Use of Nylon-Jacketed, Aliphatic Coated Bladder, Zippered Closure Cylindrical Vessels in the Construction of PVHOs under PVHO-1: 2012

Approval date: November 20, 2012
Reaffirmation date: December 3, 2015
Expiration Date: December 3, 2021

*Inquiry:* Under what conditions may a portable flexible nylon-jacketed, aliphatic coated bladder with redundant zipper closures be used in construction under the rules of PVHO-1: 2012

*Reply:* It is the opinion of the Committee that portable flexible nylon-jacketed, aliphatic coated bladder type cylindrical vessel with redundant zippered closures may be constructed under the requirements of PVHO-1:2012 and be marked as a PVHO, when the requirements of PVHO-1: 2012, with the following exceptions and additions, have been met.

1. **GENERAL**

The PVHO chamber shall be a flexible composite cylinder consisting of an inner bladder (see Dwg15T38145), an outer jacket, and webbing secured with mechanical safety buckles. The bladder and jacket are closed with three overlapping zippers that provide an initial pressure seal. Two opposing transparent windows permit viewing of the occupant. Connections for pressurization and breathing gas are located at the ends. The window shield (clear viewport retaining cover see Section AA) is supported by the jacket and webbing.

The chamber shall be pressurized with a continuous flow of air that shall be expelled through a ventilation valve. The PVHO and associated systems shall be designed, constructed, inspected, tested, marked (and installed if applicable) to ASME PVHO-1 2012 Edition, Sections 1,2,3,4, and 5 with exceptions and additions detailed in this Case.

The following sections/paragraphs of PVHO-1 are not applicable to vessels built under this Case:

Section 2-2, 2-7, 2-8 and 2-10
Section 5-5.7
Section 6
Section 1-6, 1-7.1 thru 1-7.3, 1-7.5, 1-7.8, 1-7.11 thru 1-7.16
Section 7

A User’s Design Specification shall be provided. The User’s Design Specification shall include the following data:

a) Maximum number of occupants is one.
b) The maximum allowable internal working pressure (MAWP) shall be 4 psig. (.275 bar).
c) Pressurization gas shall only be air and a label to this effect shall be suitably displayed, and an exhaust valve and an ASME overpressure relief valve shall be fitted with a “gag” device operable from outside the chamber.
d) The breathing gas supplied to the occupant of PVHO shall be 100% oxygen through a BIBS mask or hood. The operator of the PVHO shall have external control of the supply of breathing gas. The operator shall ensure that sufficient gas is available for flushing the PVHO if necessary, and have sufficient emergency gas available to complete the proposed treatment safely. All exhaled gas shall leave the PVHO via an overboard dump system.
e) The pressurization/depressurization rates shall be no greater than 1 psi/min.
f) Chamber managed airflow rate to maintain MAWP shall not exceed 15 SCFH

g) The PVHO shall have two windows in the body of the chamber. The windows shall permit external viewing of the occupant’s head, face, chest and arms.
h) Maximum internal length shall be “97” (2.46m).
i) Internal diameter shall be 32” (0.8128m) normal.

j) Three overlapping zippers shall be used. The outer zipper is necessary for ease in preparing the sealing gasket for inflation and would also prevent rapid air loss in the unlikely event of premature opening of the inner zippers.

k) The design temperature limits shall be 32° F to 100° F (0°C to 37°C). The design storage temperature range shall be -30°F to 150°F (-34.5°C to 65.5°C).

l) The design number of pressure cycles shall not exceed 4000 cycles.

m) The rated life is ten (10) years from the date of manufacture or on completion of the 4000 pressure cycles, or completion of the allowable number of folding cycles for storage, whichever occurs first.

n) Penetrators shall be located in the ends. Two breathing gas penetrators shall be compatible with the BiBS hood. One oxygen sensor penetrator shall be dedicated for monitoring internal PVHO atmosphere for excessive levels of O₂ (min. 18% - max. 25%) and CO₂. The monitor shall include an alarm alerting the operator when these levels are exceeded.

o) There is no temperature control. Patient conform may be addressed by variation in air flow through the PVHO.

p) Fire suppression shall be provided by portable internal fire extinguisher approved for Military use (AMU) and or internal fire suppression activated externally.

q) No corrosion allowance shall be required.

r) Bladder joining shall be RF welding only. No adhesives are allowed except for sealing of exterior seams.

2. MATERIALS

In lieu of the requirements of PVHO-1: 2012, Sections 1-6 and 2-2, 2-7, 2-8, and 2-10, the materials in Table 1 shall be used. All of the materials shall be used in combination to meet the performance requirements of this Case. A process control procedure in accordance with 5.7 shall identify how the materials are to be used and in what specific quantities. All materials used shall be supplied with supporting documentation consistent with the requirements of the Quality Management System detailed in Section 5 of this Case. Each “lot” shall meet the ASTM of Federal Standards material specifications as indicated. Material shelf life shall be identified as being suitable for long term storage between uses and shall not exhibit visual or performance deterioration through again, for the entire life of the PVHO.

Material test reports to recognized testing procedures (i.e ASTM, Mil Specs) for the primary strength members, which are the webbing, jacket, buckles, bladder, window shield, file and penetrator flange shall include lot information. Test conditions are 70°F ±10 °F and 30–40%RH ± 10%RH. The relevant strength data shall be recorded on the Manufacturer’s Data Report. Any changes of primary strength material shall be cause for full prototype re-testing, unless it can be demonstrated to the satisfaction of PE experienced in pressure vessel design that the integrity of the PVHO is not reduced.

Table 1 PVHO Materials of Construction

*Denotes test reports required and reported on Manufacturer Data Report

Coated Bladder Fabric

*Base Fabric: Polyethylene Terephthalate (PET) 1500 denier 13 oz – 15 oz, thread count 35/35 threads per inch.

39 – 45 oz/sq yd. Aliphatic PU / PVC Alloy

*Breaking Strength: Warp 823 lbs minimum

Fill 712 lbs minimum

*Seam Adhesion RF: 24 lbs / in minimum

Low Temperature Bending: -40° C 12 hours

Flammability: Oxygen Index 25% ASTM D 2863
Elongation: Warp 37% and Left 49% Max at 75F 30-40% RH ASTM D 751
*Bursting Strength Ball  650 Kg Min ASTM S 751
Puncture Resistance 441 lbs Fed Std 101-2031 Min
Tear Strength 110 lbs ASTM D751 procedures B Min
Low temperature crack resistance – 40C ASTM D 2136 Min
Accelerated heat aging by the oven method (max 7% loss in burst strength) ASTM D 751
Block resistance 160° F Max ASTM D 751
Abrasion resistance >3000 cycles to expose fabric ASTM D 3389 Min
Air Porosity pass (10 min at 7psi) B.S. 4F 100 clause 32.1
Flame Resistant to small-scale test of NFPA 701 per NFPA 99
Weave construction 2x2 panama
Monofilament yarn
No pre-treatment of fabric

**Nylon Jacket**: The outer cover shall be woven nylon 13-oz/sq yd. meeting Mil-C-12369F Class II Ballistic Nylon heat set and scoured (with the following exceptions: No ballistic resistance testing required; no fiber identification nor marking required (3.14 and 3/15); no infrared requirements).

*Breaking Strength: Warp 1200 lbs minimum Fill 1100 lbs minimum ASTM D5034

**Clear Polyester Polyurethane Film Window**:

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<thead>
<tr>
<th>Property</th>
<th>Measurement</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Hardness</td>
<td>90-95 Shore A</td>
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<tr>
<td>Ultimate Tensile Strength</td>
<td>1”x1” 5000 lbs</td>
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<tr>
<td>Ultimate Elongation</td>
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<tr>
<td>Minimum Tear Resistance</td>
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<tr>
<td>Low Temperature Bending</td>
<td>20°F 12 hours</td>
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<tr>
<td>*Thickness 0.052”-5%</td>
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*Acrylic Window Shield*: The window shield material shall be in accordance with PVHO-1 2012 requirements. However, the window, which is a sector of a cylinder and is supported by fabric and webbing is a nonstandard window. The test program in Section 4 exceeds the requirements for STPP in Section 2-2.6 of PVHO-1 2012 and is an alternative to the requirements for determination of LTTP and CPP Thickness 3/8”

**Zipper Closures** to meet Federal Spec CID A-A-55634A 011-03 CEF P09F 54 & 011-03 CEF P10P 54
Note: zipper manufacturer to supply C of C to this CID

*Webbing polyester*, 2 42 oz/yd 0.07” thick 2” wide Min break
Strength 6,000 lbs tested to Web Sling and Tie
Down Association T-4 or Fed Std 191A Method 4108

**Silicone Rubber** – durometer 30 Shore A ASTM 1)2240

*Safety Buckle* – Minimum Breaking Strength of 3,360 pounds FMVSS 571.209

**Polyester Thread 4 Cord** (Tex 270) Type 2 Class 1:FF (Tex 90) Type 1, Class MIL-DTL-32072.

**Penetrator Flange**: Texin 950 aromatic polyether-based thermoplastic polyurethane with Shore D hardness of 50.

<table>
<thead>
<tr>
<th>Property</th>
<th>Measurement</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Minimum Tensile Strength</td>
<td>6,000 psi</td>
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<tr>
<td>Minimum Tensile Strength C</td>
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<tr>
<td>Threads of Flange</td>
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</tr>
<tr>
<td>Anodized to</td>
<td>MIL-A 862F Ty2 Class 2</td>
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3. **DESIGN AND FABRICATION**

In lieu of PVHO-1 2012 Section 1-7, the design and fabrication shall be in accordance with this Case and the following requirements. Any changes to the geometry size, materials, design or manufacturing procedures of the PVHO shall be cause for full prototype re-testing, and shall be submitted as a new Case, unless it is demonstrated to the satisfaction of PE experienced in pressure vessel design that the integrity and factor of safety of the PVHO is not reduced.

3.1 **Design Analysis**

A stress analysis shall be performed by a Professional Engineer registered in one or more of the states of the United States of America, or the provinces of Canada, or licensed by any other country that has equivalent licensing procedures, and who is experienced in fabric composite pressure vessel design and construction. The Designer shall consider the effects of material degradation due to environmental considerations both operational and non-operational shall be accounted for.

3.2 **Requirements**

a) The MAWP shall be 4 psig at 100° F.

b) Temperature range shall be between 32° F and 100° F.

c) The MAWP shall be based on testing three prototypes to at least six (6) times MAWP.

d) The design analysis shall consider the effects of aging of the stress boundary material, plus the effects of folding, unfolding, and long term storage of the collapsed chamber. The design shall ensure that no damage will occur to the cloth within the composite shell by acute bending is defined as a bend in the cloth shell at an inside angle of less than 5 deg. The minimum bend radius for the cloth shall be no less than 0.05 in. strength reduction due to sewn connections shall be based on test data and included in the analysis. Procedures are to be written as to the type of stitch, length of stitch, stitch pattern size, type and size of thread, and results from the bend test. Two test coupons from each joint type of the bladder both heterogeneous and homogeneous dielectric welds will be performed and recorded verifying min material adhesion specification for each PVHO and lot of material used.

e) All penetrators shall be located in the ends.

f) The two windows shall be located in the body.

3.3 **Design Certification**

Conformance of the design of the PVHO to the requirements of PVHO-1 2012 shall be established by one of the two following procedures:

a) A professional Engineer (PE) registered in one or more states of the United States of America, or the provinces of Canada, or licensed by any other country that has equivalent licensing procedures, and who is experienced in fabric composite pressure vessel design shall certify that the PVHO was designed either by the PE or under the PE’s direct supervision, or that the PE has thoroughly reviewed a design prepared by others, and that the PVHO complies with PVHO-1 2012 and this Case.

b) The design of the PVHO shall be reviewed by an independent third party agency independent of the designer, fabricator, and user, who is qualified through education, test, or experience to perform the inspection, and such individual or organization shall provide a certificate that the PVHO complies with this PVHO-1 Case.
3.4 Fabrication

The PVHO shall be manufactured in accordance with a detailed process control plan. The process control plan shall clearly define the details of the manufacturing steps necessary to fabricate the PVHO, and shall document the fabrication process. Any anomalies found during the manufacturing process shall be fully documented and may be corrected according to the process control repair plan. Any production testing already completed, shall need to be repeated. The materials and manufacturing processes used for production units shall be identical to those used for the tested prototypes.

4. TESTING

All prototype testing shall be witnessed by an independent third party independent of the designer, fabricator, and user who is qualified through education, test or experience to perform inspection. In lieu of the testing requirements of PVHO-1 2012, the following requirements shall apply.

4.1 Prototype Testing

Deviation from established design parameters, geometry, size, materials of construction or fabrication process shall require a new prototype qualification test be conducted, unless it is demonstrated to the satisfaction of PE experienced in pressure vessel design that the integrity and fact of safety of the PVHO is not reduced. PVHO’s used for prototype testing will not be used other than for testing.

a) **Proof Pressure Test:**

1) Proof pressure tests shall be conducted on a minimum of three (3) full scale prototype chambers. These prototypes shall be full size and of identical construction to the end-item, with all fabrication completed which in any manner may affect the integrity of the pressure boundary.

2) The rated pressure shall be based on a minimum 6:1 ratio of proof pressure determined by testing three prototype chambers to at least 24 psig for 30 minutes. Rated pressure testing shall be performed at the most critical service temperature of 100°F.

3) The material in the primary strength members shall be tested to determine actual breaking strength. The test data shall be recorded and retained.

b) **Drop Test:** A drop test of at least one full-scale PVHO on concrete shall be conducted without failure. The PVHO shall be loaded with an evenly distributed load of 200# of bagged sand and then pressurized to the rated pressure. The PVHO shall be inclined at 45 deg elevated to a height such that the minimum distance to the concrete impact surface is 3 ft. and then dropped. The chamber will then he inverted (opposite end impacted) and dropped again. No damage, permanent distortion or increased ventilation rate of the PVHO is permissible.

c) **Cyclic Pressure Test:** The maximum permissible number of design cycles shall be determined by cyclic testing of a full-scale PVHO.

1) The cyclic pressure test shall be from 0 ambient of MAWP and back to 0 ambient. The PVHO shall be pressurized to MAWP and the time when expansion ceases shall be measured. This time shall be doubled and the greater of the doubled time or 1 minute shall be used as the minimum hold time at pressure. Cyclic testing shall be performed at the most critical service temperature of 100°F.
2) The number of approved operational cycles (CA) shall be computed as (CA) + (CT/2)-1000, where CT =
total number of test cycles performed. The chamber will be cycled for a minimum of 10,000 cycles.
3) Every 2000 cycles the PVHO shall be visually inspected for damage and excessive air flow rate. The
requirement for acceptance of the cyclic pressure test is that no crack (or other damage) shall be visible
detectable, using methods that are normally used for visual inspection of the applicable material. In
addition, air flow rate shall not exceed 110% of normal and not to exceed 15 SCHF.

d) Creep Test: Extended time tests of three(3) completely assembled PVHOs that have either undergone proof
pressure testing without failure or alternatively have not been previously tested, shall be conducted at the
most critical service temperature using the following criteria:

1) A straight line shall be plotted using semi log coordinates with pressure on the linear scale (Y) and
time on the logarithmic (x). The beginning coordinate of the line shall be the pressure at 0.1 hour and the
MAWP multiplied by 9. The end coordinate on the line shall be twice (2) the MAWP at 80,000 hours. A
straight line shall be drawn through these two coordinates. This line represents the minimum pressure-time
acceptance line. Failure to the left and below the pressure-time acceptance line is disallowed.
2) A test pressure shall be applied such that the time without failure shall exceed the line pressure-time
acceptance line; however, the minimum time shall be at least 300 hours.
3) If all three (3) chambers exceed the 300 hours and exceed the minimum pressure-time acceptance line,
the PVHO has acceptable creep behavior.

e) Cold Storage Test: A. cold storage test demonstrating that the chamber can be assembled and inflated at
minimum operating temperature shall be conducted. The chamber shall be folded and stored for a
minimum of 8hrs at -10°F, and then inflated to operating pressure at 32°F+10°F temperature in a period
not exceeding 15 minutes. Repeat the cold storage test a minimum of two times. No increase in air flow
rate, damage, or permanent distortion is permissible.

f) Cycle Folding Test: A chamber will be subjected to 4,000 cycle folding exercises. The chamber will be
unzipped and laid flat on a table at room temperature. The head end with the acrylic lens will be folded
over onto itself once. The foot end will be folded onto itself twice. The final fold will be lifting the folded
chamber onto the end cap. This will create a size suitable for storage in the carrying case. After this is
completed, it will be unfolded to the flat position and zippers closed. Upon completion of the 4,000 cycles,
the chamber will be pressurized to operating pressure and inspected for any defects, delamination, wear
and fracture of the zipper of body. No damage, defects, delamination, fractures or excessive leaks beyond
15 SCFH is permissible.

g) Off-gas Test: The off-gas requirements of Section 1-10 of PVHO-1 2012 shall be satisfied.

h) Puncture Test: A puncture test using a 3/8” wide sharpened flat screwdriver shall be performed on one
PVHO at MAWP. The force to puncture the bladder shall be at least 255 lbs. After the screwdriver punctures
the PVHO body, there shall be no extensive tearing or rapid decompression.

i) Airflow Rate Test: The airflow rate of maintain MAWP hall be determined by pressurizing three PVHO
prototypes to MAWP at room temperature for a period of 60 minutes and measuring the volume of air
expelled. The three volumes shall be measured and used for comparison to production units, and will not
exceed 15 SCFH.
j) **Pressure Drop Test:** Assuming a complete loss of pressurization or supply source during operation, conduct a pressure drop test by inflating to MAWP and shut off gas supply. The maximum allowable pressure drop shall not compromise the safety of occupants nor result in distress to the occupants.

k) **Zipper Seal Test:** To demonstrate the true pressure boundary that of the outer jacket and web straps, an air-tight film bladder approximately the size of the interior of the PVHO will be inserted into the PVHO leaving all the zippers unzipped. The jacket will be closed and held together with just the hoop straps with flat shields across the zipper opening to keep the film bladder from bulging out. The PVHO will then be inflated to MAWP and held for 30 minutes without visible signs of air leaking or tearing.

4.2 **Production Testing**

a) All production units shall be subjected to a pneumatic test of 1.5 times the MAWP to be held for 60 minutes. In addition, airflow rate will be measured at MAWP over a 60 minute period.

b) Following testing, the PVHO shall be inspected for damage to the sealing areas. Every PVHO is to be examined visually and dimensionally. Any sign of cracks, permanent deformation, or other damage or airflow rate in excess of “normal” (see 4.1 (j) by more than 10% will be cause for rejection of the PVHO.

5 **QUALITY ASSURANCE PROGRAM**

5.1 **General**
The requirements of PVHO-1 2012, Section 3, entitled The Quality Assurance Program QAP) shall be complied with including specifically the following requirements and shall be reviewed and accepted by an independent third party inspection agency experienced in fabric composite design.

5.2 **Organization**
The QAP shall describe the organizational structure, with responsibilities, authorities, and lines of communication clearly delineated. Persons shown in the QAP to be responsible for verifying the PVHO quality shall have the authority and organizational freedom to

Identify problems affecting quality

a) Initiate, recommend or provide solutions to quality problems, through designated channels

b) Verify implementation of solution

c) Control further processing, delivery or assembly of a non-conforming item, deficiency or unsatisfactory condition until proper corrective action has been taken.

5.3 **Design Control**
A methodical process shall be used to develop and control the PVHO design, which includes:

A process for design inputs and review

A requirement for formal design review

A process for product configuration management and change control

5.4 **Document Control**
The QAP shall describe the manufacturer’s measures for assuring that design output documents are correctly translated into manufacturing specifications, drawings, procedures and shop/lab instructions. Considerations shall be made for reviews and approvals, including those of the purchaser. The manufacturer shall include the procedure
for assuring distribution of appropriate documents to the working areas in a timely fashion and the process for assuring non-use of obsolete documents.

5.5 Procurement Control
The QAP shall include the controls necessary to assure that applicable requirements are included in procurement documents. The manufactures shall describe the basis for source evaluation and selection and method of objective evaluation of the quality of furnished materials, items and services upon receipt.

5.6 Material Control
The QAP shall describe the identification applied to material and items upon receipt and shall show that this identification shall remain until the material or item is incorporated into the PVHO. Identification shall be such that the manufacturer personnel can easily determine quality status, material or item type, specification, lot of part as appropriate and job number. At least five (5) test samples of the key strength parameter shall be obtained from the lot of each pressure retaining material used in the Prototype testing and each lot of material used for actual production. The upper value of the 90% Confidence Interval for the Production material shall be at least as great as the lower value of the 90% Confidence Interval for the material that were used in the Prototype units that were tested.

5.7 Process Control
The QAP shall include a Process Control Procedure that will record the identification of materials and items incorporate into the PVHO and each chronological step in its manufacture, including inspection and test steps. The Process Control Procedure shall contain periodic operator and inspector signature points so that product status can be readily determine. The manufacturer shall identify critical manufacturing activities and assure that they are accomplished by appropriately trained and qualified personnel. Inspection points shall follow the activities in the process control plan. S, the integrity of heat seals shall be verified on each PVHO.

5.8 Inspection Control
The QAP shall include the measures used by the manufacturer to assure that inspections are reliable. These measures shall include:

   Proper qualification of inspection personnel
   Assurance that inspections are performed by person other than those performing or supervising work
   Documentation of all inspections

5.9 Test Control
The QAP shall describe the measures used to assure that tests (including lab tests are performed consistently and reliably. The following requirements shall be met:

   Tests shall be performed in accordance with written instructions stipulating acceptance criteria
   Tests results shall be documented
   Examination, measurement and testing equipment used for activities affecting quality shall be controlled, calibrated and adjusted at specified periods to maintain required accuracy tests shall be performed by trained & qualified personnel.
   Tests shall be verified by persons other than those performing or supervising the test.
5.10 **Control of Measuring Test & Inspection Equipment**
The QAP shall describe the equipment used in inspections and tests and the measures used to assure appropriate accuracy. Appropriate equipment shall be calibrated and the calibration shall be traceable to standards where they exist. Where such standards do not exist. The equipment manufacturer’s recommendations shall be followed.

5.11 **Control of Non-Conforming Items/Materials**
The QAP shall describe the measures used by the manufacturer to control materials or items that are found to be discrepant to prevent their use. Nonconforming materials/items shall be identified and not used. The discrepant conditions(s) shall be documented. The process for determining, documenting and verifying corrective action shall be described, including the involvement of the purchaser.

5.12 **Quality Assurance Records**
The QAP shall provide for quality assurance records:

a) Records shall be specified, compiled and maintained to furnish documentary evidence that services, materials and completed PVHO’s meet this and applicable referenced standards.
b) Records shall be legible, identifiable and retrievable
c) Records shall be protected against damage, deterioration or loss
d) Requirements and responsibilities for records transmittal, distribution, retention, maintenance and disposition shall be established and documented
e) Records required for traceability shall be retained for a minimum of 12 years.

5.13 **Standard Repair Planning**
The QAP shall describe method for repairing discrepancies that may occur during the PVHO manufacture, such as heat-sealing burns not greater than 1" in diameter and skipped stitches. All repair procedures will be written and undergo testing similar to the requirements of prototype testing. Full details of any repair will be noted in the device history file.

5.14 **Quality Assurance Overview by an Independent Third Party**
A qualified independent third-party individual or organization shall be employed to ensure that all PVHOs produced under this Case are designed, manufactured and tested to the requirements of PVHO-1 2012 and this Case. This includes, but not restricted to the following:

a) The PVHO is designed in accordance with PVHO-1 2012 and this Case.
b) The manufacturer is working to the requirements of the quality control system.
c) The materials used in construction of the PVHO comply with Table 1 as required by PVHO-1 2012 and this Case.
d) The manufacturing operations are conducted in accordance with approved procedures by qualified operators as required by PVHO-1 2012 and this Case.
e) All defects are acceptably repaired.
f) All prototype and production testing has been performed and witnessed as required by PVHO-1 2012 and this Case.
g) The PVHO is marked in accordance with PVHO-1 2012 and this Case.
h) A visual inspection of the PVHO is conducted to confirm that there are no material or dimensional defects.

The manufacturer shall arrange and give the third party inspection individual or organization free access to all facilities associated with the manufacture of the PVHO. The manufacturer shall keep the third party inspection individual or organization informed of the progress of the work and shall notify them reasonably in advance when PVHOs will be ready for any required tests or inspections.

6 Marking

a) In lieu of PVHO-1 2012, Section 1-9, Marking, the external surface of the jacket shall be permanently marked with stencil, close to one end, with the data required in PVHO-1 2012, Section 1 9.1, and the following (sample) designation:

4-PVHO (case 16)-HTI-0001-2011

Where
4 = rated pressure, psig
PVHO (Case 16) = PVHO designator and Case number
HTI = manufacturer’s initials
0001 = manufacturer’s unique identification for the PVHO
2011 = year of manufacturer

b) The jacket of the PVHO will be labeled to indicate:

- Maximum operating pressure is 4 psig
- Operating temperature range (min/max 32°F/100°F)
- Storage temperature range (min/max -10°F/150°F)
- Allowable life is 4000 cycles
- Maximum allowable Airflow rate to maintain operating pressure is 15 SCFH (standard cubic feet of air per hour)
- Expiration date (10 years from date of manufacture)

- Maximum allowable folding cycles is 4000

c) The following restriction shall be conspicuously marked at the inlet port, “PRESSURIZE WITH AIR ONLY”.
d) Not for Hospital Use
e) Not suitable for decompression sickness treatment-emergency use only.
f) Chamber shall be operated by qualified personnel.
g) Qualified attendant required at all times.
h) Electronic devices, hand warmers, matches, lighters and other flammable items are prohibited in the chamber.

Documentation

From GR-1 in PV1-10-1 Section 1-7-9, shall be replaced with Form PVHO Case. Manufacture’s Date Report for Pressure Vessels for Human Occupancy, below. All other documentation requirements of Section 1-7.9 5-1.3, shall be complied with.

Definition of “Lot” for fabricator’s testing requirements and traceability is the amount of homogeneous run of material made at the same time in a pre-determined quantity (i.e. yards or pounds) and the specific quantity received from such a lot.
FORM PVHO CASE MANUFACTURER DATA REPORT FOR PRESSURE VESSELS FOR HUMAN OCCUPANCY

1. Manufactured and certified by __________________________________

2. Manufactured for ____________________________________________

3. Vessel Identification __________________________________________
   (mfr. Serial no.) ______ (year built)

4. The design, construction, workmanship, and chemical and physical properties of all parts meet the applicable material specifications of PVHO-1 2012 Edition and Case Nos. The ultimate strength of the webbing is ________, the jacket is ________, the buckle is, ________, the bladder is _______________________, the penetrator flange is ________ and the film is ________.

5) Window Shield: Certification Reports, properly identified and signed by the window fabricator are attached for the acrylic material.

6) Manufactured for a maximum allowable working pressure of 4 psig, a maximum working temperature of 100°F and a pneumatic test pressure of 6 psig. Ten year life ending.

7) Design analysis conducted by __________________________________

CERTIFICATION OF DESIGN, FABRICATION & QUALITY ASSURANCE

User’s Design Specification of file at ________________________________
Manufacturer’s Design Report on file at ______________________________

Prototype test program attested by _________________________________
Quality Assurance Program reviewed by _____________________________
Fabrication documentation reviewed by ______________________________

CERTIFICATION OF COMPLIANCE

We certify that the statements made in this report are correct and that all details of the design, material, construction and workmanship of this vessel conform to the ASM E Safety Standard for Pressure Vessels for 1 Human Occupancy (PVHO-1 2012) Edition and PVHO Case

Date______ Company Name________________________ Signed____________