Certificate Number: 15ABD10457 Rev. D
BV Job no.: 21ABD11657554

Certificate of Type Approval

This is to certify that the design methodology and the manufacturing processes for the product identified below was found to be in compliance with the stated Regulations and Standards

Product:	**Distributed Buoyancy Module & Internal Clamp**
Manufactured by:	**Balmoral Comtec Limited** Balmoral Park Loirston Aberdeen AB12 3GY Scotland
Specified regulations and standards:	API Specification 17L1: 2nd Edition: June 2021 (Specification for Ancillary Equipment for Flexible Pipes and Subsea Umbilicals)

We further certify that the manufacturer's arrangements for consistently manufacturing the product in accordance with the approved type have been assessed and found to be satisfactory.

This Type Approval Certificate is valid until: 29/05/2025

Issued by:	Author: Michael WILSON Position: Graduate Design Verification Engineer	Approver: Charles STEWART Position: Lead Engineer
Bureau Veritas UK Limited Craigshaw Business Park Craigshaw Road AB12 3AR Aberdeen	Signature & Stamp	Signature & Stamp
	Date: 27th September 2021	Date: 27th September 2021

Certificate Revision History

Revision	Reason for Revision
0	Initial Issue
A	Certificate validity extended
B	Certificate renewed and new clamp design added
C	Updated for revision of standard and addition of integral clamp
D	Inclusion of new material

Schedule of Approval

1 Product Description:

Modules consist of an internal clamp and syntactic buoyancy module (or an integral clamp, embodied to syntactic buoyancy module) which are spaced along a required length of the flexible/umbilical to achieve a certain configuration including lazy, steep, pliant and W-wave. These distributed buoyancy modules and clamps are developed on a project specific basis, Bureau Veritas' scope of work was to provide Type Approval Certification to Verify the design methodology, manufacturing process and testing of these elements with regards to design code API Specification 17L1: 2nd Edition along with other applicable referenced codes specified in this certificate.

2 Application/Limitations:

Typical application parameters to be considered project specific:

- Nominal Flow line OD (for buoyancy module to be secured to a flow line)
- Max. Operating Depth
- Max. Calculated assembly weight in Air
- Min. Calculated assembly weight in Air
- Buoyancy based on sea water density
- Max. Initial buoyancy at atmospheric pressure
- Min. Initial buoyancy at atmospheric pressure
- Max. short-term buoyancy
- Min. short-term buoyancy
- Max. long-term buoyancy
- Min. long-term buoyancy

The design of the Buoyancy Modules and Clamps verified by Bureau Veritas under this certificate are subject to the following limitation:

Limitations	**Value**
Maximum Internal Shell Volume	4555.2 L
Maximum Initial Buoyancy at Atmospheric Pressure	4639.1 kg

Bureau Veritas has assessed the Buoyancy Modules which are documented by the complementary independent appraisal report for which this Certificate of Type shall always be read in conjunction with:

21ABD10710 Rev. A Complimentary Independent Appraisal Report

3 Design Calculations, Design Methodology, Drawings, Documentation and Specifications:

Title	Reference n°	Rev.
Buoyancy Module General Arrangement	XXXXX-GA-01	03
Buoyancy and Component Stress Calculation	DBM-DC-2	02
Buoyancy Module and Premium Clamp BOD	DBM-DB-2	03
Buoyancy Module and Symmetrically Loaded Clamp BOD	DBM-DB-6	01
Clamping Load Calculation	CLP-DC-1	03
Symmetrically Loaded Clamp Design Calculation	CLP-DC-7	01
Slip Load Calculation for Alpha Factor Verification	CLP-DC-2	01
Slip Load Calculation for Alpha Factor Verification (Sym.)	CLP-DC-8	01
Premium Clamp Assembly	XXXXX-SA-01	03
Symmetrically Loaded Clamp Assembly	XXXXX-SA-02	02
ITP Distributed Buoyancy with Premium Clamp	14382-PD-002-001	02
Test Report Distributed Buoyancy with Premium Clamp	14382-PD-011-001	01
Buoyancy Module General Arrangement	XXXXX-GA-01	03
Three Piece Clamp Assembly	XXXXX-SA-XX	03
Buoyancy Module & Clamp Design Basis (3 Piece)	DBM-DB-6	01
Buoyancy and Component Stress Calculation (3 Piece)	DBM-DC-7	01
Slip Load Calculation for Alpha Factor Verification (3 Piece)	DBM-DC-8	01
Clamp Load Calculation (3 Piece)	CLP-DC-4	01
ITP Distributed Buoyancy with Premium Clamp (3 Piece)	14484-PD-002-001	01
Production Test Report	13766-PD-011	01
Buoyancy Module General Assembly	70101-DEV-V5	02
Integral Buoyancy Module Element	70101-DEV-V1	02
Integral Buoyancy Module Qualification Design	70101-DC-30	-
Integral Module Clamp Rubber Spring FEA Report	70101-DR-2	02
Integral Buoyancy Module Design Reference Appendices	70101-REF-1	01
Input Reference Document	70101-REF-2	-
ITP Integral Clamp Distributed Buoyancy	70101-PD-002-001	01
Pre-Production Test Report	14436-PD-009-001	01
General Assembly	14259-GA-1	01
Integral Clamped Buoyancy Module Design Basis	DBM-DB-4	02
Integral Clamped Distributed Buoyancy Ref. Documentation	DBM-DB-6	01
Integral Clamped Buoyancy Module Design Calculation	DBM-DC-3	03
Slip Load Calculation for Alpha Factor Verification	DBM-DC-5	01
ITP Integral Clamp Distributed Buoyancy	14436-PD-002-001	03
Buoyancy Module Production Test Report	14283-PD-011-001	01

Bureau Veritas' approval of the above documents are detailed in the complementary Independent Appraisal Report (21ABD10710 Rev. A).

In the case of documents with reference numbers "XXXXX", this denotes a document template and will be replaced with a contract number on project specific basis.

Material Specifications:

Balmoral Comtec Limited shall produce records of tests demonstrating that the material selected for a specific application meet the functional requirements specified for the ancillary equipment, for the service life for storage, transport, installation, and operation conditions.

Materials detailed below have been reviewed against the requirements of API Specification 17L1: 2nd Edition.

Buoyancy Module

Foam Core:	Syntactic Foam [Ref. Note 1, below]
Outer Shell:	Polyurethane/Polyethylene (BC-PU-103 / BC-PE-501 / BC-PE-506)
Tensioning Assembly:	Super Duplex (UNS 32760/UNS 32750) or Inconel (UNS N06625) or Titanium (Grade 5, UNS R56400)
Cap:	Low Density Polyethylene (BC-PE-506)

Premium Clamp:

Clamp Body:	High Performance Pure Syntactic Foam (BC-CS-750)
Radial Springs:	Natural Rubber (EM67 / EDS 6)
Tensioning Assembly:	Titanium (Grade 5, UNS R56400)
Elastomer hinge coating:	Polyurethane (BC-PU-103)

Three Piece Clamp:

Clamp Body:	Polyurethane (BC-PU-135/BC-PU-164)
Axis Bar:	Super Duplex (UNS 32760/UNS 32750) or Inconel (UNS N06625) or Titanium (Grade 5, UNS R56400)
Bolt:	Super Duplex (UNS 32760/UNS 32750) or Inconel (UNS N06625) or Titanium (Grade 5, UNS R56400)
Washer:	Super Duplex (UNS 32760/UNS 32750) or Inconel (UNS N06625) or Titanium (Grade 5, UNS R56400)
Washer:	PTFE (6/6)
Nuts:	Super Duplex (UNS S32750/ASTM A276M)

Clamp Lifting Eye Assembly:

Lifting Eye Nut:	Forged Steel (G-400)
Dual Threaded Rod:	Super Duplex (UNS S32760)
Additional Nut:	Super Duplex (UNS S32760)

Buoyancy Module (with Integral Clamp):

Foam Core:	Syntactic Foam [Ref. Note 1, below]
Outer shell:	Polyurethane (BC-PE-501)
Tensioning Assembly:	Super Duplex (UNS 32760/UNS 32750) or Inconel (UNS N06625) or Titanium (Grade 5, UNS R56400)
Cap:	Low Density Polyethylene (BC-PE-506)
Radial Springs:	Natural Rubber (EM67 formulated to EDS6)

Note 1: The buoyancy module foam core material qualification testing is carried out on a case-by-case basis, depending on the project parameters.

Test Procedures for Polymer materials to be according to standards specified in Table 5 API Specification 17L1: 2nd Edition.

Balmoral Comtec Ltd. shall produce the qualification test records to prove the compliance of material selected for Buoyancy module and clamp to the requirement specified in Sections 4.4, 8.5 and 12.4 of API Specification 17L1: 2nd Edition.

4 Fabrication/Testing Procedures:

API Specification 17L1: 2nd Edition, provides detailed procedures for performing factory acceptance tests (FAT)s. Balmoral Comtec Ltd documents 14382-PD-002-001 Rev. 02, 14484-PD-002-001 Rev. 01, 70101-PD-002-001 Rev.01 and 14436-PD-002-001 Rev.03 specify the production test procedures for Buoyancy Module and Clamp assemblies. Bureau Veritas have reviewed these documents and found them to be in compliance with the requirement.

5 Type Test Reports/Laboratory Reports/Certificates:

Bureau Veritas has witnessed a sample of production tests for the approved type and all the applicable requirements of API Specification 17L1: 2nd Edition were found to be met. Bureau Veritas' involvement is detailed in the following inspection report:

21ABD10708 Rev. 0 Witness Inspection Report

6 Marking of Product:

Marking of product shall comply with minimum requirements of section 4.8.1 of API Specification 17L1: 2nd Edition.

7 Certificate Retention:

The Type Approval Certificate is valid only if the Surveillance plan in Appendix A of this Certificate is followed.

8 Documentation to accompany each product:

The following Project Specific documentation shall accompany each product:

a) Design Premise
b) Design Report
c) Manufacturing Quality Plan
d) Installation Procedures
e) As-built documentation – with supplied ancillary equipment
f) Detailed engineering drawings

9 Comments:

10.1 Balmoral Comtec Ltd. shall demonstrate all relevant documents including design reports and calculations on a case-by-case basis for each project specific product.

10.2 This Type Approval certifies that the design methodology and the manufacturing processes for the Approved Type were found to be in compliance with the stated regulations and standards. When in-service this product shall be subject to Verification and Examination and comply with the applicable shelf state requirements.

10.3 Balmoral Comtec are currently performing aged shear testing of clamp rubber springs. The results of the ongoing test, once completed, shall be presented to Bureau Veritas for review.

End of Certificate

Appendix A – Surveillance Plan

Part (A) - Implementation of Quality Management System

* Mandatory Elements all Visits	**SURVEILLANCE** All activities & Processes must be audited at least once over each **5** year period					
ELEMENTS TO BE EXAMINED	**Initial**	**Surv. 1**	**Surv. 2**	**Surv. 3**	**Surv. 4**	**Re Cert**
	April 2020	*April 2021*	*April 2022*	*April 2023*	*April 2024*	*April 2025*
*QMS / Manual / Policy / Objectives (4.4, 5.2, 6.2)	✓	✓	✓	✓	✓	✓
*Management Review (9.3)	✓	✓	✓	✓	✓	✓
*Internal Audit (9.2)	✓	✓	✓	✓	✓	✓
*Improvement / Internal NCR Process (10)	✓	✓	✓	✓	✓	✓
*Customer Satisfaction /Requirements (9.1.2)	✓	✓	✓	✓	✓	✓
*Roles, Responsibilities Competency, & Training (5.3, 7.2)	✓	✓	✓	✓	✓	✓
Resource Management (7.1.1, 7.1.2, 7.1.3, 7.1.4)	✓					✓
Design & Development (8.3)	✓	✓				✓
Control of Documents (7.5)	✓					✓
Control of Records (7.5)	✓					✓
Customer Property (8.5.3)	✓					✓
Identification & Traceability (8.5.2)	✓					✓
Control of Product & Service Provision (8.5.1) (Process Control)	✓					✓
Inspection and Testing (8.3.4) #	✓	✓				✓
Control of Monitoring & Measuring Equipment (7.1.5) (Calibration)	✓					✓
Operational Planning & Control (8.1, 8.2)	✓	✓				✓
Control of Non-Conforming Product (8.7)	✓					✓
Preservation of Product (8.5.4)	✓					✓
Control of externally provided processes, products and services (8.4)	✓					✓
Responsibilities, Authority & Communication (5.3, 7.4)	✓					✓
Assessor's initials	CW	CES	CES			

1. In the Initial Assessment column, confirm by the use of a (✓) that all specified clauses have been audited.
2. In the Surveillance Audit columns, indicate by the use of a (✓), all of the clauses that have been audited during that Surveillance Audit and get agreement by the Client on the day of the Audit
3. In both Initial Assessment and Surveillance Audit columns, when Non Conformance, Opportunity for Improvement or Best Practice has been raised, identify by marking with abbreviated Serial Number accordingly.

Part (B) - Additional Elements (Witness Manufacturing Tests)

Design: Distributed Buoyancy Module

ITP References: 14382-PD-002-001, 14484-PD-002-001, 70101-PD-002-001 & 14436-PD-002-001

Year	Activity	ITP Activities
Initial (2020)	Witness Manufacturing Tests of Buoyancy Module, Premium Clamp and/or Three Piece Clamp	Buoyancy, IBL, Axial Slip Test & Complete Fit-Up
1 (2021)	Witness/Review Manufacturing Tests of Buoyancy Module, Premium Clamp and/or Three Piece Clamp and Integral Clamp	Buoyancy, IBL, Axial Slip Test & Complete Fit-Up
2 (2022)	Witness/Review Manufacturing Tests of Buoyancy Module, Premium Clamp and/or Three Piece Clamp and Integral Clamp	Buoyancy, IBL, Axial Slip Test & Complete Fit-Up
3 (2023)	Witness/Review Manufacturing Tests of Buoyancy Module, Premium Clamp and/or Three Piece Clamp and Integral Clamp	Buoyancy, IBL, Axial Slip Test & Complete Fit-Up
4 (2024)	Witness/Review Manufacturing Tests of Buoyancy Module, Premium Clamp and/or Three Piece Clamp and Integral Clamp	Buoyancy, IBL, Axial Slip Test & Complete Fit-Up

Surveyor **Initial:**	Surveyor **Y1:**	Surveyor **Y2:**	Surveyor **Y3:**	Surveyor **Y4:**
Craig Burgess	*Michael Wilson*			
BV Report No.: *20OEG30-1040 Rev. A*	BV Report No.: *21ABD10708 Rev. 0*	BV Report No.: 22ABD10620 REV 0	BV Report No.:	BV Report No.:
Date: *25/01/21*	Date: *16/09/21*	Date: 14/7/22	Date:	Date:

To maintain the validity of this Certificate of Type Approval, quality management surveillance and endorsements of the witness manufacturing tests to be performed annually by a BUREAU VERITAS Surveyor.

End of Appendix