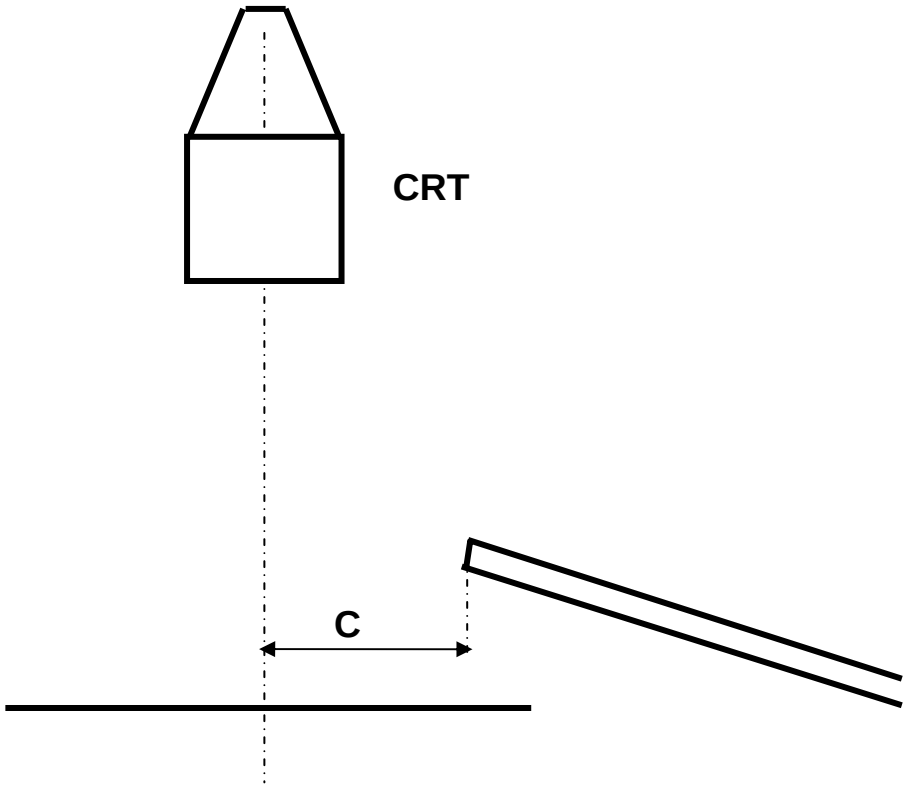
_____

_____

_____

_____

In case of single joint elevator operation:
Horizontal Distance between well center and top of casing in V-door: _____ foot.
CRT Standard sling set is available in 15 ft length only.
Additional stabbing devices being used?_____




***Take pictures whenever possible.**

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Title: **CRT-14" Pre-Installation Sheet**

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Sheet: **14** of

## CRT handling (outside it's skid.)

Check if the CRT can be assembled in a place on the rig different from the rig floor. Check if there is a crane or a heavy lift truck available for this purpose with a lifting capacity of 7.5 Mtons min. (assemble slips, bottom guide, FAC-tool, mate torque frame to body):

Check how to transfer the CRT to the rig floor and to well centre. Total weight of the CRT is 5.8 metric tonnes (excl. Skid):

## Casing program for CRT

If it is clear which casing size(s) will be run with the CRT, write it down here.
List casing size, type, weight, make-up torque and section length.
(for instance, 9-5/8", VAM TOP, 43.0 lb/ft, 9400 ft-lb, 8500 ft):

**If TTR required pls. refer to document PSEL-0100**

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Title: **CRT-14" Pre-Installation Sheet**

Document No.: **PSEL-0006**

NATIONAL OILWELL VARCO

# TEST SPECIFICATION CRT-14.

## TORQUE FRAME ASSEMBLY 50008210Y30

**Part-number:** **Serial-number.**

**Torque Frame Assembly:** **50008210Y30** :_____

**Shop-Order Number** :_____

**Test Technician Name**
**Final-Assembly** :_____ **Date:**_____

**3rd Party Witness:**
**Agency-Name, Name,**
**Signature and Date** :_____

**Final Inspection:**
**Inspectors: name, signature**
**and stamp** :_____
(See page 12)

**Remarks:** _____

_____

_____

_____

| First Issue | Name: | Date |
|---|---|---|
| Prepared | L. Sonneveld | Jun. 29 06 |
| Checked | P. Dekker | Jun. 29 06 |
| Approved | A. Krijnen | Jun. 29 06 |

| Latest Revision. | |
|---|---|
| Name; | L. Sonneveld |
| Date: | June 30 2006 |
| ECN. | 700208 |

Rev. -



Title: **Inspection Criteria CRT-Torque Frame Assembly**

Document No.: **TSEL-0150**

**This specification defines the production testing of the CRT-14 Torque Frame assembly. Each unit is to be tested according to the following procedure.**
**Any defect is cause for stopping the test until the defect has been eliminated. All defects found during the test will be noted and signed off by the test-technician on remarks page.**
**In the event of a major defect whose repair would affect items previously inspected or tested, these affected items shall also be re-tested or re-inspected after the defect has been eliminated.**

**For Test items on the CRT "Final" Assembly refer to TSEL-0152.**

## 1. LOAD-TESTING

| | | Monogram |
|---|---|---|
| 1. | Load-test CRT Torque Frame Assembly to 1.5 times API Load-rating<br><br>Rated Load: 500 Short Ton 454 Mtonnes. 4454.6 Kn.<br>Test Load: 750 Short Ton 681 Mtonnes. 6682.0 Kn.<br><br>Note the Load tester Read out _____Kn.<br>Keep load for 5 minutes activated<br>Shop order number:<br>Load test by:<br>Date: | _____ |

# 2 FINAL ASSEMBLY INSPECTION

## 2.1 Mechanical Parts on Torque frame. #50008210Y30

For reference see drawing 50008210-30 & 50008200-20

| | | Monogram |
|---|---|---|
| 1. | Check that unit has been MPE inspected. | |
| 2. | Check if all sharp corners are de-burred properly. | |
| 3. | Check if grease has been sufficiently applied to all grease points. | |
| 4. | Check if Hoist ring can move Up & Down the full travel (8.125”). | |
| 5. | Check if twist-lock can turn freely “Open” to “Close” and back. | |
| 6. | Check smooth movement of the lower pipe sensor shoe.<br>Stroke of sensor shoe is 1.25” | |
| 7. | Check smooth movement of the upper pipe sensor shoe.<br>Stroke of sensor shoe is 1.25”<br>(Keep Lower Sensor shoe activated during this check. | |
| 8. | Check smooth pipe-size adjustment of the pipe sensor assembly. | |
| 9. | Check Pipe-Sensor Assembly can be adjusted to 6.56” from CRT centerline. | |
| 10. | Check Pipe sensor Horizontal adjustment travel is 5.5” minimum. | |
| 11. | Check smooth vertical movement of the compensator. | |
| 12. | Check if link blocks can be opened fully.<br>( Must swing out below lower link-ear.) | |
| 13. | Verify presence of “O” ring inside main shaft FAC tool threads. | |
| 14. | Verify proper fitment of the FAC-tool threads into the CRT Splined-shaft<br>(Use caliper) | |
| 15. | Verify FAC Tool lock screws (2 off) are in place and hex-head of lock screw in under-flush with CRT Splined-shaft. | |
| 16. | Verify proper Fit and Up/Down Travel of Catch plate into the CRT Torque frame.<br>(Use caliper) | |
| 17. | | |

## 2.2 Hydraulics and Pneumatics.

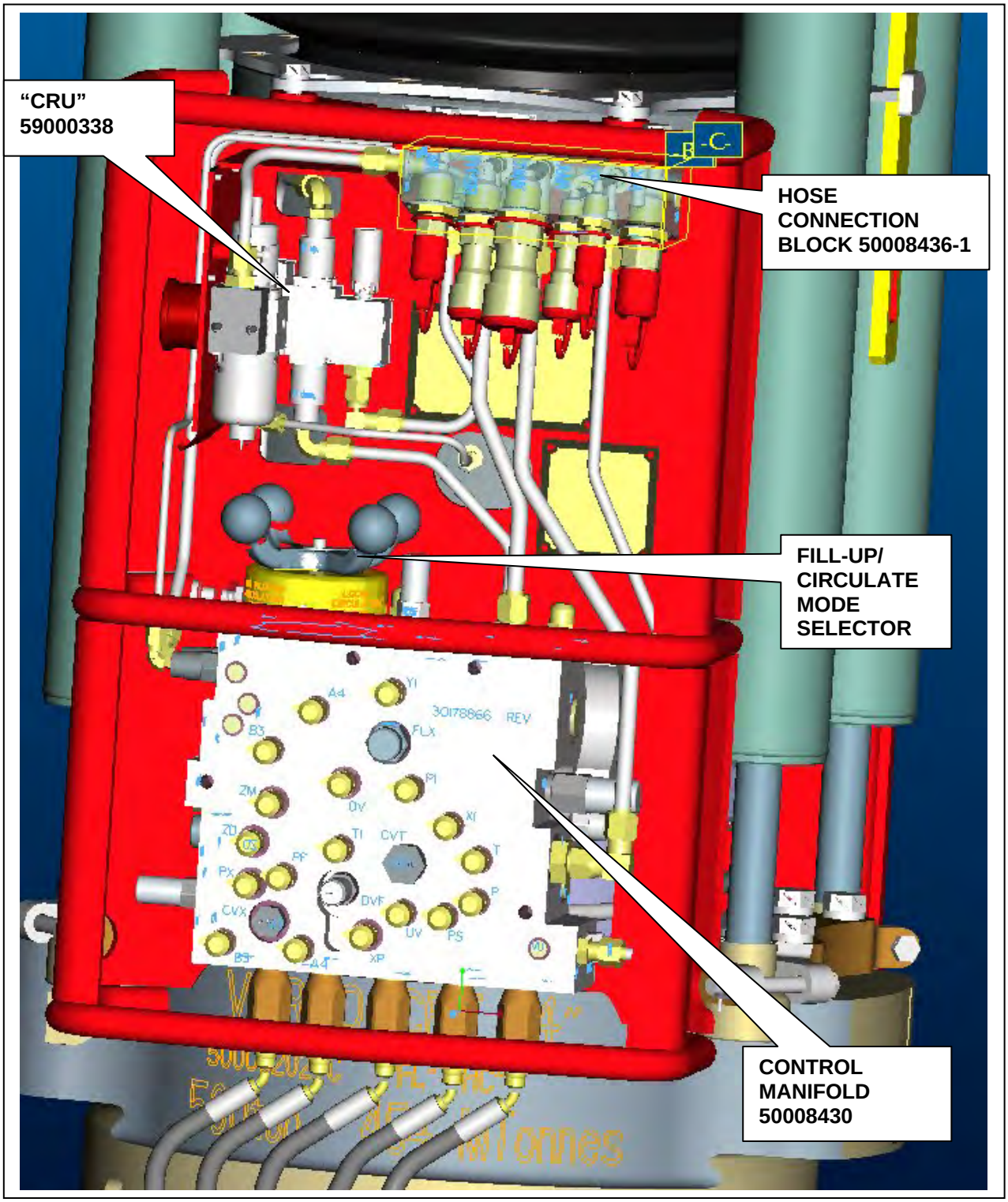
Equipment needed;

1) T= Tank line, maximum 250psi=17bar back pressure.
   ½" Hose with -8 male QD
2) P= Constant pressure, P=2000 psi=140 bar
   ½" Hose with -6 male QD
3) XP-line, the function of the XP-line is to control the slips of the body up/down and is signal line that the slips are set. We have 3 situations:
   1) XP= 2000 psi=140 bar, CRT slips up command.
   2) XP= 0 psi, CRT slips command "Armed To Close" (A.T.C.)
   3) XP= 1000 psi=70bar, CRT slips are set.

   3/8" Hose with -4 female QD
5) AIR-line, air to compensator, P= 90psi=6bar
   ½" Hose with -6 female QD
6) XAIR-line, air pilot, circulation mode, Pmax. 70psi=5bar
   ½" Hose with -4 male QD
7) XH-line, hydraulic pilot, circulation mode, P=2000 psi=140 bar
   ½" Hose with -8 female QD

- Set the assembled torque frame 50008210Y30 next to the body assembly 50008208Y20.
- Connect the slips down, slips up & XP hoses of the torque frame via extension hoses to the body manifold.
- Hook-up the Hoses to connection block 50008436-1.
- Set system-pressure to 2000 psi=140bar and flow-rate at 3-5 GPM = 10-20 Ltr/min.
- Set CRT air pressure regulator PRV1 at P= 90psi=6bar.

**For Valve settings Reference document; control schematic drawing 50008200-20.**




| First Issue | Name: | Date |
|---|---|---|
| Prepared | L. Sonneveld | Jun. 29 06 |
| Checked | P. Dekker | Jun. 29 06 |
| Approved | A. Krijnen | Jun. 29 06 |

| Latest Revision. | |
|---|---|
| Name; | L. Sonneveld |
| Date: | June 30 2006 |
| ECN. | 700208 |

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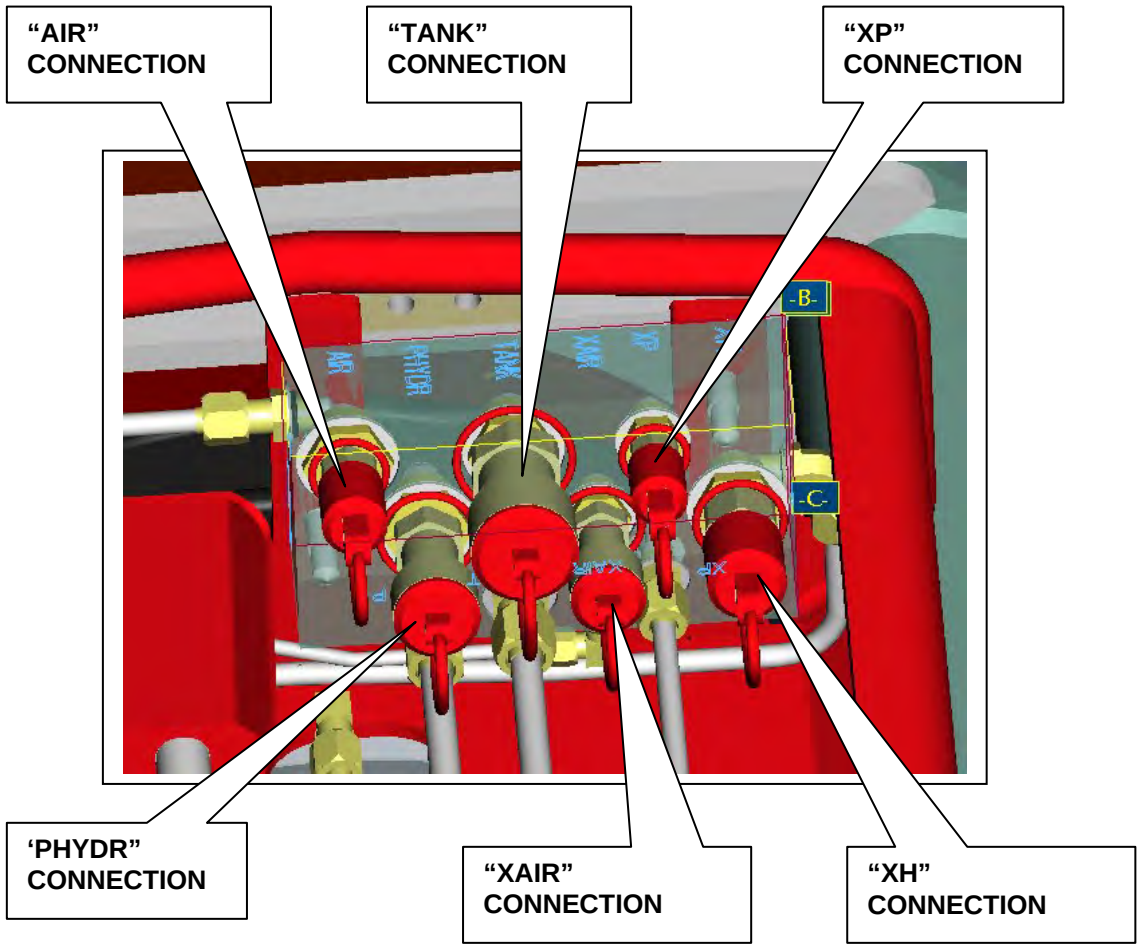
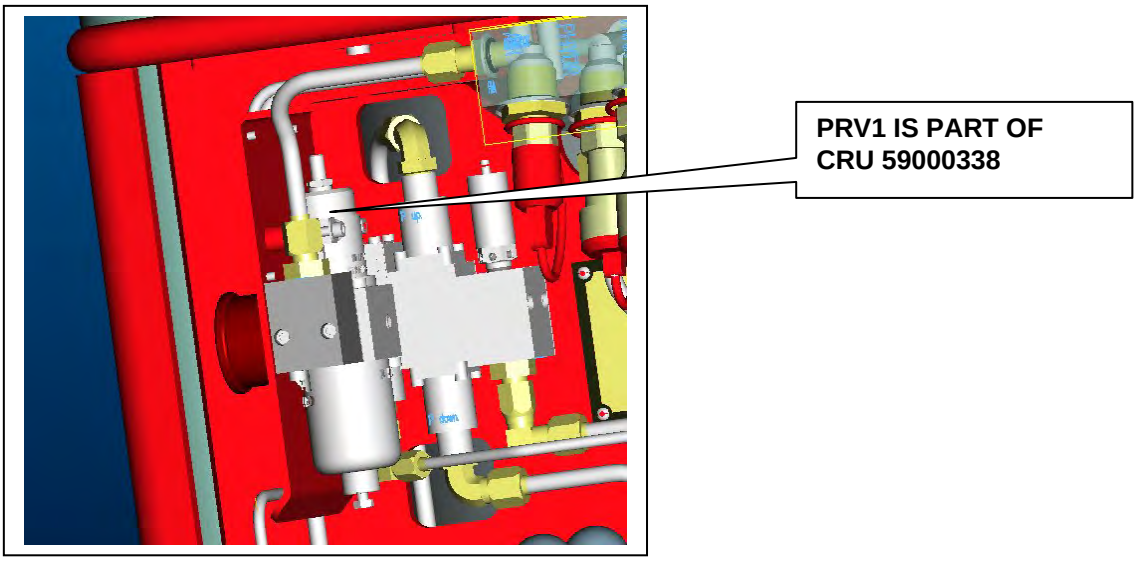
Title: **Inspection Criteria CRT-Torque Frame Assembly**

Document No.: **TSEL-0150**

Sheet: **5** of **12**

Connections Hydraulic & Pneumatic to 50008436-1

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| Latest Revision. | |
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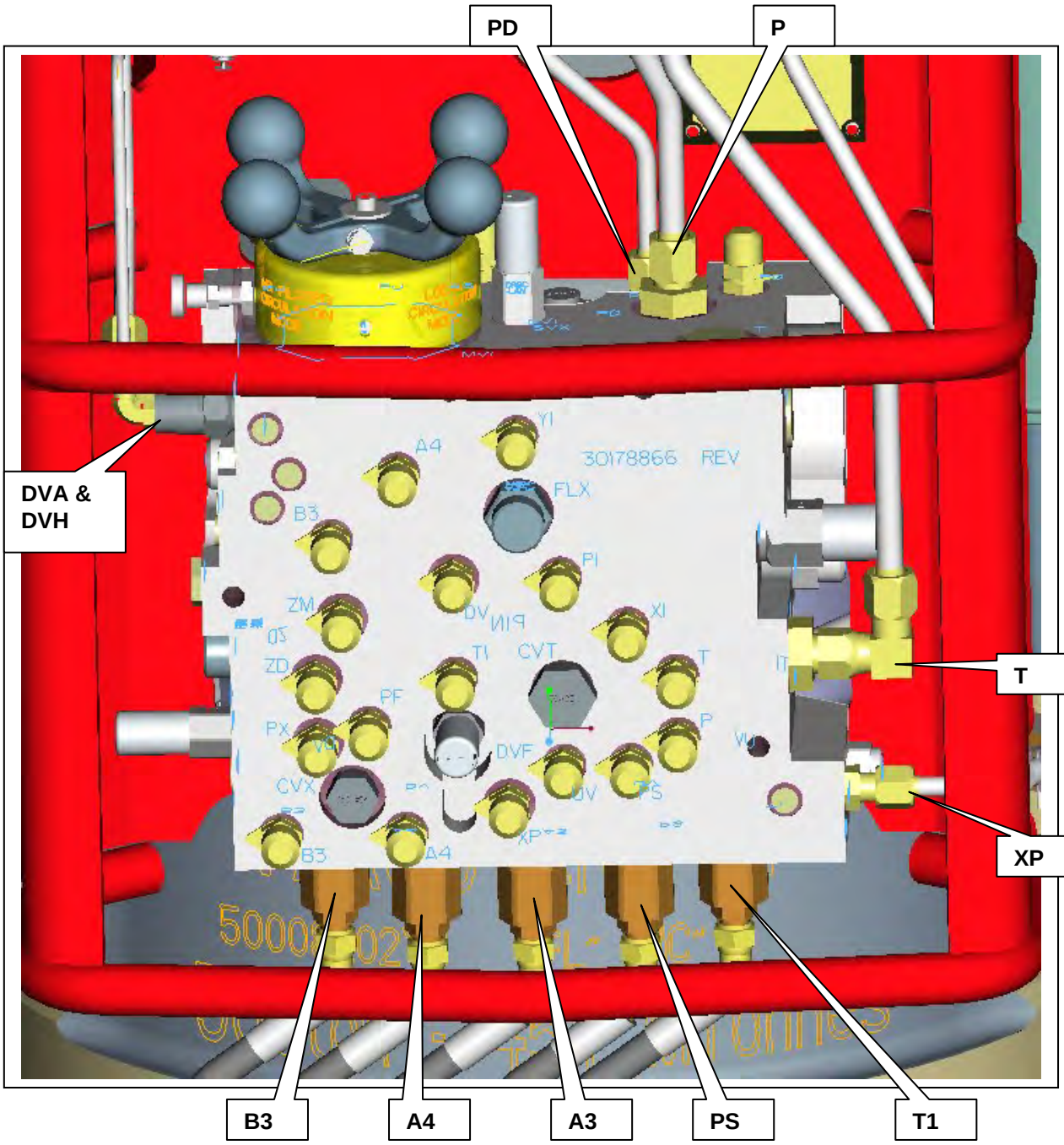
Document No.: **TSEL-0150**

Sheet: **6** of **12**




Connections to Control manifold 50008430

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| Approved | A. Krijnen | Jun. 29 06 |

| Latest Revision. | |
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Title: **Inspection Criteria CRT-Torque Frame Assembly**

Document No.: **TSEL-0150**

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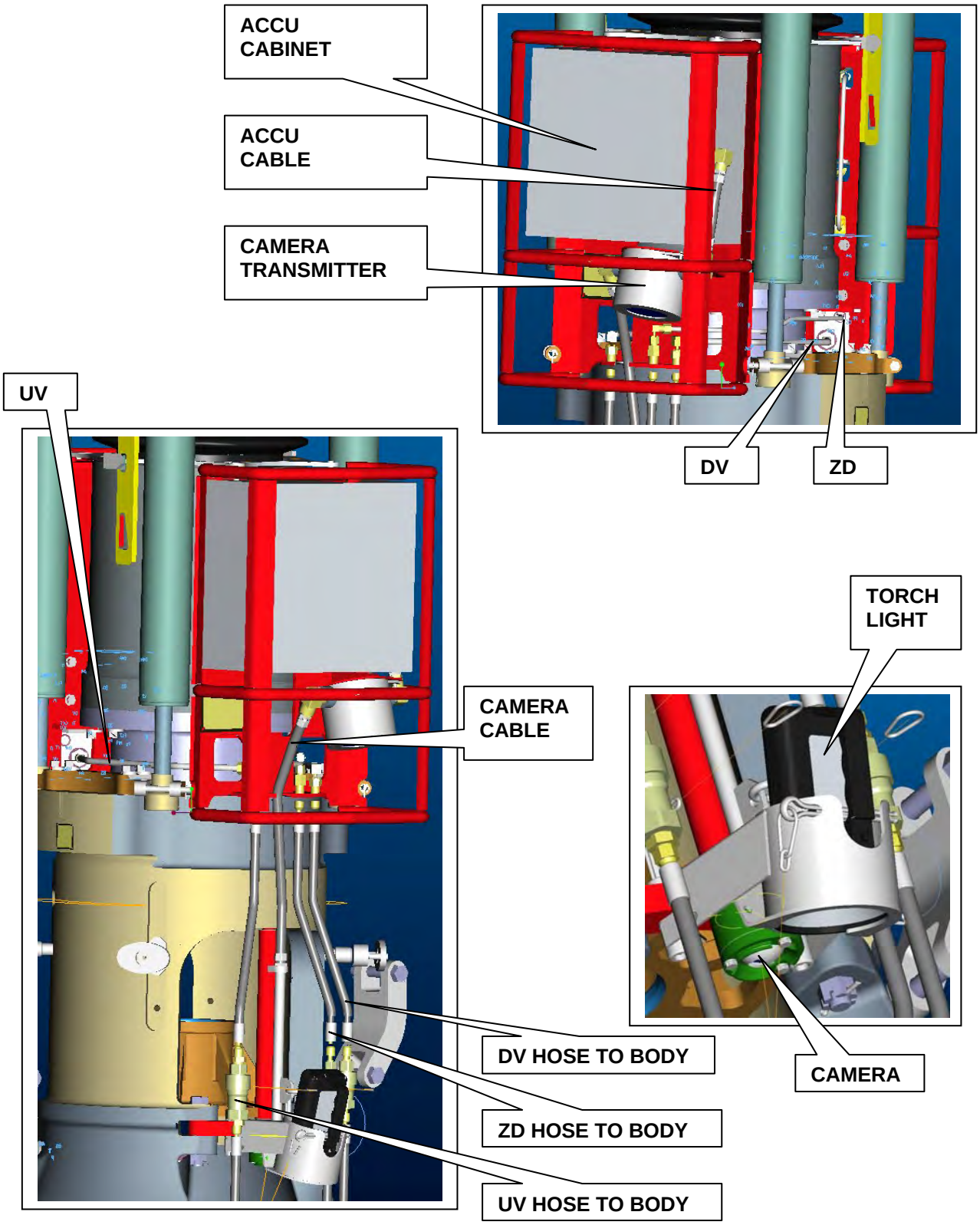


| First Issue | Name: | Date |
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Title: **Inspection Criteria CRT-Torque Frame Assembly**

Document No.: **TSEL-0150**

## 3. HYDRAULIC / PNEUMATIC PARTS

| | | Monogram |
|---|---|---|
| 1. | Check if all QD's are of the right size and connected correctly | |
| 2. | Check if air is purged out of the Hydraulic system. | |
| 3. | Lift the torque frame free from the floor with the crane.<br>(Weight ~ 2650Kg - 5840lbs)<br>Check if the compensator strokes out well below "Mid_Stroke". | |
| 4. | Set valve MV1 in the fill-up mode | |
| 5. | Put pressure on port "Slips down". Check if the slips stay up.<br>Check pressure at port DV = pressure at port P = 2000psi | |
| 6. | Increase the air pressure to the compensator by adjusting the Pressure Reducing Valve in the pneumatic assembly, until the torque frame lifts to the compensator's mid-stroke position in a continuous movement.<br>Check if the compensator stops at half it's travel.( Visual) | |
| 7. | Trigger Lower Pipe sensor and check slips travel DOWN | |
| 8. | Keep Pipe-sensor skate activated and put pressure on Slips UP.<br>Check if slips travel UP, compensator releases air. (release skate)<br>Check pressure at port UV = pressure at port P1 = 600psi.<br>If not adjust valve PC1. | |
| 9. | Put pressure on Slips DOWN and check compensator moves to MID-stroke. | |
| 10. | Repeat Items 6. 7 & 8 a total of 10 times | |
| 11. | Set valve MV1 in "Local circulation mode"<br>Repeat items 6, 7 & 8 a total of 10 times<br>Make sure to activate Lower skate FOLLOWED by Upper sensor skate. | |
| 12. | Set valve MV1 in "Air pilot circulation mode"<br>Put Pressure on Port "XAIR". Valve DVA is actvated, repeat items 6, 7 & 8 a total of 10 times<br>Make sure to activate Lower skate FOLLOWED by Upper sensor skate. | |
| 13. | Set valve MV1 in "Hydraulic pilot circulation mode"<br>Put Pressure on Port "XH". Valve DVH is activated, repeat items 6, 7 & 8 a total of 10 times<br>Make sure to activate Lower skate FOLLOWED by Upper sensor skate. | |
| 14. | Check if there are no leakages during the hydraulic test. Apply 2000psi Hydraulic pressure for 5 minutes with Slip cylinders fully extended and 5 minutes with Slip cylinders fully retracted. | |
| 15. | Verify NAS 8 cleanliness of the Oil in the Hydraulic System | |

## 4. Camera System

| | | Monogram |
|---|---|---|
| 16. | Check if all components are assembled correct.. | |
| 17. | For check working of camera, connect receiver 59001022-3 to Monitor 59001022-6. Monitor is not part of Camera system 59001022, monitor is optional. | |

## 5. SAFETY LOCKS

| | | Monogram |
|---|---|---|
| 1. | Check if all bolts on the Torque Frame Assembly are properly torqued and Lock-wired.<br>- Splined Ring<br>- Pipe-Sensor<br>- Compensator Retainer-Clamp<br>- Control Assembly's & Shields<br>- Compensator Spring Assemblies<br>- Link Grabber Assembly | |
| 2. | Check if all Cotter-pins are properly placed.<br>- Pipe-Sensor<br>- Compensator Retainer Clamp<br>- Compensator Lower Support | |
| 3. | Check if the Pipe sensor adjust bolt is locked with a cross-pin. | |
| 4. | Check if all Cross-pin's in the Pipe sensor are properly placed. | |

## 5. PRIOR TO PAINTING.

| | | Monogram |
|---|---|---|
| 1. | Check if Twistlock is covered by grease prior to painting and shipment. | |
| 2. | Check if Torque Frame / Hoist-ring Load-shoulders and Sliding surfaces are covered by grease prior to painting and shipment. | |
| 3. | Check if all hoses and Pipe Sensor rods are protected against paint. | |
| 4. | Check if all moveable parts are protected against sticking by paint. | |
| 5. | Check if the warning labels have been placed and protected against paint. | |

## 6. TRACEBILITY.

| **Traceability.** | **Monogram** |
|---|---|
| 1. Check presence and clearness of:<br>• Part-number.<br>• Serial-number. In this Format ***" TF. NL ***** "***<br>• Casting Heat-numbers.<br>• Casting Part-numbers. | |

| | **Monogram** |
|---|---|
| **NL number: _____Torque Frame Assembly** | |

| | Partnumber | Foundry | Serial number | Heatcode/number |
|---|---|---|---|---|
| | | | | |
| Torque Frame | 50008202__C | | | |
| Hoist Ring | 50008203__C | | | |
| Compensator Cylinder | 50008005 | n/a | | |

Manufacturing date & Revision manifold 50008430: _____

# FINAL INSPECTION (AFTER LAST PAINTING)

| | | Monogram |
|---|---|---|
| 1. | Verify Torque Frame is assembled according<br>Latest Revision Drawing 50008210-30 | |
| 2. | Check presence of Assembly Serial-number. | |
| 3. | Check presence of Assembly Part-number. | |
| 4. | Verify Heat code and Serial number table is correctly filled out. | |
| 5. | Check paintjob according QAW 7.2.1. | |
| 6. | Check whether all moveable parts are not locked in place by paint.<br>- Pipe Sensor.<br>- Compensator.<br>- Other movable parts. | |
| 7. | Check whether all unpainted parts are greased. | |
| 8. | Check preservation according QAP 7.2 | |
| 9. | Check whether all grease Points are greased . | |
| 10. | Check whether the TSEL is filled in completely and clearly. | |

| | |
|---|---|
| FINAL INSPECTORS STAMP<br><br>( Final Inspector to stamp-mark following, in BOTH the Torque frame as in Hoist Ring)<br>- API LOGO<br>- API LICENSE NUMBER<br>- APPLICABLE API PSL LEVEL | |

NATIONAL OILWELL VARCO

# TEST SPECIFICATION CRT-14

## BODY ASSEMBLY 50008208Y20

**Part-number:** **Serial-number.**

**Body Assembly:** **50008208Y20** :_____

**Shop-Order Number** :_____

**Test Technician Name Final-Assembly** :_____ **Date:**_____

**3rd Party Witness: Agency-Name, Name, Signature and Date** :_____

**Final Inspection: Inspectors: name, signature and stamp** :_____
(See page 6)

**Remarks:** _____

_____

_____

_____

| First Issue | Name: | Date |
|---|---|---|
| Prepared | L.Sonneveld | 30 June 06 |
| Checked | P.Dekker | 30 June 06 |
| Approved | A. Krijnen | 30 June 06 |

| Latest Revision. | |
|---|---|
| Name; | L.Sonneveld |
| Date: | 30 June 06 |
| ECN. | 700208 |

Rev. -



Title: **Inspection Criteria CRT-14 Body**

Document No.: **TSEL-0151**

**This specification defines the production testing of the CRT-14 body #50008208Y20.**
**Each unit is to be tested according to the following procedure.**
**Any defect is cause for stopping the test until the defect has been eliminated. All defects found during the test will be noted and signed off by the test-technician on the front page of this test-sheet.**
**In the event of a major defect whose repair would affect items previously inspected or tested, these affected items shall also be re-tested or re-inspected after the defect has been eliminated.**

**Refer to TSEL-0152 for CRT-14 final ASSY tests.**

## 1. LOAD-TESTING

| | | Monogram |
|---|---|---|
| 1. | Load-test CRT Body assembly to 1.5 times API Load-rating<br><br>Rated Load: 500 Short Ton 454 Mtonnes. 4454.6 Kn.<br>Test Load: 750 Short Ton 681 Mtonnes. 6682.0 Kn.<br><br>Note the Load tester Read out _____Kn.<br>Keep load for 5 minutes activated<br>Shop order number:<br>Load test by:<br>Date: | _____ |
| 2. | Load-test the “Single-Joint Elevator” Lugs (2-off) at the bottom of the CRT-body to 1.5 times API Load-rating<br><br>Rated Load: 5.0 Short Ton 4.54 Mtonnes. 44.55 Kn.<br>Test Load: 7.5 Short Ton 6.81 Mtonnes. 66.82 Kn.<br><br>Note the Load tester Read out _____Kn. Left hand side<br><br>Note the Load tester Read out _____Kn. Right hand side | _____ |

## 2. MECHANICAL PARTS (Reference drawing: 50008208-20)

| | | Monogram |
|---|---|---|
| 1. | Check that unit has been MPE inspected. | |
| 2. | Check if all sharp corners are de-burred properly. | |
| 3. | Check if all drilling-swarf is removed out of the greasing holes. | |
| 4. | Check if hoist swivel threaded holes are clean, damage free and machined at 90º to mating surface. | |
| 5. | With stationary hinge pin placed, check if unit can be opened to 18 5/8" minimum. Measured from Lug to Lug | |
| 6. | Check if leveling beam and all cylinders are "self centered" properly. | |
| 7. | Check if leveling beam can move up and down evenly. Both with and without slips placed. | |
| 8. | Check if leveling beam cam fully operates Leveling Beam Indicator Valve roller. | |
| 9. | Check if leveling beam can move freely without interference with the (hydraulic) components at the inside. | |
| 10. | Check if leveling beam can travel up and down freely both with and without slips assembled. | |
| 11. | Check if back-surfaces of all slip-segments make proper contact with machined surfaces of inside bowl. | |
| 12. | Check if unit can be easily opened and closed with leveling beam placed. | |
| 13. | Check if Removable Hinge Pin and both Leveling Beam Pin's can removed and placed back easily. | |
| 14. | Measure diameter between inserts with slips in up position. Dimensions: Pipe diameter plus 3 ¼" ± 1/8". | |
| 15. | Check if all moveable parts can move freely:<br>Slip links<br>Upper & Lower link pin<br>Leveling-beam Valve lever<br>Hoist Swivel Rings<br>Rotary-locks. | |
| 16. | Check if grease has been applied to all grease fittings. | |

## 3. HYDRAULIC PARTS (see schematic 50008200-20 sh2)

| | | Monogram |
|---|---|---|
| 1 | Verify the manifold is tested OK according to TSEL-0144 | |
| 2 | Check if air is purged out of the system. | |
| 3. | Check if leveling beam fully operates Leveling Beam Indicator Valve | |
| 4. | Check if there are no leakages during the hydraulic test. Apply pressure for 5 minutes with cylinders fully extended and fully retracted.<br>Slips up pressure UV=600psi=42bar<br>Slips down pressure DV=2000psi=138bar | |
| 5. | Check if there are no leakages after all hydraulic tests are finished. | |
| 6. | Verify NAS 8 cleanliness of the Oil in the Hydraulic System | |

## 4. SAFETY LOCKS

| | | Monogram |
|---|---|---|
| 1. | Check if Leveling Beam Retaining Nuts are torqued to 760 - 900 Lbs/ft. | |
| 2. | Check if Leveling-beam nuts 4plc cotter pins are properly placed and connected with a chain to the leveling beam. | |
| 3. | Check if Hoist Swivel Rings are mounted with Roller Bearing Loctite. | |
| 4. | Check if Hoist Swivel Rings are torqued to 100 ft-lbs. | |
| 5. | Check if Hoist Swivel Rings can pivot 180° and swivel 360°. | |
| 6. | Check if all bolts are properly lock-wired. | |
| 7. | Check if cotter pins at link pins are properly placed. | |

## 5. PRIOR TO PAINTING.

| | | Monogram |
|---|---|---|
| 1. | Check if bowl is covered by grease prior to painting and shipment. | |
| 2. | Check if all hoses and cylinder rods are protected against paint. | |
| 3. | Check if manufacturer instructions on the hoist swivel rings are protected against paint. | |
| 4. | Check if all moveable parts are protected against sticking by paint. | |
| 5. | Check if the warning labels have been placed and protected against paint. | |

## 6. TRACEBILITY

| **Traceability.** | **Monogram** |
|---|---|
| 1. Check presence and clearness of:<br>• Part-number.<br>• Serial-number. In this Format ***" Body. NL ***** "***<br>• Casting Heat-numbers.<br>• Casting Part-numbers.<br>• CE/ATEX CODE: "CE Ex 2G c T5" | |

| | **Monogram** |
|---|---|
| **NL number: _____Body Assembly** | |

| | Part number | Foundry | Serial number | Heat code/number |
|---|---|---|---|---|
| | | | | |
| Body left | 50008209__C | | | |
| Body right | 50008209__C | | | |
| Stat.Hinge pin | 200940-1 | n/a | | |
| Rem.Hinge pin | 50008222 | n/a | | |
| Hoist swivel rings | 980473-2 | n/a | | |
| | 980473-2 | n/a | | |
| | 980473-2 | n/a | | |
| | 980473-2 | n/a | | |

Manufacturing date & Revision manifold 50008375: _____

## 7. IN-LINE INSPECTION

| | |
|---|---|
| INLINE INSPECTOR STAMP MARK IN CRT Body | |

ACCEPTANCE INLINE INSPECTOR:

Signature and stamp_____

## 8. FINAL INSPECTION (AFTER LAST PAINTING)

| | | **Monogram** |
|---|---|---|
| 1. | Check presence of Assembly Serial-number. | |
| 2. | Check presence of Assembly Part-number. | |
| 3. | Verify that table with Heat codes and Serial-numbers is correctly filled out. | |
| 4. | Check whether all moveable parts are not locked in place by paint.<br>- Cylinders.<br>- Manufacturing instructions of the Hoist swivel rings.<br>- Other movable parts. | |
| 5. | Check whether all unpainted parts / surfaces are greased. | |
| 6. | Check whether all greasing areas are greased.<br>- Bowl.<br>- Hinge pins.<br>- Leveling Beam Grease Points | |
| 7. | Check whether the TSEL is filled in completely and clearly. | |

| | |
|---|---|
| FINAL INSPECTORS STAMP<br><br>( Final Inspector to stamp-mark the following; )<br>- API LOGO IN CRT Body<br>- API LICENSE NUMBER<br>- APPLICABLE API PSL LEVEL | |

NATIONAL OILWELL VARCO

# TEST SPECIFICATION
# CRT-14.
*FINAL ASSEMBLY.*

| | Part-number | Serial-number |
|---|---|---|
| **Final Assembly** | **: 50008200Y2** | **:_____** |
| **Torque Frame Assembly:** | **500008210Y30** | **:_____** |
| **Body Assembly;** | **: 50008208Y20** | **:_____** |

**Shop-Order Number Final assy :_____**

**Test Technician Name Final-Assembly :_____ Date:_____**

**3rd Party Witness: Agency-Name, Name, Signature and Date :_____**

**Final Inspection: Inspectors: name, signature and stamp :_____**

**Remarks:** _____

_____

_____

_____

| First Issue | Name: | Date |
|---|---|---|
| Prepared | L.Sonneveld | 30 June 06 |
| Checked | P.Dekker | 30 June 06 |
| Approved | A. Krijnen | 30 June 06 |

| Latest Revision. | |
|---|---|
| Name; | L.Sonneveld |
| Date: | 30 June 06 |
| ECN. | 700208 |

Rev. -



Title: **Inspection Criteria CRT-14 Final assembly**

Document No.: **TSEL-0152**

**This specification defines the production testing of the CRT-14 Final assembly. Each unit is to be tested according to the following procedure.**

***For Test items CRT-14 "Torque Frame" Assembly refer to TSEL-0150.***
***For Test items CRT-14 "Body" Assembly refer to TSEL-0151.***

**Any defect is cause for stopping the test until the defect has been eliminated. All defects found during the test will be noted and signed off by the test-technician on remarks page.**
**In the event of a major defect whose repair would affect items previously inspected or tested, these affected items shall also be re-tested or re-inspected after the defect has been eliminated.**

## 1.0 FINAL INSPECTION

1. Verify that the CRT is assembled according to latest revision assembly drawings: 50008200-2. _____

2. Verify presence, clearness and correctness of markings. _____

3. Check if TSEL is filled out completely and clearly. _____

4. Final inspector's stamp (API) monogram in; Torque frame, Hoist ring and Body. _____

| First Issue | Name: | Date |
|---|---|---|
| Prepared | L.Sonneveld | 30 June 06 |
| Checked | P.Dekker | 30 June 06 |
| Approved | A. Krijnen | 30 June 06 |

| Latest Revision. | |
|---|---|
| Name; | L.Sonneveld |
| Date: | 30 June 06 |
| ECN. | 700208 |

Rev. -



Title: **Inspection Criteria CRT-14 Final assembly**

Document No.: **TSEL-0152**

## 2.0 TRACEBILITY.

### Final assembly.

Final Assembly NL number : _____ Part-no. 50008200Y2

(note; *Final assembly NL number* shall be stamped on both the Torque frame assembly as well as the Body assembly!!
Stamp Format ( “CRT assembly NL#” ) – “Torque-frame assembly NL#”

( “CRT assembly NL#” ) – “Body-frame assembly NL#”

Example:

“CRT NL12345 – TF. NL 54321” (On Torque Frame Assembly)

“CRT NL12345 – Body. NL 98765” (On Body Assembly)

Torque-frame Assy NL number: _____ Part-no.: 50008210Y30

Body Assy NL number: _____ Part-no.: 50008208Y20

NATIONAL OILWELL VARCO

**Rig Name** :_____

**CRT-14 Serial Number (NL-*****)** :_____

**Customer Ref. Number** :_____

**Varco Sales Order Number** :_____

**Varco Service Eng. Name** :_____

**& Signature** :_____

**Varco CRT-14 Manual Revision/Date:**_____

**Commissioning Date** :_____

**Remarks** :_____

_____

_____

# Field Commissioning and Instruction Procedure CRT-14, BX-Control 50008200Y2

| First Issue | Name: | Date |
|---|---|---|
| Prepared | L.Sonneveld | 30 June 06 |
| Checked | P.Dekker | 30 June 06 |
| Approved | A.Krijnen | 30 June 06 |

| Latest Revision. | |
|---|---|
| Name; | L.Sonneveld |
| Date: | 30 June 06 |
| ECN. | 700208 |

Rev. -



Title: **Field Commissioning and Instruction Procedure CRT-14**

Document No.: **TSEL-0154**

**During Commissioning, all of the following rig personnel need to be present for witnessing. Please check and have them signed for their presence during the complete commissioning procedure.**

**Rig Commissioning Supervisor :** _____

**Rig Company Rep. :** _____

**Rig O.I.M :** _____

**Rig Maintenance Supervisor :** _____

**Driller(s) (Assistant Driller(s)):** _____

**After completion of the commissioning procedure, the following people have to sign for approval:**

**Rig Commissioning Supervisor:** _____

**Rig Company Rep. :** _____

**O.I.M. :** _____

**After final approval, hand over copies of the completed TSEL to all attendees.**

## General Warnings:

**1: Make sure a safe and clean working environment is provided when field commissioning the CRT-14.**

**2: Cleaning requirements of the system before connecting the CRT-14 to the top drive.**

- Verify the quality of the hydraulic oil coming out of the rotating head ports on the top drive, onto which the CRT-14 has to be installed, meets NAS Class 9 specifications. In case not, prior to continuation of the commissioning, clean and purge the hydraulic circuits on the top drive until all requirements are met.
- Verify that the pressurized air coming out of the rotating head ports on the top drive, onto which the CRT-14 has to be installed, is free of dirt/metal particles, is free of moisture/water and is well lubricated.
- In case the air- and hydraulic hoses running between the rotating head and the manifolds on the CRT-14 have been shipped to the rig unattached to the CRT-14, clean and purge these hoses prior to installation.
- Always remove all external dirt from any quick disconnects, prior to engagement of that quick disconnect.

**3: As the CRT-14 is to be considered as overhead hoisting equipment, always make sure that prior to installation:**

- All bolts on the tool are securely fastened and correctly lock wired.
- All safety cables, chains and clips are correctly installed.
- No loose foreign objects are present on the tool.

**4: Beware of personal injury when transporting the tool around the rig floor and/or installing the tool to the top drive. The CRT-14 is a heavy piece of equipment.**

- Do not place hands or feet underneath the tool when the tool is hanging free from the rig floor.
- When the tool is transported along the rig floor, do not place yourself between the tool and the rig structure or heavy equipment on the rig floor.
- Only lift the tool using the link ears on the CRT-14 frame and/or using the special CRT-14 lifting/transportation skid and or lifting sling.

**Violation to these rules can cause severe personnel injuries and/or cause major damage to the CRT-14 or other rig equipment.**

# ***Procedure.***

**Notes:**

- **The CRT-14 is designed to fit under a variety of top drives, this procedure is written independent to the specific top drive onto which this CRT-14 has to operate. Nor does this procedure include the commissioning of the top drive itself. In case needed to clarify this commissioning procedure, references to Varco top drives are made.**

- **The CRT-14 is designed to operate from hydraulic BX controls, this procedure is written dependent to the hydraulic BX controls that will be used to operate this CRT-14. This procedure does not include the commissioning of the controls themselves. In case needed to clarify this commissioning procedure, references to the Varco TDS operator panels are made.**

## 1: General.

- Go through the CRT-14 manual with the customer representatives, as mentioned on page 2, during commissioning procedure. Get agreement on contents. ☐ **OK**

- Specifically point out chapter 1 in the manual and highlight the operational limits (loads) of the tool, as well as the conventions to work safely with the CRT-14. ☐ **OK**

- Show storage location of
  – CRT-14 ☐ **OK**
  – CRT-14 lifting/transportation skid ☐ **OK**
  – Slip sets ☐ **OK**
  – Bottom guides ☐ **OK**
  – Guide-cones and packer seals for fill-up and circulation tool (FAC Tool) ☐ **OK**
  – Assembly and servicing tools for FAC Tool ☐ **OK**
  – Manual & Instruction list of “Do’s & Don’t” ☐ **OK**

- Check the presence of all size components (slips, guide-cones, packer seals, etc) according to the applicable sales order(s). ☐ **OK**

- Standing at the CRT-14, point out the following components and highlight their functionality (components are listed from top to bottom of CRT-14):

  - Cross-over sub. This component adapts the CRT-14 to the various top drive brands and types as well as to various link types (lengths). ☐ **OK**

- Compensator retainer. This retainer adapts the CRT-14 to minor changes in link lengths. See manual chapter 4 for detailed instructions. ☐ **OK**

- Compensator. The compensator reduces vertical loads on the casing threads during;
  - Casing Stabbing.
  - Allows for vertical travel of the casing joint while spinning In.
  - Make-up of casing connection. ☐ **OK**

- Splined shaft. The splined shaft transfers the make-up torque from the TDS/ CRT-14 main shaft to the CRT-14 frame, while allowing vertical travel of the CRT-14 frame during make-up. ☐ **OK**

- Hydraulic manifold 5008430. This manifold controls the operation of the hydraulic cylinders inside the CRT-14 body, thus controlling the slips inside the CRT-14 body. This manifold also processes the signals coming from the upper and lower pipe sensors. ☐ **OK**

- CRU 59000338. Controls the air supply to compensator. ☐ **OK**

- CRT-14 frame. The CRT-14 frame transfers the make-up torque from the splined shaft to the CRT-14 body and transfers the string weight from the CRT-14 body to the Hoist Ring. ☐ **OK**

- Hoist Ring. The hoist ring transfers the casing string weight from the CRT-14 frame to the links. TDS configuration:
  (See manual chapter 2&4 for explanation.) ☐ **OK**

- Upper sensor on CRT-14 Pipe-sensor frame.
  This sensor detects the pipe when the CRT-14 is operating in circulation mode. (See manual chapter 2&4 for explanation). ☐ **OK**

- Lower pipe sensor. This sensor detects the pipe when the CRT-14 is operating in the fill-up mode. (See manual chapter 2&4 for explanation). ☐ **OK**

- FAC tool. Allows the casing to be filled up with mud after make-up of a new joint, as well as allows mud to be circulated through the casing string at high pressure. The mud saver at the bottom of the FAC tool prevents mud from dripping on the drill floor after a fill-up. Point out the 4 retainer-buttons on the FAC tool that lock the guide cone and sealing cup in place. ☐ **OK**

- Catch plate. This component prevents the CRT-14 to be lowered too far over the next joint of casing. And is located inside the torque Frame. ☐ **OK**

- CRT-14 body containing the hydraulic slip operating cylinders, the leveling beam and the slips. Point out the removable hinge pin in the body and the 2 leveling beam pins. Refer to the procedure listed in the manual chapter 5 regarding opening/closing the CRT-14 body and changing the slips.
  **Highlight that the CRT-14 should <u>never</u> be operated without the leveling beam pins installed. Violation to this rule might lead to severe equipment damage and even to personal injuries.** ☐ **OK**

- Mounting holes in body for SJX elevator lifting sling. In case the CRT-14 has to be operated together with a SJX elevator, the corresponding lifting sling should always be attached to these holes. These holes in the CRT-14 body are Load-rated and Load-tested acc API 8C requirements. ☐ **OK**

- Bell guide with internal replaceable bottom guides. The bell guide and bottom guides allow easy stabbing of the CRT-14 over the casing as well as protect the FAC tool from being damaged during this stabbing. **Highlight that the CRT-14 should <u>always</u> be operated with the <u>correct</u> bottom guides installed in the bell guide. And with a safety cable attached to it. Violation of this rule can cause severe equipment damage and/or personnel injuries.** ☐ **OK**

## 2: Step by step installation and system check demonstration.

The following demonstration has to be performed to the customer. The demonstration features:

- Step by step rig up of the CRT-14.
- Total system check.
- Change-out of size components.
- Step by step rig down of the CRT-14.

- Prior to starting the real demonstration, check if the rig performance meets the requirements listed in the manual chapter 2. If these requirements are not met, corrective action needs to be taken before continuation of the demonstration.
  - Hydraulic pressure measured at ports of rotating head is 2000psi=140bar. ☐ **OK**
  - Hydraulic backpressure measured at ports of rotating head should never be more than 250psi=17bar. (Check when other equipment is running.) ☐ **OK**
  - The required hydraulic flow through the rotating head is: **3-8 GPM=14-36 Ltr.min**. ☐ **OK**

    *Note: This CRT-14 is specifically designed to work with the variable displacement pump of the Varco TDS-11. See Top drive manual for further information.*
  - Minimum required pneumatic (air) pressure to compensator at outlet of rotating head is 90 psi=6bar, but should not exceed 150 psi=10bar. ☐ **OK**
  - When using for circulation mode the Air pilot circulation mode. Maximum pneumatic (air) pressure: 70psi=5bar ☐ **OK**
- Remove the SJX lifting slings from the holes in the CRT-14 body if applicable. ☐ **OK**
- Check the rating and EXACT (measured) length of the links where the CRT-14 is to be installed to. Check if the right cross-over sub is installed to the CRT-14 main shaft, per the instructions listed in the manual chapter 4. ☐ **OK**
- Pick up the CRT-14 by the skid and hoist to the drill floor. Place the CRT-14 on the drill floor as closest to the well center as possible. ☐ **OK**
- Check if “Center plate” in skid confirms with spider in rotary table. Place transport skid with CRT-14 in vertical position. Transport “skid” to well center and place “transport skid” over the spider in rotary table, until the “transport skid” rests on the rotary table.
  By placing the “transport skid” like described above eases the alignment of the TDS shaft and the CRT-14 shaft during further rig-up. ☐ **OK**

- Unlock and open the link blocks on the CRT-14 link ears. ☐ **OK**

- Check that the saver-sub has been removed from the top drive shaft. Then lower the top drive until the CRT-14 cross-over sub stabs into the lower IBOP on the top drive. Beware during lowering that the links do not foul with any parts of the CRT-14, and also line up with the link ears on the CRT-14 frame. Engage the lower link eyes over the CRT-14 link ears. ☐ **OK**

- Close and fasten the link blocks on the CRT-14 link ears. See manual chapter 4. ☐ **OK**

- Make up the connection between cross-over sub and lower IBOP using the pipe handler on the top drive. The make-up torque should never be less than 50,000 ft-lbs, and should never exceed the make-up torque of the connection between the lower- and upper IBOP on the top drive. ☐ **OK**

- Pick up the weight with the top drive until CRT-14 is free from skid. Now check and, if applicable, adjust the position of the compensator retainer. There are 5 grooves in the CRT-14 main shaft that the compensator retainer can be mounted into. Which groove to take depends on the exact length of the links. See manual chapter 4 for detailed instructions. ☐ **OK**

- If the position of the compensator retainer has been changed. Again see manual chapter 4 for detailed instructions. ☐ **OK**

- Attach the 4 or 5 CRT-14 control hoses to the top drive rotating head, according to the following specification: All hose connections are on connection block 50008436-1. For more connection details see any rig specific hook up drawing.

  - Hydraulic pressure hose “P” : this is a constant hydraulic pressure connection. coming from rectifier manifold. P=2000psi=140bar ☐ **OK**
  - Hydraulic return (tank) hose “T” : this is a constant hydraulic return connection, coming from rectifier manifold. Pmax=250psi=17bar ☐ **OK**
  - XP-line, the function of the XP-line is to control the slips of the body up/down and is signal line that the slips are set. We have 3 situations:
    1) XP= 2000 psi=140 bar, CRT slips up command.
    2) XP= 0 psi, CRT slips command “Armed To Close” (A.T.C.)
    3) XP= 1000 psi=70bar, CRT slips are set.
    The XP-line is controlled by the control valve for a hydraulic BX-elevator. ☐ **OK**
  - Compensator supply hose: this is a pneumatic (air) connection. During operation of the CRT-14, this hose should be constantly pressurized with air. ☐ **OK**

- Tree options for Circulation mode: - Local circulation mode
  - Air pilot circulation mode
  - Hydraulic pilot circulation mode

Local circulation mode:
Set the handle of valve MV1 Fill-up/ circulate mode selector in Local circulate mode position. ☐ **OK**

Air pilot circulation mode:
Connect a hose to “XAIR” connection. Pmax=70psi=5bar ☐ **OK**

Hydraulic pilot circulation mode:
Connect a hose to “XH” connection. P=2000psi=140bar. ☐ **OK**

- If applicable (for instance to all Varco DC top drives), while up at the rotating head, disengage the cam roller on the rotating head from the cam plate. This allows the rotating head together with the pipe handler to rotate freely with the CRT-14. ☐ **OK**

- Check the air pressure setting of the compensator. When the air supply to the compensator is turned on, the compensator should lift the CRT-14 body from the rotary table and stroke to its middle position. In case the compensator is not strong enough to lift the body from the rotary table, adjust the pressure setting as outlined in manual chapter 4. ☐ **OK**

- Check the correct functioning of the slip cylinders and hydraulic manifold by the following procedure:
  1: Activate the lower pipe sensor manually and keep it activated.
  2: With the lower pipe sensor still activated, operate the “CRT open” button “inside the driller’s cabin. The slips should now rise. ☐ **OK**
  3: With the lower pipe sensor still activated, operate the “CRT armed to close” button. The slips should stay in the raised position now. ☐ **OK**
  4: Release the lower pipe sensor. Slips should stay UP. ☐ **OK**
  5: Activate the lower pipe sensor manually again. The slips should now set. ☐ **OK**

- Check the correct functioning of the circulation mode by the following procedure:
  1: Activate the lower pipe sensor manually and keep it activated.
  2: With the lower pipe sensor still activated, operate the “CRT open” button inside the driller’s cabin. The slips should now rise. ☐ **OK**
  3: With the lower pipe sensor still activated, operate the “CRT armed to close” button. The slips should stay in the raised position now. ☐ **OK**

4: Release the lower pipe sensor.
5: Command the CRT-14 into circulation mode.
6: Activate the lower pipe sensor manually again. The slips should now still not set.
7: With the lower pipe sensor still activated, activate the upper pipe sensor.
The slips should now set. ☐ **OK**

- Check that all hoses are securely strapped to the CRT-14 and are not susceptible to damage while rotating the CRT-14 in the derrick. Beware of the stroke of the compensator. ☐ **OK**

- Raise the top drive/CRT-14 out of “transport skid”, remove “transport skid” away from drill floor. ☐ **OK**

- Check that the CRT-14 can rotate without any interference with the top-drive or other derrick equipment. ☐ **OK**

- Raise the top drive/CRT-14 approx. 20 feet into the derrick (at least above the height of any wind wall or surrounding buildings). Start rotating the CRT-14. Slowly increase the speed from 0 to 30 RPM. Check for the absence of any unwanted vibrations in either the top drive/CRT-14 combination or in the derrick structure. ☐ **OK**

- Lower the top drive/CRT-14 until the bell guide of the body rest on the top cover of the spider in the drill floor. Be sure that the CRT body stands stable on the top cover. ☐ **OK**

- Point out the grease points on top of the CRT-14 body. Explain that these grease-points should be used to grease the back of the slips. This greasing operation should be performed during a casing run at a regular basis, but at least every 25 joints, to avoid any damage or unacceptable wear to the slip- and body tapers. ☐ **OK**

- Disconnect the 3, 1/2” hoses inside the CRT-14 frame going into the CRT-14 body. ☐ **OK**

  Lead the Hose ends outside of the torque frame.
  Then unlatch the 2 locks located on top of the Body’s Drive lugs, outside off the CRT-14 Torque frame.(Note: these actions should be performed in this sequence only!)

- Now “Untwist” the connection between CRT-14 Torque frame and Body. Turn Top-drive and the Torque-Frame assembly SLOWLY 45 degrees **CCW** ☐ **OK**

- Next raise the top drive together with the CRT-14 compensator and frame ~5 feet from the body. ☐ **OK**

- With the body opened up, demonstrate:
  - How the slips and or insert-carriers can be changed.
    See manual chapter 5 for detailed instructions and size chart. ☐ **OK**
  - How the bottom guide must be changed. See manual chapter 5 for detailed instructions and size chart. ☐ **OK**
  - How the fill-up tool can be redressed. (Since there might not be casing present on the drill floor at this moment, the special FAC packer change-out tool could possible not be demonstrated, but its use can and should be explained now).
    See manual chapter 5 for detailed instructions. ☐ **OK**
  - Demonstrate how the lower pipe sensor's radial position should be adjusted in order to adapt to the new FAC packer's outer diameter. See manual chapter 4 for detailed instructions. ☐ **OK**
  - Demonstrate how the lower pipe sensor can be easily hinged out of the way (in order to provide internal clearance around the packer) by removing the Right-hand side sensor-frame hinge pin. No bolts need to be loosened to perform this operation. ☐ **OK**
- Re-assemble all size-components. ☐ **OK**
- Close the CRT-14 body again;
  Re-assemble hinge-pins and leveling beam pins & clips. ☐ **OK**
- Lower the CRT-14 frame until the "Twist-lock" flanges on the frame align with the grooves in the body. Then turn the Torque frame ~45degrees to lock the CRT-14 body. Latch the two lock-sliders in-place and place the clips on top. ☐ **OK**
- With the CRT-14 still resting on the spider cover (no center hole cover plate installed inside the FMS; remove if applicable) start the mud pumps and feed mud trough the FAC tool (and through the FMS back into the mud diverter). Visually check for adequate mud-flow through the FAC tool. ☐ **OK**
  *Note: Maximum mud flow: 10 BBL/min.*
- Stop the mud pumps. Check that the mud saver valve on the bottom of the FAC tool adequately blocks any remaining mud-flow and prevents loss of mud. ☐ **OK**

- Hoist the CRT-14 together with its frame ~3 feet into the derrick. Then demonstrate how an SJX lifting sling should be attached to the holes in the CRT-14 body. See manual chapter 5 for detailed instructions. ☐ **OK**

- Point out according to the information in the manual chapter 5, the standard operation routines when using a CRT-14 for casing operations. ☐ **OK**

- Carry out and demonstrate the daily maintenance procedure as listed in the manual chapter 3. ☐ **OK**

**Loss of Power Test**

To verify the CRT-14 safely holds a load in the event of power loss and re-energizing of power, the following test should be performed.

**Test Setup**

1. CRT-14 is rigged up under the Top Drive and is ready for operation. ☐ **OK**
2. Prepare a test location that will support the tubular if it is dropped by the CRT-14. This could be several layers of boards placed over the Rotary Table opening, or the rig floor directly below the tubular with the blocks retracted (protect the floor and the tubular threads by utilizing wood blocks or similar on the floor). ☐ **OK**
3. Connect a test gauges to test ports “XP”, ”P” & “T” on the CRT-14 manifold assembly 50008430. Activate the lower pipe sensor manually and set the slips from the control panel. ☐ **OK**

**Test Execution**

1. Pick up a tubular with the CRT-14 in the normal manner. Insure the slips are set properly on the tubular and the “slips set” signal is activated. Port “XP” (1000psi=70bar). ☐ **OK**
2. While holding the tubular in the CRT-14 lower the traveling assembly to bring the bottom of the tubular within a few inches of the top of the wooden boards over the rotary table. Or retract the blocks so the tubular is over a protected area of the rig floor. ☐ **OK**
3. Turn off hydraulic power to the CRT-14. Verify pressure is 0 psi on ports “XP”, ”P” & “T”. ☐ **OK**
4. Observe the tubular hanging in the CRT-14 over a 5 minute time span. Any movement of the tubular is a failure of the test and cause to rig down the CRT-14 and inspect and repair as required. ☐ **OK**
5. Before Re-apply hydraulic power to the CRT-14 be sure that CRT console switch is in armed to close position. To avoid rising to slips of the CRT body. ☐ **OK**
6. Observe the tubular hanging in the CRT-14 over a 1 minute time span. Any movement of the tubular is a failure of the test and cause to rig down the CRT-14 and inspect and repair as required. ☐ **OK**

- **Rig down of the CRT-14**: There are 2 different procedures to rig down a CRT-14:
  - The first procedure regards the normal rig down of a CRT-14 at the end of a casing run. This procedure will be demonstrated now.
    For rig down procedure see manual chapter 5.
  - The second procedure regards an emergency (unplanned) rig down of a CRT-14. This procedure will not be demonstrated, but is described in the manual chapter 5. Highlight this chapter to the customer, and get agreement of content.

- End of demonstration. Ask attendees for any outstanding questions. ☐ **OK**

- At this moment, or in a separate session, point out and explain the content of those chapters in the manual to the Rig Maintenance Supervisor showing the:
  - Repair-(chapter 6), inspection-(chapter 3) and assembly instructions (chapter 6) as listed in the manual. ☐ **OK**
  - Assembly drawings (chapter 6) in back of manual (or Volume 2) ☐ **OK**
  - CRT-14 hydraulic and pneumatic schematic in back of manual (or Volume 2) ☐ **OK**

  Show, with the schematic at hand, on the tool where each control component can be found. Show where the hydraulic test ports (for connecting a pressure gauge) can be found. Show the lettering stamped into the manifold block and show the correlation to the text on the schematic. Point out the standard pressure settings listed on the schematic. ☐ **OK**

- Have the RMS's signature after completion of this dedicated session:

  Name: _____

  Title: _____

  Date: _____ ☐ **OK**

---------- End of Document ----------

| Betriebsanleitung | Operating instruction | Mode d'emploi |
|---|---|---|

# Explosionsgeschützter Handscheinwerfer

# Explosion-protected hand lamp

# Projecteur portatif antidéflagrant de secours

**6143**

**Ausführung 6143/3-65**
**Version 6143/4-65**
**Séries**

**Anwendung**
Die tragbaren Handscheinwerfer der Reihe 6143 sind explosionsgeschützte elektrische Betriebsmittel und dienen zur Ausleuchtung von Betriebs- und Lagerstätten in explosionsgefährdeten Bereichen der Zone 1 und 2, Zone 21 und 22. Sie sind für den Innen- und Außenbereich einsetzbar.

**Application**
The hand lamp of line 6143 are explosion-proof and electrical equipment and serve for illumination of shops and offices of a factory and storages in areas of zone 1 and 2, zone 21 and 22 where there is a danger of explosion. They can be used inside or outside.

**Utilisation**
Les projecteurs portatifs de la gamme de fabrication 6143 sont du matériel électrique antidéflagrant et servent à l'illumination des ateliers et bureaux d'usine et des aires de stockage avec environnement dans les zones 2, zones 21 et 22. Il peut être utilisé à l'extérieur comme à l'intérieur.

**Zweck dieser Anleitung**
Bei Arbeiten in explosionsgefährdeten Bereichen hängt die Sicherheit von Personen und Anlagen von der Einhaltung aller relevanten Sicherheitsvorschriften ab.

**Purpose of these instructions**
When working in hazardous areas, the safety of personnel and plant depends on complying with safety regulations.

**Objectif du présent mode d'emploi**
Au cours des travaux dans les zones à risque d'explosion, la sécurité des hommes et des équipements est liée au respect de toutes les consignes de sécurité.

Das Montage- und Wartungspersonal, welches in solchen Anlagen arbeitet, trägt deshalb eine besondere Verantwortung. Die Voraussetzung dafür ist die genaue Kenntnis der geltenden Vorschriften und Bestimmungen.

Assembly and maintenance staffs working on such plant therefore have a particular responsibility. They require precise knowledge of the applicable standards and regulations.

Le personnel chargé du montage et de la maintenance sur ces équipements possède à cet égard une grande responsabilité et doit connaître parfaitement les prescriptions et dispositions légales en vigueur.

Diese Anleitung fasst kurz die wichtigsten Sicherheitsmaßnahmen zusammen. Sie ergänzt die entsprechenden Vorschriften, zu deren Studium das verantwortliche Personal verpflichtet ist.

These instructions summarise the most important safety measures. They supplement the corresponding regulations, which the staff responsible must study.

Le présent mode d'emploi résume de façon concise les mesures de sécurité les plus importantes. Il ne peut en aucun cas se substituer aux prescriptions correspondantes, dont l'étude par le personnel responsable demeure obligatoire.

Änderungen vorbehalten.

Subject to alterations.

Sous réserve de modifications.

R. STAHL Schaltgeräte GmbH
Geschäftsbereich Leuchten
Nordstraße 10
D-99427 Weimar



IDENT Nr. 61 436 01 30 0/R. STAHL/01/05

**Sicherheitshinweise/ Safety instructions/Consignes de sécurité**

Beachten Sie bitte folgendes bei Betrieb der Handscheinwerfer:
Observe the following during operation of the hand lamp:
Lors et du fonctionnement, observer de projecteur portatif:

Verwenden Sie den Handscheinwerfer nur für den zugelassenen Einsatzzweck. Fehlerhafter oder unzulässiger Einsatz sowie das Nichtbeachten der Hinweise dieser Betriebsanleitung schließen eine Gewährleistung unsererseits aus.

Use hand lamp only for their intended purpose.
Incorrect or impermissible use invalidates our warranty provision.

N´utilisez le projecteur portatif que dans le but prévu et autorisé.
Toute utilisation incorrecte ou interdite annule notre garantie.

Umbauten und Veränderungen an dem Handscheinwerfer, die den Explosionsschutz beeinträchtigen, sind nicht gestattet.

Conversions and modifications on the hand lamp, which would impair explosion protection, are not permitted.

Il est interdit de procéder à des modifications le projecteur portatif d'entraver la protection antidéflagrante.

Der Handscheinwerfer darf nur im unbeschädigten und sauberen Zustand betrieben werden.

Operate the hand lamp only if it is clean and not damaged.

Utiliser le projecteur portatif un appareil lorsqu'il est intact et propre.

**Bei Errichtung und Betrieb im Anwendungsfall ist folgendes zu beachten:**

- das Gerätesicherheitsgesetz
- die nationalen Sicherheitsvorschriften
- die nationalen Unfallverhütungs-Vorschriften
- die nationalen Montagevorschriften
- die allgemein anerkannten Regeln der Technik
- die Sicherheitshinweise dieser Betriebsanleitung
- die Kennwerte der Typ- und Datenschilder
- die Prüfbescheinigungen und die darin enthaltenen besonderen Bedingungen

**When installing and operating and when in use, cognisance must be taken of the following:**

- the equipment safety legislation
- the national safety regulations
- the national accident prevention regulations
- the national installation regulations
- the generally recognised technical regulations
- the safety guidelines in these operating instructions
- the characteristic values on the rating and data plates
- the test certificates and the special conditions outlined in them

**Pour l'installation et l'utilisation/ application spécifique, observer les points suivants:**

- la législation sur la sécurité des appareils en vigueur
- the national accident prevention regulations
- les prescriptions de sécurité nationales
- les prescriptions nationales de montage
- les règles généralement re-connues de la technique
- les consignes de sécurité du pré-sent mode d'emploi
- les valeurs nominales indiquées sur les plaques signalétiques
- les certificats d'essais et les conditions particulières auxquels ils se rapportent.

Beschädigungen können den Ex-Schutz aufheben.

Damage may eliminate the explosion protection.

Suppression potentielle de la protection anti-explosion en cas de dommage au niveau du luminaire.

Eine Kopie der Baumusterprüfbescheinigung senden wir Ihnen auf Anfrage gerne zu. Sie stehen Ihnen auch auf unserer Homepage – www.stahl.de – unter Explosionsschutz zur Verfügung.
We will forward a copy of the Type Examination/Certificate on request. They are also available on our homepage – www.stahl.de under Explosionsschutz.
Nous pouvons vous faire parvenir une copie du certificat d'essai de type CEE sur demande. Les certificats d'essai vous trouvent aussi sur notre homepage sous - www.stahl.de – sous Explosionsschutz.

## Betriebsanleitung

### 1 Normenkonformität

Der explosionsgeschützte Handscheinwerfer 6143 entspricht dem Stand der Technik. Er wurde gem. EN 29001 (ISO 9001) entwickelt, gefertigt und geprüft.

Er entspricht unter anderem folgenden Bestimmungen und Normen:

Richtlinie 94/9/EG
EN 50014, 50019, 50020
EN 50281-1-1
89/336/EWG "Elektromagnetische Verträglichkeit"

Dieser Handscheinwerfer ist zugelassen für den Einsatz in explosionsgefährdeten Bereichen der Zone 1 und 2 gemäß IEC 60079-10, Zone 21 und 22 gemäß IEC 61241.

### 2 Technische Daten

Explosionsschutz:
Ⓔx II 2 G EEx e ib IIC T[1)] Zone 1 und 2
[1)] T4 bei $T_a \leq 35$ °C
T3 bei $T_a \leq 40$ °C

Ⓔx II 2D IP66 $T_0$ [2)]
[2)] $T_0$ 135 °C bei $T_a \leq 35$ °C
$T_0$ 140 °C bei $T_a \leq 40$ °C

Prüfungsschein:
VTT 04 ATEX 009 X

Konformität: CE 0102 nach 94/9/EG

**"X" Besondere Bedingungen für den sicheren Betrieb:**

- Es darf nur die Philips-Halogenlampe Typ HPR 60, 2,4 W, 6 V, PX 13,5 S eingesetzt werden!
- Der Handscheinwerfer muss nach den Herstellerangaben geladen werden!
- Der Handscheinwerfer darf nicht im explosionsgefährdeten Bereich geladen oder geöffnet werden!
- Die Umgebungstemperaturen sind wie folgt festgelegt:

  Temperaturklasse
  T4: -20°C...+35°C
  T3: -20 °C...+40°C

Gehäusematerial: Polypropylen

Schutzart: IP 66 (EN 60529)

## Operating instruction

### 1 Conformity with standards

The explosion-protected hand lamp 6143 is produced in accordance with the latest state of the art. It was developed, manufactured and tested in accordance with EN 29001 (ISO 9001).

The regulations and standards it complies with include:

EC-Directive 94/9
EN 50014, 50019, 50020
EN 50281-1-1
89/336/EEC "Electromagnetic compatibility"

This potable lamp is approved for use in potentially explosive location (zones 1 and 2) in accordance with IEC 60079-10, zones 21 and 22 in accordance with IEC 61241.

### 2 Technical data

Ex-protection:
Ⓔx II 2 G EEx e ib IIC T[1)] zone 1 and 2
[1)] T4 bei $T_a \leq 35$ °C
T3 bei $T_a \leq 40$ °C

Ⓔx II 2D IP66 $T_0$ [2)]
[2)] $T_0$ 135 °C with $T_a \leq 35$ °C
$T_0$ 140 °C with $T_a \leq 40$ °C

Test certificate:
VTT 04 ATEX 009 X

Conformity: CE 0102 according to 94/9/EC

**„X" Special conditions for safe use:**

- The halogen bulb shall be type of 2,4 W, 6 V, PX 13,5S, Philips type HPR 60!
- The hand lamp must be charged according to the manufactures recommendations!
- The hand lamp must not be opened or charged in hazardous area!
- The ambient temperatures range is for temperature class

Temperature class:
T4: -20°C...+35°C
T3: -20 °C...+40°C

Housing material: polypropylene

Protection rating: IP 66 (EN 60529)

## Mode d'emploi

### 1 Conformité aux normes

Le projecteur portatif 6143 correspond à l'état actuel des techniques. Il a été mis au point, assemblé et homologué en conformité avec la norme EN 29001 (ISO 9001).

Il satisfait en particulier aux réglementations et normes suivantes:

Directive 94/9/CE
EN 50014, 50019, 50020
EN 50281-1-1
Directive 89/336/CEE "Compatibilité Electromagnétique"

Ce projecteur portatif est homologué pour être utilisé dans des environnements à risque d'explosion des zones 1 et 2 selon IEC 60079-10, zones 21 et 22 selon IEC 61241.

### 2 Caractéristiques techniques

Mode protection:
Ⓔx II 2 G EEx e ib IIC T[1)] Zone 1 et 2
[1)] T4 bei $T_a \leq 35$ °C
T3 bei $T_a \leq 40$ °C

Ⓔx II 2D IP66 $T_0$ [2)]
[2)] $T_0$ 135 °C avec $T_a \leq 35$ °C
$T_0$ 140 °C avec $T_a \leq 40$ °C

Certificat de test:
VTT 04 ATEX 009 X

Conformité: CE 0102 selon 94/9/CE

**"X" condition spéciale pour le fonctionnement en sécurité :**

- Utilisez exclusivement la lampe à halogène type Philips HPR 60, 2,4 W, 6 V, PX 13,5 S !
- Le projecteur portatif doit être chargé suivant les instructions du fabricant !
- Le projecteur portatif ne doit pas être chargé, ni ouvert en zone explosible !
- Les températures ambiantes sont définies comme suit :

  Class de température:
  T4: -20°C...+35°C
  T3: -20 °C...+40°C

Matériaux au boîtier: polypropylène

Indice de protection: IP 66 (EN 60529)

## Betriebsanleitung

3-Stellungsschalter:
Handscheinwerfer
Notlichtfunktion

| ohne | mit |
|---|---|
| halb [1] | voll [1] |
| voll [1] | halb [1] |
| AUS | AUS |

[1] halbe/volle Leistung

Lampen: Halogenlampe
6 V ; 2,4 W; PX 13,5S

Leuchtdauer:
volle Lichtstärke: 10 Stunden
halbe Lichtstärke: 15 Stunden

Batterie: NiCd, 6 V, 5 Ah

Gewicht: 1,4 kg

Umgebungstemperatur: -20 °C...+40 °C

**Notlichtfunktion**
In der Ladestation ist der Handscheinwerfer mit Notlichtfunktion „6143/4-65" ständig im Notlichtstatus und schaltet sich bei Stromausfall mit voller Leistung ein. Der Notlichtstatus wird durch die grüne LED an der Seite des Handscheinwerfers angezeigt, die gleichzeitig signalisiert, das die Glühlampe intakt ist.

## Operating instruction

3-position switch:
Hand lamp
Emergency light function

| without | with |
|---|---|
| half [1] | full [1] |
| full [1] | half [1] |
| OFF | OFF |

[1] half/full power

Lamps: Halogen lamp
6 V; 2,4 W; PX 13,5S

Flash duration
full luminous intensity: 10 hours
half luminous intensity: 15 hours

Battery: NiCd, 6 V, 5 Ah

Weight: 1,4 kg

Ambient temperature : -20 °C...+40 °C

**Emergency light function**
In the charging unit, 6143/4-65 hand lamp with emergency light function is in a permanent emergency light state and switches itself on with full power in cases of power failure. Emergency light state is indicated by the green LED at the hand lamp side, which is also a signal of the bulb being intact.

## Mode d'emploi

Commutateur 3-position:
Lampe portatif
Fonction de lumière de secours

| sans | avec |
|---|---|
| à moitié plein [1] | plein [1] |
| plein [1] | à moitié plein [1] |
| AUS | AUS |

[1] à moitié plein/plein puissance

Lampes: Lampe halogene
6 V ; 2,4 W; PX 13,5S

Durée d'éclair
plein intensité lumineuse: 10 heures
à moitié plein intensité lumineuse:
15 heures

Accumulateur : NiCd, 6 V, 5 Ah

Poids: 1,4 kg

Température ambiante : -20 °C...+40 °C

**Fonction d'éclairage de secours**
Le projecteur portatif 6143/4-65 mis dans le chargeur est toujours dans l'état d'éclairage de secours. En cas de panne d'électricité, il se branche à pleine puissance. L'état d'éclairage de secours est indiqué par la LED verte sur le côté du projecteur, qui montre en même temps que l'ampoule est intacte.

**Bei anderen vom Standard abweichenden Betriebsbedingungen nehmen Sie bitte Rücksprache mit dem Hersteller.**
**In the event of operating conditions other than standard operating conditions, please contact the manufacturer.**
**Pour d'autres conditions d'utilisation différentes des conditions standard, veuillez prendre contact auprès du fabricant.**

### 3 Montage

Der Handscheinwerfer wird zum „Parken" und Laden einfach in die Ladestation 6143/96 von oben eingeschoben.

Befestigen Sie die Station so, dass oberhalb der Ladestation genügend Platz bleibt den Handscheinwerfer problemlos herauszunehmen und einsetzen zu können. (siehe Betriebsanleitung Ladestation).

### 3 Mounting

The hand lamp is simply pushed from above into charging station 6143/96 for „parking" and charging.

Mount the station in such a way that there is enough space above the station for the hand-lamp to be removed and replaced easily (see charging station instructions).

### 3 Montage

Placez simplement le projecteur portable par le haut dans le poste de charge 6143/96 pour l'entreposage et la charge.

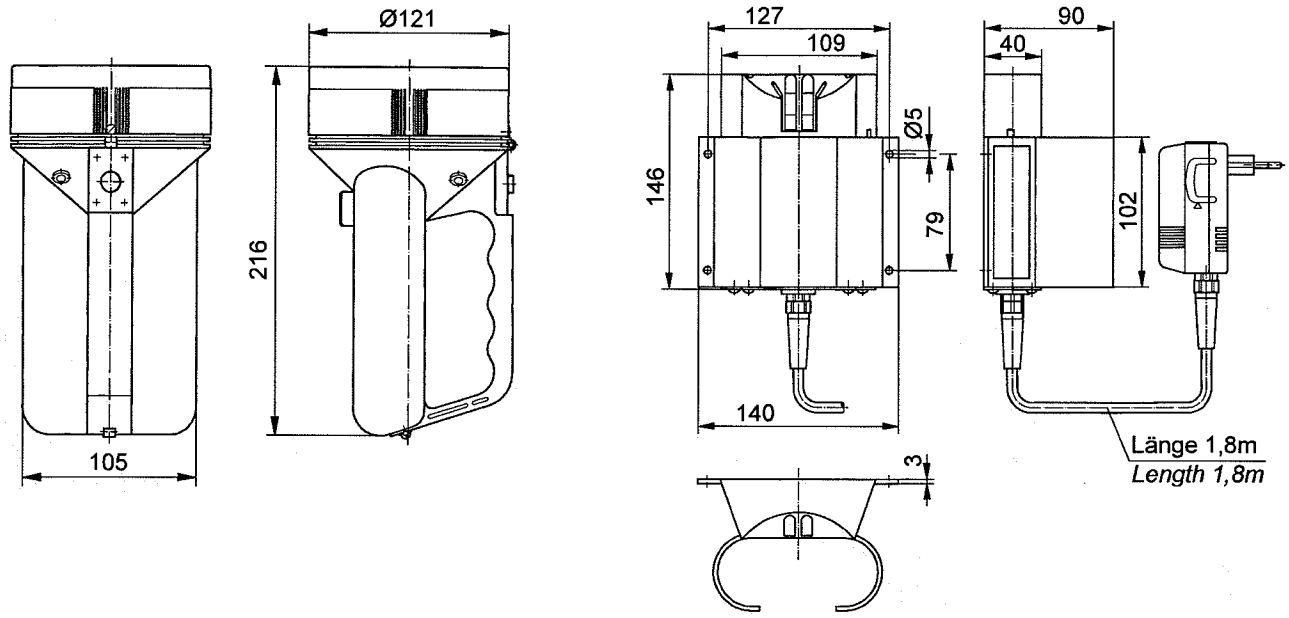
Fixez le poste de manière à conserver suffisamment de place pour pouvoir retirer et remettre en place le projecteur sans problème (cf. La notice du poste de charge).

**Die Ladestation ist außerhalb des explosionsgefährdeten Bereiches zu montieren!**
**The charging station must only be mounted outside the hazardous area!**
**Le montage du poste de charge est autorisé uniquement en dehors de la zone explosible !**



IDENT Nr 61 436 01 30 0/R. STAHL/01/05

**Maßzeichnung** | **Dimension drawing** | **Dessing cotés**




## 4 Inbetriebnahme

Der Akku entlädt sich bei der Lagerung und ist auch bei der Auslieferung ungeladen.

Der Handscheinwerfer ist deshalb vor der Inbetriebnahme aufzuladen. Die Ladezeit bei leerem Akku erfordert 7 bis 9 Stunden – je nach Temperatur und Zustand des Akkus.

Das Aufladen darf nur mit der für den Handscheinwerfer geeigneten Ladestation 6143/9 erfolgen. Der Akku erreicht seine volle Leistung nach ca. 5 Auflade-/Entladeperioden. Wir empfehlen, den Handscheinwerfer immer in der Ladestation aufzubewahren (Lesen Sie auch die separate Betriebsanleitung des Ladesgerätes sorgfältig!).

Wird der Handscheinwerfer zwischen den Aufladeperioden wiederholt nur für kurze Zeiten benutzt, empfiehlt es sich, den Handscheinwerfer nach jeder zehnten Benutzung bis zur Tiefentladung leuchten zu lassen. Dadurch wird der „Memory-Effekt" der Akkuzellen verhindert und die Batteriekapazität steht wieder voll zur Verfügung. Die Tiefentladungs-Abschaltung schützt den Akku vor schädigender Totalentladung.

## 4 Commissioning

The accumulator discharges during warehousing periods and is not charged on delivery either.

The hand lamp must therefore be charged before initial operation. Charging an empty accumulator takes between 7 and 9 hours – depending on the temperature and the state of the accumulator.

For charging the hand lamp, use a suitable 6143/9 charging unit exclusively. The accumulator reaches its full power after approx. 5 charging/discharging periods. We recommend to always keep the hand lamp in the charging unit (Please also read the separate charging unit operating instructions carefully.)

If the hand lamp is repeatedly used for only short times between charging periods, it is advisable to let it shine to deep discharge after every tenth use thus preventing the memory effect of battery cells and providing full battery capacity again. Deep discharge cutoff protects the accumulator from damaging total discharge.

## 4 Mise en service

L'accumulateur se décharge pendant le stockage. Il n'est pas non plus chargé à l'état de livraison.

Il est de ce fait nécessaire de charger le projecteur avant la mise en service. Pour charger un accumulateur vide, il faut entre 7 et 9 heures, en fonction de la température et de l'état de l'accumulateur.

Pour charger le projecteur portatif, il ne faut utiliser que le chargeur approprié 6143/9. L'accumulateur atteint sa pleine puissance après environ 5 périodes de charge/décharge. Nous recommandons de toujours garder le projecteur dans le chargeur (Lisez aussi soigneusement le mode d'emploi séparé du chargeur.)

Si le projecteur portatif n'est fréquemment utilisé que pendant de courtes durées entre les périodes de charge, il est recommandable de le garder allumé jusqu'à la décharge profonde après chaque dixième utilisation. Cela empêche le « memory effect » des éléments d'accumulateur et la capacité complète de batterie est de nouveau disponible. La coupure de décharge profonde protège l'accumulateur contre une décharge totale nuisible.

**Handscheinwerfer mit Notlichtfunktion** (siehe Beschreibung unter „Technische Daten")

**Hand lamp with emergency light function** (see description in "technical data")

**Projecteur portatif avec fonction d'éclairage de secours** (voir description dans « caractéristiques techniques »)

**Restkapazitätsanzeige**

Bei 5 bis 10 % Restkapazität der Batterie, bzw. ca. 10 bis 30 Minuten restlicher Betriebszeit beginnt der Handscheinwerfer in Intervallen von 15 Sekunden zu blinken. Die verbleibende Betriebszeit hängt von der Temperatur und dem Zustand der Batterie ab.

**Residual capacity indication**

At 5 to 10 % residual battery capacity, which corresponds to a remaining operating time of approx. 10 to 30 minutes, the hand lamp starts flashing at intervals of 15 seconds. The remaining operating time depends on the temperature and the state of the battery.

**Affichage de capacité résiduelle**

A une capacité résiduelle d'entre 5 et 10 %, respectivement un temps de fonctionnement résiduel d'environ 10 à 30 minutes, le projecteur portatif commence à clignoter à intervalles de 15 secondes. Le temps de fonctionnement résiduel dépend de la température et de l'état de la batterie.

**Der Handscheinwerfer ist im Auslieferungszustand ungeladen.**
**The hand lamp is not charged on delivery.**
**Le projecteur portatif à main n'est pas chargé à l'état de livraison.**

## 5 Reparatur und Instandsetzung

Wartungsarbeiten an Verschleißteilen – wie folgt beschrieben – dürfen nur von dazu befugtem und entsprechend geschultem Personal durchgeführt werden.

Um die einwandfreie Funktion des Handscheinwerfers zu gewährleisten, ist nur der Austausch der in der Ersatzteilliste aufgeführten Originalersatzteile zulässig.

**Beschädigungen am Gehäuse oder an der Elektronik gefährden den Explosionsschutz und bedürfen der Werksreparatur**

## 5 Repair and Maintenance

Maintenance work at wearing parts must be executed only by authorised and properly trained staff.

In order to ensure the blameless working of the hand lamp only original spare parts given in the spare part list are replaced.

**Damages at the casing or at the electricity endanger the explosion-proofness and require repair in the plant.**

## 5 Réparation et maintenance

Des travaux d'entretien aux parties résistantes à l'usure seront réalisés seulement par un personnel autorisé et formé.

Pour garantir le fonctionnement propre du projecteur portatif à main seulement l'échangement où le remplacement des pièces de rechange citée dans la liste des pièces de rechange originales est permis.

**Des endommagements au corps ou aux parties électriques endommagent la protection antidéflagrante et doivent être réparés à l'usine.**

**Der Handscheinwerfer darf nicht im explosionsgefährdeten Bereich geöffnet werden!**
**The hand lamp must not be opened in the potentially explosive zone!**
**Il n'est pas permis d'ouvrir le projecteur portatif à main aux zones explosives!**

Das Wechseln der Glühlampe sowie des Parabolreflektors – um die Form des Lichtkegels zu verändern – kann vom Benutzer ausgeführt werden, ebenso das Auswechseln des Akkus (siehe folgende Beschreibung).

**Der Handscheinwerfer darf nur mit einem Ersatzakku bzw. mit einer Ersatzglühlampe der Fa. R. STAHL betrieben werden – ansonsten erlischt das Zulassungszertifikat!**

Changing the bulb and the parabolic reflector - in order to modify the light beam shape - can be effected by the user, as well as replacing the accumulator (see following description).

**For operating the hand lamp, use only spare accumulators and spare bulbs made by R. STAHL company. Otherwise the approval certificate will cease to apply!**

Le changement de l'ampoule et du réflecteur parabolique - pour modifier la forme du faisceau lumineux – ainsi que le remplacement de l'accumulateur peuvent être effectués par l'utilisateur (voir description suivante).

**Pour faire fonctionner le projecteur portatif, n'utilisez que des accumulateurs et des ampoules fabriqués par la société R. STAHL. Autrement, le certificat d'autorisation cessera de s'appliquer.**

### 5.1 Reflektor und Glühlampenwechsel

Schrauben Sie zuerst die Sicherungsschraube (1) und den Verschlussring (2) ab. Danach nehmen Sie die Linse (3) samt 0-Ring (4) heraus, indem Sie die Linse nur an den Kanten anfassen.
Den Verschlussring (5) abschrauben und die Lampe (6) mit Hilfe von weichem Papier oder Tuch aus der Halterung nehmen, ohne dass die Glühlampe mit bloßen Fingern berührt wird. Danach können auch die Halterungshülse (7) und auch der Reflektor (8) abgenommen werden.

Hinweis: Verunreinigungen der Oberflächen an Glühlampe, Reflektor oder Linse vermindern die Lichtstärke. Sollten insbesondere die Lampe und der Reflektor aus Versehen mit bloßen Fingern berührt worden sein, reinigen Sie diese Teile mit weichem Papier oder Tuch und etwas Reinigungsflüssigkeit, z.B. Äthanol.

### 5.1 Changing the reflector and bulb

First undo the safety screw (1) and the locking ring (2). Then remove the lens (3) with 0-ring (4), while gripping the lens only at its edges.

Undo the locking ring (5) and remove the bulb (6) from its holder using soft paper or cloth, without touching the bulb with bare fingers. It is then possible to remove the holding sleeve (7) and the reflector (8).

Note: Contamination of the surfaces of bulb, reflector or lens reduces the light level. Should the bulb and reflector accidentally be touched with bare fingers, clean these parts with soft paper or cloth and a little cleansing liquid, e.g. ethanol.

### 5.1 Changement du réflecteur et de l'ampoule

Dévisser tout d'abord la vis de sécurité (1) et la bague (2). Extraire ensuite la lentille (3) avec son joint torique (4) en veillant à ne saisir la lentille que par le rebord.
Dévisser la bague (5) et extraire l'ampoule de son support à l'aide d'un papier doux ou d'un chiffon, en veillant à ne pas toucher l'ampoule avec les doigts. Oter ensuite la douille de fixation (7) et le réflecteur (8).

Remarque: Toute impureté à la surface de l'ampoule, du réflecteur ou de la lentille diminue l'intensité lumineuse du projecteur. En cas de contact; en particulier de l'ampoule ou du réflecteur, avec les doigts, nettoyer ces pièces à l'aide d'un papier doux ou d'un chiffon légèrement imbibé d'un produit de nettoyage, par exemple de l'éthanol.

### 5.2 Komplettes Einbau-Set (Ausbau) Glühlampenwechsel

Die zwei Schrauben (9) am Boden der Leuchte abschrauben und die Ladekontakte (10) herausnehmen. Jetzt sollte sich das Einbau-Set (11) (Innenkonstruktion, Akku, Elektronikeinheit) ohne Kraftanwendung aus dem Leuchtenkörper schieben lassen. Sollte das Einbau-Set sich ohne ersichtlichen Grund nicht aus dem Leuchtenkörper schieben lassen, versuchen Sie durch leichtes Klopfen nachzuhelfen.
Schieben Sie das Set zur Hälfte aus dem Körper und klemmen Sie die beiden gelben Kabel von den Schalteranschlüssen ab.

### 5.2 Complete internal assembly (removal)

Undo the two screws (9) at the bottom of the lamp and remove the charging contacts (10). It should now be possible to push out the internal assembly (11) (internal structure, battery, electronics unit) from the lamp body without using force. If it is not obvious why the internal assembly cannot be pushed out of the lamp, try to remedy this by light tapping.

Push the assembly half out of the body and disconnect the two yellow leads from the switch terminals.

### 5.1 Kit d'installation complet (démontage)

Dévisser les deux vis (9) au bas du projecteur et enlever les contacts de charge (10). A partir de cet instant, le kit d'installation (11) (structure intérieure, accumulateur, boîtier électronique) doit s'enliver du projecteur sans forcer. Si pour une raison quelconque, le kit d'installation ne s'enlève pas, essayer de le détacher en donnant de légers coups.

Sortir le kit à moitié et débrancher les deux câbles jaunes au niveau des connexions du commutateur.

### 5.3 Zusammenbau

Die Leuchte wird in umgekehrter Folge wieder zusammengebaut.

### 5.3 Assembly

The lamp is reassembled in reverse order.

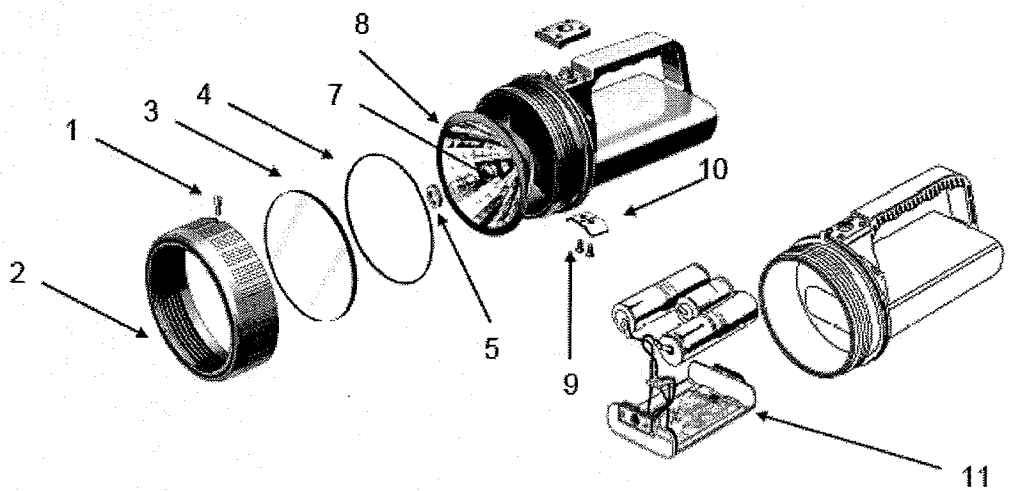
### 5.3 Montage

Remonter le projecteur en sens inverse.

Veranschaulichung der Konfektionierung

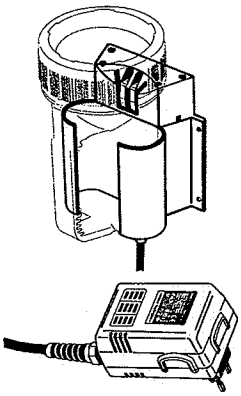
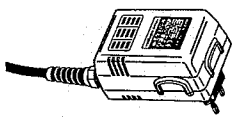
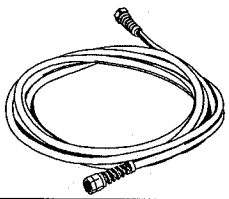
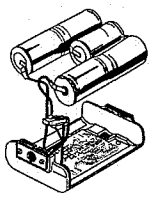
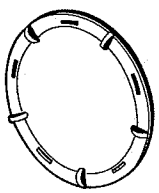
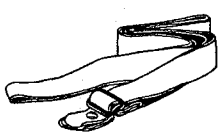
Illustration of prefabrication

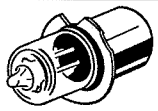
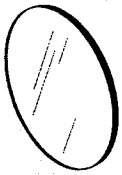
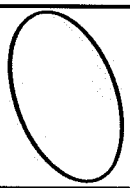
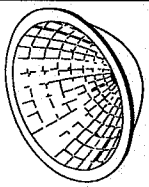
Illustration de préfabrquation



## 6 Zubehör/Ersatzteile/ Accessories/Spare parts/ Accessoires/Pièces de rechange

Verwenden Sie nur Original-Zubehör sowie Original-Ersatzteile der Fa. R.STAHL Schaltgeräte GmbH.
Use only original spare parts as well as original accessories made by R.STAHL Schaltgeräte GmbH.
Utilisez uniquement des pièces de rechange d'origine es des accessoires d'origine de R.STAHL Schaltgeräte GmbH.

| Benennung/ nomenclature/ désignation | Abbildung Picture Illustration | Beschreibung Description Description | Bestellnummer Ordering code Référence |
|---|---|---|---|
| Ladestation<br>Charging station<br>La station de chargement |  | 6143/94:<br>ohne Netzteil<br>without mains unit<br>sans bloc d´alimentation électrique 12 ... 30V, DC | 61 430 03 01 0 |
| |  | 6143/95:<br>mit Netzteil<br>with mains unit<br>avec bloc d´alimentation électrique 230V, AC/50Hz | 61 430 04 01 0 |
| Netzteil<br>Mains supply unit<br>Le bloc d'allimentation |  | Zum Anschluss für Ladestation<br>For connection to charging station<br>Pour raccordement de la station de chargement 230V, AC/50Hz | 680 666 0 |
| Versorgungskabel, 3 m lang<br>Supply lead, 3 m long<br>Le cable d'allimentation à longleur 3 m |  | Zum Anschluss der Ladestation an eine Fahrzeugbatterie<br>For connection charging station to a vehicle battery<br>Pour raccordement d´une station de chargement à une batterie d´automobile 12/24V,DC | 385 638 0 |
| Batteriepack<br>Battery pack<br>Le ballot de batterie |  | gasdicht<br>gas tight<br>Imperméable aux gaz 5,0 Ah, NiCd | 672 602 0 |
| Streuscheibe, rot<br>Diffusing glass, red<br>Le verre diffusant, rouge |  | kann vorne auf die Leuchte aufgesteckt werden<br>can be placed on lamp front<br>il est possible d´attacher lequel en luminaire par devant | 385 632 0 |
| Tragriemen, schulterlang<br>Carring strap, shoulder length<br>La bandoulière |  | der an vorhandene Ösen angebracht werden kann<br>which can be fitted to existing eyelets<br>il est possible de placer laquelle en l´œillet existant | 385 633 0 |
| Stativ<br>Support<br>Le support |  | zum Aufstellen der Leuchte auf ebener Fläche, Winkel über „Ratsche" problemlos verstellbar<br>to support lamp on an even surface, angle is easily adjusted using „ratchet" adjuster.<br>pour placement de luminaire en plan, angle est réglable sans problème à l´aide d´élément de regulation | 385 631 0 |

| Benennung/ nomenclature/ désignation | Abbildung Picture Illustration | Beschreibung Description Description | Bestellnummer Ordering code Référence |
|---|---|---|---|
| Glühlampe<br>Bulb<br>Ampoule |  | Kryptonlampe, 6 V, 3,3 W für Version 6145/3 und 6145/4<br>Krypton incandescent bulb, 6 V, 3,3 W for version 6145/3 and 6145/4<br>Ampoule krypton, 6 V; 3,3 W pour version 6145/3 et 6145/4<br><br>Halogenglühlampe, 6 V, 2,4 W, P13,5X für Version 6143/3 und 6143/4<br>Halogen lamp, 6 V, 2,4 W, P13,5X for version 6143/3 and 6143/4<br>Lampe-tungstène halogène, 6 V, 2,4 W, P13,5X pour version 6143/3 et 6143/4 | 512 661 0<br><br>512 674 0 |
| Glaslinse<br>Glass lense<br>Le bouton de verre |  | Ø 110 mm | 385 635 0 |
| O-Ringdichtung<br>O-ring seal<br>Le O-anneau de joint |  | für Glaslinse<br>for glass lense<br>pour bouton de verre | 518 820 0 |
| Parabol Reflektor (Hochglanz-Aluminium)<br>Parabolic reflector (mirror finish aluminium)<br>Le réflecteur parabolique (le poli à reflets aluminium) |  | Standard: Facetten-Reflektor für Punktlicht mit Umgebungslicht<br>faceted reflector for spotlight with ambient light<br>le réflecteur à facettes pour lumière très dirigée avec lumière ambiante<br><br>Sonder: Punktlicht mit schmalem Kegel<br>spotlight narrow beam<br>lumière très dirigée avec un cône étroit | 385 634 0<br><br>385 637 0 |

## 7 Entsorgung

Beachten Sie die nationalen Abfall-Beseitigungsvorschriften.

Denken Sie an den Umweltschutz!

Verbrauchte Batteriepacks bitte umweltgerecht entsorgen. Wenn dies nicht möglich ist - wir nehmen verbrauchte Batteriepacks zurück und führen die Akkuzellen einem geordneten und vollständigen Recycling zu, dass heißt, mögliche umweltbelastende Stoffe werden zurückgewonnen und neu für die Produktion von Akkuzellen verwendet.

## 7 Disposal

Observe the national orders of refuse removal.

Remember environmental protection!

Used batteries must be disposed of in accordance with environmental requirements. If this is not possible we take them back and have the battery cells recycled correctly and completely, i.e. potentially polluting materials are recovered and used for the production of new battery cells.

## 7 Réglementation concernant les déchets

Respectez les réglementations nationales concernant l'élimination des déchets.

Avez-vous pensé à la protection de 'environnement!

Les accumulateurs usagés doivent être recyclés en respectant l'environnement. Si cela n'est pas possible, R. STAHL reprend vos accumulateurs usagés et les soumet à un processus de recyclage systématique et intégral, c'est à dire que les substances potentiellement polluantes sont récupérées et réutilisées pour la production d'accumulateurs neufs.

Für spezielle Fragen stehen wir Ihnen gerne zur Verfügung. Wenden Sie sich bitte an die für Ihr Gebiet zuständige R.STAHL Organisation.
If you have any queries, we will be happy to deal with them. Please contact the R.STAHL dealership responsible for your area.
Nous restons à votre disposition pour toute question spécifique. Veuillez vous adresser à l'organisation commerciale R.STAHL compétente pour votre région.

EC-TYPE EXAMINATION
CERTIFICATE
VTT 04 ATEX 009X



1. **EC-TYPE EXAMINATION CERTIFICATE**

2 **Equipment or Protective System Intended for use in Potentially explosive atmospheres Directive 94/9/EC**

3. Reference: **VTT 04 ATEX 009X**

4. Equipment: **Hand lamp**

Certified type: **6143/.-..**

5. Applicant: **R.STAHL Schaltgeräte GmbH**

6. Address: **Am Bahnhof 30**
**74638 Waldenburg**
**Germany**

7. This equipment or protective system and any acceptable variations thereto is specified in the schedule and possible supplement(s) to this Certificate and the documents therein referred to.

8. VTT Industrial Systems, notified body number 0537, in accordance with Article 9 of the Council Directive 94/9/EC of March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective system intended for use in potentially explosive atmospheres given in Annex II to the Directive

The examination and test results are recorded in confidential report no TUO26-032336.

9. Compliance with the Essential Health and Safety Requirements has been assured by compliance with the standards:

**EN 50014 (1997) +A1&A2**
**EN 50019 (1994)**
**EN 50020 (2002)**
**EN 50281-1-1 (1998)**

**VTT INDUSTRIAL SYSTEMS**
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# NATIONAL OILWELL VARCO

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