5 VIT WINCH AND UMBILICAL MANUAL

IODP VIT Assembly Part Number OV7000

IODP JRSO

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0	3/5/19	Mike Meiring	Mike Meiring
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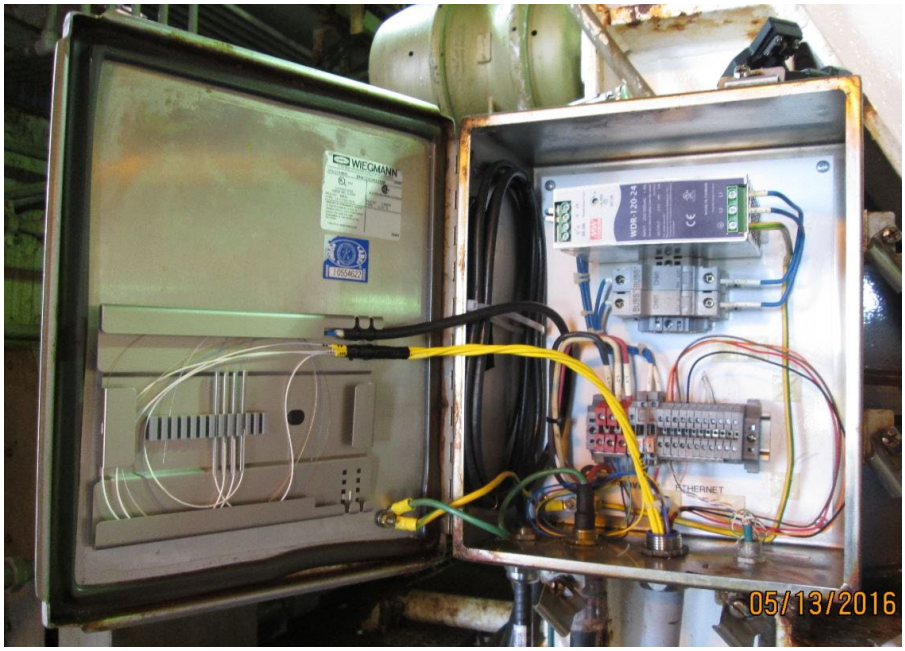
CHAPTER 1.0 WINCH

See schematic 9. *Winch Schematic* (Confluence > Engineering and Tools > VIT > Schematic Diagrams).

1.1 WINCH J-BOX

The Winch J-Box (**Fig. 1**) is mounted on the starboard side of the winch frame. Three cables (a 3-phase 480 VAC power, a 6-core Optic fiber, and one shielded 4pr Cat5e cable) enter the J-Box from Subsea. A fourth cable connects the AC power, 2x twisted pairs and the Optical fibers to the FORJ/Slipring. Fibers from the SUBSEA cable (black) are fusion spliced to those from the FORJ (yellow) and the splice tray is mounted in the J-Box door. Two remaining fibers from the 6 core Subsea cable are not used.

Figure 1. Winch J-Box.



1.2 FIBER OPTIC ROTATOR JOINT (FORJ/SLIPRING) (OM3027)

Mounted inside the drum shaft on the starboard side, the Fiber Optic Rotator Joint (**Fig. 2**) provides connectivity between the Winch and Reel J-Boxes.

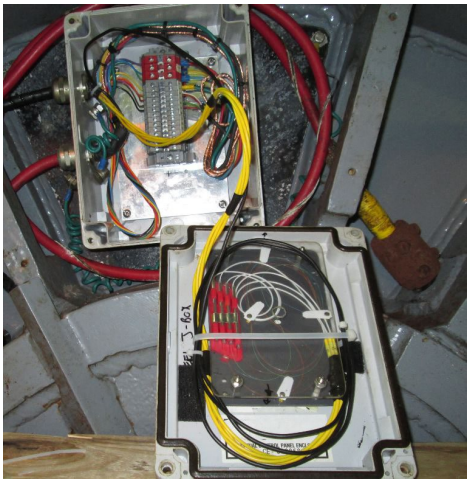
It has 8 X 10 A/1000 VAC rings and 4 X SM Optical channels. Optical insertion loss is 1-3 dB, depending on Channel and wavelength used.

Figure 2. Fiber Optic Rotator Joint (FORJ)/Slipring.

1.3 REEL J-BOX

The Umbilical terminates in the Reel J-Box (**Fig. 3**) on the drum flange. The four SM optical fibers from the umbilical are fusion spliced to the FORJ fibers and supported on a splice tray mounted in the J-Box lid. Eight electrical conductors, four for 3-phase 480 V Power and two twisted pairs, connect the umbilical to the FORJ.

Figure 3. Reel J-Box.



CHAPTER 2.0 UMBILICAL

2.1 OVERVIEW

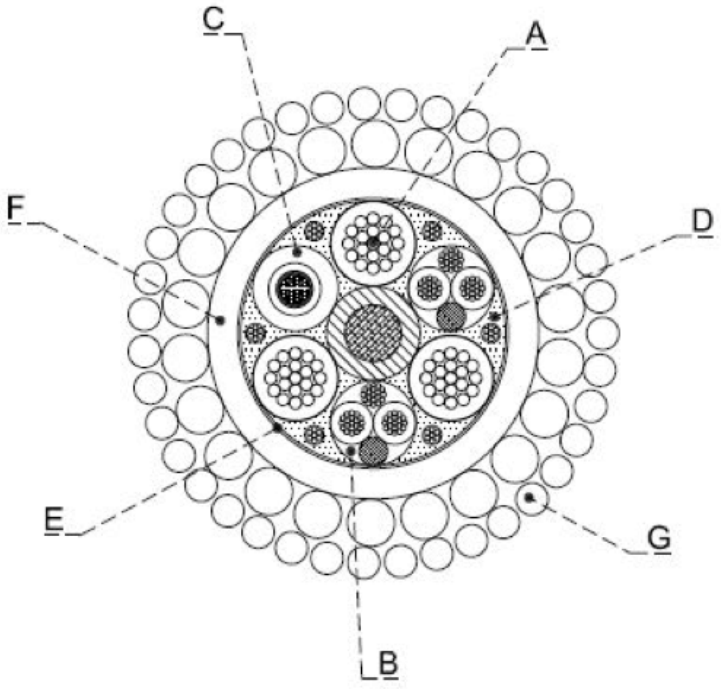
The RM0021 R.O.V. LIFT CABLE (OV0806; **Fig. 4**) was custom made for IODP by CORTLAND CABLES. It is a double armored, torque-balanced design, capable of mechanically supporting the 1800 lb (wet) VIT frame to a depth of 6000 m.

Figure 4 lists the cable's mechanical characteristics and shows a cross sectional view of the cable. Armoring (G) is composed of two layers of dressed high tensile galvanized steel wire. At 6000 m length, the cable weight approaches its safe working load (SWL) of 14,000 lb and added dynamic load as a result of drag and heave could potentially result in reduced cable life if not managed. Three 3-mm squared plain copper conductors (A) with 1.5 kv insulation supports the 3-phase 480 VAC primary power to the Pod.

A jacketed gel filled SS-tube (C) contains 4 x SM optical fibers. This cable element is wound in a helix that protects the fibers from cable elongation, thus eliminating strain in the fibers. The jacket surrounding the optical element also protects it from crushing forces.

Two individually screened 0.5 mm twisted pair signal conductors (B) provide electrical signal connectivity in the unlikely event of total optical fiber failure.

Figure 4. Mechanical Characteristics and Cross Section Diagram of Umbilical.



Nominal Mechanical Characteristics:	
Finished diameter:	17.3 mm
Weight in air:	1,065 kg/km 1)
Weight in sea-water:	815.0 kg/km
Minimum static bend radius:	250 mm
Minimum dynamic bend radius:	280 mm
Minimum breaking load:	180 kN

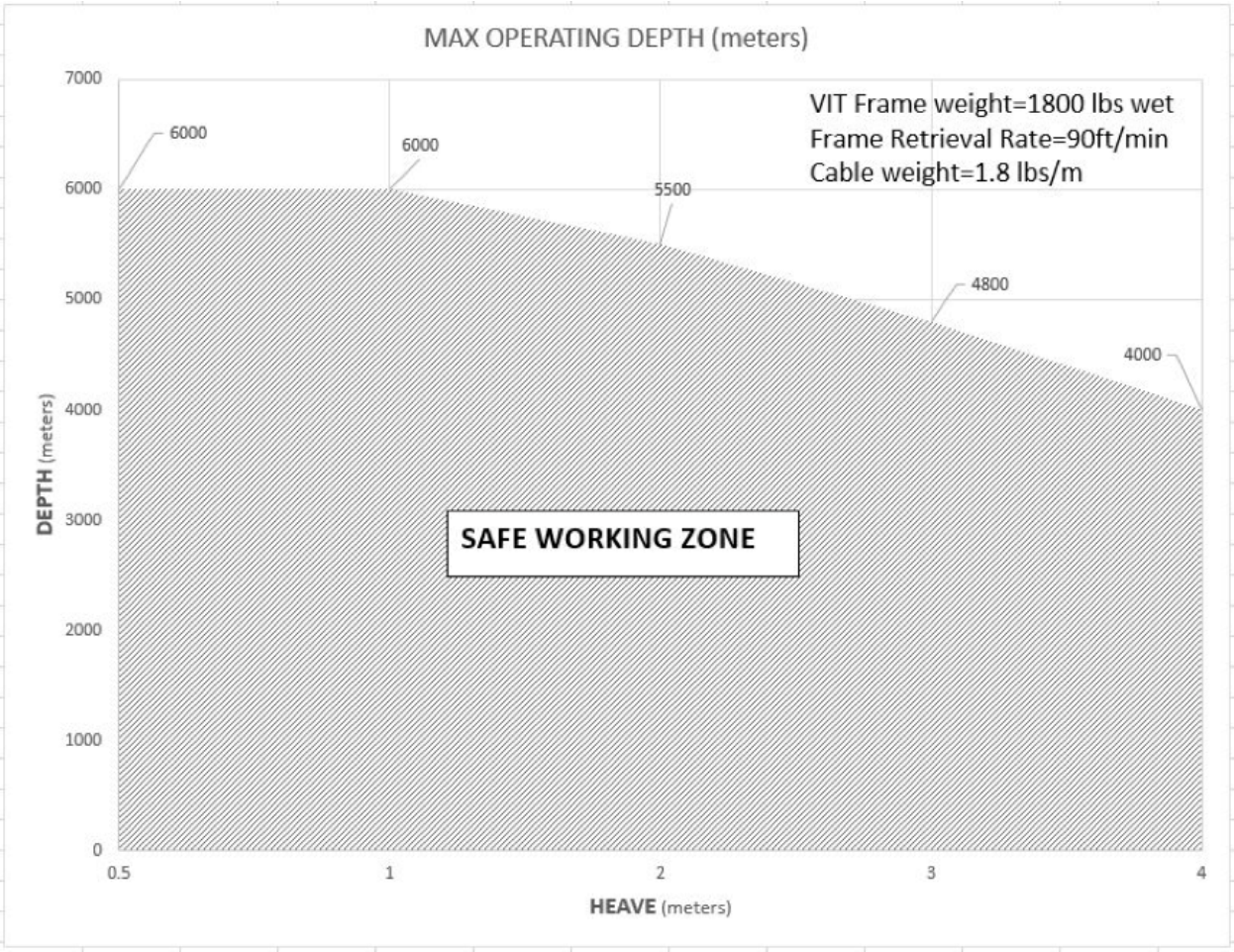
Note 1: Assumed sea-water density of 1026 kg/m³

2.2 CABLE LOAD MANAGEMENT

The nomograph (**Fig. 5**) for deploying the Cortland VIT cable is a guideline for staying within the cable's SWL of 14,000 lb. While the static load on the cable is the sum of the deployed cable weight (1.8 lb/m in seawater) and the VIT frame weight (~1800 lb in seawater), the total load must take into account dynamic loading as well.

Forces acting on the cable are a sum of the acceleration and drag on the frame during retrieval as a result of retrieval rate and ship heave. For the drag coefficient, 1.15 was used, and the VIT frame retrieval speed was set at 90 ft/min. The VIT frame cross-sectional area was conservatively calculated to be 20 ft^2 based on a SolidWorks model. Heave numbers are peak-to-peak.

Figure 5. Safe Working Zone Nomograph.



2.3 CABLE SPECIFICATIONS DATA SUPPLIED BY CORTLAND

1.	Cable weight in water	815 kg/km (1.796 lb/m)
2.	Breaking Strength	180 kN (40,466 lb)
3.	Yield Strength	135 kN (30,349 lb)
4.	Safe Load Limit	62.3 kN (14,005 lb)
5.	Overall Diameter (nominal)	0.681 inch
6.	Minimum bend radius (Dynamic)	14 inches
7.	Weight in air	740 lb/kft
8.	Weight in sea water	576 lb/kft
9.	Breaking load	46,000 lb

2.4 CABLE TERMINATION WINCH

See schematic *10. Umbilical Schematic* (Confluence > Engineering and Tools > VIT > Schematic Diagrams) for electrical information. The cable penetrates the winch reel from Lebus grooving on the starboard side of the drum. It is secured with a cable clamp and terminates in the Winch Reel J-Box. The Cortland cable has a right hand lay (RHL) construction.

2.5 CABLE TERMINATION FRAME INSTRUCTIONS

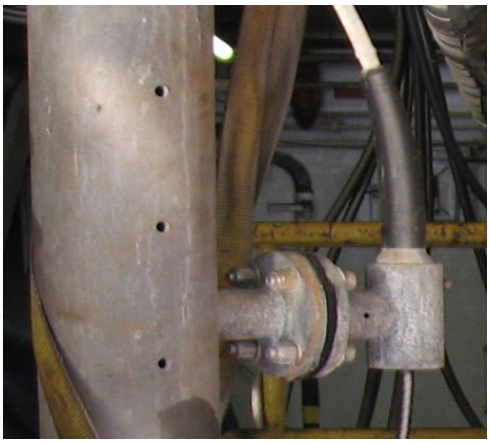
To terminate the cable, follow these steps.

1. A CABLE-GRIP™ (OM3007) is installed on the frame side on the umbilical to bear the load. The termination is designed to hold (in most applications) 100% of the cable's rated break strength. If reinstallation is necessary after a CABLE-GRIP™ Termination has been loaded, it must be replaced with a new termination.

Caution! The termination must have the same lay direction as the cable armor. Never use a CABLEGRIP™ Termination with an opposite lay direction. See section in Maintenance.

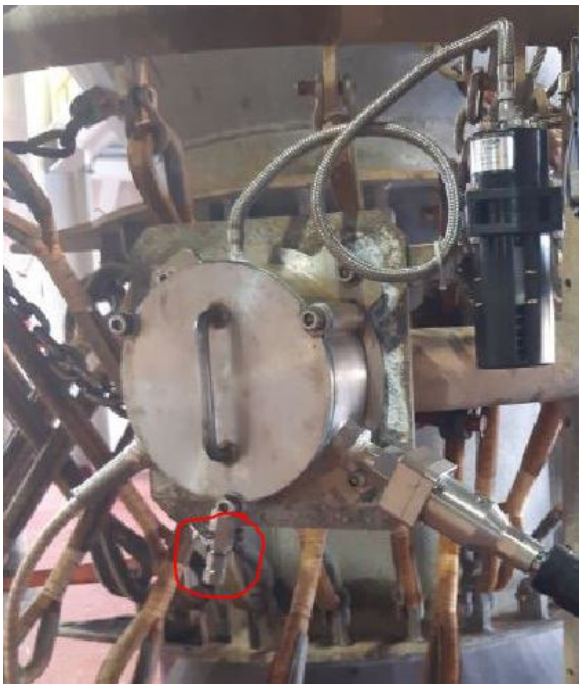
2. CABLEHEAD (OV6124). The umbilical armor is cast in epoxy within the cable head and the Cable stress boot (OV6059) is attached to provide strain relief. The assembly is mounted to the VIT frame and is not load bearing (***Fig. 6***).

Figure 6. Cablehead Preparation and Mounting.



3. VIT FRAME J-BOX (**Fig. 7**). See Schematic *10. Umbilical Schematic* (Confluence > Engineering and Tools > VIT > Schematic Diagrams) for more information.

Figure 7. VIT Frame J-Box and Pressure Compensator (A) and open J-Box (B).



A

B

The VIT frame J-Box connects the umbilical to the Telemetry Pod via the new TTL harness. The umbilical enters the J-Box via a pressure gland. The harness penetrator end terminates in the Frame J-Box, while the connector end mates with an AMMETEK Hybrid connector on the Telemetry pod. The harness assembly is a self-contained unit,

oil filled and sealed. In the Frame J-Box, three SM Optical fibers are fusion spliced and appropriately supported on a splice tray. The forth fiber (BRN) from the umbilical is a spare and is not terminated. Three 16AWG conductors from the umbilical is connected to conductors from the Pod and provide AC Power. Two unused twisted copper pairs in the umbilical are available for future use. The J-Box is filled with silicon oil and is pressure balanced. A charge/bleed valve at the bottom of the J-Box can be opened to discharge a small amount of oil to inspect for the presence of water. This should be done periodically as 480 VAC is present in the J-Box top side and will arc in the presence of seawater.

4. PRESSURE COMPENSATOR (***Fig. 7A*** and **Fig. 8**). A Forum pressure compensator is attached to the VIT Frame J-Box. The compensator's main purpose is to compensate for changes in oil volume as a result of changes in oil temperature. It also maintains the internal oil pressure of the VIT frame J-Box to slightly higher (4-7 psi) than hydrostatic pressure to prevent water-ingress. The additional volume also provides a margin in the event that the J-Box develops a slow leak. The telescoping white plastic cylinder provides instant visual feedback of the piston position and the remaining oil volume in the compensator/J-Box system. Piston position should be between the two yellow Max/Min marks on the compensator body. The pressure compensator part number is SA-HC-0406-MAS. Serial No: PTX-4/19-1 (www.f-e-t.com).

Figure 8. Close up of Pressure Compensator.

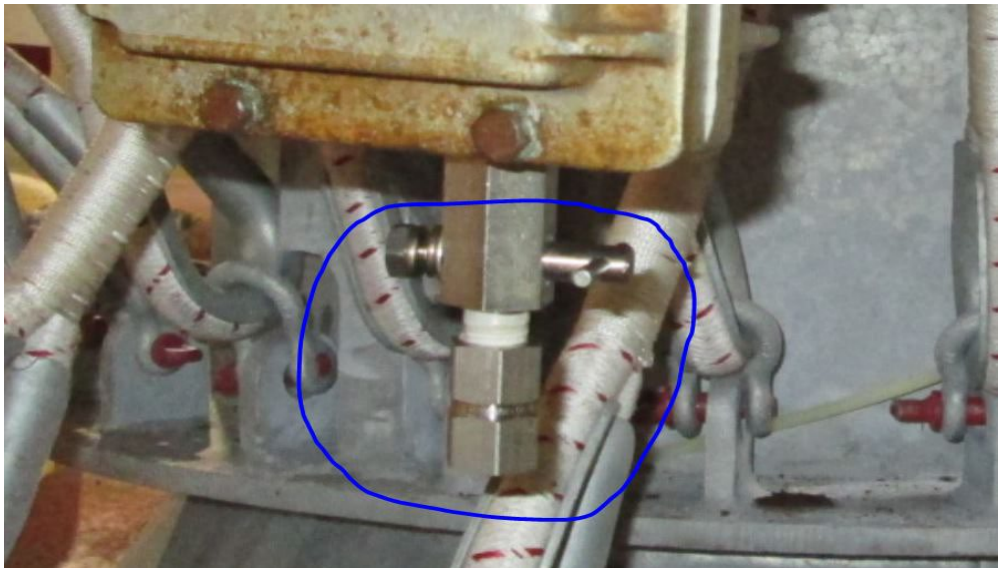
2.6 VIT FRAME J-BOX FILLING PROCEDURE

TOPPING UP

To top off the VIT Frame J-Box, perform these steps:

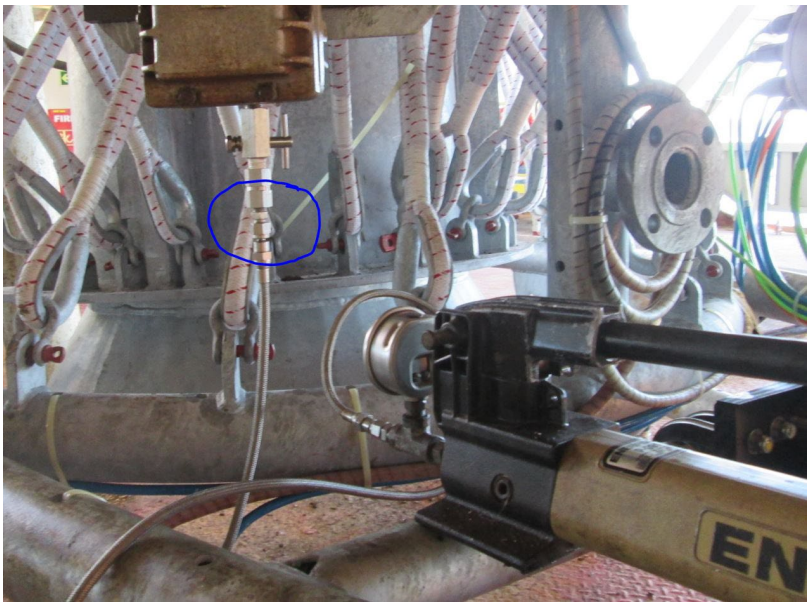
a. Release some fluid from the Charge/Bleed valve (***Fig. 9***) at J-Box bottom. Confirm there is no evidence of seawater. Keep in mind the J-Box is under some pressure (~4 psi) from the compensator.

Figure 9. J-Box Charge/Bleed Valve.



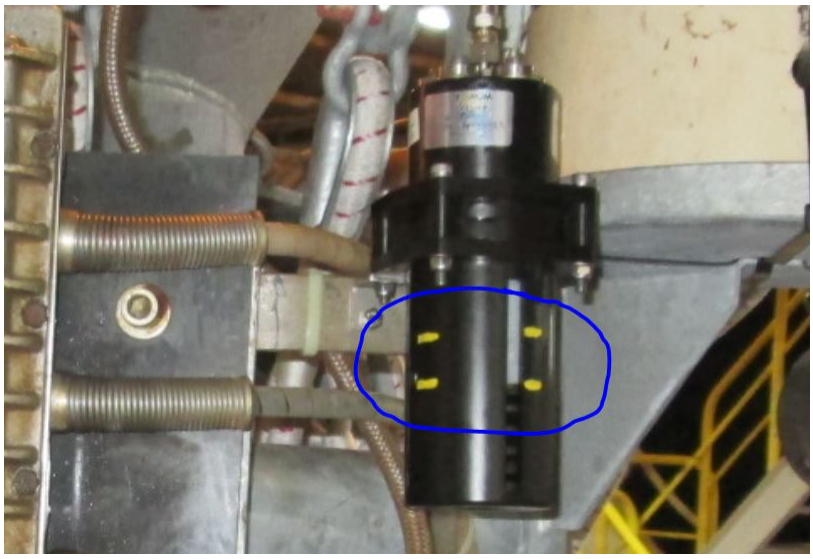
b. Screw extension pip from pressure pump (**Fig. 10**) into bottom of compensator Charge/Bleed valve. Thread is 1/8" BSPP.
c. Ensure piping and fittings are purged and all air is displaced before tightening connectors.

Figure 10. Silicon oil pump connected to J-Box.



d. Open the Charge/Bleed valve to connect pump to J-Box system.
e. Start pumping while watching the white plastic cylinder extend from the compensator. Stop when it reaches the bottom yellow Max mark (**Fig. 11**).
f. Another pump stroke or two may now be required to get the white plastic cylinder in the compensator back to the bottom yellow max mark again (**Fig. 11**).
g. Close the Charge/Bleed valve and remove pump from J-Box. System is topped up.
h. Confirm the white plastic cylinder in the compensator did not move. Movement after a period of time would indicate a leak.

Figure 11. Min/Max Marks with White Plastic Cylinder in Compensator.



INITIAL FILLING FRAME J-BOX WITH SILICON OIL

Initial Filling of Frame J-Box with silicon oil requires these steps:

1. Confirm J-Box lid O-ring is installed and bolts are tight.
2. Confirm J-Box Charge/Bleed valve is installed and closed.
3. Undo the J-Box/Compensator connecting pipe at the J-box end. (**Fig. 7A**)
4. Top up the J-Box to the brim (**Fig. 7A**) with silicon oil and reconnect the Compensator pipe.
5. Undo the J-Box/Compensator connecting pipe at the Compensator end and lift vertically. (**Fig. 7A**)
6. Fill the Compensator to the brim with oil.
7. Fill the Compensator connecting pipe at the compensator end with oil and reconnect to the compensator.
8. Confirm Pressure Compensator and connecting pipe are installed.

9. Top up the hydraulic pump with silicon oil.
10. Screw extension pipe from pressure pump (**Fig. 10**) into bottom of compensator Charge/Bleed valve. Thread is 1/8" BSPP.
11. Ensure piping and fittings are purged and all air displaced before tightening connectors.
12. Open the Charge/Bleed valve to connect pump to J-Box system.
13. Start pumping while watching the white plastic cylinder extend from the compensator. Stop when it reaches the bottom yellow Max mark (**Fig. 11**).
14. Close the Charge/Bleed valve and remove pump from J-Box. System is charged.
15. Confirm the white plastic cylinder in the compensator did not move. Consistent movement over a period of time (30 minutes) would indicate a leak.

Refer to Pressure Compensator manual entitled *Pressure Compensator Brochure.pdf*.

2.6 TELEMETRY POD (OV0860)

The Telemetry Pod is a cylindrical stainless-steel pressure vessel with two end caps that support and protect the telemetry devices to 6000 m water depth. Underwater cables and connectors connect the Pod to end devices on the one end and to surface equipment onboard the ship.

See *2 VIT Manual v3 End Devices* for more information about the Telemetry Pod.

CHAPTER 3.0 VIT WINCH/UMBILICAL REVISION LOG

3.1 REVISION DATA

Revisions to the manual are recorded in this table. Please include the page, section or Chapter numbers in the revision Details.

Revision Date	Authority	Page	Revision Details
1/29/19	Graber	Title Page and Ch 3	Added VIT assembly part number on Title page and added Revision Log chapter. Corrected file name and footer file name from 3 to 5. Did not change revision number or dates.
2/5/19	Meiring	p. 9 and 13	Mike changed initial filling frame procedure and replaced Fig 7 (right) with a different figure.
3/5/19	Graber	All	Adding hyperlinks and final clean up.
3/5/19	Meiring	Document	Approved manual.
11/5/19	Graber	Pg 9-13	Replaced 3 figures with new ones and made Mike's text changes.
5/13/20	Howard	Pg. 10-13	Added a closeup photo and part number info for the pressure compensator. Redid hyperlinks and fig. numbering after new photo.
4/22/21	Howard	Pg. 9-13	Changed photos to reflect new TTL harness, drum J-box, and procedures for filling the J-box with oil.
9/25/22	Howard	Various	Minor changes to update document and remove Cumulus references.