Ballard Power Systems Europe A/S
Majsmarken 1
9500 Hobro
Denmark

Revision history		
Rev.	**Date.**	**Description**
001		First Issue
002		Drawing added
003		Revision corrected

Document Title:	**BLPH Project - PED Compliance H2 Manifold Addendum**
Document Number:	K559-2254-CWIWP4202202-K01-3
Revision:	Rev003
Sequence Number:	3
File Name:	K559-2254-CWIWP4202202-K01-3Rev003
Purchaser Job:	K559-2254
Purchase Order:	CWIWP4202202
Code:	K01
Requsition Number:	n/a
Customer:	CrossWind C.V., Rotterdam, The Netherlands

PED compliance H2 manifold

Full Title: *Addendum – PED compliance H2 manifold for DoC*

Abstract: The following document will contain an internal walk through of the compliance of the Pressure equipment directive and the technical dossier for Declaration of conformity

THIS DOCUMENT, SUBMITTED IN CONFIDENCE, CONTAINS PROPERIATARY INFORMATION WHICH SHALL NOT BE REPRODUCED OR TRANSFERRED TO OTHER DOCUMENTS OR DISCLOSED TO OTHERS OR USED FOR MANUFACTURING OR ANY OTHER PURPOSE WITHOUT PRIOR WRITTEN PERMISSION FROM BALLARD POWER SYSTEMS.

Ballard Power Systems Europe A/S
Majsmarken 1
DK-9500 Hobro

contact@ballardeurope.com
+45 8843 5500
ballard.com

Specifications and descriptions in this document were in effect at the time of publication. Ballard Power Systems, Inc. reserves the right to change specifications, product appearance or to discontinue products at any time.

Table of Contents

1.0 Executive Summary 3
2.0 Reference documents 3
3.0 Definitions and Acronyms 3
4.0 Purpose 3
5.0 Analysis of technical demands in relation to 2010/68/EU 4
5.1 Background for analysis 4
5.2 Analysis of conformity category 5
6.0 Technical documentation 6
6.1 General description of the product 6
6.2 Drawings of the Construction 6
6.3 Results of construction calculations and examination 6
6.4 Inspection and test 7
6.4.1 Hydrogen pressure test 7
6.4.2 Welding testing 7

List of Figures

Figure 1: Conformity category PED 2008/68/EU Tabel 6 5
Figure 2: Technical drawing of H2 Manifold 6

List of Tables

Table 2-1: Reference documents 3
Table 3-1: Definitions and Acronyms 3
Table 4-1: Background for conformity assessment 4

THIS DOCUMENT, SUBMITTED IN CONFIDENCE, CONTAINS PROPERIATARY INFORMATION WHICH SHALL NOT BE REPRODUCED OR TRANSFERRED TO OTHER DOCUMENTS OR DISCLOSED TO OTHERS OR USED FOR MANUFACTURING OR ANY OTHER PURPOSE WITHOUT PRIOR WRITTEN PERMISSION FROM BALLARD POWER SYSTEMS.

Here for life™
Template: FRM5104316 0A

This Document is valid only at time of Printing.
Any Copies made are considered uncontrolled unless stamped otherwise in red.

Ballard Power Systems Europe A/S
Majsmarken 1
DK-9500 Hobro

contact@ballardeurope.com
+45 8843 5500
ballard.com

Specifications and descriptions in this document were in effect at the time of publication. Ballard Power Systems, Inc. reserves the right to change specifications, product appearance or to discontinue products at any time.

1.0 Executive Summary

The document will contain a walkthrough of the analysis of Pressure equipment directive compliance accordingly to 2008/68/EU. The analysis concluded that the maximum pipe diameter is a DN32 and a pressure of 6,5 Barg. Due to this the conformity category is "category 1" which leads to "Module A" conformity assessment procedure. Documentation according to this is described, and/or combined in a PED dossier to verify compliance with PED module A.

2.0 Reference documents

Table 2-1: Reference documents

Document no.:	Document name:
2014/68/EU	Pressure equipment directive
550002	DoC FC PowerGen 1000kW®
	Certificate dossier
SPC ID 0104	H2 Leak Test Procedure

3.0 Definitions and Acronyms

Table 3-1: Definitions and Acronyms

Document no.:	Document name:
PED	Pressure Equipment directive
DoC	Declaration of Conformity

4.0 Purpose

The following document will contain the PED analysis of the H2 manifold as an add on part to the FC PowerGen 1000kW®. The document is created based on the process described in the PED 2014/68/EU

The following part which is not a part of the document 550002 and will be covered by this PED statement: **DN32 H2 collector manifold**

THIS DOCUMENT, SUBMITTED IN CONFIDENCE, CONTAINS PROPERIATARY INFORMATION WHICH SHALL NOT BE REPRODUCED OR TRANSFERRED TO OTHER DOCUMENTS OR DISCLOSED TO OTHERS OR USED FOR MANUFACTURING OR ANY OTHER PURPOSE WITHOUT PRIOR WRITTEN PERMISSION FROM BALLARD POWER SYSTEMS.

Ballard Power Systems Europe A/S
Majsmarken 1
DK-9500 Hobro

contact@ballardeurope.com
+45 8843 5500
ballard.com

Specifications and descriptions in this document were in effect at the time of publication. Ballard Power Systems, Inc. reserves the right to change specifications, product appearance or to discontinue products at any time.

5.0 Analysis of technical demands in relation to 2010/68/EU

5.1 Background for analysis

Table 5-1: Background for *conformity assessment*

Item	**Document name:**
Dimensioning pipe size	DN32
Maximum operating pressure	6,5 Barg
Fluida groupe[1]	Hydrogen Groupe 1

[1] According to article 13 a)

THIS DOCUMENT, SUBMITTED IN CONFIDENCE, CONTAINS PROPERIATARY INFORMATION WHICH SHALL NOT BE REPRODUCED OR TRANSFERRED TO OTHER DOCUMENTS OR DISCLOSED TO OTHERS OR USED FOR MANUFACTURING OR ANY OTHER PURPOSE WITHOUT PRIOR WRITTEN PERMISSION FROM BALLARD POWER SYSTEMS.

Ballard Power Systems Europe A/S
Majsmarken 1
DK-9500 Hobro

contact@ballardeurope.com
+45 8843 5500
ballard.com

Specifications and descriptions in this document were in effect at the time of publication. Ballard Power Systems, Inc. reserves the right to change specifications, product appearance or to discontinue products at any time.

5.2 Analysis of conformity category.

According to article 4 section C, the category for Fluida groupe 1 is defined in following table 6 in the PED shown in Figure 1.

Figure 1: Conformity category PED 2008/68/EU Tabel 6

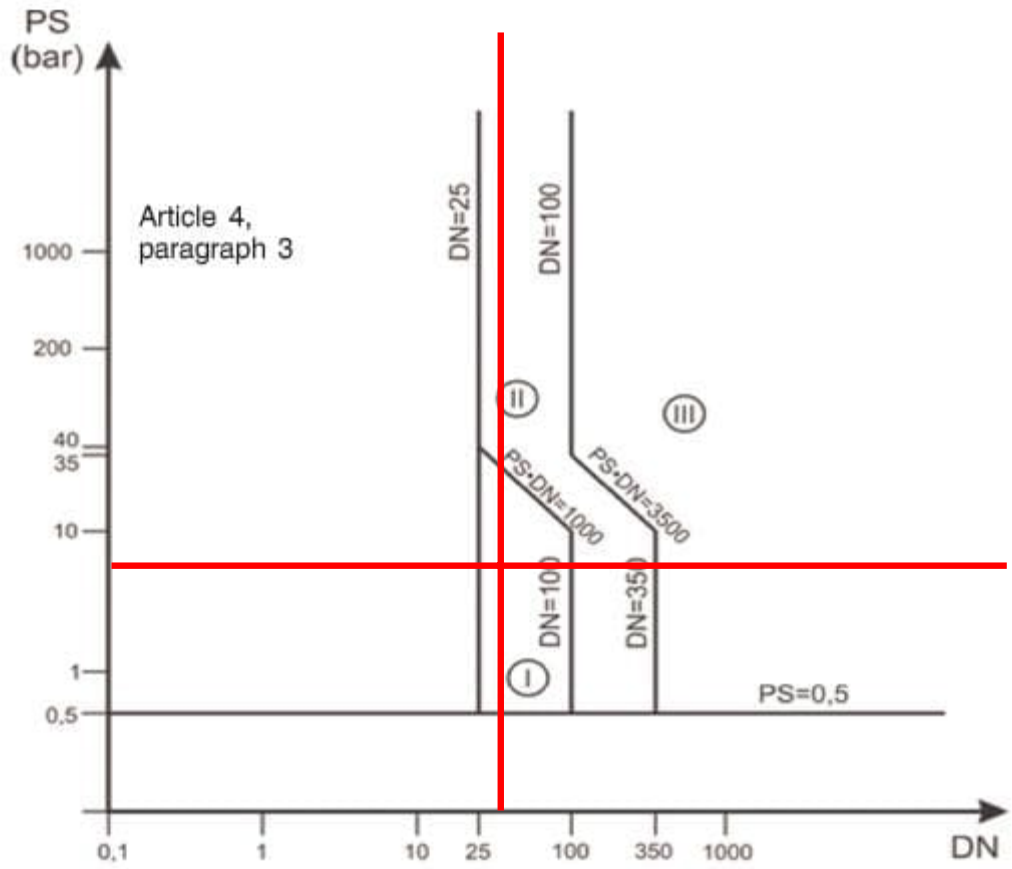


Table 6

Piping referred to in Article 4(1)(c)(i), first indent

The Red lines is an approximate line of the Size and pressure of the part. The intersection will define the point defining the category.

As visualized in the Figure 1, the category applicable for the part will be **Category 1.** As shown in the diagram from PED Annex II section 1. The "Conformity group I" will refer to a "module A" Conformity assessment procedure according to PED Annex III. The following procedure will be described in the following sections of this document.

THIS DOCUMENT, SUBMITTED IN CONFIDENCE, CONTAINS PROPERIATARY INFORMATION WHICH SHALL NOT BE REPRODUCED OR TRANSFERRED TO OTHER DOCUMENTS OR DISCLOSED TO OTHERS OR USED FOR MANUFACTURING OR ANY OTHER PURPOSE WITHOUT PRIOR WRITTEN PERMISSION FROM BALLARD POWER SYSTEMS.

Ballard Power Systems Europe A/S
Majsmarken 1
DK-9500 Hobro

contact@ballardeurope.com
+45 8843 5500
ballard.com

Specifications and descriptions in this document were in effect at the time of publication. Ballard Power Systems, Inc. reserves the right to change specifications, product appearance or to discontinue products at any time.

6.0 Technical documentation

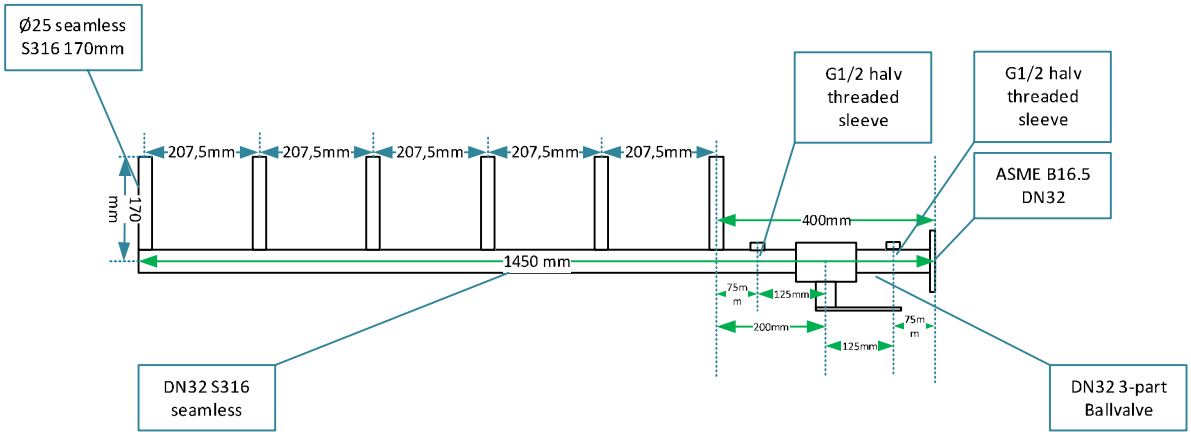
6.1 General description of the product

The product is a hydrogen manifold capable of distributing hydrogen from a single input into 6 independent outputs. The product contains an ASME B16.5 flange for connecting the input. A DN32 pipe with 25mm branches all in stainless steel. There is installed a 3-part welded ball valve type DVC 131150032 suitable for hydrogen 6,5 Barg. The valve is for manually blocking the hydrogen supply during e.g. service.

The product may not be installed in applications where a non-sufficient pressure relief valve set to 10 Barg is not installed.

6.2 Drawings of the Construction

Figure 2: Technical drawing of H2 Manifold



6.3 Results of construction calculations and examination

As the part is not relying on any structural strength since the pipe is not holding any weight, the only relevant construction is the pipe pressure rating. The following pipes are used:

- DN32 42.40x2.00mm EN-10216-5 1.4401/1.4404 TC2 pressure tested to 1500 PSI
- 25.00x2.00mm EN-10216-5 TC2 A269 213 pressure tested to 199 Barg

Further Certificates on welds and parts for the manifold will be in a separate file. And is done according to the "module A" requirements

THIS DOCUMENT, SUBMITTED IN CONFIDENCE, CONTAINS PROPERIATARY INFORMATION WHICH SHALL NOT BE REPRODUCED OR TRANSFERRED TO OTHER DOCUMENTS OR DISCLOSED TO OTHERS OR USED FOR MANUFACTURING OR ANY OTHER PURPOSE WITHOUT PRIOR WRITTEN PERMISSION FROM BALLARD POWER SYSTEMS.

Ballard Power Systems Europe A/S
Majsmarken 1
DK-9500 Hobro

contact@ballardeurope.com
+45 8843 5500
ballard.com

Specifications and descriptions in this document were in effect at the time of publication. Ballard Power Systems, Inc. reserves the right to change specifications, product appearance or to discontinue products at any time.

6.4 Inspection and test

6.4.1 Hydrogen pressure test

The hydrogen manifold has gone through several tests to verify the tightness of the system, even though the material used for manufacturing the hydrogen manifold is higher than the intended maximum pressure of the Hydrogen manifold.

To sum up the test:

- Individual test of component (document not released. Procedure according to 62282-3-100:2020 section 6.2 Leakage test)
- Complete assembly test Formier gas 5% H2 (document not released. Procedure according to 62282-3-100:2020 section 6.2 Leakage test and SPC ID 0104)
- Complete test pure H2 (document not released. Procedure according to 62282-3-100:2020 section 6.2 Leakage test and SPC ID 0104)

6.4.2 Welding testing

The following welds on the hydrogen manifold has been tested according to the certificates included in the Certificate dossier.

THIS DOCUMENT, SUBMITTED IN CONFIDENCE, CONTAINS PROPERIATARY INFORMATION WHICH SHALL NOT BE REPRODUCED OR TRANSFERRED TO OTHER DOCUMENTS OR DISCLOSED TO OTHERS OR USED FOR MANUFACTURING OR ANY OTHER PURPOSE WITHOUT PRIOR WRITTEN PERMISSION FROM BALLARD POWER SYSTEMS.

Ballard Power Systems Europe A/S
Majsmarken 1
DK-9500 Hobro

contact@ballardeurope.com
+45 8843 5500
ballard.com

Specifications and descriptions in this document were in effect at the time of publication. Ballard Power Systems, Inc. reserves the right to change specifications, product appearance or to discontinue products at any time.