



BV Job No.: 25ABD26218702

**BUREAU
VERITAS**

Cert No.: 25ABD10890 Rev. 0

Page 1 of 7

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: Bend Restrictor (Static Application Only)

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: 29th May 2030

Issued by: Bureau Veritas UK Limited The Quadrant, Poynerook Road, Aberdeen AB11 5QX	Author: Rahul Gopal Position: Senior Engineer	Approver: Callum MacLennan Position: Senior Engineer
	Signature & Stamp 	Signature & Stamp 
	Date: 16 th December 2025	Date: 16 th December 2025

Certificate Revision History

Revision	Reason for Revision
0	Recertification of Type Approval Certificate 15ABD10595 Rev. H

This document has been prepared by Industry & Facilities Division of Bureau Veritas UK Limited on the basis of a contract for services made on terms and conditions agreed with the client to whom this document is issued. It is issued strictly on the basis of and subject to those terms and conditions. It has been compiled with all reasonable skill and care but may not be relied upon by any person who is not a party to the contract under which this document is issued. Industry & Facilities Division of Bureau Veritas UK Limited cannot accept any liability whatsoever to any third parties to whom this document may be copied or circulated.





Schedule of Approval

1 Product Description:

Bend restrictors (BR) are designed to limit over-bending at the interface between subsea umbilicals, risers and flowlines (SURF) and rigid structures.

The bend restrictor string is made up of a number of bend restrictor units, each comprising of two halves bolted together around the SURF. Each unit has a male (external) end and a female (internal) end, which interlock with the adjoining bend restrictor units when assembled.

2 Application/Limitations:

The bend restrictor is designed in such a way that there is a clearance between the interlocking male/female ends of each unit. The bend restrictor units initially move independent of one another as the SURF begins to bend. As the SURF approaches its minimum bend radius (MBR), the interlocking male/female profiles of the adjoining bend restrictor units begin to contact each other until the bend restrictor reaches its geometric locking radius (GMLR).

The bend restrictor reaches its GMLR at a point before the MBR of the SURF is reached, thus preventing over-bending.

A short, summarised, definition of a bend restrictor is given below:

"A bend restrictor is a mechanical device that functions as a mechanical stop which limits the local radius of curvature of the flexible pipe to a minimum value"

Design Limitations are assessed using reference documents listed in Section 3 of this report. Typical parameters to accompany the design report for each product are shown below:

Typical Parameters	
Design Life	Installation Shear Force
Sea Water Density	Service Bending Moment
Deck Handling Air Temperature	Service Shear Force
Short Term Subsea Temperature	Bend Restrictor Element Material
Long Term Subsea Temperature	Fastener Material
Deck Handling Bending Moment	Reaction Flange/Collar Material
Deck Handling Shear Force	Interface Flange/Collar Material
Installation Bending Moment	Reaction Flange/Collar Fastener Material

The design of the bend restrictors verified by Bureau Veritas under this certificate are subject to the following limitations:

Manufacturing Limits	BC-PU-109	BC-PU-135	BC-PU-164
Maximum Pumping Capacity (PU Material)	574 lit / 14min		
Design Limits	Value		
Maximum Design Temperature (WET Condition)	+ 65 °C	+ 85 °C	+ 90 °C
Maximum Design Temperature (DRY Condition)		(Note 1)	(Note 1)



BV Job No.: 25ABD26218702

**BUREAU
VERITAS**

Cert No.: 25ABD10890 Rev. 0

Page 3 of 7

Note 1: Creep Strain and Creep Rupture tests are unaged at 4°C, 23°C, 50°C and 75°C, accordingly the maximum temperature is limited to 75°C when the BR is subjected to creep loading. This is not applicable to the high temperature contact region between the BR and the pipe, which is subjected to low stress/strain levels and does not contribute to creep failure as a result.

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

25ABD10889 Rev. 0

Independent Appraisal Report

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

Historic Table of Document References

Title	Reference No.	Rev.
Bend Restrictor General Assembly	14375-GA-01	06
Bend Restrictor Load Test Arrangement	14375-GA-02	03
Bend Restrictor Design Report	14375-DR-01	03
Bend Restrictor Structural Calculation	14375-DC-01	03
BR Short Term Locking Radius Calculation	14375-DC-02	03
BR Long Term Locking Radius Calculation	14375-DC-03	02
BR Load Test Arrangement Calculation	14375-DC-05	03
Bend Restrictor Locking Radius Calculation	14375-DC-06	-
Bend Restrictor Design Basis	14375-DB-01	03
PU Bend Restrictor General Arrangement	13029-DW-BR-GA-01-001	04
Load Test Arrangement	13029-DW-LTA-GA-01-001	03
Bend Restrictor Design Basis	13029-DD-BR-DB-01-001	02
Bend Restrictor Structural Calculation	13029-DD-BR-DC-01-001	04
BR Locking Radius Calculation - Short Term	13029-DD-BR-DC-01-002	02
BR Locking Radius Calculation - Long Term	13029-DD-BR-DC-01-003	02
Load Test Arrangement Calculation	13029-DD-BR-DC-01-004	02
Bend Restrictor Design Basis	13029-DD-BR-DB-01-001	02
Inspection Test Plan	13029-PD-002	04
Bend Restrictor General Assembly	00136-DW-BR-GA-01-001	01
Bend Restrictor Structural Calculation (WIP)	70088-DD-BR-DC-01-001	01
Bolted Mould Standardisation - FEA Report	70088-DD-BR-DR-01-001	01
BR Qualification Basis Summary	70088-DD-BR-QB-01-002	01
BR Standardisation Qualification Basis	70088-DD-BR-QB-01-001	01
Inspection and Test Plan	70123-PD-002-001	01
Inspection and Test Plan	14375-PD-002-001	02
Production Test Report	13029-PD-011	01
Production Test Report	14375-PD-011-001	01
Production Test Report	70123-PD-011-001	01
Technical Laboratory Report	BGLR 75239	00
Technical Laboratory Report	BGLR 75203	06

**Addition of Documentation References**

Title	Reference No.	Rev.
Bend Restrictor Design Basis	VBR-DB-01	02
Bend Restrictor Design Calculation	VBR-DC-01	03
Bend Restrictor Design Calculation	VBR-DC-09	01
Bend Restrictor Locking Radius Calculation	VBR-DC-10	01
Bend Restrictor Load Test Calculation	VBR-DC-11	01
Bend Restrictor General Arrangement	VBR-GA-01	01
Bend Restrictor Load Test General Arrangement	VBR-GA-02	01

Bureau Veritas' approval of the above documents is detailed in the Independent Appraisal Report 25ABD10889 Rev. 0.

4 Material Specifications:

Balmoral Comtec Ltd 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.

Component	Material
Bend Restrictor Element	Polyurethane (BC-PU-109 / BC-PU-135 / BC-PU-164)
Reaction Flange/Collar	Structural Steel (BS EN 10025-1 S355J2 + N) Polyurethane (BC-PU-109 / BC-PU-135 / BC-PU-164)
Fasteners	Super Duplex (UNS S32670)/ ASTM A276M (bolts and nuts) Super Duplex (UNS S32670) / ASTM A240M (washer)

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

Metallic material used for ancillary equipment and fasteners shall comply with the requirements of API Specification 17L1: 2nd Edition, Tables 6 and 7. Material data sheets provided by Balmoral Comtec Ltd satisfy the requirement.

Balmoral Comtec Ltd. shall demonstrate the qualification test records to ensure the compliance of material selected for bend restrictors to the requirement specified in Sections 4.4 and 6.4 of API Specification 17L1: 2nd Edition.

5 Fabrication/Testing Procedures/QMS Audit Procedures:

API Specification 17L1: 2nd Edition, provides detailed procedures for performing factory acceptance tests (FATs). Balmoral Comtec Ltd document 15069-PD-010-002 Rev. 03 specifies the production test procedures for Bend Restrictor assemblies. Bureau Veritas have reviewed these documents and found them to be in accordance with the requirement.

Bureau Veritas conducted an audit to assess the quality management system (QMS) arrangements, and practices in place for design and manufacturing process of Bend Restrictor



BV Job No.: 25ABD26218702



Cert No.: 25ABD10890 Rev. 0

Page 5 of 7

at Balmoral Comtec Ltd. The audit was carried out on 16th & 17th of June 2025 and is detailed in Type Approval Audit Report No. 25ABD10479 Rev. 03.

As a result of the Type Approval Audit, it was concluded by the Auditor that Balmoral Comtec Limited have adequate systems in place which are in compliance with the specified regulations and standards.

6 Type Test reports/Laboratory Reports/Certificates:

Bureau Veritas has witnessed a sample of production tests for the approved type and the applicable requirements of API Specification 17L1: 2nd Edition as summarized in the following:

25ABD10888 Rev. 0

Witness Inspection Report

7 Marking of Product:

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

8 Certificate Retention:

The retention of the type approval certificate is subjected to satisfactory annual surveillance according to the plan provided in Appendix A.

9 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

10 Comments:

- 10.1 Balmoral Comtec Ltd shall demonstrate all relevant documents including design reports, calculations, manufacturing and test documentation as applicable 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.

End of certificate



BV Job No.: 25ABD26218702



Cert No.: 25ABD10890 Rev. 0

Page 6 of 7

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				
S.No.	ELEMENTS TO BE EXAMINED	Recertification	Surv. 1	Surv. 2	Surv. 3	Surv. 4
		2025	2026	2027	2028	2029
1*	*QMS / Manual / Policy / Objectives (4.4, 5.2, 6.2)	✓	✓	✓	✓	✓
2*	*Management Review (9.3)	✓	✓	✓	✓	✓
3*	*Internal Audit (9.2)	✓	✓	✓	✓	✓
4*	*Improvement / Internal NCR Process (10)	✓	✓	✓	✓	✓
5*	*Customer Satisfaction /Requirements (9.1.2)	✓	✓	✓	✓	✓
6*	*Roles, Responsibilities Competency, & Training (5.3, 7.2)	✓	✓	✓	✓	✓
7	Resource Management (7.1.1, 7.1.2, 7.1.3, 7.1.4)	✓				
8	Design & Development (8.3)	✓				
9	Control of Documents (7.5)	✓				
10	Control of Records (7.5)	✓				
11	Customer Property (8.5.3)	✓				
12	Identification & Traceability (8.5.2)	✓				
13	Control of Product & Service Provision (8.5.1) (Process Control)	✓				
14	Inspection and Testing (8.3.4) #	✓				
15	Control of Monitoring & Measuring Equipment (7.1.5) (Calibration)	✓				
16	Operational Planning & Control (8.1, 8.2)	✓				
17	Control of Non-Conforming Product (8.7)	✓				
18	Preservation of Product (8.5.4)	✓				
19	Control of externally provided processes, products and services (8.4)	✓				
20	Responsibilities, Authority & Communication (5.3, 7.4)	✓				
	Assessor's initials	CM/GR				



BV Job No.: 25ABD26218702



Cert No.: 25ABD10890 Rev. 0

Page 7 of 7

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.
4. S.No. 7 to 20 to be agreed with the Client for the respective surveillance visits
5. # check Part (B) for Additional Elements

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

Design: Bend Restrictor (BR)

Activity	Status of ITP Activities	Witness Inspection Report
Witness Manufacturing Tests for Bend Restrictor – Recertification 2025 ITP: 15069-PD-010-002	Completed	25ABD10888 Rev. 0

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