



**Heavy Duty
 Flying Lead Orientation Tool (HD FLOT) - Lease Tool Set.**

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Heavy Duty Flying Lead Orientation Tool (DH FLOT) O & M Manual

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DISCLAIMER

This technical manual has been drafted by Sub-Sea Tooling (SST) at the request of Subsea Americas, and in no way leaves SST liable for the accuracy contained herein. Furthermore, SST bears no responsibility for the safety and operation of the Heavy Duty Flying Lead Orientation Tool (HD FLOT).

This technical manual contains information required to successfully operate and maintain the HD FLOT as of the date of publication. It is assumed that trained and experienced technicians will exercise judgment concerning the operating conditions and provide constant inspection and maintenance whilst operating the system. By delivery of this manual, SST makes no statement of assurance of its completeness or accuracy with respect to the delivered equipment. SST assumes no responsibility to modify, update, or change the manual content at any time beyond its initial delivery. Such changes or modifications are the subject of separate contractual agreements and not part of this manual delivery.

SST herewith provides notice that the Isolated HD FLOT design is based on assumed operating conditions and loads with included design margins. It must however, be understood by technicians that actual offshore operating conditions cannot be completely defined and that primary responsibility for the safe and successful use of the HD FLOT is the responsibility of the technicians. It is further the responsibility of the technicians to identify any and all damage or wear to the system and to take action to return the equipment to serviceable condition prior to continued operation.

SST and Subsea Americas disclaims any liability for safety, damage to third party equipment, life of the system or its components beyond those areas specifically discussed herein.

1.0 INTRODUCTION

1.1 Description

This document is a Technical Manual for the HD FLOT as a complete system, to capture specific Torque Tools and operate on fluids as supplied by the ROV operator, such as ISO fluids and environmentally friendly alternatives.

The heart of the system is the Helac Rotary Actuator. When anchored to the ROV correctly, the HD FLOT and customer furnished Class 4 Torque Tool will be capable of latching into standard Flying Lead Heads via the API Class 4 interface bucket;

- Pitching the Flying Lead Heads +/- 90 deg,
- Rotating the Flying Lead Heads +/- 60 deg,

This manual provides the necessary information required for the prospective user to install and operate the HD FLOT on a standard work class ROV. The ROV will be required to supply at a minimum, hydraulic capabilities of up to 3000 psi at 2 gpm via hydraulic lines from the ROV valve pack which must be closed centre to the HD FLOT.

The HD FLOT has been designed to accommodate any industry supplied torque tool that has casing dimension of 6 7/8" (or less) x 4" long, such as;

- Perry GOM Torque Tool
- Perry UK Torque Tool
- Emanate Torque Tool
- Ogre Torque Tool

1.2 Scope

The HD FLOT has been fabricated from predominantly T6-6061 Aluminium and Steel components where additional strength is required. The DH FLOT is not supplied with any Buoyancy System to compensate for added mass.

Subsea Americas Responsibility

Subsea Americas shall provide the HD FLOT complete with;

- Transit Case,
- Hydraulic Hoses,

Operator Responsibility

The Operator will supply;

- The hydraulic power and the interconnection to the HD FLOT,
- The pressure and flow to accurately control the operation of the HD FLOT,
- Mounting hardware for the HD FLOT to the ROV weldment
- Additional Buoyancy to compensate for the added mass

The operator shall also be responsible for the most effective method of mounting the equipment to the ROV in order not to damage the Torque Tool.

Design Life

The design life of the HD FLOT is up to a maximum of 5-years from November 2008. Components must be removed from service after November 2013.

1.3 Definitions

DCV	Directional Control Valve
gpm	gallons per minute
HP	High Pressure
IHPU	Isolated Hydraulic Power Unit
HD FLOT	Heavy Duty Flying Lead Orientation Tool
ISO	International Standards Organisation
JIC	Joint International Conference
LP	Low Pressure
MSDS	Material Safety Data Sheets
NAS8	National Aeronautical Standards cleanliness level 8
PPE	Personnel Protective Equipment
psi	pounds per square inch
ROV	Remotely Operated Vehicle

1.4 Specifications

The HD FLOT is designed to interface onto a Remotely Operated Vehicle (ROV) via the ROV hydraulic valve pack or switchable hydraulic supply. The ROV will also be required to supply closed centre capabilities from the valve packs to control the HD FLOT.

Length x Width x Height	Approx 12" x 17" x 27"
Weight (in air)	165 lbs
Weight (in water)	Approximately 130 lbs
Primary Fluid	ISO 32 or equiv
Max Pitch Load	1,000 lbs
Max Rotational Load	600 lbs
Max Input Pressure	3,000 psi
Max Input Flow	4 gpm
Primary Bearings	NiAlBz
Helac Cylinder Material	Steel
HD FLOT Side Plates	T6 6061
HD FLOT Front/Rear Plates	T6 6061
Fixing Hardware	316 SS
Max Pitch	+/- 90 deg
Max Rotation	+/- 60 deg
Secondary Piston	Drawn Aluminium Bronze
Helac Hydraulic Fitting	No 4 JIC
Rotate Motor Fitting	No 4 JIC

1.5 Theory of Operation

The heart of the HD FLOT is the Helac. The Helac is a helacally cut, double acting piston, powered by the ROV's ISO hydraulic fluid system. The HD FLOT is designed to pitch loads up to 1000 lbs in the longitudinal plane and, rotate loads up to 600 lbs in the lateral plane using the ROV hydraulic system.

The torque tool is held within the HD FLOT by two stainless steel half shells. One of the half shells will also include the Rack Gear to rotate the torque tool +/- 60 degrees.

The Helac is capable of pitching the load held by the torque tool approximately +/- 90 degrees

The HD FLOT has been designed to operate at pressures up to 3,000 psi. However, the HD FLOT can operate at pressures as low as 1,500 psi.

The HD FLOT must be mounted rigidly to the ROV lower weldment using the 5/8" bolts supplied in the Helac, or an alternatively rigid rail system capable of transferring the loads to the ROV framework (eg; 2" x 2" x 1/4" steel angles) .

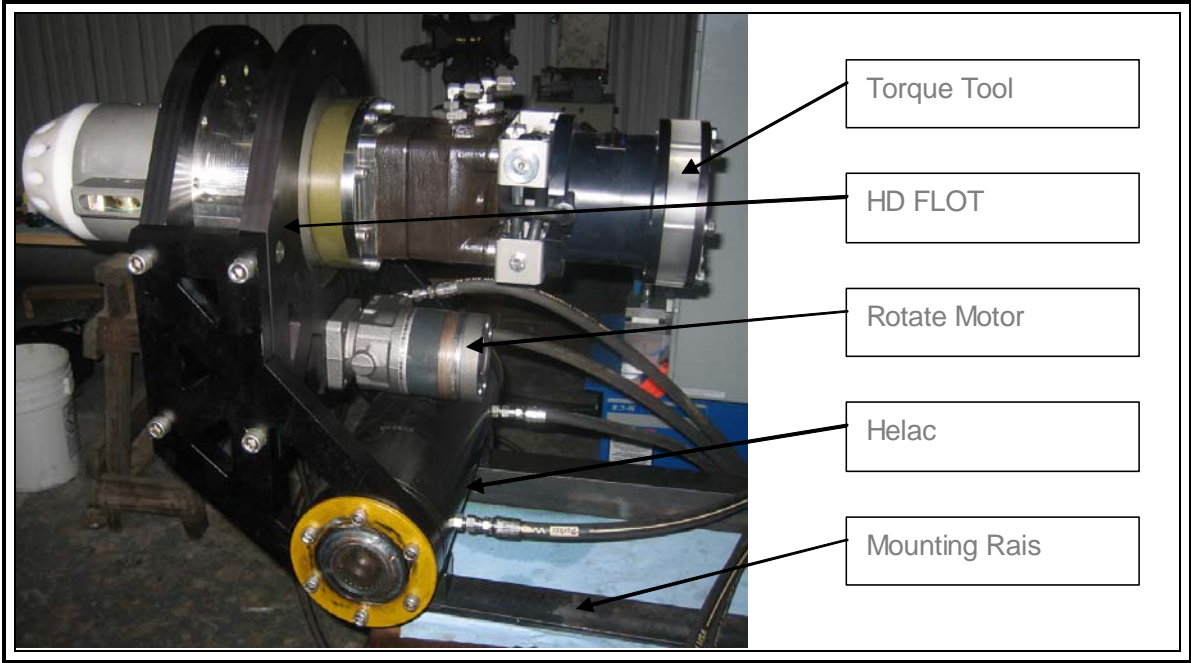


Fig 1.5 HD FLOT System

2.0 SETUP AND OPERATION INSTRUCTIONS

2.1 Mechanical Installation

The HD FLOT, should be mounted reasonably close to the front of the ROV and attached via the four 5/8 x 11 UNC mounting holes at the base of the Helac. Note: the Helac may also be mounted directly onto extension rails (eg 2" x 2" x 1/4") no longer that 18" in front of the ROV.

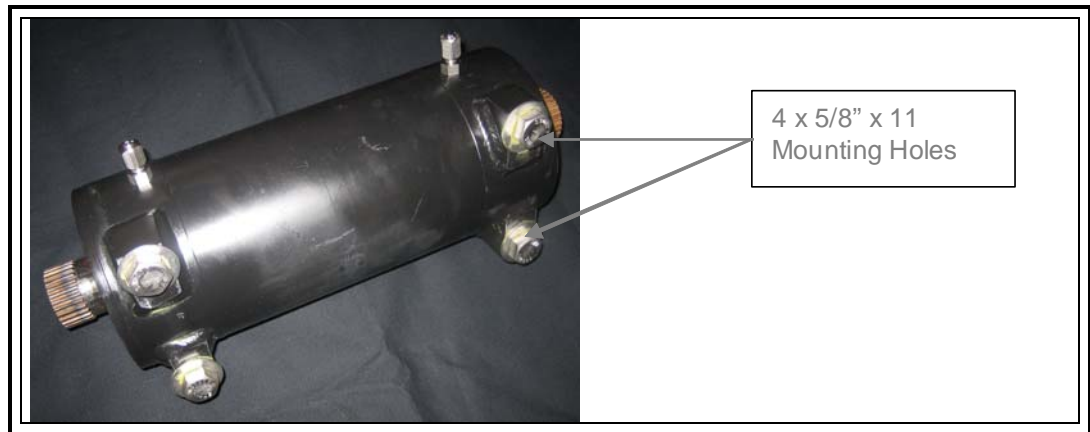


Fig 2.1.1 HD FLOT Mounting Pattern

Note: There are two possible mounting configurations for the HD FLOT - Supported Mounting (standard mount) and Suspended Mounting

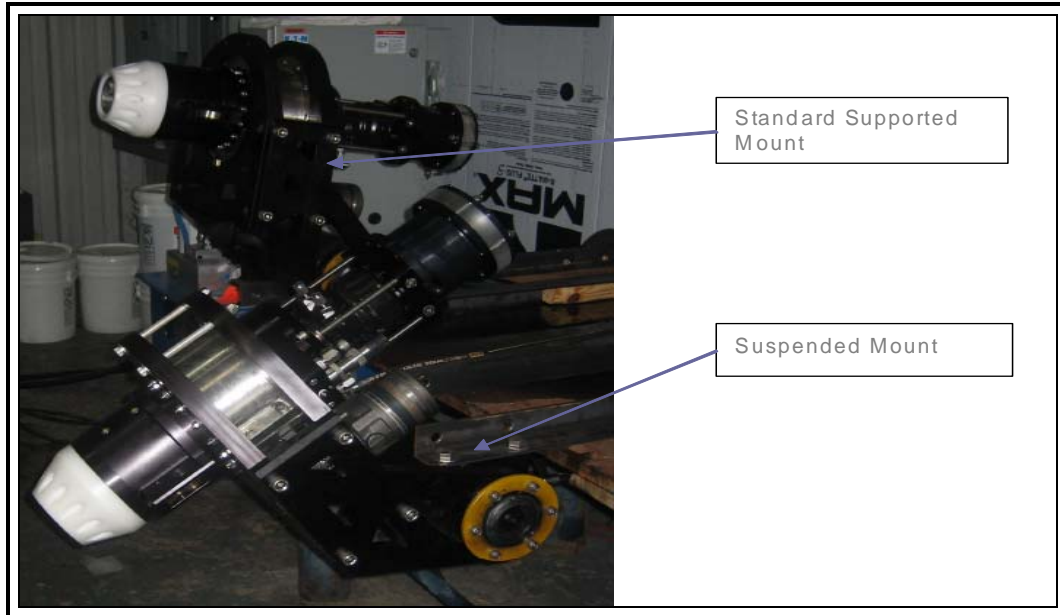


Fig 2.2.2 HD FLOT Mounting Options

2.2 Hydraulic Installation

Once the mechanical installation of the HD FLOT is complete, the pressure lines to the HD FLOT (operator furnished) may be plumbed directly to the HD FLOT from the ROV switchable valve with variable pressure/flow capability or a proportional valve set. The supply lines should be 1/4" hydraulic hoses.

NOTE

The ROV switchable valve with variable pressure/flow capability or a proportional valve must be held OPEN during deployment to allow a return to tank in order for the system to remain compensated during transit to working depth.

2.2.1 Helac Hydraulic Lines; The Helac hydraulic lines should be 1/4" lines, approximately 15 feet long. These lines will be connected

from the No 4 JIC fittings at the HD FLOT to the No 4 JIC fittings at the input of the DVC.

2.2.2 Rotate Motor Hydraulic Lines; The Rotate Motor hydraulic lines should also be $\frac{1}{4}$ " lines, approximately 15 feet long. These lines will be connected from the No 4 JIC fittings at the HD FLOT to the No 4 JIC fittings at the input of the DVC.

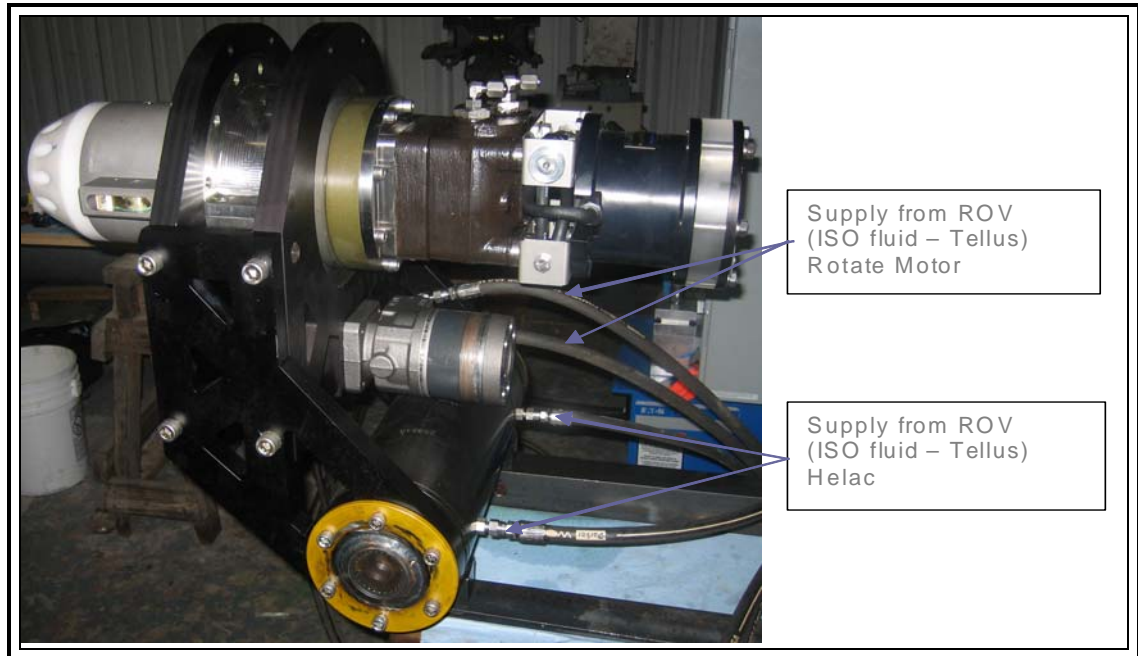


Fig 2.2.1 IHPU 131

2.3 Hydraulic Setup

WARNING

This HD FLOT operates at pressures up to 3,000 psi. The operator is responsible for ensuring the safety of all personnel and equipment associated in the installation, setting-up, testing and operation of this equipment. Personnel Protective Equipment (PPE) must be worn by all personnel associated in the installation, setting-up, testing and operation of this equipment. PPE must include, but not limited to Safety Glasses, Full heavy material Coveralls, Hard Hat, Safety Boots and Protective Gloves. It is also the operators responsibility to obtain and read the MSDS sheets associated with the fluids intended for use with this equipment.

CAUTION

Excessive oil temperature can severely damage system components. Do not let oil temperature exceed manufacturer's limits. If overheating occurs, shut down operation and wait for components to cool before proceeding.

CAUTION

This circuit will not function as designed on a boosted return hydraulic power supply.

2.3.1 The input pressure to the HD FLOT should initially, be limited to approximately 1,500 psi during setup in order to limit damage from slamming of the equipment into end stops. The ROV operator **must** ensure the correct flow rates are set to both the Helac and Rotate Motor. The input flow to both the Helac and Rotate Motor must initially be set to zero. Once the IHPU is turned on hydraulically, the input flow to both the Helac and Rotate Motor may be increased to a maximum of 2 gpm.

Once confidence is gained in the operation of the equipment, the input pressures to both the Helac and Rotate Motor can be increased to 3,000 psi and new flow rates can be adjusted accordingly.

CAUTION

When testing the system on deck using a purge cart, pay attention to the return line. Returning oil through a purge cart directional control valve could result in return pressures exceeding manufacturers recommendations with respect to equipment installed. If in doubt, connect the return line directly to tank. Also, be aware that at higher flow rates, the pressure drop across a directional control valve on the purge cart supply and may result in a lower delivery pressure than required for normal operation (for small Cv DCVs).

CAUTION

Operating HD FLOT with contaminated fluids can result in component damage. Ensure that the reservoir fluid is at a cleanliness level of NAS 8 before operating the system. If water contamination occurs, purge the contaminated fluid and replace with fresh fluid.

This completes the hydraulic setup procedures for the HD FLOT.

3.0 TORQUE TOOL INSTALLATION

3.1 Half Shell Installation

The HD FLOT Half Shells must be removed from the HD FLOT, split by removing the 4 x 3/8" SHCS (note that two of the SHCSs are shorter – these will be used on the side adjacent to the rack gear)

For the Perry Torque Tool, a piece of shim stock must be installed between the Torque Tool body and the Half Shells

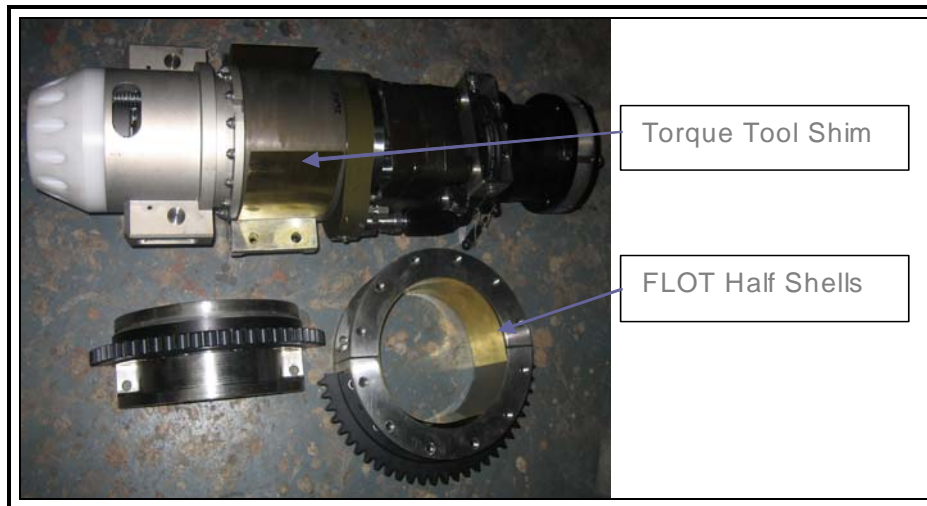


Fig 3.1 HD FLOT Half Shells

3.2 Setting HD FLOT Position

The HD FLOT must now be tilted slightly aft (approx 10 – 30 deg) in order to accept the Torque Tool and Half Shells



Fig 3.2 HD FLOT Tilt Aft

3.3 Insert Torque Tool into the HD FLOT

Load the Torque Tool into the HD FLOT by placing the rack gear into the pinion drive. Ensure that the rack meshes into the pinion drive correctly for the Half Shells to fall into place within the HD FLOT Plate Bearing



Fig 3.3.1 Loading the Torque Tool into the HD FLOT

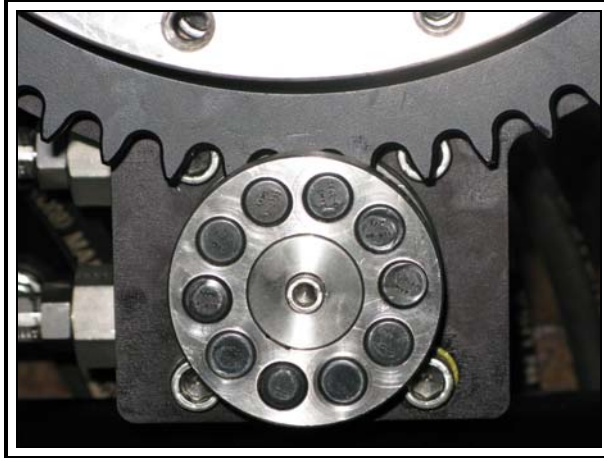


Fig 3.3.2 Rack and Pinion Mesh

3.4 Install the HD FLOT Front Plate

Using the hydraulic motor, rotate the Torque Tool Latches into the vertical position. Place the front plate over the Half Shells and locate Front Plate into position.

NOTE: the HD FLOT side bolts may need to be slackened off, in order to locate the Front Plate.



Fig 3.4.1 HD FLOT Front Plate

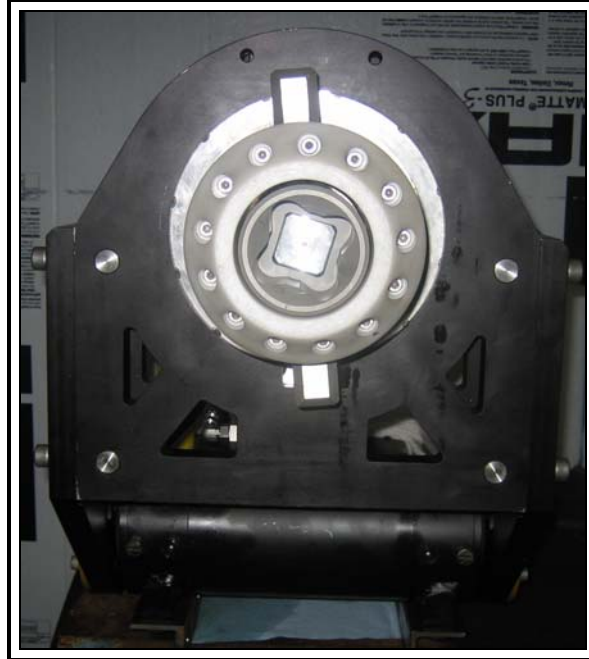


Fig 3.4.2 HD FLOT Front Plate Installation

4.0 SYSTEM MAINTENANCE

System maintenance shall be broken into two sections.

- Post Dives,
- Post Operation and General Maintenance.

4.1 Post Dives

After each dive the HD FLOT should be washed down with fresh water. The mechanical attachment points and hydraulic interconnects should be inspected for loose fittings and leaks. Should the HD FLOT not be required for more than 24 hours, the Helac and Rotate Motor must be flushed internally with an ISO fluid. Storage of water contaminated fluids in the HD FLOT is not recommended for more than 24 hours.

4.2 Post Operations and General Maintenance

Once the hydraulic circuit is no longer required, the circuit should be washed down with fresh water and flushed with an ISO fluid as per section 3.1. The hydraulic interconnects should be flushed and plugged. Each individual component should be capped. The components should then be removed from the ROV and placed in the shipping container supplied for long-term storage.

Should there be any noticeable deterioration in the HD FLOT's performance for the given input pressure or fluid contamination, the HD FLOT Rotate Motor may be removed and replaced as described below.

APPENDIX A - Drawings

HD FLOT-000-001

HD FLOT GA

APPENDIX B - Vendors Information