CURVETECH

TECHNICAL MANUAL

COMPENSATOR - 11 LITRE
SMD P/N'S: EV_4010-XX

Refer to the 'Applicability' section for units covered by this manual

REVISION 0 - 30 November 2018

SMD

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SMD GENERAL NOTES:

ABOUT CURVETECH®

With over 20 years' knowledge and experience of providing integrated solutions for subsea and marine applications, Curvetech® subsea component products provide cost-effective and reliable solutions for use with marine and subsea operators, system integrators and original equipment manufacturers (OEMs). We have a dedicated team of engineers who specialise in the design and testing of SMD's Curvetech® components, to deliver world-leading products that enable customers to maximise on remote subsea operations.

For more information go to: www.smd.co.uk/product-category/curvetech-components/

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CAUTIONS & WARNINGS KEY

DANGER:
INDICATES A HAZARD WITH A HIGH LEVEL OF RISK WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.

WARNING:
INDICATES A HAZARD WITH A MEDIUM LEVEL OF RISK WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.

CAUTION:
INDICATES A HAZARD WITH A LOW LEVEL OF RISK WHICH, IF NOT AVOIDED, COULD RESULT IN MINOR OR MODERATE INJURY.

NOTICE:
INDICATES A POTENTIAL RISK OF DAMAGE TO THE SUPPORTED PRODUCT, PROPERTY, SMD CONFIDENTIALITY AND COPYRIGHT.

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SAFETY

SMD Statement on Product Safety and COSHH material safety data sheets can be found on the Safety & COSHH CD (SMD Part No. AC8901).

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REVISION CONTROL

Change Log

The table below details the changes made to this document revision.

Description	Date	Created By	Checked By	Approved By	Revision
					6
					5
					4
					3
					2
					1
Initial Release	24/09/2018	JFK	MvZ	KA	0
Title	COMPENSATOR - 11 LITRE				
ID	8101-1377901				

Applicability

Part Number	Description
EV_4010-8	Assembly Compensator 11L - 4 X 1 1/2" SAE 3K - 6-13PSI - Impulse3 - 4-20mA & Water/Temp Sensor
EV_4010-9	Assembly Compensator 11L - 4 X 1 1/2" SAE 3K - 6-13PSI

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1) SYSTEM OVERVIEW

Figure 1 - 11L Compensator

Within a subsea hydraulic system, oil volume changes as a result of pressure and temperature.

Compensators are included in these closed systems to account for this volume change. As the system volume lowers or raises, the compensator piston can move. Typical uses of compensator are:

- Compensation of electrical boxes (ie. valve packs, electrical junction boxes, electrical terminations).
- Compensation of enclosed cavities such as bearing housings and seal cavities.
- Reservoirs as part of open and closed loop hydraulic systems.

Important considerations required in the use of compensators in subsea hydraulic systems:

- Correct compensator size for the oil volume under compensation. The main parameters that affect oil volume are pressure and temperature. If required, SMD can advise further on compensator sizings.
- Relief valve included to limit system maximum internal pressure (see accessories section).
- Mounting is secure (see accessories section).

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- Space is available for the lower piston guide to move through its full range. Mounting is protected from inadvertent damage of components. Component is readily accessible for maintenance purposes.

CAUTION:
COMPENSATOR SHALL BE FITTED WITH A RELIEF VALVE SIZED IN ACCORDANCE WITH INSTALLATION. PRESSURE RATING OF THE RELIEF VALVE SHALL BE IN ACCORDANCE WITH INSTALLATION BUT SHALL BE NO GREATER THAN 15PSI.

1.1) Compensator System Specification

- Type: Rolling diaphragm with internal spring.
- Oil Volume: 10.6 L (19 imperial pints).
- Maximum Working Pressure: 2 Bar / 30 psi (relative to atmosphere).
- Diaphragm: Fabric Reinforced Nitrile Rubber.
- Diameter#: 280mm.
- Length#: 535mm (575mm Including transducer).
- Filled Length#: 645mm.
- Weight - Circa 30kg. See GA Drawing for detailed weight information.
- Materials
  - Top Plate and Spring - Stainless Steel
  - Bottom Plate and Coupling Flanges - Engineering plastic; Housings - Acrylic (Norlite),
- Recommended Oil Types:
  - HVI type hydraulic mineral oils (ie. Shell Tellus, Mobil DTE 10).
  - Transformer type oils (ie. Mobilect 39).
  - Environmental/HEES Oils (ie. Panolin HLP Synth, Panolin Atlantis).

 # See approved general arrangement drawing for component layout. Please request latest copy from SMD sales.

1.1.1) General Specification

Compensator Variant	EV_4010-8	EV_4010-9
Pressure range Empty to Full*	0.4 - 0.9bar (6 - 13psi)	0.4 - 0.9bar (6 - 13psi)
Hydraulic Connections	4 off 1½" SAE 3k 2off ¼" BSPP	4 off 1½" SAE 3k 2off ¼" BSPP
Sensor	Level sensor 4-20mA MCBH3M-SS Temperature/Moisture sensor MCBH4M-SS	No Transducers fitted (Can be fitted retrospectively)

*** Values are engineering estimates and may vary between units. See latest GA for approved estimates.**

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2) MOUNTING ARRANGEMENT

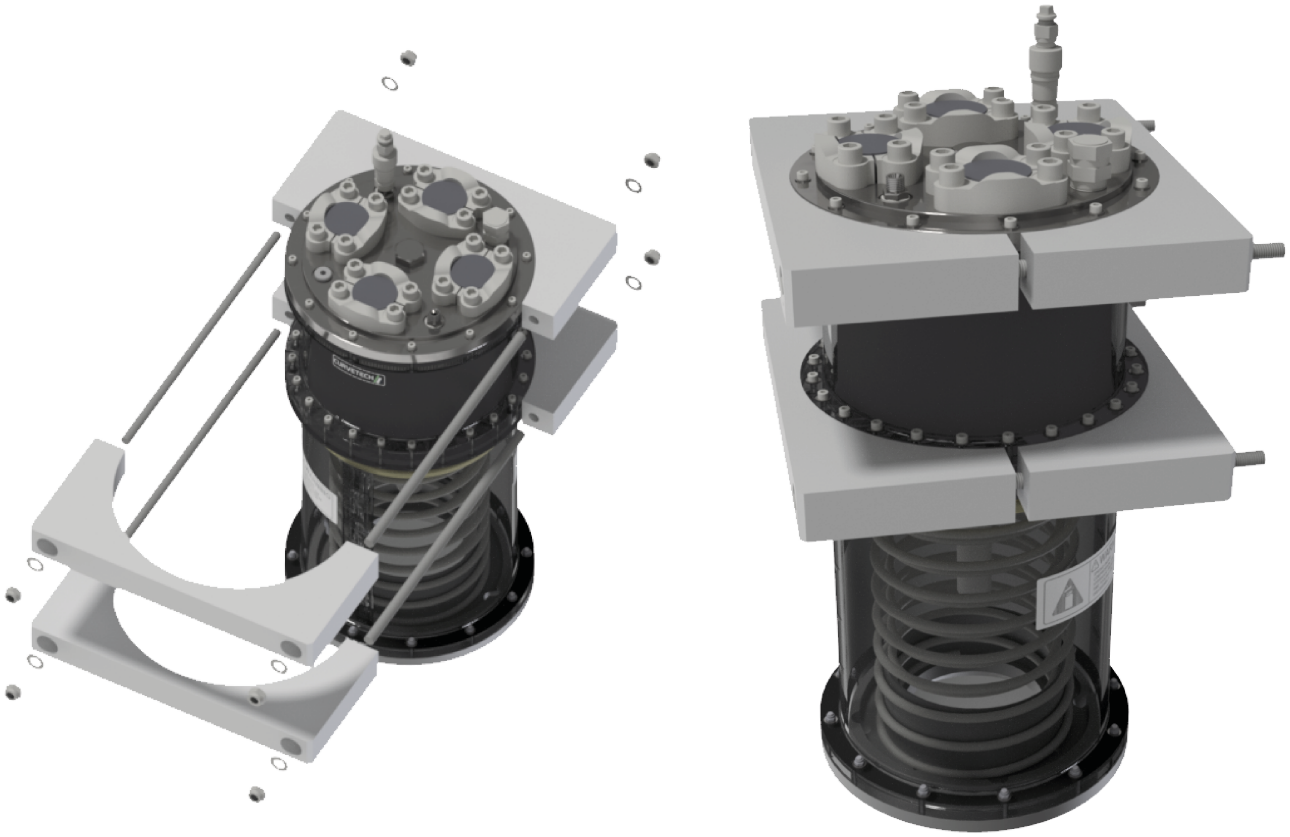

Figure 2 - 11L Compensator Mounting Arrangement

The compensator is best mounted vertically. Standard procedure is to mount the top of the compensator using 4 off half clamps. The half clamps are secured around the upper flanges using 4 off lengths of M12 threaded bar and 8 off washers and 8 off M12 nyloc nuts. The excess on the threaded bar is then used to secure the compensator to the vehicle. See relevant GA for details or contact SMD for further details.

The mounting arrangement should ensure that the compensator has suitable sea-water drainage via the holes provided in the lower housings. Care should be taken to ensure the mounting structure is stiff but no additional strain is placed on the compensator sub assembly. Room should be left below the compensator for the transducer guide to exit the compensator as the unit is filled.

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3) MAINTENANCE

This section will describe the various maintenance activities that are required to ensure that system remain in a good working condition that allow the system to maximise component life. This section also describes some of the key component removal and assembly procedures.

CAUTION:
EQUIPMENT DAMAGE MAY OCCUR IF THE FOLLOWING PRECAUTIONS ARE NOT TAKEN. PRIOR TO ALL MAINTENANCE ACTIVITIES ENSURE THAT THE SYSTEM IS DE-PRESSURISED. MAINTENANCE ACTIVITIES INVOLVING BREAKING INTO THE HYDRAULIC SYSTEM MUST BE PLANNED IN SUCH A MANNER THAT THEY ARE CONDUCTED IN A CLEAN ENVIRONMENT TO PREVENT INGRESS OF DIRT, RUST OR OTHER EXTRANEOUS PARTICLES. IF THE SYSTEM CONTAINS SMD VALVE PACKS WHICH USE PROPORTIONAL HYDRAULIC DIRECTIONAL CONTROL VALVES THEN HYDRAULIC OIL OF CLEANLINESS SUPERIOR TO NAS1638 CLASS 7 IS REQUIRED. ONLY USE OIL OF THIS QUALITY OR SUPERIOR.

3.1) Inspection Frequency

3.1.1) Daily/Pre And Post Dive Checks

- Visual inspection of unit. Confirmation that unit fixings and hoses are secure. Confirmation that oil level is correct and no evidence of leaks.

3.1.2) Weekly

- No specific actions.

3.1.3) Monthly

- Thorough visual inspection. Removal of any vehicle components to aid this inspection.
- Oil contamination check - Particle count (NAS level or ISO level), oil water content and oil condition (if required).
- Confirm relief valve is free to move.

3.1.4) Yearly

- No specific actions.

3.1.5) Every 2 Years (after Heavy Use)

- Full strip and inspect. Replace rolling diaphragm.

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3.2) Filling Compensator

CAUTION:
UNCONTROLLED FILLING OR FILLING AT HIGH FLOW RATES MAY OVER-PRESSURISE THE COMPENSATOR AND CAUSE DAMAGE AND INJURY.

- Always fill the compensator in a slow and controlled manner.
- Monitor the fill level at all times to prevent overfilling. It's recommended to fill to 80-90% maximum volume to leave room for some expansion.
- Fill the system through a check-valve or quick-release coupling. Once filled, the system pressure is raised above atmospheric pressure.
- After filling, leave the system to settle and bleed trapped air from system. For a vertically mounted compensator, the air bleed valve can be loosened and the cap depressed. Horizontally mounted units are best mounted at a slight inclination and air bleed value at the highest point. Alternatively they can be filled vertically prior to installation.
- Monitor system oil levels during operation to prevent leaks and protect against component failures.

3.3) Replacing The Rolling Diaphragm

To replace the rolling diaphragm, please follow the instructions below. The relevant general assembly drawing should also be used for reference. If in doubt, stop and contact SMD for assistance.

WARNING:
INTERNAL SPRING REMAINS COMPRESSED EVEN WITH UNIT EMPTY. IF THIS IS NOT RESTRAINED, AS NOTED BELOW, THE PARTS CAN SEPARATE WITH SUFFICIENT FORCE TO CAUSE A MAJOR INJURY.

- Drain all oil from the compensator.
- Disconnect the compensator from the system.
- Remove all hydraulic fittings from the top plate of the compensator.
- Place the compensator in a suitable press.
- Carefully remove 12 off M5 fasteners to detach the lower end cap from the main body.
- Use the press to uncompress the internal spring.
- Remove the lower housing by removing 24 off M5 fasteners.
- Withdraw the piston with diaphragm attached.
- Remove the diaphragm retainer bolts (4 off M6).
- Clean all residue from all parts before re-assembly, checking all o-rings for damage and replacing as necessary.

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3.4) Reassembly

- Apply a light coat of silicone spray or Molykote 111 to both sides of the diaphragm.
- Fit piston into diaphragm & replace the diaphragm retainer and 4 off M6 bolts.
- Fit the piston assembly into the upper housing, then refit the lower coupling flange.
- Make sure the flange faces are clean then apply a coat of Molykote 111.
- Fit the diaphragm and tighten the 24 off M5 nuts and bolts around the central flange in an opposing tightening sequence.
- Fit the spring and lower end cap, use a press to compress the assembly then attach the lower end cap to the spring housing with M5 nuts, bolts & washers.

3.5) Cleaning

NOTICE:
ONLY CLEAN EXTERNALS USING WARM WATER WITH WEAK SOAP SOLUTION FOLLOWED BY A FINAL RINSE WITH FRESH WATER. OTHER CHEMICALS MAY REDUCE THE APPEARANCE AND SERVICE LIFE OF PLASTIC AND RUBBER COMPONENTS.

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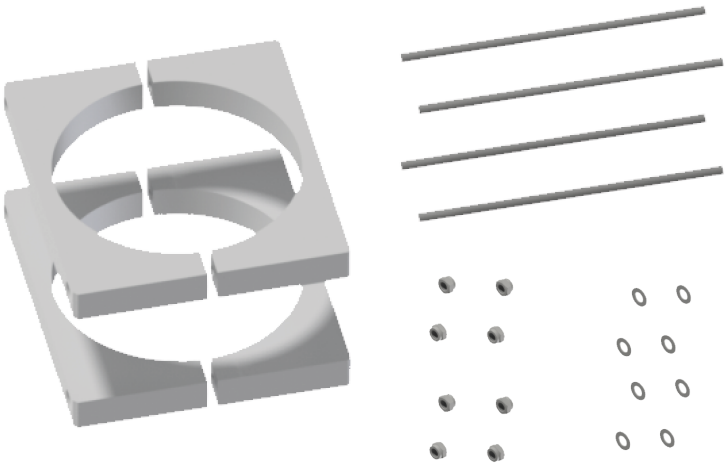
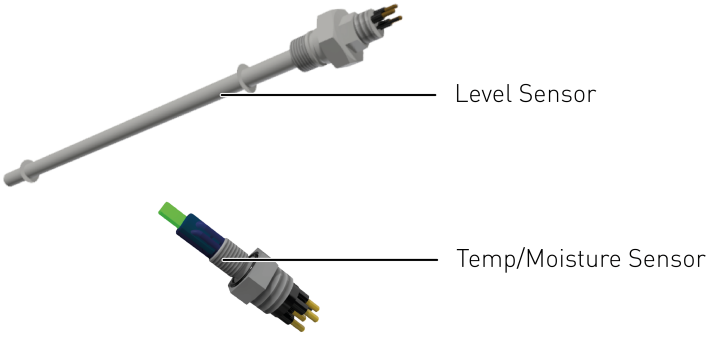
4) ACCESSORIES

Compensator mounting parts 4 off Clamp 22L Reservoir Single - AF1143 4 off Threaded Bar A4 SS - AB9752 8 off Nut M12 Nyloc SS A2-70 - PB8110 8 off Washer M12 Flat BS4320 Form B SS A2 - PA4860	
Transducers. SMD compensators are designed for simple retro-fit of level transducers. These are available with a variety of connectors (Impulse, Subconn, Burton, Seaconn) and outputs (4- 20mA or 0-10V).	

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Seals Kit (Diaphragm and O-Ring Seals). EV_4010-SP2.	
Assembly Compensator Fill Bottle AK1679.	
Tool - Oil Transfer Pump & Filter IA9433	2 Bar 15 LPM NOTE : Transfer pump only recommended for use on compensator systems of >20 litres. eg Tandem EV_4010 units

Refer to the GA Drawing for final confirmation of part numbers. Ordering by SMD part number reduces the risk of wrong parts being provided.

Use of non-approved SMD parts will invalidate the warranty.

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5) STORAGE

Compensators are shipped assuming they will be fitted to a system within 12 weeks. This assumes no extraordinary storage conditions, as no special precautions are taken for long term storage. Should there be a storage requirement, use the following procedure.

NOTICE:
ONLY CLEAN EXTERNALS USING WARM WATER WITH WEAK SOAP SOLUTION FOLLOWED BY A FINAL RINSE WITH FRESH WATER. OTHER CHEMICALS MAY REDUCE THE APPEARANCE AND SERVICE LIFE OF ALUMINIUM, PLASTIC AND RUBBER COMPONENTS

For storage, the following actions should be taken:

- Unit cleaned externally. Full strip, clean and rebuild if use may have caused particles to enter internal cavities.
- Unit drained of oil. If oil is contaminated (dirt or water content), the unit should be flushed with clean oil.
- All ports blanked.
- Store at relatively constant temperature (+5°C to +25°C) and out of direct sunlight.

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6) DISPOSAL

In the event that the unit is no longer required, it should be stripped down and cleaned to remove oil and other contaminants. The constituent parts should be sent to dedicated local waste disposal units or appropriate recycling facilities.

Waste oil must always be disposed of in appropriate facilities. If in doubt, contact your local oil supplier.

If in doubt, contact SMD who can arrange environmentally acceptable scrappage.

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7) SERVICE AND SPARE PARTS

7.1) Service Return Procedure

Standard return procedure is:

- Assembly should be suitably packaged and returned to SMD.
- Advise SMD of the required service work.
- A maintenance/failure report by the customer is required.
- A quotation for service/repair will be provided by SMD.
- An order to service/repair the unit is required before work can commence.
- On completion of the required work SMD will re-warranty item and return to client

7.2) Spare Parts

Refer to the GA Drawing for part numbers. Ordering by SMD part number reduces the risk of wrong parts being provided.

Use of non-approved SMD parts will invalidate the warranty.

7.3) Distributors

A current list of distributors and agents can be found on our website www.smd.co.uk, alternatively SMD can be reached using the below contact information.

Telephone: ++44 (0) 191 234 2222

Fax: ++44 (0) 191 234 8599

E-mail: support@smd.co.uk

Address: Soil Machine Dynamics Limited
Turbinia Works
Davy Bank
Wallsend
Tyne & Wear
United Kingdom
NE28 6UZ

SMD's network of distributors can provide in-field support for Curvetech® products in their relative areas and also hold stock of spare parts.

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