



The Calorfloat® Technology

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CALORA
MOORING SYSTEMS

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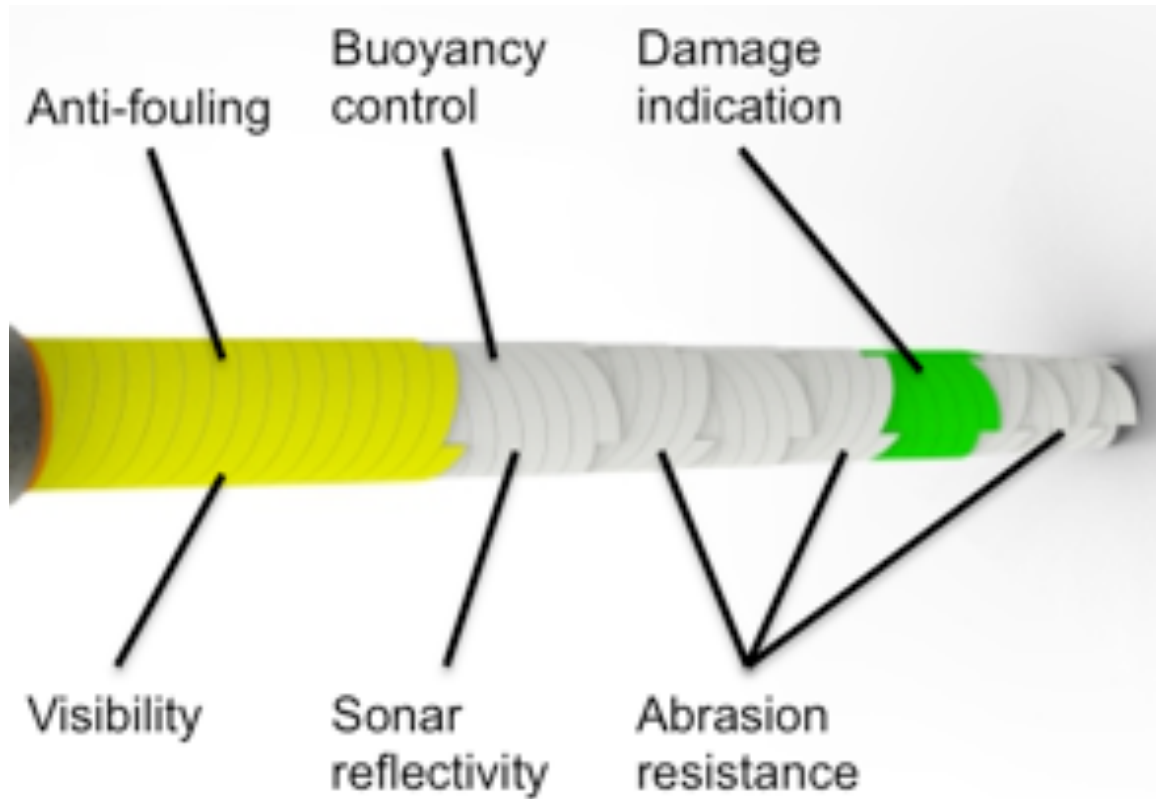
Spooling 200m demonstrator MODU rope with Calorfloat® on Skandi Vega

Brief History

- **Calorfloat® was invited as 1 of 44 technologies in 2010 by Statoil regarding the AHA project**
- **Calorfloat® was 1 of 3 picked for AHA DNV GL test in June 2013 (best in test)**
- **Further qualification and verification work 2013-2017 including offshore demonstration**
- **Obtained DNV Technology Certificate in 2018**
- **Patented technology**



Calorfloat® - The Multi-Functionality Approach



STATEMENT OF QUALIFIED TECHNOLOGY

No. 2018-3089 Valid until: 1 May 2021

This is to state that the technology designated

CALORFLOAT® FIBRE ROPE JACKET

has been qualified by DNV GL with basis in DNVGL-PP-A203 Technology qualification /1/.

DNV GL considers that product certification of offshore fibre ropes with retro-fit Calorfloat rope jackets can be performed in accordance with DNVGL-OS-E303 /2/, when Calora Mooring Systems AS has been certified for approval of manufacturer in accordance with DNVGL-CP-0173 /3/.

Owner: Calora Mooring Systems AS

Objective of this document: To affirm with basis in /4/ that DNV GL has completed the technology qualification process of Calorfloat® rope jackets for existing offshore fibre ropes up to commencement of the approval of manufacturer for Calora Mooring Systems AS.

Purpose: Increased robustness of mooring lines during handling, installation, and in-service

Description: Independent, retro-fit jacket system for offshore mooring fibre ropes as explained in /5/

Limitations: Limitations include, but are not limited to:

- Mooring legs shall be torque-free
- The qualified minimum bending radius shall be complied with

Verification and certification: Product certification of the combined Calorfloat® rope jacket and offshore fibre rope shall be in accordance with DNVGL-OS-E303 /2/. Detailed product certification requirements will be determined in the approval of manufacturer process in compliance with DNVGL-CP-0173 /3/.

Conditions: Calora Mooring Systems AS shall hold a valid DNVGL-CP-0173 approval of manufacturer certificate for the applicable combinations of offshore fibre rope and Calorfloat® rope jacket design. The incoming offshore fibre rope shall have a DNVGL-OS-E303 product certificate, and the limits of use shall have been complied with during previous service of the offshore fibre rope. Documentation of the fibre rope properties required for the design and application of Calorfloat® rope jacket shall be the responsibility of the provider of the offshore fibre rope.

Reference documents:

- /1/ DNVGL-PP-A203, Technology qualification
- /2/ DNVGL-OS-E303, Offshore fibre ropes
- /3/ DNVGL-CP-0173, Fibre ropes for designated service
- /4/ DNVGL-SE-0160, Technology qualification management and verification
- /5/ DNV GL report No. 2018-3089, Calorfloat® technology qualification, rev. 0

DNV GL shall not be held liable for undiscovered failure modes or failure causes. Information which might affect the technology qualification shall be brought to the attention of the below signatories immediately.

Havik, 27 April 2018
for DNV GL AS

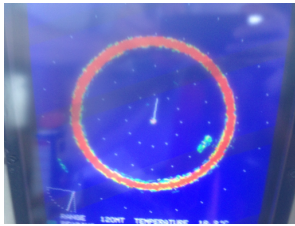
Hanne A. Hjerpetjønn
Head of Section, Materials Technology

Vidar R. Rønne
Senior Principal Specialist

This document is issued under the terms and conditions of client form agreement 3.1052928 (DNVGL) 3.1, signed 1 May 2016.

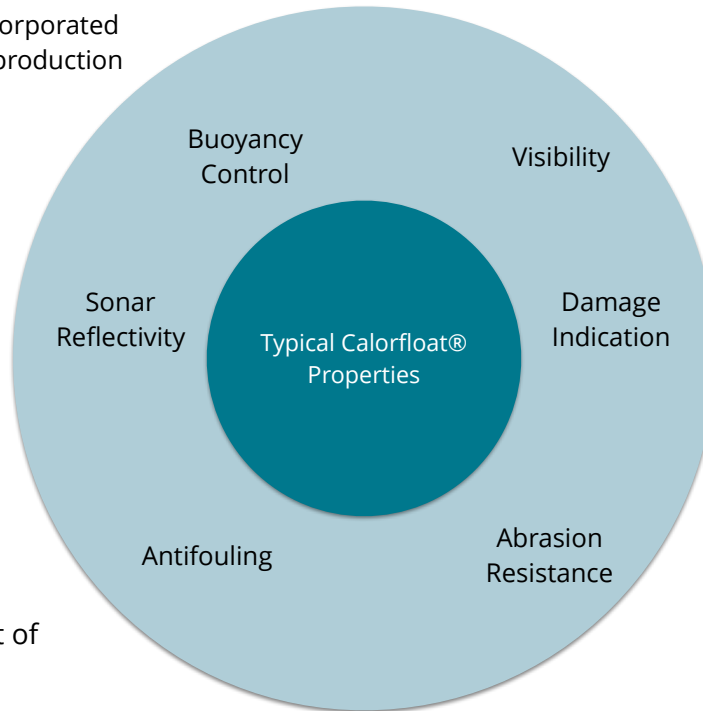
Calorfloat® - The Multi-Functionality Approach

680 - 4000 kg/m³ can be incorporated as part of Calorfloat® tape production

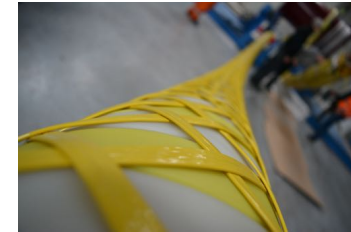


From DEMO2000 Sonar/Pre-Lay Test
WD=115m, Distance to sample >200m

Antifouling can be incorporated as part of Calorfloat® tape production



ROV Colour Coding can be incorporated as part of Calorfloat® tape production



CRJ ("High" PV)



Pre-Lay ("Low" PV)

Excerpt from *Technology Description Document* in DNV GL Certification Process

Business Model

- **Qualification and Certification activities as *independent* technology that adds *functionality* to ropes**
- **Can be applied to any rope, new or used**
- **End-User familiarity of “Company Provided Item” in other business areas, e.g. rigid pipelines**

4.5.3 Commercial Aspects and Risks

The ultimate objective of the Calorfloat® technology is market acceptance and commercial success. In this respect, the end-users, buyers, system integrators and rope suppliers have key roles. This section explains the Calorfloat® business model, describes known risks, and assumptions placed on rope suppliers and buyers.

Table 12 Supply Chain Model

POSITION	EXAMPLES
End User	Upstream companies involved in offshore non-renewable or renewable energy projects whether temporary facilities, e.g. MODU or permanent facilities, e.g. offshore wind farms or FPSOs
Facility owner	Owners of drilling rigs, floatels, AHVs, offshore fish farms.
System Integrator	Companies involved in rental equipment including synthetic ropes
EPC (I) Contractor	Companies involved in total engineering and equipment supply towards end-users. May often include installation scope (permanent facilities)
Rope Supplier	Supplier of synthetic mooring lines
Others	Authorities, certifying agencies

4.5.3.1 Calorfloat® Business Model

Calorfloat® technology is mostly developed by internal CSU resources (See section 1.3.2). As such, the technology is not part of the existing supply chain, and the inherent risk associated with such a position was manifested through the Aasta Hansteen project and the selected procurement strategy by the end user (CSU presentation to DNV GL 13 May 2016).

As the Calorfloat® technology brings *added* functionality to a rope and is not *an integral part of rope construction*, the Calorfloat® technology assumes that ropes can be contractually handled as a Company Provided Item (CPI).

CPI in this respect is in this case defined as any rope of any construction and material from any source whether new or used. The motivation for the selected business model is as follows:

1. Provides greater flexibility for the end-user and buyer through direct access to various functionality options
2. Can lead to cost reductions through fewer steps in the supply chain
3. Clear interfaces regarding responsibility and liability w.r.t rope and the external jacket
4. Better position for the Calorfloat® technology in the supply chain
5. Eliminate risk of lost opportunity and commercial benefits by being a sub-contractor to rope suppliers.