Base Load Power Hub (BLPH)

Hydrostatic Test Procedures and Pneumatic Test Procedures
(FAT procedures)

Hydrogen Vent KO Drum, TAG V-43001

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C.A.M.P.I. Srl
Ferrara - Italy

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Oggetto: PRESSURE TEST and PAD Leak TEST PROCEDURE
Subject

RISERVATO AL CLIENTE / A.I.
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ATTACHMENTS:

C.A.M.P.I Procedures

1) ❶PressureTests Procedure 24003 IO-PT206AS rev.1 (9 sheet)
2) PAD Leak Test Procedure 24003 IO-PT207 rev.0 (5 sheet)
3) ❶Appendix to Test Procedure 24003 IO-PT207 rev.0

Section 1)

DOCUMENT TITLE:

PRESSURE TESTS ACCORDING TO ASME VIII DIV. 1 & PED 2014/68/EU

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STATUS OF DOCUMENT REVISIONS

Rev.	Date	Prepared by	Verified by	Approved by	Description of modification
5					
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1. SCOPE

1.1 This procedure describes generally the requirements to be followed carrying out the main steps of pressure tests.

1.2 This procedure is in accordance with ASME, Sect VIII, Div.1 and Pressure Equipment Directive 2014/68/EU; Code edition applicable shall be shown in a separate specific test procedure or on the applicable drawing.

2. GENERAL

2.1 General precaution and rules

2.1.1 Pressure tests preparation and performance will be made by trained personnel

2.1.2 Personnel must stay far from work zone, until pressure test values are reached and maintained for the specified time and the structural resistance of vessel is assured

2.1.3 The vessel shall be positioned in such a way to allow a complete visual examination of each single chamber being tested.

2.1.4 Before tests, internal surfaces shall be cleaned and all dirt, sand, weld metal spatter, welding electrode stubs and foreign matters shall be removed; external surfaces will be dried.

2.1.5 The nozzles/connections shall be provided with temporary blind flanges or temporary caps

2.1.6 The test equipment for hydro-test shall be examined before pressure is applied to ensure that it is tight, and that all appurtenances that should not be subjected to the test pressure have been disconnected or isolated by valves or suitable means.

2.1.7 All hydro-tests will be performed at the end of the fabrication, after final PWHT, where any.

2.1.8 For hydro-tests, two pressure gauges will be located on the highest nozzle(s), for each chamber to be tested.

2.1.9 For hydro-tests, water filling will be performed slowly in such a way to vent air pockets.

2.1.10 Custom-designed flange assemblies, including modified standard flange assemblies where additional calculation are required, within the geometric scope of this division shall be tested with gasket and bolting that meet the following requirements:

(1) be assembled with the identical gasket used for operation on the pressure vessel or a gasket with the same outside diameter, inside diameter, thickness, gasket factor (m), and minimum seating stress (y) used in the flange design calculations.

(2) be assembled with bolting having identical allowable stress at room temperature as used in the design calculations.

2.1.11 For pneumatic tests: all tests will be performed in conformity with what indicated in addendum, with the Company evaluation of risks herewith enclosed.

2.1.12 ❶The equipment will be pressurized through a pneumatic pump that will be connected to one of the lower nozzles.

2.1.13 ❶The area where the test will be carried out will be delimited by reflective tape and only the people involved in the execution of the test will be able to access it.

2.1.14 ❶No blast/walls barriers are necessary as the test is performed with non-compressible, non-flammable fluid and at a very low pressure.

2.1.15 ❶During the test, persons near the device must wear protective goggles

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2.2 Types of tests

Two types of pressure tests are considered:

TYPE OF TEST	SECT. VIII. Div. 1
- HYDROSTATIC TEST	X
- PNEUMATIC TEST	X

2.3 Applicability

Generally the following directions are applicable:

TYPE OF VESSEL	HYDROTEST	PENUMATIC TEST
Vessels designed and supported so that they cannot safely be filled with water		X
Vessels not easily dryable that are to be used in service where traces of the liquid cannot be tolerant.		X
All other vessels.	X	

3. HYDROSTATIC TEST

Test pressure

The test pressure shall be determined by the greater of:

$P_t=1,25 \times P_d \times fa/fT_d$

or

$P_t=1,43 \times P_s$

Where:

P_t is the test pressure measured at the highest point of the chamber of the vessel

P_d and Td are the coincident design pressure and design temperature values for the maximum pressure load case

P_s is the maximum allowable pressure of the vessel

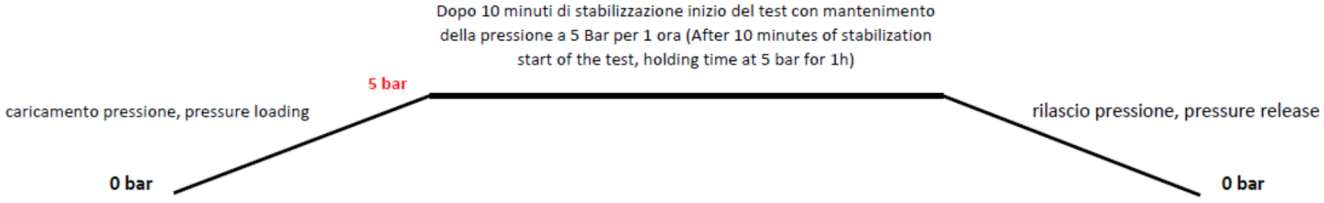
f_a is the nominal design stress for normal operating load cases at test temperature

f_{Td} is the nominal design stress for normal operating load cases at design temperature

Test pressure shall meet also PED 2014/68/EU requirements.

- For this Job only the hydrostatic test shall be performed at a pressure of 5 bar(g),
- see diagram below for execution modes

Job 24003 - Diagramma dei tempi da rispettare per la prova idrostatica / Diagram of the times to be respected for the hydrostatic test



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Normally, the vessel to be tested shall be supported by own saddles or, for vertical vessels tested in horizontal position, by saddles/supports.

3.1 Extension

3.1.1 Pressure chambers of combination units that have been designed to operate independently shall be hydrostatically tested as separate vessel, that is, each chamber shall be tested without pressure in the adjacent chamber.

3.1.2 When pressure chambers of combination units have their common elements designed for the maximum differential pressure, these shall be subjected to a different hydrostatic test pressure.

Following the adjacent chambers shall be hydrostatically tested simultaneously; care must be taken to limit the different pressure between the chambers to the pressure used when testing the common elements.

3.2 Performance

3.2.1 Before performing any hydrostatic test, the pressure vessel shall be inside visually inspected.

3.2.2 The water used for hydro-test shall be of a quality which do not cause corrosion in the tested vessel, potable water with concentration of chlorine ion in water shall be controlled to be not greater than 50 mg/L (if no different requirement are indicated in the contractual documents).

3.2.3 to minimize the risk of brittle fracture, the coldest metal temperature during the hydrostatic test should be at least 30° F (17°C) warmer than the minimum design metal temperature for vessels according to ASME VIII Div.1. For material not covered in part UCS the hydrostatic test temperature shall never be colder than the vessel MDMT

Also for vessels fabricated with steels that allow hydrostatic test at lower temperature, it is advisable to keep test temperature higher than that above mentioned.

The metal temperature during the hydrostatic test need not exceed 120°C (48°C).

The test pressure shall not be applied until the vessel and its contents have not reached the test temperature. 1 Wait about 6 hours for the wall temperat. to stabilize

3.2.4 Vents shall be provided at all high point of the vessel in the position in which it is to be tested to purge possible air pockets, while the vessel is filling.

3.2.5 Before applying pressure, the equipment to be tested shall be examined to see that it is tight and that all low-pressure filling lines and other appurtenances that should not be subjected to the test pressure have been disconnected.

3.2.6 The hydrostatic test pressure shall be always under control. Mainly it is recommended that the pressure never will be greater than the maximum value permitted.

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3.3 Visual examination

3.3.1 Following the application of the hydrostatic test pressure, a visual inspection shall always be done of joints, connections and all zones of high stress, such as heads, zones around opening and thickness transition sections.

This inspection shall be made at a pressure not less than the test pressure divided by 1.3 according to ASME SECT. VIII, Div. 1.

3.3.2 The visual inspection may be waived, for vessels constructed in accordance with ASME SECT. VIII, Div. 1, provided:
- a suitable gas leak test is applied
- all welded seams which will be hidden by assembling be given a visual examination for workmanship prior to assembly
- the vessel will not contain lethal substances

3.4 Acceptability

Leaks eventually found shall be corrected in accordance with the Code.

The part shall be again hydrostatically tested according to this procedure.

4. PNEUMATIC TEST – N.A. for this project

4.1 Execution

4.1.1 On welds pressure vessels to be pneumatically tested, the full length of the following welds shall be examined by magnetic particle or liquid penetrant for the purpose of detecting possible cracks:

- all welds around openings
- all attachments welds, including welds attaching non pressure parts to pressure parts, having a throat thickness greater than 6,3 mm

4.2.1 The test equipment shall be examined before pressure is applied to ensure that it is tight and that all appurtenance that should not be subjected to the test pressure have been disconnected or isolated by valves or other suitable means.

4.1.3 The pressure in the vessel shall be gradually increased to not more than one-half of the test pressure.
There after, the test pressure shall be increased in steps of approximately one-tenth of the pressure until the required test pressure has been reached.
The test pressure shall not be applied until the vessel contents are not at about the same temperature.

4.1.4 The metal temperature during pneumatic test shall be maintained at least 30°F (17°C) above the minimum design metal temperature for ASME VIII Div. 1.

4.2 Visual examination

4.2.1 The test pressure shall be reduced to a value equal to the test pressure divided by 1.1

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4.2.2 The visual inspection may be waived, for vessels constructed according to ASME SECT. VIII, Div. 1, provided that:
- a gas leak test is applied
- all welded seam which will be hidden by assembly be given a visual examination for workmanship prior to assembly
- substitution of the gas leak test is by agreement reached between manufacturer and inspector
- the vessel will not contain a lethal substance

5. PRESSURE GAUGES

5.1 At least two of these pressure gauges shall be connected directly to the vessel and at least one pressure gauge shall be readily visible to the operator.

5.2 Indicating pressure gauges used in testing shall preferably have dials graduated over a range of about double the intended maximum test pressure, but in non case shall the range be less than 1,5 nor more than 4 times that pressure.

5.3 All indicating pressure gauges shall be calibrated against a calibrated standard gauge. The calibration of pressure gauges has to be carried out once a year, and every time a doubt arises about test gauge accuracy.

6. DRAINING

After the test the vessel shall be drained careful not to have negative pressure in the vessel by opening some vents.

7. REPORTING

After the test, certification showing all data required by this procedure shall be issued together with calibration report relevant to the manometers used for the test. For the hydro-test, a time pressure diagram shall also be issued, when required.

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C.A.M.P.I. **Ferrara - Italy**	**RAPPORTO DI PROVA IDROSTATICA** *Hydrostatic pressure test report*

CLIENTE: *Purchaser:*	ORDINE N. *Order no.*
COMMESSA: *Job:*	DISEGNO N. *Drawing no.*
APPARECCHIO / *Equipment:*	SIGLA: *Mark:*
N. FABBRICA: *Mill no.:*	N. MATRICOLA ANCC: *ANCC NO.*
PARTI ESAMINATE- *Examined parts*	

CONDIZIONI RICHIESTE */ REQUIRED CONDITIONS*

PRESSIONE DI PROVA *Test pressure*	xxxxxx
VELOCITA' DI SALITA IN PRESSIONE *Pressure rising speed*	/
DURATA DI MANTENIMENTO IN PRESSIONE *Pressure holding duration*	1h (ora)

CONDIZIONI DI PROVA */ TEST CONDITIONS*

FLUIDO UTILIZZATO *Utilized fluid*	ACQUA ■ *Water*	OLIO □ *Oil*	_____ _____
		Altri □ *Others*	_____

TEMP. DI PARETE *wall temperature*	xxxxxxx
PRESSIONE *Pressure*	xxxxxxx
VELOCITA' DI SALITA IN PRESSIONE *Pressure rising speed*	/
DURATA DI MANTENIMENTO IN PRESSIONE *Pressure holding duration*	1h (ora)

Manometri per prova idrostatica / *Gauges for hydrostatic test*

Tipo di strumento *Instrument*	No. Identificazione *Identification No:*	No. Certificato *Certificate No:*	Data Taratura *Calibration date*	Data scader *Expiry dat*
Manometro *Manometer*				
Manometro *Manometer*				
Controllo strumentazione effettuato prima del test con esito positivo Control instruments made before the test successfully				
Controllo effettuato da *Test performed by*				

RISULTATI DELLA PROVA */ TEST RESULTS*

SATISFACTORY (no leak, no deformation)

Test performed according to C.A.M.P.I. Proc

DATA Date	**C.A.M.P.I. Srl** Ufficio Collaudi Inspection Dpt	ISPETTORE CLIENTE Purchaser Inspector	FOGLIO N. *Sheet no.*
_____	_____	_____	

C.A.M.P.I. **Ferrara - Italy**	**RAPPORTO DI PROVA PNEUMATICA** *Low pressure pneumatic test report*

CLIENTE: *Purchaser:*	ORDINE N. *Order no.*
COMMESSA: *Job:*	DISEGNO N. *Drawing no.*
APPARECCHIO: *Equipment:*	SIGLA: *Mark:*
N. FABBRICA: *Mill no.:*	N. MATRICOLA ANCC: *ANCC NO.*

OGGETTO DEL TEST / *SUBJECT OF TEST:*

Componente provato:
Component tested: _____
Lato pressurizzato
Pressurized side: _____
Tipo di giunto:
Type of joint: _____
Finitura saldatura:
Weld finishing: _____
Trattamento termico post-saldatura
Postwelded heat treatment: _____

TECNICA / *TECHNIQUE*

Pulitura con:
Cleaning by: _____
Fluido usato per la prova:
Fluid used for test: _____
Pressione di prova
Test pressure: _____
Periodo di immersione:
Soaking time: _____
Temperatura metallo °C:
Metal temperature °C: _____
Illuminazione
Illumination:
Manometro *Gauge* N. matricola *Number* _____ Fondo scala *Range* _____

RISULTATI / *RESULTS*

Risultato del test:
Result of test: _____

Note:
Remarks: _____
_____

DATA Date	**C.A.M.P.I. Srl** Ufficio Collaudi Inspection Dpt	ISPETTORE CLIENTE Purchaser Inspector	FOGLIO N. *Sheet no.*
_____	_____	_____	

Section 2)

DOCUMENT TITLE:

PAD LEAK TEST WITH AIR ACCORDING TO ASME

RISERVATO AL CLIENTE:
Customer reserved:

STATUS OF DOCUMENT REVISIONS

Rev.	Date	Prepared	Verified	Approved	Description of modification
0	08/05/24	C. Cervellati	De Candia	Antolini	Issue for Job 24003

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1.0 SCOPE

This procedure is issued to perform the Leak Test of the reinforcing PAD for nozzle opening of the KO Drum V-43001

2.0 RESPONSABILITY

Quality Assurance is responsible for the correct and clear definition in the technical specification of the test requirements.

3.0 TEST EXECUTION

3.1 This test description explains the leak testing with bubble test method

3.2 Codes and specifications

The following codes and specifications shall be applied:

- ASME Code, Sec. V, Art. 10 Appendix 1, last edition
- Job Specification 123A90-DDL-MAC-SP-50026 Rev.00 par.5.4

3.3 Surface conditions

Before tests are carried out, all test items must be free from oil, grease, dye and other substances that could influence the visual evaluation of leakage or even hide a leakage.

3.4 Test time

The performance of the test takes place after termination of welding and any other non-destructive tests such as ultrasonic, dye penetrant or magnetic particle, however before coating or painting.

3.5 Test pressure

The test pressure shall be at a pressure of 0,5 to 1 barg

3.6 Test medium

As a test medium normally dry compressed air is used, however application of inert gases such as nitrogen is also allowed (non inflammable and non-toxic gases).
The test liquid must have the property to form a dense, even film on the test items. The blowholes that are built up due to a leakage must not burst too fast when drying in the air or owing to surface tension.
When test items made of austenitic Cr-Ni(Mo)-steel are examined, the test liquid must not contain more than 50 ppm of chloride.

3.7 Test method

The pressure must be increased slowly up to the required test pressure.
The specified test pressure must at least be kept for 1 minute but at least for the necessary time to perform the weld check
After the test pressure was held the test liquid is applied on the test areas may be effected by spraying, with brush or coating.
All connection joints shall be examined, also the internal part (if accessible).
The test item is accepted when there are no leaks.
In case of blowholes, the test area is marked. Should leakages not be repairable by simple means, i.e. replacement of seals or tightening of screws, measurements to repair the leakage are discussed and agreed upon.
After termination of the repair work, the leak test will be repeated as originally specified.
After completion of the test, the pressure is decreased slowly.

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3.8 Manometer

One manometer shall be used and shall have dials graduated over a range of about twice the specified test pressure, but under no circumstances must the range be less than 1.5 times or greater than 4 times that pressure.
The manometer, calibrated according to PAQ-11 shall be mounted on the pressure reducer device

3.9 Test certification

The execution of the leak test is recorded in a test report (sample attached). This report contains all the necessary information. The person in charge of the quality control fills in the form "Leak test report".
After successful completion of the test, this report is stamped and undersigned by all parties who attended the test.

4.0 DOCUMENTATION

The effected test is documented on the form "Low pressure pneumatic test report" (example attached).

5.0 DISTRIBUTION

The last revision of this test instruction is distributed to the testing personnel.

6.0 FILING

All the record documents of the tests are included in the "Inspection Book" of the job and filed by the Quality Dpt.

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C.A.M.P.I. Ferrara -Italy	**RAPPORTO DI PROVA PNEUMATICA** *Low pressure pneumatic test report*	**Certificato n.** *Certificate no.* **BT XXXX-xx** **Foglio / Sheet 1/1**

CLIENTE: *Purchaser:*	ORDINE N. *Order no.*
COMMESSA / *Job*:	DIS./*Drawing no.*:
APPARECCHIO/*Equipment:*	SIGLA: *Item No:*
N. FABBRICA: *S.No.:*	C.A.M.P.I ITP No.:

OGGETTO DEL TEST / *SUBJECT OF TEST*

Componente provato:
Component tested: *Reinforcing pad for connection N2*
Lato pressurizzato: interno
Pressurized side: *Internal*
Tipo di giunto:
Type of joint: *WELDED*
Finitura saldatura: /
Weld finishing: /
Trattamento termico post- saldatura: NO
Postwelded heat treatment: *None*

Example

TECNICA/ *TECNIQUE*

Pulitura con:
Cleaning by:
Fluido usato per la prova: ARIA
Fluid used for test: Air
Pressione di prova: 0,5 Barg
Test pressure:
Periodo di immersione: /
Soaking time:
Temperatura metallo °C: 14,3
Metal temperature °C:
Illuminazione: NATURALE
Illumination: *Natural*
Manometro: _____ N Matricola 8-10209 Fondo scala 1,6 BAR
Gauge: *No Number* *Range*

RISULTATI DELLA PROVA / *TEST RESULTS*
SODDISFACENTE - Satisfactory

NOTE / *REMARKS*
Test acc. to EN-14015 - Proc. XXXX-IO-PT207 rev.0
Mezzo di rivelazione fughe: soluzione saponosa – Fluid leak detection: soap solution

DATA / Date	**C.A.M.P.I. Srl** Ufficio Collaudi / QA Dpt	Inspector	Inspector

Section 3)

Appendix to Test Procedure 24003 IO-PT207 rev.0

On some nozzles of the device it is planned to carry out the leak test of the Reinforcing PAD, for this reason, these additional recommendations should be followed

1. The area where the test will be carried out will be delimited by reflective tape and only the people involved in the execution of the test will be able to access it.
2. No blast/walls barriers are necessary as the test is performed at a very low pressure.
3. During the test, persons near the device must wear protective goggles
4. No leakage are admitted for the tested welds